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A GLOBAL UNDERSTANDING OF MENTAL HEALTH

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Abstract: *The modern day concept of mental health in Western European culture has deep historical roots which continue to shape their understanding of mental health and mental disease. This article reviews the history of concepts of mental illness and the progression of ideas and historical events which have influenced modern mental health intervention. It examines the forces which lead to the three competing views of mental health: biological/physical; psychological; and societal. Recently the field of Global Mental Health has emerged. This movement places priority on improvement of the mental health and general level of functioning for all people with respect to cultural differences. Caution must be taken not to impose Western European values as counseling spreads globally.*

An Historical Background to Understanding Today's Global Mental Health Movement

The concept of Mental Health dates to at least the 5th century BCE.[1] The Greeks first described mental illness and by the 4th century BCE had developed a manual cataloging mental disorders.[2] Three major illnesses were identified: madness (psychotic behavior), melancholy (depression) and epilepsy. The first major schools of philosophy were the Stoics, the Skeptics and Epicureans, later came the Socratics and the Aristotelian schools of thought. These philosophies expressed some of the earliest ideas about mental illness and how to treat it. Even today these philosophies have an influence on the way we conceptualize mental illness. For example: the founders of cognitive therapy and rational-emotive therapy explicitly cited Stoic philosophy as the principal precursor and inspiration to their approach.[3]

In Greek and Roman times there were two theories about the origin of mental illnesses. The first theory that emerged was supernatural in origin. A psychotic individual was seen as having visions from the gods or perhaps the gods were speaking through them. Mental illness could be seen as either a blessing or condemnation by a god.

The gods could act for the benefit of mankind or do unspeakable harms. Religious leaders sometimes felt it necessary to rid the body of the god's possession through religious rites. Many cultures around the world have had similar beliefs. Some faiths even today conduct exorcisms in order to rid a person of demons and evil spirits.

A second view was that mental disorders were a consequence of some physiological abnormality. Hippocrates, the founder of the Hippocratic Oath, which is still taken by physicians in Western medicine today, wrote of seeing his colleague Democritus dissecting animals in an effort to locate the organs involved in mental illness.[4] Blood-letting, hot baths, purgatives, smelling incense and other

physical interventions were used to relieve the mental suffering of patients.

The competition between the spiritual and physical views of mental illness for dominance persisted through the height of the Roman Empire's reign. By the end of the 4th century A.D. mental illness had become nearly synonymous with sin. The search for physical roots of mental illness was forgotten by Europe for more than a millennium.

The Roman Catholic clergy felt mental illness was God's visitation of punishment for sin. This belief lead to a fear of the mentally ill as essentially evil beings intent on doing harm to others. It was thought that the mentally ill must be separated from the population, not so much for the good of the mentally ill as for the protection of the society. The conditions which we might label schizophrenia, mania, or obsessive compulsive disorder were thought to be the result of demonic possession. In the name of God exorcisms were brutally conducted as treatment to save the soul, if not the body.

Sufferers of melancholia (depression) were treated with colonics and herbal teas and medicines. Other unfortunate individuals were locked away in dungeons or tortured in an effort to drive out the "evil" spirits. Many were simply killed to "protect the community." Those in the dungeons received no medical care, little in the way of food and were left in rotting rags and their own soil. Many children born with some physical deformity were also deemed mentally ill and were locked away with criminals and those who suffered madness.

The first known specialist "hospitals" for madness developed in what is modern day Iraq. In 705 A.D. a hospital was built in Baghdad, another soon followed in Fes and a third in Cairo in 800 A.D. Several Medieval Islamic physicians wrote treatises on the diagnosis and treatment of mental illness.[5] Little of the literature of those scholars survives today. The first European hospitals for the mentally ill appeared in the 13th century and then these did not attempt a cure. Their purpose was to incarcerate, to protect the general public from the lunatics. Treatment in these hospitals was no different than in previous centuries in Europe. The mentally ill, the physically deformed, and criminals were frequently locked up together. They were tied or chained to beds, locked in small cages without blankets or even clothes.

The renaissance period witnessed the beginning of a new view of mental illness, one in which physical and social causes were sought as the origin of mental illness. In 1621, an Oxford University mathematician, astrologer, and scholar Robert Burton published an English language book, *The Anatomy of Melancholy…* [6] He made a scholarly case for the need to study the human mind. His call for the study of the human mind went unanswered until the English physician William Battie wrote his *Treatise on Madness* in 1758. He advocated humane treatment of the mentally ill and the search for the causes and cures for such conditions. When the English King George III recovered from his mental disorder a new era dawned.[7] Mental illness was then seen as an illness which could be cured or at the very least controlled. By the 1790's Philippe Pinel,[8] M. D., of France and William Tuke, an English Quaker and tea merchant, independently advocated for the removal of chains from the mentally ill.[9,10] The York Retreat (Tuke's facility) in England became a model for the Americas and Europe for the treatment of the mentally ill. A focus on moral development, healthy living and humane conditions was viewed essential for the patient's recovery to mental health. Despite these emerging views the conditions and treatments offered to the mentally ill showed no improvement outside of a few enlightened institutions.

In 1808 Johann Christian Reil took the Greek words *psyche* "soul" or "breath" and *iatros or* "healer" and combined them to create "psychiatry" as a new division of medicine.[11,12] During the next hundred years the understanding of mental disorders and their categorization grew dramatically, as did the housing of those who were ill. Much of this change must be attributed to the rise of the scientific method which began its ascendency in the 17th century over the previously dominate religious fervor. This shift in thinking allowed for the re-emergence of the

search for physiological basis for mental illness.

During the latter part of the 1800's mood disorders, levels of depression, monomania (obsessive-compulsive behaviors) and neurosis were identified and treatments were sought. Mesmer began mesmerism in the 1850's (hypnosis therapy), Freud followed with his version of psychotherapy and the Vienna School. He believed that the brain function was somehow altered by childhood experiences and that by discovering those experiences which have been subjugated to the subconscious or unconscious mind one could effect a cure within the individual. He also said that his technique would become obsolete someday because medicine would be able to explain the physiological malfunctions which caused various forms of mental disorders.

While Freud and his Vienna Circle colleagues were exploring the art of psychoanalysis and creating an understanding of human behavior that included the ego, alter ego, unconscious and subconscious mind another movement was also developing independently of medicine and psychiatry.

Due to industrialization across Europe, England and the United States, living conditions deteriorated for the masses of people who migrated to the industrial centers for work or to escape the European armed conflicts and famine. These are the conditions which the famous author Charles Dickens portrayed in his novels. A social conscience movement emerged in which poverty, living conditions, and the social class system were challenged. The social conscience movement postulated that many of the mental health issues of the day were the result of poverty and the lack of education and opportunity. This new movement was a social justice or social welfare model which eventually created the modern concept of social work. This social welfare movement was gaining strength in the United Kingdom and the United States.

Dorothea Dix was a prominent American leader in this movement. In 1843 her "Memorial to the Legislature of Massachusetts"[13,14] described the conditions in which the mentally ill were kept and their brutal and inhumane treatment. She lobbied for the humane treatment of the mentally ill for many years. By the 1860's the New York State Legislature established separate asylums for the mentally ill.[15] Despite these new facilities and improved living arrangements treatment was minimal and often still brutal. Ice cold water submersions, the use of strait jackets and the experimentation with drugs were used without the modern constraints of patient's rights or the ethical standards of practice understood today.

By the early 1900's the United States of America housed approximately 150,000 mental ill and physically deformed people. German speaking countries had more than 400 public and private mental facilities and psychiatry was a recognized medical specialty. Treatments included psychoanalysis and the traditional treatments of ice cold baths, electric shock, experimental drugs, colonics, and other purgatives.

Clifford Beers described what it was like to be a patient in an American asylum in 1908 in his book *A Mind That Found Itself.*[16] This marked the beginning of the "mental hygiene" movement with its emphasis on childhood prevention. It also signaled a rejection of the medical model of the common treatments of the time and a refocusing on mental health, not illness. The movement examined the social environment and its impact on maladaptive behavior. Now there were clearly three competing views regarding the original

and thus the treatment of mental illness: biological/physiological; psychological; and sociological.

By this period the academic discipline of psychology was well established in many universities. There were studies of how the mind, as opposed to the physical brain, worked. The American philosopher James and others began to postulate theories of learning and memory. Others examined group or mass psychology and what we would term propaganda for the manipulation of the masses. Intelligence testing for educational purposes advanced. Employment and career counseling emerged.

The temperance movement convinced Americans that alcohol and alcoholism were "social diseases" which prohibition could cure. Alcohol and drug addictions were labeled as morale weakness from which the government needed to protect the greater society. Physicians saw addictions as a psychologically based disease with physiological aspects. The social welfare movement viewed excessive drinking as a symptom the decay of the social environment and endemic poverty. Alcoholics Anonymous was founded by a physician on tenets of religious faith, social fairness, and psychological insight.

Throughout the first half of the century the debate regarding mental health raged between the medical, biological proponents, the psychological/psychiatry approach and the social work belief that mental illness was at least in part a response to the inequities of society.

After World War II a host of new approaches to mental health emerged. In the last half century there has been an astonishing growth in mental health services available in the United States, Canada, and the United Kingdom. With this growth came the introduction of new therapy models and theories. Today the variety of psychotherapies is staggering. There are Albert Ellis' Rational Emotive Behavior Therapy (REBT), Aaron Beck's cognitive therapy (CBT), Human Social Functioning, Gestalt, Positive psychotherapy, Narrative Therapy, Coherence Therapy, Feminist and Brief Therapies. There is of course Client-Centered Counseling (Rogerian), Somatic Psychology, Expressive Therapy including art and play therapies and EMDR. There is career counseling, couples counseling, divorce counseling, addictions counseling and a host of other variations. And then there are specialties in the medical field of psychiatry.

Notably Carl Rodgers began the "counseling movement." He was a trained psychoanalyst who felt the patient–doctor relationship was an incorrect model for treatment of most mental conditions. He preferred the legal model of client and counselor in which the client determined the direction of therapy and what issues were to be discussed. He stressed the relationship between the therapist and client as the key to assisting the client in attaining a healthier way to function in life. His goal in therapy was to help clients become "fully functioning individuals" within the social context in which they found themselves. This model shifted the control of treatment from the doctor to the patient. Behaviour modification, first seen in the 1920's, became popular in the 1960's and 1970's. It emphasized the biological concept of stimulus and response and learning theory. Notable contributors were Joseph Wolpe of South Africa, Shipiro and Eysenck in the United Kingdom, and J.B. Watson and B.F. Skinner in the United States.[17] Another significant therapeutic approach grew out of the Second World War. Existential Psychology concerned itself with the individual's ability to create and preserve meaning and purpose in life, despite terrible experiences and circumstances.[18] This approach placed its emphasis on the social circumstances in which the individual was situated and how that individual responded. Vocational Counseling, begun in the early 1900's, never had much support or recognition as a profession. Following World War II and the Korean Conflict the United States government funded vocational education and built upon John Holland's theories. The government had two basic objectives. One was to employ as many of the veterans as possible, and the second was to out-pace the Soviets in science and technology. Although each new theory or

approach was different in structure and theoretical foundation each originated from social needs and was not based on medical model assumptions.

By 1950 the psychological model was also re-emerging with its own new approach to mental health. In that year the *Diagnostic and Statistical Manual* (DSM) was first published. This was an attempt to label disorders for research purposes and to collect data using a code system which categorized mental disorders. It was not dissimilar in conception to Karl Ludwig Kahlbaum's disease classification[19] on which Emil Kraepelin built early in the last century.[20] These ideas culminated in medicine's development of the *International Classification of Diseases (ICD).*[21]

There were many opponents to the original *DSM* as it seemed to some to adopt a medical model: perhaps most notable was William Glasser, M.D., who still remains an opponent of the system and its subsequent editions. One repeated complaint is the *DSM* model portrays social adjustment and many normal behaviours as mental disorders. In May of 2013 the 5th Edition of the *DSM* was released with nearly 1000 pages with several new diagnoses.

The discoveries that lithium carbonate stabilized manic-depression (now known as bi-polar disorder) in 1948 and chlorpromazine was effective in treating schizophrenia in 1952 helped in the establishment of Biological Psychiatry.[22,23] By the end of the decade the psychoanalytic school of thought had been marginalized. Psychology and counseling techniques had become dominant in dealing with the "simpler" forms of mental illness (neuroses).

Social Workers, the natural outgrowth of the social welfare models of service of the first part of the century, also became common. Career counseling services were established in every US secondary school, university and college. Although initially the funding was federally based, most institutions found it advantageous to continue services even after federal funding ended. In the secondary schools these counselors helped "track" students into vocational education or preparation for entrance into colleges and universities. In colleges and universities counselors focused on placement in jobs post-graduation.

Biological Psychiatry and Neuropsychology grew quickly in reputation and the number of providers after Otto Loewi's discovery of acetylcholine's neuromodulating properties.[24] This was the first of many neurotransmitters to be identified. Neuroimaging was developed and utilized in the 1980's. These discoveries have further advanced the pharmacological approach of Biological Psychiatry which dominates psychiatric interventions in mental health today.

Perhaps the most frequently employed model of initial data collection regarding a client's care is based on the "bio-psycho-social" model which recognizes the interaction of the environment with the human organism and heredity. Although there are differences in the emphasis placed on the three basic components of the model by different theories and practitioners, the model recognizes the intersection and interaction of the three components. In medicine greater emphasis is placed on the biological component. In psychology the emphasis is on the psychological development of the individual, whilst counselors, social workers, marriage counselors, career counselors and addiction specialists stress the social and family aspects of life influences.

Even within these three approaches there is another distinction between those psychotherapies that employ a medical orientation and those that employ an humanistic one. The medical orientation considers the patient as unwell and in need of "curing" or at least controlling the progression of the disease. The *DSM* and *ICD* are the guide books for this orientation and have become the Global standards. The humanistic view stands in stark contrast to the medical orientation. It seeks to depathologize the human condition and to understand emotional turmoil in the context of the environmental stressors faced by the client. Reactions to these stressors are seen as normal responses to difficult situations. Some responses are unsuccessful or less successful than others in coping with life circumstances. These counseling approaches strive to assist the client in developing more successful coping strategies which will be available to the client for future use as needed.

Therapeutic Efficacy

The proliferation of therapies has resulted in competing claims regarding the greater efficacy. Controversy surrounds which form of psychotherapy is most effective and which interventions are optimal for certain diagnoses. "Furthermore, it is controversial whether the form of therapy or the presence of factors common to many psychotherapies best separates effective therapy from ineffective therapy."[25] It has been argued that the quality of the relationship is of greater importance than the therapeutic theory. This position would be supported by Client-Centered therapists.

Psychotherapy outcomes research as early as 1952 found that two thirds of patients improved significantly or recovered fully within two years with or without treatment.[26] The Helsinki Psychotherapy Study which is examining long-term effects of therapy will continue until 2014. The three and five year follow-up reviews revealed that brief therapies bring more immediate results, but long-term therapy yields greater results.[27]

In 2001, Bruce Wampold published *The Great Psychotherapy Debate*[28] which reported; 1. psychotherapy is effective,
2. the type of treatment was not a factor,
3. neither the theoretical bases of the techniques used nor the strict adherence to the techniques were not factors.
4. the therapist's belief in the efficacy of the technique is a factor,
5. the personality of the therapist is a factor, and
6. the alliance (rapport, trust, collaboration in treatment) between the client and the therapist is a key factor in effecting a positive therapeutic outcome.

The conclusion drawn by Wampold was therapy can effect an improvement in the client due more to personality, client-counselor relationship, and a belief in the effectiveness of the therapy than on the type of therapy or the counselor's skill in utilizing the techniques of the theory.

The Global Mental Health Movement

The World Health Organization, seeking to find a definition which serves common ground across cultures, defines mental health as "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community."[29] The agreement that mental health must be understood from a cultural perspective with the goal of improving one's ability to succeed within one's own culture has gained wide acceptance. Recently a global mental health field has emerged and has placed a "priority on improving mental health and achieving equity in mental health for all people worldwide."[30] This movement recognizes the biomedical aspects of mental illness whilst endeavoring to hold the humanistic aspects of counseling as foremost in importance to mental health.

Psychiatry and psychology have agreed upon some definitions of mental disorders that appear worldwide. Depression, paranoia, suicide ideation, eating disorders, schizophrenia, addictions and mania are some disorders upon which there is a general consensus. The *ICD* and the *DSM* are global

attempts at gaining universal acceptance of definitions of specific disorders by listing a series of behaviours and thoughts which a patient/client reports or that are directly observed by the therapist which serve as a basis for diagnosis. Both the *DSM* and the *ICD* have tried to objectify diagnoses by stating specific behavioural criteria on which to base a diagnosis. One need not demonstrate all of the listed criteria but a specified number must be met to receive a proper diagnosis. In both of these diagnostic systems the presence of illness is determined on a polar basis: either one has the disorder or one does not. If one meets enough of the criteria then the individual is ill. In parts of Canada a system with a Likert type scale in which the degree of functioning is estimated is being used. The higher the number on the scale the greater the particular behaviors or thoughts and feelings are present. This recognizes that mentally healthy people may not always function well and it allows for a fluid diagnosis as conditions change. It incorporates mental health into the mental illness model on a continuum from healthy to unhealthy. The Chinese have developed their own system for diagnosis of mental disorders based on their traditional understanding of medicine.

Although there is some agreement on what constitutes mental illness, there is wide divergence in what is considered mental health. Health is not simply the absence of illness and there is no one universally agreed upon definition of mental health. Mental health has been described as the capacity to enjoy life in the absence of a mental disorder.[31,32] It may also be defined as the ability to cope appropriately and effectively with life's stressors within one's cultural environment. The idea that coping behaviors are culturally contextual means that nothing more than a very general definition of mental health will serve all peoples in various nations and subcultures.[33] Cultural differences make a globally acceptable definition impossible at this time.

A notable criticism of therapy suggests that to some degree it is idealized as only a helping relationship. But because of the cultural context and its dominant value system therapy is fundamentally a political practice supporting societal norms and practices while undermining or disqualifying viewpoints which deviate from the acceptable variation from the norm. While this may be unintended, the counselor-client relationship always participates in the society's understanding of relationship power and political dynamics.[34] Thus the Global Mental Health Movement presents a danger. The theories and systems from which the movement stems originate from Western European culture with its long history and evolution. If care is not taken the underlying European values may be imposed in a new colonialization of less developed nations.

The understanding of cultural importance cannot be overstated. Even in countries which share a common language and heritage there cultural differences exist and words do not always have the same meaning. Different experiences and cultural histories, which are at times subtle and often unrecognized, influence how people think about and react to the same stimuli. When two cultures do not share a common language the difference in understanding can be even more complex. How one organizes thoughts is both culturally and linguistically determined and then in turn how one thinks aids in the social construction of culture. This interaction is dynamic and continuous causing an evolution of the cultural experience. The culture in which one grew to

adulthood is not the same culture in which one's children and grandchildren will mature.
Language is symbolic shorthand for objects, thoughts, ideas, and concepts of human experience. Some languages are more abstract than others thus permitting greater opportunities for misunderstandings. Anyone who speaks multiple languages recognizes that some words and phrases have no identical meaning in another language, thus requiring an approximation in translation.
Despite these considerations and difficulties there is merit in attempts to create an international agreement in general terms as to what constitutes good mental health and how it can be achieved. There is room for both a biological, medical understanding of the brain physiology and chemistry which underlies some mental illness, and there must also be an acceptance of the social and environmental circumstances into which humans are born. It seems that there needs to be a new system created which does not impose concepts of mental health which initiated in ancient and medieval, Western European cultures universally. Therein lays the danger of diagnostic systems such as the *DSM* and the *ICD* and a Global Counseling Movement rooted in Western European culture.

Summary and Conclusion

Mental disorders were recognized by ancient cultures for at least 2500 years and many of the original conceptualizations of the ancient Greeks have been incorporated into today's theories about mental health and illness. The attempts to codify and catalogue mental illness began in Greece about 500 years BCE and continue to this day in the forms of the *ICD* and the *DSM*. The early belief in the dualistic nature of the etiology of mental illness, i.e. physiological basis versus the experiential basis, continues today with just as much controversy.
There is a cultural component to the definition of mental illness as well as mental health which is inescapable and underlies therapies of all types. This makes gaining agreement on what constitutes mental health on a world wide scale nearly impossible. However, the World Health Organization has proposed a broad statement of healthy behavior which can focus efforts on improving the quality of emotional well-being. There is a global mental health movement growing which is focused on just such a goal. Caution must be taken not to impose values which are deeply imbedded within the theories and techniques originating in the Western European cultures and the dualistic understanding of human beings.
Within the two positions of biological/medical model and the humanistic model of mental health care a great many theories have evolved. Wampold's and others research have demonstrated the efficacy of therapy regardless of type but associated with the counselor-client relationship. Therapy works even if we do not always know why.

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1. MANAGEMENT, MARKETING, FINANCE

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THE SCIENCE OF OPPORTUNITY IN ROMANIA

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Abstract: *Most countries in the world are actively trading with Romania. The service sector has grown ever larger, with the development of national economies. Presence in all elements of profit economic performance of an company highlights the central place in assessing the effects produced per unit effort or expense. Therefore, of great importance in the development and substantiation of economic efficiency indicators system has accurate about the role of profit and profitability at the micro level.*
How to negotiate delivery condition for the benefit by the company or the customer? This article will present some of the obligations and risks it has assumed both contractual partners but also the opportunities that arise in Romania.

Keywords: *logistics methods, SMED method, Obeia method, reorganization, logistics solution.*

1. INTRODUCTION

Based on trends observed in the market in recent years, from the way they played some categories or subcategories of products, from the changes in consumer buying habits and Romans, the author found significant business development opportunities generated by current circumstances or desirable in the medium and long term. These opportunities are due to adaptation logistics management methods used today by the Japanese, American, German ... But in this article, the case study was conducted on the field of services, in terms of logistics.

Few cities in Romania can boast high development of modern retail. The vast majority of cities shows interesting opportunities for commercial networks, with plans to expand.

There are significant disparities between regions in Romania, and within them. The main issues to be tackled in order to promote balanced development in Romania are:

- Increased capital importance compared to the overall development of other regions;
- Increasing imbalance between west and east because western markets acting as a growth factor, the less developed areas in the north-east, respectively border with Moldova and south, along the Danube;
- Intraregional inequalities;
- Urban decline of small and medium-sized cities;
- Negative impact of industrial restructuring in mono-industrial rural. [3]

Modern age had a significant impact on the evolution of the Romanian industry. The map would grow enormously in the interwar period and the final shape during the communist regime. Currently, in the context of industrialization, industrial map of Romania, unfortunately, more refreshing than it is enhanced, making the prosperity of the country to make limited and piecemeal.

2. CASE STUDY

2.1 Organizational structure

The rapid development of trade (or distribution) is due to the role it plays in the evolution of society. Trade - distribution is the link between production and consumption.

Company, starts its activity in 2008, with specific services. This business develops, as shown in Fig.1

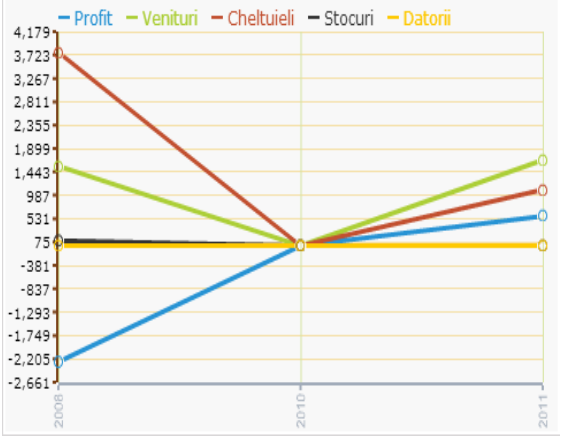

Fig.1 Financial Indicators. [4]

The financial indicators are:
- Profit with blue
- Total revenues with the green color
- Expenses with red
- Yellow represents liabilities

The company was able to substantially increase its turnover by cross selling Important is the client for future business development.

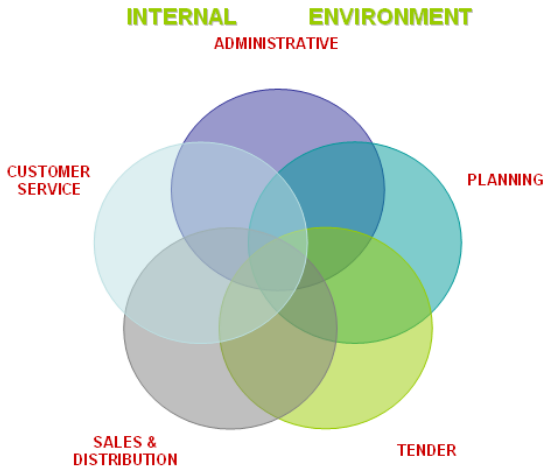

Fig.2 Organizational structure, each department.

The company has 5 departments:
- PLANNING – the activities and the processes, ensuring product availability;
- TENDER - identify customers;
- SALES & DISTRIBUTION – the activities and the processes, ensuring product availability;
- ADMINISTRATIVE - provide the support, to the four departments;
- CUSTOMER SERVICE – the activities and the processes, ensuring product availability.

Each organizations, are the systems, that are capable of input, which then turns it into output.

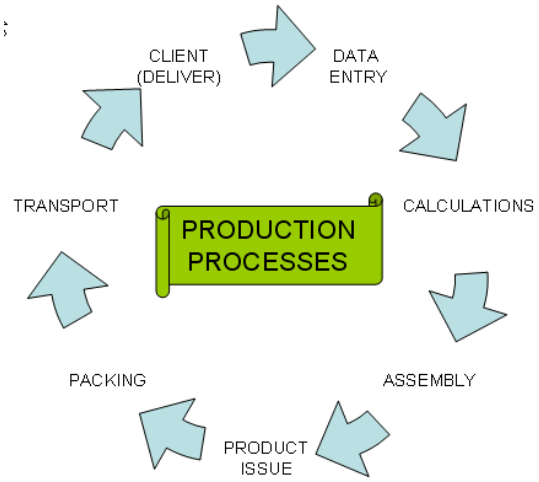

Fig.3 Production Flow Chart.

2.2 The solution is: change by implementing methods

In a previous article the author, has done an analysis on logistics methods implemented, which includes above table.

The idea, on this article, is based on the Quick Changeovers method that facilitates the reduction of lost time during a product change. The principles of quick changeover resulted originally from the concept of SMED, which means Single Minute Exchange or Die. Although it is a method used only in production, here this method was implemented from necessity, because otherwise customers buy the same products at the same price elsewhere. Should seek opportunities that give them customers that benefit from purchasing products. Therefore, the company operates as a niche to quality services, but the program is 24 of 24 from disposal of the client.

Experience showed that the flow of managing customized products was missing.

Table 1. Analysis Tools for Logistics Management (ATLM). [2]

METHODS IMPLEMENTED	DEGREE OF IMPLEMENTATION
MRP	100%
KANBAN	-
JIT	100%
FIFO/LIFO	LIFO
HEIJUNKA	-
KAIZEN	100%
5 S	90%
JIDOKA	-
KANO	99%
PULL/PUSH	PULL
ABC	-
SMED	100%
TRIP. "A"	80%
OBEYA	100%
SCM	60%

Of course, in this particular case, the company's strategy does not coincide with those with whom it competes.

METHOD OBEYA

We need to find at least a few ways that the open office or "obeya" concept increases profit in a direct way.

2.2.1. **Reduced space** . At a minimum organizations who remove walls recover one meter of space on either side from the center of the wall. Multiply this times the linear meters of the wall to determine the savings. Realistically the removal of walls consolidates a lot of small bits of dead space within offices, makes storage or meeting rooms redundant, and generally turns up free space. While space may be a so-called soft savings for many lean manufacturing implementations, many times office space is leased, can be sub-leased more easily than manufacturing space, or can be sold to reduce fixed and variable costs and increase profit.

2.2.2. **Fewer meetings** . When walls come down, the need for meetings is reduced. More time can be spent in small but timely bursts of communication. More progress is made on issues within an obeya than within the traditional meeting room due to the information displayed there and the fact that it is a working area for a cross-functional team; they want the meeting over and you out of their space so they can get back to work. Multiply the man-minutes of meetings reduced times the cost and this is another concrete way that removing walls increases profit.

2.2.3. **Reduced gold plating** . We over-design product, processes and even our physical work space, adding costs that customers will not pay for. This happens either because customer requirements are poorly defined, poorly communicated across functional barriers, or because decision are made behind walls. The obeya puts the best information on the wall for all to see. It puts the people from different functions in the room for regular face to face communication, problem solving and discussions about the need for gold plating. This improves profit.

2.2.4. **Clearing the e-mail jungle** . Finding a way to recover lost productivity due to the cost of managing via e-mail will make some clever innovator very wealthy. Otherwise we can save it for the daily team reviews in the obeya, save everyone some time, and save some money in the process.

2.2.5. **Making resource bottlenecks visible**. There is nothing like an open room to show who is busy, who is not and to enable cooperation in getting the day's work done. When people cooperate and move to relieve bottlenecks, this reduces cost by avoiding extra hiring, overtime, penalties due to project delays and so forth.

The obeya is far more than simply a big open room. It must be deliberately designed as a communication center for the status of daily work as well as the progress of projects involving cross-functional teams, customers and suppliers. This is especially important today as more teams work virtually and across language and culture barriers. [5]

3. CONCLUSIONS & ACKNOWLEDGMENT

It is a trend that can be harnessed relatively easily, especially as often, supply creates demand. A trend valuable, credible, supported by quality products and services can quickly grow and strengthen market. This gives me, most times, rapidly evolving.

The proposals:

- streamlining distribution operations (transport)
- promote company visibility
- increasing the number of clients, through the hiring of specialized staff
- motivate existing staff
- performance measurement within each department and pay according to achievement
- decrease in fixed costs, here is possible

After 2000, the value of the customer is given by production flexibility, high quality and low cost linked to availability. In other words, if they want to survive in a global market, companies must profit, contracts and renewed growth. For this, companies have to be the best in ensuring delivery of quality products at competitive prices. We can say will matter less time than the competition.

"The theory behind Obeya is based on a simple idea: Dedicate time and space to coordination and problem-solving and organizational barriers will be minimized.

The result: effective solutions and actions that can be developed and implemented quickly." [1]

Consequences of SMED, for our production system are:

• Shorter innovation, adapt quickly to new or modified

• Fast and safe delivery, high quality despite frequent changes

• Improving the working cycle capability (standardization)

• Improved repeatability change the manufacturing operations

• Stocks of small / zero production

• Lean Production: customer pull (pull) products flow

• Meeting the diverse market by providing several variants of product, even if the application is in small quantities.

Consequences of OBEYA, to our production system are:

• Change offices in one large room

• closer links between employees

• Improved communication, as (horizontal or vertical)

• Meeting demand by the same quality, but with great rapidity.

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TRACES OF THE ECONOMIC CRISIS IN ROMANIA
Without identifying the causes can not understand the effects

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Abstract: *The current economic crisis has led manufacturers to cut long chain of suppliers and customers to look more closely at the quality / price ratio. If products are now becoming more common, prices have not been changed, even it is lower All countries are consuming and search new opportunities.*
Companies are required to create new strategies for economic growth and development.
In this article I will show you macroeconomic analysis (GDP, inflation, current account, unemployment ... etc.) but also something about the microeconomic level.
Romanian economic environment faced major imbalances caused by inflationary phenomenon.
In the period under review, inflation had a particularly persistent shocks generated largely by domestic and international markets, as rising fuel prices and raw materials, or fiscal changes and the evolution of the exchange rate.

Keywords: *crisis, GDP rate, unemployment, Romanian economic environment, direct effects of the crisis.*

1. INTRODUCTION

We know that the origin of the current economic crisis started with the collapse of the housing market and the banking system in America, events that brought down the economies of other countries.

How?: between the years 2006 - 2008 U.S. banks would be credited population in an easy way and over a long period of time. The American people took advantage of these offers and leveraged over power, especially in real estate. Because of this, banks found themselves overnight to have a financial gap to be covered in a shorter time than previously expected. The crisis was felt globally because the U.S. was forced to withdraw money supply from the other financial markets, result: an earthquake of global proportions.

Why did this happen?: Because we are a consumer society, the banks wanted and still want profits through leveraged.

In an economy marks a crisis will be seen in:

- GDP declines resulting from low consumption
- Decreases in cash - will follow the current account deficit share in GDP (inputs / outputs,

Currency in the country) watched indicator almost all rating agencies

- Unemployment accentuated, rising

International system has shown weakness this time, that does not have effective means of prediction and prevention national financial crisis, which, here, can develop into a systemic crisis, replicated in several countries and geographical areas.

2. ANALYSES

Phenomena and processes succeed quickly today, we remember the country's vulnerability to external shocks.

What is obvious in 2011, average annual inflation rate is s the highest of all even declined a bit, from 6.1% in 2010 to 5.8%, as shown in table1.

Table 1. Average annual inflation rate [4]

	2000	2009	2010	2011
UE-27	1.9	1.0	2.1	3.1
Romania	45.7	5.6	6.1	5.8
Ireland	5.3	-1.7	-1.6	1.2
Sweden	1.3	1.9	1.9	1.4

Direct effect of the economic crisis triggered in the second half of 2008, the average number of the employees in 2010 was 4376.0 thousand, down 398,300 people from the previous year. The most pronounced decreases were observed in the activities: manufacturing, construction and trade.

Unemployment in Romania recorded an incremental curve, the peak being reached in February-March 2010 (8.4%) and then continued to decrease in the next period, reaching in 2011 a value of 7.4%.

Table 2. Unemployment %[4]

	2000	2008	2009	2010	2011
UE-27	8.8	7.1	9.0	9.7	9.7
Romania	6.9	5.8	6.9	7.3	7.4
Spain	11.7	11.3	18.0	20.1	21.7
Greece	11.2	7.7	9.5	12.6	17.7
Latvia	13.7	7.5	17.1	18.7	15.4
Lithuania	16.4	5.8	13.7	17.8	15.4
Austria	3.6	3.8	4.8	4.4	4.2

In 2011, the gross domestic product in nominal terms, was 578 551 900 000 lei, returning £ 27017.7 per capita.

In 2011, services have the highest contribution to GDP, or 45.4% of the total (£ 262,705,600,000) industry stood second place respectively 26.3% to GDP (152062900000 lei);In 2011, gross value added was recorded 509 350 700 000 lei and accounted for 88.0% of GDP. [7]

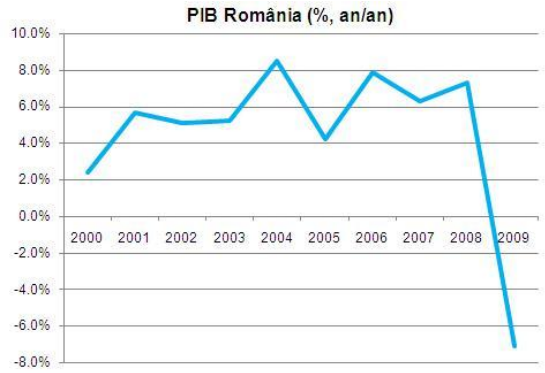

Fig.1 Romania's GDP before the crisis [3]

In 2011, the gross domestic product in nominal terms, was 578 551 900 000 lei, returning £ 27017.7 per capita. [7]

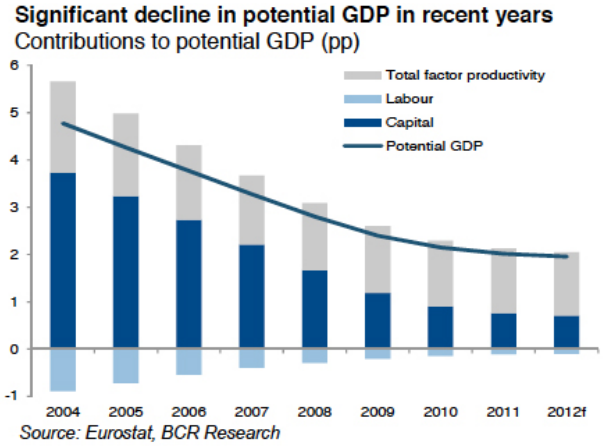

Fig.2 Contribution to potential GDP (pp) [2]

In 2012, economic growth will lose speed and will stay at 1.2%, in a scenario consistent with the better absorption of EU structural funds and flat inflows of private external capital. The negative outlook for the zone Euro, the main trading partner (absorbing 55% of Romanian exports and accounting for 80% of FDI inflows), is a key assumption behind our view that 2012 will end with lower economic growth. A negative contribution from agriculture could be counterbalanced by the further recovery of retail sales, due to an increase in public wages ahead of the elections. The prerecession real GDP level will be reached no sooner than 2014. The unemployment rate (ILO methodology) is expected to remain stable at around 7.4% in 2012-13. Structural changes in employment will continue, with an increase in employment

in services paralleled by a natural decline in agriculture. The number of public employees will decline further, due to the replacement of only one in seven departing workers, while the private sector of the economy will continue to create new jobs. [2]

Economy has experienced a slight recovery towards the last two years of economic contraction (-6.6% in 2009 compared to 2008, -1.6% in 2010 compared to 2009).

In 2011 compared with 2010, GDP in real terms has increased by 3.3 percentages and decreased in 2012 by 1.9 percentages.

Table 3. Real GDP growth rate –volume % [4] date eurostat.ec.europa.eu

	2007	2008	2009	2010	2011	2012
UE-27	3.2	0.3	-4.3	2.1	1.5	-0.3
Rom	6.3	7.3	-6.6	-1.1	2.2	0.3

Last statistics presented by the President of NSI (National Statistics Institute), Tudorel Andrei, show that GDP grew by 0.1% unadjusted series in the first quarter of 2012 compared to the previous year, by 1.3% in the second quarter of 2012, decreased by 0.3% in the third quarter, then increased by 0.3% last quarter. In seasonally adjusted GDP increased by 0.8% in the first quarter, 1.4% in the second quarter fell by 0.2% in the third quarter and rose 0.1% in the fourth quarter. [7]

In 2012, Romania's GDP grew by 0.3%, while the EU-27 economy decreased by 0.3%. Increases above 1% of GDP recorded in 2012 Latvia, Lithuania, Estonia, Slovakia, Poland, Sweden and Malta, and falls over 1% suffered Greece, Portugal, Cyprus, Slovenia, Italy, Hungary, Spain, Czech Republic.

The current account deficit recorded a reduction of 35.4% during January-July 2012 compared to the same period of the previous year, suggesting that it is possible to get the share in GDP indicator below 4% by the end of 2012 according to NBR (National Bank of Romania). [6]

From the information NSI (National Statistics Institute) reveals that industrial production as series adjusted by number of working days and seasonality increased in January 2013, up 3.4% from the same period of the previous year, due to increased mining and quarrying (+5.9%) and manufacturing (+3.6%).[7]

Industrial production, one of the most important indicators of the economy returned to positive territory in January 2013. Industrial production increased from the previous month both as gross series and as series adjusted, depending on the number of working days and seasonality, by 6.3% and 0.3%. Thus, the increase in industrial production (gross series) was sustained manufacturing growth (+8.2%).[1]

It seems that is healthy for the Romanian economy to produce.

3. CONCLUSIONS & ACKNOWLEDGMENT

It is known that about 70% of foreign trade is done with EU countries, the crisis has led to slower growth of imports and exports (with a slight advantage for exports in the sense that the growth rate will be higher for exports) but remains to see how they evolve and how much foreign investment will send home those who work abroad (most workers are in Spain and this country member of EU is one of the countries hit by the crisis).

In Romania, unfortunately, or fortunately some will say, economic growth depends largely on demand for goods and capital inflows from abroad.

In terms of unemployment, I think they will still be problems. Some industries will be massive layoffs, especially those that sell cheap labor and low value added: outsurcing the production, furniture, part of the auto industry and textile industry lohn but it is likely that this workforce to be absorbed by industries and services where demand is currently unmet.

Finally, What will be in 2014? We buy fewer cars (high taxes), electronics, the appropriations will be more expensive and inaccessible. The lack of financing or cash, many small firms that are part of the distribution or supply chains will go bankrupt (SME sectors most hit by the crisis, productivity is very low).

What certainly will not be in 2014 are: recession, bank failures and reduce consumption.

Do not know why investors choose between higher investment risk in Romania or other countries gaining acceptance (even fast) considering the opportunities that Romania has to offer.

Solution to the current crisis can be solved only at the agreement between the EU countries and they are quite complicated to Romania because we are among recent arrivals.

"In the short term the main challenge is to find solutions to restore investor and consumer confidence. In the long term, the main challenge is adjusting principles guiding reform the international financial system, mainly on transparency, improving regulations on securities accounts, ensuring proper regulation of markets, firms and financial products, ensuring the integrity of financial markets (on market manipulation and fraud), and closer cooperation between the world's financial institutions modernize governance structures of the IMF and World Bank). Business Ethics is missing from this list of challenges ahead." [5]

What we can compare the current crisis? With chess game where: some are crazy, some are kings and others pawns who want to play the game.

This paper is supported by the Sectoral Operational Programme Human Resources Development (SOP HRD), ID76945 financed from the European Social Fund and by the Romanian Government under the contract number POSDRU/107/1.5/S/76945.

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RISKS AND THREATS RECOGNIZED IN THE SECURITY ENVIRONMENT

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Abstract:

Since the terrorist attacks have not ceased being a problem on the agenda of South - Eastern Europe countries, and also for large organizations / international actors, the security strategies / policies in the region continue to sustain further changes so as to ensure public safety, first of all.

Thus, starting from the situations where the lack of information led to significant losses as a result of not taking optimal decisions, through this paper are returned to the forefront the intelligence services and information needs.

Significant in this respect are intelligence key-elements on economic, political and military situation issues that are reflected in security initiatives or doctrines.

Prior to obtaining informations, there has been a long process of cooperation between states, ie - a configuration of information communities, together with setting information leaders.

Specifically, at the base of the relations between the countries in South - Eastern Europe there are common objectives, such the capabilities and intentions of potential enemies / competitors.

Keywords: *security environment, global stability, risks and threats, Homeland Security, geopolitical changes*

1. INTRODUCTION

Unsettling and unpredictable, the new security environment requires a specific and determined approach regarding the new asymmetric border threats and risks. During the Cold War and beyond the collapse of the Soviet Union, the issue of threats was dealt from a national perspective, focusing on the dangers of known enemies, definitively identified, even on transnational issues - terrorism, organized crime, proliferation, drug trafficking - were approached from the national perspective. This vision guided the great powers national security policy towards actions designed to influence the behaviour and attitude of other states through intimidation, measures, economic sanctions, military assistance, etc.., with emphasis on the military power, as a guarantee for national security. Currently, this approach in terms of homeland threats remains necessary, but not sufficient, as they can't cover the full spectrum of threats.

The fact that the present security environment is characterized by high instability, unpredictability, - as a manifestation of risks and threats, particularly asymmetric ones, of redefining the relations between the great powers and of the growing freedom of action of the regional actors, set and unset - has already become a common topic in the specialized studies. The recent extension of asymmetric threats can generate insecurity spirals unpredictable for the contemporary international relations. It

manifests strongly the temptation and tendency of some actors (state or non-state) to overcome their inferior hierarchical rank in the system with military, economic, political, ideological or religious weapons. The concepts, capacity and volitional characteristic of their actions may cause some internal and external developments with profound reflections on the near or distant security environment.

2. EUROPEAN SECURITY STRATEGIES

Several key factors were identified as those influencing this process: Eastern European policies aimed at integration into Western organizations, a set of conditions imposed by these institutions and the communist legacy, in addition to traditional models of civilian-military relations in those societies.

On the other hand, Western countries, who want to meet this challenge, but also to realize "the design of stability" in neighboring regions and - sometimes - guided by a sense of duty to reunify Europe, have defined specific criteria for the institutions membership at an European and Euro-Atlantic level.

Revising the existing national defense concepts - or in force - in South-Eastern Europe, where large nations, medium and small states, try to coexist and cooperate is difficult.

Countries that make up South Eastern Europe, most of them sources of culture and civilization, cover differently certain portions of this area, each one with some specific features that we commonly call:

i. The Wider Black Sea Region with the Asian area;
ii. The Balkan region composed of the Western Balkans, Eastern Balkans and the complementary area, Bulgaria and Romania;
iii. The South-East European maritime region.

The distribution is heterogeneous, some states (parts of states) in south - eastern Europe are part of one, two or more regions.

Wide security risks increased in parallel with the broadening definition of security.

A feature of the international system in the restructuring process is the simultaneous presence of traditional security risks and new threats that often take a form and aime at a global scope. New types of challenges and threats are more numerous, less transparent and forward-looking.

A typical trend is represented by the vague line between external and internal risk factors. Risk factors are manifested both at a global, regional, and national level, in general not separately, but simultaneously, mutually reinforcing.

New challenges can be met effectively through cooperation with international organizations and institutions and other forms of cooperation.

The chain of events and changes in south-eastern Europe during the 90's led to political responses, political approaches and long-term strategies sophisticated enough for the region as part of Europe.

The experience of the four wars that took place in recent years in the South-Eastern Europe led to rethinking and improving the strategic principles and instruments of the European Union for South Eastern Europe.

The largest and most dangerous instabilities in international relations are typical for transition periods between old and new structures of the international system at different levels. In these circumstances, even the smallest changes can cause strong reactions of transforming the initial conditions.

The approach betwen security policies applied not only in South-Eastern and Central Europe to the U.S. ones, integrated in the Homeland Security concept continues to be realized gradually, given the common goals of removing threats from non-state actors, leading to the proliferation of such phenomena as the ones mentioned above.

The challenges of the contemporary world, although different in nature, have in common the fact that they challenge the

capacity of security institutions to meeting them.

The new security and stability architecture was and is shaped by the values and standards of democracy, freedoms and human rights, the rule of law and market economy, in order to ensure the global, regional and zonal stability.

Within the global social system occurs, through this movement, a resetting of interests and thus, of forms and means of achieving them, correlated with changes / mutations in the fields of technology, social, economics, politics and mind.

Being one of the main threats to human society and the world states, after more than a decade of the sinister event in the United States, international terrorism continues to be a very serious threat both to the structure and social cohesion, and also to the security of European states, which were not immune to this kind of danger.[1]

Thus, changes affecting the international security environment have resulted in clarifying a vision of the international community aimed at strengthening global peace and security and hence on reducing the conflicting tensions of all kinds and causes generating major international disputes.

3. HOMELAND SECURITY – AMERICAN AND EUROPEAN PERSPECTIVES

While for the U.S. developing the concept of Homeland Security means engaging in a comprehensive reorganization process of the national security system, for the European countries, implementing and developing the same concept is realized within the existing institutional framework and regards countering terrorism and other types of hazards and security threats. Overall, the core of the European approach on societal security is homeland security, ie protection of citizens.

The european definition of terrorism, in Article 1 of the *Framework Decision on combating terrorism (2002)*, provides that terrorist offenses are those actions, criminal in nature, included in a list of serious crimes against persons and property, which "produce a country or an international organization, some damage, in order: to intimidate the population, to force unjustified government or international organization to do or not in some way, to destabilize or destroy their fundamental political, constitutional, economic or social structures".[2]

The list includes nine crimes: attacks on a person's life which may cause death, physical attacks on a person, kidnapping or hostage taking, producing severe damage to government or public facility, a transport system, an infrastructure facility, including an information system, a fixed platform located on the continental shelf, a public place or private property, damages that may endanger human life or cause major economic losses, seizure of aircraft, ship or other persons or property transports; production, possession, acquisition, transport, supply or use of weapons, explosives or NBC weapons, also the biological weapons research and development, chemical and nuclear, spills of dangerous substances or fire, floods or explosions with effects that endanger human lives, interfering with / destroying water supplies, electricity networks and vital natural resources, with effects that endanger human lives, threat with producing any of the actions listed above.

EU, which now assumes the position of "global partner", began since 2003 conducting

civilian, police and military forces in areas of crisis and conflict.[3] Thus, in this period, Member States have conducted over 9,500 people in 19 operations, of which 10 are continued to the present (EUFOR-Althea, EUPM, EU Planning Team Kosovo, EUPOL COPPS, EUBAM Rafah, EUJUST Lex, EUPOL Afghanistan, EUPOL RD Congo, EUSEC DR Congo, Darfur).

According to the European Security Strategy, these operations are tools to achieving strategic objectives of the organization, in order to develop a strategic culture that promotes an early, rapid intervention, and when necessary, intensive.[4]

Thus, similar to the American vision, staff development beyond the organization's members is one of the most important ways to achieve security in the Union, protect its interests.

Unlike the U.S. case, the European budget instrument for achieving "the security in the space of interest" is more difficult to identify. Up to and including 2006, the European budget was divided into eight chapters, as follows: agriculture, structural operations, internal policies, external action, administration, reserves, pre-adhering strategy, compensations.

At an international level, there are opinions that Europeans have not urged the application of the law enforcement tools to strengthen the "security in the area of interest."[5] Meanwhile, other analysts say that European governments strategy in terms of homeland security lies in the integration of counter-terrorism strategies in existing efforts to manage crises and emergencies, so as to give greater flexibility in responding to the challenges to security.

On the other hand, the U.S. continues to play a role in both the security of the European continent, despite the crisis related to the intervention in Iraq and the fight against terrorism. U.S. strategy for Europe has its traditional content of military defense, but also a strong intelligence component. The U.S. has the ***Linked Operational Intelligence Centers Europe (LOCE)*** system, which provides strategic and tactical informations for the NATO troops. The original system, exclusively American, called ***Operational Capability Europe Limited***, which didn't reveale its specific intelligence as its current name which, has kept the acronym LOCE. Balkan wars turned LOCE from a military safe and effective communication network in an intelligence model, essential for Joint Deployable Intelligence Support Systems (JDISS), a common base of informations in NATO.

A common European intelligence policy is not only necessary but also indispensable, Alessandro Politi assessed in a study for the Institute for Security Studies in Paris. This enthusiastic assessment should be seen more as signaling a normal course for the principles of European construction, but which often contradicts with the reality. While we hope for a common European policy on intelligence, we must acknowledge the persistence of autarchic traditions, especially in services with a long history.

A common security policy, in the countries of South - Eastern Europe involves a common perception of risks, implicilty a common approach on threats. Modern activity will thus be necessary for the precise application of these common European policies, this time in the security field.

Intelligence cooperation is indeed a matter of high confidentiality in a scene where shadows matter as much as light. People involved in that business will certainly not expose the nature, the purpose, the scope, the channels and the depth of their cooperation. To such opacity, one has to add the very nature of what is at stake. It is about using the means offered by international cooperation for exchanging very sensitive information in order to identify, deter, prevent and act against terrorism. In that sense international intelligence cooperation for protecting the nation, the homeland, is about linking the local to the global.[6]

To some degree, the fusion process involves every level and sector (discipline) of government, the private-sector, and the public. The level of involvement from these participants will vary based on specific circumstances. Some disciplines, such as law

enforcement, represent a core component of the fusion process because of the relationship between crime and because, in many cases, law enforcement authorities are best-suited to coordinate statewide and local fusion efforts. Minimally, the fusion process should be organized and coordinated on a statewide level and each State should establish and maintain an analytic center to facilitate the fusion process.

The public should be engaged through public education programs that describe what they should look for and what to do if they observe suspicious activities or circumstances.

Efforts should be organized and managed on a geographic basis and scalable so adjustments can be made based on changes in the operating and/or threat environment. While national standards and guidelines should guide the institutionalization of the process, the actual technological infrastructure and operational protocols used by individual jurisdictions should be based on the management structure, specific needs, and capabilities of each individual jurisdiction.[7]

4. CONCLUSIONS

Systemic nature of the principal risks and instabilities caused by structural causes, legacies of the past, ethnic and religious diversity of the area, heterogeneous social content and low political culture, also the policies of particular states requiring a complex system of interrelated strategies in the European Union with a sophisticated implementation management.

The problem of transforming the national armed forces is a subject on the agenda of almost every European country, whether belonging to the European Union or NATO or not yet a member of any one of the two.

In the past 20 years, major geopolitical changes in Europe and new perceptions as failed states and terrorism within the military field have caused a shift from traditional homeland defense tasks to peacekeeping operations, crisis management and networking security.

According to the presentations on the complexity of European, it concludes that the countries of South Eastern Europe are a favorable environment for active cooperation in intelligence between several states. Also, to achieve its ambitious goals, the EU needs a modern and efficient intelligence activity.

Also, the countries in South Eastern Europe could learn many more lessons in reforming the security sector.

But this harmonizing process can not generate unifying solutions required for transforming armed forces in South - Eastern Europe, which are not taken into account in particular as various economic opportunities and social conditions in each Balkan country.

Conceptual and also functional, national defense and security, the North Atlantic and European area security and defense, in general, but also in terms of the specific case of Romania, in particular, are influenced by the geopolitical and geostrategic changes produced in the international environment, in fact, in the global environment.

The European security system is facing recently times the same major problems that characterize the evolution of European integration: extending and deepening of the European project. Meanwhile, the impact of external factors, mostly related to globalization, is more intense and complex.

European security is an indivisible phenomenon, and thus also the European security system is more uniform, and ceased to be a purely military problem and witnesses a lot of implications or economic, social, environmental, informational, cultural, religious aspects.

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e-INSURANCE - ASPECTS REGARDING THE ROMANIA ON-LINE INSURANCE MARKET

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Abstract:

This paper proposes to analyze some aspects regarding the online Romanian insurance market. The most important step made towards the development of the insurance electronic commerce in Romanian was due to ISC decision to oblige the Romanian insurers to issue compulsory insurance policies only in the electronic system. In the period 2007-2012 the Romanian insurance market had had increased and decreases this was due to the economic crisis. This market is dominated by motor insurance at a rate of over 60%. Despite the fact that over 50% of the insurance policies in Romania are issued online, electronic commerce with insurance represents only 5% of the total market.

Keywords*: e-insurance, rate comparator, electronic emission, insurance broker*

1. INTRODUCTION

The evolution of informatics society is being felt in all fields and in the farthest corners of the world. In the financial-banking and insurance sectors due to the high volume of information to be processed and sent to long distance sometimes, the use and development of software programs has become a necessity for many years.

Besides the large amount of information that is processed in a financial market is important to note the value of trades or businesses menus in this market. Different levels of development of member states are increasing internal competition between the companies.

This makes large multinational corporations, very active in financial and banking and insurance domain, to enter into the national markets. Appearance of the financial crisis has led to the need to reduce production costs, trading and other administrative expenses. IT solutions have always been an important lever to reduce operational costs.

The evolution and development of online trade is a priority for all areas including insurance. In this paper we present several problems that lead to the creation and development of the online market in the insurance sector.

2. ON LINE & OF LINE IN THE ROMANIAN INSSURANCE MARKET

2.1. E lectronic C ommerce w ith Insurances. Electronic commerce has turned from a novelty of the past to a nowadays necessity. Now everyone is online and

presence in this area is essential for evolution and business development. Electronic commerce is defined as "a modern technology to do business, which addresses the needs of organizations, merchants and consumers to reduce transaction costs while improving the quality of goods and services and increasing the speed of delivery."(1, p.38) We would like to present below some aspects of online issuance trading and of online issue for insurance policies. Currently, in Romania there are 18 classes of insurance approved by the Insurance Supervisory Commission (8). To these 18 classes are relate two compulsory insurance policies: MTPL and PAD, and a variety of optional insurance policy. From the variety of insurance products offered by insurers not all are accessible to the online insurance trade. Legislation provides that two mandatory insurance policies (RCA and PAD) to be issued only in electronic system, online. Obligation of electronic issue of insurance policies was a necessary step in the development and modernization of the insurance market and electronic commerce with insurance. Each insurance companies authorized in Romania have advanced software that issue insurance policies in various forms depending on the type of insurance policy and the class in which they fit in. With the development and implementation of various accounting and management solutions for the insurance market was done one step forward in strengthening the e-insurance area.

The most important step was taken with the issuance of the Insurance Supervisory Commission Order No. 21/2009 (8). Thus all insurance companies licensed to practice MTPL insurance were obliged since January 1, 2010 to issue these insurance policies only electronically through online systems. By issuing MTPL policies online it could achieve a unified database to apply the bonus-mauls system from MTPL insurance pricing.

The transition from the classic sales took place not very easy since every motor vehicle liability insurer uses its own software application to electronic issuance of insurance policies. In this sense we give examples for the preparation and operation of insurance software. Insurance company Astra SA began issuing electronic motor third party liability policies from august 2009. This allowed him to experiment more and get a significant advance on start. Today on same interface software can deliver all mandatory and optional insurance policies of the company. This insurance company has the first rank in top 10 insurers in Romania.

By implementing online issue of MTPL policies, the insured and vehicle information are recorded in real time, for the first time in the history of insurance in Romania, into a common database. This is CEDAM database which is managed by the Insurance Supervisory Commission. In this database is included a centralized evidence MTPL insurance policies issued by all insurers authorized to conduct mandatory liability insurance in Romania. It is also a public database that provides nonstop data about online history for MTPL insurance policy for vehicles registered in Romania. The access to the database is done by entering the registration number or vehicle identification number and the date in which we're interested to check the data for the car insurance. CEDAM database will provide basic information "vehicle with registration / identification number is insured at the insurance company ... branch ..." (Fig.1) CEDAM database can be accessed also for information on registered and paid damages. (Fig.2) Information about damages is available for insurance policies issued by Romanian insurers from 1 July 2009. The information provided by CEDAM inform antic system refers to the distribution of the insured to a certain class of bonus malus. You can track this way to accurately track for MTPL policyholders since 2009.

2.2 The rol e of MTPL policies to t he development of the online sales. To issue auto insurance policies, a large amount of information needs to be processed and stored. Correctness of the date data entered influence the bonus-malus classes and the price of the insurance policy.

The creation of the national CEDAM

database was one of the first steps to develop online trade with auto liability insurance.

Now in its third year of electronic issuance, when for each of the vehicles registered in our country the identification data were introduced at least once through the insurers electronic platforms where corrected almost all data recording errors.

Electronic commerce with any products can take place between partners who are long distance one from the other. The electronic commerce with insurance in addition to advantages, for MTPL has some deficiencies. If at the purchase certain features had been entered incorrectly the car will get a lower price for the insurance. If the insurance period of 6 or 12 months had passed and no insured event happened, damaged in the collection of insurance premium is the insurer because he didn't charged properly the insurance price. Therefore we find that it was defrauded the insurer.

2.3 The role of PAD policies in the development of the online insurances sales. Starting with 15 July 2010 a second class of policies has the obligation to be issued electronically directly from insurers portal. This policy is called PAD and it is a compulsory home insurance policy (8). If MTPL insurance policy has different rates from one insurer to another insurance policy PAD is standardized. The premium is the same for all insurers authorized to be subscribed. The price is 10 or 20 Euros depending on the type of construction. Broker's fee for this product is small. Sales volume increased in the first months because of the law enforcement. Later subscriptions declined considerably as a result of the substitution with voluntary policies. Subscriptions have dropped also because the local government did not apply the sanctions provided by law.

2.4 Motor Hull on line - opportunities and logistical difficulties for insurers and brokers. Motor Hull insurance policy is issued online from the insurer's portals, or through the web-service of the insurance brokers. For the insurance contract to be valid, it must be signed by the insured person or his representative. Also is required an all risk inspection for the vehicle. This involves performing a minimum number of photographs of the vehicle. Are highlighted the cars identification number, registration number, mileage on board, and the date of the conclusion of the policy, other technical or existing damage on the vehicle. At some insurance companies the online issue of Motor Hull insurance policy has some restrictions in the computer applications. Online issue is conditioned by simultaneous loading pictures in risk inspection and registration certificate with valid technical inspection of the vehicle.

Electronic commerce with insurances encounters some difficulties in relations with insurance companies and brokers. Insurers support in a very small measure the brokers for electronic issuance of insurance policies and the development of online commerce with insurers. Some insurers (Allianz Tiriac, City Insurance) practice differentiated tariffs to electronic sell of policies. The tariffs for the policies are reduced by 5-10% in online sales through their own sites. Insurers are aware that through the electronic issuance of policies, insurance brokers have access in real, time through comparative sites, to all insurance rates in the market at a time. Brokers can influence the buyer for an insurer or another. The decision to choose the best insurer may be in competition with the intention of insurance brokers to sell / mediate insurance policy for one insurer or another. It

can be chosen the insurer that gives to the broker the highest percentage of the insurance premium fee. "The Web has become a new channel for public exploration where traditional brokers must be present as well. Has become unavoidable necessary to have a website dedicated to the public that can provide information about products, prices, and enable subscription rates" (5, pag.51)

On the insurance market in Romania in the period 2007-2012 the share of general insurance underwriting had a rate of about 90% (3). These are completed through brokers in increasing proportions from year to year. In 2012, the volume of intermediation through brokers reached 54% of total general insurance. (6).

Among the general insurance the motor insurance are sold in the highest percentage occupying more than 60% of the subscriptions. MTPL insurance occupies over 50% of subscriptions. This type of insurance is issued only electronically and is a favorite within the electronic commerce with insurance. Most of insurance brokers are selling insurance policies in the classical system. There are insurance brokers who have dedicated all them activity only to the e-commerce insurance. Both types of brokers are using the prices comparators. (Figure 3).

The 12 insurers authorized by ISC to sell insurance MTPL policies have a great diversity of rates. With MTPL insurance tariff liberalization they were segmented by several criteria. Besides the characteristics of the vehicle and apply the bonus malus MTPL rates are influenced by: urban or rural residence, driver's age, vehicle usage, geographic area. There are applied social protection measures by reducing tariffs for pensioners, people with disabilities, employees, etc... (Figure 4).

The online insurance sales websites of the brokers have insurance prices comparators. We can say that in this case not the brokers are selling the insurances but the prices from the comparators. The broker is consultant and client representative. Broker's promise of selecting the best insurance deals based on customer needs is more complex. It's hard to communicate it and to keep it, than just click on a button to command for an insurance policy.

3. CONCLUSIONS

From the statistics of the Insurance Supervisory Commission and those from organizations who monitor the online insurance market in Romania are shows that electronic commerce with insurance does not exceed 5% of sales. (6) Most insurance sold online are MTPL policies and policies for travel abroad. Mandatory electronic issuance of insurance policies MTPL was the most important step that made Romanian insurers for insurance e-commerce development and implementation of financial market e-insurance concept.

If applying Bonus Malus system for MTPL had positive effects, the creation of a common database among insurers for damages recorded and hull insurance is recommended. Online commerce is gaining ground in Romania, but still suffers from a lack of trust among the clients. Currently CSA has not issued clear guidelines for this trade.

It requires more and more in the near future a clear need for regulation in the online insurance sales. Insurance premium discounts can only be granted by the insurer decision and not for the ones of the brokers. Currently in Romania online insurance selling is carried out also by other e-commerce companies that are selling computer equipment, auto parts or fuel, travel agencies and others. Not all of these companies have specialized personnel in insurance consultancy.

Online insurance market regulation should start with setting a minimum package of information required to be transmitted by the insurance broker. It cannot forbid the creation of online insurance selling websites and other financial products, the Supervisory Institution may determine in consultation with professional entities of insurers and brokers for a set of trade rules to be followed in the online commerce with insurance.

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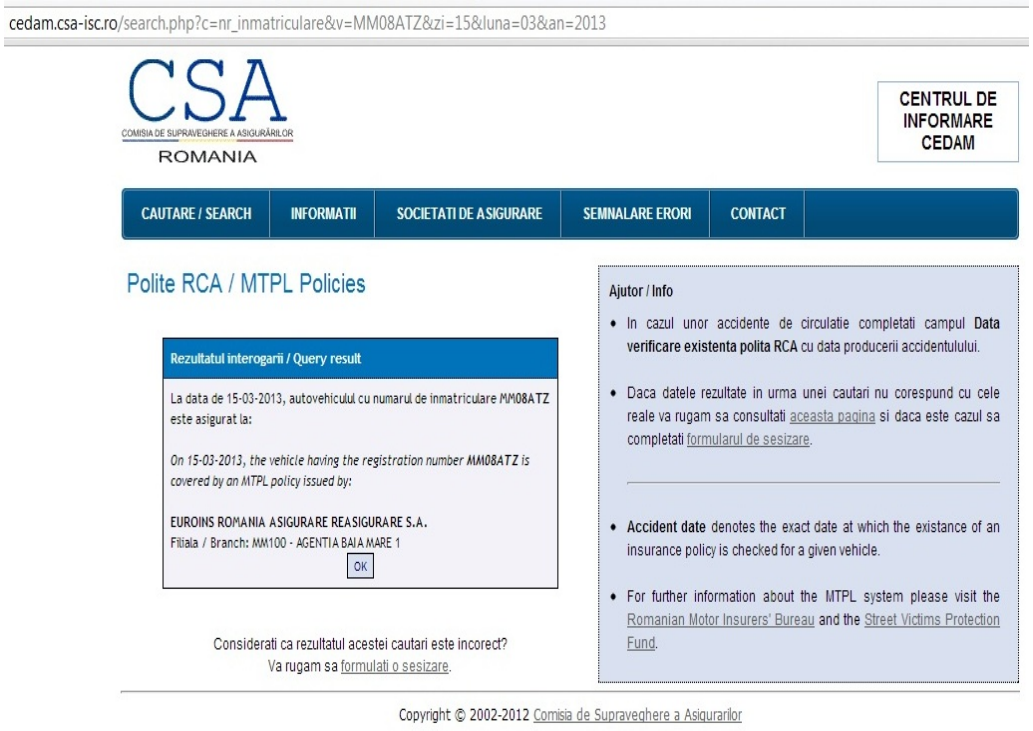
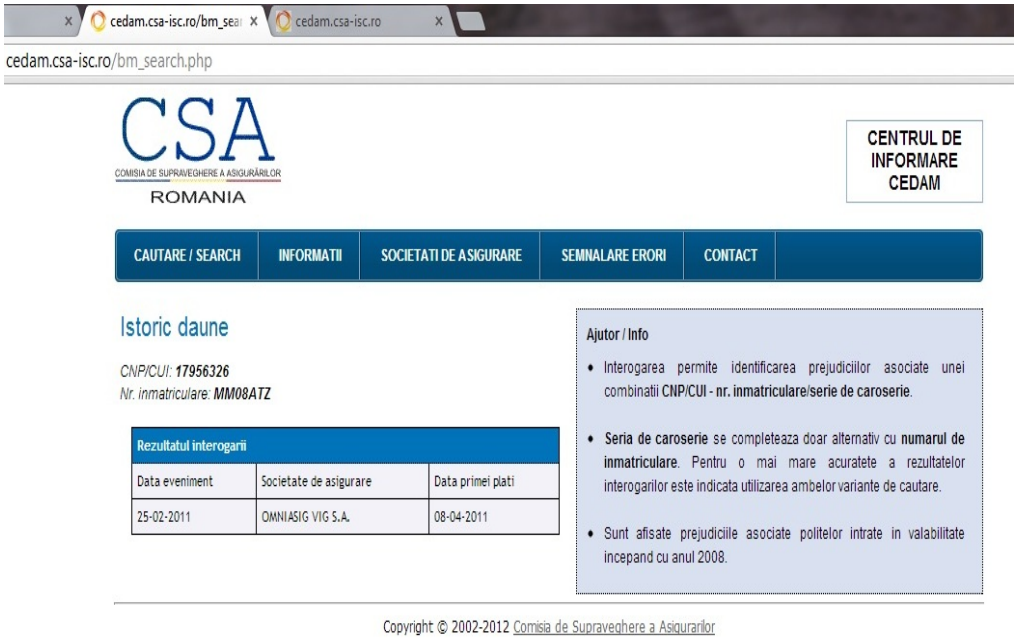


Fig. 1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Nr. inmatriculare: MM08ATZ
Rezultatul interogarii
Data eveniment
Societate de asigurare
Data primei plati
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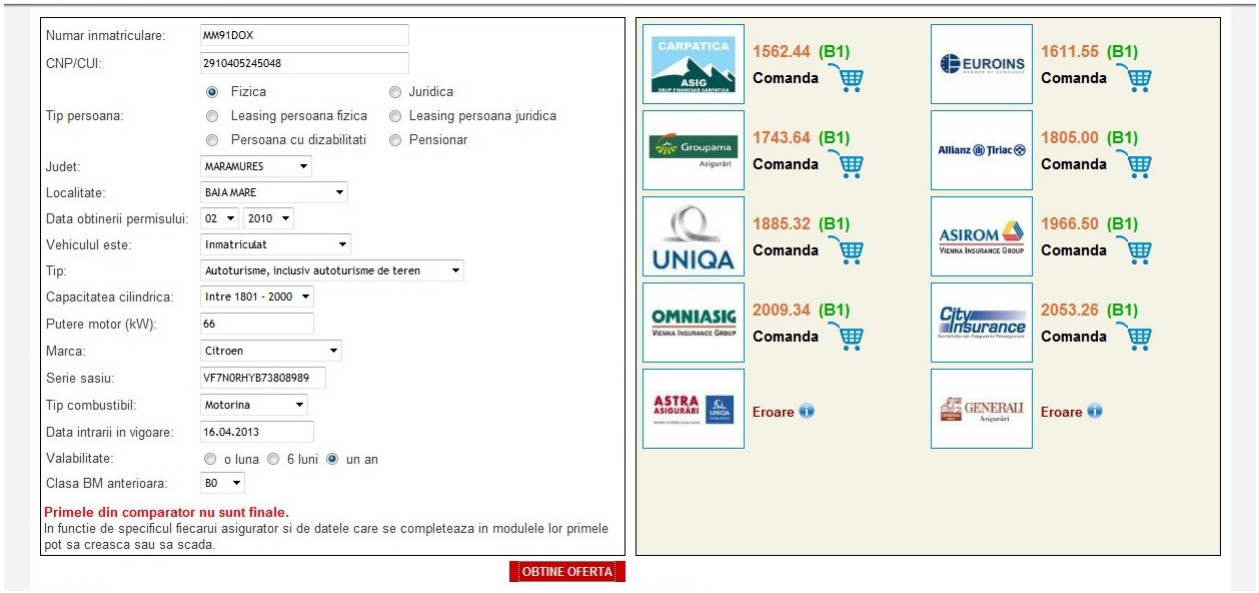
08-04-2011
Ajutor / Info
Interogarea permite identificarea prejudiciilor asociate unei combinatii CNP/CUI - nr. inmatriculare/serie de caroserie.
Seria de caroserie se completeaza doar alternativ cu numarul de inmatriculare. Pentru o mai mare acuratete a rezultatelor interogarilor este indicata utilizarea ambelor variante de cautare.
Sunt afisate prejudiciile asociate politelor intrate in valabilitate incepand cu anul 2008.
Copyright © 2002-2012 Comisia de Supraveghere a Asigurarilor

Fig 2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Localitate: BAIA MARE
Data obtinerii permisului: 02 2010
Vehiculul este: Inmatriculat
Tip: Autoturisme, inclusiv autoturisme de teren
Capacitatea cilindrica: Intre 1801 - 2000
Putere motor (kW): 66
Marca: Citroen
Serie sasiu: VF7N0RHYB73808989
Tip combustibil: Motorina
Data intrarii in vigoare: 16.04.2013
Valabilitate: o luna 6 luni un an
Clasa BM anterioara: 80
Primele din comparator nu sunt finale.
In functie de specificul fiecarui asigurator si de datele care se completeaza in modulele lor primele pot sa creasca sau sa scada.
OBTINE OFERTA
CARPATICA ASIG 1562.44 (B1) Comanda
EUROINS 1611.55 (B1) Comanda
Groupama Asigurări 1743.64 (B1) Comanda
Allianz Ţiriac 1805.00 (B1) Comanda
UNIQA 1885.32 (B1) Comanda
ASIROM Vienna Insurance Group 1966.50 (B1) Comanda
OMNIASIG Vienna Insurance Group 2009.34 (B1) Comanda
City Insurance 2053.26 (B1) Comanda
ASTRA ASIGURARI UNIQA Eroare
GENERALI Asigurări Eroare

Fig 3

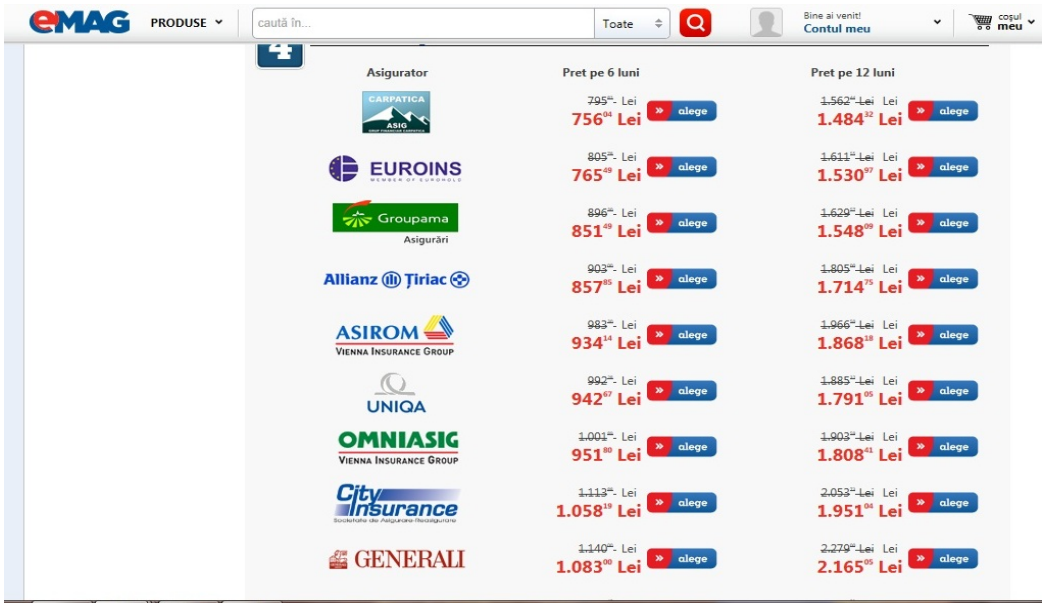

Fig 4

Table 1

Evolution of general insurance in Romania in 2007-2012

Year / Lei	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Gross Written Premiums-General insurance	**5.726.752**	**7.068.173**	**7.241.584**	**6.639.733**	**6.083.943**	**6.419.711**
Gross Written Premiums-Auto insurance	**4.120.191**	**5.400.859**	**5.583.054**	**4.947.736**	**3.961.491**	**3.949.406**

Source: authors procession based on information from annual Reports of ISC in 2007-2011. For 2012, estimation based on information provided by insurers, unaudited data

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REACTIONS TO SHOCKS OF THE ROMANIAN COMPANIES STOCK PRICES

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Abstract: *In the recent context, capital markets are often affected by extreme events which generate sharp changes to the stock prices. According to the Efficient Market Hypothesis, all the information that causes such shocks is incorporated in the same day in stock prices. However, empirical researches revealed situations in which the reactions of stock prices to shocks lasted for many days. In this paper we investigate the reactions to shocks of the stock prices of 14 companies from the first tier of the Bucharest Stock Exchange. We employ daily values of their closing stock prices between 2000 and 2012. In order to capture the impact of market instability we split this sample of data into two sub-samples: a relative quiet period from 2000 to 2006 and a more turbulent period from 2007 to 2012. We identify positive and negative shocks and we quantify the stock prices reactions to these sharp changes. The results indicate that turbulences of the capital market stimulated underreactions to the negative shocks.*

Keywords: *Stock market shocks, Romanian capital market, Underreaction, Overreaction*

1. INTRODUCTION

In the last decades the capital markets became very sensitive to extreme events that could caused sharp changes of stock prices. The study of the financial market reactions to such shocks is stimulated by practical and theoretical reasons. The knowledge about after shock behaviors of stock returns could be useful in the investment strategies. The financial market reactions to shocks became also one of the main battlefields between two theories: the Efficient Market Hypothesis (EMH) and the Behavioral Finance. EMH presumes that investors behave rationally and all the information that caused a shock is incorporated in the same day in stock prices [5]. By contrary, the Behavioral Finance revealed two types of the irrational reactions. The first type, Overreactions Hypothesis (OH) describes a situation where the investors display exaggerated behaviors when a shock occurs aggravating its effects. In the next days they adjust their attitude restoring the equilibrium [4, 8]. Such circumstances could be exploited by contrarian strategies based on buying the past loser stocks and selling the past winner stocks [1]. The second type, the Underreaction Hypothesis (UH) presents a situation in which investors initially underestimate a shock correcting lately their behavior [6]. This kind of circumstances could be exploited by momentum strategies in which the past loser stocks are sold and the past winner stocks are bought [2].

An important aspect of the after shock reactions consists in their persistence over time. Some studies revealed different behaviors during quiet and turbulent times [3,7].

In this paper we approach the reactions to shocks displayed by the stocks of 14

companies from the first tier of the Bucharest Stock Exchange (BSE). We investigate the after shock behaviors for two periods of time. The first one, from 2000 to 2006, when the Romanian capital market consolidated, could be considered as relatively quiet. Instead, during the second one, from 2007 to 2012, the effects of some processes (Romania's adhesion to European Union, the recent global crisis etc.) generated turbulences on BSE.

The rest of this paper is organized as it follows. The second part describes the methods of investigating the after shocks reactions, the third part presents the results and the fourth part concludes.

2. DATA AND METHODOLOGY

In our investigation we use daily closing values of 14 companies stocks from the first tier of BSE for a time period between January 2000 and December 2012. The sample of 14 companies includes six financial companies: a bank, BANCA TRANSILVANIA S. A. (TLV) and five investment funds (SIFs): SIF BANAT CRISANA S.A. (SIF1), SIF MOLDOVA S.A., (SIF2), SIF TRANSILVANIA S.A. (SIF 3), SIF MUNTENIA S.A (SIF 4) and SIF OLTENIA S.A. (SIF5). There are also eight non-financial companies ALRO S. A. (ALR), ANTIBIOTICE S. A. (ATB), S. C. AZOMUREŞ S. A. (AZO), ELECTROMAGNETICA S. A. BUCURESTI (ELMA), IMPACT DEVELOPER & CONTRACTOR S.A. (IMP), OIL TERMINAL S. A. (OIL), OLTCHIM S. A. RM. VALCEA (OLT) and TURBOMECANICA S. A. (TBM). For each stock we split the sample of data into two sub-samples:

- first sub-sample, corresponding to a relative quiet period, from 1st of January 2000 to the 31st of December 2006;
- second sub-sample, corresponding to a turbulent period, from the 1st of January 2007 to the 31st of December 2012.

The reactions of stock prices to the shocks are analyzed following the method used by Lasfer et al. (2003) [7]. For each stock i we compute the raw return ($r_{i,t}$) by the formula:

$$r_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} * 100 \quad (1)$$

where $P_{i,t}$ and $P_{i,t-1}$ are the closing prices of stock i on the days t and t-1, respectively.

We identify a positive shock occurred in a day t^+ by imposing the condition:

$$r_{i,t^+} > AVG(r_{i,[-60;-11]}) + 2 * STD(r_{i,[-60;-11]}) \quad (2)$$

where r_{i,t^+} is the return of the index i from the day t^+, AVG ($r_{i,[-60;-11]}$) is the average daily returns for a period that starts 60 days before the day t^+, and ends 11 days before the day t^+, while STD ($r_{i,[-60;-11]}$) is the standard deviation for the same period.

We identify a negative shock occurred in a day t^- by imposing the condition:

$$r_{i,t^-} < AVG(r_{i,[-60;-11]}) - 2 * STD(r_{i,[-60;-11]}) \quad (3)$$

where r_{i,t^-} is the return of the index i from the day t^-.

The autonomous shocks are revealed by excluding the successive shocks (A successive shock is a shock that occurs less than 10 days after an autonomous shock).

For each autonomous shock we compute the post-shocks abnormal returns ($AR_{i,t}$) using the formula:

$$AR_{i,t} = r_{i,t} - AVG(r_{i,[-60;-11]}) \quad (4)$$

Then we calculate the Cumulative Abnormal Returns for the next 1, 2, 3, 4 and 5 days as:

$$CAR_{i,t}^n = \sum_{t=1}^{n} AR_{i,t} \quad (5)$$

where $CAR_{i,t}^n$ is the Cumulative Abnormal Returns of the stock i for the next n days that follow an autonomous shock from a day t.

We compute the Average Cumulative Abnormal Returns of the stock i for the next n days ($ACAR_{i,t}^n$) as:

$$ACAR_{i,t}^n = \frac{1}{n}\sum_{t=1}^{n} CAR_{i,t} \quad (6)$$

We use t-statistics to test the significance of Average Cumulative Abnormal Returns. The results are used in classifying the after shock behaviors of returns into three categories:

- overreactions, when a positive shock is followed by significant negative abnormal returns or when a negative shock is followed by significant positive abnormal returns;
- underreactions, when a positive shock is followed by significant positive abnormal

returns or when a negative shock is followed by significant negative abnormal returns;

- efficient reactions, when we don't find significant positive or negative abnormal returns after an autonomous shock.

3. EMPIRICAL RESULTS

The Table 1 reports the reactions to autonomous positive shocks. For the period 2000 - 2006 we find underreactions for six stocks: ATB (the days t+1 and t+5), AZO (the days t+2, t+3 and t+5), OIL (the day t+2), OLT (the days t+1, t+2 and t+3), SIF4 (the days t+3, t+4 and t+5)and TLV (the day t+1). A single stock, ELMA (the day t+5) overreacted, while the other seven stocks exhibited efficient reactions. During the period 2007 - 2012 the results indicate underreactions for five stocks: ALR (the day t+3), OLT (for all five days that followed a positive shock), SIF2 (the days t+1 and t+2), SIF3 (the days t+1 and t+2) and SIF4 (the days t+1, t+2 and t+3), while the other nine stocks had efficient reactions.

The reactions to negative shocks are presented in the Table 2. For the period 2000 - 2006 12 stocks displayed efficient reactions, OIL underreacted (the day t+1), while OLT overreacted (the days t+1 and t+2). During the period 2007-2012 we find overreactions for four stocks: ATB (the days t+4 and t+5), AZO (the day t+4), OIL (the days t+3 and t+4) and TBM (the days t+3 and t+4), underreactions for six stocks: IMP (the day t+3), SIF1 (the day t+2), SIF2 (the days t+1, t+3, t+4 and t+5), SIF3 (the day t+3), SIF4 (the days t+2 and t+3) and SIF5 (the day t+2), while the other four stocks exhibited efficient reactions.

4. CONCLUSIONS

In this paper we analyzed the reactions to shocks of 14 stocks from BSE for two periods of time: the first one relatively quiet, from 2000 to 2006 and the second, a turbulent one, from 2007 to 2012. Our results indicate some significant differences between the two periods.

In the case of reactions to positive shocks we find that passing from quiet to turbulent circumstances increased the number of stocks with efficient behaviors from seven to nine. This change could be associated to the BSE instability which eliminated some patterns in the investors' behaviors. In the case of negative shocks the changes are more obvious. All the five stocks of fund investment passed from efficient reactions to underreactions. This evolution could be linked to a pessimist attitude induced to investors by the global crisis. Such attitude made them believe that effects of the bad news would persist for more than one day.

This investigation could be extended to other stocks from BSE.

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APPENDIX

Table 1 - Reactions to autonomous positive shocks

Stock	Number of positive shocks	AR-1	ACAR-2	ACAR-3	ACAR-4	ACAR-5
Panel A: 2000-2006						
ALR	36	1.28471 (1.12975)	2.15614 (1.23723)	0.666471 (0.351136)	0.57635, (0.290496)	-0.818546 (-0.39608)
ATB	40	1.47279 (2.09871**)	1.83873 (1.60004)	2.34465 (1.54005)	2.63577 (1.581)	3.26851 (1.7502*)
AZO	23	1.83056 (1.64647)	2.67821 (2.31369**)	3.33716 (1.81371*)	2.39534 (1.65175)	3.55225 (2.14091**)
ELMA	32	-1.42958 (-1.10591)	-3.18512 (-1.59113)	-2.09238 (-0.947892)	-2.79982 (-1.52455)	-4.09914 (-1.9347*)
IMP	35	0.109293 (0.138027)	0.400268 (0.398896)	1.29648 (1.02353)	0.103885 (0.0703047)	0.174713 (0.109392)
OIL	35	1.47792 (1.48648)	2.7361 (1.89127*)	2.36805 (1.45265)	2.47425 (1.20813)	2.60958 (1.0877)
OLT	39	2.16208 (2.0455**)	2.69795 (1.7968*)	2.54531 (1.69779*)	2.62837 (1.50555)	1.87578 (0.977103)
SIF1	39	0.991198 (1.50263)	0.369261 (0.38551)	0.950514 (0.825641)	0.774697 (0.663631)	1.95589 (1.59843)
SIF2	43	0.621611 (0.792831)	-0.308069 (-0.325303)	-0.0546573 (-0.063285)	-0.192802 (-0.210617)	0.056298 (0.048057)
SIF3	38	0.241134 (0.403702)	-0.392023 (-0.38363)	-0.058085 (-0.04544)	-0.0940346 (-0.057578)	0.007883 (0.004832)
SIF4	38	0.299996 (0.542162)	0.751979 (0.951136)	2.10742 (2.27312**)	2.24801 (2.11362**)	3.09963 (2.65977**)
SIF5	35	0.62086 (0.753914)	0.599622 (0.718237)	2.20236 (1.63747)	1.76518 (1.49375)	2.2653 (1.5483)
TBM	39	-0.277131 (-0.26535)	-0.357937 (-0.274867)	-0.652565 (-0.474401)	-0.67533 (-0.46758)	-1.20345 (-0.7665)
TLV	34	1.08552 (2.11384**)	0.50092 (0.5788)	0.917534 (1.02003)	1.51017 (1.41469)	1.30297 (0.95927)
Panel B: 2007-2012						
ALR	31	1.12816 (1.57308)	0.948182 (1.02804)	2.27741 (1.75213*)	2.74448 (1.64023)	2.79951 (1.39485)
ATB	32	0.994999 (1.38944)	0.695639 (0.791918)	0.62878 (0.569866)	0.281583 (0.28697)	-0.297027 (-0.278535)

AZO	37	1.18965 (1.19791)	1.01652 (0.721718)	1.5545 (0.804131)	2.42872 (0.978391)	2.5851 (1.03347)
ELMA	34	0.0281777 (0.0297107)	-0.215611 (-0.224353)	-0.191639 (-0.158145)	-0.851403 (-0.646633)	-1.2737 (-0.927948)
IMP	31	-0.134904 (-0.118769)	1.51198 (.90663)	0.885133 (0.399295)	0.926103 (0.343167)	0.86303 (0.25644)
OIL	32	0.912754 (0.817113)	0.590447 (0.418741)	1.01363 (0.749784)	1.05501 (0.708919)	1.05957 (0.672403)
OLT	31	4.982 (3.61657***)	6.23061 (3.46849***)	6.84 (3.08878***)	9.05757 (3.3449***)	11.0244 (3.2176***)
SIF1	28	0.484375 (0.66641)	0.314409 (0.371009)	0.438862 (0.335758)	1.38089 (0.77403)	1.98361 (1.01268)
SIF2	31	1.51855 (2.20264**)	1.30963 (1.71486*)	0.53111 (0.652913)	0.480955 (0.411264)	1.75214 (0.936007)
SIF3	37	1.41469 (2.16775**)	1.19874 (1.74593*)	0.556784 (0.639032)	0.26843 (0.242935)	0.253653 (0.22199)
SIF4	31	1.88128 (2.91357***)	1.71052 (2.88232***)	1.44464 (1.88356*)	0.985456 (1.48065)	1.45146 (1.23076)
SIF5	28	0.712514 (0.941642)	1.07285 (1.11177)	0.418724 (0.321376)	0.803163 (0.431304)	1.88285 (0.81806)
TBM	31	1.00307 (0.914403)	1.2201 (1.17547)	1.2985 (1.0538)	2.42997 (1.54543)	2.26397 (1.3173)
TLV	36	0.321113 (0.605463)	0.358994 (0.525421)	0.744188 (0.87307)	-0.177906 (-0.21463)	-0.464823 (-0.43419)

Notes: t-statistic appears in parentheses; ***, **, * mean significant at 0.01, 0.05 and 0.1 levels, respectively

Table 2 - Reactions to the autonomous negative shocks

Stock	**Number of positive shocks**	**AR-1**	**ACAR-2**	**ACAR-3**	**ACAR-4**	**ACAR-5**
Panel A: 2000-2006						
ALR	30	-0.652694 (-0.59151)	-0.147905 (-0.08766)	-1.72605 (-0.755632)	-3.55249 (-1.26144)	-2.3353 (-0.951415)
ATB	27	1.27011 (1.23177)	-0.282812 (-0.17279)	-1.94684 (-0.830454)	-3.07961 (-0.980731)	-5.05781 (-1.29412)
AZO	15	0.391889 (0.220283)	1.63612 (0.587814)	1.55451 (0.592858)	1.8344 (0.591366)	1.2889 (0.401516)
ELMA	25	0.0610092 (0.0820935)	2.58315 (1.59984)	2.4813 (1.42168)	2.19943 (1.3144)	1.43816 (0.758186)
IMP	29	-0.198151 (-0.184435)	-0.569518 (-0.35169)	-0.779294 (-0.378966)	-1.58704 (-0.649825)	-1.70443 (-0.710633)

OIL	20	-2.78912 (-1.85297*)	-1.16255 (-0.65606)	-1.78164 (-0.752569)	-0.79702 (-0.456474)	-0.976569 (-0.554744)
OLT	28	2.2739 (2.65095**)	2.28942 (2.02123*)	2.11817 (1.37588)	3.03578 (1.35113)	2.41127 (0.915416)
SIF1	32	0.711265 (1.04481)	0.33294 (0.310625)	0.621689 (0.548477)	0.407887 (0.309344)	-0.089362 (-0.06001)
SIF2	34	-0.360819 (-0.382265)	-0.371012 (-0.29026)	-0.942389 (-0.59064)	-1.11434 (-0.63838)	-0.776724 (-0.4125)
SIF3	31	0.300398 (0.352551)	0.591515 (0.528843)	0.955291 (0.717792)	1.21581 (0.834575)	1.50397 (0.97561)
SIF4	32	0.277779 (0.271206)	0.754993 (0.484549)	0.917493 (0.54822)	1.03883 (0.545987)	1.05155 (0.506358)
SIF5	35	0.488871 (0.63212)	0.948851 (1.0331)	1.2008 (1.349)	0.993305 (0.81314)	1.16542 (0.935872)
TBM	27	0.991738 (0.63111)	-0.969154 (-0.47511)	-0.565332 (-0.21894)	-1.85852 (-0.55292)	-0.625495 (-0.17014)
TLV	30	-0.668406 (-0.98969)	-0.358702 (-0.35928)	-0.76737 (-0.7582)	-1.99504 (-1.5411)	-2.08526 (-1.2628)
Panel B: 2007-2012						
ALR	25	-0.4333 (-0.4383)	-1.0788 (-0.85063)	-1.68241 (-1.22479)	-2.00722 (-1.35538)	-1.42906 (-0.837285)
ATB	28	-0.607398 (-0.772334)	-1.27836 (-1.09888)	1.2784 (1.22775)	2.09113 (1.9821**)	2.40777 (2.52248**)
AZO	21	2.29972 (1.59046)	3.09297 (1.07643)	4.69142 (1.36501)	6.28902 (1.77089*)	5.26419 (1.16727)
ELMA	23	-1.08166 (-0.864464)	-1.14299 (-0.86586)	-1.56279 (-0.859265)	-0.0716091 (-0.051192)	-0.0114573 (-0.006144)
IMP	30	-1.50804 (-1.56877)	-2.52051 (-1.6048)	-2.91587 (-2.0542**)	-2.11301 (-1.20726)	-2.69441 (-1.53682)
OIL	27	1.30271 (1.31789)	1.17913 (0.943233)	3.35958 (3.1789***)	3.68148 (3.27869***)	4.66966 (3.47756***)
OLT	26	-0.115365 (-0.089129)	-1.41898 (-0.60957)	-0.412388 (-0.157106)	0.564132 (0.219507)	1.15913 (0.411306)
SIF1	28	-1.43278 (-1.51517)	-3.47999 (-2.549**)	-3.01374 (-1.49024)	-2.30056 (-1.0095)	-1.52313 (-0.7717)
SIF2	21	-2.16137 -(1.80833*)	-2.98767 (-1.57792)	-5.04911 (-2.2251**)	-4.6962 (-1.8687*)	-5.05335 (-2.54808**)
SIF3	27	-0.192365 (-0.234544)	-2.0299 (-1.26469)	-3.55446 (-1.84234*)	-3.54032 (-1.50578)	-3.48125 (-1.56693)
SIF4	31	-1.01589 (-1.52425)	-2.27377 (-2.341**)	-2.7007 (-1.9614**)	-1.65515 (-0.99316)	-1.64155 (-1.12451)
SIF5	26	-1.12908 (-1.43636)	-3.45662 (-2.141**)	-2.58622 (-1.42947)	-2.66372 (-1.2851)	-2.09386 (-1.07036)
TBM	31	1.13367 (1.48892)	0.608368 (0.761296)	1.52218 (1.80129*)	2.89066 (1.97659*)	2.16765 (1.2637)
TLV	25	-0.55403 (-0.7199)	0.726172 (0.71938)	-0.763059 (-0.6406)	-0.157031 (-0.1625)	-0.16957 (-0.1315)

Notes: t-statistic appears in parentheses; ***, **, * mean significant at 0.01, 0.05 and 0.1 levels, respectively

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MANAGERIAL SKILLS DEVELOPMENT AS AN INTEGRAL PART OF MANAGERIAL COMPETENCE

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Abstract: *The 21st century brings with it a number of significant economic, political, social and cultural changes that are largely reflected in the quality of people's lives. The quality of life is determined by the competence of managers that they have in the management of the company, as well as different types of organizations to continuously develop and improve. The objective reality is not only related to a manager in the civil sector organizations, as well as managers - commanders in terms of the Armed Forces of the Slovak Republic. Their full professionalization requires managers to thoroughly know the basic aspects of management skills and be able to use them in their practical work. Therefore we tried to outline some of the generally accepted theoretical basis that affect management as well as the related responsibilities of managers in organizations.*

Key words: *management, learning and development of managers, manager's competencies, quality of human resources, managerial work style, personality of the manager.*

Contemporary Management

Seldom in the history of mankind has entered an institution on the scene same pace as the management, reflected both in the short term their distinctive properties. During the nearly one hundred and fifty years management transformed the social and economic structure of developed countries. Powered global economy and outlined new rules for states wishing to become parties to this economy as equal partners. Management underwent transformation too. However, it remains that the task of the management is the same: *this role is to enable people to collective performance through common goals, shared values, structuring, training, and development, all of which need to be given to performance and respond to changes*. (1)

The fundamental purpose of this task has changed - if only because the performance management turned labour resources of unskilled manual workers to high-educated employees with knowledge.

The world of the third millennium brings new requirements for successful performance of management work. It grows the complexity of issues, the dynamics of changes flowing from them growing uncertainty and risks. It's true that tomorrow does not arise. As a result of global development, organization's management is constantly changing and it is clear that managers of 21st century must become masters of change, if they want to be successful. Increase in the pace of these changes and competition accelerate so that organizations must continuously innovate and respond very quickly if they are not

extinguished. Managers who can effectively use the human and material resources for their organizations are an indispensable source of their prosperity in the new global economic conditions.

Managing the changing economic conditions is carried out in the global competitive environment, where the four basic functions - planning, organizing, leading and controlling of people - are performed both in the national and increasingly multinational environment. Shift to the information society, while the quality of human resources has become an important tool to achieve success and competitive advantage. Employees are seen as bearers of knowledge, whereas the binding of geographical location, are becoming increasingly less of a hindrance. Managements of organizations are realizing that now is no longer important where one is coming, but it is essential that you can bring to the organization.

Any changes that managers need to respond in their work are bound to affect the style of *managerial work. It* will be a change in the position of "head of the powerful" the highest authority in a formal position coach, visionary and supporter of creative ideas. This change in style of managerial work is not an end in itself matter as very significant contribution to the formation of qualitatively new way of dealing managers, not to formally telling, but to a form of more personalized and more open contact. New style of behaviour of managers contributes to the creation of a new *organizational culture* in the spirit of shared values, which are a prerequisite for creating a common perception of the objectives and progress of the organization. In that context, an important element without which it is impossible to different management functions and activities carried out, the *managerial skills and capabilities*. There are countless studies that deal with the definition of managerial competencies and capabilities. These include the following:

1. *Create a shared vision*. All employees must know where the organization is going, what it means for them and what specific job requirements in it for them arise.

2. *Develop and adopt a healthy scale of ethical values*. If the manager's ethical values are not high, then the organization will deal with the most likely or fair. This does not mean the end of the organization, but will it cost to human capital because people do not like to work for an organization whose values do not believe in them.

3. *Contribute to the development of people and delegate to them powers*. Ability to judge people is a prerequisite for their successful integration into the right type of place. It requires intuition as well as experience.

4. *To have emotional confidence*. Share keeping with the wide variety of people requires the ability to work with people who may have more knowledge, which must lead and motivate co-decision. Successful managers must be able to say "I do not know how to go on, let's discuss this".

5. *Accept the changes*. Be able to see a change as an opportunity, even at the cost of unpleasant decisions.

6. *Effective communication skills*. A relatively new requirement, which is the result of increasing penetration of the outside world: the media, shareholders, customers, industry analysts, and the public into organizations. This requires managers to be able to properly articulate a compelling vision, interested in the views of all stakeholders, to assess the value of these ideas and get the support of people to promoting and implementing the changes and goals of the organization.

7. *Thinking in global context and prove to set clear priorities*. Select the right opportunities for future development that will support long-term strategy and competitiveness of organizations in a globalized environment. (3)

Basic competencies of managerial workload

To summarize the previous general competencies and capabilities, which should have a manager in current modern management organization, we come to the conclusion that: "*Competence of Manager is his ability to perform a particular function or set of functions, and yet achieve a certain level of performance.*" (5)

Implementation of the management cycle in any organization requires from the manager knowledge of basic competencies, without which the implementation of management at the appropriate level is not possible. Every manager can develop these competencies. The more they are developed, the more successfully he may operate in a stable environment.

Usually, the competencies are specified as a set of knowledge, skills, attitudes, and personality characteristics. We can talk about technical competence and competence in dealing with people. These two groups are sometimes referred to as hard and soft site of management. This distribution is very useful because it reflects two main pages for each work manager, t. j. *technical page* and *work with people*.

On the performance of his duties a manager needs to have some knowledge. These should include economic, business and management skills, technology, specific organization, its structure and organizational culture, management concepts, systems, policies and methods; social, psychological, cultural, political factors, affecting its activity. Of course, different levels of management require different levels and depth of knowledge in different areas.

Skills are the ability to do certain things, to apply knowledge. In generally, the skill to hold managerial positions includes three groups of skills: *professional and technical* (which are tied to a particular industry, sector), *conceptual (*analytic and diagnostic), *and interpersonal* (the ability to communicate, understand and motivate). When characterizing analytical and conceptual skills should be based on this, what position in the hierarchy manager takes. They give an answer to the question "what to do?".

At higher levels they should handle file management approaches each activity: finance, technology management, control system and human resources management. It is also necessary to understand the links between activities, see the organization as a whole. It should also be able to diagnose the problem and its context, to decide on the solutions and implement solutions.

The highest levels of management require analytical and conceptual approaches to the development of the overall strategic objectives of the organization. At this level, it is difficult to understand the economic, industry and competitive forces that affect on the future of the organization, cannot process complex information of the general environment.

Another group consists of *procedural skills*. They give an answer to the question "How to do it?" These include general interpersonal skills. The point is that in order to lead to the application manager effective, it should be able to:

– always clearly defined and specific goals and objectives to people,

–clearly express own wishes, orders, guidelines, ideas, suggestions, etc..,

–accurately articulate their thoughts clearly and objectively, and their report,

–decisions making even in difficult situations,

–accept people's behavior, understand, tolerate and regulate,

– giving people feedback and also from them and expect to receive.

In the perception of managerial work in the context of competence is important to know the *manager personality*

characteristics, based on the assessment of *personality*.

Personality is understood as a unity - integrity - the whole set of biological, psychological and social characteristics of a person. Personality is what determines the behavior of a person in a particular situation. The personality is hidden what specifies uniqueness - individuality - individual (personality structure), but also what determines changes in its behavior (dynamic personality).

For assessing the personality of the manager seems appropriate following psychological breakdown structure of personality which are defined: *activation-motivational characteristics* - attitudes, interests, aspirations, values, ideals, and so on., *Self-regulatory properties* - will, conscience, discipline, *performance characteristics* - physical properties intelligence, creativity, education, expertise, management skills (analyze, predict, decide, lead, control), *social-relational properties* - the need to have an impact, need and ability to co-operation, communication skills (social competence).

However, it is difficult to make a clear list of personality traits manager, because demand for them will vary as different levels of government, as well as various levels of management in different types of organizations to their content and scope. An important role is played by the social context. What are some situations and organizations may be seen as highly desirable, it may be inappropriate in others. Another subject might be, it does not provide a fixed list of properties change over time, as developments in the organization and in society, changes in all these factors in an organization.

Therefore, it is always necessary to define the properties with respect to a particular function in a particular place. You can not do a one-off assessment manager irrespective of social conditions which govern the evolution of the situation in the workplace, in the organization, as well as the further development of subordinates.

Practical implementation of the managerial competence strengthening at the Slovak Armed Forces Academy

a) current system of education

Before we address the practical implementation of management responsibilities in terms of the Armed Forces Academy of the Slovak Republic, we consider it appropriate to point out its mission. The Armed Forces Academy of General Milan Rastislav Štefanik located in Liptovský Mikuláš, is the state military college of university type. It is a top educational and scientific institution, and the only military college university type, prepares officers for the Armed Forces of the Slovak Republic in all three levels of higher education:

- accredited programs in undergraduate study,
- fields of study in engineering studies,
- Sciences doctoral study.

Higher education is carried out in four fields of study:

-Mechanical Engineering – the study program of Mechanical Engineering,

-Electronics - Electronic Systems study program,

-Management - Management study program,

-Security and Defence - the study program of Security and Defence.

Education takes place in a variety of activities (seminars, training courses) and in different organizational forms of study (part-time, additional studies, specialization, retraining ... from highly traditional and the latest teaching methods, including multimedia). The main mission of the Academy is especially higher education.

At the academy is studying nowadays in various forms of university study 276

students. An important role is playing lifelong learning, professional soldiers and workers in a variety of long-term career courses and short-time courses undertaken by individual departments and institutes of the Academy. During the academic year, is going through this type of training around 1,500 members of the Armed Forces. A substantial proportion of students gaining knowledge of fundamentals of management those are included in the curriculum. (4)

b*) Key competences of manager*

In the previous paragraph, we briefly outlined the basic theoretical foundations of managerial competence within management and highlighted some of the fundamental aspects. Now considers it appropriate to indicate how to implement the theoretical - practical training of soldiers and workers in the qualitative strengthening of managerial competencies that are implemented by the Department of Management short courses on "*manager's key competencies*."

Course organizationally runs for three days in which lecture internal as well as external experts. The whole course (which lasted for 100 hours) is divided into six modules, which are aimed at:

- efficiency of the manager – an effective manager,
- teamwork - creating a team building,
- communication of manager,
- Human Resource Management,
- etiquette of the manager,
- Project Management.

Life and experience has shown that we headed in the right direction, course participants present publicly their satisfaction with the practical skills, our analysis of the feedback from the courses and personal experiences of this form of education is only confirmed this opinion.

We can give each other in the form of education in which we see the meaningfulness of these activities and the development of practical implementation of a management theory in everyday practice.

Conclusions

Managerial capabilities and the workload in a wider context is an area with which we can be satisfied for now. The quality of this work has a decisive impact on the workers of organizations, as well as its further progress. Cultivating of skills and purposeful use in organizations is determined by the increase in the overall level of human resource management.

Managers simply need to become more skilled, capable to perform the job. They need to develop the skills, knowledge, attitudes and behaviours that stand in the background above-average performance of the whole organization.

Managerial competencies are becoming one of the key building blocks of success in fulfilling the organizational mission and vision, to create value for all stakeholders. (2) Without these factors can be filled either role well in terms of the Armed Forces of the Slovak Republic. Therefore, it is necessary to improve the competence of managers - captains in their lifelong learning process.

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REDUCE TIME MANUFACTURING IN FLEXIBLE SYSTEMS BY REDUCING RISK FACTORS

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Abstract. *In presented paper will show how we can reduce manufacturing time in flexible manufacturing systems by increasing the flexibility has the effect bad reduce programming time. The case study presented will integrate all operations involving processing stations to be served simultaneously activated and transfer system and increasing flexibility has the effect of changing tools and devices setting. Improving transport and storage of materials leads to lower production down time and unfinished. Length control and optimization of processing operations have the effect of directly reducing operative time. If the risk is underestimated, the protection will be insufficient to cover losses and if overstated, the cost of protection will reduce the excess proceeds of that business. So by identifying and minimizing risk factors will establish an optimal level of production.*

Keywords:.*Flexible manufacturing system, Risk, Production capacity, Degree of usage.*

1. INTRODUCTION

Risk is defined as an uncertain but possible event that appear permanently in the process of technical, human, social, political, events, reflecting the changes of possible results distribution, the probability to happened according to subjective and objective values and having possibly damaging and irreversible consequences [1,2]. Other ways to define risk are [1]:

- the chance to lose
- possibility of losing
- uncertainty affecting the outcome
- actual dispersion expected results
- multidimensional concept that can not be reduced to a single element or a single figure.

The degree of manifestation of risk is directly related to the probability of achievement and therefore there is a risk severity classification (Fig.1).

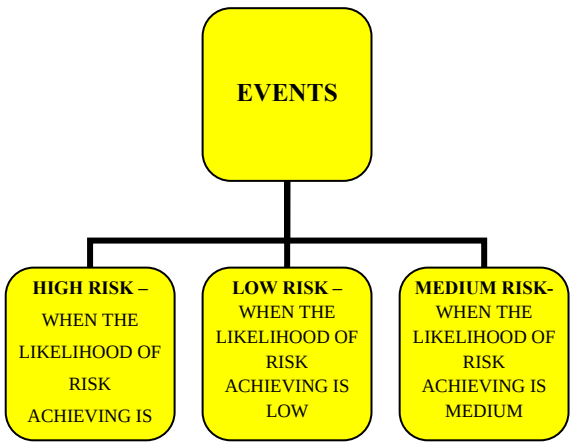

Fig.1. Events classification on the basis of the seriousness involved in their realisation

Risks can be internal or external. In the internal risk we will show that the technology risk, the production risk, the innovation-

modernize risk describe technical and incompatibility between old and new technologies, the inappropriate application of the innovative modeling-simulating results using information technology.

Technological risk appears as a result a failure in modernizing and innovating in the production process. It refers to aspects such as reliability, the aesthetics of manufacturing products or of technologies, the efficiency of computer system in the production. The manufacturing risk has as components to using or developing new technologies. Risk of innovation and modernization may appear as a result of the transfer of technologies, through proprietary innovation or applications so may not be able to offer their services and products made under license, the website programs at parameters project, at the same level as developed countries. Technical risk is present in information technology where the internet may give signs of technical risk (Fig. 2) reduction addresses available, races-search saturated, difficulty of installation and configuration.

Risk identification is fundamental for the establishment of an optimal level of protection for a specific international business [3, 4]. If the risk is undervalued, the level of protection will be insufficient to cover losses, and if it is overvalued, the costs of excessive protection will reduce the excess gain obtained from the business concerned.

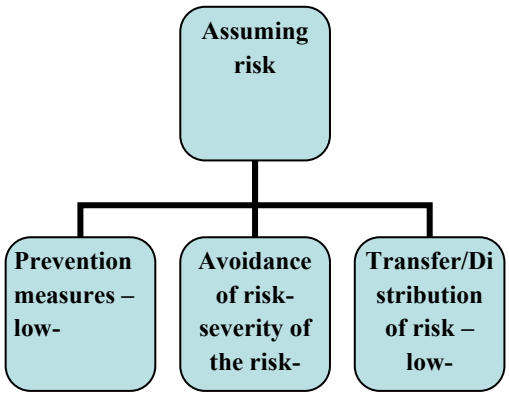

Fig.2. Presentation of main alternatives in the management of risk

2. ANALYSES

The case study that is analyzed is treated as a separate project taking into account the fact that any modern activity it is considered as a component of a project deals with project management methodology with rigor and flexibility of a successful outcome.

The case study on the reduction of manufacturing time in flexible systems, by reducing risk factors is carried out on a flexible manufacturing system presented in figure 3. The flexible system is composed of:

1. mill;
2. lathe;
3. robot;
4. two storenhouse of semi-finished parts;
5. transport system loading/ unloading the parts gross semi-finished and finished parts.

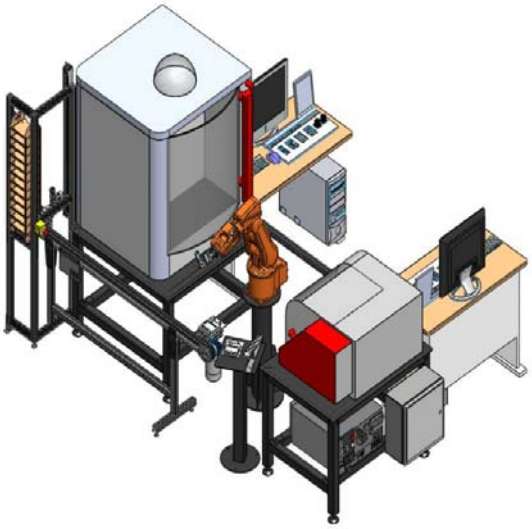

Fig.3. Flexible system for case study

It is considered that this system of manufacture can operate 65 hours/week at full capability of the production, at the rate of production Rp= 20 products/hour. In a week there have been obtained 1000 products of high quality. There be determined the degree of usage. The degree of usage is a percentage parameter that refers to the quantity of products obtained actually in relation to the

actual capacity of production of the system of production:

$$U\% = \frac{finished\_products}{the\_production\_capacity} \quad (1)$$

In the case studied the production capacity of the system of manufacture is:

C_p= 65*20= 1300 products/ week (2)

Use the manufactured system in the week which has been analyzed is:

$$U\% = \frac{1000}{1300} = 76{,}92\% \quad (3)$$

The result of actually time processing for 1000 products is:

$$O = \frac{1000\,products}{20\,products/hour} = 50 hours \quad (4)$$

$$U\% = \frac{50}{65} = 76{,}92\% \quad (5)$$

Other objectives of flexible manufacturing systems consist in increasing production capacity (C_p) without increasing the number of employees.

To increase flexibility, total global control of the manufacture and all computerized information that are closed to 100 %. (tab.1)

Utilization ($U_{\%}$) is important indicators reflecting automation performance. Percentages close to 100% indicates a good automation, efficient use of equipment and personnel and the economic need for developing the manufacturing system.

Table 1. The strategies of automation performance indicators

Number	Strategy	Increase
1	Specialisation operations	< U%
2	Combined operations	< U%
3	Simultanious operations	< U%
4	Integrating operations	< U%
5	Increase flexibility	U%
6	Improving transport and storage	< U%
7	The on- line al execution	< U%
8	Time control operations	< U%
9	The global control of the manufacture	U%
10	Computerized information processing	U%

3. CONCLUSIONS & ACKNOWLEDGMENT

The on-line control of execution will entail the replacement of inspection and unique final testing, with inspections and tests carried out on flow tests. As a consequence there is a growth of the savings due to the substantial growth of the chances to remedy a possible processing failure and the drastic reduction of the finished products that are discarded.

The control of the length of processing operations and their optimization has as direct effect the reduction of operating times and implicity the possibility obtain a higher operative production volume with the same equipment. The global control should ensure the global optimization of all available resources in a manufacturing system.

The most of the products involve hundreds or even thousands of stages in processing; using combined operations determine design and using some machinery and dispositive carrying out several phases of processing, thereby reducing our times efficacious in transport adjustment. Simple or combined operations must be performer simultaneously (as far is technology possible), thereby reducing total manufacturing time.

The integrate operations assumes that all the processing stations to be activated and shall be served simultaneously by the transfer system and increase flexibility has the effects the reduction programming times, adjustment, changing tools and devices. Improving transport and storage of materials lead to the diminishing times as well as the unfinished production.

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QUALITY MANAGEMENT SYSTEM AS A SIGNIFICANT PILLAR OF THE MILITARY EDUCATION PLATFORM

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Abstract: *The author in her contribution focuses on the interesting issue for the needs of the Slovak Armed Forces - implementation of quality management system in terms of state university in the Slovak Republic. The author is concerned with standardized conceptions of quality management and specific quality management systems in the field of military education.*

Keywords: *quality management systems and their implementation in military education, principles of creating quality policy, implementation of quality objectives, quality management system and the Slovak Armed Forces.*

1. INTRODUCTION

Nowadays it is not disputed that a company should be directed and managed in a systematic and transparent way in order to achieve its successful management and functionality. Among others, the success of the company can be significantly influenced by implementation and maintenance of selected quality management – company management activities, quality policy, objectives and responsibilities of individual company actors. All this can be realized in quality planning and management, securing and continuous quality improvement in each organization including military organization /although a military organization has its own specific features/. Despite various initiatives from the Ministry of Education of the Slovak Republic the educational institutions have refused a range of quality management systems. Nowadays the quality management system in education has been represented by the phrase – system: educational and administrative processes and the resources of the educational institution which interact /i.e. Management – determining the organization direction and targeted creating and allocation of resources through activities of managing employees; quality –a perceived value produced by fulfillment of requirements. From the history of individual countries emerges that the company wide quality was the most promoted in Japan where also the base for modern quality systems was born. A range of various standards has been gradually developed, e.g. a Directive for quality assurance in the NATO marked as AQAP (Allied Quality Assurance Publication). The elaboration of standards based on company or sector specific standards in the eighties of the twentieth century was a reaction to Japanese competition. The first standards ISO 9000 for company processes were published in 1987 and since then they have been revised for several times. In the area of quality management the philosophy TQM (Total Quality Management) has been currently the most applied. This philosophy originated from Japanese company wide quality control (CWQC) and it has been developed dynamically. It was also a basis for quality awards. The quality is, therefore,

considered to be one of the most significant tools for establishing the company´ s stable position in the market. However, the opinions on quality are changing over the course of the market economy existence.

2. THE DEFINITION OF THE QUALITY AND QUALITY MANAGEMENT

2.1 The definition of quality. The word quality (grade) represents a complex category and capability of the product to perform its functions, i.e. to meet customer expectations. It includes following features of the product: the product life, the product reliability and use, the product safety, functionality and performance, etc. However, quality is not understood only as the highest level, something best or most expensive. In short: quality should be understood as "the rate at which a set of intrinsic characteristics meet the requirements." "Quality is a summary of the product characteristics which contribute to its capability to meet the requirements." It follows from the above that quality can refer to both the product and the customer.

2.2 The quality manag ement. There exist some genesis in the development of this term (quality management, quality control, grade control are part of company management). According to the standard STN EE ISO 8402/1996 the quality management is defined as all activities of overall management function which determine the quality policy, objectives and responsibilities and which are applied in the quality system through quality planning, operative quality management, and quality assurance and improvement. The objective of quality management is optimalization of work procedures or manufacturing processes which takes into account material and time resources, expected product final quality and the envisaged future company´ s growth and development. The quality system includes organizational chart, procedures, processes and resources required for application of quality management. It has been proved that quality management leads to: improving economic performance, higher interest in customer requirements, development of culture and leadership of the company, significant changes in personality growth of the company employees.[1]

2.3 The quality man agement systems. The quality management system is understood as the system determining quality policy and objectives. These strategic intentions for the attainment of the objectives in the educational institution represent a target position which determines "what and how" the organization aims to achieve by its performance. To sump up, the quality management system consists of these activities: ***quality planning*** (elaboration of quality objectives, specification of processes required for quality objectives attainment, identification and allocation of resources to meet the objectives) ; ***quality control*** (intended to meet the quality requirements); ***quality assurance*** (activities aiming at providing confidence so that the quality requirements will be fulfilled); ***quality improvement*** (enhancing the ability to meet the quality requirements). The proposal and implementation of the quality management system in each organization is influenced by various needs, specific objectives, products, used procedures, company size and structure.

2.3.1 The basic conceptions of quality management. There exist three basic conceptions of quality management, e.g.: conception of corporate standards, conception of quality management according to ISO, and conception of total quality management. The standardized conceptions are based on standards defining requirements or recommendations for quality management system. The quality management is based on general principles for management of organizations of any type – so called ISO Standards (educational institutions): **1. customer orientation** (educational institutions depend on their students and employers of the students**), 2. leadership** (leaders determine unity and direction in educational institutions, university top management and guarantors of courses of study play a prominent leader role)**, 3. commitment an d involvement of employees** (full involvement of employees means that employees are qualified and **aware of** their duties, they **can**, they are experts with competence, they **want** and are committed and interested**, 4. process orientation – process approach** (the desired outcome can be more

effectively achieved if educational activities and related sources are managed through processes, that is, an educational institution is able to identify processes in order to produce the desired outcomes)**, 5. systemic approach to management** (systemic identification, understanding and control of interrelated processes contribute to the efficiency and force of an educational institution in achieving its objectives)**, 6. permanent improvement – continuous improvement** (continuous performance improvement of an educational institution should be its permanent objective)**, 7. decision s based on the facts available** (effective decisions are based on analysis of data and information specifically obtained particularly from identification of requirements, performance measurements and determining satisfaction of the educational institution and its parties involved)**, 8. mutually beneficial relationships w ith suppliers** (an educational institutions and its suppliers – secondary schools, providers of information technologies, suppliers of didactic technologies, other equipment and laboratory equipment depend on each other and their mutually beneficial relationship helps to create a value for both institutions).[2] The original ISO standards have been amended by the standards ISO 9000:2000. These standards Slovakia adopted in April 2001. The ISO 9001:2000 (Quality Management Systems) can be considered basic international standard.

2.3.2 Conception of Total Quality Management (TQM). In comparison with standardized conceptions the conception of Total Quality Management is based on approaches that can be freely implemented. They are of philosophical nature rather than of clearly defined recommendations or requirements. The concept is broader in scope and it focuses on customers, company employees, processes, working environment, company, objectives and results. The basic principles of Total Quality Management applied to educational institutions are as follows: customer orientation, leadership and stability of intentions, development and commitment/involvement of employees, process management based on facts available, responsibility towards the public, continuous learning, innovation and improvement, results orientation and their measurement, development of partnership. In comparison with conceptions based on the ISO series of standards this conception represents an open system in which it is possible to integrate all that could be useful for enhancing satisfaction of customers, operation of an organization, minimization of costs of failures and all that contributes to the organization (university) development. It provides for maximizing the profit, enhancing the company competitiveness, and minimizing the costs related to "poor quality". The conception of Total Quality Management can also be applied to universities (EFQM- Excellence model) which was developed in cooperation with the founders of the European Foundation for Quality Management (EFQM) in 1988. The main motive was the ambition to renew and strengthen the competitiveness of European companies against American and Japanese companies in the global market. There were nine criteria developed which serve as the base for long-term success and the "excellence model" was declared. The CAF (Common Assessment Framework) model was designed for the needs of public administration and public educational institutions. It works on an assumption that an organization wants to achieve exceptional performance in relation to citizens/customers, employees and society on the basis of leadership, strategy and planning

as well as in relation to workers, partnerships, and processes. This model views an organization from different angles and at the same time it analyzes organization's performance from a holistic point of view. The CAF model is provided to public-sector organization across Europe as a simple tool of applying quality management practices for the purpose of improving performance. It also provides a self-assessment system.

2.4 Specific quality management systems for education field. Besides all the previously mentioned basic quality management conceptions and systems, when it comes to the field of education we can also make use of other systems. The IWA2 was developed in October 2002 in Mexico and it was approved in Korea in 2003 as a quality management system providing an educational institution with a possibility to control and check its activities in order to fulfill needs and expectations of the parties involved. With a view to react to urgent market needs, ISO prepared international workshop agreements, so called IWA which are not in contradiction with the already existing ISO standards. This agreement was developed to provide educational institutions all over the world with a unified approach to quality management and to translate technical language of the then ISO 9001:2000 into educational institutions. It is appropriate for educational institutions providing primary as well as secondary education. On the basis of the IWA2 content, they gradually developed a new American standard ASO/ANSI Z1.11 which is designated for people who teach, prepare or administer educational activities. This norm sets requirements for educational management systems and it also serves for certification purposes. ISO 29990, an international standard is devoted to important area of services such as further education and especially to services provided within the scope of informal education. It deals with individual phases of a service lifecycle, requirements regarding finance and risk HR management and communication management. Special stress is laid upon identification of adult learners' needs, monitoring and assessment process of educational service and review of management system within key competencies of education services providers. In 2010, the CAF model was implemented into the field of education in public educational institutions via the CAF and Education model. The CAF model already has its 2012 version, which is based on the previous models and it was developed for the educational sector in general, from kindergarten to higher education.

2.4.1 ESG Standards and Directives for universities. They were primarily designed for education at universities and they should present a source of inspiration for lower education, eventually for the area of informal education. These standards and directives are divided into 7 areas: **quality assurance policy** (standard of educational programs and academic titles conferring, relation between teaching and conducting research, strategy and the quality assurance system, reliability of individual departments, institutes, faculties, integration of students, policy and fulfillment of objectives monitoring); **educational programs assessment system** (elaborated and published set educational results, mechanism for curriculum and educational programs development, specific needs of different education forms, accessibility of appropriate educational resources, educational growth and students' results, educational programs assessment, employers' feedback, labor market); **students' assessment system** (measurement, publishing, diagnosing criteria for marking, rules concerning student absence, assessment strategies); **assurance system of pedagogical staff quality** (well-established procedure of teachers' competence and qualification, ability to accept feedback on their performance, provision of optimal gradual growth, an opportunity to develop and widen their teaching capacity, to evaluate their abilities in teaching, to develop proper mechanism for teachers who have been insufficient in the long term); **educational resources and supporting resources for students** (to assure appropriateness of available resources for each educational program offered, to develop literary and technical resources supporting education and to make them available, to provide tutors, assistants and other consultants, to implement students' feedback when completing supporting materials, to monitor, revise and

improve efficiency of supporting services for students on a regular basis); **information systems** (to ensure gathering, analysis and use of relevant information for effective management of educational programs, graduates' employability, students' satisfaction with a program, teachers' efficiency, students' population profile and key indicators for comparing to other universities); **system o f information publishing** (every university should regularly publish current, impartial and objective information about educational programs, expected results of study and educational assessment while putting emphasis on impartiality and objectivity of released information). Implementation of this internal quality assurance system by means of the ESG standards mentioned above also includes an obligation of submitting an evaluative report on regulations of students' assessment within the bounds of our higher education act. Based on what have been mentioned above it is evident that one of the key processes regarding quality management system for educational institutions is choosing the most appropriate model. When choosing a model it is proper to respect the following procedure: to create a set of comparative criteria; to introduce and verify criteria; consider criteria by university management representatives and to use methods of multi-criteria analysis of choosing the most appropriate quality management model.

3.3 QUALITY MANAGEMENT SYSTEM IN THE ARMED FORCES

In the Armed Forces of the Slovak Republic the quality management is mainly applied in acquisition process within the defense system life cycle. The acquisition process represents one of many ongoing processes in the Ministry of Defense of the SR and it fulfills a specialized function (purchase). The acquisition process in the Armed Forces of the SR is the part of a distribution and logistics chain. Its main task is to ensure that every product is acquired in compliance with statutory provisions, for a planned price and that it is delivered as required, within predefined time and to pre-agreed place. Practical experience show that quality is best achieved through an approach which is based on utilizing an integrated system through the life cycle. The NATO policy on an integrated systems approach to quality through the life cycle is included in the SOŠ AQAP 2000 (Slovak Defense Standard) from 2005, which is an implementation of the AQAP 2000: 2003 allied publication (NATO Policy on an integrated systems approach to quality through the life cycle) into our practice. For one thing, it confirms the fact that quality management is a continuous process involving a great number of participants. And for another, it contributes to the development of support, supply and it also contributes to maintenance of the armed forces capacity from a proposal to liquidation. The intention of this policy is to gain products, which fulfill requirements consequent on life cycle perspective. Products intended for the armed forces needs are of highly specific nature. That's the reason why, within the SR Armed Forces, products quality assurance has been put at the level of state quality assurance by means of a Act No. 11/2004 Coll. Defense Standardization. Quality verification comes under the competence of a public body called "The Office for Defense Standardization, Codification and State Quality Assurance". With respect to what has been mentioned above, one can say that also the Armed Forces Academy of General Milan Rastislav Štefánik in Liptovský Mikuláš is standing at the

crossroad and it will have to choose the right direction of its further orientation. Innovation of the existing education strategy, elaboration of the strategy regarding scientific, research, innovation, expert activities and personnel as well as elaboration of strategy on marketing and external relations will be necessary. In connection with the mentioned strategies it will be also necessary to completely rework a long-term plan of the Armed Forces Academy in accordance with the Higher Education Act amendment and the SR White Papers on Defence.

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MANAGEMENT METHODS AND TECHNIQUES USED TO ENSURE THE INTERNAL AUDIT PERFORMANCE

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Abstract: *This approach shows a research on the usage of managemental methods on the internal audit activity through qualitative and quantitative indicators of performance assurance. Balanced Scorecard, the management method and tool, referred to the Dashboard, contributes to the internal audit performance through resource planning, setting objectives and scope of the audit, communication and approval, following the recommendations, deferring to the code of ethics and how to achieve the objectives. The listed indicators, are components of the proposed management methods and tools, and they define efficency, effectiveness, economy and quality, all elements of the internal audit performance.*

Keywords: *methods and techniques, audit, corporate governance, internal control system, performance indicators, Balanced Scorecard, Dashboard.*

JEL: M 42

1. INTRODUCTION

The importance of using the management methods and techniques concerning the internal audit, is given by providing a new approach to this problem, which highlights the need to ensure the performance by applying new methods and techniques, based on scientific management. This approach was born from the need to adapt the internal audit to the new demands of the economical, social and technical development, faced by public entities. Using the management methods and techniques in the internal audit ensures the contribution to the audit development and the performance assurance, by using Balanced Scorecard (Kaplan R. S., Norton, D.p., 1996: 75 – 85) [11], the management method and tool and the Dashboard (Nicolescu O., Verboncu I., 1999: 379 – 381) [15], the management technique and tool.

The objective of this appr oach results from the proposed title, "Management methods and techniques used to ensure the internal audit oerformance". To achieve the proposed objective it is necessary to establish **a working hypothesis: do Balanced Scorecard and the Dashboard ensur e the internal audit perfo rmance?** The aknowledgement or the invalidation of the working hypothesis is based on the following question: " what do the management methods and techniques bring to the internal audit performance?"

Within this approach we hope to define the concepts of methods and techniques, governance, to eliminate confusion and to estalish the internal audit role concerning the governance and the management system of the public entity. The approach continues by defying the indicators that mesure their internal and external performance and evaluation.There are defined the qualitative

indicators, the finanical and quantitative indicators and there is showed the way the internal audit contributes to the public entity performance.

Hereinafter there are displayed the advantages and disadvantages of using Balanced Scorecard in the audit activity, identified from research and there is analysed the way the quantitative indicators and qualitative indicators contribute to the audit and public entity performance. There is showed the Dashboard and there is analysed the way it can be used in the current activity of the internal audit. There were identified the advantages and disadvantages of this management tool and the posibility of using it in the audit activity.

The conclusions, which follow the usage of Balanced Scorecard and the usage of Dashbord, contribute to the internal audit performance by defining, whithin these management methodes and techniques of the general and specific objectives, the resource planning and the use of resources.

The r esearch method used for developing this scientific approach was the qualitative analysis and the synthesis (Chelcea S., 200:76 – 80) [3]. By analysis there was researched the use of Blanced Scorecard and the decay of the indicators that measure the audit performance (efficency, effectiveness, economy and quality) concerning the components (resources, the audit scope, the risks analysis, the planning, the communication and the acceptance, audit methodes, techniques and tools, following the audit) and their research, by using the research techniques and tools. The Dashboard was researched by analysis, by dissolving the indicators into components and by analyzing them. Synthesized, the investigated elements were united on their interdependence to establish the links between the internal audit and its performance.

Our approach **analyzing scope** was defined by the public entities that organised the internal audit structure whithin the state funded undergraduate education. From a conceptual point of view, the research scope was established at the use of the Balanced Scorecard and Dashboard internal audit practice, to show the connection between this management method and tool and the internal audit performance.

2. CONCEPTUAL ASSIGNATION ON MANAGEMENT METHODS AND TECHNIQUES

The current context of economical, social and technical development of the nowadays society, decide the appearance of new risks, leading to the adaptation of the audit structure, by enhancing the methods and techniques of used to analyse the risks and by increasing the internal audit perfomance. The application of scientific management methods by the internal audit in analyzing the risks, accounting the control systems, the governance, these all are mandatory requirements for establishing the strategic objectives, planning the audit resources and ensuring the use of internal audit of Balanced Scorecard [11] an Dashboard [15], management methods and techniques.

The management system of public entity is object of the internal audit, and its analysis contributes to ensuring the entity performance, by constant assessing of the risks, which lead to the efficensy, effective and economical use of the resources. The structure of the management system must meet the current chalenges, which are more and more complex, based on knowledge (Fatu T., Tugui A., 2010) [6] and information (Draganescu M., 2007) [5]. The management activity is only operational by the communion of the whole public entity (Nicolescu O. si Verboncu I., 2008:57) [14], and the internal audit must assess the system management, by planning and assessing the risk, using management methods and techniques, for ensuring its performance through scientifically established recommendations. The internal audit performance was explored by qualitative analysis of the indicators system, grouped by efficency, effectiveness, economy and quality. This analysis was based on specific account methods and techniques, which, in practice, vary depending on the specific environment in which the public entity operates.

By definition, the method featur es the way of analyz ing the objective r eality, and the

technique featur es a set of pr ocedures applied for ensuring the public audit performance [3].

According to some authors (C. Bota Avram, 2009: 256) [1] corporative governance is a system that includes ethical principles, social responsibility, the good bussiness practices and control activity. Establishing the framework of implementation of corporate governance within public entities consists in economical conditions, juridic and social system, which manages the activity and environment of the entity and which affects the internal audit and its performance. Concerning the public sector, the Organisation for Economic Co-operation and Development (OECD) definiton best suits the legal, economical and social conditions existent in our country. By approaching this organism, the corporate governance can be defined as **a system of standards by w hich public entities ar e dir ected and contr olled to ensure the achieve mnet of the objec tives through the efficient and effective management of the ris ks.** The corporate governance system ensures the disjunction between the entity management attributes and the superior entities, the local public administration and the direct and indirect beneficiaries of the public entity. These governance standards concerning management are given functions (forecasting, organization, coordination, implementation and control - account), and corporate governance, internal audit object, constantly analyzes and resource management system with internal control, which ensures the strategic and specific objectives of the entity.

3. PERFORMANCE MEASUREMENT INDICATORS

The internal audit performance requires the adoption of a system of specific and constantly analyzed indicators, by using appropriate methods and techniques. This indicator system, specific even for management analysis performance, features the indicator system of the corporate governance – internal control system and management system. The system of indicators of the organizational management structure of the entity, defined bye organizational, informational, decisional system, human resources, and other management elements (O. Nicolescu, I. Verboncu, 2008: 177) [14], affects the internal audit performance.

For constant evaluation of internal audit performance, it is essential to establish an indicator system, assumed from the international management practice (Kaplan R. S si Norton D.P., 1993: 134 – 147) [12], which should be based on financial or quantitative indicators and non-financial or qualitative indicators. According to the authors (Brătian C., 2010) [2], non-financial indicators provide a better measurement of the entity performance. According to these approaches, qualitative and quantitative indicators must ensure future planning of the internal audit performance (Higgins L. and B. Hack, 2004) [8] and provide internal and external evaluation of the individually analysed indicator performance (Crowther D ., 1996: 4-13) [4]. **The defining of the indicator system, financial or non-financial, is done according to the objectives s et by multi-annual and annual plans of the audit or the goal of the evaluation.**

The evaluation of the internal audit indicators has a internal part and an external one. The internal evaluation is done by self-assessment at the end of the audit mission and management assessment, based in internal control standards (OMFP 946 / 2005 concerning internal control standars of the public entity) [16], although the internal control system is part of the audit. The internal

evaluation of the audit indicators regards the keeping of the independence, objectiveness and the audit aptness, the supervising activity, the audit quality development program, has continuity and regards every audit activity. The external evaluation of the audit indicators is based on the evaluation of the UCAAPI (Unitatea Centtrala de Armonizare a Auditului Public Intern) (www.mfinante/auditintern /the evaluation guide of the internal audit) [18] and aims the observance of the regulation and annealing framework, observance of the ethical code and it has cyclic character, once every five years.Another way of evaluating the internal audit indicators is done by the Court of Auditors and it aims the evaluation of the public entity control system and of the internal audit control system. The goal of the evaluation is to determine the way the internal audit ensure the public entity internal control evaluation and the way the risks are controled and evaluated by the audit. The external evaluation of the internal audit, done by the Court of Auditors, (Law 94/1992 regarding the organisation and action of the Court of Auditors, with further altertions) [17] leads to ensuring the constant improvement of the audit activity and enforces the public audit structure to constantly improve the internal entity control system and to contribute to reaching its goals, fact that features the audit structure performance.

3.1. Non-financial indicators for measuring the audit performance

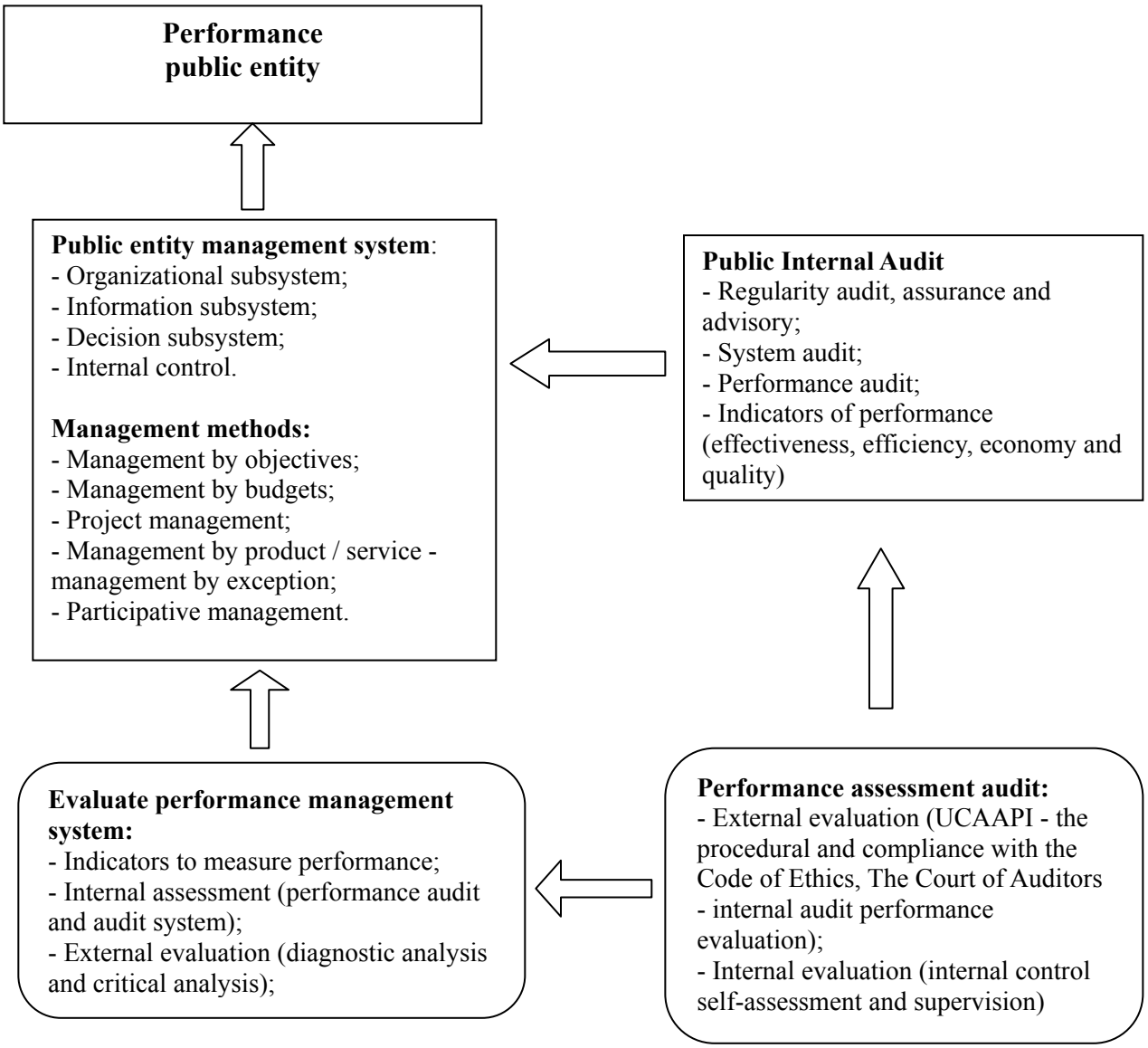
The non-financial indicators for the measurement of the internal audit are established in accordance with the fundamental objective of public entity established by the regulatory framework. The indicators that measure the internal audit performance, non-financial, as it appears in Table 1. The non-financial indicators, feature qualitative indicators of the internal audit, which are essential to reaching the its goals and the specific activities that assure the reaching of the goals. The fundamental objective of the internal audit performance evaluation is the way the final results are obtained by assessing the way the resources are used and the way the feedback is provided.Both management methods used and management public entity management system are subjects to audit performance and system, or regularity audit, and its functionality leads to management and public entity performance, as shown in Figure 1.

Tabel 1. Non-financial performance indicators

Objectives	**Performance indicators**	**Activities**
Providing counseling and management	Efficiency	Human resources (capacity, independence, objectivity) Financial resources (budget, activity financing); Matter resources (endowments)
		Heard scope
		Risk inventory
		Results and its pursuance
	Effectiveness	Planning
		Communication and approval
		Audit methods, techniques and tools
	Economy	Objectives
		Resources
	Quality	Profesional ethics code
		Regulation and annealing framework
		Resources
		Audit assessment
Control and governance assessment system	Assurance audit	Efficency;
		Effectiveness;
		Economy;
		Quality;
	System audit	Efficency;
		Effectiveness;
		Economy;
		Quality;
	Performance audit	Efficency;
		Effectiveness;
		Economy;
		Quality;
Control system assessment	Assurance audit	Efficency;
		Effectiveness;
		Economy;
		Quality;
	System audit	Efficency;
		Effectiveness;
		Economy;
		Quality;
	Performance audit	Efficency;
		Effectiveness;
		Economy;
		Quality;

Source: Author Projection

Fig. 1. Internal audit contribution to the public entity performance



Source: Author Projection

The qualitative indicator system that measures the audit performance, contributes to the assurance of the performance by establishing an internal strategy based on the public entity objectives by means of tha planning, the resources, the audit scope and the risks analysis, by developing the human resources (improvement and complex motivation); by means of financial resources, by developing the intr-institutional and inter-institutional relationships and the links between them, trying to reduce the informational redundances and contortions, the efficency and development of the informational channels The finality of the specified indicators is the anchor of the public entity control and management system by gaging the audit (Bota Avram C., 2009: 291) [1] by the means of the internal audit canons, approved by the public entity management and by legally approved and the activity procedure [16], which, conjunctively contribute to the development of the internal control, optimization of the management system, development of the organizational culture etc.

3.2. Financial indicators

The analysis of the indicator system that measures the internal audit performance, quantitativly speaking, recruits the scope of the qualitative analysis and offers a complete image of the assruance of the internal audit performance. The quantitative approache of the indicators that underlies the internal audit performance, has tu ensure their dynamic in an evolutional way and their interdependence and the well working of the audit.

The financial and non-financial indicator system that measure the performance of the internal audit, as recommended by experts [4], only the financial indicators, in practice the financial resources defined by the budget dimension, the financing level of the audit structure (auditors salary expenses, prizes and advancements, profesional training expenses, excursion expenses etc), can't contribute to the assurance of the internal audit performance. The indicator system that measure the internal audit performance is complete only when all the quantitative indicators that define the efficiency, effectiveness, economy and quality, are taken under consideration.

Tabel 2. Quantitative indicators that measure the performance

Performance indicators	**Activities**	**Quantitative indicators**
Efficiency	Human resources (capacity, independence, objectivity) Financial resources (budget, activity financing); Matter resources (endowments) Financial resources (budget, activity financing); Matter resources (endowments)	**Human resources** - auditors number; - number of days spent on profesional training and number of objetives achieved; - number of situations of auditors interdependence defying; - number of complaints regarding the defying of the objectivity; Financial resources - approved budget; - salary, bonuses, auditors advancements expenses; - expenses regarding the equipping the audit structure with materials and inventory objects, fixed devices (ex: photocopier); - auditors excursions expenses (structure missions placed in a different area);
	Heard scope	- number of established objectives; - number of heard objectives; - number of objectives left to hear;
	Risk inventory	- number of known risks; - number of unsolved risks; - number of solved risks; - number of risks on risk levels; - standards of analyzing the risks, balance;

	Results and its pursuance	- number of recommendations expressed by aknowledgment documents (FIAP, FCRI) and audit reports; - fulfilled by the audit; - number of unfulfilled recommendations
Effectiveness	Planning	- number of planed missions; - number of planed and fulfilled missions; - number of planed and unfulfilled missions; - number of ad – hoc missions; - number of risks and their level; - number of audit structures; - time balance; - human resources;
	Objectives	**The audit structure strategy** - number of strategical resources; - number of main objectives; - number of specific objectives; **Audit mission strategy** - number of established objectives; - number of heard objectives; - number of objectives left to hear;
	Comunication and approval	- number of daily informations regarding aspects of the audit mission developmenet; - number of informations regarding problems and/or constant irregularities; - number of established channels (manager – audit structure head – auditor, structure audit head / auditor – audit structure – organizational tructures in the public entity, audit structure of the public entity – audit superior structure); - number of approved missions, documents, annual plans and/or strategicaly approved, number of reports etc.
	Audit methods, techniques and tools	- number of applied methods (diagnosis analysis, critical analysis); - number of methods applied during mission (economical and financial analysis, static and mathematic analysis for the risk analysis , etc.); - number ofquestionaries, verification lists, interviews, relation notes; - number of tests, sample dimension;
	Resources	- level of human, financial, matterial resources;
Economy	Objectives	- audit structures objectives; - audit plan objectives;
	Roesources	- human, financial, material resources level;
		The independence - number of situations regarding the defying of the audit independence; - number of situations regarding the defying of the audit indepnedence and the decay of the incompatibilities; - number of situations regarding defying of the audit

Quality	Ethical Code	independence and the impossibility to decay the incompatibilities; *The capacity* - număr de obiective de pregătire profesională stabilite; number of profesional trining established objectives; - number of days of profesional training executed by the audit; - the individual level of profesional training of the audit members (studies, specializations); - pregătirea postuniversitară (număr de auditori cu nivel Licență, Masterat, Doctorat) postgraduate training (number of audit members with bachelor degree, master, doctor's degree) *Objectivity* - number of recommendations and aknowledgments developed during the audit missions; - number of recommendations and aknowledgments developed without legitimate documents
	Regulation and annealing framework	- the financial level of the problems / known iregularities / audit department – public acquisitions, financial system – accountant, human resources, internal control system, external financing programs; - level of gyp regarding the state funded budget the social assurance, the local bufget;
	Resources	- human, financial, material resources level;
	Assessment of the internal audit	Internal assessment - the performance level established after the assessment of the stuff, by the audit structure head; - the performance level established after the self-assessment - the level of performance established after the management assessment External assessment - the performance level established after the UCAAPI assessment - The performance leverl established after the Court of Auditors assessment

Source: Author Projection

From Table 2. the quantitative indicators that mesure the internal audit performance , we can observe: analyzed indicators (efficiency, effectiveness, economy and quality) are inder-dependent. Changing one of them would lead to changing the whole indicator system. For example, it effects the profesional training of the audit members and their motivation (developing

career by advancing, prizes), effecting the fulfilling of the objectives and the decay of the performance,

The most important role in ensuring the internal audit performance is in the external assessment of the internal audit.The internal audit assessment contributes to the assurance of the performance bye detecting the needs of profesional training, of the problems regaring the independence, capacity and ojectivity, apllying the regulatory and annealing framework, also tracking down the errors in the way the resources are used.

The well being of the internal audit indicator system, efficiency,l effectiveness, economy and quality, all put together, feature the main object of the external assessment of the internal audit structure. The assessment of the audit contributes to the constant improvement of the audit activity and it forces the assessed structure to constantly ensure the assessment of the internal entity control system and to fulfill its objectives, which contributes to the accomplishment of the entity performance.

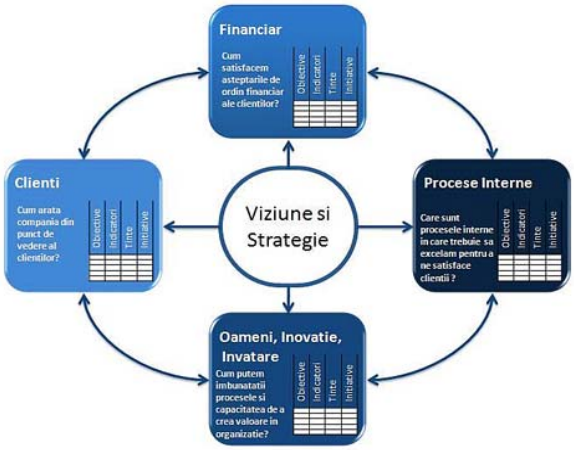
4. METHODS AND TECHNIQUES OF MEASUREING THE INTERNAL AUDIT PERFORMANCE

The assessment of the management performance is done by the means of the Balanced Scor ecard methods / tools and the performance indicators and the dashboard.In another r espect, the assessmen t method can be given by establishing the quantitative and qualitative indicators of the audit performance, and as for techniques (semples, verification, analysis) being featu red by the tracking of the quantitative and qualitative performance indicators by the means of special too ls (tes ts, verifivation lists and questionaries) that ensur e its detailed analysis.

The assessment of the management performance by the means of Balanced Scorecard, concerning the public entity, implies the use of a performance indicator system established for measuring its performance. Ionascu I. and corporate (2006: 212) [10] defines Balanced Scorecard as "a tool that delivers an operational display of the global performance of the entity, granting the guidance and assessment of the strategy". Balanced Scorecard highlights its importance and the necessity to establish the indicators based on the entity and the environment in which the entity works.The entity activity or Balanced Scorecard is considered by some authors as a management method of the performance (Hanson J. and Towle J, 2000: 12 – 16) [7], and by others, a strategic management tool (Hueng P, 2000; Pforsich H, 2005: 67 – 85) [9].

In management practice, Balanced Scorecard ensures the link between the performance indicators and the act of management, used of every level by establishing the objectives and tracking the evolution of the indicators established according to the manager's objetives and actions. Accordinc to this example, Balanced Scorecard ensures the fulfilling of the entity strategy [11], like shown in Fig. 2 Balanced Scorecard

Fig. 2. Balanced scorecard.



Source: www.indicatorideperformanta/kapis.ro/ [19]

From the major advantage of Balanced Scorecard,we ditinguish:

– definition of the entity startegy, develpoment of the inter-institutional and intra-institusional communication;

- development of the organisational

culture, with the assurance of respecting the moral, ethical and conscientiously standards

- rofesional development of the human resources
- Development of the complex motivation management, by using the award and sanction system

From Fig. 2 – Balanced scorecard, we can tell that by using this managerial intrument, in relation to the environment of the public entities in our country, in encounters an array of barriers, the most important being:

- lean technological support
- disfunctional integration with other systems
- Lean human and financial resources.

Implementing Balanced Scorecard in entities from the research scope, can start, considerin g the definition of the management system, ori definition of the objectives.Both versions are based on the same principals: establishing the indicators that ensure the entity performance, specific to a organizational structure or objectiv.

Acommodated to the public audit requirements from the researching scope after the Kaplan R. S. and Norton D. P. [11], from Fig. 2. Balanced Scorecard can be buit according to the publin entity objectives. Designing Balanced Scorecard based on the structure of the entity objectives, starting with by establighing the general objectives resulting from the fundamental objectiv, the secondary and specific objectives and indicators that lead to t performance (financial indicators and non-financial indicators).

In the internal audit practice, Balanced Scorecard is displayed as a method, by aproaching the strategic objectives and the qualitative and quantitative indicators, specific to the internal audit activity. Balanced Scorecard is also a tool of constant assessment of the audit management processes, by assessing the performance indicators. The Balanced Scorecard description in Fig. 3 concerning the internal audit, features a general aproach and it can be acommodated according to the public entity, but only under the condition that it will contrubute to the ensurance of the structure performance.

Fig. 3. Adapting the Balanced Scorecard in the internal audit

Financial resources planning: How to audit performance

Objectives Indicators		**Targets**	**Initiatives**
Efficiency	Expenses / mission	Provide feedback	Resource planning
Effectiveness	Personal expenses	Promotion and motivation	Communication and Approval
Economics	Features	Development of internal control	Resource control

Users audit report: How to ensure performance and added value

Objectives	**Indicators**	**Targets**	**Initiatives**
Scientific basis of recommendations	Independence	Surplus value and feedback	Resource planning
Risk Analysis	Objectivity	Debugging	Sampling and testing
Communication report	Competence	Managed	Training
		Development of internal control	Code of ethics and legal regulations

Vision and Strategy

Internal Processes: How is the performance and added value

Objectives Indicators		**Targets**	**Initiatives**
Planning	Efficiency	Providing surplus value	Resource planning
Fast assignment	Effective-ness	Preventing fraud	Rate control
Therefore recommend ations	Economi-cing	Developing organizatio nal culture	Risk Analysis
Code of Ethics	Quality	Provide feedback	Resource planning

Human Resources: How to structure performance audit

Objectives Indicators		**Targets**	**Initiatives**
Quality	Independence	Providing surplus value	Planning
Efficiency	Objectivity	Preventing fraud	Code of Ethics
Effectiveness	Competence	Developing organizational culture	Risk Analysis
Economics	Quality	Provide feedback	Follow recommendations

Source: adapted by the author, [19]

According to this presentation, Balanced Scorecard features a strategic aproach of the internal audit, by establighing the general objectives of the audit, but also a constant assessment based in financial and non-financial performance indicators, capable of track down the risks. Blanaced Scorecard is a management tool, because it shows the way the objectives are fulfilled. As a contraint, this tool can't display the evolution of the environment the entity is working on and argues the budgetary execution, but the advanteges of this tool are huge considering an using advantage.

Dashboard. The use of the dashboard bye the mangement, ensures synthetising the useful activities of the management and allows o constant analysis of the permanent activities, which lead to fundamental, opportune and reliable decisions [15]. The informations that this tool holds are managerial balanced, accesibile, accomodation and ensured the efficient and economic of the risks by trackin them in time, because of the prisibilities offerd byw tracking the current activities. The information shown in the table differs according to the management activities, the entity specific, ao it can ensure the analysis needs.

In the audit practice, the Tavle has ti same roles as those in the management activity and its use implies taking the following steps:

- it is called the structure audit report, it is established the Graphic that implements the recommendations by the use of the Raport.
- The audit structure sends the structure audit to the data established by the use of the Graphic that implements the recommendations, the level of implemmentation (implemented or not implemented and that lead to non-implementing them.)
- The auditor works in the Board Table, like it is shown in Table 3. the board table, the implementation of the recommendations, established in the audit report, the main causes, the responable persons, inmplementation terms and the things that lead to it's non implementation;

In audit practice, where the terms of implementation are not taken into consideration, the auditors must travel to the audit structure, based on the working order, established at the beginning of the mission, to establish the causes that lead to this malfunction. In this situation the audit tries to eliminate the problem, by installingthe disfunction bye establishin a new term, if the causes are objective, or reports that there were no implementations to the general manager / Court of Auditors or the superior audit structure of the organisational entity.

The board table helps to compile the annual report of the audit activities, by informin the manager about the resource administration, risk control and vulnerability diminishment.

In the same way, the board table can be compiled and used for all the important activities which features the internal audit activity(profesional training, audit planing, risks analysis, audit missions and interventions etc.)

Table 3. Board table regarding the recommendations implementations

The audit mission	The audit structure	Mission Objectives	Genera-tive causes	Raport recommenda-tions	Implementa-tions respondent	Implementa-tion terms	Implemented	Not imple-mented	Causes / measures
1.									
2.									
…									
n.									

Source: Author Projection

The constraints of using the board table drift from the chronologic approach, involving a lot of information, gathering the information takes time, regarding the audit free time.The efficiency of using this tool drifts from being forced to register the information. The disadvantage comes from its inflexibility and from the big volume of information. The board table features a efficient and effective tool for ensuring the track of analysed indicators evolution, comparing it from time to time, and helps finding the problems on time. The biggest advantageis that it features a management tool used for ensuring the internal audit performance.

5. CONCLUSIONS

Reasearching the aknowledgment or the invalidation of the established hypotesis during this scientific approach, using Balanced Scorecard and the Board Table contributes to the assurance of its performance. Using this approach, the agreed hypothesis is being confirmed.Balanced Scorecard is a management method used by the internal audit, helping to establish the general and specific objectives, but also a tool used to ensure the performance by anallysisng the efficiency, the effectiveness, the economy and the quality of
the audit.Through Balanced Scorecard there are established objectives on all the levels of the audit structure management (human and financial resource planing, internal processes).
It is a tool used for planing the audit resources, analysing the risks and assessing the internal control, based on specific audit techniquies and tools and contributes to detecting problems, usage of efficiency, effectiveness and economy.The internal audit performance contributes to the management of the public entity risks and ensures a efficiency, effective and economic use of feedbackThe board table contributes to the performance by having the opportunity to assess all the time the fulfillment of specific objectives, whichleads to diminishing the vulnerability of the audit.We consider that the advantages offerd by Balanced Scorecard and the board table in audit practice, are by far superior to their contraints. The big volume of information that the public entities are commitedto, leads to increasing of the vulnerability to risks.By using Balanced Scorecard and the board table, the audit structure ensures the resources planing, analyses the risks, synthetises the information of the performance.

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THE SOVEREIGN DEBT CRISIS – DETERMINING FACTOR IN ENHANCING THE INSTABILITY DEGREE AT MACROECONOMIC LEVEL

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Abstract: *The sovereign debt crisis certainly affects macroeconomic evolution, with its strongest impact being upon economic instability. Thus, the current paper has several specific objectives: to present the theoretical aspects related to sovereign debt crisis; constructing a mathematical model regarding sovereign debt crisis impact and completing an empirical study regarding the impact of the sovereign debt crisis on economic instability in Romania; presenting several measures to decrease the impact of the sovereign debt crisis on economic instability.*

Keywords: *economic instability, sovereign debt crisis, EU, budgetary deficit*

1. INTRODUCTION

The factors that guide the macroeconomic mechanism are determined by both the international context and the dependency relationships between the countries of the world. Thus, shocks at national and international level can enhance the degree of instability at macroeconomic level, determining, in this way, disorders of the dynamic components of the economic unit. The sovereign debt crisis, determining factor in enhancing the degree of instability, is based on a debtor-creditor relationship between two countries that have constraints regarding the underlying credit payments, the creditor not being able to pay the obligation in time.
The current economic situation at global level is determined by the commercial relationships between the countries of the world. In order for each country to reach a balance at macroeconomic level it must finance itself or make a loan as to cover the budgetary deficit.
The sovereign debt crisis can be determined by several factors such as the effects of the monetary crisis, the effects of the financial crisis, the fluctuations at macroeconomic level etc. A first aspect is the one regarding the monetary crisis. This concept designates that short period of time when the exchange rate depreciates continuously, this phenomenon leading to the depreciation of the national currency and hence to an increase in the incapacity of payment as the GDP falls. The second aspect is the one related to the financial crisis. The financial crisis refers to "any deviation from the optimal saving-investment plan of an economy that is due to imperfections in the financial sector" (after Haldane, 2004) or to the fact that instability is characterized by an increased loss probability or decrease in the profit (after Goodhart, 2006).

The current crisis has been triggered in 2007 after the decline of the mortgage industry in the Unites States of America. This crisis has generated the following effects:

- the downfall of the stock exchanges;
- discrepancies of the banking system;
- credit downfall.

On the background of these changes, in order to diminish the crisis effects, the ailing countries have made loans, that afterwards could not honor, thus being triggered the sovereign debt crisis. The sovereign debt crisis is a concept with great implications at macroeconomic level, determining thus the evolutionary trajectory of the economy.

There have been numerous studies regarding short term and long term debts. Here can be remembered as short term debts, the debts of the countries affected by the tequila crisis. Related to these debts, Sachcs, Tornell and Velasco (1996) have verified the correlation between the short term debt ratio and the sensibility degree of the economies of these countries to shocks. Also, recent studies (Bordo, 2002) have shown that the government of a vulnerable country engages in a fiscal stabilization if only if a decline in the external financing is foreseen. In this situation the government has to make a short term loan.

According to the literature regarding the crisis, two aspects must be taken into account, namely:

1. the sovereign debt crisis spreading in the European Union is determined by the increased global economic risk;
2. in the crisis periods the markets emphasize the macroeconomic disequilibrium.

2. THE SOVEREIGN DEBT CRISIS – ECONOMIC FACTOR OF INSTABILITY

The sovereign debt crisis is common among countries where there is insolvency or lack of liquidity or macroeconomic disequilibrium. In other words, o country finds itself in the sovereign debt crisis if:

- there are consistent arrears regarding debt pays or external interest obligations of commercial creditors (banks or bondholders) that surpass 5% from the total remaining debts;
- there is a rescheduling or debt restructuring agreement with commercial creditors[1] which is found in the GDF (Global Development Finance).

Emphasizing the sovereign debt crisis (through its component factors) leads therefore to changes with negative effects on the economy. For example, in 2010, due to the financial crisis, the public European debt has increased significantly, causing an alarming wave of financial and monetary instability.

This economic context has led to a grim forecast of the economists regarding a collapse of the EURO currency, as evidenced in 2011 in the case of Greece. IMF has given Greece, a country forced to adopt and apply austerity measures, a loan of 110 billion EURO. Across Europe the countries most affected have been Spain, Germany and Italy. In these countries, in order to reduce the effects of the debt crisis and therefore the degree of economic instability, resorted to the Central European Bank, that has expressed its decision to buy almost half of the sovereign debt of Italy and Spain.

On the whole, the sovereign debt crisis was born in an economic conjuncture dominated by large budget deficits due to the illusion of "saving the euro" through the national markets. As a consequence of the financial crisis that hit the global economies and the effect of increased public spending and of reduced public income, the volume of the public deficits increased, preceding the great economic instability.

On the other hand, increased borrowing of the OECD in order to maintain the same level of social welfare was another cause of the sovereign debt crisis.

Although regulation is difficult regarding the decisions on government spending:

- issuing the money supply is slow;
- involving monetary funds leads to a higher external debt.

One of the countries mostly affected by the crisis, Germany, said it will reduce considerably the rescue guarantee in order for the public debts to be taken on by foreign

[1] Arrears or official debt restructuring are not considered crisis events.

investors, the latter having a very high loss probability starting with the second decade of 2013.

Very high public debts provoke a very high degree of instability because they assume discouraging the national economy affecting in this way drastically the macroeconomic interventions. A concrete example in this regard is Ireland. In Ireland in 2010 there has been registered a budgetary deficit of approximately 33% of the GDP and a foreign debt of 80% of the GDP, a situation resulted from the failure of the Irish government to support banks. In this context, in the Irish economy, has been produced macroeconomic instability, this situation leading to the discouragement of investments in this country.

The debt crisis, seen from the level of the European Union, has manifested through the following characteristics[2] in 2011:

- an average deficit of 4,2%;
- an average value of the public debt of 75%;
- the average borrowing was 16% of the GDP.

In the vision of Thomas Mirow, "The sharp rise in sovereign debt will impose large liabilities on taxpayers in the West for a generation" stating altogether that the Eastern European Countries and Central Asia where EBRD has intervened have been less affected by these problems.

3. A MATHEMATICAL MODEL OF THE SOVEREIGN DEBT CRISIS IMPACT OVER ECONOMIC INSTABILITY

Economic instability can be seen as a disturbance of the macroeconomic system, a cybernetic system, provoking a negative feedback for the national economy. In this context, economic instability includes, therefore, the most sensitive macroeconomic components, elements that can cause shocks in the national economy such as:

- the exchange rate;
- the inflation rate;
- the GDP rate;
- the volume of imports;
- the volume of exports.

The sovereign debt crisis, the factor influencing economic instability, can be quantitatively aggregated through government borrowing and public deficit.

Starting from these elements the following multidimensional model can be built:

$$GDP_t = \alpha_0 + \alpha_1 \mathrm{L}_t + \alpha_2 Def_t + \\ + \alpha_3 \mathrm{Import}_t + \alpha_4 \mathrm{Export}_t \quad (1)$$

$$C_{st} = \beta_0 + \beta_1 \mathrm{L}_t + \beta_2 Def_t + \\ + \beta_3 \mathrm{Import}_t + \beta_4 \mathrm{Export}_t \quad (2)$$

(multidimensional model)

where:

t - represents the moment in time of the analysis;

C_{st} - represents the exchange rate national currency/euro;

GDP_t - represents the GDP volume;

Import_t - represents the volume of the imports of the analyzed EU country;

Export_t - represents the volume of the exports of the analyzed EU country;

L_t - represents the value of the analyzed country loans;

Def_t - represents the public deficit of the analyzed country.

The multidimensional model given by the relations (1) and (2) shows precisely the

[2] (Prohnițchi, 2012)

impact of the components of the sovereign debt crisis, given by: the loans given and the public deficit of the analyzed country, the volume of the imports of the EU analyzed country, the volume of the exports of the EU analyzed country, over the dependent variables at the level of economic instability (the exchange rate national currency/euro, the GDP volume).

4. EMPIRICAL RESULTS

Starting from the econometric model given by the relations (1) and (2) an empirical study at the level of Romania has been done, using the Eviews7 software, taking into consideration the official data obtained from Eurostat[3](for the period 1999-2012).

Through this study we aimed to analyze the impact of the loans made by Romania, of the public deficit, of the Romanian imports and exports on the Romanian economy represented by the GDP volume and the exchange rate national currency/euro. So, the impact of the loans made by Romania will be found in their degree of influence over the Romanian GDP and exchange rate.

The Romanian econometric model from relations (1) and (2) is:

$$PIB_t = 48774.69 - 3896.994 \cdot L_t - 4646.862 \cdot Def_t - 0.366 \cdot Import_t + 36.821 \cdot Export_t \quad (3)$$

$$C_{st} = 2.54 + 0.003 \cdot L_t + 0.1272 \cdot Def_t - 0.0002 \cdot Import_t + 0.0017 \cdot Export_t \quad (4)$$

Based on relation (3) we can say that the infinitesimal change of the loans (when all the other factors remain constant) leads to a decrease of the Romanian GDP of 4646,862 million €. Therefore, loans, the base component of the sovereign debt crisis have a great impact on the Romanian GDP thus conducting the Romanian economy. Moreover, it is worth mentioning the fact that the variation of the independent macroeconomic variables affects the GDP variation rate with 97,39%.

Over the exchange rate (relation (4)) the sovereign debt crisis impact is moderate, the variation of the latter influencing 71,57% of the variation of the exchange rate. The significant amount of the sovereign debt crisis impact over the exchange rate shows that the international Romanian economic relations can be affected greatly by the exchange rate national currency/euro.

By plotting the trends of the dependent variables and the Romanian sovereign debt we can infer the oscillating evolution of the latter. Therefore, based on figure 1 we can say that the Romanian sovereign debt has known an abrupt increase because the latter took a 20 billion € loan from the International Monetary Fund and the European Commission in 2009 in order to cover the budgetary deficit. The GDP decreased significantly during the crisis, recovering to a low growth rate in 2010. Due to the impossibility to honor in time its obligations the national currency has known a continuously depreciation (see figure 3).

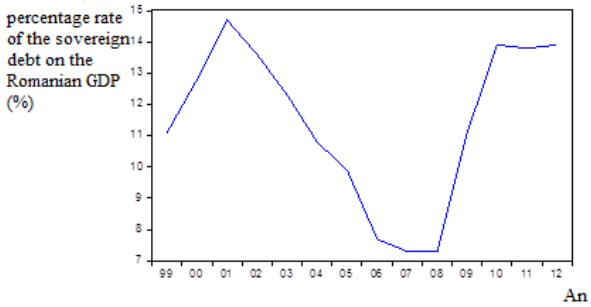

Figure 1. The evolution of the percentage rate of the sovereign debt on the Romanian GDP over the period 1999-2012

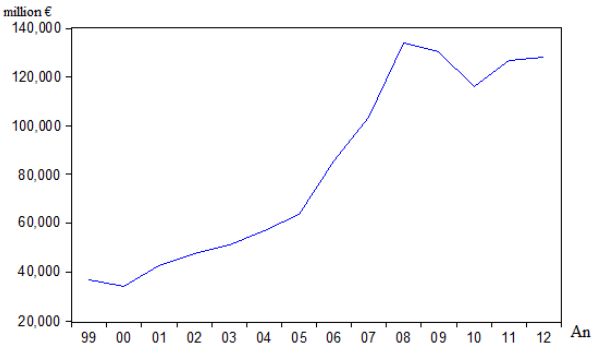

Figura 2. The evolution of the Romanian GDP over the period 1999-2012

3 http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/

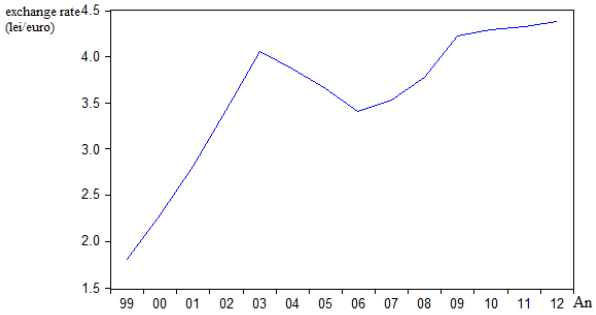

Figura 3. The evolution of the exchange rate (lei/euro) over the period 1999-2012

The sovereign debt crisis at the level of Romania will tend to stress if our country will continue to make foreign loans and not balance the national economy through adequate monetary and fiscal policies. Since the Romanian economy depends on its foreign relations it must step up the adaptation rhythm to the European economy through the growth of exports improving this way the macroeconomic indicators.

5. MEASURES TO MITIGATE THE IMPACT OF THE SOVEREIGN DEBT CRISIS ON THE ROMANIAN ECONOMIC INSTABILITY

The limitation of a phenomenon (economic, social and financial-monetary) means:

- first of all reducing the negative effects over other phenomenon or mechanisms of the systems where the studied phenomenon exists;
- on the other hand, stabilizing the system that directs the relationships between its components.

In order to adapt the concept of "mitigation" to the approached problem in this paper, namely the sovereign debt crisis (an economic phenomenon characterized through the impossibility of a country to honor the outstanding obligations), the factors that negatively affect the national economy must be taken into consideration. Thus, the government and the National Bank of Romania (NBR) must, through fiscal and monetary policies, diminish the impact degree of the negative factors such as: budgetary deficit, external debt, unemployment rate, exchange rate etc. over the functioning of the Romanian national economy.

The Romanian economy, that is in fact an unstable economy, must stabilize at optimal economic growth parameters so that through this process to ensure the timely refund of the sovereign debt. All through this process economic instability would diminish significantly and the economy would know an increasing development favoring the growth of the macroeconomic welfare.

The measures that could contribute to mitigate the impact of the sovereign debt crisis over economic instability could be:

- intensifying the exports;
- diminishing the imports;
- rigorous control:
  - of the transactions on the internal market;
  - of the transactions of Romanian investors with the exterior;
  - of the foreign investments in Romania;
  - of the debts of the foreign investors in Romania;
  - of the state apparatus (NBR, Government, parliament etc) by the European Commission and IMF;
  - of the inflows at macroeconomic level.
- the regulation and enforcement of the laws in order to mitigate corruption and

infrastructure at micro and macroeconomic level;
- the quantification with a greater precision of the economic reality applying advanced multidimensional analysis methods of the data over the macroeconomic indicators sensitive to the international economic conjuncture;
- creating the clearest and most accurate forecast regarding the future economic evolution.

6. CONCLUSIONS

On the one hand, the sovereign debt crisis is the determining factor in enhancing the degree of instability at macroeconomic level and therefore of the economic conjuncture. Of course, it can be said that this crisis will affect the global economy many years from now. So, it is necessary to quantify the value of the sovereign debt crisis impact on the dynamic components at macroeconomic level.

And last but not least, the economic instability in Romania tends to increase as our country will continue to borrow in order to cover the budgetary deficit, so the government must take measures to stabilize the national economy.

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CHAOTIC BEHAVIOUR AT MICRO AND MACROECONOMIC LEVEL

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Abstract: *It is well known in the related literature that the fractal theory supports the idea that any existing element or phenomenon represents or may be represented as a fractal. Hence, fractals should be regarded as simple processes generating complex results as, by its intervention, chaos cerates a unique output, with a chaotic dimension directly proportional to the complexity of the analysed phenomenon. Also, any component or characteristic of a system may be regarded as a fractal. It is needless to mention that the fractal theory can be approached at microeconomic level, therefore characterising the aggregate behaviour, seen as an extension of the individual ones. The analysis of the capital market, component of the economic cybernetic system, is one of the most interesting applications of fractals at macroeconomic level.*

Keywords: *capital market, chaos theory, fractal, dynamic system, management*

1. INTRODUCTION

According to the specialty literature, any existing element or phenomenon represents or may be represented as a fractal.
Fractals should be regarded as simple processes generating complex results, as chaos creates a unique output, with a chaotic dimension directly proportional to the complexity of the analysed phenomenon.
The fractal theory can be approached at microeconomic level, therefore characterising the aggregate behaviour, seen as an extension of the individual ones.
The study of the capital market, component of the economic cybernetic system, is one of the most interesting applications of fractals at macroeconomic level.
Economy, being a cybernetic system, meaning a self-adaptive one, cannot be fully controlled as, by its dependency on the initial, basic conditions, serious changes may occur, affecting it.
The macroeconomic system presents a high degree of instability as regards the evolution, both at individual level, meaning at the level of components, and at aggregate level. The macroeconomic system is therefore a chaotic system.

2. FUNDAMENTALS OF FRACTALS AND OF CHAOTIC DYNAMIC SYSTEMS

According to J. Yorke1, the theory of chaos is based on the self-similarity of fractal geometry shapes.

In compliance with the literature in the matter, the chaos theory is a concept equivalent to the stochastic process, as it considers the dependency on the initial conditions.

Small changes in the initial conditions of a dynamic system can cause different final results, for such reason this issue being conceptualised in the theory of fractals. The experiment of Lorenz reveals that the complex system considered reacts otherwise than the initial one.

The related literature defines chaos as a characteristic of a complex system, the analysis of the latter not being able to encompass all of the system variables.

The consequence of the analysed system complexity resides in the fact that, starting from the final state of the system parameters, the initial conditions cannot be estimated or deduced.

3. PRESENCE OF CHAOS AT MICROECONOMIC AND MACROECONOMIC LEVEL

3.1. Presence of chaos at microeconomic level

The behaviour analysis at microeconomic level is equivalent to the study of the economic agents' behaviour and of the system structure, under conditions of risk and incertitude.

J. Gleick succeeded in outlining the chaotic characteristics of the administrative management. Thus, management is a new science that should to be approached from a chaotic perspective.

At present, the emerging idea is that the theory of chaos represents the fundamentals for the theory of complexity of business management.

Considering the Lorenz attractor example, we could state that a complex system reacts in a different manner to each process. So, the same inputs can generate different outputs.

Within a complex system, the context is unique as the system continuously adapts itself to the environment, meaning to the influence of the endogenous and exogenous factors. Therefore, the system will always have a different state. At the level of the decisional system, for instance, a decision is never made and a strategy is never conceived within the same context.

Due to the strange attractors, the regular or uniform behaviour of a system becomes, in time, unstable or turbulent.

Nowadays, the researchers' interests focus on the analysis of the characteristics and behaviour at the level of the management system. In this context, the managerial system may be seen as a dynamic, complex system, with a chaotic behaviour, that is not linear, adaptive, with a certain degree of instability.

Thus, the role of a manager is not to control the system, but to exploit its complexity. The scientific researchers, as Stacey, start from the premises that, even if the long-run forecasts are dominated by a high degree of incertitude, it is necessary to optimally analyse each change in order to obtain positive results.

In this way, the organisation, a complex system, deals with attractors favouring the change or the alteration of such system behaviour. This is the result of the mutual interaction of the scientometric, technical, psychological etc. factors that direct the system to a well-defined state.

The sudden changes or shocks in the system results, as a consequence of the modification of at least one state parameter, are known as bifurcations at the system level.

According to the fractal theory, at the level of the organisational or administrative management, we can ascertain that miscellaneous hierarchies present common or even identical characteristics, similar to a fractal.

As well known, an organisation has several departments (administrative department, human resources department, IT department operational department etc.) where there are hierarchies (department management, operational management etc.).

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Within each type of management, the following processes are carried out: planning, execution, acquirement of new knowledge, monitoring, analysis, reporting.

Therefore, at the management system level, the fractal specific characteristic is revealed: the macroeconomic processes, meaning the organisational management (the most advanced type of management) processes will be also reflected at microeconomic level (operational management). Thus, the planning, execution, acquirement of new knowledge, monitoring, analysis and reporting processes will be found at each managerial level.

Figure 1 outlines the fractal concept, meaning the identification of the macroeconomic level characteristics reflected at micro-managerial level.:

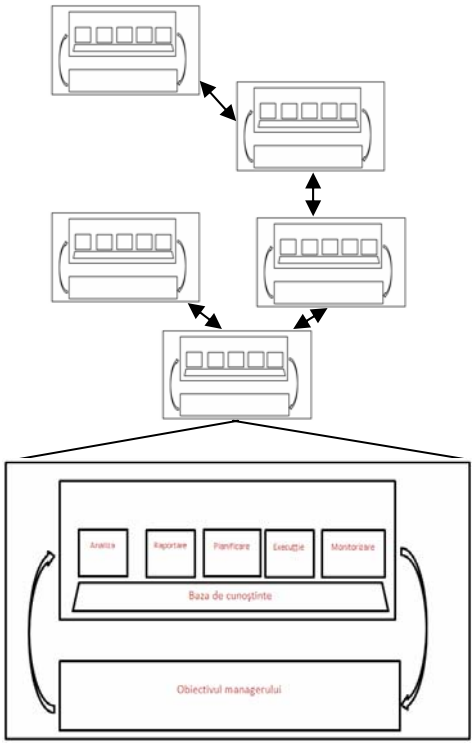

Figure 1.

3.2. Presence of chaos at macroeconomic level

The capital market, a dynamic component, is a system characterised by parameters with a chaotic evolution, dominated by an ever increasing instability level.

On the capital market, the evolution of individual transactions is highly dependent on the initial conditions, as there is a very tight correlation between past, present and future, in the sense that prices, as a decision parameter, influence evolution both at the society and at the capital market level.

The individual behaviour tends to the transactional market behaviour and vice versa, the capital market behaviour tends to the individual behaviour of the companies listed at BVB (Bucharest Stock Exchange). Therefore, we can state that the capital market and its components are fractals, as the characteristics of one of them can be observed to the other one.

Figures 2, 3, 4 and 5 reveal the monthly, daily or annual evolutions, both at a company level, for BANCA TRANSILVANIA S.A., and at the capital market level, characterised by the BET stock exchange index.

4. CONCLUSIONS

The analysis of what is known as fractal is necessary to outline the behaviour of the studied object or phenomenon. Therefore, most phenomena may be characterised by resorting to the fractal geometry.

As concerns fields such as: mathematics, physics, artificial intelligence etc., fractals are nothing else but elements connecting the mirco level to the macro one.

Any complex system may pass the test of the theory according to which each system has imprinted an unpredictable behaviour, dominated by incertitude, which can suffer from significant changes at aggregate level, caused by infinite decimal changes at the state parameter level.

The economic system may be regarded as a chaotic system, the behaviour of which is strongly dependent on the changes occurring inside or outside the same.

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Figure 2. Monthly evolution, between 01.04.2012-03.03.2013, of the transactions carried out by BANCA TRANSILVANIA S.A.
(http://www.bvb.ro/ListedCcompanies/SecurityDetail.aspx?s=TLV)

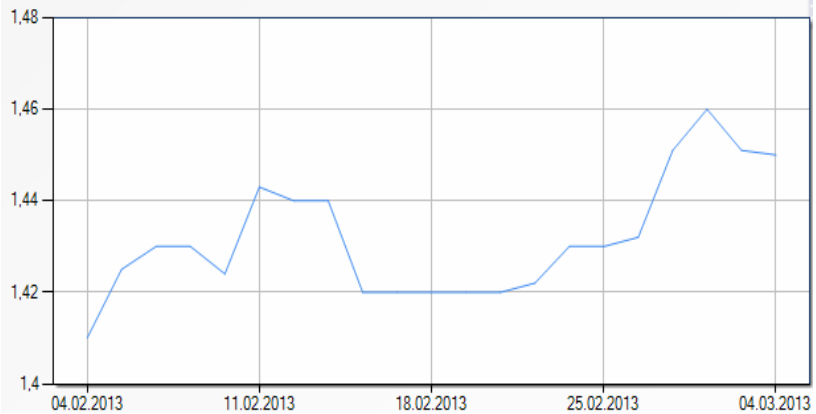

Figure 3. Daily evolution, during February 2013, of the transactions carried out by BANCA TRANSILVANIA S.A.
(http://www.bvb.ro/ListedCompanies/EmitGrafic.aspx?s=TLV)

Figure 4. Monthly evolution of BET stock exchange index, between 01.0.2.2012-01.02.2013 (http://www.bvb.ro/IndicesAndIndicators/indices.aspx?t=4&p=BSE&i=BET&m=&d=3%2f4%2f2013)

Figure 5. Annual evolution of BET stock exchange index, between 1998-2013 (http://www.bvb.ro/IndicesAndIndicators/indices.aspx?t=4&p=BSE&i=BET&m=&d=3/4/2013)

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SHORT-TERM INFLUENCE OF THE OIL PRICE ON STOCK PRICES FROM THE BUCHAREST STOCK EXCHANGE

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Abstract: *In the last decades, several studies revealed the significant impact of oil price variation not only on the real economic activity but also on the financial markets evolutions. Such relations are affected by some particularities of the national economies. In this paper we examine the impact of the oil price on the Romanian capital market evolution from January 2000 to February 2013. In our analysis we employ daily values of the Brent oil price and of BET C, one of the main indexes of Bucharest Stock Exchange. A GARCH model allows us to investigate the effects of the oil price fluctuations on returns and volatility of the stock prices. We split our samples of data in three sub-samples in order to capture the influence of three major processes that affected the Romanian economy: the last stage of transition to a capitalist system, the transformations induced by the adhesion to European Union and the global crisis. Our results revealed significant changes on the relation between oil price and stock prices that occurred during these three periods of time.*

Keywords: *Oil Price, Romanian Capital Market, Volatility, GARCH Model*

1. INTRODUCTION

Since 1970s the impact of oil prices on economic systems became an important issue for governments and for researchers. Quite often, sharp increases of energy prices were followed by economic recessions, sometimes accompanied by raises of inflation. In these circumstances, the stock markets became sensitive to the oil prices fluctuations [10, 11, 14, 17, 19, 20, 21].

The relationship between oil prices and stock prices was highly approached in the specialized literature. Several studies highlighted some particularities of a national economy that could affect the relationship between the two variables. For many developed capital markets it was found a negative connection between oil prices and stock prices [12, 15, 16]. Instead, for the emerging markets the results were rather inconclusive [13]. For some oil exporting countries or oil companies it was found a positive correlation between the two variables [8]. Some studies identified a significant impact of the oil prices fluctuations on the stock prices volatility [9, 18].

In this paper we approach the short term impact of oil price on Romanian capital market from January 2000 to February 2013. During this period of time the Bucharest Stock Exchange (BSE) experienced significant changes caused by finalizing the national economy transition to a capitalist system, by Romania's adhesion to European Union and by the global crisis. In order to investigate the effects of these changes on the relationship between the two variables we use three sub-samples of data: first from 5th of January 2000 to 19th of December 2006, second from January 2007 (when Romania became European Union member) to 15th of

September 2008 (when it was announced the bankruptcy of Lehman Brothers) and third, from 16th of September 2008 to 20th of February 2013. We employ daily values of BET C, one of the main indexes of BSE and of Brent oil price. We use GARCH models to investigate the impact of oil price variation on returns and volatility of BET C.

The remainder of this paper is organized as it follows. The second part describes the methods used in the analysis of the relationship between oil prices and stock prices, the third part presents the results and the fourth part concludes.

2. DATA AND METHODOLOGY

This investigation employs daily closing values of BET-C index, provided by BSE, and of the Europe Brent Spot Price FOB (dollars per barrel), provided by Thomson Reuters, from the period of time January 2000 - February 2013 (Figure 1 and Figure 2). We perform the analysis of the oil prices impact on stock prices for three sub-samples:

- first sub-sample, from 5th of January 2000 to 19th of December 2006;
- second sub-sample, from 3rd of January 2007 to 15th of September 2008;
- third sub-sample, from 16th of September 2008 to 20th of February 2013.

For the two variables we calculate returns in logarithmic forms:

$$r_{i,t} = [\ln(P_{i,t}) - \ln(P_{i,t-1})] * 100 \qquad (1)$$

where $P_{i,t}$ and $P_{i,t-1}$ are the closing values of BET C index or of the Brent Price on the days t and t-1, respectively.

Table 1 reports the descriptive statistics of returns. The results reveal the non normality of returns and significant differences, in terms of means and standard deviations, among the three sub-samples.

We employ the Augmented Dickey – Fuller (ADF) unit root tests (Dickey and Fuller, 1979) to analyze the stationarity of the returns [6]. The graphical representations of the returns time series suggests the use of intercept terms in the ADF regressions for the two variables (Figure 3). We chose the numbers of lags based on Akaike (1973) Information Criteria [2].

For the returns of BET C index we perform ARMA (p, q) models. The values of p and q will be determined by Box-Jenkins methodology. Then we employ Ljung-Box test Q and the Engle (1982) Lagrange Multiplier (LM) test for ARCH effects to investigate the presence of the autocorrelation and the heteroscedasticity on the residuals of ARMA regressions [7].

We investigate the influence of oil prices returns on BET C index returns and volatility by the two equations of GARCH models: the conditional mean equation and the conditional variance equation [4, 7].

The conditional mean equation of the returns of BET C has the form:

$$retBETC_t = \mu_0 + \mu_1 * retBRENT_t + \sum_{k=1}^{n} (\xi_k * r_{t-k}) + \varepsilon_t \qquad (2)$$

where:

- retBETC is the return of BET C index;
- μ_0 is a constant term;
- μ_1 is a coefficient which reflect the influence of returns of oil price changes on BET C returns;
- retBRENT is the return of the oil price;
- ξ_k (k=1,..n) are coefficients associated to lagged returns of BET;
- n is the number of lagged returns, calculated by the Akaike (1969) Final Prediction Error Criterion [1];
- ε_t is the error term.

The conditional variance of BET C returns has the form:

$$\sigma_t^2 = \omega + \nu * retBRENT_t + \sum_{k=1}^{q} \alpha_k * \varepsilon_{t-k}^2 + \sum_{l=1}^{p} (\beta_l * \sigma_{t-l}^2) \qquad (3)$$

where:

- σ_t^2 is the conditional variance of the returns of BET C index;
- ω is a constant term;
- ν is a coefficient which reflect the effects of oil price returns on the volatility of the BET C index;
- α_k (k = 1, 2, …q) are coefficients associated to the squared values of the lagged values of error term from the conditional mean equation;
- q is the number of lagged values of the error term, calculated by the Akaike (1973) Information Criteria [2];
- β_l (j=1, 2, …p) are coefficients associated to the lagged values of the conditional variance;

- p is the number of lagged values of conditional variance, calculated by the Akaike (1973) Information Criteria [2].

We investigate the robustness of the two regressions by employing Lagrange Multiplier (LM) test for ARCH effects on the residuals.

3. EMPIRICAL RESULTS

The Table 2 presents the results of the ADF tests. The null hypothesis of non stationarity is rejected for all three sub-samples. The results of Ljung-Box Q and ARCH LM tests indicate the autocorrelation and the heteroscedasticity of the residuals of ARMA regressions (Table 3).

The Table 4 reports the parameters of the GARCH model equations. The conditional mean equation displays positive significant values of μ_1 for the first and third sub-samples. The conditional variance equation displays a negative value of ν for the second sub-sample. The ARCH LM tests performed on residuals of these regressions suggest, for all three sub-samples, no reminiscence of ARCH effects.

4. CONCLUSIONS

This paper explored the short term impact of oil prices fluctuations on BSE stock prices for three periods. The results of GARCH regressions revealed some differences among the three sub-samples of data.

Between January 2000 and December 2006 we found a positive influence of oil prices over stock returns. We could link these results by the significant impact of the Romanian oil producers stocks and by the growing influence of developed capital markets, some of them positively correlated to the oil prices. For the second sub-sample, the impact of oil prices on stock returns seemed to be receded by the substantial foreign capital inflows stimulated by Romania's adhesion to European Union. Instead, perhaps as a result of the growing integration of BSE with international financial markets the volatility of stock prices became sensitive to the oil prices fluctuations. For the third sub-sample we found again a positive influence of oil prices on stock returns. We could explain this evolution by the growing importance of the Romanian oil producers companies. During this period of time the impact of oil prices on the volatility of stock prices seemed to disappear. We could link this evolution by the much bigger influence of other factors, in the context of the global crisis.

This investigation could be extended by the study of the oil prices influence on the stock prices of the Romanian companies from the energy sector.

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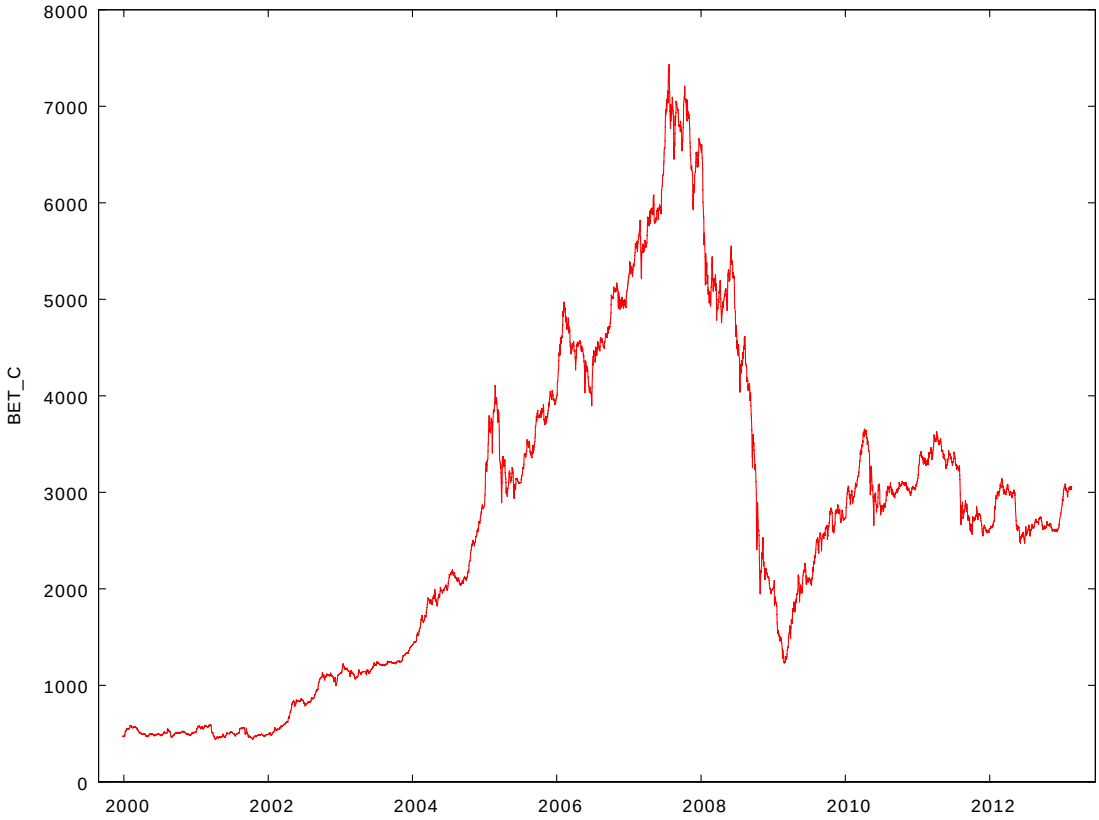

APPENDIX

Figure 1 - Evolution of BET C index from January 2000 to February 2013

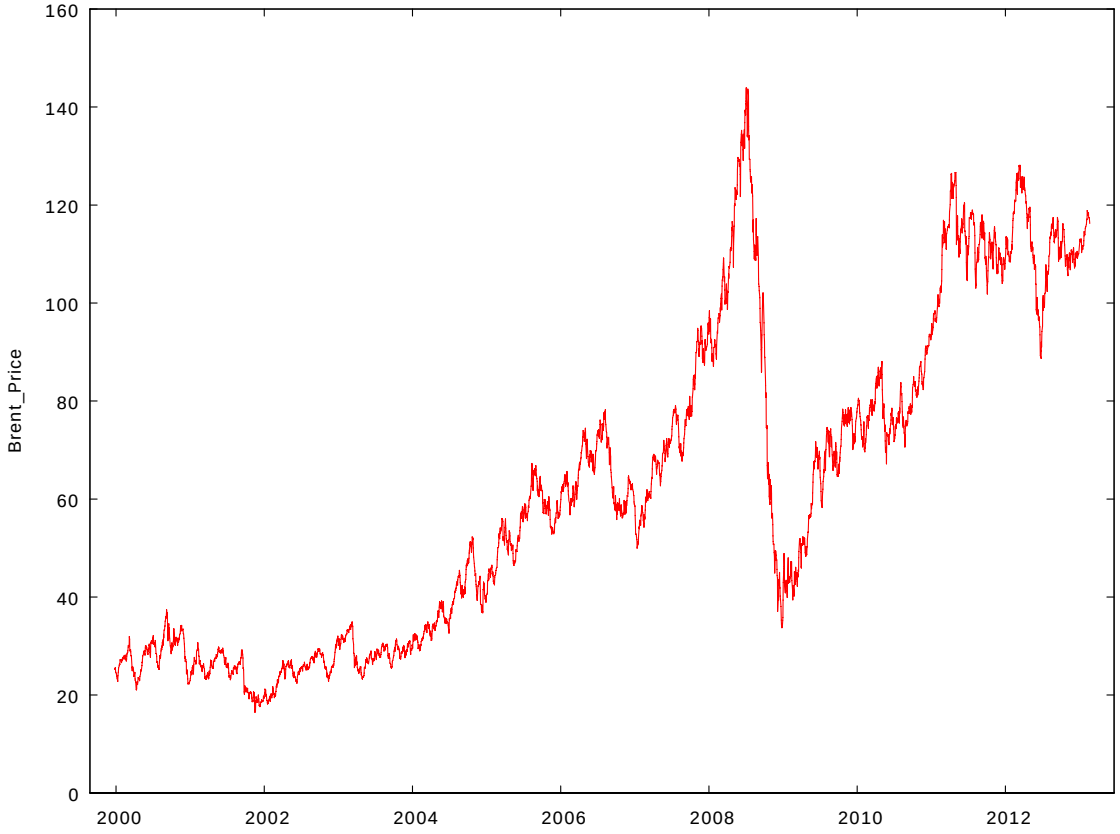

Figure 2 - Evolution of Europe Brent Spot Price from January 2000 to February 2013

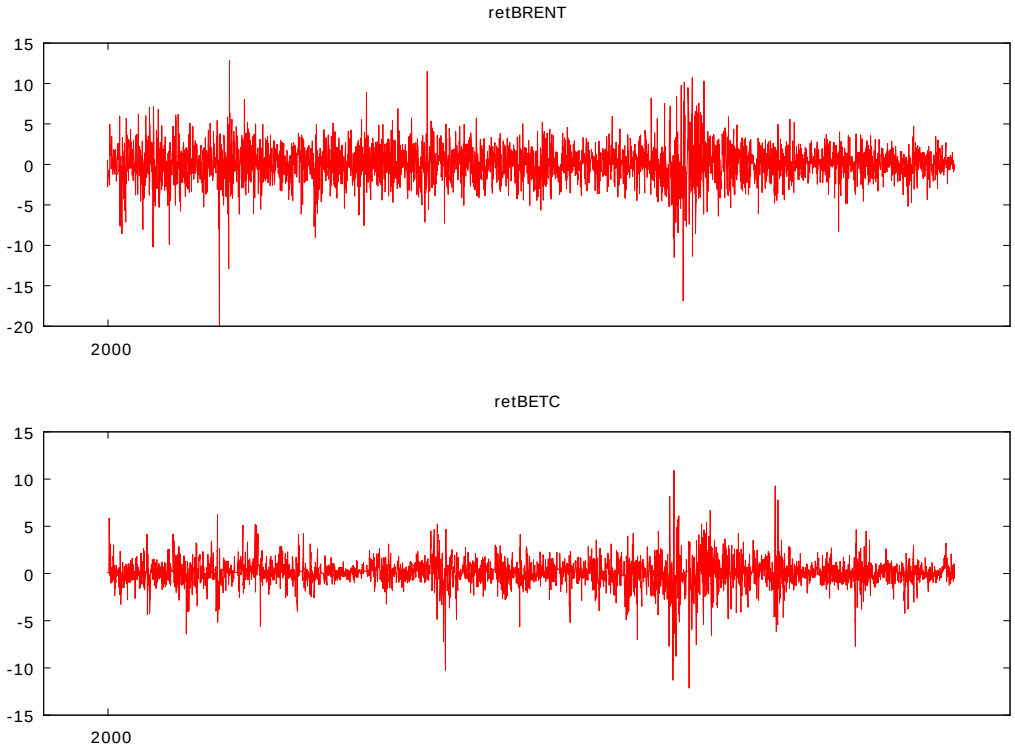

Figure 3 - Returns of Europe Brent Spot Price and of BET C index from January 2000 to February 2013

Table 1 - Descriptive Statistics of the returns

Indicator	First sub-sample	Second sub-sample	Third sub-sample
Returns BET C			
Mean	0.131130	-0.0800471	-0.0151332
Median	0.109813	0.0224794	0.0609585
Minimum	-10.2876	-6.95772	-12.1184
Maximum	6.24570	4.45800	10.8906
Std. Dev.	1.26519	1.50295	1.82303
C.V.	9.64835	18.7758	120.466
Skewness	-0.424856	-0.570615	-0.626211
Ex. kurtosis	5.84709	1.44315	7.84218
Jarque-Bera test	2661.92	62.906	3022.02
p-value of Jarque-Bera test	0.00001	0.00001	0.00001
Returns Brent Price			
Mean	0.0463623	0.0959502	0.0218064
Median	0.119972	0.101468	0.0531513
Minimum	-19.8906	-4.60487	-16.8320
Maximum	12.8534	8.19520	10.6982
Std. Dev.	2.35322	1.86421	2.31054
C.V.	50.7572	19.4289	105.957
Skewness	-0.507452	0.163488	-0.285374
Ex. kurtosis	4.65200	1.11223	5.68477
Jarque-Bera test	1728.68	24.9753	1564.12
p-value of Jarque-Bera test	0.00001	0.00001	0.00001

Table 2 - Results of ADF tests for returns

Period of time	Returns of BET C		Returns of Brent Price	
	Number of lags	Test statistics	Number of lags	Test statistics
First sub-sample	12	-10.5864 (0.0001***)	6	-15.6667 (0.0001***)
Second sub-sample	10	-5.06635 (0.0001***)	8	-18.9389 (0.0001***)
Third sub-sample	16	-6.04909 (0.0001***)	13	-8.49135 (0.0001***)

Notes: p-values are within brackets ***, **, *; mean significant at 0.01, 0.05, and 0.1 levels, respectively

Table 3 - Results of Ljung-Box Q Tests and ARCH LM Tests for BET C returns

Sub-sample	**Ljung-Box Q Test**	**ARCH LM Test**
First sub-sample	9.22244 (0.02648**)	180.923 (0.0001***)
Second sub-sample	4.69056 (0.09582*)	41.2296 (0.0001***)
Third sub-sample	10.9702 (0.01189**)	216.685 (0.0001***)

Notes: p-values are within brackets ***, **, *; mean significant at 0.01, 0.05, and 0.1 levels, respectively.

Table 4 - Results of GARCH regressions

Indicator	**First sub-sample**	**Second sub-sample**	**Third sub-sample**
Panel A: GARCH conditional mean equation			
μ_0	0.137540 (0.0245159) [0.0001***]	0.0285288 (0.0686727) [0.6778]	0.0171506 (0.0273580) [0.5307]
μ_1	0.0161311 (0.00820332) [0.0493**]	0.0280570 (0.0311160) [0.3672]	0.149025 (0.0229257) [0.0001***]
Panel B: GARCH conditional variance equation			
ω	0.146012 (0.0528692) [0.0057***]	0.396972 (0.113645) [0.0005***]	0.0313427 (0.0160396) [0.0507*]
ν	0.00252446 (0.0178436) [0.8875]	-0.192886 (0.0658653) [0.0034***]	0.00679185 (0.0151830) [0.6546]
α	0.386667 (0.0837415) [0.0001***]	0.202205 (0.0692290) [0.0035***]	0.147464 (0.0413136) [0.0004***]
β	0.610367 (0.0748684) [0.0001***]	0.641773 (0.0828204) [0.0001***]	0.852283 (0.0372222) [0.0001***]
ARCH LM tests for residuals of GARCH model	4.77856 (0.4435)	6.28679 (0.2793)	4.3975 (0.4937)

Notes: Standard Errors are within round brackets; p-values are within squared brackets; ***, **, * mean significant at 0.01, 0.05, and 0.1 levels, respectively

2. SOCIO and HUMANITIES

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CONSTRUCTIVIST APPROACHES TO CAREER COUNSELING

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Abstract: *In addition to a thorough specialized training, the counselor should possess the skills to understand each individual's particular situation, to demonstrate that he has the ability to reconfigure each time the counseling process according to the needs, the characteristics and the expectations of each client. Innovation, creativity and the ability to re-think each situation represent the analytical approach, which is the commitment to identify opportunities for the client's career development in order to complete each step. Initial research reveals the complexity and relevance of career counseling from the perspective of all those involved in the process. The object of this study is the constructivist approach to career counseling, as well as the extent to which this guiding procedure is considered significant for those involved in the process. The approach we present is aimed at identifying students' perceptions of career counseling activities, as well as the importance given to the traditional or the constructivist perspective to perform specific activities. The results show that there are gender differences and study differences (differences according to high school curricula) in terms of the perception of the counseling process conducted according to the constructivist model.*

Keywords: *career counseling, constructivism, success, needs, expectations*

1. INTRODUCTION

In order to have a realistic picture, we need to clarify the concept of career. Some consider the career as a position held on the professional level [1], others see it as a series of promotions [2], or even consider it to be the identified and practiced profession [3]. According to HR specialists [4] career is an occupation undertaken for a significant period of time in life which is associated with opportunities for progress. From this perspective, students will be *prepared* to take advantage of opportunities that arise during employment. They are in a stage which involves a change for success. Why? A career is a redefinition of their identity, along with an identification of what they think about their future professional role, as well as the identification of what they want to convey to others about themselves, about how they want to live their life. [5] Nowadays, success has become a synonym of achieving performance above expectations. Initial success is determined by the clarity of purpose and by an effective strategy to achieve it. In order to identify the objective of their development, they must find the answer to some questions: Who am I? Where am I going? What are the things I do best? What do I expect from myself? Where do I want to arrive? What do I like? Career counselor can provide the answers to these questions, along with an essential support in career development [6], when the young people reach the next stage after the initial decision is taken. By definition, counseling is the process through which a specialist (counselor) provides support within a well-defined methodological frame [7], to another person (the client) who receives thus aid for making decisions in regard to his personal and professional life. This is a holistic approach [8] because the client is supported to clarify issues related to his lifestyle, the significance of the

concept of career, as well as the manner in which he gets involved in his own development, with a view to achieving a balance on a personal level. The ideal answer for *identifying a desired career (the one I am heading towards)* should belong entirely to the student. Often the answer is not an easily identifiable one. Constructivist counseling proposes an approach based on the students' active involvement (based on discovery and interaction) [9]. The counselor starts from the student's natural needs and interests and identifies the educational and professional path together with the student. This path is based on what the student pictures about his desires, as well as about the context in which he lives or in which he would like to live. Thus, the information provided by the counselor or obtained by the student on his own are not treated as absolute truths, but they are interpreted and used according to the recipient's needs and expectations. V. Peavey in his work *Sociodynamic Counselling*, describes the career counseling process as a general method of life planning [10]. It is an approach based on the life of the young people. This counseling model aims at: respecting the personal freedom principle (the initiative to make a decision), offering specialized support to people in order to successfully participate in social life, offering specialized support to identify a personal goal in regard to personal development. In this framework, each of the team members (the counselor and the student) has their own contribution to complete the act. The counselee is considered an expert in his own life (because it is considered that only he knows what he wants from his life and his future), and from this perspective, he is the only one to make a decision. The counselor is the expert who builds and provides a favorable context [11] for communication, so that discussions are truly useful. The sociodynamic perspective is a holistic one and it frequently resorts to common narrative and autobiographical elements seen as essential in the process of helping the beneficiary to achieve self-understanding, to recognize the relationships between the self and the environment, as well as to initiate an action plan. The sociodynamic counseling promotes respect for young people to find answers to the question - How should I live my life?, as well as respect for the effort to become socially integrated and to develop a sense of social responsibility. Even if we share or do not share certain values, we establish membership in a particular social group. We confront our values with others when we choose our discussion partners, life partners or our work line. The constructivist approach makes the students to feel valued. All these are important elements needed in the counseling approach, but they are not enough. The young people are determined to make their own efforts in order to establish a target for his personal development and in order to identify a career plan. The counselors who project their intervention by exploiting the constructivist model provide the students with the tools of knowledge [12], such as: problem-solving exercises, exercises based on investigating reality, etc.. From this perspective, the counseling activities look into manners in which students make the most of the information they receive, conduct thinking and manage to build a vision for their personal and professional future [13]. Through this approach, we aim at capturing the students' perceptions on the specifics of the counseling process proposed and conducted by specialists in school, from both a traditional and constructivist perspective.

2. METHODOLOGY

The main objective of research is investigating the students' perceptions on career counseling activities conducted in high schools with students in terminal grades. The overall impression [14] that students have about traditional and constructivist counseling activities (in terms of importance and frequency) was identified.

Specific Assumptions

a) There are significant differences between boys and girls regarding their perception on career counseling in the sense that:
- Girls give more importance than boys to constructivist counseling;
- Girls will appreciate that the most commonly performed activities are the constructivist ones rather than the traditional counseling ones in contrast to the boys;

b) There are significant differences between students based on high school pathway in terms of the perception of career guidance in regards to:
- Students from theoretical high schools will appreciate more the constructivist counseling

in comparison with their peers from vocational or technological high schools, who give more importance to traditional counseling.

Correlational study variables:

Dependent Variable: students' perceptions on career counseling of in terms of the importance of constructivist/traditional counseling;

Independent variables:

- The subjects' gender: female, male;
- Type of education: general, vocational, technological

2.1 Participants

The study involved students in upper secondary education, respectively the twelfth grade and all the three types of education found in the organizational structure of secondary education were covered: theoretical, technological and vocational.

The lot includes a total of 257 participants, including:

- 130 girls;
- 127 boys;
- 194 students from urban areas;
- 63 students from rural areas (this dimension was not taken into account due to the fact that it was not a balanced group);
- 84 students studying in theoretical high schools;
- 92 students from vocational high schools;

Research was conducted in NE region and questionnaires were answered by respondents.

2.2. Instruments

The instrument used in research: the CCSES questionnaire (Career Counseling Self-Efficacy Scale). With its help we identified cross-individual differences on perceiving the career counseling process. The CCSES questionnaire was developed by Karen O'Brien, Lynette Heim Bikos, Mary J. Heppner, Lissa Y. Flores and published in the Journal of Counseling Psychology [15]. The initial questionnaire contained 54 activities specific to career guidance (which underlined the traditional and the constructivist approach). Respondents had to indicate on a Likert scale with six steps the extent to which these activities took place in the counseling sessions they attended.

The questionnaire was translated and adapted to the Romanian population and was pre-tested on a group of experts. These experts were asked to read the 54 items and give their opinion on which described best the constructivist counseling. The analysis of the answers helped remove a large number of items that were considered ambiguous by experts so that, finally, we kept our questionnaire for a total of 24 activities to describe the two types of career counseling.

Examples of items specific to traditional counseling: providing information on occupations the student is interested in, applying psychological tests and questionnaires, developing new skills required when entering the labor market (writing a letter of motivation, a resume, participating in an interview for employment), etc..

Examples of items specific to the constructivist counseling: using metaphors in order to uncover the meaning, understanding metaphor, constructive questioning in order to facilitate communication, designing a plan in order to achieve the future goal, voicing out experiences and stories, etc..

Deviation from the initial questionnaire is also represented by the introduction of a new dimension, the importance given to these activities by students. The internal consistency (Alpha Cronbach) of the questionnaire is very good (0.898 on the questionnaires filled in by the students), which allowed us to provide optimal use of questionnaire validly and reliably. In processing the results we used: T tests for independent samples, One Way Anova statistical method, the Bonferoni test.

2.2 Results

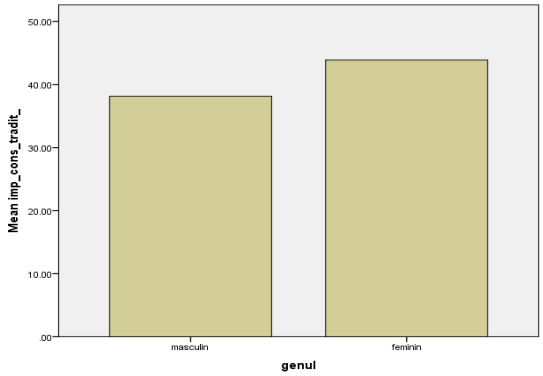
In order to check if there is an effect of the variable of the *subjects' gender* on the *students' perception on career guidance*, we used the statistical method - t tests for independent samples. The statistical analysis shows that:

a) *Perception on the importance of career counseling and the subjects' gender*

p<0,001 indicates that there is a significant difference between female and male subjects in the perception of the importance of career guidance; girls got higher scores on this variable;

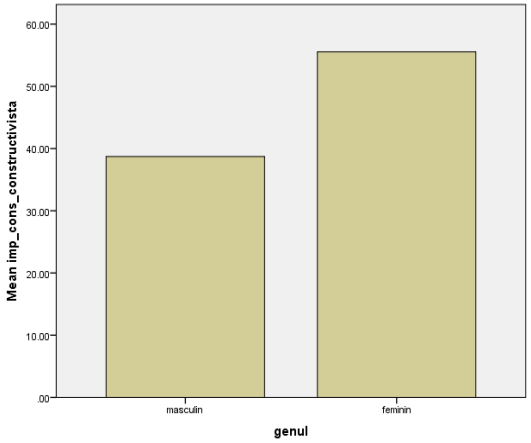
b) *Perception on traditional career counseling and the subjects' gender*

p<0,001 indicates that there is a significant difference between the female and male perceptions regarding the importance given to traditional career counseling, meaning that girls have higher scores on this variable;



c) *Perception on the importance of constructivist career counseling and the subjects' gender*

p<0,001 indicates that there is a significant difference between the female and male perceptions regarding the importance given to constructivist career counseling, meaning that girls have higher scores on this variable;

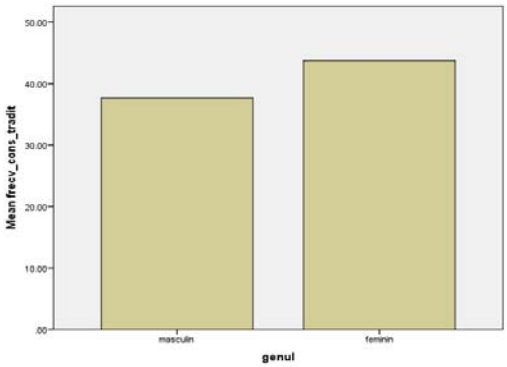


d) *Perception on the frequency of use of activities specific to career counseling and the subjects' gender*

p>0,05 indicates that there is a significant difference between the female and male subjects perceptions regarding activities specific to career guidance frequency, meaning that girls have higher scores on this variable;

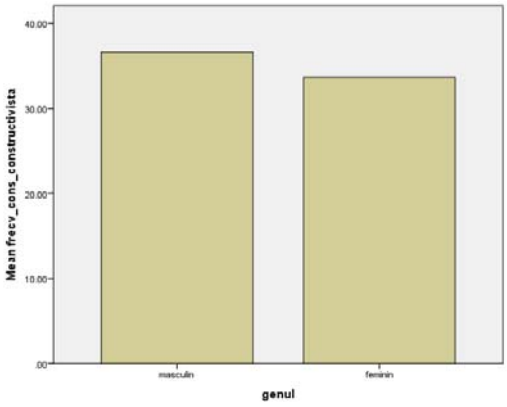
e) *Perception on the frequency of use of activities specific to traditional career counseling and the subjects' gender*

p<0,001 indicates that there is a significant difference between the female and male perceptions on the frequency of activities specific to traditional career counseling, meaning that girls have higher scores on this variable;



f) *Perception on the frequency of use of activities specific to constructivist career counseling and the subjects' gender*

p<0,001 indicates that there is a significant difference between the female and male perceptions on the frequency of activities specific to constructivist career counseling, meaning that boys have higher scores on this variable.

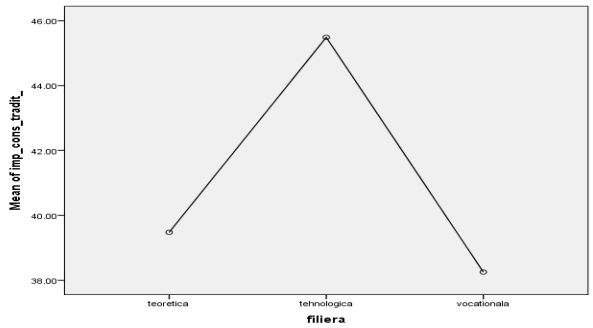


The first hypothesis is confirmed, there is a significant gender effect on the subjects' perception on the importance and frequency of career counseling activities. Girls attach increasing

importance to the activities performed in a constructivist manner.

In order to check if there is an effect of the variable of the type of secondary education on the variable of students' perception career counseling, we used the One Way ANOVA statistical method.

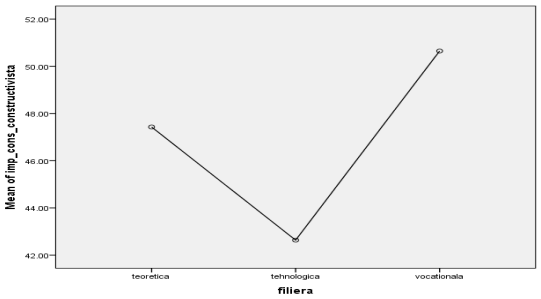
a) Perception on the importance of traditional career counseling and type of secondary education



The Bonferroni test indicates the following:

- M1-M2 = -6.011 p = 0.001 <0.001 indicates that there is a significant difference between students who study in theoretical high schools and students who study in technological high schools, meaning that the latter attach greater importance to traditional counseling than the former;
- M1-M3 = 1.223 **p**= 1,000 >0,05 indicates that there is no significant difference between students who study in theoretical high schools and students who study in vocational high schools with regard to the importance attached to traditional career counseling;
- M2-M3 = 7.235 **p**= 0,001 <0,05 indicates that there is a significant difference between students who study in technological high schools and students who study in vocational high schools, meaning that the former attach greater importance to constructivist counseling than the latter;

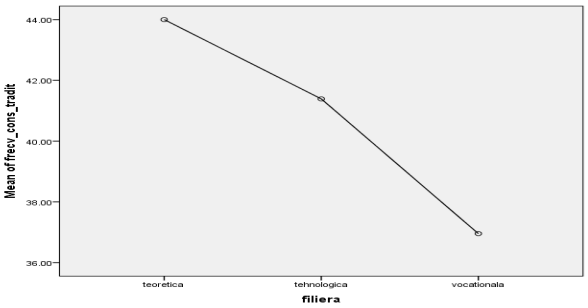
b) Perception on the importance of constructivist career counseling and type of secondary education



After analyzing the results, we conclude that:

- M1-M2 = 4.794 **p**= 0,023 <0,001 indicates that there is a significant difference between students who study in theoretical high schools and students who study in technological high schools, meaning that the former attach greater importance to constructivist counseling than the latter;
- M1-M3 = -3.219 **p**= 0,198 >0,05 indicates that there is no significant difference between students who study in theoretical high schools and students who study in vocational high schools with regard to the importance attached to traditional career counseling;
- M2-M3 = -8,014 **p**= 0,000 <0,001 indicates that there is a significant difference between students who study in technological high schools and students who study in vocational high schools, meaning that the latter attach greater importance to constructivist counseling than the former;

c) Perception on the frequency of the traditional career counseling and type of secondary education



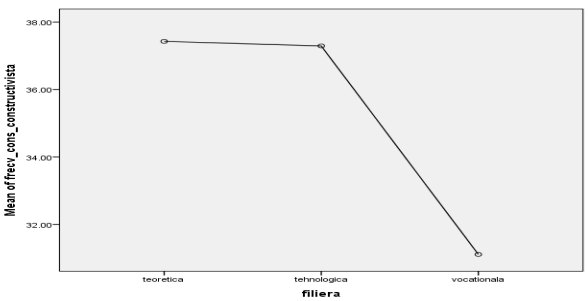
These results indicate that there is a significant relationship between the two variables as follows.

- M1-M2 = 2.609 **p**= 0,131 >0,05 indicates that there is no significant difference between students who study in theoretical high schools and students who study in technological high schools in terms of perception on the frequency of traditional career counseling activities;

- M1-M3 = 7.043 **p**= 0,000 <0,001 indicates that there is a significant difference between students who study in theoretical high schools and students who study in vocational high schools in terms of perception on the frequency of traditional career counseling activities, the former appreciating them as being often used by their counselor in class;

- M2-M3 = 4.434 **p**= 0,002 <0,05 indicates that there is a significant difference between students who study in technological high schools and students who study in vocational high schools, meaning that the former consider that constructivist career counseling activities are much more frequent in their class than the latter;

d) Perception on the frequency of the traditional career counseling activities and type of secondary education



These results indicate that there is a significant relationship between the two variables. Thus:

- M1-M2 = 0.135 **p**= 1.000 >0,05 indicates that there is no significant difference between students who study in theoretical high schools and students who study in technological high schools in terms of perception on the frequency of constructivist career counseling activities;

- M1-M3 = 6.318 **p**= 0,000 <0,001 001 indicates that there is a significant difference between students who study in theoretical high schools and students who study in vocational high schools in terms of perception on the frequency of constructivist career counseling activities, the former appreciating them as being often used by their counselor in class;

- M2-M3 = 6.182 **p**= 0,000 <0,05 05 indicates that there is a significant difference between students who study in technological high schools and students who study in vocational high schools, meaning that the former consider that constructivist career counseling activities are much more frequent in their class than the latter;

The second hypothesis was confirmed, therefore there is an effect of the independent variable of the type of secondary education on the students' perception of the importance and frequency of career counseling.

3. CONCLUSIONS

We conducted an analysis of how students perceive the importance and frequency of performing career counseling activities in high school from both a traditional perspective and the constructivist model. Statistical data confirmed initial assumptions. Thus, *biological gender* statistically demonstrated its effect on students' perception on career counseling, girls considering both traditional and constructivist career counseling activities more important than boys did. Another determinant of the perception on career counseling is *the type of education* variable. Related to this hypothesis, it is very important to pinpoint the fact that all three experimental groups achieved high scores on *the importance of career counseling* variable, but if we differentiate on a cross-individual level according to preferences and needs, we can assess that students who study in technological high schools appreciate traditional career counseling activities more than their peers from theoretical high schools who consider the

constructivist counseling as being more useful. This may also be a result of their initial orientation, given the fact that the technological and vocational types of education allow students to obtain a professional qualification. The open-mindedness specific to the students from theoretical high schools towards the counseling activities designed according to constructivist model is also supported by their needs to identify career paths they want to follow, since their initial orientation is rather general.

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CREATIVITY AND CREATION IN THE SOCIO-MILITARY MEDIUM

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"He who thinks himself and rummages light
He gave a new life and a man of iron, the machine
Being conceived, thinking and dreaming,
Beats unimaginable arm and back
.....
Time, old servant, and the role of the wicked,
You, man and your brother be your master".

Tudor Arghezi – "He who thinks himself"

I. Definitions of creativity

1. „The ability to produce new things, the use behaviors, to find solutions to problem."

2. „Mental capacity to generate new human individuals, to reveal aspects, unknown reality, and ways to develop original solutions to solve problems and to express themselves in personal forms unpublished."1

3. „Overall subjective and objective factors that lead to the achievement by individuals or groups an original product and value."

4. „Activity whose defining feature is new."

5. „Ability of a system (either human person or wider social group or society) to find its problems, new solutions. original."

II. Creation eternity

Creative work, in whatever form it may be, scientific, technical, artistic, literary

[1] http://www.google.ro/#hl=en&sclient=psy-ab&q=Capacitatea+psihic%C4%83+a+indivizilor+umani+de+a+genera+noul%2C+de+a+releva+aspecte+deosebite%2C+necunoscute+ale+realit%C4%83%C5%A3ii%2C+de+a+elabora+c%C4%83i+%C5%9Fi+solu%C5%A3ii+originale+de+rezolvare+a+problemelor+%C5%9Fi+a+se+exprima+%C3%AEn+forme+personale+inedite.%E2%80%9D&oq=Capacitatea+psihic%C4%83+a+indivizilor+umani+de+a+genera+noul%2C+de+a+releva+aspecte+deosebite%2C+necunoscute+ale+realit%C4%83%C5%A3ii%2C+de+a+elabora+c%C4%83i+%C5%9Fi+solu%C5%A3ii+originale+de+rezolvare+a+problemelor+%C5%9Fi+a+se+exprima+%C3%AEn+forme+personale+inedite.%E2%80%9D&gs_l=serp.12...2515.2515.0.3672.1.1.0.0.0.0.0.0..0.0.les%3B..0.1...1c.1j2.whqCIwdsAek&pbx=1&bav=on.2,or.r_gc.r_pw.r_qf.&fp=af7e13e630b545bc&biw=917&bih=576

and so on, is human specific. However improved honeycomb built by bees as he is not a work of creative.

The first human being was discovered by geologists then called "homo sapiens". Without denying wisdom as a characteristic of human beings is the ability to create - creativity - and that name was "gay craters". Moreover, I appreciate that very meaning of life on earth is the creation of our appliances in any field would be. Indeed, the desire for immortality dwells man who, according Bibiliei, he was made the first humans, Adam and Eve, by God, instead bestowing love.

Man can satisfy the desire for immortality in many ways[2]:

a) about religion, embracing one religion that postulates the immortality of the soul and believing in this postulated;

b) by children who, in some way, we prolong life. Why, most of the time, we like more grandchildren than children, although the line of lineage, they are ahead of us? Because through them we see prolonged and longer life. In the novel "Les Miserables" by Victor Hugo, Marius was anxious because he did not know how he will get his grandfather, Victor Hugo opportunity to comment: "Poor Marius, he did not know if there are parents who do not love their children, there is no grandfather who does not love their grandchildren!"

c) through creation. Horace, the great Latin poet, wrote in "Ode to the 30 th" in book three, verse b: "Non omnias moriar" (I will not die for all) thinking that thousands and thousands of years, his work will be read and, thus, he will continue to live through his literary creation.
Similarly, in our literature, the poet Alexander Philippide, in one of his poems write:

„I hang you, poetry,
As a lap child mummy,
Do you pass the bridge world".

The idea is the same: passing into eternity by his literary activity. In this respect there are other examples: Aristotle, Plato, Archimedes, Pythagoras, Galileu, Newton, Einstein are just a few of the thousands of mortals who have forged the great work of the world.

III. Creation and creativity

A key feature of the age we live in is looking "new" for a full adaptation to reality as concrete and immediate, evolving, growing requirements of mankind.
In recent years emerged as essential to the creation of a new research extension in all areas of human concern, leading naturally to the adoption of a theory (and practice) wider in a multi sciences: Creative.
Romanian is a new vocation: the wheel Vlach (exposed to the Polytechnic Museum in Munich) was to consonantistă psychology who founded cybernetics, Romanian examples are numerous, linked to the introduction of the new bold in the new job, among them reminding him Victor Babes pioneered the discovery of antibiotics (1885), Traian Vuia who managed 18 March 1906, the first in the world, the separation of land an aircraft heavier than air with their own on board.

So we display with pride that our country has given mankind many creative people in the different branches, of which we mention only some, focusing on the particular contribution to introduce a "new" the sacred world:

- in artistic creation: Eminescu, Blaga, Enescu, Brancusi, Grigorescu, Luchian Țuculescu and others
- Scientific Crete, we can enumerate the doctors: Babes, Paulescu, Gheorghe Marinescu, Levada, Danielopol, Parhon, Odobleja etc.
- naturalists: Cobalcescu, Mrazec, Murgoci, Sabba, Stefanescu etc.
- mathematicians: crude oil, Pompei, David Emmanuel, Mălăncioiu etc.
- chemists: Petru Poni, C. Istrate, N. Teclu etc.
- engineers: Vuia Vlaicu Coanda Saligny Gogu Constantinescu, etc. Hermman Oberth.
- great historians: N. Iorga, Parvan, etc Xenopol.

[2] Florence LITTAUERPersonality Plus - How to understand others understanding yourself, edition 2009, Publisher Business Tech, pp. 39-41

- great army commanders: Marshal Averescu Prezan Marshal, Marshal Antonescu etc.

It is generally admitted today that there are essential differences between artistic and scientific[3], but both have a common goal - the man and his work. In some studies it highlights the priority of features common to all creators, such as attitude to work, imagination, ability to understand, capacity choice, adaptability, experience.

"NEW" (fundamental requirement of creation of any kind) is always the "old", it comes from the scrutiny of the surrounding reality, the inevitable result of creative leap due to the accumulation of individual and collective labor.

One of the conclusions of researchers November 1 is the dissociation creativity skills to create - important but not decisive! - And especially the performance of "intelligence". N. Cox was among the first who stressed the importance of motivation, hard work and strength of character Priority creative work. Since the eighteenth century, Boileau said in poetic art "Vingt fois sur le metier, remettez votre ouvrage" (meşterească twenty times and take it all the way). It means that an invention claimed Edison 1% inspiration and 99% perspiration and great writer Hemingway said: "creation has no secrets, just a superhuman work." S. Sutherland (Nature 1981) in a book review of DN Perkins - The Mind, and Best Work (spiritual masterpiece) exclaim, "Eureka! Nothing mystical creative thinking."

As a consequence of the unanimous recognition of the role of directed activities and strenuous labor in the creation of any kind, imposed a "method". Existence of creative methods, which are capable of discriminating be applied scientific and technical creation, be artistic and make a major contribution to the development of society; methodology is an effective weapon against obscurantism, backwardness in all spheres of activity which occurs human mind. Mankind faces the obligation to find new solutions in order to ensure survival, population explosion, shortage of essential raw materials and energy crisis often require finding new ways to solve old cases. "Technical thinking, that wonderful and subtle bridge that engineering mind holds between imagination and reality, the secret passage, from a theoretical idea, the abstract, a practical reality" (Gh oil), calls for highly intellectual processes complex processes after N. Wiener can be classified into two "models": Black box (BB) (black box or opaque) and White box (WB) (white box or transparent).

BB model is predominant thinking in the right cerebral hemisphere, which geberează spatial perception, capacity of synthesis and perception aesthetic values, called dyonisiace. How right hemisphere controls the left hand, thinking "model opaque box" thinking is called left hand. Thinking WB model is predominant in the left cerebral hemisphere, the hemisphere that includes analytical ability called apollinică. Since the left hemisphere controls the right hand "transparent box model" is called "thinking right hand".

Collaboration between the two ways of thinking is essential; creation of any kind is always "bivalent" a work of art, a genuine scientific theory or a new technique achievement without input both ways of thinking, would be unthinkable. The two "models WB-BB" inspired many metaphors seeking to emphasize their unity dialectical

[3] Dialogue with Mircea Flonta, February 4, 1986, Creation is a scientific fact and a moral art

antinomy and also revealing a strong link between Jung typology and models "cyber":

- ❖ Creation insight[4] - is a creation of new meanings to items older own music, poetry, visual arts, architecture;
- ❖ Creation extraspectivă - nine communication is a creation that ste own biology, geography, economics and law.
- ❖ architect Le Corbusier - considers creation - of any kind "initiate change in things made by humans for humans".

One of the fundamental requirements for the success of such a change is imagination or fantasy.

This topic so interesting, vast and complex CREATIVITY created, generated a number of ideas that I consider important and valuable.

"ART - means Development of reality through language deeply ... Artwork is in the hands of all, but is born from one parent than the creator is a loner[5]. "

"CREATION - is superior to all states. It always expands the horizons of a future that we announce and expect it. It is therefore only factor unlimited progress ".

- o Under these conditions reach detection "coordinates" creative phenomenon - answering the three questions most basic necessity and logic:
  - ♣ WHAT create?
  - ♣ How do I?
  - ♣ CREATE WHAT?

Inevitable responses are:

I create a material preferably all created by me;

I create building[6];

a "Creating a well defined purpose in both the real and the ideal"[7].

Lack of continuity in the work of creation is the greatest evil. The rapid evolution of ideas forces you to devote yourself all the time. Loss of contact with the library is a great tragedy. "Going increases efficiency" (Academician Caius Iacob).

Artistic work is a finite harmonic creation, artistic creation differs from philosophical or mathematical.

Understanding these views (ideas) can sketch a comparison test between the artistic and technical-scientific.

In conclusion, I can say that.

Artistic creation is closed, individual, unique.

Scientific and technical creation is open, collective, partial.

CREATION - is a fact once determined was achieved, a consequence of almost permanent state.

CREATIVITY - is a state continuously evolving investigation and useful like "state geometry" that speak great mathematicians.

Every word induce in our minds a picture not only certain that we can consider that sense, but along with that word, pass by in our minds, half clear many associations, secondary meanings. A new language means a new model of thinking, requires a new language.

IV. Faces of Creativity

„Genius is patience "- said Newton, and naturalist Huxley said that" Genius is the ability to work unlimited ".

Is renowned brain scientists, the artists and writers more than ordinary people? Yes and no! The average weight of the human brain is 1370-1380 g 1250-1270 g in men and women.

Turgenev's brains, Cuvier, Byron, Mendeleev, Lavoisier was much higher - between 1700-2000 g - but those of Kant, Anatole France were relatively small.

Then there are animals whose brains are three times higher than human - elephant, whale - not that they are still smarter!

More business information gives us the ratio of brain weight and body weight. Dubois has even algebraic formula by which it may be inferred weight and some anatomical and physiological constant. But no relative weight of the brain does not solve the problem.

[4] Dumitru Tiutiuca, Literary theory, European Institute Publishing House, Iaşi, 2002

[5] Sabin Bălaşa

[6] Sabin Balasa

[7] Dimitrei Cuclin

The great creators, imagination[8] is often confused with creation: Flaubert, writing poisoning scene Emmey Bovary fell ill himself "poisoned" the imagination, Dickens, after describing the death of the child in "Dombey and Son" was so disturbed that she wandered all night crying red eyes, to Tolstoy, Turgenev and other writers, strength and clarity of imagined reached such a degree that was confused with real imagination. Of course, there is no need to demonstrate that creative imagination is not an exclusive privilege of artists.

No invention, no discovery in the world of science would not have been possible without it.
Great discoveries are not made by chance. Pies note: "Luck favors only prepared spirits." All that is valuable required a continuous effort, a lot of work. Eloquent in this respect is the work of Darwin's work "The Origin of Species" scheme ideas about evolutionary theory appeared for the first time in his diary in 1837, in 1842 wrote the first draft relatively short of his theory: Two years later Darwin wrote "study in 1844" comprehensive four times and only after 15 years, gathering all the material he gave his work its final form. Characterized by hard work and Tolstoy, who rewrote the six or eight times its main work. Buffon has recovered "epochs of nature" 11 times, and Pascal - "Provincial Letters" 16 times, Leonardo da Vinci interrupted for a year working on the painting "The Last Supper" in order to achieve the image of Judas, which not succeeded. To engrave "Transfiguration.

After Rafael, Jordaens took 10 years. Beethoven sought "theme Joy" from the Ninth Symphony for 30 years and tried 200 variants before finding the theme, apparently so simple in the end Sonata opus 53. Seeking a incandescent material, Edison made 6,000 experiences, and for alkaline battery nearly 50,000. That is why he claimed that "genius is 1% inspiration and 99% perspiration". A potential "recipe" of genius should therefore not be missing: awareness purpose, focus and attention, imagination and voice, and will work, but its application in practice can not only deliver spirits endowed.

V. Definitions genius

Minkowski - "Genius is that creator whose work transsubiectivă and superindividual rank than even the creator himself the attribute of universality is crucial axiological note".

Kant - "Genius is a product of nature, very original, natural energy which does not work by the rules, but that puts clarity and order in his Meditations".

Kretshemer - "A man is a genius when his work survives ephemeral spirit of his time."

Baldwin - "Genius has superior skills to a degree unusual".

VI. Creation - way to redefining human[9]

Maybe today is more important than ever our appliances reflection of Francis Bacon "mind survive the monuments of power". I say this because in today's world, a world equally, questions and answers, trying, more or less initiated, patient or set in late or sick silent words, try saying, in faith or unbelief, with voluptuousness passage through

[8] GOLEMAN D, Emotional intelligence, Old Court Publishing, Bucharest, 2008

[9] Alfred ADLER, Human knowledge, IRI Publishing, Bucharest, 1996

life, the truth about ourselves. Since we have known it ever?

From it we learn? And when?

Story (for it would be to call the only way) is to ascribe, consciously or not, of our own existence, ideals.

There are people who know how to create ideals, are people that replace them canceling each other, are those who deny, they are then those who leave before knowing. Are men of the day, caught in their own power demand, which can not be opposed and which can not detach pride of being (a "being" limited by its very existence solution that have signed it themselves).

But there are (and how naturally the words this time) those people who create, why not in fidelity, not of passion and what I say in redefining our consciousness. It is perhaps a way to explain the survival time and space inspired respond to what our spiritual time and space

Are therefore those who choose, identifying both not ideal enough, but especially with the way ahead for our redefinition, through creation.

If the world was created, giving the origin and value dimensions terrestrial and astral planes apart and approaching possible Asola (provided exceeded the earthly life), there have always been people able to recreate it in an attempt the retrieval, orientation, the world and beyond in trying funndamentală human being: to relive and to overcome himself.

By preserving a creative past, present forward giving him the chance to be present continuously or longer future.

But one possible and not just imaginary, one feasible and not just a dream. Because it is creating it at a time, similar to being. Man identifying himself through creation, made in turn, to man the possibility of an inner knowledge of its history and further universlae, of symbols and their transcription (development, on the one hand, the discovery the other), juxtaposition of meanings, sometimes parallel, sometimes complementary, double reason - mind, giving shape in confrontation brain - abstract, creative euphoria that man and, ultimately, the creation itself.

However, in all that is profoundly human, creation (of all kinds: artistic, scientific, literary, etc.) gives the temporary and spatial individuation, the membership and at the same time, all other. In other words it gives and universality. And thus comes to bring us so many times, confirming our imagination, and inventiveness of our intellectual acuity, the civilizing efforts in a position to justify our spirit to our own I, with our own human and social reality. And later in the century to express the release of individual and social transition to universal, ie, to finding yourself, to becoming whole

VII. Creativity and value[10]

Full sense of values entails, inter alia, coverage and definition of poetic rhythms, theatrical or musical, the colors or shapes, of attire or geometry, elements or phenomenological states. At their base is equally natural language and sense of movement and proportions of the island - shaped, of ethnic unity that feeling or spirit release that it imposes history.

Finding and putting them out we can offer only penetrate the essence. Ie reaching those trăriri conscious initiation of the island and island-creator-consumer who gives power and efficacy in socially and spiritually, and volitional plan.

Values given assume a phenomenology as its own. Being based on island-creative talent, the ability of islet-consumer perception of availability of social, material and spiritual-moral conservative island to retain, preserve and transmit to posterity.

In scope, creations creations assumed to be included in the units against which are defined as values. They are anchored in the immediate space and time involving a flow.

Their constraint on these two coordinates are required related to ethnicity in which life arises. Ie that entity which confers unique identity. And when taken in other

[10] M ZLATE, Ego and personality, Third Edition, Three Publishing, Bucharest, 2002

places or times following it, is its identity document. Moreover, taken in the + and create a own radiant mass-consumer guys. The brightest examples representing them great masterpieces of world culture, creations of Homer or Cervantes, Michelangelo or Leonardo da Vinci, Arsitotel or Plato, Kant or Hegel, Shakespeare or Goethe, etc.. For a culture to save all fresh and creative force is required for it to be dominated by values autohhtone; practice not to accept excessive or indiscriminate cultural values in other areas, but also not close to its own borders world. Contact with other cultures is mandatory. This, however, does not become excessive. For only when excessive amounts are not treated in other areas are "fertile". They really require and stimulate the local culture, gives the force propulsatorie spaces universe. Not by the mere fact of imitation. How stimulating the need to include subjective understanding other cultural spaces. Imperator spirit of universal values opposing her own deepening tendency.

Between eigenvalues and cash equivalents must be a balance. Especially in the social unit. Her condition is potentiating interest, effort and preparation that compose the human factor to said creator. Imposing the values and personality, able to satisfy the requirements and needs not only national, but universal values are useful and usable by the entire human race, regardless of the level of culture and civilization which is, in the sense that they correspond to any social environment and enable effective adaptation aceaasta natural environment.

Local values have a natural priority. The assimilated are added, and they need to respond naturally to specific requirements. In that it does not appear as required or entered violently, that cultural space, but entering the creative spaces, culture and civilization as a natural extension of their domestic without being directed or introduced as coming from outside. They are not an annex, a little primitive but are allowed to enter themselves in the social wild. Thus offering to be assimilated by the Island-socaial continuous movement between state and state fulfilled fulfilled as eminently social act human, making the entire ethnic progression to achieve, undifferentiated.

Thus conceived, the unit of indigenous values and similar values put Insul-effective social situation rises to the tops of the entire national cultural culture. So particular. Integral and integrable universe. Allowing the island-social, whatever aspect-creator, consumer, valued - to become hub through which the whole obviously in a state more accomplished than the beginning.

As matrix being and development of the individual in a position Insul-social culture should assure him a free personal experience by which to exploit all that offering creative spirit of innovation voltage, alternating innovations. Its Autodepăşirile are included in the values that endowed in spatial culture was born, attained and realized that Ins-creator.

Occurring disorders, stoppages, disruptions in the normal course of social development can be removed from the table INSI - creators, the only condition we need to impose, but to secure society, being that you put in a position to act. They are the ones who create and enforce through everything, removes unpleasant states that can establish at one time or another, that human community as a result of breaking the balance between creativity, culture, civilization, on the one hand, language, history, ethnicity, on the other hand.

INSI-creators table that determines the whole, which is the nation, find the will and

activity. This is beneficial repercussions on the mass-consumer fellows, prompting consumer as their instruments to participate in the life and work of the whole. Which occurs only when the whole is unity of life, feelings, activities, creations materialized in value.

The act of restoring the normal course of development of culture, role plays table-social guys (in order of rank, men-creators, men-consumers, guys, conservators). Changing this hierarchy (bringing to the forefront of consumers or the guys-guys-conservative) efectedestabilizatoare is worse than those generated by deregrările or turning back the normal course of cultural development.

First are the moral effects that impose even more unpleasant social statuses, remove surface contrasts mass-social guys willing to sapping the values (or speculating values) made by INSI-creators. Interests of society as a whole is not to change the hierarchy of INSI-makers, men-consumer-conservative guys who aim to preserve and transmit to posterity the table values created. The only way you can return to normal if it was a disturbance or imposed ideological, political, or "found" through ignorance or incompetence.

Desires, his will, judgments company can not be successful unless they are based on value creation. Remaining state programs, speech, as is now happening to us, ARE NOT BASIS. And does not help the inner movement of the whole to progress. Their blood, stands on the propeller under creation, and comes with its force shaping culture. After, civilization as a state of comfort in thinking, at work, in leisure.

VIII. Paradoxes of Creativity

There are known several cases of famous personalities came after a youth not predicted anything good or just ... second tinerțe! Their talent has not erupted normally but, paradoxically! Still present some outstanding examples not only scientific and artistic value of these personality but through their temporal novelty event:

- creator rabies vaccine, Pasteur was about to fall to baccalaureate and writer Anatole France fell to the exam;
- H. Poincaré, the great French mathematician was to lose the competition for admission to polytechnic;
- In 1932, France was killed in a duel, a young man of 20 years, Evariste Galois. In the last 13 hours before the duel would end fatally for him, Galois filled 60 pages with algebraic equations, pages that made him one of the great mathematicians of the world.
- author of the novel "Ivanhoe", known as his work, Walter Scott, was characterized by his teachers as "It's a stupid and will remain stupid" and Carol Swedish biologist Linnaeus, was considered in school retarded!
- Great creative system of philosophy, G.W. Hegel had written on college graduation certificate: "Unable to philosophy."
- Giuseppe Verdi, Italian composer became famous through his life's work was to fall to conservative;
- Luzin, founder of the Moscow mathematical school, the creator of new trends in modern mathematics had in high school math Note 2 - 1-5 scoring system. Luzin learn with a tutor you consider the lack of skills for this subject;
- Maxim Gorky, the famous writer and his compatriot F. Şaliapin were presented to youth in a contest to be received in a choir. F. Şaliapin fell in the contest, but he was the biggest bass of all time!

IX. Creation and creativity in military operative

1. Alexandros III Philippou Makedonon (July 356 BC June 10 323 BC), commonly known as Alexander the Great or Alexander III of Macedon, king of Macedon (336 BC-323 i.Hr .) was one of the first great strategists and military leaders in history. In the fight which took place on October 2, 331 BC near the city of Gaugamela, Alexander the Great, with his usual tactics (right cavalry, and King led the Macedonian phalanx strong center) front break Persian

army, and defeat, with only 30,000 people, large Persian army (1,000,000 soldiers) and Darius is forced to abandon the battle, chariot and weapons.

Its spectacular achievements have made the Greeks masters of the Middle East. At his death at the age of 33, Alexander the Great was ruler of the greatest empire ever conquered. Alexander the Great spread Greek culture contributed to the world.

2. Napoleon Bonaparte (1769 - 1821) - was king of France, consolidated and institutionalized many reforms of the French Revolution. It was one of the greatest military commanders of all time, conquered much of Europe and did much to modernize the nation that he led. Bonaparte was promoted to brigadier general at the age of 24 years.

In France the administration was reorganized, the court system was simplified and all schools were put under centralized control. French law was standardized in the Code Napoléon or Code Civil and six other codes. They guaranteed the rights and liberties won in the Revolution, including equality before the law and freedom of religion.

In 1810 Napoleon's empire reached its greatest expansion through annexation of Bremen, Lübeck and other parts of northern Germany along with the entire kingdom of the Netherlands that followed forced the abdication of Louis Bonaparte. Napoleonic government in Europe in all kingdoms created new emperor was imposed as law, Napoleonic code, Feudalism and serfdom were abolished, and freedom of religion (except Spain).

French administrative and judicial systems were required. Schools were put under central administration and have created free public schools. Higher education was open to all qualified without discrimination of class or religion. Every state had an academy or institution to promote the arts and sciences.

Were created for eminent scholars and scientists.

Napoleonic influence in France is still evident today. To commemorate his victories, he built the Arc de Triomphe in central Paris. Today, the impact is felt in the Napoleonic Code laws of all the countries of Europe. Napoleon was a man who carried it out successfully, safely and never ever satisfied.

3. Charles I, King of Romania, Prince of Hohenzollern-Sigmaringen, on his full name Karl Eitel Friedrich Ludwig von Hohenzollern-Sigmaringen Zephyrinus (born April 10, 1839 in Sigmaringen - died on October 10, 1914 at Sinaia) was the ruler then king of Romania, who led the Romanian Principalities, and Romania, after the abdication of Alexandru Ioan Cuza.

In the 48 years of his reign (the longest reign in the history of Romanian states), Carol country gained independence, which has grown immensely and prestige, the economy recovered and founded a dynasty. A built Peles Castle in the Carpathian Mountains, which remained and now one of the most visited attractions in the country. After the Russo-Turkish war, Romania câştigatDobrogea and Carol ordered the lifting of the first bridge over the Danube between Fetesti and Cernavoda, linking new province from the rest of the country.

Reign of Charles I began actually înaprilie 1866, with entry into the country. Proclaimed prince of Romania on 10 May 1866, (he was only 27 years old when he was appointed ruler constitutional) about this title until March 26, 1881, when proclaimed king, becoming the first king of Romania. He was the first monarch of Hohenzollern - Sigmaringen, whose name turns from King Ferdinand I, the Royal House of Romania, the dynasty that will rule the country until the proclamation of the Romanian People's

Republic in 1947.

During his reign, the country gained full independence from the Ottoman Empire, after a war vivid, modern and very effective (known in history caRăzboiul of Independence, and the Russo-Turkish War, 1877-1878), the Romanian contribution was decisive. During the battles waged today in Bulgaria, Romanian Army had Carol as effective leader, King was personally present on the battlefield.

4. Marshal Ion Victor Antonescu (born June 1882 in Pitesti, died on June 1, 1946, in prison Jilava) was a Romanian politician, a career officer, general, operations chief of the General Staff Army World War First attached London and Paris military, commander of the Superior War School, chief of the General Staff and Minister of War, and from 4 September 1940 to 23 august 1944, former Prime Minister of Romania and "head of State". Antonescu ruled Romania's entry into the Second World War ("Holy war for territorial reunification") by the Axis powers, Hitler's promises on the Romanian territory ceded in 1940, under pressure from Germany (correlated with the Ribbentrop-Molotov) will be returned to Romania.

He participated in World War I (1916-1918), according to the chief of staff of General (Marshal 1930) Constantine Prezan. In this position, Antonescu designed defense plans of Moldova to the German invasion led by Field Marshal Mackensen in the second half of 1917 (in 1916 the majority Romania was under German occupation). King Ferdinand recognized his merits, saying, "Antonescu, no one else can know better than your king great services that you brought the country in this war." To contribute to the defeat of the Red Army conquered Budapest and Hungary, Lieutenant Colonel Ion Antonescu was awarded the Order of Michael the Brave grade III (Royal Decree no. 5454/31 December 1919). In war, Antonescu reputation for skilled military commander and pragmatic, meticulous and tough performer - toughness earned him the nickname "Red Dog".

Soldiers! I order you: go Prut "With this order was on" holy war, anticommunist and national law. On June 22, 1941, the Romanian army crossed the Prut River, attacking the Soviet Union, with Germany and its allies. In august 1941, Antonescu was autoavansat to field marshal. By Royal Decrees. 2240/7 august 1941 and august 2352 bis/21 1941 - imposed by it - Antonescu autodecorat Order of Michael the Brave Class II and Class I.

In 1943 he began to think about leaving the war, allowing Foreign Minister Mihai Antonescu to establish more contacts with representatives of the Allies in Bern, Istanbul, Madrid and finally to Stockholm. Exploration were mainly British and U.S. representatives, but have made it clear that Romania must necessarily deal mainly with the USSR. Discussions started in April 1944 in Stockholm, but have not progressed too far, because refusal to cede Bessarabia Marshall and Northern Bukovina.

On 23 august, afternoon, was summoned to the Royal Palace where King Michael I immediately asked him to sign an armistice with the Allies. Marshal refusal to do so, the King ordered his arrest and Mihai Antonescu, then aropiați of his other collaborators. After a brief detention in the safe palace was surrendered by General Marshall Sanatescu, the new Prime Minister, comunşitilor, which confined him to a safe house in Vatra Lights. He was later handed over to the Soviets on September 1 and transported somewhere near Moscow, where he was kept imprisoned in a castle and was treated very well. It seems that he tried to commit suicide but failed.
In May 1946 he returned to the country to be judged by "People's Court". Following a process masquerades on May 17, 1946, was sentenced to death six times, twice to life imprisonment and the other 80 years in prison and 140 years of civic degradation. The execution took place on June 1, 1946 at 6:03 p.m. at Jilava prison. Marshal asked to be executed by the army, but was refused platoon consisting of 12 guards.

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RACE TO DOMINATE SPACE

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ABSRACT: *Conquering cosmos around ground as a new sphere of human activity and its influence on the development of science, economics and social conditions of life on Earth beyond incomparable consequences they had conquered oceans and airspace.*

Space became the fourth dimension possible war. It's a win recently, but its influence is ever-present and in the near future will be decisive. Effect of using space feels isolated from fighter action, up to the highest level of military art. Spatial dimension of power could have a decisive impact in a possible military confrontation and a key role in ensuring the security of states and regions in peacetime.

Flight in space technology and specific needs, depending on the latest scientific discoveries in aeronautics, electronics, metallurgy, chemistry and information technology, all of which ultimately require substantial financial support.

Keywords: outer space, lasers, missiles, landing, space power, space orbit.

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I. GENERAL:

One of the ongoing concerns of human actions throughout its evolution was entering the space located beyond the horizon of knowledge and existence. With resources becoming more sophisticated, the man began to conquer the air, first by ballooning, then flight with wings means (glider, plane, etc.). Continuing with rockets propelled him into space. After this stage, the man became an "average" space, using increasingly sophisticated technical means. Conquering airspace has enabled man to dominate land and water, helping to expand its scope of action. Associating these means sophisticated information technology, man has managed to completely dominate the airspace, so that today, for example, a surface to air missile shot is more accurate than a gun[1].

Today, more and more players have ongoing geopolitical cosmic programs at various stages of development (the U.S., Russia, China, EU, Japan, France, Italy, United Kingdom, Israel, India, Brazil, Canada, etc.).[2] The existence of such programs and opportunities substantially alter the global balance of power, in that power

[1] Nicolae BUZATU, Aerocosmica dimension of war and its impact on military thought and practice, PhD thesis, published by National Defense University "Carol I"2011;

[2] Michael R.Mantz, *„The New Sword, a Theory of Space Combat Power"*, Air University Press, Maxwell Air Force Base, Alabama, Research report No.AU-ARI-94-6, mai 1995, pp. 4-8.

generally and particularly its military adds a new dimension, the spatial[3].

Spatial trend in technology is to reduce the size of the satellite mass. In 1990, Stanford University U.S. developed program called "cubes" for satellites standard size 10 X 10 X 20 cm and a weight of 1 ÷ 10 kg[4] (weight class of satellites known as nanosateliți), which has a cost of about $ 250,000 U.S. the mission. The next class lower, falling picosateliți, weighing 0.25 ÷ 1.0 kg and dimensions of only 3 X 8 X 10 cm is developed experimental USAF Aerospace Corporation.[5]

Laser emergence in the mid twentieth century, scientific and technical creation of exceptional importance for mankind led to a new revolution in military technology and weaponry. In laser space not changed due to the presence of the atmosphere and can be used in conditions of maximum efficiency for a variety of missions. Not be neglected using it as a weapon in space (ASAT),[6] strong and effective. Installed on an orbital station, a satellite or ground-based technical platform or water, the laser can, through the power and precision to destroy, in seconds, aircraft, missiles or space objects. Can also neutralize satellites broken the electronic circuits, solar cells or photographic objectives (optical). Potential is very large laser weapon in space, research and experimentation continues to this day, usually in secret. However, most developed military application of the laser is in the delivery of communications between satellites and between satellites and ground weapon systems (large) or nuclear submarines in immersion, respectively leadership structures tactical, operational and strategic located on land, at sea (ships) and air.

II. COMPETITORS MARKET SPACE

On 1/10/1996, the United States was founded "the National Geospatial Intelligence" (National Geospatial Intelligence Agency - NGIA) by merging several structures including the Defense Mapping Agency (Defense Mapping Agency), Central Bureau of Images (Central Imagery Office), National Center for Interpretation Photos (National Photographic Interpretation Center) of the CIA. NGIA specializes in the collection and interception of information obtained by photographing and filming made secret spy satellites. This agency has three divisions composition (Operations, Systems and Technology, Business Agency[7]) and respond to requests for imaging activity coming from the

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[3] http://www.presamil.ro/OM/2004/04/pag%/2011,12,17,18.htm accesat la 17.01.2013.

[4] Cf. Daren Buck, „*Space 2035: Technology Transparency, and Trusted Immunity*", Air War College, Air University, SUA 2010, p.11 şi http://spacenews.com/cubesats_galore.html , accesat la 17.01.2013.

[5] Hincley David şi Janson Seigfried, „*Building Miniature Spacecraft at The Aerospace Corporation",* în revista „Crosslink", SUA, nr.1/10,vara 2009, pp.37-38 .

[6] Cf. Wright David, Grego Laura and Gronlund Lisbeth, „*The Physics of Space Security – a reference manual"* American Academy of Arts and Sciences, Cambridge, SUA, 2005, p.125.

[7] Cf.Mihai Axante, „ Research, business intelligence, "Niculescu Publishing, 2006, p.208.

Department of Defense and other ministries and agencies of the U.S.. [8]

The first military space plane (X-37B) completely autonomous successfully launched into orbit by the U.S. Air Force (USAF) on 22 April 2010 from Cape Canaveral in Florida. X-37B is able to take off, to reach low Earth orbit and land 100% autonomous. An important feature of X-37B is that it can operate in optimal conditions in orbit for 270 days without returning to Earth.[9] And other countries - India, China, Russia, France, Israel, etc.. - Have their own satellites, only certain segments and certain areas and their orbit maneuver is unlikely to be achieved except Russia who have the almost similar to those of the U.S.

Russia has an extensive ongoing research program entitled "Cosmos" aimed at studying several areas of physics Earth to medical and biological research using satellites from 500 kg to 4.5 tons heavier ones types: Cosmos, Vostok , Meteor, Molnos and Intecosmos. France has used several research satellites under the SRET (Recherches et d'Etudes satelitte the technologique) including Pollux (D5-A), Castor (D5-B), SRET-3 (MAS-3) etc. Japan launches its own satellites Research (Oshumi, Tans, Kiku, etc.). Mainly from bases in Tanegashima and Kagoshima carrier rocket production facilities. England has research satellites X Series (Prospero X-3, X-4-Miranda) China has a program called "China", France and Italy cooperate on the Duetto (Meteosat satellites and Sirio), India possesses series satellites Rohini RS and the list remains open for more countries development programs of certain spatial abilities.[10]

III. DEFINING ELEMENTS OF SPACE

Analyzing the outer space of geopolitical and geostrategic environment can divide this into three relatively distinct sectors [11]:

a. near circumterestru space that extends from Earth's surface up to about 40,000 km away from it, and the maximum orbit satellites main characteristics is given in missile carrier, eg Russian missiles such as PROTON - M, K, Soyuz - 2 , U, Molnos - M, and so on, the U.S. ATLAS type (MERCURY, agencies, centaurs, etc.) Chinese missiles CHANG Zeng series - Long March - (CZ-1, CZ-2A, B, C, CZ -3, CZ-4), the

[8] Dr.Tiberiu Tănase, „ The U.S. defense intelligence - intelligence community and Department of Defense strategy "in Romanian Military Thinking nr.2/2010, p.99.
[9] www.af.mil/news/story.asp?id=123199790, accesat la 19 decembrie 2010.
[10] Gl.mr.ing.Dumitru Andreescu "Encyclopedia space programs "Vol.II, Military Publishing House, Bucharest 1980, pp.10, 49, 52, 53.
[11] Col. Prof. univ. dr. Giurcă ION, "Geostrategy sea, air and space, "AISM Publishing, Bucharest, 2001, p.13.

European Space Agency ARIANE type 1, 2, 3, 4, 5, etc [12].

b. moon outer space (which can become the theater of war lunar space) includes space ranging from 300,000 to 450,000 km within Earth's surface including areas of Moon L4 and L5 points librație the groups could be carried orbital forces and means of launching, guidance, and ensure their functionality and fighting forces and means Moon-Moon-Earth and Cosmos;

c. distant space that extends beyond 450,000 miles away from Earth is accessible, yet just means cosmic unmanned.

Space power theory, created and developed by American analysts, based on the models of Mahan, Mackinder and John Collins (higher analyst at the Library of Congress) in the study entitled "Military Space Forces: The Next 50 Years", is essentially following:[13]

- who controls the planet possesses circumterestru space;
- Who controls the moon controls the space circumterestru;
- who controls the L4 and L5, mastered Earth-Moon system.

Space programs have astronomical prices. U.S. allocates a share of about 65% of NASA's budget for military purposes which was only for the period 1955-1995, 251 billion.[14] If for fiscal year 2011, NASA has a budget of 19 billion dollars for fiscal year 2012, an estimated allocation of U.S. $ 18.724 billion [15], down from the previous year due to budgetary constraints imposed by the Obama administration.[16] Defense budget by China for 2008 amounted to 83.1 billion U.S. dollars [17] but lacking official information on the expenditure spatial. Budget for defense in 2010 by the Russian Federation was U.S. $ 42.5 billion, up 3.5% from 2009, representing 4.07% of GDP.[18] Russian Space Forces budget has not yet been released. The defense budget for 2010 was 692.780 billion U.S. dollars, research / development in space programs were allocated $ 2.626 billion for the payment orders engaged in space was allocated $ 4.163 billion, and for the preservation program kinetic energy interceptors were allocated $ 80 million[19]

Also of importance is the assessment of the first Romanian cosmonaut Dumitru Prunariu saying that "*the EU is a considerable space power. Undoubtedly, the military superpower and space are the United States. Currently, the U.S. invested six times more than the whole of Europe in space. Runner already are not Russians. Russians have a strong infrastructure that have inherited and which he still develops where needed. Like others, Russians invest more now*

[12] „*Rockets & Launch Vechicles"*, The Internet ENCYCLOPEDIA OF SCIENCE, http://www.daviddarling.info/enciclopedia/R/rockets_list.html și http://www.mil.ru/848/1045/1276/1871/index.shtml, accesate la 28.01.2011.

[13] Alvin și Heidi Toffler, *Op.cit.*, p.130.

[14] „ Bulletin of the Ministry of National Defense Information and Documentation*"*, nr.3 /1999 p.15.

[15] http://www.nasa.gov/pdf/516675main_NASAFY12_Budget_Estimates-508.pdf, accesat la 14.01.2011.

[16] http://www.whitehouse.gov/omb/budget/fy2012/assets/hist.pdf, accesat la14.01.2011.

[17] Conf. „*The Military Balance 2010"*, tabel 34, p.392.

[18] Ibidem, tabel 21, p.219.

[19] Ibidem, tabel 6, p.26.

in national security through the use of space, so the military cosmos. Perhaps second place is the Chinese who have already put their own means, three astronauts in outer space. Fri catching up India, Japan, the EU also through programs European Space Agency (ESA) and the EU ordered this institution is organized apart from other European institutions. One of the prospective allies is the Russian Federation: let's not forget that at Baikonur ESA Kourou in French Guiana on already is devised throughout the infrastructure type Russian Soyuz carrier rockets with Europeans on board satellites, or even space ships piloted." [20]

Since placing weapons in space is illegal space powers have chosen the placement in space, orbit circumterrestrial, of "platforms" - satellites, orbital stations and space shuttles - fulfilling missions whose results can be used both in the civil and in the military[21].

From the point of view of space înamării there are three reasons for this choice:

a) control - who controls the military and commercial space has immeasurable advantages that provide indisputable sovereignty;

b) vulnerability - reliance on space assets show particular vulnerabilities;

c) inevitable - succeeding temporal space weapons on land, sea and air (historical analogy sea and air power design - "trade follows the flag" on military development in terms of protecting commercial expansion)[22].

IV. PROSPECTS OF RACE ESCALATION TO CONQUER SPACE

In recent years, the possibility of earthly astronauts to reach the Red Planet is increasingly taken into account. However, despite the optimistic expectations of fans travel and space exploration experts say that such travel involves huge risks related to exposure to radiation, but also any technical failure, not least in how isolation can affect human behavior. An equally serious danger, unknown until now, was highlighted two years ago: the possibility that astronauts going blind because of the long stays in weightlessness[23].

Our seductive Selene absence would put another question. Luna is one that stabilizes the tilt of the Earth in relation to the axis of rotation. This axis

[20] Dumitru Prunariu, „ Aerospace power is Romania? "In Top Business Magazine nr.710/2008, p.9.
[21] Mihail ORZEA□Ă, Continuous war, p.44, Military Publishing, Bucharest 2011
[22] Dorin LUPARU, Space as a medium between law and military power (II), Military Thought Magazine nr. 6/2012, p 81.
[23] Review magazine. 29 September 2012

tilted about 23 degrees from the planet causes the alternation of seasons. But without moon inclination may vary by about 85 degrees in a few hundred thousand years and chaotic motions of the planet would have a major influence on the distribution and even the very survival of living species. A delightful view at all, but fortunately remains still, for a long time, the state of scientific hypothesis[24].

Juno, American spacecraft launched in august 2012 from Florida to Jupiter to get close to giant planets in 2016, after 2.7 billion will go miles. Flight energy required is provided by the three large solar panels equipped with 18,000 photovoltaic cells, becoming the first probe will cover such a distance using solar energy.

Near the planet, astral light is 25 times weaker than the Earth which implies avoiding passing through the shadow of the planet. If all goes well, the probe will remain a year to make polar orbit 33 times world tour, during which you see the dense gaseous atmosphere. Study its structure could provide new information about the other giant planets discovered lately orbiting other stars of the Galaxy. Juno will try to respond to questions like gaseous planet's core is full? Its powerful magnetic field is generated by a vast ocean of metallic hydrogen? How was born the oldest planet in our Solar System? Will it reveal some of his secrets about the origin and evolution?

After data collection, the probe will go into the planet's atmosphere to get us inside information about it, confused by titanic hurricanes[25].

In 2010, a Japanese company (Shimizu Corporation) has proposed to install a network of solar panels circular equatorial belt along the 10,920 kilometers. Width is several tens of kilometers Luna Ring project. The advantage is that sunlight is captured continuously and weather conditions are always favorable. Energy produced can be transmitted receiving stations installed in various areas of the entire surface of the Earth through huge antennas.

Apollo missions revealed the presence of gold and silver in the basement of the moon (near the surface) in the 1970s. Then they were spotted deposits of titanium and platinum. In 2010, during the American LCROSS mission, was detected mercury, methane and hydrogen in Cabeus crater. Unfortunately, the quantities of items are too small to justify their exploitation. But looming interesting track towards another element, helium 3, carried by the solar wind (found in small quantities on Earth). It is estimated that at a depth below the crust monthly insignificant, there are millions of tons. An ideal fuel for nuclear fusion (a few hundred tons would be needed to meet the power needs of humanity in a year). Theoretically, it is a godsend. But basically, things get complicated because there are technical means to exploit deposits and transfer them to Earth.

[24] Review magazine. 43 of 27 October

[25] Review magazine. on September 29, 2012

Although President Obama has decided to cancel the space program Costellation to return to the moon, NASA, which has $ 8 billion annually for manned flights continue to develop a program to achieve a huge rocket and a spacecraft - Orion - with the consent of Congress, the decision was logical that stopping the project would bring financial harm because it is in an advanced stage. Orion spacecraft will make a test flight in 2014 and 2021, a flight crew.

Long term objective aims to install a monthly basis and a permanent space stations in Lagrange point (where gravitational forces are balanced) between Earth and the Moon, necessary stopovers, especially the flight to Mars. On the other hand, the European Space Agency is ready to achieve automatic spacecraft landed in 2018 could[26].

A version of the latest NASA space shuttle astronauts to fly will allow to and from the International Space Station was officially presented to the United States in the last week of May 2011. Orio Shuttle was originally designed for a new ground missions to the moon, mission canceled at the last minute by President Barack Obama. It is hoped that two type Orion spacecraft can be used in a long-term mission, targeting a manned landing on an asteroid by 2019.

Spacecraft will have a much more limited role of "carrier" for supply missions to the International Space Station, located circumterrestrial orbit. For docking operations in space to flow perfectly, cosmic vehicle makers, engineers and specialists from Mardin Lockheed built a huge test point in the Waterton Canyon south of Denver, where the size of the model space station and Orion can practice maneuvers required shuttle transhipment.

Fitting this place called Space Operations Simulation Center, cost $ 35 million. Test version of the device, although no special ceramic coating outside, is otherwise fully equipped inside with all necessary equipment. Initially, Orion was part of a mission called Constellation, which the American administration during President George Bush Jr. planned to spend no more than $ 100 billion. But President Obama canceled the project last year, saying the space program should focus on a more advanced technology in missiles. He revived only that part of the project on the shuttle Orion, which will act as a "rescue vehicle" for astronauts in difficult situations.

NASA expects shuttle could play two important roles in future manned flights, including transport to the space station in orbit around the Earth low

[26] Magazine shop No. 46 of 15 Nov. 2012

and long journeys, to other heavenly bodies.

"Orion will evolve from what was at first the Constellation program, as should, as part of a complex missions, manned," said NASA spokesman Bob Jacobs. Officials at Lockheed Martin suggests that Orion could be the next generation of space rockets, first to explore the unseen moon, then to land astronauts on asteroids and eventually take them to one of the moons of Mars, where could control robotic instruments on the surface soil.

Orion includes a module for crew and cargo related, a service module for propulsion, electrical generators and other devices and a release / surrender to raise capsule safe to rocket propulsion fails. NASA has already successfully tested this system three weeks ago at White Sands Missile Range, New Mexico.

The first Orion capsule is assembled at Waterton Canyon, another plant of the company Lockheed Martin and will be used first to test the ground before being launched on a suborbital test flight. The first orbital mission of the Orion capsule could happen, said John Karas, vice president of Lockheed Martin Space Systems Co.., In 2013[27].

It seems strange, but once managed to win the battle space to conquer the moon, Americans seem to abandon the idea of returning to the "astral night." Such a new program is too expensive or simply too dangerous, impractical? In early 2010, U.S. President Barack Obama officially announced that abandons the "Constellation" of NASA, which aims to send a U.S. per month is considered too expensive. China has initiated a spectacular manned space program, found himself at the forefront competitors, although probably few have seen on television in 1969 Apollo 11 mission success.

Now, to prove the status of world power, China wants to be the first Asian country, and not only to send a man to the moon. To this end, China has launched an ambitious program called "Chang'e" already scored two probes Monthly successful missions. "Chang'e-1" (released in October 2007) and "Chang'e-2" (released in October 2010) enabled after placing in orbit, making detailed observations of the Moon. Next stage is set for next year.

In 2013, the mission of "Chang'e-3 'landing is a module capable of performing scientific analysis of the soil. This will be the first moon landing in Chinese history, even if comes 44 years after Neil Armstrong's adventure is especially important to allow China to join the club of great powers etilist space. Finally, a fourth mission of the "Chang'e" provides for a new monthly probe landing and then return to Earth.

In June 2012, Shenzhou IX space mission demonstrated China's ability to master a rendezvous space technology, an essential step in the conquest of space. At that time, China sent the first woman into space orbit. With these technological achievements, China is trying to shorten the delay with the U.S. and Russia in the field of manned space flights. But other Asian countries have ambitions monthly. And foremost, India, on 14 November 2008 managed

[27] Review magazine. 22 of June 2, 2011

to place a space probe to the moon, which is a first for Indian space program initiated in 1963. India, which is planning manned space flight for 2016, 2013, announced the launch of space probes to Mars, even if "Mars mission" is led and dominated by NASA.

Regarding the ambitions of Japan, is also a space power first hand, particularly involving the International Space Station program[28].

European missile Park recently included a small ally: Vega, the result of a Franco-Italian collaboration. It has three floors, a height of 30 meters, has a carbon engine and can carry low orbit (up to 700 km altitude) 1.5 tonnes of freight (for comparison, the Soyuz has a transport capacity of 3 tons, to an altitude of 36,000 km).

Is an economical solution for launching satellites that orbit so far were transported Russian SS-19 ballistic missiles, called Rockot with low reliability, which missed the launch of several European satellites[29].

Tuesday, May 22, 2012, Space X has become the first private company in the world to send a spacecraft to the International Space Station (ISS) before, unmanned space missions aboard being conducted by government agencies.

The day the world premiere Falcon 9 rocket, privately owned SpaceX, the Dragon capsule placed in space, launch point is Cape Canaveral Air Force Base near the Kennedy Space Center in Florida. It is no less true that this was associated first and NASA, as a government agency, without which no space flight is not possible in the U.S..

The next day, on May 23, the Dragon capsule, weighing 6 tons, a length of 5.2 meters and a diameter of 3.6 meters, has successfully connected to the ISS. Elokim Musk (40 years), SpaceX company owner promised to keep trying even if they failed. "The attention caused by this mission creates high expectations, even if it is just a test flight, the consequences of failure could be significant," said John Logsdon and former director of the Space Policy Institute at George Washington University, close associate of NASA.

Bet NASA SpaceX much success as the U.S. space agency relies on the private sector - which has partnered to take over after the withdrawal of U.S. space shuttle in July 2011 - to carry yet this year and at lower cost materials and supplies aboard the ISS and then astronauts since 2015. Interest and impatience are explicable because NASA depends exclusively on Russian Soyuz capsules for each paying $ 50 million per seat on board these vehicles. In addition, supply missions, SSI depends on vehicle type automated

[28] Review magazine. 36 of 6 September 2012
[29] Review magazine. 7 of 16 February 2012

Russian Progress cargo, European (ATV) and Japanese (HTV, which are designed to be used only once and at the end of the mission to self-destruct, burning on re-entry atmosphere.

SpaceX Dragon Capsule firm who can carry on the ISS payload of six tonnes, is reusable, it can return to Earth with a load of three tons, operating costs are much lower in these conditions. $ 1.6 billion contract signed with NASA, SpaceX requires to perform 12 missions to ISS supply over four years. At the press conference after the successful launch on May 22, Elokim Musk wanted to remember, besides the honor of collaborating with NASA and the 1,800 employees of SpaceX, that is the third consecutive launch success Falcon 9 rocket out of 5.

Explaining the significance of May 22, Musk said: "The mission marks a new era in space exploitation. Can be compared with the advent of the Internet in the mid 90's, when private companies have entered into what was a government mission. This incredibly fast pace of Internet development market. I think we are at the same time today on space transportation technology."

Flight schedule

May 22 2012: SpaceX Dragon space capsule launched a Falcon 9 rocket from Cape Canaveral Air Force Station;

May 23: Dragon enrolled Earth orbit and was heading towards SSI;

May 24: Dragon Capsule sensors and flight systems have undergone complex tests to finish if the vehicle is ready to engage with Space Station. These tests included maneuvers and airborne systems checks when the capsule is 2.5 km from the ISS.

May 25 to May 31: After docking, the ISS astronauts opened the hatch dragon and had time over the six days carrying cargo capsule to download and upload Dragon Station on Station materials for return flight.

May 31: After a two week mission, Dragon emerges Space Station and returned to Earth, landing in the Pacific Ocean, a few hundred kilometers west of South Carolina.

SSI is a space project worth 100 billion dollars, funded primarily by the United States of America and to the realization that L16 participating countries. The station is manned continuously occupied since November 2000. ISS is orbiting Earth at an altitude of 350 km, making a complete revolution around the Earth's each 90 minutes, an average speed of 28,000 rowing k / hour. Weighing over 408 tons, SSI offers a living space equivalent to a Boeing 747[30].

A Swiss company prepares its first flight around the world of an aircraft powered only by solar energy. It was time for this performance, especially with how many years solar car races are held.

The high performance expected by Swiss solar plane is named Solar Impulse. He landed safely in 2012, Madrid Barajas Airport, with international flight point first phase of Payerne (Switzerland) and Morocco. However, the decisive moment is around the world, the Solar Impulse adventure is scheduled to start in 2014.

The 2000 kilometers have been

[30] Review magazine. 22 of 31 May 2012

traveled to Spain in 17 hour flight, no dizzying speed, but promising. The plane, which does not use any fuel, crossed the border at high altitude surveying Spanish Pyrenees, the main obstacle in his path, the aircraft being pilot Andre Borschberg.

Solar Impulse has the scale of an Airbus A 340 (63.4 m) but weighs only 1600 kg, the weight of an average car. Flight on stage was necessary because the device is not large enough to allow a longer route to use the two pilots. From Madrid, Solar Impulse was piloted by the other co-founder of the project explorer Bertrand Piccard, who had the task of leading device over the Straits of Gibraltar, to the final destination Rabat. About 150 specialists worked seven years to this plane carbon fiber. He began the construction of the second unit, HB-SIB, which will travel round the world without fuel in 2014. It will be great to have a more spacious flight deck, and new batteries and motors. The plane will be ready in 2013, this year is set and the first test flight[31].

ZEHST called supersonic plane, which is in prototype phase, conducted several French companies can travel the distance Paris-Tokyo in 2 hours and 30 minutes! A time of challenge and a great privilege for passengers to be achieved given a speed of Mach4? (5000 km / h, four times higher than that of sound)

It is equipped with three engines, two biofuel-powered jet (used for takeoff and landing) and is in feasibility studies. Between the two reactors is three rocket engines, the models of the Ariane rocket. After reaching an altitude of 23 km and speed of Mach 2.5 comes into operation two hydrogen statoreactoare providing a speed of Mach 4 spots up to 32 km altitude.

At the end of the journey, stratoreactoarele will be decoupled plane down in flight hovered between 23 and 10 km altitude until entering service turbojets providing landing.

The aircraft will emit 80% less gas emissions and will be 65% less noisy than those made so far. The first flight will take place before 2020[32].

Since 2012, Romania entered the orbit space. European Space Agency (ESA) launched on February 9, 2012, between 12.00 and 14.00 (GMT), from its base in French Guiana, the first Romanian microsatellite, baptized with the name Goliath project in a Romanian Space Agency (ROSA). Our country has become, since December 22, 2011, a member of the ESA, the largest European intergovernmental organization of scientific and technological activities which, in 2012-

[31] George Lucaci, Review magazine. 23 to 7 July 2012

[32] Review magazine. 38-22 sept. 2011

2013, Romania has to contribute about 7.4 million.

Important to note is that GOLIAT is not a single idea Romanian specialists (which contributed to remember, students from the University of Bucharest - Faculty of Physics, but also from Polytechnic - Faculty of aircraft). Conversely, achieving microsatellite is part of the ROSA program that tries to be imposed in Europe. "It's a fairly new concept that change certain aspects of the space industry"[33].

V. CONCLUSIONS

Today, there are more countries with space activities than they were 40-50 years ago, capable contracacreze solitary freedom of action by various types of interference such as jamming signals solitary.

We appreciate that it would be accepted that security will be more efficient in space achieved by a system based on rules rather than by implementing destabilizing weapons systems.

In the long run, the best way to protect commercial interests, scientific and security stability in space will be through the rule of law, obviously better than the unilateral assertion of military power.

Space, time and technology are and will be key factors with decisive impact on the strategy and tactics used in the war of the future. In Lu, the emergence of cyberspace (virtual) will further increase the complexity of future warfare. Complementarity and compatibility of future confrontations spațialo / cyber will make certainly the next century in human history.

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ADOLESCENTS' TOLERANCE TOWARDS THE LEVEL OF MORALITY/IMMORALITY OF MORAL VALUES

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Abstract: *Living in the 21st century, we are witnesses at the humankind's alienation in a postmodern world, and the boundaries that separate good from evil are becoming more and more blurry. The need for rational answers to irrational questions, such as why do people believe in transcendental experiences, why are humans capable of committing atrocious acts, and why are we so breakable and submissive to orders, are just some of the questions that pop into everybody's mind. Now we can, at least in part, offer scientific answers to these questions. The most important factor in man's allegiance to the Supreme is represented by the religious behavior and by the social and political conduct. With the help of cognitive and social explanations, we now know that man is not just a 'tiny insect', incapable of standing up for itself, but is capable of changing social settings, of manipulating the course of the events, and of deciding its own destiny. Moreover, human behavior and human societies are mostly affected by moral values and social standards. That's why it's important to study the distribution of moral values among those who represent the future of every society: adolescents and young adults.*

Keywords: *adolescents, young adults, moral values, morality, religion*

1. Introduction

The development of moral values system among young adults, and their mental self-regulation ability is crucial for a society to work at its best. Some of the researchers associated adolescents' way of giving importance to moral values with their tendency towards moral deeds (Bond, M.H. and Chi, V.M., 1997; Hardy, S.A., and Carlo, G., 2005; Padilla-Walker, L.M. and Carlo, G., 2007 in Hardy, S.A., Padilla-Walker, L.M., Carlo, G., 2008). From here comes out the need for analyzing the means by which Romanian adolescents and young adults are attributing moral values. By apprehending the mechanism by which moral values system works, the use of socialization could be priceless not only for the youth, but for schools, churches, and other institutions of this kind.

It is said that the human being is, by its nature, religious, aiming for a religious orientation. McCauley comes to the conclusion that, for to have religious ideas or concepts, it is enough to think "naturally" (McCauley, R. in Terrin, A.N., 2004). In agreement with McCauley, Mircea Eliade - the Romanian historian of religion – alleged in *Sacred and profane* that man is, first and foremost, *homo religiosus* - religion marks the most distinct human action: believing (Eliade, M., 1995).

The psychology of religion studies the premises of religious system regarding human personality, its structure, motivations, and psychological mechanisms (Cuciuc, C., 2006). This area has accounted for systematic research starting from 19th century. Yet, remarks regarding the psychology of religious

experience have existed since the early days (Aristotle). The founder of the psychology of religion is thought to be Rudolf Otto (1860-1937), by whom the religious experience is irrational, „a secrecy of horror, power and fascination" (Otto, R., 2006). Freud defined religion as the „widespread obsesional neurosis of humanity" (Freud, S., 1991, p.154). C. G. Jung thought that the religious experience has been located in what he used to call „collective unconsciousness". In 1950, G. W. Allport considered religion to be founded on feelings and emotions. This subjective perspective has evolved to the point where religion was considered a product of human imagination.

The theorists of cognitive psychology have reduced religion to a collection of religious represenations fixed onto our mind through diverse mechanisms. The question posed is not what religion is, but how religious representations are formed (Terrin, A.N., 2004). Same theorists have tried to naturalize human knowledge, involving computational methods and hoping to transpose meanings into physical causes. Cognitive theories complete the phenomenology of religion, giving the opportunity to understand religions without social and cultural biases. But is it possible to completely naturalize the religious experience, like it has been tried to do with the human mind? The risk would be total naturalization, and that would diminish the idea of *homo religiosus* to a simple cerebral mechanism (Terrin, A.N., 2004).

Formerly in history, the areas of morality and religion were overlapped (Cuciuc, C., 2006). Religion had separated as a distinct area of concern before legal systems and even before politics; it substituted, in the first communities, these yet unborn areas. Religious systems had brought up standards of social coexistence before law and morality as distinct preoccupations. Religion has been offering a system of standards and criteria for social cohabitation. Subsequently, some of the criteria have been brought unde regulation: you shall not kill, you shall not steal, the prohibition of marriage between close relatives. Thus, there is an autonomous morality referred to profane criteria, which considers that deeds should be according to profane principles of a rightful cohabitation, and a religious morality which refers to religious criteria: the Bible, the life of Jesus, etc. Nowadays, the values to which people accede are not only religious, and the option for certain values – sacred or profane – relatively devides the moral domaine into its religious and profane aspects. The non-believer is neither immoral nor amoral, but he only abides by those values he considers socially or personally useful, with no linkage to the sacred (Cuciuc, C., 2006, pp. 179-182).

Comes out the question if moral and psychological development are related to one another, so that moral development goes hand in hand with psychological development, or at least with some aspectes of it. Lawrence Kohlberg considers that there are some stages in the development of morality, and a certain consistency with the psychological development. There are three levels in the development of morality, each level having two stages, therefore six stages overall. These stages start with obedience and fear of punishment, and end with adherence to the principles of universal ethics (Doron, R. and Parot, F., 2006). The sequence of the stages is constant, none of them can be skipped. However, one can remain only at the fourth or fifth stage (Thomas, L. in Singer, P., 2006, pp. 495-496).

It's been noticed that the practice of religion seems to assure the basis for practicing morality, by helping in acquiring moral abilities. By opposition with skeptics, religious people analyze and criticize their level of morality, resulting in an increase of moral abilities. However, religion is not imperative for the development of morality – a non-religious environment could lead to moral abilities as well (Rossano, M.J., 2008). In that direction, two researchers, wanting to identify criteria by which moral persons could be identified, found out that for 19 out of 24 persons religion has been an important aspect of moral attitudes and deeds (Colby, A. and Damon, W., 1992). Although religion seems to offer increased possibilities for the development of moral abilities, some of its aspects have had the opposite effect. For

example, negative beliefs about the self and about the humankind in general, encouraged by the concept of primordial sin or that of eternal punishment, could lead to maladaptive coping techniques that block the attempts for self-actualization, and even jeopardize individual's well-being (Anno, G.G. and Vasconcelles, E.B. in Rossano, M.J., 2008).

Theism is represented by the belief in a personal and living God. Some of the arguments of theism are based on three fundamental questions: why are religious people happier than non-religious ones? Why are religious people more generous? Why the majority of people are religious? Analyzing the data collected from many research studies, Arthur Brooks had concluded that religious people are indeed happier and, emotionally speaking, they present themselves much better than non-religious people. The relation between religiousness and personal happiness persists when certain variables such as gender, age, level of education, income, and marital status are controlled (Myers, D.G., Seybold, K.S. and Hill, P.C. in Graham, J. and Haidt, J., 2010). The odds of offering themselves volunteers and committing generous acts are greater in religious persons than in non-religious (Brooks, A.C., Gronbjerg, K.A. and Never, B., Lazerwitz, B., Pharoah, C. and Tanner, S. in Graham, J. and Haidt, J., 2010). This is valid when age, gender, income, and political adherence are controlled (Brooks, A.C. in Graham, J. and Haidt, J., 2010). As for why the majority of people are religious, the practice of religion and its rituals have evolved simultaneously, strongly related to each other (Voight, B.F., Kundaravalli, S., Wen, X., Pritchard, J.K., Williamson, S.H, et al., in Graham, J. and Haidt, J., 2010).

Atheism is a doctrine or an attitude that resides in the abnegation of any representation of a personal and living God (Didier, J., 2009, p.28). But this abnegation isn't always explicit. In Nietzsche's opinion, there are people who have never been concerned with the existance or non-existance of God, their first and only concern being mundane, about man's situation and destination. The theorists of modern atheism were Ludwig Feuerbach and Karl Marx. They alleged that any belief in God is an alienation, a run from reality, from the fundamental question, which is not whether God exists or not, but what is the future of humankind. Therefore, atheism does not disbar the moral virtues of humanism, it just refuses the intervention of a divine Providence in world's business, and counts only on people's courage, will, and hard work. As for the reasoning that stands at the basis of atheism, there are twelve impossibility arguments, says Patrick Grim: is impossible for God to be omnipotent, omniscient, and morally perfect, the imposibility of attributes combinations, etc.

But how is religion seen today? Do people attend church anymore? If so, how often? In Romania, in 2005, 46% of the population declared they were attending churh once a month. Therefore, Romania was the country with the most intense religious practice in Europe. In 2000, 76% of the population used to pray at least once a week (Voicu, M., 2007). A research made in Romania has differentiated, related to religious practicing, three categories: christians who practice religion, christians who don't practice religion, and undeclared atheists. Hierarchical, Romania is situated after Poland and Italy, with 45.3% christians who practice religion and 51.5% christians who don't practice religion. Undeclared atheists are represented by 2.3% of the population, and they are most likely males

(76%), with higher education, and residents of big cities. As for the declared atheists, they are very few, only 0.3% of the population declared themselves atheists (Voicu, M., 2007).

Other studies in this area of concern have shown that: morality is partially represented on the vertical dimension, but not to the persons with low interest in morality (Meier, B.P., Sellbom, M., Wygant, D.B., 2007. Failing to take the moral high ground: Psychopathy and the vertical representation of morality, *Personality and Individual Differences*, no. 43, pp. 757-767); parenting dimension (implication, support, and structure) is associated with adolescents' global internalization of moral values (Hardy, S.A., Padilla-Walker, L.M., Carlo, G., 2008. Parenting dimensions and adolescent's internalization of moral values, *Journal of Moral Education*, 37(2), pp. 222-223).

2. Methodology

2.1. Objective

The purpose of the present study is to assess adolescents' and young adults' tolerance towards the level of morality/immorality of moral values, in relation with variables such as gender, level of education and denomination. The idea for this research came from the data and observations that had been published in two studies: *Failing to take the moral high ground: the vertical representation of morality* (Meier, B.P., Sellbom, M., Wygant, D.B., 2007) and *Parenting dimensions and adolescent's internalization of moral values* (Hardy, S.A., Padilla-Walker, L.M., Carlo, G., 2008). The objective of the study is related to the issue of moral values among adolescents and young adults.

2.2. Participants and procedure

A total of 175 participants were included in the study, thus: 50 (28.6%) Orthodoxes, 50 (28.6%) Catholics, 50 (28.6%) Neo-protestants (Baptists), and 25 (14.3%) skeptics; 89 (50.9%) of them were males, and 86 (49.1%) were females; 76 (43.4%) of the participants were high-school students (11th and 12 grade), and 99 (56.6%) of them had higher education. Participants were aged between 18 and 30 years old, with an average age of 20.41 years (σ=2.85 years).

The testing took place between June and July 2010; participants were approached at the institution where they were learning - high-school or university, thus: "Iosif Vulcan" High-School and the University of Oradea – for the Orthodox participants; Catholic High-School and the Catholic Institute – for the Catholic participants; "Emanuel" High-School and Emanuel University – for Baptist participants, and the University of Oradea for the skeptic participants (because they were harder to find, we had been able to approach only 25 skeptics).

Participants were asked to fill in two questionnaires, with no time limit. None of the participants were compelled to complete the questionnaires. There was no missing data at any of the variables.

2.3. Instruments

For this study, two questionnaires were used: *Word Stimuli* (Meier, B.P., Sellbom, M., Wygant, D.B., 2007) and *Responding Desirably on Attitudes and Opinions (RD-16)* (Schuessler, Hittle, Cardascia, 1978 in Paulhus, D.L., by Robinson, J.P., Sharer, P., Wrightsman, L.S., 1991).

Word Stimuli (W.S.) is a questionnaire proposed by Meier, B.P., Sellbom, M., and Wygant, D.B. in 2007. It consists of 10 items (words), five of which represent morality (caring, charity, nurture, trustworthy, truthful), and five – immorality (adultery, corrupt, dishonest, evil, molest). Items are scored on a nine-point Likert scale (1="high degree of immorality"; 9="high degree of morality"). Participants were asked to circle the number that best represents their personal attribution of morality/immorality degree. Thus, the lower the score given to a certain moral value, the lower is the degree of morality attributed to it (the higher is the degree of immorality), and vice-versa. The value of α Cronbach coefficient used to estimate internal consistency for items representing immorality was equal to .811, and the value of α Cronbach coefficient used to estimate internal

consistency for items representing morality was equal to .821.

Responding Desirably on Attitudes and Opinions Scale (RD-16) consists of 16 items and was especially designed to detect socially desirable responding in attitude and opinion surveys of the general population (Schuessler, Hittle and Cardascia, 1978 in Paulhus, D.L. by Robinson, J.P., Sharer, P., Wrightsman, L.S., 1991). The subject is asked to agree or disagree with each item. The first eight items are keyed in positive direction (1 for agreement and 0 for disagreement; e.g.: „I feel that I can help others in many ways"), and the other eight items are keyed in negative direction (0 for agreement and 1 for disagreement; e.g.: „Many people are friendly only because they want something from you"). Possible scores range from 0 to 16 with higher scores indicating more desirable responding. The value of α Cronbach coefficient was equal to .575.

3. Results

The tolerance towards the level of morality/immorality of moral values differs when put in relation with the variable "sex".

Table 3.1. shows the difference between male and female participants in perceived degree of morality/immorality associated to a set of moral values.

Table 3.1. The comparison of perceived degree of morality/immorality associated to a set of moral values, in relation with the variable "sex"

	m		z
	males	females	
adultery	88,54	87,44	-0,161
corrupt	89,89	86,05	-0,528
dishonest	93,15	82,67	-1,416
evil	93,33	82,49	-1,506
molest	89,35	86,6	-0,439
caring	80,64	95,62	-2,024*
charity	81,24	95,00	-1,882
nurture	80,00	95,28	-2,298*
trustworthy	82,04	94,16	-1,902
truthful	82,96	93,22	-1,585

*p<.05.

As for the tolerance towards the level of morality/immorality, gender is not a significant discriminator. However, the two moral values for which were found significant differences are *caring* (z=-2.024, p<.05) and *nurture* (z=-2.298, p<.05), for which girls presented higher scores, compared to boys' scores. This is rather due to particular female characteristics or to the set of expectations from the society.

In a research conducted on 1079 Catholic and Protestant subjects (aged 13 to 16 years old) from Northern Ireland, investigating moral values and attitudes, was shown that girls are better keepers of traditional moral values than boys (Francis, L.J. and Greer, J., E., 1992).

Regarding moral consent, "Indians believe that cows are possessed by dead people's spirits, so they won't eat beef. In U.S.A., we don't believe our dead relatives' souls could rest in a cow, so we don't have a problem eating beef. At large, what could seem a moral difference is, in fact, an agreement – we, as they do, believe that eating grandma is wrong!" (Geisler, N., L. & Turek, F., 2007).

The tolerance towards the level of morality/immorality of moral values differs when put in relation with participants' level of education.

Table 3.2. The comparison of perceived degree of morality/immorality associated to a set of moral values, in relation with participants' level of education

	m		z
	High-school education	Higher education	
adultery	92,59	84,47	-1,165
corrupt	94,35	83,13	-1,53
dishonest	97,43	80,76	-2,236*
evil	92,73	84,37	-1,152
molest	94,19	83,25	-1,735
caring	86,86	88,88	-0,271
charity	82,11	92,53	-1,413
nurture	83,06	91,79	-1,222
trustworthy	79,70	94,37	-2,162*
truthful	85,24	90,12	-0,746

*p<.05.

As for the tolerance towards the level of morality/immorality, level of education is not a significant discriminator either, though there were found significant differences for two moral values: *dishonest* (z=-2.236, p>.05) and *trustworthy* (z=-2.162, p<.05). By comparison to high-school students, participants with higher education have shown lower level of tolerance for considering *dishonest* immoral, and they have considered *trustworthy* more moral than high-school students did.

For high-school students, being honest and trustworthy could imply not to cheat on exams. The observed differences could be due to age, but mostly to education and life experience that people with higher education have acquired. They have come to understand the value of loyalty much deeper than high-school students; situations are more complex and it takes some uprightness to work them out.

The tolerance towards the level of morality/immorality of moral values differs when put in relation with participants' denomination

Table 3.3. The comparison of perceived degree of morality/immorality associated to a set of moral values, in relation with participants' denomination

	m				χ^2
	Skeptics	Orthodoxes	Catholics	Baptists	
adultery	103,64	111,42	86,74	58,02	37,629***
corrupt	84,62	109,12	86,19	70,38	16,547**
dishonest	86,78	103,29	89,52	71,80	10,438*
evil	102,74	97,29	91,61	67,73	13,66**
molest	91,72	100,86	97,62	68,66	19,044***
caring	80,48	89,25	93,14	85,37	1,319
charity	68,80	76,43	105,19	91,98	13,454**
nurture	80,22	85,42	97,64	84,83	3,186
trustworthy	88,16	84,42	76,63	102,87	9,183*
truthful	83,50	80,57	88,63	97,05	4,024

*p<.05; **p<.01; ***p<.001.

As for the tolerance towards the level of morality/immorality, denomination is a significant discriminator.

Tables below show the differences between denominations, compared two-by-two. Because the distribution of the moral values among denominations was asymmetrical and the Mann-Whitney U test was used for the comparisons, the critical reference value for significance testing was lowered to 0.008 (according to Bonferroni's correction).

Table 3.4. Comparisons according to denomination for the moral value *adultery*

		Mean Ranks							
	Denomination	1		2		3		4	
		m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}
ul te	1. Skeptics			34,78	39,61	42,86	35,57	52,00	31,00
	2. Orthodoxes					57,48	43,52	65,53	35,67

3. Catholics				58,65	42,35
4. Baptists					

	Differences between Mean Ranks (Mann-Whitney U multiple comparisons)			
	1	2	3	4
1. Skeptics		-0,931	-1,472	-4,903*
2. Orthodoxes			-2,545	-5,828*
3. Catholics				-3,601*
4. Baptists				

*P<.01.

Concerning the moral value *adultery*, there are differences between Baptists and all the other denominations, meaning that Baptist participants have considered adultery more immoral than skeptics, Orthodoxes, and Catholics.

Table 3.5. Comparisons according to denomination for the moral value *corrupt*

		Mean Ranks							
	Denomination	1		2		3		4	
		m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}
	1. Skeptics			30,76	41,62	37,64	37,18	42,22	35,89
	2. Orthodoxes					57,33	43,67	61,17	39,83
	3. Catholics							55,34	45,66
	4. Baptists								

corrupt	Differences between Mean Ranks (Mann-Whitney U multiple comparisons)			
	1	2	3	4
1. Skeptics		-2,097	-0,107	-1,315
2. Orthodoxes			-2,439	-3,868*
3. Catholics				-1,811
4. Baptists				

*P<.01

For *corrupt* there were found differences only between Orthodox and Baptist participants, thus Baptists consider corruption of a higher immorality compared to Orthodox participants.

Table 3.6. Comparisons according to denomination for the moral value *devious*

		Mean Ranks							
	Denomination	1		2		3		4	
		m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}
dishonest	1. Skeptics			33,28	40,36	37,20	38,40	42,30	35,89
	2. Orthodoxes					54,43	46,57	59,50	41,50
	3. Catholics							55,55	45,45
	4. Baptists								

	Differences between Mean Ranks (Mann-Whitney U multiple comparisons)			
	1	2	3	4
1. Skeptics		-1,368	-0,223	-1,282
2. Orthodoxes			-1,395	-3,217*
3. Catholics				-1,830
4. Baptists				

*P<.01

In addition, Baptist participants have had a lower level of tolerance in considering *dishonest* immoral.

Table 3.7. Comparisons according to denomination for the moral value *evil*

		Mean Ranks							
	Denomination	1		2		3		4	
		m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}
	1. Skeptics			39,18	37,41	41,14	36,43	48,42	32,79
	2. Orthodoxes					52,11	48,89	58,77	42,23
	3. Catholics							57,29	43,71
	4. Baptists								
evil		**Differences between Mean Ranks (Mann-Whitney U multiple comparisons)**			
		1		2		3		4	
	1. Skeptics			-0,343		-0,920		-3,222*	
	2. Orthodoxes					-0,580		-3,105*	
	3. Catholics							-2,578	
	4. Baptists								

*P<.01

Referring to the moral value *evil*, the variable 'denomination' is a significant discriminator between Baptist participants compared to skeptic and Orthodox participants. Baptists have obtained lower scores related to the variable in cause, proving lower tolerance towards considering it immoral.

Table 3.8. Comparisons according to denomination for the moral value *molestation*

		Mean Ranks							
	Denomination	1		2		3		4	
		m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}
	1. Skeptics			32,54	40,73	33,38	40,31	41,80	36,10
	2. Orthodoxes					51,75	49,25	59,38	41,62
	3. Catholics							59,06	41,94
	4. Baptists								
molest		**Differences between Mean Ranks (Mann-Whitney U multiple comparisons)**			
		1		2		3		4	
	1. Skeptics			-1,772		-1,503		-1,808	
	2. Orthodoxes					-0,477		-3,973*	
	3. Catholics							-3,833*	
	4. Baptists								

*P<.01

Baptists consider *molestation* more immoral than Orthodoxes and Catholics do, differences being statistically significant.

Table 3.9. Comparisons according to denomination for the moral value *charity*

		Mean Ranks							
	Denomination	1		2		3		4	
		m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}k	m_{rank}	m_{rank}	m_{rank}
	1. Skeptics			35,76	39,12	27,68	43,16	31,36	41,32
	2. Orthodoxes					42,26	58,74	46,05	54,95
	3. Catholics							54,29	46,71
	4. Baptists								
charity		**Differences between Mean Ranks (Mann-Whitney U multiple comparisons)**							
		1		2		3		4	
	1. Skeptics			-0,659		-3,073*		-1,945	
	2. Orthodoxes					-2,993*		-1,601	
	3. Catholics							-1,411	
	4. Baptists								

*P<.01

By inspecting the table above, it can be seen that Catholic participants have registered significantly higher scores to *charity* compared to skeptic and Orthodox participants. For that matter, Catholics consider generosity more moral than skeptics and Orthodoxes do.

Table 3.9. Comparisons according to denomination for the moral value *loyalty*

		Mean Ranks							
	Denomination	1		2		3		4	
		m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}	m_{rank}
	1. Skeptics			39,06	37,47	41,3	36,35	33,8	40,1
	2. Orthodoxes					52,51	48,49	45,44	55,56
	3. Catholics							42,79	58,21
	4. Baptists								
trustworthy		**Differences between Mean Ranks (Mann-Whitney U multiple comparisons)**							
		1		2		3		4	
	1. Skeptics			-0,336		-1,011		-1,475	
	2. Orthodoxes					-0,757		-2,096	
	3. Catholics							-3,053*	
	4. Baptists								

*P<.008

Baptists had higher scores than Catholics for *trustworthy* too, meaning they consider this value of a higher morality than Catholics do.

4. Discussions

Concerning the issue of moral values, in particular the tolerance towards moral/immoral values among adolescents and young adults, we can assert, based on numerous studies including the present, that there are a few significant differences among denominations. Thus, for the comparison of skeptics' scores with Orthodoxes' and Catholics' scores, there were found differences for the moral value 'charity' ($p<.01$), for which Catholic participants presented higher scores, meaning they consider charity more moral than skeptics and Orthodoxes do. However, Catholic participants came out desirable in relation with the value 'charity' ($r = .381$, $p<.01$). This could be due to collectivism, to liabilities and benefits that Catholic people are willing to carry out in order to feel they belong. M. Farias and M. Lallje (2008) have noticed that Catholics give more importance to collectivism compared to the non-religious group. They have high scores to conservatism and uniformity. Non-religious people have higher values to hedonism, stimulation and self-directing – which emphasizes individual's independence.

It is known that religious persons are more likely to offer themselves as volunteers and to commit charitable acts (Brooks, A.C., Gronbjerg, K.A. and Never, B., Lazerwitz, B., Pharoah, C. and Tanner, S. in Graham, J. and Haidt, J., 2010). Likewise, people tend to be more generous when they are moved by other people's pain (Batson, C.D. and Shaw, L.L., Slovic, P. in Graham, J. and Haidt, J., 2010), suggesting that individual differences can predict one's tendency of being or not charitable.

When the scores of skeptics and Baptist participants were compared, we found significant differences for the values `adultery` and `evil` ($p<.01$), for which Baptists showed a lower tolerance towards considering these values immoral. The practice of religion seems to assure the basis for practicing morality, by helping in acquiring moral abilities.

For the comparison of Orthodox and Baptist participants, we found significant differences ($p<.01$) for `adultery`, `corrupt`, `dishonest`, `evil`, and `molest`, for which Baptist participants showed lower tolerance towards considering these values immoral. However, Baptists were desirable in relation with `corrupt` ($r = -.295$, $p<.05$) and `dishonest` ($r = -.346$, $p<.05$).

For the comparison of Catholics' with Baptists' scores, we obtained significant differences ($p<.01$) for `adultery` and `molest`, for which Baptist participants showed lower tolerance towards considering these values immoral. Baptist participants have considered `trustworthy` of a higher morality than Catholic participants. However, Baptists gave desirable responses to 'trustworthy' ($r - .478$, $p<.01$).

5. Conclusions

By apprehending the mechanism by which the moral value system works, the use of socialization could be priceless not only for the youth, but for schools, churches and other institutions of the kind. This way, it is easier to understand and interpret certain attitudes of adolescents and young adults, in the context of certain morally controversial situations. Parents and educators should find ways to improve their relationship with the adolescents, and to favor their autonomy, self-efficiency, and personal identity. In addition, the results are useful in adolescents and young adults counseling, as the information is global, but not shallow.

The limits of this study are represented by the participants' self-reporting and small sample size. Future studies could take into consideration, along with participants' self-reporting, other variables such as parents' evaluations; thus, the relation between parenting styles and moral values attribution could be evaluated. However, past studies have shown that there is a greater accuracy in adolescents' self-reporting compared to parents' evaluations concerning internal attributes (Clarke, G.N., Lewinsohn, P.M., Hops, H., Seeley, J.R., 1992, in Hardy, S.A., Padilla-Walker, L.M. Carlo, G., 2008).

Furthermore, future research could use a scale that assesses the level of atheism and agnosticism. This scale could differentiate the way moral values are distributed among irreligious population. In addition, larger samples and a more complex design could be used in evaluating ethnic differences concerning the role of parenting styles in moral values attribution.

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THE EVALUATION-A WAY OF MOTIVATING THE STUDENTS

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Abstract *The role of evaluation is essential in a context that is an objective image of the progress and can be a valuable indicator in new teaching and learning strategies. Also the evaluation process must be an effective tool in motivating creativity and encourage constantly innovation and the originality of solutions. Evaluation represent a perpetuating and continuous updating of content, a touch of pragmatism, a quantification of value without which education would be ineffective.The assessment with teaching and learning, contribute to the student personality, controlling relationship between them. The evaluation process influences student motivation in learning through many forms and ways that it is done.*

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Keywords: *evaluation, motivation, education, students, teachers, results.*

1. INTRODUCTION

Generally, education system, teaching process are undoubtedly under the value sign. The school's axiological function create and give consistency of this value chain, that comes to perpetuate and secure an original and fundamental way of communication between the educational actors and social actors.

The evaluation is an act of valuing which occurs intrinsic and inseparable to the whole of human activities, but more so the work done in school, seen as a primary axiological swing.

The abstract value doesn't exist. It achieved existence only in relation to human referential. It's an dependence relationship : bi-univocal, which creates value people and is designed to turn them.

Therefore, the evaluation, along long with the other two components of the educational process, contribute to the developing of human beings in plurivalent.

The multifaceted refers to the facts that the evaluation affects the subject's personality without even having to act solitary on an isolated system.

What interests us in this research is the student's motivational subsystem as part of a whole evaluation process. In this study we try to explain the subsidiary of the evaluation process. Sometines, the act of evaluation, is determining an artificial frame, marked by a remarkable distance between the observed behavior and other likely behavior. The evaluation test can be converted into a manufactured situation, meaning that the student is required to adopt the desired behavior. Of course, if we look at the problem from the positions of contemporary desirability in evaluative act, the student is transformed into a genuine partner of the teacher in the self-evaluation, peer evaluation and control.

The literature mentions a motivational function of evaluation, along with the descriptive, diagnostic and prognostic funtions. (Manolescu, 2005:24)

Motivational effect is mediated by the personality of the student and by the existence of the relationship between evaluation and self-evaluation. A clear and well defined relationship between assessment and student motivation can not be established entirely, because, it is the student's personality that mediates and controls the nature of this relationship.

But what interest is the role that assessment plays in influencing students' motivational's optimum, which is a pillar of stability in school success.

Each of these and all of them combined can lead to possible three motivational situation, in the act of learning: optimum, ”under-motivated” and “overmotivated”.

Possitive and negative effects in motivational plan are influenced by the ability to corellate the evaluation method with individual features of the group.

Oral evaluations, have already become history in evaluative practice, because they encourages some students and discourage others.

A motivational effect-with later consequences-can determine effects of subjectivism presence in evaluation. Hallo effect, may or not, determine the maintening the current behavior in learning and give satisfaction to the student. Can be the version in which the student accepts the reality of the evaluation situation and found solutions to improve personal performance, a desirable options, which determines the students to indulge in this situation, to rely on generosity of the teacher or the effect of bitter candy, in which the students knows that there is not a juxtaposition between note and performance.

2. RESEARCH METHODOLOGY

2.1 The purpose of this research is to postulate a relevant relashioship between student motivation for learning and evaluation process. In order to obtain an accurate result of school realities, will be realized a survey, based on questionnaire and an interview. The target group of this survey consisted of high school students and teachers who train those students.

2.2 Research objectives

- Negative/Positive changes in motivational plane of the student, generated by the phenomen of subjectivity in evaluation;
- The effects in behavioral, attitudinal and motivational plane, of scorring process and assesment;
- Adequacy of evaluation strategies to individual psychological features of the students.

2.3 Stages of research

- Stage one- Research based on questionnaire;
- Stage two- Research based on interview.

The option to prosecute the research with interviews and questionnaires is justified by the next reasoning: research on that we propose is of a qualitative nature and preparation of interview schedules to capture the depth and essential aspects of the problem needs investigating prior the land to obtain quantitative data, predominantly, this is necessary for optimal srucuration categories in grid questions, and categories of analysis and interpretation of the next stage of applying questionnaires and the interviews.

French psychologist P. Pichot wrote in Les testes Mentaux (1954: 65 cited Chelcea, 2007:212): "The questionnaires are tests consist of a larger or smaller number of questions submitted in writing subjects and covers opinions, preferences, feelings, interests and behavior in specific circumstances. "

A definition of interview is following: “interview is a meeting designed to collect dates in which one person – an interviewer- put questions of other people.”(Babbie, 2010:367).

Questionnaires were applied to students and teachers. There were produced using mixed and direct questions which is fiting into a number of category of questions:

- Results of evaluation/selfevaluation;
- Evaluation strategies;
- Motivation by evaluation process;
- Relationship between evaluation staff and evaluated people;

The number of questions that compile each category wasn't the same as weight, but was a criteria structuring according to the importance, their relevance in research and in structuring a relationship between evaluation and motivation.

Therefore, construction and questionnaire used in investigation are necessary for a better structuring of categories of questions in interview and interview questions to determine a trend before the interviews. After the questionnaires was built the interview, which was based on the same categories that I mentioned above.

What interested us was whether weight categories in interview remains the same as in the questionnaire. Changing the weights depend on the results of the first stage of the investigation, and that is based on a questionnaire. By making based interview survey we shall test the fidelity of the results obtained in the previous stage.

Subjects were students and teachers in high school. After data collection, followed analysis and interpretation, according to the four categories established.

2.4 Results of interpretation. The final stage will consist of extracting conclusions, outlining a type of relationship that is between evaluation and motivation.

All teachers that have been questionnated are teaching in high-school. At question if obtaned results of evaluation tests are the same those that they estimated themselves, 78% from those state that are the same in 51-75% from all cases, while 38% presume that are the same up to 75%.

The majority of teachers state that there is few situation when the relation teacher-student influenced the result of evaluation, 88%, while only 12% of them think that most of the time their evaluation was changed by emotional reason. For 60% teachers the results of evaluation process point the real level of achieved skills, and they think that they are interesed for grades. The opposite, 4% thinks that the evaluation process don't represent the real level of knowledge. 32% believes that is a very rare situation when the evaluation process highlight the students skills, because sometimes the standars must be lower for better evaluation.

For 72% from respondents, the evaluation represent very largely, a method of student motivation, for 12% that is not so efficient, while for 8% it is a partial motivation or there is no motivation at all.

When they were asked if in the evaluative practice, the modern evaluation methods (project portfolio, homework in classroom) are more motivating for students than traditional ones (oral and written evaluation), 84% say that they are very much motivating while 16% believe that they are largely more attractive than traditional ones.

The proportion of 52% respondents estimated that they do not use the grade power to exert authority, believing that this would be a lack of professionalism and there are other ways to do follow in classroom, while 48% said sometimes resort to such practices as students exhibit inappropriate behavior in classroom, this is one of the means of coercion of students.

Students believe that most or assessment tests are constructed in accordance with the contents taught, but sometimes ignoring the

content. Ways in which students prefer to be evaluated are, the portfolio were they are able to structure information, to record progress in a certain period of time using their creativity and practical assessement which highlights their skills and abilities. Also obtaining prizes and scholarships raises the assessment results because they are more motivated to learn.

3. CONCLUSIONS

The forms and ways through which evaluation is performed, evaluation methods, the frequency of a particular type of evaluation and, consequently, of a particular type of grading, the influence of subjectivism in evaluation and disruptive effects in evaluation and social structure of students and individual features of each student involved in the evaluation like a agent receiver, vertical relationships are factors which must be analized in describing relationship evaluation-motivation of students.

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FACTORS AND CONDITIONS WHICH CAUSE SCHOOL ABSENTEEISM

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Abstract:

Education is an important part of social life, being a state institute and included in state budgets, and the school - the main institution through which society perpetuates its existence. Today, from school we all expect everything: essential knowledge, attitudes, values, finding a vocation, a profession training, personality shaping and creating ideals. But, due to many causes,today school do not always satisfy contemporary society's expectations about its role.

In this case, formal education space becomes part of a context which exacerbates the act of school inadaptability, and the goal to prepare young people for life turns into breaking their life. In addition, the educational institution is designed in contemporary society as the core of crime prevention.

In recent decades, school inadaptability was the transition time from the small and individual problem hypostasis to a problem concerning masses.

There is a inadaptability of students to adapt to school demandings. But does the school is capable to self adapt to developments of the society?

Keywords: absenteeism, school deviance, school environment.

This paper regards absenteeism in IX and X grades, its relations to other forms of school deviance, the influence of the main factors in the roots of school deviance (family, school, family-school relation, school group, the student's environment, the student's personality) on himself, and preventive measures / actions to be taken in this regard.

School as an institution promotes assimilation roles and social statuses, communication and assimilation of scientific, technological and cultural legacy. Through the contribution of school education, children are developing informational-cognitive structures, his abilities and also the emotional side, in the phrase of Jean Piaget, is behavior's energy. Affective and cognitive dimension are inseparable, they are expressed in human conduct.

"The school relationship has the main role in socialization achieving process and the [...] teacher-student relation is preprogrammed, objectives and goals are set at higher level" (M. Golu, 1993, Dynamic personality).

Stated objectives are:

1. Analyzing students' attitude towards school and the teachers;

2. Determining factors and conditions that favor the emergence of school absenteeism;
Assuming that if school regulations concerning absences provisions are not applied unexcused absences not generating visible reaction from the school authorities, the absenteeism rate increases. Group of research has been made from a batch of 98 students:

a) Age: 16-19 years old

b) Gender:
- Female: 15 students (15,3%)
- Male: 83 students (84,7%)

c) Types of families from which students came from:
- Organized families : 64 students (65%)
- Dysfunctional families: 34 students (35%)

d) Socio-cultural level of the parents:
- higher education: 11 (11%)
- secondary education: 56 (57%)
- secondary stage: 29 (30%)
- primary stage: 2 (2%)

From the collected data were calculated unexcused absences for each student. Grouping unexcused absences of each student in every group was choosing the limit reporting number 20. This choice is based on the fact that according to the rules of organization and functioning of school education, Article 125 (1), a total of 20 unexcused absences shall be „awarded" with the expulsion notice.

Comparing the graphs of absolute frequencies (number of students) in semester I and II (Fig.1, Fig.2, Fig.3, Fig.4) is observed an increase in the number of students with high absenteeism, in the second semester compared to the first semester. Cause may be tolerance of the school system on absenteeism and parents lack of control on students, their contact with the school is becoming less.

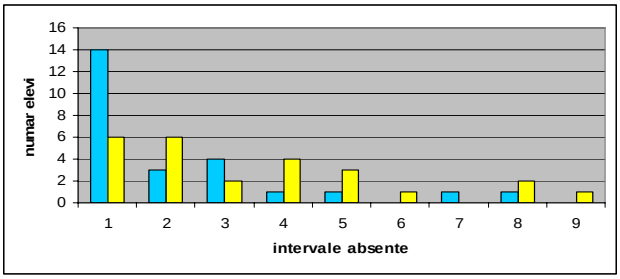

Fig.1 Graphical comparison of absolute frequencies (number of students)

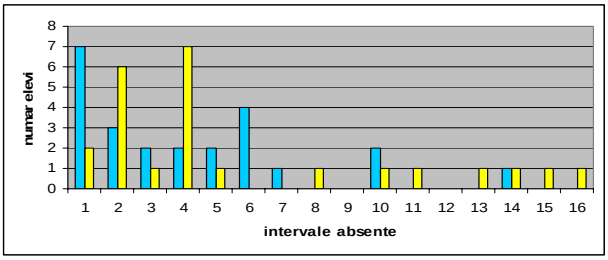

Fig. 2 Graphical comparison of absolute frequencies (number of students)

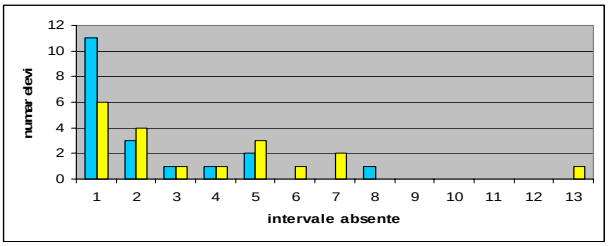

Fig. 3 Graphical comparison of absolute frequencies (number of students)

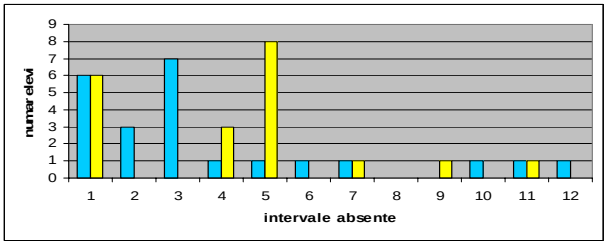

Fig. 4 Graphical comparison of absolute frequencies (number of students)

Students with the highest absenteeism are in classes where class teachers:

- Not applying school regulation provisions relating to absences without leave (Art. 131 from Regulation of organization and functioning of pre-school organizations): the higher the number of unexcused absences for less a point to good behaviour with the number of students with high absenteeism increases in the next semester and next year also;
- Not maintain a direct and permanent contact with student's parents (through parents meetings, telephone etc.); in this case we can observe an increase in absenteeism since the first semester of ninth grade because of a lack of control parents on student performance;

Following the conclusions we come, to the class level, with the next recommendations:

- compliance with school regulations by grade teacher through lowering the behavior qualification if they reach the number of maximum absences forecast by regulation;
- maintaining contact between teacher / teachers, with parents through parent meetings, home visits or by telephone;
- continuity of class teacher during at least one cycle of education;
- meetings on various topics, in master classes,with representatives of the police;

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THE ORIGINS OF HAMAS: AN OFFSHOOT OF MUSLIM BROTHERHOOD, OR A RESULT OF THE PLO'S MORAL CORRUPTION?

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Abstract: *Since its creation in 1987, Hamas has been at the forefront of armed resistance in the occupied Palestinian territories and is considered a terrorist group by U.S. and Israel, and seen as a militant fundamentalist Islamic organization which is operating in the West Bank and Gaza, by others. Despite of that, Hamas has an annual budget of $70 million, according to its Council on Foreign Relations, funds that are coming from expatriate Palestinians, or private donors, from Middle East, and states, such as Iran. Its name is an acronym for "Harakat Al-Muquwama Al-Islamyya," or Islamic Resistance Movement in English. The word "Hamas" means Zeal, or Enthusiasm, in Arabic. As an organization, it has sections dedicated to religious, military, political as well as for security activities. In addition, it runs a social welfare program, and operates a number of schools, hospitals and religious institutions, following the Muslim Brotherhood's model. But not the data provided above is the concern of this paper, but the origins and reasons which led to the emergence of Hamas on a territory, where, were already acting PLO and its favourite group Al-Fatah, or Muslim Brotherhood for charity activities, and because the origins and purpose of this organization are questioned by different scholars. For example, Israel accuses Hamas, of using civilians in Gaza, as a "human shield," and the territory's schools and hospitals as a cover for military hardware, while, on the other hand, there are voices, which are accusing Mossad of funding Hamas in order to use it as a Casus Belli at a certain point, while it enjoys widespread backing from the general population in Gaza, due to its charity program.*

Keywords: *Intifada, PLO, Hamas, Palestinian national identity's crisis, Muslim Brotherhood;*

- **Historical Background**

The creation of the State of Israel in 1948 was one of the events that marked the decisive system of post-war regional relations in the Middle East. Sustained by political and diplomatic actions of Zionism, for more than a half of a century, finally, it was managed to establish after nearly two thousand years, a new State for the Jewish people. The problem was, however, that the territory of Eretz Israel had meanwhile a different history than the destiny of the Jewish Diaspora spread around the world. Once, part of the Roman and Byzantine Empire, Palestine was conquered in 636, following the famous battle of Yarmouk, by the army of Caliph Omar. From now on, it will be a part of the territory of Islam, which was governed by different political entities within the expanding Umayyad, Abbasid, Fatimid Caliphates, or those, which have followed them: the Mongol Empire, the Egyptian Mamluk State, and starting with 1516, it, become a part of the Ottoman Empire. Throughout this long period, the Jewish population from Palestine was insignificant, rather contained groups of scholars in the holy centres of Judaism. Only at the end of the 19th century, with the emergence in Europe of the Zionist movement of Theodor Herzl, was initiated, in particular, the problem of the "Jewish question" by the formation of a State to gather the Jewish nation. WWI

accelerated this problem. On the one hand, the well-known „Statement," of British Foreign Minister Balfour, in 1917 gave the Zionists leaders the idea, that after the war, England would accept the formation of a Jewish "national home" in Palestine, though, such a term didn't exist before in the international law. On the other hand, however, as early as 1916, Britain and France had decided, through the secret Sykes-Picot agreement, the division of the territory in the Middle East, after the defeat of the Ottoman Empire. Work accomplished otherwise by the Conference of San Remo (1920), when there were plotted, rather artificial, boundaries of new states, subject to a system of government by mandate, meaning by the effective exercise of power by the victorious powers.

The implementation of the Balfour Declaration in the first years after the war, allowed a strong Jewish population exodus from Palestine, first from Russia and after 1933, from Germany and Central Europe. They meet, however, more and more opposition and revolt of the Arab population, thus, in 1939, the British authorities restricted the Jewish immigration drastically just at the peak of anti-Jewish Nazi policies. The conclusion of the war, the revelations about the Holocaust, is enhancing the Jewish activism in Palestine and fight against the British power. Eventually, England waives its mandate, transferring the problem to the United Nations, which, by its resolution 181 in 1947 proposed dividing Palestine into a Jewish and an Arab State, with Jerusalem under an international regime. In 1948, in the very moment of the British withdrawal and without waiting for the U.N. authorities, David ben Gurion proclaims in Tel Aviv, the new State of Israel, which was quickly, recognized by the United States and the Soviet Union. Instead, the major Arab States, does not support the U.N. Partition Plan, and declares war on Israel. This first Arab-Israeli War ended in 1949 with a clear victory of the Jews. Moreover, the territory of Israel will increase from 55% to 78% of Palestine. Instead, the Palestinian State does not exist: the Palestinian authorities, together with the Arab States continue to not support the Partition Plan, therefore, by default do not recognize neither the legality of Israel. Until the destruction of the "Zionist entity", however, the Palestinian territory remained under double administration: Gaza Strip by Egypt and the West Bank and East Jerusalem by Transjordan, which became now the Hashemite Kingdom of Jordan. In addition, appears the problem of the Palestinian refugees: almost half of the Arab population is forced to leave their native places; grouped in the following decades in overcrowded and unsanitary refugee camps in neighbouring Arab countries, they will be the main melting pot from which will be recruited the future militants, nationalists and Islamists [11, pp. 161-258].

Until the 1967's defeat, the Arab countries will continue to consider themselves as responsible for the Palestinian problem, by coordinating insurgency warfare against Israeli domination. The leader is now, Gamal Abdel-Nasser, who became the hero of the Arab world after the failure of the British-French-Israeli Alliance. Is the golden age of the Arab socialist ideologies. Thus, the Nasserites, the Ba'athists, and the nationalists conquered power in Egypt, Syria, Iraq, Algeria, and Tunisia, but the struggles for hegemony between the various leaders make it impossible the fulfilment of the Declaration of a major Pan-Arab State. In 1964, the Arab League – in particular, Nasser, put the Palestine Liberation Organization bases, but Syria will support the Al-Fatah organization, while King Hussein of Jordan wants him to be recognized as the ruler of all the Palestinians. Iraq, in turn, under Qassem and then Aref brothers, has its own scenarios on Palestine.

In the following decades, the Palestinian groups' actions, will mostly fulfil and represent the policies of the States behind them; hence, the endless kaleidoscope and almost impossible to understand the different and often antithetical positions of Palestinian options But, the Six-Day War will eliminate the egos and the Arab excessive rhetoric: Israel doesn't occupy just Gaza, the West Bank and East Jerusalem, but especially important Arab territories, such as Sinai and the Golan Heights. It is a key moment of the entire history of the Middle East: from now on, the completely Palestinian territory enters into a system of military occupied area with all rigors arising from this type of regime; in addition, Egypt and Syria are directly involved from the geopolitical point of view. The major change is that the Palestinian people will transfer the confidence

from the Arab States to the Palestinian resistance groups, that decided in July 1967 to continue alone hostilities against Israel by guerrilla warfare backed by „a people's war for long term". In the same year, the head of Fatah, Yasser Arafat, becomes President of the Executive Committee of the PLO. The following years, are marked by struggles at the borders with Israel, and in particular, of the numerous terrorist attacks made by Palestinian groups [13, pp. 24-42].

The end of the 1960s and especially, next decade are marked by a growing influence of the Gulf monarchies, especially that of Saudi Arabia. The oil boom and the rising price of a barrel will bring important funds in the region, of which a large part begin to be used as a geopolitical activism. The policy agenda of King Faisal extends also, over the Palestinian issue; in addition to financing groups, Saudi Arabia will be the one who proposes the oil embargo in 1973, following the Yom Kippur war, even though it had more a psychological impact, marks the ascension of Saudi Arabia hegemonic stage in international relations. However, the oil tool is increasingly, conditioned by leaving the leftist model, and by assuming the size of Islamic Liberation struggle: hence, the fluctuations of Saudi attitude towards PLO or other grouping of Marxist orientation. Nevertheless, after 1973, the PLO is recognised by the Arab countries as the "sole representative of the Palestinian people", and even though, Arafat seeks gradually, to entry into legality and bring about a solution, even partial, at the Palestinian diplomatic problem. The Camp David Treaty in 1978 between Egypt and Israel, except the fact that marks a victory for Israel, which is the first serious flaw in the otherwise nonexistent, "Arab unity," and put Egypt in the international Arab and Islamic organizations, does not resolve the Palestinian problem.

The end of the eight decade brings two great events. The first is the outbreak of protest movements in the occupied territories in December 1987, called the "Revolt" (The Intifada). It is a reaction of the population, particularly young people, born after 1967, which saw every year blocked future prospects and hopes of a State of their own, while Palestinian militant groups from outside was powerless and mostly engaged in endless fratricidal struggle. The actions try to be as less violent: general strikes, street protests daily, etc. The violent reaction of the Israeli authorities, however, is: arrests of armed repression, destruction of buildings. The movement just ask the withdrawal of Israel from the occupied territories and the formation of a Palestinian State. Syria is trying to hijack the movement in their own interest but the PLO will take the leadership [11, pp. 561-610].

In addition to accelerating a diplomatic solution, Intifada also marked the emergence of Islam in the Palestinian issue. It appears, precisely at the time of a spreading jihad in Afghanistan, which, otherwise, seized a few years' attention and resources of the Islamist movements, by leaving in a shadow, the Palestinian cause. However, the youth movement in the occupied territories began to find the messages of a revived Islam as a substitution to the national identity. The Afghan mujahedeen, throughout the Muslim world already had acquired the status of heroes and models: a connection between their struggle for the cause of Islam when attacked by unbelievers and the Palestinian territory's case was made especially by classical writings of Abdullah Azzam. Actually, the Intifada was just the opportunity expected for the emergence of a Palestinian Islamist movement, which require that new leader for a new battle – and this movement will be Hamas.

- **The origins of Harakat Al-Muqāwama Al-Islāmiyya**

The Islamic Resistance Movement (*Harakat the Mouqawama of Islamiyya*) actually represents a militant extension of the Palestinian branch of the Muslim Brotherhood. The Palestinian brothers' history is connected to the very beginning of the movement: since 1929 Hassan al-Banna, the founder of the Brotherhood in Egypt, had come to Jerusalem and gained the support of a significant group of followers: one of the movement's leaders, who had died in the battle against the Jews in 1936, will give his name to the military wing of Hamas: *Azzeddine el-Qassem*. However, the branch itself will only be founded in 1945; at first related to Egypt, during Nasser's crackdown it will become closer to the Jordanian brothers. In the 50s - 60s, the Palestinian Brotherhood will be surpassed by the nationalist movement, whose members will come mainly from its own ranks. During this entire period, and particularly after the defeat in 1967, the main activity of the movement was focused on the primacy of the re-Islamization of the society, of moral reform, of creating social, educational, health infrastructure in the occupied territories which could make up for the lack of authority [3]. Israel had thus tacitly accepted the Brothers' action, as an outlet that could fulfill some of the population's needs, and which could have led to trouble, but also because the Brothers rejected the idea of a Palestinian state which was restricted only to Gaza and the West Bank. In 1973, they created the *Islamic Society*, an organization that coordinated social solidarity actions, hospitals, mosques, Koranic schools, sports clubs etc., very active in the Islamic University of Gaza, led since its inception by Sheikh Ahmad Yassin, a charismatic figure and a very successful preacher among young people [2]

But, starting with the 80s, this prudent policy will be subject to an increasingly strong challenge coming from a new generation, among whom were many graduates of Middle East universities, especially in Egypt, where they had been enthused with a militant Islamism, or who had been imprisoned in Israeli jails. Grouped around Ahmed Yassine, they wanted a more active involvement, even violent, against the Israeli presence in Gaza and the West Bank. The outbreak of the Intifada took by surprise the Brotherhood, which kept a reserved attitude at first, leaving Yassine's faction to take the lead: on December 14, 1987 the first statement is released, announcing the birth of Hamas and calling for resistance against the occupation. Only in February 1988 did the Palestinian Muslim Brotherhood effectively assume authorship of Hamas: it now had an opportunity to reconcile Islam with patriotism and even provide their own response to the Unified National Command of the Intifada, the old Palestinian movements group gathered around Yasser Arafat. Its role was from the very beginning to participate in the resistance against the Israeli occupation on the one hand, and to ensure the "re-Islamization" of the Palestinian society on the other hand. The competition between Arafat-Hamas stems from the very beginning of the movement and Hamas will continually take advantage of PLO's compromises, failures or corruption in order to propose its own program as the true solution to the Palestinian cause: to them, "Israeli occupation has only been possible by forcing Palestinians away from their faith, only the re-Islamization of the social capital and the establishment of an Islamic state are likely to lead to the restoration of full sovereignty" [8, p. 2]

The emergence of an Islamist option in Palestine is therefore a reaction to an external alignment, as well as to local realities. First, it is a result of increased re-Islamization of the Muslim political discourse of the '80s and especially of the Afghan *jihad*. Withdrawal of the Soviet troops created the euphoria that it was due to the Islamic fight's effectiveness; in addition, a few of the Arab mujahidin will return to their homeland, including the Palestinian territories, convinced of the Islamic Revolution solution. Internally, the movement takes advantage of the positive impact of the infrastructure built by the Brothers and of the fact that, unlike the leaders of traditional groups, who were outside the Palestinian territory, those of Hamas are present amongst the population. Even if P.L.O. will soon come to take the lead and organize Intifada's actions, Hamas will have its own partisans who will take parallel action. Then, differentiation will occur in terms of social and professional components. Members of the Islamist groups are recruited rather among urban youth, often

with high rate of education but with poor prospects for a fulfilled future to measure up to their education, or poor youth raised in refugee camps, but also new traders and what is called "the pious bourgeoisie". Raised in an environment of political, social and economic alienation, constantly subject to the Israeli occupant's whims, they will resonate positively to the message of an integral Islam, which would offer the means to retrieve their nationality, but even more importantly, their identity and spirituality.

On August 18, 1988, Hamas broadcasts its Charter, which defines the statute of the movement and its ideological and action principles. Here are some of its key points: „The Islamic Resistance Movement: Islam is its system" (art. 1), „The Islamic Resistance Movement is a branch of the Muslim Brotherhood chapter in Palestine... It professes a comprehensive understanding and precise conceptualization of the Islamic precepts in all aspects of life: concept and belief, politics and economics, education and social service, jurisdiction and law, exhortation and training…" (art. 2), the Hamas slogan: „Allah is its Goal. The Messenger is its Leader. The Quran is its Constitution. Jihad is its methodology, and Death for the sake of Allah is its most coveted desire" (art. 8), „The Islamic Resistance Movement [firmly] believes that the land of Palestine is an Islamic Waqf [Trust] upon all Muslim generations till the day of Resurrection…" (art. 11), „Nationalism, from the point of view of the Islamic Resistance Movement, is part and parcel of religious ideology..." (art. 12), „The problem of liberating Palestine is related to three spheres: the Palestinian sphere, the Arab sphere, and the Islamic sphere. Every one of them has a role to play in the struggle against Zionism" (art. 14), „When an enemy occupies some of the Muslim lands, Jihad becomes obligatory for every Muslim. In the struggle against the Jewish occupation of Palestine, the banner of Jihad must be raised" (art. 15). At this stage, still, the state can afford to also say that „The Palestine Liberation Organization is closest of the close to the Islamic Resistance Movement" (art. 27) [1].

However, at the beginning, Hamas acted in the social and political field, deriving its strength from the important educational, charitable and religious network which had been set up by the Muslim Brotherhood along the years. In addition, the first year of the movement is characterized, despite its program, by far more radical, by a peaceful relationship with Israel, which even saw in the Islamist option a way to weaken the nationalist block within the PLO [6]. Only in 1989, after Yithak Shamir's rightist government came to power in Israel, amid refusal to negotiate with the PLO and the continuing repression of Intifada, the Palestinian action in the territories becomes more radical and the authority of Hamas increases: it is the moment when the first violent actions of its military wing start: the Azzeddine el-Qassem Brigades - a result of the merger between the intelligence machine and the militarized branch of the movement. As a consequence, Sheikh Yassine and most of the activists were arrested, but repression only serves to increase the legitimacy of the movement, in addition, the arrested leaders are replaced by a new generation, without much political experience but more and more violent, according to the slogan attributed to Azzeddine: „The Book of God in one hand, the rifle in the other". Since 1990, Hamas increasingly shares its authority within territories with CNU, in addition, the subsidies received from the Gulf countries get to be even higher than those of P.L.O. The actual influence exerted by the movement over the population movement is visible through the results of the elections in professional organizations (lawyers, engineers, doctors, chambers of commerce, etc.), starting with 1990, when its representatives appear to have won 30% of the seats However, in April 1990 Arafat proposes them to enter the Unified Direction of Intifada, hoping to bring under control a movement that was an increasingly

strong competitor of P.L.O. and was refractory to its directives. But Sheikh Yassine asked for 40% of the seats in the Palestinian National Council and also the acceptance of the movement's principles: eliminating Israel and proclaiming jihad as the only way to solve the Palestinian problem [6, p. 5]. Obviously, these conditions which undermined Arafat's long fought for authority and which, moreover, cancelled the decisions made in Algiers in 1988 were not accepted. Although relations between the Palestinian central and Hamas were not completely broken, they have cooled significantly and were manifested in an increase of clashes between the two militant camps in the territories, especially between 1990-1992, when Arafat's authority declined.

The Gulf War, although it had weakened PLO, has eventually made possible the dialogue between the Organization and Israel, following pressure from the USA. But Hamas rejects any agreement that would limit the territory of a Palestinian state and, criticizing PLO for being „subjected to imperialism-Zionism", aligns itself, at the start of the Madrid Conference, to the „Front of refusal", which became afterwards „The Alliance of Palestinian Forces" made of nine other Palestinian groups which opposed to the peace process. Likewise, the Oslo agreements are rejected, being seen as a betrayal of the Palestinian struggle and sacrifices, especially because the discussions on sensitive issues such as the refugees' right to return, the status of Jerusalem and the implants of Jewish colonies in the territories were reported at the end of the first three years' autonomy. However, the peace agreement brought excitement to the Palestinians for the moment, so that a very severe opposition from Hamas towards a PLO which had become legitimate not only nationally but also internationally was now inoperative. Therefore, it was decided to increase political involvement and participation in elections, decision which was stated by Yassine himself, from prison, in November 1993, so that Hamas could „oppose (PLO) from within the legislative institution" and confront the Israeli-Palestinian agreement „by any civilized means".

This has led, however, just as in the case of Hezbollah or the PLO, to a real rethinking of Hamas strategy and it especially caused internal disputes on the necessity to accept the compromises of taking part in the political game – so, implicitly to the tacit recognition of the Oslo results, or to continue fighting against Israel. This dilemma actually reflects the strategies of the two main command centers of the group: the leaders in Amman were followers of the maximalist principle of liberating the entire Palestine, while the rulers of the territories, even Yassine, wanted to create a legal Islamist party to take part in the elections. And this even more so as, according to the Cairo agreements in 1994, Arafat had to coerce the Islamist opposition to give up armed opposition to Israel, - an obligation not at all convenient, which will also contribute to undermining the leader of the Palestinian Authority. At this point, however, the 1995 elections showed clearly the domination of PLO. Continuation of anti-Israeli operations by Hamas leads to arrests of Islamist leaders, to mutual accusations of being Israel allies, so that eventually the political headquarters of the movement and even the armed wing decide to recognize Arafat's authority and cease any anti-Israeli attacks, which offers Israel a pretext to delay even further the full withdrawal from territories.

Indeed, *The Interim Agreement on the West Bank and the Gaza Strip (Oslo II),* signed at Washington on September 28, 1995, provided, in addition to the expansion of Palestinian autonomy to the West Bank and organizing presidential and legislative elections, a series of directives regarding security measures to prevent terrorism and violence: Palestinian police is the only Palestinian authority in terms of security, it must intervene systematically against any expression of violence or terror, it is allowed to arrest and detain any individual suspected of preparing acts of terrorism, the Israeli and Palestinian parties will exchange information and will coordinate policies and actions in order to fight violence and terrorism. Ever since his arrival in Gaza, in July 1994, Arafat had instated an administrative as well as police system; his popular support was based here on traditional Arab clans, on those returned from exile, PLO member or not, as well as on some famous families and personalities. From the very beginning, he tried to prevent any internal opposition, either by making use of the new repressive system, or by enrolling opponents in the administrative and security system - often assimilating former

district leaders or anti-Israeli opposition leaders. This led to the decrease of violent actions from Hamas in Gaza, for they were followed by arrests, blocking interventions in the social and political field [8].

In exchange, the situation in the West Bank was somewhat different. According to the *Oslo II* agreement, withdrawal of the Israeli army and deployment of the new Palestinian Authority was supposed to take place gradually, and in terms of internal security, the territory was divided into three zones: Zone A included six major cities: Djenine, Naplouse, Toulkarem, Qalqilya, Ramallah, Bethlehem - they came fully under the control of the Palestinian Authority, regarding administration, security and public order; Zone B contained small towns and villages which concentrated 68% of the Palestinian population - here the Palestinian Authority would be responsible for administration and maintaining order but Israeli forces are solely responsible for the fight against terrorism and for Israeli citizens' security, in addition, Palestinian police could only move in coordination with the Israel defense forces; Zone C comprised Hebrew colonies and uninhabited territories which lacked strategic interest - Israeli forces are solely responsible for security and public order while the Palestinian Council has only economic, health and education prerogatives [11, p. 628]. It was so therefore an overly complicated system, which favored the Israeli side: firstly, effective Palestinian autonomy was restricted to big cities, leaving in suspension such issues as Jerusalem, dismantlement of colonies and the refugees' right to return - all these depended on how the new Palestinian Authority fulfilled its conditions, especially those related to maintaining security. As soon as the *Oslo II* agreement was signed, Israel began to retreat from the six cities in Zone A.

In early 1996, legislative and presidential elections take place; even though Hamas calls for boycott, the movement refrained from violent actions. Thus, on January 20, Arafat was elected president of the Palestinian Authority and his partisans win two-thirds of the 88-seat Palestinian Council of Autonomy, which now becomes the new Legislative Council. Arafat's obvious victory strengthened for the time being the political marginalization of Hamas and at the same time the internal disputes regarding the fate of the movement and its adopted strategy [10, pp. 113-146]. At this point, the diplomatic solution of agreements with Israel proved to be effective, despite all the conditions which favored the Israeli side and all ambiguities related to the Palestinian requirements, gradually phased over five years. As such, Hamas stops its series of attacks, in order to prevent repression from Palestinian security or from the Israeli army in the West Bank, as well as to avoid losing part of its sympathy capital among the population, at this time full of optimism to the prospect of a Palestinian state. „Hamas has made mistakes. But we must not forget that Hamas is a religious group. Religious groups are not flexible. They follow their slogans (...) Hamas has failed to understand the situation (...) It failed to clarify its vision and objectives. Hamas should have changed its strategy and to distinguish between the two sides, ie between Israelis and Palestinians" said one of the political leaders of the movement in late 1996 [8]. In December 1995, in Cairo, a series of negotiations between Arafat and Hamas take place, and a decision is made to waiver any mutual pressures. Meanwhile, *Fatah* attempts to increase religious legitimacy by promoting members connected to Islamist groups in important positions; among other things, this strategy pursued an increase of financial support from the Gulf monarchies. The strengthening of ties with the Muslim Brotherhood leads to "nationalization" of the Islamist discourse, „even though they still consider that <<the Zionist entity is a defiance of the Muslim world >>, Hamas now want to see the emergence of a Palestinian state in part of Palestine as a first step to the liberation of all the territories occupied by Israel" [9, p. 115]

This period of relative calm lasted from summer of 1995 until January 1996, when the

Shin Beth kills in Cyprus the „engineer" of Hamas, Yahya 'Ayyāsh, the main artificer responsible for the most terrorist attacks. It is the moment where a dissident group of the military wing, *Shahid martyr Yahya Ayyāsh Cells'*, breaks the „truce" with the Palestinian Authority and a series of spectacular suicide bombings begin: it seems actually an external action of the foreign branch of Hamas (Amman, Damascus, Beirut), politically hostile to the rapprochement between Hamas and PLO - which made the anti-Israeli ripostes illegitimate [10, p. 75]. However, the attacks appeared to be the work of a faction of the military wing which does not obey the central leadership of territories; although political leaders have assured Arafat on the compliance with the „truce" concluded in Cairo, the media impact of bloody attacks against Israeli civilians gave the Tel Aviv government a pretext to once again criticize the anti-terrorist effectiveness of the Palestinian Authority. Killing 'Ayyāsh just when the two Palestinian camps had fallen to an agreement, is itself a challenge, known being the Palestinian side and its predictable consequences. Forced by the international community to take action against „terrorism", Arafat was thus caught between the „hammer and anvil" [7, p. 317]: the killing of the Hamas artificer caused a huge wave of indignation among the Palestinian population, which made it difficult to attempt to block the violent anti-Palestinians. On the other hand, U.S. reproached to Palestinian leader the lack of response against the authors of the wave of suicide attacks in the spring of 1996.

Finally, in March, at the indications of the political leadership, the *Azzeddine el-Qassem* Brigades gave up their weapons to the Palestinian authorities and declare the cease of operations against Israel. However, the impact of the February-March attacks on Israeli population (25 February in Jerusalem and Askhelon - 27 dead and 80 wounded, 3 March in Jerusalem - 19 dead, 4 March in Tel Aviv - an explosion with 13 dead and 125 injured) was huge and had serious consequences for the further development of the peace process. Although Hamas denied bombings and Arafat arrested over five hundred members of the movement, public opinion in Israel is increasingly distancing peace process. Israeli repressive strategy was also another factor undermining the authority of the Palestinian and increasingly caused in both camps, the decrease enthusiasm for normalization.

Israeli elections of May 29, 1996 mark the defeat of the parties who made the peace agreements and the coming to power of a right-wing government led by Likoud, with Benjamin Netanyahu as prime minister, said opponent of the formula „land for peace". It was a sign of voter attitudes in the Hebrew sense of insecurity caused by the wave of attacks in early and increased aversion to what is considered unable or, worse, Arafat's duplicity in ensuring stability in the territories. On June 18, the exposal of government's program traces the essential lines of the new policy towards the Palestinian problem: the recognition of an autonomous regime in the territories, but not an actual Palestinian state, too, sharing Jerusalem was out of the question. In addition, Netanyahu said the decision to increase the Hebrew settlements in the West Bank, resuming talks with Syria to establish a peace agreement but in no case by removing the Golan. It was then, in principle, a policy that made futile the previous agreements, it shocked the Arab states and the U.S., which although reacted quickly for providing the flexibility to the new government's attitude has not softened its rigidity [11, pp. 640-645].

Netanyahu's arrival hardened too the situation of Arafat, a part of the population begins to lose confidence in his ability to achieve the aspirations of the Palestinian people. Sharing between the supporters of the resumption of armed struggle by Hamas and the followers of continuous restoring of the internal order and awaiting deployment to the peace process becomes greater. Fatah supporters will criticize the Islamist movement policy, considering that it leads to the weakening of national cohesion and especially to the radicalization of the Israeli electorate and thus Likoud reaching power. However, by March 1997 the armed wing of Hamas will not claim any new attack. Only in March 1997, the Israeli government's decision to build a colony on the Arab side of Jerusalem, at Har Homa, reactivated the military wing of Hamas actions, especially in the context of support and collusion of the population, provoked by the breach of the peace and especially U.S. opposition to vote on the resolutions in the Security Council to compel Israel to stop building the colony. On 21 March 1997 an

attack takes place in Tel Aviv, but already the attitude of the Palestinian Authority has no vehemence of yore, it is seen as a reaction to the „challenges" of Netanyahu government

In addition, through an amazing return, Israel agrees to release Sheikh Yassine for few Mossad agents imprisoned in Jordan; on September 6, 1997 the spiritual leader of Hamas is received triumphantly in Gaza. Many saw in this action a „Machiavellian" strategy of Netanyahu to enhance the Palestinian Islamist movement, whose new shares would be offered as many excuses to block the implementation of *Oslo II* agreements. Indeed, the coming of Sheikh raised the popularity of Hamas share, especially because of his tour in Gulf countries and Iran in the spring of 1998, the organization brought hundreds of millions of dollars, which are used for social purposes and relief, increasing population and more responsiveness to the Islamist message [10, pp. 111-112].

As Netanyahu government is showing less and less willing to follow the program of *Oslo II* agreements, the Palestinian Authority was set in a delicate situation. Its authoritarianism against Islamists, socio-economic degradation of lands, blocking negotiations led to its unpopularity and increased the support to Hamas. The group continued to be caught between the two options (moderate - in the Palestinian territories, radical - the leaders of Amman and Damascus), but it will put less emphasis on the desire of state Islamisation and especially on the issue of Palestinian territory. Violence is repudiated even by some leaders, aware that it gives justification to block the peace agreements Israel and to make more difficult the Arab population's fate.

- **Hamas: A product of Muslim Brotherhood, or a result of the PLO's moral corruption?**

The beginning of the second Intifada in September 2000, simultaneous with the failure of implementation of peace plans and then with the installing of Sharon regime has radicalized relations between Palestinian and Israeli forces. The Arafat's inability to establish itself as a legitimate and desirable partner for further negotiated solutions, the non-availability of Likoud to accept the words "territories for peace" led to the blocking perspective to accept the formation of a Palestinian state on the borders in 1967. The political failure of Hamas opportunity to lend the validity of its option and the second Intifada militant revival coincides with violence and anti-Israeli attacks, in competition with Islamic Jihad. Israel's response is predictable, and every action of the Islamist movement is succeeded by a systematic policy of repression against both leaders and civilians, further increasing the climate of aggression and the rift between the two parties. As a result, the Israeli services initiate a plan to eliminate the leaders of Hamas in the Palestinian territories: on March 22, 2004, was killed Ahmed Yassine, and not long after that, his successor as the head of the movement, Aziz al-Rantissi to have the same fate [4].

The disappearance of historical leaders lead to a new strategy of rethinking Hamas: Israel's continued attacks on the movement will determine the organization to participate in new elections in January 2006. The electoral success of Hamas (56%) in front of the Fatah rivals, produced a huge surprise, especially at the international level [16]. In fact, it quite clearly illustrate the adherence that the popular movement was enjoying, especially in Gaza, and decreased confidence in historic Palestinian parties such as Fatah, which was torn by internal rivalries, corruption, lack of a credible and charismatic leadership, as Arafat, was [12]. At the same time, the option to integrate the Palestinian political field show and availability of Hamas to become flexible and adaptable to new local and regional realities [17].

In reality, the political success of Hamas blocked more chances of resolving the Palestinian issue. Marked by its negative past, the movement (which the Palestinian Authority President, Mahmoud Abbas, will delegate the task of the new government, with Ismail Haniyeh as prime minister) fails to be recognized as a legitimate interlocutor at the international level; Israel refuses any dialogue with the new Palestinian government authority, much less the idea of a geopolitical compromise. Blocking the foreign aid, further riots and anti-Israeli Jew state lines, and especially the increasing disputes and rivalries between Hamas and Fatah have increased political and economic crises in the occupied territories. Following the violent clashes in June 2007, Hamas banishes Fatah forces in Gaza, which is a stronghold of the Islamist movement only. In response, Abbas dismiss the Prime Minister Haniyah, but now President of the Palestinian Authority and Fatah is restricted to the West Bank [14]. This inter-Palestinian fragmentation deep freezes, then the chances of real options to solve the Palestinian problem and from that, the main beneficiary was Israel, for lack of a Palestinian partner for dialogue is taken univocally as a pretext for Israel to initiate low availability negotiated resumption of talks. In addition, successive violent crisis marked relations between Gaza and Israel, and Israeli military offensives in December 2008 - January 2009, or the November 2012 - initiated in response to Hamas rocket attacks.

Again, as, indeed, throughout the period after the formation of the Islamist movement, it can see that any violent option against Israel has, in fact, a pretext consistent political and military elites in Tel Aviv rather need to validate a security strategy against the search options leading to a negotiated settlement of the Palestinian problem by accepting concrete formation of a Palestinian state. This is what has caused countless interrogations on actual status and whether Hamas continues to hypostasis as aggressor and threat to Israel's destiny is, in fact, just a pretext goal (and maintain, even by Israeli services) to block any diplomatic project. These perspectives are obviously trying to decipher interpretative scenarios infinite nuances and multiple meanings and interests games they produce intricate interactions between actors involved in the Palestinian issue. What is remarkable, however, clearly, is that Hamas has a real mass support, especially in Gaza, where it has become almost the only effective agent to structure social order, safeguards, political and especially offering an ideal identity and mobilizing new Palestinian generations. This success resulted from the existence of very foundations made previously by the Muslim Brotherhood movement and constant support by the other branches of the Brotherhood, especially in Jordan. At the same time, Hamas was able to shape their own paths, breaking part of traditionalism and pietism Brotherhood and assuming specific new movements rather radical Islamist militancy after the model of the Egyptian or Lebanese Hezbollah. It remains to be seen what will be his destiny in a changing regional context after the Arab revolutions, where political Islam is rising. What is found is a visible reallocation of a Sunni identity matrix, cooling relations with Iran, close in recent years, a sign of connection to the new Hamas-controlled regional front Gulf monarchies [15]. Nevertheless, as always, the Palestinian movement strategies are in close dependence (as opposed or contrary, already traditional in strange collusion) with those of Israel. Resolving the Palestinian issue remains uncertain designed in a horizon or even unlikely, however, Hamas will remain, certainly, one of the actors of the inextricable problems.

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THE FORMATION OF INTERPERSONAL RELATIONSHIPS WITHIN A MILITARY NAVAL CREW

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ABSTRACT: *This study aims to explore the specific nature and succession of processes which define the formation of interpersonal relationships on board military vessels, with a particular focus on personological particularities and, implicitly, on the social behavioural styles of military crewmen. The article will systematically approach the interdependency and reciprocal influences between psychosocial, psycho-individual and sociocultural variables specific to military naval activities and environments.*

Keywords: *interpersonal relationships, behavioural styles*

It may seem paradoxical, but our entire psychosocial life is underscored by the existence of and the inclusion in different social groups where, through complex social learning mechanisms, we become individual personalities – that is, we become creators and disseminators of values, in an axiological sense, changing both ourselves and our sociocultural environment.

The permanent exchange of meaning and messages with one's sociocultural environment, which offers up a complex system of social groups, ultimately leaves its mark on the individual's personality, making one the carrier of specific models for practical action and introversion with regard to social relationships.

On the other hand, through one's level of activism or efficient intervention in the order of one's social reality, the individual is capable of dominating and transforming the surrounding environment to one's use.

This assertion is supported by R. Linton [5], who argues for the "cultural basis of personality" in the following terms: "In humans, the social, through its cooperative nature (in Piaget's terms) is both conditioned by as well as a conditioning factor in an endless moulding process, the ultimate result of which is a functionally modelled social behaviour that is not instinctive or biologically determined. Herein lies the source of the apparently limitless individual variations we see in humans, as opposed to the automated, standardized responses of animals. " (p.14)

From a psychosocial perspective, Pierre De Visscher [2] an authoritative voice among European specialists in the field, puts forth an operational, working definition of the restricted group:

- " a unit of space and time – a"here and now" – with a high level of physical and inter-individual proximity;

- a source of meaning: a reason to be a part of a whole, without necessarily imposing common objectives or experiences;
- a common way of being, the communal sharing of events and experiences;
- each member can be perceived or represented by the others;
- a feeling of being a sole entity or group with relation to the larger outside social context;
- sufficiently stable over time to allow for institutionalisation (the setting up of structures, stable relationships, functional processes, roles and norms) and member identification." (p.206)

With this definition as a starting point, the crew of a military vessel can be seen as a social microgroup, or, to be more exact, a working team whose professional activity is subordinate to common objectives and aims, and which has its own psychosocial structure, with clearly determined, well articulated and concisely prescribed statuses and roles. The group is made up of a relatively small number of individuals, heterogeneously assembled, who interact in direct, unmediated ways – that is, "face to face".

Interpersonal relationships on board military vessels can be said to have their own specific traits, both in terms of formation and dynamics, and it is these specific traits that we will present in summary below.

During the process which leads to the formation of interpersonal relationships, the shaping of the relational field is intrinsically linked to the current complex and extremely dynamic context which requires the presence of professional military personnel on board these vessels, personnel capable of handling military issues during peacetime as well as during potential conflicts.

The Navy's specific activities aim to fulfil set missions through a strict observance of procedural guidelines and rules, stipulated by interior regulations and instructions. As such, a crew is necessarily made up of leaders and subordinates who are part of a rigorous hierarchy which contributes to group cohesion and internal stability.

Since interaction between crew members is direct and reciprocal and features, in turn, direct and conscious psychological involvement, interpersonal relationships on board require reciprocal influence, both conscious and motivated, regulated by psycho-individual, psychosocial and sociocultural factors.

By appealing to Kelly's theory of social constructs, interpersonal relationships can be identified as psychosocial constructs which are the result of dynamic interaction between the subjective personological equation of the partners, the situational context and the existing sociocultural model on board military vessels.

Interpersonal behavioural styles are thus formed and made outwardly manifest within the crew, with the support of the socio-empathic structure of the group.

As a generative system of relationships which shapes the cognitive, emotional and inter-relational development of its members, the military unit is a facilitating framework of sympathetic relationships where the empathic-evaluative component holds a determining role and where "interpersonal gratification", as Newcomb so aptly calls it, takes on new meaning.

Personality studies carried out on navy personnel have shown that interpersonal relational styles, understood as social performance, are rational and emotional, socio-culturally adaptive, showing not only high socio-relational potential, but also a high degree of socialisation, a result of the formative nature of the military environment and the specific nature of group tasks routinely carried out.

An in-depth study of the personality profile of the navy officer written by Cojocaru [1] has identified, on the basis of the factorial analysis of statistical data, a set of stable

patterns or configuration of factors inherent to the intrinsic nature of the personality of naval military professionals:

- the ability to integrate oneself into institutionalised structures, groups and professional milieu (military);
- an ability to adapt to status requirements (military), in the sense of the formation of an awareness of one's professional military status;
- affective rationality, in the sense of self-discipline, self-control, high tolerance to frustration and uncertainty;
- emotional intelligence, with a higher incidence of cognitive empathy and empathic predictivity as factorial solutions.

Of the simple variables, we find those with high factorial concentrations most worthy of mention:

- Social abilities
- Verbal intelligence
- Lively intellect
- Emotional control
- Realism
- Dominant nature
- Self-control
- Expensive character
- Tolerance
- Responsibility
- Intellectual effectiveness
- Productive group relationships
- Emotional balance
- Creativity

The processes through which interpersonal relationships are formed aboard military vessels show themselves to be strongly influenced by the defining characteristics of the individual crew members' personalities, as well as by the strength of authoritative and task structures.

The functional relationship between members of the crew are predefined by the requirement for optimal handling of its missions. Working tasks have a high degree of structure, are complex, interconnected and have an integral completion time. These tasks become the regulating factors of the basic interactions within the military microgroup.

As a constitutive function of the military microgroup, the carrying out of military missions is, in itself, an indicator of the social efficiency of the crew, providing data on the dynamics of interpersonal relationships, the level of integration and how it relates to outside constraints.

The evaluation of the performance of a military group is determined by productivity, efficiency and efficacy indicators.

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ORGANIZATIONAL COMMUNICATION WITHIN LIMITS, BOTTLENECKS AND AGGRESSION

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Abstract: *Economic factors, cultural policy led to an emphasis on their role in social communication processes. Because of this, in this paper we are interested to find out the order communicative performances, theoretical and methodological aspects of investigating formative consequences of communication in the organization. Organizational communication can be defined as the discipline that studies the professional and institutional information. (Prutianu Ş, 1998). The definition can be considered restrictive, highlighting that any form of communication or process interested organizations. To understand organizational communication must start from the idea that in this context the organizational structure overlaps interpersonal communication. Overlapping communication has implications for the direction and contents of the communication, creation of communication networks and emergence of specific communication roles.*

Keywords*: communication, organization, conflict, attitude.*

INTRODUCTION

Our research is explorative and the investigation is related to a social space led to an organization, using the method in this context, case study. Growing ability to communicate more fully and precisely was what led to the progressive development of advanced technology in creating myths, legends, perceptions, representations, explanations, habits and behavior of complex rules that make civilization possible (Zlate, M. 1981). In this case, the history of human existence should be adequately explained by a theory of transitions, that should be explained in terms of distinct stages in the development of human communication, each of which has profound consequences on individual and organizational social life (Bollinger D., Hofstede G. 1997).

RESEARCH PURPOSES

The central concept of our research is aggressive communication and we try to define communication as manifested verbal or nonverbal behavior that seeks to assault a person to a dominating ridicule it and promote their own interests.

RESEARCH METHODOLOGY

In the case study we used the techniques of data collection and analysis questionnaire and observation sheet (Chirica S., 1996). The questionnaire is mixed, comprising both closed questions and open questions, addressing a single theme, aiming to identify aggression manifested through

communication within the organization. We considered possible to eliminate the halo effect. Processing, analysis and interpretation of data, I made use SPSS, which allowed us to call on correlation tables, hierarchical scales with different degrees of intensity.

RESEARCH OBJECTIVES

To achieve diagnostic relations established within the organization aggressively investigated and determination of verbal and nonverbal behavior, we proposed that the central objective: to identify the defining variables that appear in the relations established to develop a tool to measure these variables.

RESEARCH HYPOTHESES

1. Suppose unwillingness for cooperation, understanding competition between employees and the organization in maintaining a status generates aggressive behavior. 2. Suppose that mentality that creates organizational heads the reality aggressive behaviors.

INVESTIGATED SAMPLE

Consists subjects belonging to an organization's security and protection in Iasi, with branches in cities and Roman Pascani. Investigated group consists of 100 people between 22-45 years old, male, thanks to the specific activity. They were chosen based on a sample availability.

DATA PROCESSING AND INTERPRETATION

For starters we analyze attitudes towards colleagues language, combining all items that attitude variable status in the company of subjects.

1. The language of arrogant attitude towards colleagues.

We calculated weighted average for the population investigated and obtained results 2.7. This value expresses the lack of popularity of this form of the language in the context of relationships between employees that have the same status. Intensity of negative attitudes in these cases may be due to the fact that the profession is exposed to this kind of verbal aggression.

2. Attitude towards colleagues ironic language.

For the investigated population weighted average is 4.08, which means a high enough value on a scale with six degrees of intensity. If we average the total land agents (4, 3.7 versus 4.08) which means that these groups are most exposed to this kind of verbal aggression and therefore the reaction is stronger. This group is engaged in preference kind of aggressive behavior. It should be noted that in this case only 25% of subjects felt that there is a language vocabulary ironically their peers, and among them is the most heads.

3. Sarcastic attitude toward colleagues language.

For the investigated population weighted average is 4.2. In this case the direction is reversed attitude, heads the only category of investigated group expressing a negative attitude towards colleagues sarcastic language. Hence we realize that they are the most exposed to this kind of verbal aggression and therefore their reaction is violent. Should be noted that 80% of investigated subjects felt that there sarcastic language in the vocabulary of their peers.

4. Attitudes towards peer trivial language.

For the population investigated, the weighted average is 3.1, which means a relatively low value. In particular field agents are more exposed to this kind of verbal aggression and therefore their reaction is more virulent, this reaction is visible in more radical attitude of heads. It should be recalled here that 45% of the sample said that there is no foul language in the vocabulary of their peers.

5. Attitude towards language authoritarian leaders.

For the investigated population weighted average is 5.4 which means a

relatively high value. This implies the existence of a dominant authoritarian language in relations between bosses and subordinates. The higher in the hierarchy of the organization, paternalistic attitudes tend to diminish in intensity and this is not "democratic leadership" to the top of the military hierarchy, but transforming into authoritarian behavior.

6. Attitude towards the language of arrogant bosses.

For the surveyed population weighted average is 3.2 which means a mild attitude pursued. This means that employees of the organization are investigated against using the chief of an arrogant language. But I could capture a hostile attitude towards subordinates to leaders from arrogance leading to sarcasm, and this shows that there is good dialogue between leaders and subordinates.

7. Investigating the behavior of employees in the heads.

We note that 10% of subjects adopt a state of indifference, a neutral state, and 5% are indifferent try to negotiate to find a compromise. Highest weight of subjects, 60%, but show aggressive behavior: 20% exhibits nonverbal aggression surprised gesture of dissatisfaction, mimic, look, they showing so a nervous conformism, 10% of subjects investigated nervous behavior, aggressive are irritated and irritable, 25% of investigated subjects verbally aggressive behavior, giving them superior response regardless of where they are, and 5% aggressive behavior manifested by violent language Ironically, they are severely punished Heads, which bears irony to them. We know that the best resolution of conflict in an organization is not its settlement or compromise, but very positive confrontation, consulting the parties to the conflict (Corcaci, G. 2010).

8. Investigating the behavior of leaders to employees.

Most of the respondents expressed their reproachful behavior, remaining relatively close percentages distributed on other selected alternative. We observed that 35% of those investigated adopts a permissive position to employees while 65% of those surveyed show an aggressive communication.

9. Finally conclude the study analysis variables contribute to conflict situations.

In this case I was interested in attitude towards team work, working conditions and job content, thus obtaining an overview of the framework within which members of the organization operates. Note that most investigated subjects that relationships with colleagues produced the least stressful situation-state weighted average is the lowest (2.5). Relationships with leaders in turn, are seen as stressful sometimes with weighted average (3.1). These are followed by two other factors as weight on the same place as intensity: of activity and busy schedule with an average of 3.9.

We conclude that the factors producing a major conflict state are dealing with bosses, nature of business and busy schedule. Thus deduce that relations between superiors and inferiors are friendly, so we can assume that there are many misunderstandings because there is dialogue and communication is mostly aggressive. Also, working conditions are carried out in difficult conditions because labor content and material and financial constraints.

CONCLUSIONS

In our research we aimed capturing the ways in which they collaborate in the organization of the relations between workers and bosses, how they communicate. Within these relationships we observed that at every level there are using aggressive language. The relationships among peers, we see that leaders frequently use ironic and sarcastic language. In this case, employees reacted quickly enough, disagreeing with the use of such language. The relationships among the subjects investigated and their superiors noted that heads of department are strongly agree with the emphatic language of heads, while senior line managers consider that this behavior should be eased with completing certain levels in the hierarchy.

In connection with aggressive language, arrogant, vulgar superiors that it addresses relations with inferiors, we can say that the heads are reacting promptly and aggressively against the use of this language. Analyzing the behavior of subjects found that 55% of them in case of conflict with superiors show aggressive behavior, verbal or nonverbal. On the way, I noticed that the relationships between superiors and subordinates line managers are the biggest factor challenging conflict situations, aggressive, and besides, creating conflict situations helps busy schedule of activity and causing the same conditions, but a smaller share. From the above we realize that aggressive language, verbal and nonverbal aggressive behavior is present in this environment, and this behavior instead of being diminished, is maintained by several factors. And we conclude we can say that the research hypotheses were confirms.

In a study I noticed that we are dealing with a lack of willingness for cooperation and competition in preserving a status in the organization generates aggressive behavior. We also found that thinking about the reality that organizational leaders generate aggressive behaviors.

In conclusion, we can say that in an organization, builds and maintains communication is based on the characteristics of the organization, the work environment, the type of work performed, but especially the active involvement of its members for collaboration, cooperation and good networking, just to reduce and eliminate bottlenecks that limited his power.

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STUDENTS PERCEPTION ON THE FEEDBACK SUPPLIED BY THE SCHOOL

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Abstract: *The purpose for this study is to identify the existing relationship between elements like the original background, the biological genre, self-esteem level, the perception of self-efficiency and the learning satisfaction of the students on one hand, and their perceptions on the feedback they receive at school, on the other hand. A questionnaire has been carried out on a group sample containing 420 students, aged 15-19 years old (233 girls; 216 boys). This study has been presented to the students as an opportunity of thinking about the importance of the feedback throughout the learning process. The results distinguish the importance of developing a more profound dialogue between teachers and students, a dialogue linked to the understanding of an individual perception on the feedback. An important result of this study is the possible connection between student's preferences for feedback and the learning approaches.*

Keywords: *assessment, feedback, student's perceptions on the feedback, the preferences for the feedback*

1. INTRODUCTION

Formative assessment and formative feedback was constantly addressed in theoretical debates and empirical research, along with the development of the two concepts. Although there is scientific work done for illustratting the impact of formative feeedback on learning and achievement, less effort has been directed towards establishing connections between certain characteristics of students and how they perceive the feedback provided by teachers.

Providing an effective and high quality feedback has been identified as a key element in the student's learning process. Receiving the feedback information, as well as the way in which students will respond to it, is determined by a series of elements that also include the perception on the received feedback.

The purpose for this study is to identify the existing relationship between elements like the original background, the biological genre, self-esteem level, the perception of self-efficiency and the learning satisfaction of the students on one hand, and their perceptions on the feedback they receive at school, on the other hand.

In final section, general conclusions are provided and future research ideas are suggested.

2. THE DETERMINERS OF THE STUDENTS PERCEPTION ON THE FEEDBACK SUPPLIED BY THE SCHOOL

2.1 Theoretical backgrounds. Literature founding the present study covers both the concepts of formative assessment and formative feedback. When used properly,

formative assessment provides students with feedback on their learning and provides an opportunity to control their own educational progress, increasing autonomy and self-directing learning. Thus, they become active participants in the learning process by evaluating their efforts in light of the objectives and shared responsibility to act in order to promote learning. Practicing formative assessment, teachers will provide feedback on what students know, understand and can make (Biggs, 1995; Radnor, 1994; Clarke, 1995), and through dialogue with students, teachers can generate opportunities to promote understanding and to enable students in order to better direct their learning efforts (Sadler, 1989, Brown and Knight, 1994).

Valerie Shute analyze a corpus of research on formative feedback defined as information communicated to students in order to change how the student is thinking, or behavior, to improve learning. (V. Shute, 2007). In most theoretical approaches feedback is viewed as a "consequence" of performance (Hattie, Timperly, 2007) as "the information provided by an agent (eg, teacher, peer, book, parent, self, experience) regarding aspects of one's understanding or performance.

David Nicol and Debra Macfarlane-Dick propose a theoretical model of feedback in which students build their understanding takes messages received feedback from teachers, thus enabling self-learning with categorical effects on motivation and self-esteem. The concept of formative assessment and feedback proposed by David Nicol and Debra Macfarlane-Dick (2006) summarizes the key elements of representative research in the field (Sadler, 1983, 1989, Black and Wiliam, 1998; Yorke, 2003; Torrance and Pryor, 1998). John Hattie and Helen Timperly (2007) propose an explanatory model that identifies the particular properties and circumstances that are effective feedback, along with some thorny issues like timing in providing feedback and possible positive and negative effects. Hattie and Timperly meta-analysis synthesized 12 studies including 196 aimed at using feedback effects in the classroom, the results indicate that some types of feedback are more effective than others.

Any explanatory model concerning feedback should take in account of how students make sense of and use the feedback information. One of Sadler's arguments is that, to be able to compare their own performance with the current standard, and to be able to close the gap, students should already possess some of the evaluative skills of teachers. Their conceptual model of formative assessment and feedback synthesizes research findings on this topic, such as Sadler 1983, 1989, B & W, 1998; Yorke2003; Torrance and Pryor 1998

2.2 Why a study on student perceptions on feedback provided by teachers?.

The provision of effective and high quality feedback has been identified as a key element of quality teaching and this views well supported by meta-analytic studies (Black & William, 1998; Hattie, 1987; Hounsell, 1987; Ramsden, 2003). Nevertheless this element of teaching has been largely neglected in research, and in particular, the experience of students has not been extensively investigated.

For the purpose of this paper Hattie and Timperley's (2007) definition of feedback will be adopted, which they conceptualise as: information provided by an agent (e.g. teacher, peer book, parent, self, experience) regarding aspects of one performance or understanding feedback is thus a "consequence of performance (Hattie & Timperly, 2007).

Some studies have focused at the interaction between preferences and student characteristics, that is personality, cognitive styles, attitudes, learning strategies. Such studies suggest that preferences for feedback in school are related with student's self-esteem, self-concept and self-efficacy. The relationship between feedback and self/efficacy has been supported both by theory (Bandura, 1986) and experimental studies, and also, some gender differences in perceptions have been found.

Other studies enhance a few differences in student and teacher perceptions. Such studies demonstrate the importance of considering the point of view of both students and teachers, and that teachers have to be more sensitive to student perceptions concerning the feedback.

For the last years the formative evaluation has been reconsidered in Romania, on the educational politic level and also on the

educational practice level. In these terms, the current study can be an explanatory support but also a possible motivation of the teachers so that they could become more sensitive to the needs of the students to receive feedback and to their perception regarding the feedback received in schools..

2.3 Research questions . The aim of the study is that of exploring the students' perceptions on the formative feedback and of identifying the relations between different demographic and psychological factors on one hand and the perception on the feedback received in schools, on the other hand. The complexity of this issue binds us to acknowledge the impossibility of the ending of this subject exclusively by research which is the object of the current paperwork. In this context, we intend to identify answers to the next questions: In what way the factors such as the original background, the biological genre, the type of the high school which he/ she attends, the level of self esteem, the perceived self-efficiency, the level of school satisfaction influence the perception of the teenagers on the feedback supplied by the educational actors?

2.4 .4 Method.

2.4.1 Participants The study included 420 students, between 15 and 19 years old, from different high schools from Bacau. The distribution of the subjects, according to the three independent variables, was the following:

1. the biological genre: 233 boys, 216 girls
2. the level of the attended grade: IX th grade 126 students, X th grade 114 students, XI th grade 120 students, XII th grade 89 students.
3. the original background: 238 students having an urban background, 211 students having a rural background.
4. the type of the high school: theoretic high school 157 students, technical high school 142 students, vocational high school 150 students.

2.4.2 Survey instrument. The perception of the students on the feedback supplied by the teachers has been studied by the help of a questionnaire which covered the following dimensions: the meaning of the feedback (as a motivation of the mark, as the verbal appreciation with the role of orientation / guiding the student in the learning activity, as an expression of the interest of the teacher toward the students, as an instrument of motivation for learning), the importance of the feedback , the type of feedback supplied the most by the teachers, the preference for the feedback of the students.

Both full scale and its subscales were pre-tested on a total of 30 students, all achieved an internal consistency Cronbach Alpha which allowed us to use optimal conditions of validity and reliability.

Pretest-reduced sample

scale tested	Alpha Cronbach	number of subjects
Perception of feedback	0,764	50

Full-sample testing

scale tested	Alpha Cronbach	number of subjects
Perception of feedback	0,793	420

Self-esteem was measured with the questionnaire developed by Toulouse. We chose this tool to capture the level of self-esteem and possibly overcompensation. In addition the instrument has been used successfully in Romania, easily administered. Good internal consistency (> 0.70) allowed us

to use scales in terms of statistical validity and fidelity.

scale tested	Alpha Cronbach
Self-esteem (full scale)	0,756

Questionnaire measuring school satisfaction :

scale tested	Alpha Cronbach
Schoool satisfaction	0,875

Questionnaire to measure perceived self-efficacy:

scale tested	Alpha Cronbach
Self-eficacy	0,716

2.4.3 Results

The analysis and the interpretation of the results has been performed with SPSS 17 for Windows, where we proceed to give the definitions of the variables, the introduction of the data and then their processing by the analysis of the distributions and the setting of the existing relations between the variables, in order to be able then to check the hypothesis of the research. The hypothesis of the study have been confirmed, the statistical results proving the existence of some important differences induced by the independent variables on the dependent variable - the perception of the students on the feedback supplied by the teachers, with the four subscales (the meaning of the feedback, the importance of the feedback supplied by the school, the perception of the frequency of every type of feedback supplied by the teachers, the preference of the students for a type of feedback).

Based on assumptions, the study revealed the following:

Hypothesis 1. (*The biological type influences the perception of the students on the feedback supplied by the teachers*) has been confirmed. Thus, there are important differences induced by the biological type variable on the feedback perception variable. The girls understand by the feedback given by the teachers more a stimulus of the motivation for learning and the expression of a special interest of the teacher toward the activity of the students than a simple justification of the mark. The latter is the meaning perceived more by the boys.

Hypothesis 2 (*The original background influences the perception of the students on the feedback provided by their teachers*) is confirmed only partially. Thus there are some important differences induced by the original background variable on the feedback perception variable. The students who have an urban background, as compared to those who have a rural background, see the feedback as being more a simple justification of the mark rather than a stimulus of the activity of learning. regarding the importance students with different backgrounds give to the feedback, the answers do not differ much. In the perception of both categories, the feedback proves to be essential for the learning activity. Concerning another dimension of the dependent variable, namely the perception on the frequency of a certain type of feedback , the results were surprising. It seems that the students having a rural background identified the individual feedback (written or verbal) , as being more present in the activity of the teachers than the collective one , underlined especially by the answers of the students with an urban background. With regard to the preference of the students from the two categories (rural, urban) on the feedback, the students with an urban background showed their preference for the individual- verbal feedback supplied by the teachers, and those with a rural background for the collective - written feedback.

Hypothesis 3 (*the type of the high school influences the perception of the students on the feedback supplied by their teachers*) has also been confirmed.

The results obtained show that the students who come from high schools with theoretic channel perceive the feedback more as a justification of the mark intended to stimulate the motivation to learn of the students, while their mates who come from high schools with technical or vocational channel, perceive the feedback received from their teachers as a simple verbal appreciation of the activity. Regarding the importance that the students give to the feedback, it seems that the grade

channel variable does not influence the results in any way, the three samples of subjects registering similar scores. The important differences that existed between the subjects concerning the perception on the frequency of the individual verbal feedback. Thus, the students from the theoretical high schools underlined a greater use of this type of feedback from their teachers. The results that occurred in the study by searching the variable the preference for a certain type of feedback are interesting. thus, the students from the theoretical high schools prefer their teachers to use in the teaching- learning activity the individual verbal feedback ,while their mates from the technical and vocational high schools prefer the collective written feedback , and if possible with predefined answers.

Hypothesis 4 (*The level of the class influences the perception of the students on the feedback supplied by their teachers*) has been confirmed. The results underline the fact that there are no important differences induced on the class level with regard to the perception of the feedback as a simple justification of the mark. An interesting result has been obtained on the scale the importance given by the students to the feedback, the highest scores belonging to the Xth grade pupils. Being asked what kind of feedback they prefer to receive, the Xth grade students, for whom the feedback is very important in the learning activity, showed interest for the individual feedback but also for the collective one, regardless of the form of sending it, verbally or in writing. The students from the XIIth grade showed a special interest for the collective feedback, be it written or verbal, with predefined answers , while their mates from the XIth grade showed their preference for the individual feedback without predefined answers from the teacher. The students from the IXth grade did not show any particular preference for a certain type of feedback in their answers. Regarding the perception on the frequency of different types of feedback used in the educational activity, the IXth grade and the XIITh grade students marked in their answers the written collective feedback as being the most used by their teachers, while their mates from the Xth and XIth grade consider that the verbal collective feedback is more used in classes. According to the answers of the students, the teachers use more often the individual verbal feedback in the IXth grade and the collective verbal one in the Xth grade.

Hypothesis 5 (*The self esteem influences the perception of the students on the feedback supplied by their teachers*) . The more elevated is the level of self esteem , the more the students perceive the feedback as a justification of the mark or as a verbal appreciation of their activity. The more pleased are the students by their own person, the more they will perceive the feedback as a stimulus of the school motivation. Concerning the importance that students give to the feedback received from their teachers, the more elevated is the level of the self esteem, especially of the emotional and physical self, the bigger the scores of this variable are. By the further study these correlations we notice that the students who have an elevated level of the self esteem with all its components, have the tendency to perceive as being more frequent the feedbacks supplied by the teachers, in comparison to those students, with a low level of self esteem.

Hypothesis 6 (*The school satisfaction influences the perception of the students on the feedback supplied by their teachers)* has also been confirmed. There have been made important positive average correlations between the satisfaction toward the evaluation

and the satisfaction toward personal development of the students and the perception of the feedback received in classes as a justification of the mark, but also as an appreciation of the school activity meant to direct the student in learning. The students that got an elevated level of satisfaction with regard to teaching, evaluation, interpersonal relations, development and security, perceive the feedback as an expression of the interest of the teacher toward his students. Regarding the importance given to the feedback , the students who are satisfied with the process of evaluation performed by the teachers but also with the conditions which help the personal development are those who got the highest scores in this dimension. According to the statistic results, the verbal individual feedback is perceived as being the most used in class, especially by the students with high scores in the curriculum satisfaction variable. The feedback between the students seems to be used more among students satisfied with the evaluation process but also with the interpersonal relations between mates. The preference for the feedback correlates positively with the school satisfaction, so that the students who prefer the individual feedback are satisfied with the curriculum and with the evaluation process, those who prefer collective feedback got higher scores in the teaching, evaluation and personal development satisfaction, and those who prefer verbal feedback are very satisfied with the security that the education institution provides.

Hypothesis 7 (*The level of self-efficiency perceived influences the perception of the students on the feedback supplied by their teachers*) has been confirmed. The more elevated the level of academic self- efficiency is, the more tempted are the students to perceive the feedback supplied by the teachers as a justification of their mark, as a verbal appreciation meant to direct their learning, as a stimulus of the school motivation. The level of academic self- efficiency does not influence the importance given to the feedback, for all the three lots the feedback being very important. The students with an elevated level of academic self- efficiency perceive as being very frequently used in class the collective verbal feedback.

3. CONCLUSIONS & ACKNOWLEDGMENT

This study has been presented to the students as an opportunity of thinking about the importance of the feedback throughout the learning process.

The results distinguish the importance of developing a more profound dialogue between teachers and students, a dialogue linked to the understanding of an individual perception on the feedback. The way in which students perceive and approach the learning context influences their performances. An important result of this study is the possible connection between student's preferences for feedback and the learning approaches. This might evolve in a relevant theme for a further development of a study in this area.

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SOCIAL AND PSYCHOLOGICAL IMPLICATIONS AT DEINSTITUTIONALIZED PEOPLE WITH SUICIDE RISK AND DEMONSTRATIVITY

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***Abstract**: Of all the levels where reform measures have been felt in recent years, the protection of children in difficulty and the deinstitutionalized people are special- treated areas. Their exposure especially at an international level increased the interest of public opinion in this respect.*
The present research stopped on a sample of deinstitutionalized people from Bihor County and aimed to demonstrate that there are significant differences between these individuals in terms of implication in the work environment, involvment in activities and the manifestation of their demonstrativity and suicide risk.No doubt suicide is by far the desperate act of a person who doesn't want to live anymore. But the real fact is that because these people are still attached to life the moment they commit suicide, the suicidal act is an abandonment. His purpose may be avoiding an unacceptable situation, having a self-agressive behaviour, giving his entourage a desperate message or being indiferent towards the social ssystem he belongs to.
The integration of young people in the society and in the active life, as well as the optimum use of their potential are esential elements to reduce the risk of social exclusion and to achieve sustainable growth of any society.

***Keywords:** suicide risk, demonstrativity, deinstitutionalized young people, system, personality.*

1. INTRODUCTION

The suicide (from sui=de sine and cidium=omorator) means „all cases of death resulting directly or indirectly from a positive or negative act of the victim himself, which he knows will produce this result." (Durkheim, as cited Tudose and collab, 2002). It can thus be a rational act, made as a result of religious, moral, philosophical, social or personal beliefs or it can be a pathological act as it occurs in the self-agressive raptus of acute existential crises or in different mental disorders. The term suicide tends to be replaced with that of suicidal behaviour, which includes successful suicide, attempted suicide, suicidal ideas and the presuicidar syndrome.

Suicide had also got a psychological-operational definition under which „is a human act of termination of life, self-produced and with own intention" (Shneidman, 1980, as cited F. Tudose and collab, 2002).

The Dictionary of Psychology (Șchiopu, U.,1997) defines the suicide as an act of selfdestruction caused by a strong psychological crisis, the loss of any sense of existence and by insurmontable difficulties.

Suicide is defined by W.H.O as the act by which an individual seeks physical self-destruction, with a more or less authentic intention of losing life, being more or less conscious of his reasons(Cosman, 2000, as cited Dindelegan, C. 2006).

The medical and psychological views consider suicide as having a pathological cause and being the expression of a psychiatric disorder, most frequently associated with depression- either reactive depression or endogenous melancholic depression.

In a very extensive study devoted to suicide, W. Poldinger defines from a clinical and psychiatric point of view three main stages in the organization, conduct and completion of the suicidal behaviour (C. Enachescu, 2005). These are:

1. Presuicidal syndrom, which comprises all psychopathological transformations which preeced suicidal crisis and which are represented by the following aspects:

a) Preparation, which includes: social isolation of the individual, a state of agressive, difuse, nonspecific, intrapsychic tension and the presence of suggestive induction situations such as films, literary reading, shows.

b) Ambivalence phase which consists of: oscillation between „to be' or „not to be", affective ideation, suicide occurence and development of ideas, hesitation, searching for exact reasond for suicide as a form of self-explanation of the act itself and to others, anxiety, depression and insomnia.

2. Suicidal crisis, the stage where we go directly to the act of suicide itself, is represented by the suicidal act. This phase consists of the setting of the crisis and the suicidal act itself. After a long premeditation or abruptly under a strong emotion, the individual commits suicide. Men prefer more brutal ways of suicide such as gunfires, drowning or hanging, while women choose poisoning with drugs, poisons and insecticides or gas or carbon monoxyde. Therefore, though suicide attempts are more frequent in women, those who succed in commiting suicide are men because of the methods they choose.

3. The post-critical phase, which follows the discharge of tension with a specific psychopathological configuration, is represented by the following aspects: emotional- affective state of exhaustion, feelings of guild, shame and regret, desire to hide the act. In the post- suicidal phase we can notice the following aspects: the regret of failure, the guilt of those who saved him from death and the desire to repeat the suicidal act in order to die.

1.1. Loneliness

Loneliness is a lifestyle which can be definitely established in the case of people who were never married, as a a result of a divorce or widowhood.

Between 1970-1978 the number of people aged between 14-34 who lived alone tripled in the USA (according to Mitrofan and Ciuperca, 1998). American statistics (Cavanaugh, 1993) show the fact that in early youth most people are alone (75% of men and 57% of women aged between 20-25 are unmarried). A statistical comparison between the categories of singles (Vander Zanden, 1993) show that those who were never married represent more than 70% of all single and divorced people represent only 13% of all (though divorce rate is high, most of the divorced people get married again).

Among the explanations they gave to their options we can mention: the change of society and young people's conception about the marriage institution- which can sometimes be

an impediment to professional evolution; the legalization of sexual relationships outside the legal institution of marriage, focusing on variety, novelty and quality; the recognition and legalization of homosexuality which leads to the creation of a fourth sub-group within the single people; the changing of economical conditions, including the growth of women's financial independence (Mitrofan and Ciuperca, 1998); the changing of the conception of society on loneliness; if in 1957 polls showed that 80% of Americans associated women's loneliness with psychiatric disorders or immorality, this conception decreased in 1978 to 25%. Nowadays many Americans don't see loneliness as a category only the unhappy are part of (Cavanaugh,1993).

As the number of singles rose, there are cities which have special residential areas, bars and group activities organized especially for them. Even if it offers more independence than the marriage, loneliness has also got its disadvantages: lonely people are less happy that married people and they live solitude in a greater measure than the other category (Lefrancois,1984).

2. METHODOLOGY OF RESEARCH

2.1. Hypothesis: There are significant differencies in terms of having the guilt of affective isolation (limited, light, moderate, high) in the case of deinstitutionalised people according to their demonstrativity and suicidal act.

2.1.1. Variables

Independent variables – affective isolation;

Dependent variables

- - demonstrativity - a1- absent;
  - a2 - moderate;
  - a3 - high.
- - suicidal act - b1- absent;
  - b2 - moderate ;
  - b3 - high.

2.1.2. Design

Experimental design: unifactorial inter-group

2.2. Method

2.2.1. Subjects

In order to test the hypothesis and achieve the objectives, the comparative study was conducted on a total of 129 deinstitutionalized people. The group was heterogeneous in terms of employment, gender, background and level of education and included people from both rural and urban areas, people without education or secondary education and people having different characteristics. The subjects are between 18 and 37 years old.

The subjects included in the study were chosen thanks to data provided by ASCO.
All the subjects were voluntarily involved in the clinical trial and in the objective evaluation made according to the four scales.

2.2.2. Materials

Wechsler Test – (D. Wechsler; WAIS- R, 1981)

Beck's Hopelessness Scale BHS (Hopelessness Scale ; *A.T.Beck, 1993)*

2.2.3. Procedure

In order to check the hypothesis we worked individually with every subject. We have established the instruments of evaluation

which will be applied to subjects un order to check the hypothesis. We used *Wechsler Test* and *Beck's Hopelessness Scale.* Then we organized appointments with the subjects in the most important cities of Bihor: Oradea, Marghita, Beiuş, Ştei and their roundabouts: Diosig, Şuncuiuş, Bălnaca, Izbuc, Popeşti.

The tests were administrated individually in order for the subjects to understand as better as they can all the statements in the two questionnaires and they didn't have a time limit as well. The subjects were told to answer as honestly as possible at all statements in the questionnaires being also specified the fact that there were no good or wrong answers.

2.3. Results and their interpretation

There are significant differences concerning the feeling of affective isolation at deinstitutionalized people according to demonstrativity and their suicidal risk.

Table no. 1 Comparisons between deinstitutionalized people regarding affective isolation according to their demonstrativity.

Affective isolation			Demonstrativity			Pearson Chi-Square	df	Sig. (2-sided)
			absent	moderate	high			
	limit	Count	1	13	17	16.686	6	.011
		Adjusted Residual	1.8	3.0	-3.3			
	light	Count	0	9	26			
		Adjusted Residual	-.6	.5	-.4			
	moderate	Count	0	6	31			
		Adjusted Residual	-.6	-1.1	1.2			
	high	Count	0	1	25			
		Adjusted Residual	-.5	-2.5	2.6			

- As for the analyse of the above results, it shows that there are significant differences between deinstitutionalized people regarding affective isolation according to their demonstrativity. The significance threshold is $p<0.05$. These differences show that deinstitutionalized people having a higher degree of demonstrativity live the feeling of affective isolation lightly or moderately. They feel humiliated, manipulated, disadvantaged, distrustful and can get to a more intense behaviour characterized by feelings of abuse and rejection- all these feelings are offset of demonstrativity shown by this social category.

Studies made in a family show that this feature is found in the families where such tendencies or manifestations of demonstrativity appear. It is rather unclear if these abnormalities are related to the human gene or to the result of processes in the family environment and in the present study to deinstitutionalized people.

Table no. 2 Comparisons between deinstitutionalized people regarding affective isolation according to their suicidal risk.

Affective isolation			Suicidal risk			Pearson Chi-Square	df	Sig. (2-sided)
			absent	moderate	high			
	limit	Count	24	2	5	2.975	6	.812
	light	Count	25	2	8			
	moderate	Count	27	3	7			
	high	Count	19	0	7			

o *Analysing Table no. 2 we notice significant differences between*

deinstitutionalized people as for affective isolation according to the suicidal risk. The significance threshold is p>0.05.

o Possible explanations for these results would be that suicide is first of all a desperate act of a person who doesn't want to live anymore. But, in reality, these people are still attached to life the moment they commit suicide, the suicidal act being an abandonment. A person's puropose may be: avoiding an unacceptable situation, having a self-agressive behaviour or calling for help or having a desperate message addressed to a hostile or indiferent entourage. The answer to all these events in the life of deinstitutionalized people is rather lack of hope or despair than suicide, life being the most precious asset they have even if they feel neglected, permanently humiliated, manipulated and disadvantaged.

3. CONCLUSIONS

The integration of young people in the society and in the active life, as well as the optimum use of their potential are esential elements to reduce the risk of social exclusion and to achieve sustainable growth of any society. Young people who leave the child protection system are a social category with specific problems and difficulties; they represent a priority for the general system of health and welfare because they need immediate action.

After conducting this study we have reached the conclusion that deinstitutionalized people are different in terms of having the feeling of affective isolation according to their demonstrativity and the suicidal risk.

As for the demonstrativity, people showing high tendencies of demonstrativity participate in activities of moderate difficulty because of the shalowness which characterizes people with this dominant; on the other hand, poeple with light demonstrativity train in activities with a light degree of dificulty- they being driven only by thoughts which involve their person and the strong fantasies of power and success.

Deinstitutionalized people with a high degree of demonstrativity live the feeling of affective isolationfrom light to moderate, because they feel humiliated, manipulated, disadvantaged, distrustful, to a higher form because they feelabuse and continuous rejection.

The present paper aimed to identify, clasify and make psychological personality profiles in the case of deinstitutionalized people. Through the information we got, we intend to elaborate intervention programs that target social networking and their social and professional reintegration. These intervention programs imply the existence of specialized services to help them find a job according to their abilities and to become responsible in engaging in a romantic relationship, in keeping a job or renting a house.

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FRUSTRATION TOLERANCE AND THE DEGREE OF NEUROTICISM OF DEINSTITUTIONALIZED INDIVIDUALS

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Abstract: *Being tolerant to frustration is a solution increasingly promoted in the literature, as a prefferential method to deal with the emotional and behavioral reactions. Frustration tolerance implies that frustration is already part of the system.*

It is obvious that life in institution gives birth to some frustrations at the level of individual personality of the deinstitutionalized young man; these frustrations will rise deep suffering as a result of the family separation and can also degenerate in neuroticism, deviant or anti-social behaviors. In fact, the core of frustration is in the constellation of psychological factors which turned a negative emotion of low or medium intensity into a high negative emotion which unbalances the psyche through a high power of cognitive, emotional and affective energy.

The number of children who live in institutions until de age of 18 is about 4500 a year, at a national count. Only some of them , especially those with disorders get into adult institutions. The others have no other institutional alternative because they don't have families or relatives.

The general purpose of this study is to identify, clasify and make some psychological personality profiles in the case of deinstitutionalized people in order to establish possibilities for their professional, social and cultural integration through social politics.

Young people who leave the child protection system represent a social category with specific problems and difficulties, being a priority for the general system of heath and welfare in Romania and it requires an immediate intervention.

Keywords: *frustration tolerance, deinstitutionalization, neuroticism, implication in activities, young people.*

1. INTRODUCTION

Frustration is a negative affective state which appears when the individual finds an obstacle in his way which stops him from satisfying one of his needs.

Frustation is one's condition expressed in specific feelings and behaviours, it is caused by invincible objective goals occuring while achieving a goal or solving a problem.

Frustration is in fact the affective experience of failure, perceived in a more dramatic and intense way.

T. Rudica (1981)- underlines that being conscious of a state of deprivation which will create emotional tensions or the need to free from a situation are signs of frustration. Moreover there are times when the subject cannot associate frustration to a certain cause.

Frustration may also appear unmotivated or not sufficiently motivated from an objective point of view. It is specific to persons who interpret reality constrained by selfishness, by their inability to detach from their own emotions and egotic tendencies, which make them believe they have only rights and no duties. This category of persons show *low tolerance to frustration*, because of their egotism, their selfishness, and in order to satisfy their needs they may resort even to illegal attemps.

Because frustration is expressed in a high negative affective tension, the individual may show a disorganized behaviour- anarchic and deviant.

Not every obstacle has a frustrating effect on the child. It was observed the daily work of preschool children in different situations (at home, at the nursery, on the playground) and noticed that although children have encountered different obstacles in the playground activities (restrictions, loss of toys etc), most of the obstacles don't cause the child a problem- i.e it has no frustrating effect.

We may say that, frustration is caused by subjective factors, dependent on the previous experiences the individual had and by his personality.

A notable example in this way is given by Mussen (1961)- a parent's leaving home may cause a big frustration to a child who is highly dependent on this parent; whereas his playmate's superiority and his violent tendency to dominate the playground don't botter him because he is rather passive and withdrawn in the game.

Another child who experiences a low depedence on his parent, may not be so affected by his parent leaving home but he should be more affected by a dominant partner in the playground- which can be a strong frustrating factor.

Thus, some children bear more, other bear less frustration, but this does not change the fact that frustration arouses anger which leads to an agressive behaviour.

Yarrow (1948 – as cited Cicchetti, D., 2003) confirms this statement in an experiment involving 60 preschool children.

In the first stage, children were allowed to play freely for 30 minutes and they could be observed by the experimenters through a semi-transparent mirror in order to notice any agressive behaviour: hitting with the hand, the foot, threats, injuries etc.

After this stage, children were divided intor 3 groups:

Children from the first group were given tasks they couldn't do- they were frustrated.

Children from the second group were obliged to play with the same toy for 20 minutes because the experimenters assumed that excessive playing leads to a certain state of frustration.

The control group didn't do any of the above mentioned.

Finally, the three groups were invited to play freely back again for 30 minutes and the experimenters noted children's agressive behaviour. In this case, the agressive effect of frustration was confirmed in the case of children from the first two groups. These children manifested more agressive reactions than those from the control group.

1.1. Frustration- agression theory

Frustration- agression theory was one of the most influent in this field. It was proposed by a group of psychologists from Yale University – Dollard, Doob, Miller, Mowrer şi

Sears – 1939. This theory appeared as a reaction to the freudian theory.

Thus, the theory states that any agression leads to frustration and any agressive behaviour is based on frustration. After the war, many psychologists have shown that agression can be determined by other factors, not only by frustration.

In fact, immediately after the publication of this book, there were many critics which emphasized the fact that frustration doesn't always lead to agression, there are other possible reactions such as apathy, the cry of helpnessness etc.

2. METHODOLOGY OF RESEARCH

2.1. Hypothesis:

There are significant differencies in terms of working (absence, working under a contract or on a daily basis) in the case of deinstitutionalised people according to the major issues such as: neuroticism and their frustration tolerance.

2.1.1. Variables

Independent variables – involving in the work environment;

Dependent variables

- neuroticism - a1- absent;
  - a2 - moderate;
  - a3 - high.
- frustration tolerance - c1- absent;
  - c2 - moderate ;
  - c3 - high.

2.1.2. Design

Experimental design: unifactorial inter-group

2.2. Method

2.2.1. Subjects

In order to test the hypothesis and achieve the objectives, the comparative study was conducted on a total of 129 deinstitutionalized people. The group was heterogeneous in terms of employment, gender, background and level of education and included people from both rural and urban areas, people without education or secondary education and people having different characteristics. The subjects are between 18 and 37 years old.

The subjects included in the study were chosen thanks to data provided by ASCO.

All the subjects were involved voluntarily in the clinical trial and in the objective evaluation made according to the two scales.

2.2.2. Materials

Wechsler Test – (D. Wechsler; WAIS- R, 1981)

Eysenck Personality Inventory (E.P.I.) (H. Eysenck, S.B.G. Eysenck, 1969).

2.3. Results and their interpretation

2.3.1. Hypothesis. Therea are significant differences in terms of deinstitutionalized persons' involvment in the work field according to their neuroticism and their frustration tolerance.

Table no. 1 Comparisons between the deinstitutionalized persons as for their implication in the work environment according to their neuroticism.

Implication in the work environment		Neuroticism					
		absent	moderate	high	Pearson Chi-square	df	Sig. (2-sided)
nowhere	Count	0	6	24	13.135	6	.041
	Adjusted Residual	-1.3	-1.5	1.6			
On a daily basis	Count	0	9	23			
	Adjusted Residual	-1.3	-.2	.8			
With a work contract	Count	3	12	14			
	Adjusted Residual	2.6	1.7	-2.5			

o *As for the neuroticism shown by deinstitutionalized persons, the results presented in Table no. 1 show that there are significant differences between the deinstitutionalized persons in their implication in the work environment accordind to this feature. The significance threshold is p<0.05.*

o According to these results, the deinstitutionalized persons who don't have a job or work on a daily basis, ocasionally, show a higher level of neuroticism to those who work legally, with a contract. These results can be explained by the fact that neuroticism is part of the deinstitutionalized persons' personality. This feature of personality is manifested through inability to establish positive relationships with others and the behavioral tendency to disrespect the social values and rules.

Table no. 2 Comparisons between the deinstitutionalized persons as for their implication in the work environment according to their frustration tolerance.

✓ *The results in Table no. 2 show that there are no significant differences as for the implication in the work environment in the case of deinstitutionalized persons according to their level of frustration tolerance. The significance threshold is p>0.05.*

✓ These results are explained by the fact

Implication in the work environment		Frustration tolerance			Pearson Chi-square	df	Sig. (2-sided)
		absent	moderate	high			
Nowhere	Count	0	6	25	6.988	4	.137
On a daily basis	Count	0	7	25			
With a work contract	Count	1	12	16			

that deinstitutionalized persons who don't work or simply work on a daily basis have a high level of frustration tolerance- i.e are less tolerant, this being a cause for their inability to enter the work environment, they can't adapt to the rules of an institution. This characterises most the young people who were raised in institutions and now they reject any form of obedience and conformation.

Frustration may also appear unmotivated or not sufficiently motivated from an objective point of view. It is specific to persons who interpret reality constrained by selfishness, by their inability to detach from their own emotions and egotic tendencies, which make them believe they have only rights and no duties. Because frustration is expressed in a high negative affective tension, the individual may show a disorganized behaviour- anarchic and deviant.

Because of the fact that children had a traumatising childhood in which they developed many frustrations, their refusal to enter the work environment is a desire to escape the conformism of institutionalized childhood.

3. CONCLUSIONS

The children who leave the child protection system represent a social category with specific problems and difficulties, being a priority for the general system of heath and welfare in Romania and it requires an immediate intervention.

As a result of this study, we concluded that deinstitutionalized persons who don't work tend to have health problems and experience solitude.

Neuroticism is a feature which manifests in the case of deinstitutionalized persons who don't work or simply work on a daily basis and it is determined by their inability to establish positive relationships with others and their tendency to disrespect the social rules and values.

Frustration tolerance determines significant differences between the deinstitutionalized childen – i.e those who aren't tolerant prefer moderate activities which imply average difficulty, showing self-protection abilities manifested only under coordination; on the other hand, deinstitutionalized persons having moderate frustration tolerance prefer light activities, the results showing that frustration may also appear unmotivated or insufficiently motivated from an objective point of view.

Consequently, we can say that deinstitutionalized persons who have problems in involving in the work environment show high scores of neuroticism and sometimes their frustration tolerance is rather low.

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SCHOOL COUNSELLOR'S PROBLEMS AND DIFFICULTIES IN ROMANIA

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Abstract: *This paper proposes a summarized analysis of problems and difficulties faced by the Romanian school counsellor. The reference frame is offered by a work sheet obtained from a County Centre of Psychopedagogical Resources and Assistance. The basic idea of this paper is to underline the need of change of the school counsellor's work vision, if the specific of his activity is not very well understood then it is not supposed that he should be offered other activities not connected to his specialty. Essential aspects of Romanian education psychology have been introduced, thus we expect positive consequences in the educational domain*

Keywords: *school counsellor, psychopedagogical counselling, initial and continuous development.*

1. INTRODUCTION

The school counsellor is the education specialist that plans and develops activities of educational counselling, at an individual level and at a group level, so that the pupil can adapt to school environment problems, he implements career educational programs, organizes extra-curricular programs of vocational orientation and promotes health educational programs.

The activities of psychopedagogical counselling are realized by school counsellors in school offices, career orientation offices and in the classroom, in a controlled and secured environment.

An occupational analysis for the occupational are School Counsellor is found in RWC 2359 (Romania Work Code)**.** [1]

The school counsellor received numerous activities, facing different problems and difficulties. Thus we will present a synthesis of the school counsellor's activities, according to the Efficiency and Organization Regulation of the County Centre of Psychopedagogical Assistance and of practice offices and according to the Order no. 5418/08.11.2005 of the Ministry of Education, Research and Youth [2], from a Romanian county centre:

1. He ensures the pupils, parents and teachers' informing and counselling on different subjects:

- Knowledge and self-knowledge;
- Pupils' adaptation to school environment;
- The school adaptation to pupils' needs ;
- The optimisation of school-pupils-parents relations.

2. He organizes and promotes the activity of school counselling.

3. He elaborates and organizes programs, projects and activities of prevention and diminishing of factors that determine behaviour disorders, risk behaviours or psychic discomfort through specific methods, procedures and techniques:

- The development of healthy behaviours;

- The prevention of drug consumption and traffic of human beings;
- The prevention of ITS/HIV/AIDS
- The prevention of violence, aggressiveness and deviant/delinquent.

4. He ensures the pupil's psychological examination (realized only by psychologists, according to their authorization received from the Romanian Psychologists College and to their licences obtained in professional tests existent in his office) at his demand, or at the parents, the school management of school inspectorates demands, in the following situations:

- In cases of school failure;
- In cases of school abandon;
- In the case of pupils with disharmony personality structures;
- In cases of conflicts;
- In case of demands from Child Protection, for the offering of social or medical help;
- In the case of psychopedagogical studies demanded by the County Centre of Psychopedagogical Assistance (C.C.P.A.), the Institute of Educational Sciences (I.E.S.) and the County School Inspectorate (C.S.I.)

5. He realizes a specialized intervention for children/pupils with SEN (special educational needs), characterized with emotional disorders, psychosomatic disorders, physical deficiencies, gifted children and he offers psychopedagogical assistance to pupils with special needs.

6. He proposes and organizes programs, projects and activities of information, counselling, school and professional orientation for pupils found in schools in collaboration with education counsellors and other representatives of local community (CEA, NGO-s, associations, economic agents etc.).

7. He ensures counselling services and courses for parents and supports the teachers' methodical activity (educators, primary school teachers, teachers and class masters) and sustains professional development courses for them.

8. He elaborates psycho-social studies regarding the pupils' school options in terminal classes, aiming for professional qualifications through professional and high school education and the types of schools inserted in the network and other important themes.

9. He elaborates and fills in registration and evidence documents of his school counselling activity.

10. He ensures quality and efficiency for the activity specific for his office.

11. He participates in activities of formation and professional development and intensive promotion of the formation offer of CJRAE/ CJAP.

2. THE SCHOOL COUNSELLOR'S PROBLEMS AND DIFFICULTIES

A fast analysis of the counsellor's activities (12) shows that the twelve months of a year are not to fulfil all his tasks. Each category of activities, from a reality point of view, demands time and he can not always fulfil the quality criteria proposed. The greatest problems is represented by the huge number of pupils "assigned" to one school counsellor (he can treat to 800 pupils). The proof for fulfilling his activities is represented by documents files archived by the school counsellor. The profession of school counsellor is a noble one, but he can rapidly reach a moral and professional wear if he renounces quality in favour of quantity. I consider that all activities proposed are necessary, but each counsellor must have the possibility to work with a small number of pupils and with fewer classes ascribed. The professional activity is not efficiently fulfilled if the time allocated for his personal formation and development is limited. For this reason, programs of professional formation are recommended to be centred on formation needs and to be realized inside the respective school.

Psychopedagogical counselling, similarly to educational counselling, is realized in schools and demands a high formation and preparation of the school counsellor. The problems that appear are frequently from the category of psychological counselling, but when counsellors verify documents regarding the person in counselling, they lose track of the problem content.

Filling in documents represents the most time demanding activity, but from the control perspective it is the most important with an affirmative opening towards renouncing bureaucracy in the educational system.

The realization of psycho-sociology studies regarding career orientation supposes the school counsellor's ability in the domain of qualitative and quantitative research and reminds us that a qualitative research in the socio-human domain in Romania is still hard to realize. Even if these studies are realized, there are socio-economic factors that may determine the election of other options by pupils (according to the parents' financial possibilities), and these studies never reach their goal, in universities or high schools near the schools were they were realized. In the same manner, research modules are extremely rare in continuous professional development programs for school counsellors.

The organization for courses for parents and teachers supposes the formation of the school counsellor, he has to have authorization as trainer, mentor and socio-educational animator, but all these suppose years of practice and professional development (consuming time and money).

The activities of psychological counselling demand the school counsellor's professional development in this domain (at least four years in Romania), a course that is paid by the counsellor. It is possible that university masters cover at least the educational curricula and a part of the personal development in a certain form of psychological counselling. Thus, the school counsellor is exposed to a great risk of exhaust and he may bring prejudice to pupils/clients.

The activities developed by students with S.E.N. suppose special psychopedagogy studies or courses in the mentioned domain.

The activities of psychological examination (for 800 pupils) demand licence psychological tests, thus the acquisition of these tests by the school where he works. This is thus another problem, how much money can the school offer for the acquisition of psychological tests with a licence (on different periods of time) from suppliers authorized by the Psychologists College and to insure the counsellor professional development in order to be able to use these tests. If the school doesn't buy these tests then the school counsellor (with psychology studies if he uses these tests) has only the possibility to work with studies gained during his university studies (without a licence).

Child, teenager or young psychopedagogical counselling is realized by the school counsellor in psychopedagogical assistance offices in school, but also in private practice offices recognized by the Romanian Psychologists College, but only if these psychologists are authorized by the Educational Psychology, School Counselling and Vocational Orientation Commission.

Another problem is the absence of laws regarding the statute of school counsellors as psychopedagogical teacher, without the compulsory condition that they are recognized by the Psychologists College. Thus, this is where they arrive if they want to work on their own.

Programs of continuous professional development demanded by school counsellors are authorized by the ministry, in order to gain the necessary number of credits during a certain period of time, and less those authorized by the Psychologists College (which are used only by those who want to work on their own). In other words, the majority of continuous professional development programs authorized by the

ministry of education are free of charge (realized on European funding) and the programs authorized by the College are paid by the school counsellors, thus results reduced motivation for these programs. A reconsideration of the normative frame of this subject is imposed.

3. CONCLUSIONS AND PROPOSALS

For an improvement and an efficiency of the school counsellor's activities the rethinking of the work sheets from counselling centres and offices is demanded. The nucleus of the school counsellor's activities is represented by psychopedagogical counselling and pupils' school and vocational orientation, from which all other activities derive.

Initial education received during university studies as psychologist, can not enable the future school counsellor. Thus the rethinking of master programs in educational psychology is also necessary.

The school counsellor's working instruments (especially psychological tests) are hard to acquire from financial reasons. For this reason, the methodology commissions of the Psychologists College and authorized suppliers for the creation of these tests should establish partnership relations with university with master programs in educational psychology. When the psychologists intents to follow a master in education psychology he should also receive a few licence test, and the study fee should also cover these tests.

Psychopedagogical counselling is a part, in most cases, of psychology counselling and my proposal is that professional development programs for school counsellors to approach aspects of psychological counselling and some university master programs to cover the basic education and professional development in psychological counselling. This king of master programs will be recognized only by the Ministry of education, but also by an authorization received from the Educational Psychology, School Counselling and Vocational Orientation Commission and from the Commission of Clinical Psychology and Psychotherapy of the Romanian Psychologists College. The connection between universities through education and the enabling of future specialists in educational counselling (in general) and school (with its problems) will become tighter. Most criticism addressed university refers to the fact that the curricular programs offered are not the most appropriate for students to face reality.

Another proposal is to realize a normative frame for the school counsellor's compatibility situation between its statute as teacher and as psychologist authorized by the College. As long as competency recognition from the College is optional, there is no motivation for a participation in professional development programs offered by the College.

County centres of psychopedagogical assistance, in partnership with universities and centres from schools are recommended to organize meetings for professional supervision and a professional intervision. The concept of professional supervision for most school counsellors (especially those without an authorization from the College and which are not obliged by the law to acquire an authorization, because they are considered teachers) has no well established meaning, because, even those found in professional supervision, being recognized by the College, have not benefited from weekly or monthly meetings with their supervisors. A reconsideration of the manner in which the Romanian Psychologists College offers the right to professional supervision to experienced psychologists (which are not bored by their work in education and which take in consideration only the monthly fee) is required.

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CHILD AND TEENAGER PSYCHOPEDAGOGICAL COUNSELLING. LEARNING COMPETENCY

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Abstract: *Child and teenager psychopedagogical counselling is represented by an ensemble of activities described in the school counsellor's personal working sheet. In my personal opinion, psychopedagogical counselling is centred on developing a learning competency (to learn about ones self and about the others, the final result being social adaptation).*

Keywords: *psychopedagogical counselling, educational counselling, school counsellor.*

1. INTRODUCTION

Counselling in all its forms has its own development path in a theoretical and in a practical plan, gaining its own identity. Psychological counselling is the most common counselling form and it is delimited from psychology; for example, an analysis of the professional development suppliers of the Romanian Psychologists College (C.O.P.S.I.) shows that more professional associations of professional development in psychotherapy have accredited programs for psychological counselling, with a minimum duration of 4 years, programs which are different from a formation in psychology. In Europe, a professional development in psychological counselling may last from a few months to a few years.

The concept of *counselling* includes different forms as: psychological counselling, educational counselling, pastoral counselling etc. Counselling is often described as being "spoken therapy" by which the counsellor offers clients time and space to explore their problems, insuring the client of his confidentiality. [5]

Differences between psychological counselling and other forms of counselling have been presented by Culley and Bond (2004) [2], according to the following criteria: therapist, therapist professional development, client and its variables, working place etc.The definition of counselling is difficult to realize due to the numerous activities it includes, the most representative activities for counselling being the following [4]:

- the specific communication form based on a contract;
- the help offered without judging the client;
- the creation of a relation in which a person helps another one;
- the offering of support to people in order to solve their problems;
- the client's reconsidering as a unique person etc.

Educational counselling represents the process of orientation-learning with an accessibility for educational subjects (pupils, students, adults who are learning) and for their educational partners (parents, teachers, employers), to improve their abilities with the most efficient educational methods, techniques and problem solving procedures [6].

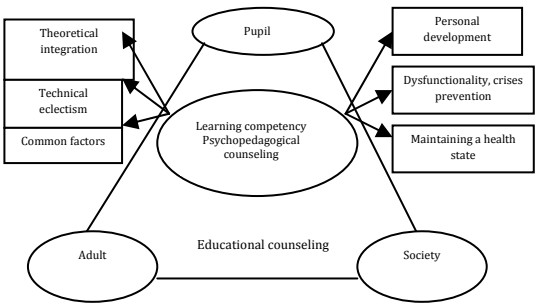
At the level of a common perception, through education counselling we understand the help a subject – pupil – receives from an authorized person in order to maintain health, to enter a

personal development plan, to learn how to face problematic situations and to avoid what could harm him. After a general analysis we can observe that educational counselling is not over for that pupil (young person) when studies are finished. The ending of his studies allows the observation of an eventual ending for his formal education, and for mot people, it may represent the development of a permanent educational content. Each person brings, more or less, his contribution to the development of the society he lives in by his own competencies [3].

The individual is not the only one involved in the learning process. The society is also a part of this process. Thus the need for educational counselling doesn't belong only to the individual who is learning, the need for educational counselling also exist at the society level, being represented by its form of social educational counselling. Social educational counselling may represent the attribute of social pedagogy.

In a more general belief, the clients of educational counselling are: the child, the adult and the society; in a more restricted belief, psychopedagogical counselling is represented by educational counselling that has as clients: the child, the teenager and the young. Thus, psychopedagogical counselling is the initial form of counselling practices until individual becomes of age.Learning is the basic activity of human kind and the competency to learn is indispensable to humans and to our society. From this perspective, educational counselling represents a basic step in the formation, cultivation and practicing of the learning competency, not only for the pupil in the classical acknowledgment, but also for the social adult (adults' educational counselling, social educational counselling). See Fig. 1

Fig. 1 - Graphic representation of psychopedagogical and educational. Drobot, 2009



2. PSYCHOPEDAGOGICAL COUNSELING AND THE LEARNING COMPENCY

Learning, as a basic human activity has its proper adaptative purpose. The learning product is represented by an "ensemble of (intellectual and psycho-motor) habits, cognitive strategies, information strategies, logical strategies (notions, judgments, reasoning, principles, laws) and cognitive attitudes objected in specific studies, usually included in (pre)school programs and (post)university programs [1].

The learning process is influences by internal and external factors. Learning internal factors have a biological nature (age, sex, mental development, health) and a psychological nature (intellectual development, life style, cognitive capacity, affective attitude and motivational attitude). The learning external factors refer to: a formal and curricular organization (curriculum design), the methodology of teaching-learning-evaluation, these being also mentioned in specific pedagogical documents. In the same category of external learning factors we may also include the direct and indirect action of socio-cultural environments (family, cultural institutions, political institutions, economic agents, representatives of the national educational community, of the territorial community and of the local one). Being an activity, learning is also specific to the subject (client) in counselling or therapy. The client learns, being guided by his counsellor-therapist, so that he will be able to solve or ameliorate his problems and to eliminate the difficulties discovered in front of the fulfilling of his objectives. In other words, learning through counselling or therapy, the client (child or adult) is able to form, develop and exercise his competencies [3].

This competency represents the capacity to truly face situations, to fulfil the tasks received, being an ensemble of dispositions. Personality is connected to knowledge with the help of these competencies and through learning the individual develops his personality and learns more things that will be used during his lifetime.

Nowadays kindergartens and schools, by trying to solve more and more new appeared problems, have alienated from one of their essential roles "learning how to learn". Without "learning how to learn" the child finds it difficult to learn using the competency "to learn how to be in order to learn how to become".

Educational counselling used on a child during the effort of "learning how to learn" competency formation and development represents a great challenge for the education specialist. In order to make the discussion easier we will use the abbreviation *learning competency* instead of the "learning how to learn" competency. In reaching his objectives of the intervention plan, the educational counsellor (school psychologist) will keep in mind the learning competency of his client,

but also of the client's parents and family. The educational demarche will be a strategic one, but a clear map will be difficult to conceive. Methodological landmarks may be offered, by keeping in mind the principles of counselling and therapy. The counsellor won't sele4ct the intervention techniques and methods randomly, before all, it is necessary that he respects the principles of functional flexibility, thus he will work with those techniques and methods that sustain and help the client's need satisfaction [3].

The most useful landmarks of the educational counsellor's activity in parents counselling for the formation, cultivation and exercise of the learning competency, are the following:

- parents are the first "assistants", "facilitators" in the child's development, this assertion being sustained by numerous attachment and cognitive theories;
- the realization of a task by a child may be determined by an adult, by more than one method. The simulation method is the most efficient and the one that corresponds at that moment to the child's reality, leading to the demand that the adult, especially the educator, to apply interactive methods in the child's development and education;
- in order to be sensed and understood by children, parents-adults must be flexible in selecting communication frame; they will be adults, parents and even children while talking. The child becomes a responsible adult only because the parent desires it to, with the recommendation that parents shouldn't avoid parents classes and "parents schools;
- the child's "wisdom" is represented by games, through games the child develops his personality and discovers new channels of communication with adults, through games, the counsellor may enter the child's interior world;
- tails, stories, heroes, legends and metaphors represents access paths and come back paths from the child's world and the actual reality;
- parents play according to the children's rules and, when necessary, they will commute from the main director role to the assistant director role and vice versa;
- the child doesn't communicate only through words, by also through his body, through drawings, actions, crying, looks and senses, the main communication channel being the affection one;
- you can reach a child by passing through the his imaginary world door; the educational counsellor offers parents only the key chain needed for that door;
- most often, the parents' interpretations don't correspond to the child's interpretations, the child's world doesn't correspond to the adult's world, the events meanings offered by the child are frequently different from the adults' meanings.

3. CONCLUSIONS AND PROPOSALS

Child, teenager or young psychopedagogical counselling is realized by the school counsellor in offices of psychopedagogical assistance from schools and in private practice offices. Psychopedagogical counselling realized by educational psychologists in private practice offices of psychology is recognized by the Romanian Psychologists College, only if these psychologists have an authorization from the Commission of Educational Psychology, School Counselling and Vocational Orientation.

One of the greatest problems of the school counsellor is represented by the great number of pupils that need to be treated by only one specialist, a number that can reach even 800 pupils. Still it is important that every school has its school counsellor.

Programs of professional development needed by school counsellors are the one authorized by the ministry, in order to gain the necessary credits for a determined period of time, and less the programs of professional development offered by C.O.P.S.I. (these being necessary for counsellors who went on their one to college). In other words, the majority of professional development programs authorized by the ministry of education are free of

charge (realized with European funding) and the authorized programs of C.O.P.S.I. aren't free of cost, thus resulting a reduced motivation of school counsellors to get this college authorization. Thus a reconsideration of the normative frame is needed in this matter.

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SOCIAL – CULTURAL INTERPRETATIVE DIMENSIONS OF HEALTH AND ILLNESS

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Abstract: *The conclusions which can be important for research in psychosomatics are the ones obtained following an opened vision on the health issues which experience the interference of political, economic, moral and medical issue. The culturally "tailored" perceptions, the types of communication and the coping mechanisms of the patient are examined within the illness experience of the patient and of the family, but they are also understood by taking into consideration the possible effect on the practice of the clinician and researcher. Elisabeth Miller and Margaret Lock*[2] *researchers in Sociosomatics, which combines medicine and anthropology within the didactical and research activity, demonstrated in their studies the fact that the experience of the illness and its diagnosis are "socially constructed". From the sociosomatics and ethnographic point of view, the moral, political and medical landmarks are inseparable.*

Keywords: *anthropology, coping, communication, beliefs, prophylaxis*

It is well known that the individual perception on health and illness differ, "the cross –cultural variables making the difference between collectivism and individualism. The individual's mental representation of illness is highly influenced by the dominant medical models of their particular culture. The medical models known and investigated are: biomedical, Traditional Chinese, Ayurvedic".[3]

The beliefs on illness are derived from the social and cultural beliefs, known as "popular knowledge on illness". The patients have beliefs on illness corresponding to the dominant medical model of their particular culture. Most of the studies from the field of the cultural differences at the level of perceptions on illness focused on the causal contributions of health and illness.

The cultural differences which occur within the therapeutic goals and the variable in their cognitions and significances are also known. Within this contextual frame, we noticed the interferences occurring between the social – cultural interpretive dimensions of health and illness, so that their recognition, understanding and "translation" by an anthropologist would be beneficial in the prophylactic and curative medical activities.

Knowing the health "folklore", the cultural factors associated with the health and illness condition is important in order to find out the significances assigned by the patient to his pathology. Subsequently, knowing the information the patient acquires from family, friends and neighbours regarding the nature of a health issue is definitely a key to solve certain cases which sometimes seemed to have minimum chances of therapeutic success. Anthropology helps to decode the local culture

related to health and illness. In certain cases, illness is explained and associated with other personal experiences, its significances being negotiated in a manner in which it would comply both to the context and personal expectations, and to the social – cultural regulations shared at the community level. "In the description or interpretation of health and illness related events, the individual always uses a preset frame of values and attitudes, established in his particular culture and society. Starting from the simple description of symptoms and up to the evaluation of the consequences of illness, each nation is guided by the dominant speeches present in the context where the patient is positioned."[4]

The possibility of a proximity relationship with the patient and with his social – cultural environment, the interdisciplinary coordination and the course of his pathology, as well as the establishment of an efficient medical communication created the favourable background for the observation and study of these types of relationships by the family doctors. They are the most accessible individuals, called the "gatekeepers" of the system, they perform their activity in the same place where the patients live, being familiar to their social – cultural environment. The patient seeks information related to his personal illness and to its treatment from the individuals around him, this is why the knowledge of the local social – cultural specific character is so important in order to understand the significances of the illness attributed by the patient and to prevent the eventual mistakes in following the therapeutic, diet and life style recommendations.

In addition, most of the theories related to the adjustment to the illness converge on the fact that the manner in which people "see" their illness represents the basis for the following coping mechanisms Stanton and co. in Health Psychology: Psychological Adjustment to Chronic Disease, focusing on neoplasties, cardio – vascular and rheumatism diseases, conduct a review on the distal mechanisms constituted in social – economic, ethno – cultural variables and the gender – related and proximal variables: interpersonal relations, personality attributes, cognitive evaluations and coping processes studies as risk and protection factors to adjustment throughout time. Lazarus stress and coping theory (Lazarus & Folkman, 1984) represents the basis for most of the current researches on the mechanisms of adjustment to the illness.

The coping strategies are classified in two categories: of acceptance or pro-active and of avoidance; *of acceptance,* which includes seeking information and social support, solution of problems, actively attempting to identify benefits in his experience and creation of commodity markets for the emotional expression; *of avoidance,* contrasting with the first one, which involves cognitive strategies, as denial and suppression and behavioural strategies, as disengagement.

The other adjustment efforts, as the spiritual coping, can be useful for both strategies.

Mecanic (1978) presents a simple model of individual health – related decisions which suggest the individual reporting to the number and persistency of the symptoms, if they are easier to recognize or familiar, the possible debilitating aspects, to all being applicable our cultural and social definitions of the illness. "The beliefs of the patients in terms of the causes of the symptoms will directly influence their decisions about the medical treatment. These beliefs indirectly affect the manner in which the information and treatment suggested by the doctor will be received".[5]

Each of these aspects are encountered in practice, the multiple significances of the illness attributed by the patient and the coping mechanisms he tends to use varying on a daily basis, which gives a particular character to the specialization. Thus, the necessity of the psychosomatic approach appears in a physiological manner. For a family doctor trained according to the classical curriculum it is more difficult to correctly and efficiently approach the "pathology" and the current expectations of the individuals requesting the medical services. We can also investigate the utility of a multidisciplinary team which could include: the doctor, psychologist, sociologist within "the qualified re-humanization of medical activities by involving other specialists from the humanistic sciences"[6] and optimization of the therapeutic process. Deciphering the psychosomatic particularities,

correctly using the instruments of the other specialists from the team would shorten the patient's road to healing. However, the most important desideratum would be the primary prophylaxis – equally achieved in the spirit of a proper knowledge of the local social – cultural specific character and also through a psychosomatic approach of the patients. The improvement of the communication competences and techniques is part of an efficient bio – psycho-social approach of the patient, with important application in the family medicine.

Traditionalism vs. modernism, social structuring, fulfilment and social positions in the community, representation of the important social actors, knowing the unwritten law, all allow deciphering the factors which can influence the medical act by recognizing their importance within the holistic medicine. The late visit to the doctor, the prophylactic attitude, the attitude towards the disease, the adherence to the treatment – can be better deciphered and extracted from the cultural pattern following their "translation" by the anthropologist. The structure of the patients from a list of a family doctor is heterogeneous and subsequently the doctor has to hold anthropological information.

All the cultures have belief systems in terms of health, in order to explain the causes of the disease, how it can be healed or treated. The modernists, present especially in the urban area and to a lesser extent in the rural environment, attribute to the disease a scientific cause and require state of the art diagnosis and therapy methods. The traditionalist patients, belonging to the rural areas – in Romania, the percentage of the rural amounting to almost 70% of the population – can attribute to the disease supernatural causes, invoking religious rigors (i.e., the food Lent) at the diet or prophylactic recommendations of the doctor, factors which directly affect the therapeutic compliance.

In the conservatory, traditionalist societies, it is important to know the composition of the entire enlarged family and the family "head", who is frequently "the one who talks". The family elders are observed, their authority being frequently questioned. Usually, a key member of the family is consulted in the important health cases. The family interests and honour are more important than the ones of the individual family members, subsequently the genetically transmitted diseases (i.e., epilepsy) are refused to be diagnosed and treated, in order to be "hidden", with the motivation not do diminish the chances to marriage of the other family members (especially of the girls within the family, potentially carriers of genes with pathology).

Up to present, the classical approach predominates. In Romania, the psychosomatic approach is in the tendency stage. The anthropologisation of medicine is also developing within the anthropologisation process of social and humanistic sciences. The structure of patients from a doctor's lists is heterogeneous from the point of view of their particular cultures and subsequently the doctor has to hold anthropological information.

"Medical anthropology studies the indigene or "folk" beliefs on health and illness in various cultures; it studies the ideas and behaviours of health practitioners in various cultural spaces. In certain cases, the medical anthropology even assumed the role and mission to reveal, through a sort of an ethno – epistemology, the ideological presumptions underlying the biomedical model (A.Young 1993). For instance, the approach of the symptom as subject of anthropology was

possible exactly because the biomedicine neglected the social and cultural dimensions of illness. Within this context, the medical anthropology developed a special strategy expressly to include this discursive dimension and to interpret it. The purpose is to understand the illness and its expressions (symptoms) as symbolical constructions which do not exclusively make reference to biological disorders, but also to a local world of significances and experiences. In this case, the task of the anthropology is to open towards the cultural, social and political dimensions where the individuals displaying the symptoms live, as well as understanding and interpreting these dimensions".[7] In this field there are medical anthropology studies based on evidenced – MBD.

The anthropologist helps to decipher the culture, he is the one who has the data necessary to identify and eliminate the cultural factors disturbing the adequate performance of the medical process. The late visit to the doctor, the prophylactic attitude, the attitude towards the disease, the adherence to the treatment – can be better deciphered and extracted from the cultural pattern following their "translation" by the anthropologist. The multicultural structure of the patients is a continuous challenge. All cultures have systems of beliefs in terms of health, in order to explain the cause of the disease, how it can be healed or treated.

The social – cultural interpretative dimensions of health and illness, with the results of the medical activity, varies according to the progress of health or illness stages.

The integrative approach of healthy or sick individual has a conclusion in practice, in the following manner: the improvement of quality of medical act, the implicit increase of satisfaction degree of patients within the concept of patient –focused medical communication – PFC, all these being obtained with reduced medical costs for the sanitary system.

The modern concept of "PATIENT – FOCUSED COMMUNICATION – PFC" is widely approved as a high quality central component of health services (Committee on Quality of Health Care in America, 2001) "Stewart (2001) described the PFC as a holistic concept whose components interact and uniquely reunite within every doctor – patient meeting."[8] PFC includes four communication fields: patient perspective, psychosocial context, joint understanding and change of power and responsibility.

Using the multiple regression analysis, the authors D'Angelo şi Dimatteo demonstrate (page 80) the fact that "only three variables were predictive for the satisfaction degree of overall patients, and these were: the affective behaviour of family doctor, discussion about the psychosocial subjects and references to other medical specializations. This later element had a negative impact on the satisfaction of patients. Another negative element is represented by the occurrence of a significant discrepancy between the various expectations within the doctor – patient meeting. In particular, there is a discrepancy when the patient's expectations are highly discrepant correlated to the lack of existence of an efficient treatment. Examples are the chronic patients, especially oncology patients. In terms of "care and cure" concept, it is known that most of the times there is a "care deficiency in providing efficient psychological and social interventions". (Marian Pitts, Keith Phillips1998, pages 80-82).

However, the most important desideratum would be the primary prophylaxis – equally achieved in the spirit of a proper knowledge of the local social – cultural specific character and also through a psychosomatic approach of the patients.

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MIGRATION AND VARIABLES IN THE REMITTANCE BEHAVIOUR AMONG THE SERBIAN VLACH MIGRANTS - A KEY TO IDENTITY DYNAMICS

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Abstract: *The paper collects some reflections, as a result to preliminary field studies, representing a part of a larger research; it points out some hypothesis, focusing on the remittance motives and typical remittance behavior of a specific group of Serbian citizens working for generations in Western-European countries: the Romanian-speaking population from Eastern Serbia (a.k.a. Vlachs). The socially-motivated prestige-quest of this group seems to cause a specific and apparently paradoxical remittance behavior: the remittances are invested in luxurious oversized houses and agriculture machines in their more and more depopulated villages back home, that seem to be a symbolical lieu d'appartenance. The purposes of the extended research are: to explore to what extent the quest for local prestige and the need of consolidating a sense of "acceptable" identity is a variable significantly influencing the remittances behavior of the Vlach communities; to prove the intention of return of an important number of migrants, to forecast some future social, cultural and economical directions of the group, as well as to highlight the potential of the remittances in contributing to a long-term local development.*

Key words: *migration, remittances, identity dynamics*

1.DEFINITION OF TERMS AND THEORETICAL APPROACHES

Broadly defined, remittances are the money migrants earn abroad that are sent back home. They represent a private flow of capital from the country of employment to the country of origin. In this paper we will refer to *workers remittances* that are the value of monetary transfers sent or invested back home from workers abroad for more than one year. The circumstances and characteristics of migration may influence remittance behaviors in a number of ways, including the motivations for migrating, intentions to return to the country of origin, the duration of time since immigration and the number of emigrants leaving the source household.

Recent surveys on the complex phenomenon of international migrant remittances are leading to the following conclusions: international migrant remittances are a very important source of capital for developing countries; they surpass official development assistance and capital market flows. Moreover, remittances represent a very *stable* source of capital: in opposition to foreign investments that fell significantly in the last years, due to the recession, international migrant remittances continued to grow. Who transfers, why, how much, what are the economic consequences of remittances for developing countries and for the communities? The context in which remittances in our study case take place is that of a developing country, characterized by inequality and income volatility. Since

remittances have an effect on each of these dimensions, their overall economic impact is likely to be quite large.

At a macro level, it is not always possible to test appropriately for the macroeconomic impact of remittances because of poor data quality. At a micro level, it is extremely difficult to discriminate between competing theories of remittances, truly discriminative tests have to rely on additional variables for which details are not always available (Rapoport and Docquier 2000). This is where qualitative research can provide useful data and subtle insights.

Some scholars argue that a meaningful way to assess the economic role of remittances is to rely on household surveys and estimate the proportion of households for which remittances are an important source of income. Such surveys tend to show that remittances are often a crucial element of survival and livelihood strategies for many - typically rural- poor households (Rodriguez 1996; Cox, Eser and Jimenez 1998). The long run implications of remittances seem to be quite significant, as they have an influence on households' decisions in terms of labor supply, investment, education, migration, occupational choice, etc., with potentially important aggregated effects upon communities, at a bigger level.

According to various remittance theories, remittance behaviors are consistent with altruistic, exchange, and/or investment motives. There is rarely only one motive involved : for example, Cox, Eser and Jimenez (1998) or Feinerman and Seiler (2002) combine altruism and exchange, Foster and Rosenzweig (2001) combine altruism and mutual insurance, and Docquier and Rapoport (2000) combine altruism and the strategic motive. These approaches, as well as the results of empirical studies, lead to the conclusion that a mixture of specific individualistic and familial motives explains the likelihood and size of remittances.

May remittance behavior be predicted by the migrants' characteristics, or is there something beyond that, justifying a separated treatment? Funkhouser's (1995) study remains exemplary, stating that migration and remittance decisions, although interdependent, are generally influenced by different sets of determinants. These "behavioral differences" link directly to different motivations to remit. At a theoretical level, we have on one hand, a variety of motives that are not exclusive one of the other, and, at the empirical level, difficulties inherent to the implementation of truly discriminative tests and researches.

Obviously the remittances are not driven by a single motive. A combination of different motives applies, with the exact mixture varying over times and places, and discriminative tests are not always available. Were they not so, it would still be quite presumptuous to infer from the results that a particular motive is dominant in explaining remittance behavior. Methodologically, my study will favor the qualitative approach, because a repetitive pattern among the Serbian Vlach population, observed by successive field researches, along generations of migrants, might lead to more accurate conclusions.

In terms of remittance motives, this paper will concentrate on the *prestige-seeking* as a main motive of remitting. Status-seeking economic behavior has been seriously studied, but little economical and even sociological literature was dedicated to social status and prestige as a main reason of migrants to remit, although the anthropological field of research is abundant in "proof". The main literature reference is Schierup and Ålund's in-depth research in the 80's and the 90's, among Vlach migrants in Scandinavian societies (Schierup and Ålund 1987, 1996). Prestige as a reason to remit and as a variable shaping the remittance behavior is also revealed in a study by Naiditch and Vranceanu (2009).[1] They highlight the importance of the usage of

[1] The paper first highlights prestige seeking as a major remittance motive, but then it focuses on „strategic remittances", comparisons between "successful and unsuccessful" migrants and the subsequent games of appearances in their home communities.

remittances in acquiring, building, consolidating and changing social status.

Most of the Serbs remittances are invested in real estate or agricultural production. For many households in Serbia, the remittances are an important and stable source of income. Branko Hinic (National Bank of Serbia) emphasized that of the approximately four million persons of Serbian origin living abroad, those with commercial or family ties send money back to their country of origin and remittances are the most stable and independent source of funds. Beatrice Meyer, Country Director of the Swiss State Secretariat for Economic Affairs (SECO), spoke in a conference about the Swiss-Serbian remittances corridor; according to a study - based on interviews with 343 households in two rural areas of Serbia, 600 interviews with Serbian households in Switzerland plus interviews with key individuals in the banking sector, financial institutions, government, diaspora and focus groups, and with specific companies in Switzerland and Belgrade - 75% of the Serbian households interviewed in Switzerland sent money or goods to their relatives in Serbia in the twelve months before the interview. These opinions show clearly the relevance and potential of remittances for Serbia and for the Serbian society as a whole.

2. SERBIAN VLACH MIGRANTS – A PARADOXICAL REMITTANCE BEHAVIOR

The studied region (Eastern Serbia) is a rural and highly conservative one, but its inhabitants have been very mobile for the last fifty years. After the Second World War, large waves of people from the rural areas started migrating to the industrialized regions. After this "first wave" of internal migration, the workers, due to the favorable conjuncture of the international labor market, became part of a second move of migration abroad (Sorescu-Marinkovic, 2007). Official emigration from socialist Yugoslavia began in 1965, after the government launched a radically liberal reform of the country's economy, continued in the 80's (when the Yugoslav economy had entered a phase of severe crisis) and, in the beginning of the 1990s, political, economic and social collapse of the former Yugoslavia resulted in the exodus of a substantial number of persons (Kogan, 2003).

By 1973, the number of Yugoslav citizens in European and overseas countries had already grown from a few thousand to almost one and a half million (Schierup and Ålund 1987, Vesić 1978). As far as the percentage of Vlach workers from abroad is concerned, studies show contradictory figures, but some researchers state that the percent of Vlachs working abroad was about four times bigger than that of Serbs (see Sorescu-Marinkovic,).

The concrete processes of migration among individual groups have varied greatly in relation to socio-professional, cultural and historical factors. With our target-group, the Romanian-speaking Vlachs from eastern Serbia, this mass migration of workers had the fewest traits of emigration – partly because of the considerable investments into the property, household and economy (Marijanović 1981), partly because of the regular return home, at certain, well established dates, most often linked to ceremonial events.

As literature and field researches show, the Vlachs are involved, for several decades now, in massive migrations to western countries. The remittances are invested back home in huge households and agriculture machines.

Even in the absence of development policies, these remittances should have a significant influence on local entrepreneurship and revive the life of the rural areas back home. But our preliminary field observations *(*2007-2010) showed an apparent *paradox*: more and more migrants are still staying abroad, local population decreases, but the remittances continue to be abundantly invested in impressive houses, properties and agriculture machines. Thus, the immediate sense of the use of remittances is unclear.

A closer historical look to the process shows that, at the beginning of the migrations period, in the typical Vlach household, consisting of three, up to four successive generations, the elderly would care for youngsters and children while the parental generation left to work in western countries. At first, the main motive for migration was achieving, as soon as possible, a better material situation (and, subsequently, increase of the relative social status). But when the most immediate needs had been covered, remittances from abroad started to be used to buy land, houses, dowries, etc. (Schierup, 1973). This rapidly led to a huge increase in the needs of the average household, inducing more people to migrate abroad; dowries rose, ceremonies became ostentatious and spectacular, exceeding the resources of those households who had no foreign remittances (Schierup and Ålund, 1987); prices of land grew and, with them, the norm as to what was considered a "decent" household evolved to unexpectedly high levels. Huge, sometimes opulent, 2-3 storey villas and mansions took the place of once humble peasant cottages. Nowadays, in many migrants' villages, the small traditional houses are seldom to be seen. They represent a rarity soon to be extinct, an anomaly in the context of a totally reshaped architectural landscape. Similarly to many migrants villages in Romania, the family still uses only two or three rooms; many of them are empty or populated by a few old people, with the rest of the family absent in Western Europe most of the year and over the years.

Some social and cultural characteristics of the Serbian Vlachs are revealed by literature and by previous anthropological research. Their actions pursuing prestige are due to many factors: a critical level of self-esteem as an ethnic group with ambiguous denominations and object to political conflicts and claims, the lack of ethnical minority rights, the perpetuation of a rural society with oral language, the low level of education and the lack of elites. The Vlachs haven't taken part in the process of urbanization in Serbia and have until recently resisted the school education of their children, thus having no crystallized elites.(The first optional Romanian language classes were implemented in 2013 in a few schools from Eastern Serbia). Vlachs are seen, even today, as the most "rural" and one of the most "traditional" population groups in Serbia. Consequently, their main social structure and self-identification remained anchored in the structure and "traditional" values of the family. The poor educational level among migrants acted as an obstacle against integration in the host-countries, reinforcing family ties and consolidating eventual return as the most acceptable choice. Family values – important between migrants, also acted as a tie and a shield against what might have been perceived as a strange, hostile and cold milieu.

My hypothesis is that an important part of the migrants developed a *special remittance behavior***.** They are acting led by two distinct but simultaneous motives: the need to increase their financial level and *the need to establish and consolidate their sense of identity and local prestige, back home*. The migrants seem to be planning to return home by the age of retirement, with a better financial situation and a significantly increased status, due to the "proof" of their financial boost (huge decorated houses, modern agriculture machines). Furthermore, their prestige might be increased via their children; some of them are now studying abroad and might return home as successful businessmen, experts or even local investors.

Schierup and Ålund, in a study describing the formation of a Vlach immigrant ethnic community in Denmark and Sweden and discussing the reasons of obstinately

preserving the ethnic identity and traditional customs, found out that "for the vast majority of Vlachs – young and old – the primary point of identification remained the village or the local area of origin in Yugoslavia. One's link to the local microcosm in Yugoslavia would end in the homestead and the house, for the sake of which years of hard work and abstinence in Scandinavia had been sacrificed" (Schierup and Ålund, 1996). In the 80's and 90's , one could already observe, among migrant Vlachs, some developing strategies of integration in the society of immigration (Schierup and Ålund, 1987). They were seen as emerging ethnic minority cultures, but still, at the same time they continued to harbor profound feelings of attachment to their country of origin and a desire for eventual return. This desire ranged from real plans for social and economic reintegration back home, to the more frequent vague ideas of returning "someday".

Conspicuous status display in the back-home context seemed to become at first a purpose by itself. Investments in tractors and agriculture machines increased, even among those owning no land! A contradictory phenomenon occurred soon after: the belief that agriculture itself was no more sufficient to fulfill the needs of the "developed" families and households. At the same time, the low level of education/specialization of the migrants left them with few possibilities of reintegration and finding jobs back home, so they postponed their return. Lacking a solid "link" from one historical and generational context to another (which could be represented for instance, by coherent plans of local investment), they continued the process over the years, and the "temporary migration" developed into a continuous *"migrancy process"*. (Schierup and Ålund).

Speaking of intention to return in a context of decades of migration, when the length of stay loses its characteristics of temporariness, Ivo Baucic expressed it in the excellent phrase of "*a state of continuing temporariness*". This might be explained by their evolution in a complex socio-historical context, as well as by their special minority status.

Vlach migrants use most of their savings for investments in huge houses in their villages of origin and in agricultural machines and tools – investments definitely connected to "prestige games" among migrant households, but also representing a justification for emigration: that of conveying a social status that the migrant is deprived of in his country of adoption (Ålund 1986). I would add that this behavior, by creating a status, by signaling a consolidated financial equilibrium and by bringing into Vlach communities successive layers of well-assimilated western cultural patterns, represents an attempt of *crystallizing an acceptable and respectable identity*, one which they are still deprived of in Serbia.

The attachment to the home village through household investments is supplemented by periodical returns (especially for the complex cult of the dead) and by expensive and lavish ritual practices. All the important rites of passage are taking place in the villages back home, through rich ceremonies that become themselves, year after year, identity markers. Schierup and Ålund see in them a "commitment to return". I also see them as a confirmation of belonging, a symbolic investment fot their "lieu d'appartenance", a performance successively

adding sense and legitimacy to their feeling of "meaningful belonging" (Mihailescu, 2002). [2]

3.SOCIAL PROCESSES AND SOME "POSSIBLE FUTURES"

Even after years of migration, the Vlach migrants describe themselves as belonging to one (multigenerational) household, with its roots in the village of origin. Bonds to homeland are enforced by endogamous marriages with partners chosen from their village. Many youngsters still spend time in the land of origin, at least during primary school. On the other hand, a younger generation, multilingual and well educated in western schools, emerges.

There is an ongoing system of socialization in the communities of origin, reinforced by yearly visits for ceremonial purposes. These rich ceremonies, with all generations taking part, enforce socio-cultural links and maintain the idea of a future return.

Several future perspectives are "opening" for the Vlach migrant families :

In the first scenario, as younger generation becomes better educated and more cognizant of the possibilities for economic independence, in the context of global crisis, conflicts between the generations may tend to become more frequent and divisive. The authority of the older generation is resting on conservative moral and ideological foundations, on mythical and magical sanctions and a common attachment to symbols of "the little tradition" (Redfield, 1960), merely connected to contemporary survival mechanisms. This could eventually lead to a "rupture" between generations, endangering the future of Serbian-based Vlach villages.

In a second, more optimistic scenario, the presently active working generation, cosmopolite, mobile and better educated than their parents, but still connected to family and homeland, might become the architect of the "missing link" between generations. They can encourage local development through means of remittances, and they can constitute a new political elite, polarized around community interests. This way, several goals could be acquired: strengthening their sense of identity (including strong political contributions of newly formed elites), maintaining the family and community ties, as well as an economical stability for all generations, in the increasingly developing homelands. Paradoxically, the global economical crisis might encourage this second option: rising unemployment and structural transformations in western economies can become an obstacle for migrants, pushing them to return home and come up with alternative solutions. The processes of transformation are collective (when asked about their date of return home, the migrants would answer "when the others will start departing" – cf Schierul and Alund, 1997). "Traditions" as well, remain an inter-generational socialization area, interweaving cultural values and meanings and allowing the collective process of transformation.

As far as identity is concerned: the economical and status-seeking motivations of Vlachs are by far a priority and they seem to outclass, by far, the "identity" questionings or turmoils. But this might turn into an advantage in the identity crystallizing process. The emancipation and the recuperation of minority rights under an obsolete, *strictly ethnical,* frame of reference, might be a "late victory", unsatisfactory in the context of the global identity crisis and the "de-traditionalization" that came along with globalization.

As Cohen and Taylor put it, the quest for "identity making" in contemporary society becomes the expression of a particular dialectic between real needs and the culture industry's simultaneous articulation and distortion of these needs. In this sense, it will be interesting to see how younger generations of Vlachs will experiment and apply new ways of identification and new ways of articulating identities in a coherent system, compatible with their economical dynamics and braided with their community values.

No important social movements or developments are possible without ties. In this context, attachment to homeland and – adapted but still strong - family ties may

[2] See Mihailescu - identity as a "legitimate discourse about a meaningful belonging".

constitute part of the structure on which the layers of group identification will be weaved.

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Households (Photo - Annemarie Sorescu-Marinkovic)

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ASPECTS OF DEVIANCE IN MILITARY ENVIRONMENT

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Abstract

The military institution represents a human group with its own traditions, cultural norms specific to a certain social status, with features from certain person that carries a specific gun to another one, but the rigors and privations are not easy to face and overcome.

The communication of persons who are for a determined period in military institution is a complex process that consists of a dynamic set de-socializing and socialization again - to waive some rules, behaviours, customs, habits and learning new ones. This process is obviously in conditions mastering military role, associated with a professional model, unique in its own way, and entry into a specific social environment.

The contact of the young man with the disciplined society, with prohibitions and frustration, with an authoritarian hierarchy could activate, for some, aggressive tendencies or signs of insubordination. The psychology of recruit person at adolescent age represents a great originality, which will result in particular difficulties for commanders. The independence and even opposition of parents and educational models and life down, and search their life style will spill over into this community that is authoritarian military. The isolation tendency arises particularly in the first three months of the incorporation, and if during this period the phenomenon represents a justified action, having gone through this stage he should give thought about. In this case it raises the question discovering the causes that have led to this situation and find the most effective ways of solving them.

Such behaviour may be labelled as deviant and should be treated as such. To deviate from the norms and patterns of behaviour - acting unanimously accepted by the members of the group can always generate failures at this level, establish unity of thought and action group and therefore establish group fighting force of group.

Keywords:
Communication, educational models, aggressive tendencies, dysfunction, behavioural patterns

1. INTRODUCTION

In any society deviant behaviour covers a large range of types, from the so-called « eccentric » behaviour, defined by "unusual" gestures, particular clothing and behavioural disorder, until dysfunctional or altered behaviour, pertaining to delinquency area, to subcultures and to countercultures, deviant or marginal.

Deviancy and marginality phenomena, seen in terms of military specificity, present a number of specific features.

This paper approaches the problem of deviancy and marginality at military environment level: risk elements imposed by the integration of young persons within the soldierly groups, the manifestation of the phenomenon of marginality, and elements that can contribute to proliferation among soldiers of deviant behaviour.

The military institution constitutes a human group with its own traditions, specific cultural norms, with a certain social status, with features from a weapon to another but with rigors and privations not easy to face and overcome. Generally it is shown that the adaptation process is conditioned by psychological and socio-psychological features of young recruits: temperament, character, skills and inclinations, by the socio-psychological climate in military collectives, leadership, character and content of the command.

From the family environment to the environment at school and then at work or in the military service, the human being suffers several successive remodelling steps, it must give up certain habits, attitudes, values and interests to continuously acquire new ones, accepted and respected by the social group.

It is a proven fact that adaptation to the military environment is even easier as there is more consistent motivation. Although the military environment is all new for those who join the service, it will be perceived differently depending on the time spent by the young man in community, on whether he was separated from his family or not, from work, whether he is dependent or independent of his parents, etc.

First of all it must be shown that the integration process is highly complex and, although unitary, it takes place at several distinct levels – at biological, physiological, mental level. On one hand it is about adaptation to a certain work and life regime by acquiring new skills, abilities and capacities, in accordance with the requirements of the new lifestyle, and about the development of new skills and beliefs, in accordance with the requirements of the new social status, on the other hand.

Military service is performed in an environment requiring high adaptive resources from the young man at an age when his maturation process is not yet completed. Regardless of what is achieved at some point in terms of education, adaptation to the environment and to the new social status is an actual phenomenon in the life of the individual and in the life of the group.

Most young people go through this period of their life, achieving performance in preparation for battle and achieving disciplined conduct, favourable for their integration in the military environment. Data obtained from social surveys and based on documentary analysis reveal that for some young conscripts deviant behaviour, behaviour disorders or maladaptive reactions to the military environment – anxiety in the unit appear

Such maladaptive responses to the military environment usually occur within the first 4-5 months of active service, a period considered as adaptation of the person to the new life style. Maladaptive reactions appear also at the end of the military service, which shows the significance of contact with social perspective that the young person had before conscription; if this perspective is burdened by social problems - unemployment, material difficulties faced by the young person in general, these create prerequisites for disciplinary and behavioural disorders.

Military life is not spared from deviant moral acts, even if it takes place in a specific way in relation to other social activities. Military activity in its entirety cannot be regulated by laws, orders and directives.

Specialized studies and sociological studies reveal that behaviour disorders rarely derive from a single cause (monocausal explanation). The contribution of several factors shall be efficient (multicausal explanation). Only the contribution of several factors (variables), their mutual influence usually reveals abnormal behaviour (interactionist estimation) - this being also

the type of explanation that is gaining more ground today.

2. RESEARCH METHODOLOGY

This research aims to provide an insight into the dimension of deviance phenomenon within the military system, to show risk factors and the causes determining young recruits to adopt behaviours inconsistent with the values and norms specific to military environment.

This research aims to:

Determine the relationships between personality types, areas of origin and predisposition of militaries to deviant behaviours;

Establish the relationship between the rough military lifestyle and the occurrence of deviance.

Highlight the psychological and moral features of militaries who show deviant behaviour.

Prepare a program to avoid (prevent) deviant behaviours, to rehabilitate militaries who show deviant behaviour.

The following hypotheses were developed:

If personal traits of the subject define a strong personality, the predisposition to deviant behaviour is reduced;

If militaries face issues in adaptation and integration within the military environment, the risk of occurrence of deviant behaviour increases;

If the IQ of militaries is superior, the risk of occurrence of deviant behaviour is reduced;

Survey sample

This study aims to be a correlation study, so the research was conducted in two military units and includes 28 subjects who perform military service. They are aged between 20 and 22 years, general, secondary or post-secondary studies and come both from urban and rural areas. 14 of them have normal behaviour and 14 have different manifestations of deviant behaviour such as desertion, self-mutilation, theft, acts of aggression.

The research methods used are: observation, interview, questionnaire and test.

3. ANALYSIS AND INTERPRETATION OF RESULTS

Data obtained from the tests were processed monitoring any correlations between the variable "manifestations of deviant behaviour" and other variables used in research. The question is to assess the relationship between these variables, to express it in numbers.

Unlike the experiment, that reveals cause-effect relationships, the correlation study does not offer directly a measure of causality, but simply a measure of association method, covariance of features and it will reveal the deeper nature of the relationship. While in experimental studies the relationship is unidirectional (x causes y), in a correlation study variables are offered instead of being manipulated, and the relationship is not vectorized.

The statistical analysis performed shows the following conclusions: the first and second hypotheses are confirmed, and at hypothesis no. 3 there is no correlation.

Determination of correlation is always performed considering two variables.

Findings

The issue implied by the phenomenon of deviance that occurs, in one form or another, at each type of society or social group level, is too complex to be contained in the pages of a paper of this size. Addressing theoretical aspects and

the analysis of the phenomenon of deviance and marginality in the military division, allowed us to form an adequate image on their complexity. At the end of this study, we will try to systematize the main findings resulting from this approach.

Each type of society is characterized by a series of specific rules that present the behaviour of its individuals, and define it as consistent, marginal or deviant.

Deviance can be seen as a failure of social solidarity, which disrupts harmonious relationships between social roles that unite and integrate the individuals in the community they belong to.

Deviance depends on rules and values existing within the group, on its cohesion, degree of tolerance and social control. The best example from this perspective is represented by the military group.

Integration of young persons in the military environment means adapting to a specific regime of work and life by developing skills, abilities and requirements in accordance with the new lifestyle, and developing attitudes and beliefs specific to the new social role. Where appropriate integration is not performed there is a risk of deviations from prescribed behaviour, the emergence of maladaptive reactions from recruits who are in such a situation.

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SUGGESTIONS FOR POSSIBLE MOTIVATIONAL STRATEGIES TO BE IMPLEMENTED IN THE MILITARY ENGLISH COURSES IN THE 21ST CENTURY CLASSROOM

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Abstract: The paper analyses different types of language acquisition-related values and attitudes, i.e. intrinsic, integrative and instrumental values; it also takes into consideration how difficult it is to modify one's value system in a positive way, as a means of changing individual attitude and perception as to learning English. The basic idea of the paper is that values cannot be transmitted directly through traditional instruction, but can be socialized rather by centering teaching on three main processes, i.e., exposure to recognized language-acquisition models, persuasive communication and student involvement in the development and success of the linguistic program.

Keywords: motivation, motivational strategies, English language learning

1. INTRODUCTION

People often use the term 'motivation' to express the idea that success or failure in any learning situation (in our particular case, in learning a foreign language) are to a large extent caused by the student's enthusiasm, involvement and endeavor. Motivation-related issues underlie the most basic aspects of the human mind, inasmuch as they provide a driving engine for an individual or collective enterprise: in other words, if the reason is strong and relevant, regardless of the individual's language aptitude, any effort/sacrifice is worth making.

So far, the papers and studies made on the language courses in the Romanian military education system have focused on the life-long (encompassing both the 'intensive' and 'non-intensive' type) learning component. In the context of the recent developments and normal evolution of the approach to European education in general (e.g. the Bologna process, the adoption of the Common European Framework of Reference for Languages: Learning, Teaching, Assessment, abbreviated as CEFR) and in NATO in particular (e.g. the 'smart defense' concept imposing new training and education requirements), the aim of our study is:

- to provide the general framework for the English language modules conducted within the Master's degree courses of "Carol I" National Defense University, by referring to the challenges, constraints and shortcomings we have identified;
- to suggest possible and feasible motivational strategies for the students in this respect, starting from a critical analysis of the theoretical framework resulting from the careful reading of the dedicated bibliography.

The greatest challenges we are currently being faced with in conducting the English language module for the Master's degree courses are the following:

- the areas of expertise addressed are: Joint command – Land Forces; Joint command – Air Force; Joint command – Navy; Logistic Management; Economic-Financial Management;
- the selection for courses is competition-based and the first test to qualify for admittance is a written exam in English (level A2 on the CEFR scale);
- English is a compulsory subject matter;
- the total length of the module is 42 hours, conducted in 1 semester out of the total of four throughout the 2-year master's degree study program;
- the number of hours allocated for the study of service-related military English is insufficient to develop the core competencies and skills included in the syllabi;
- the students' interests are mainly focused on their area of expertise, rather than the study of the foreign language;

Even from this concise description it is obvious how important it is for us teachers of military English to concern ourselves with the fostering of master's degree student motivation, as it is considered to be the most effective and proactive power relationship that can be established in the classroom and beyond.

Here we need to differentiate between the two basic types of motivation, i.e., intrinsic vs. extrinsic. The discussion needs to be extended to the consideration of group processes, because teaching implies the existence of a group of people undergoing training in a specific area and whom teachers are called on to motivate.

Tuckman (1969, quoted in Argyle, 1969) established that a group went through four stages from its formation, which has important implications for the study of the classroom and the use of group activities during teaching. The stages are as follows:

- Forming
- Storming
- Norming
- Performing

Throughout these processes, the teacher is a sort of magician who is expected to have 'tricks **and** treats' in his/her hat in the attempt to manage their classroom and motivate the learners. In other words, the teacher should lure students and motivate them to learn.

Our experience of MELT teachers has demonstrated that one of the keys to success in the classroom is to keep in mind that the student's general perception of school activities is that the latter are mostly boring, with little reward and scarcely connected to the student's interests; moreover, that it is the teacher's task to make learning fun and enjoyable, hopefully useful and rewarding.

What is to be done? One remedy we used was to remove the imaginary T-S barrier and to transfer some of the course responsibility to the students, by empowering them to decide on topics to be included in the syllabus, on activities which appealed to them in order to better meet their expectations. Apart from these, for this is the result of empirical experience, we needed a scientific background and a theoretical approach to the matter in order to identify the motivational strategies to be used on our target student population.

An important element in the framework of motivational strategies is to make decisions on their organization into separate themes. The following taxonomy, around which our main discussion will revolve, is based on the process-oriented model by Dornyei and Otto (1998:43-69). The key units in this taxonomy are as follows:

- *Creating the basic motivational conditions;*
- *Generating student motivation*;
- *Maintaining and protecting motivation*;
- *Encouraging positive self-evaluation.*

2. CREATING THE BASIC MOTIVATIONAL CONDITIONS

Keeping in mind that motivational strategies cannot work in a vacuum, the first taxonomy says it is imperative to meet first some prerequisites before any attempts to generate motivation can be effective. Some of these conditions will be elaborated on in what follows.

Among the most powerful motivational tools, the dedicated literature (Dornyei, 2001:43-50) stresses out the teacher's behavior complemented by teacher-student rapport. Consequently, our efforts are channeled to establishing and fostering good rapport with the students, promoting mutual trust and respect, considering them performers in the same successful play: this further leads to enthusiastic learners, as shareholders of the benefits and course gains. One more key element in this equation is the empathetic teacher, who also admits he/she as a linguist cannot have the students' expertise in their military specialty and who is open to learning from them about the military field and all it encompasses. In this way learning is demonstrated as a two-way road: the teacher is interested in the subject matter, is committed to learning too.

Next, we highly praise the classroom atmosphere, in the sense that – if the latter was supportive and pleasant – it became obvious that student motivation reached its peak: learners could freely express opinions, felt safe among friends and peers, and learning turned out to be a seamless experience. Other ingredients to spice up the recipe of motivation that we would like to stress out are: offering students opportunities for expression, steady encouragement and support, acknowledgement of their efforts.

In addition to the above, it stands to reason that the teacher who fosters cooperative learning, by denying counterproductive competition and promoting cohesiveness, is ultimately an enabler of the students' increased motivation and commitment to learn.

3. GENERATING STUDENT MOTIVATION

Thanasoulas (http://iteslj.org/) lists some of the demotivating or weakening factors affecting the students, e.g. "compulsory school attendance, curriculum content and grades – most importantly, the premium placed on them". The solution the author suggests and which we have successfully adopted falls into the teachers' bailiwick, namely "to increase their learners' 'goal-orientedness', make curriculum relevant for them, and create realistic learner beliefs".

As far as the two solutions are concerned, our method is to make a needs-analysis upon the first encounter with the students in order to find out together what that specific group's goals and topics of interest are, and to incorporate them ASAP in the syllabus. Fast positive reaction is therefore a display of the teacher's willingness to share and adapt to the learners' needs and concerns.

Sometimes, having too high, unrealistic expectations of personal progress can have a strong demotivating impact. Besides, there are other deterrents of students' progress. Traditional approach may look obsolete and determine students' lagging in as it is not connected with the new information society where knowledge is

praised above all. New courses with a modern flavor are student-centered, teachers' effort being towards developing modern ways to motivate them and build their language awareness. In addition, teachers become a sort of jack-of-all-trades having to master different fields in order to develop successful and motivational courses. The result will be on the one hand, a highly complex course which will combine the latest in education: learning platforms, use of social media, portfolios, on the one hand, and student-approach, cooperative learning, self-paced learning, and life-long learning, on the other.

The use of modern technology and the Internet is considered to build motivation as it offers access to a huge database of knowledge that can improve learning. The learners of the 21st century are accustomed to using modern technologies, tablets, ePads, mobile phones etc. to browse for knowledge so the eLearning comes as a normal consequence of this trend. Moreover, life-long learning has got a new dimension with the use of PLEs (Personal Learning Environments) or VLSs (Virtual Learning Environments) which mirror the advancement in science and education with the settling down of communities of learners who use blogs, social media, and wikies, and are interested in learning by cooperation and socialization.

Self-development and continuous learning is also based on the new identity people create by activating on the Internet and being covered by its anonymous character. This new identity people build helps them to express their ideas in a freer way so many proponents of eLearning consider virtual classes and avatars as a better motivational source than the traditional, face-to-face approach.

According to Andrew Churches (http://www.masternewmedia.org), the profile of the educator has to change in order to meet students' needs in the 21st century. The new teacher has to possess multiple technological and educational skills to be successful and manage to motivate students. In the technological society, the educator will be a combination of many characteristics having to function as:

- adaptor
- communicator
- learner
- visionary
- leader
- model
- collaborator
- risk taker.

One of the most important features of on-line courses is that they are designed to motivate students to actively participate in their learning while discovering by themselves optimal methods and techniques. The success of eLearning is due to students' involvement and understanding of the nature of second language learning so that they will not have false believes and pre-conceived notions that may hinder their language acquisition.

Motivation is therefore an important feature to be taken into account and protected during the course as it can be easily worn out in time and result in demotivation.

The on-line courses improve learners' **self-confidence** as they provide them with the possibility of making decisions on the content, the moment, and the time of learning. As many language courses offer packages of activities learners' can choose from, the content of a course is more flexible than the one from the traditional approach.

By providing encouragement, the less stressful environment filtered by the platform, by creating contexts where students can have regular experiences of success, and by prompting them to contribute to their learning, the virtual teacher will build and foster motivation.

In addition, asynchronous courses offer the possibility of access to courses from different locations and at a moment chosen by the learner, a very motivational feature to the military personnel who have limited time or are involved in other activities: attending other courses, going to work, having busy schedules, participating in missions, being involved in research projects etc.

Another motivational strategy is the creation of **autonomous learners** who are able to make decisions and assess their knowledge in a realistic way. In an on-line course, platforms provide better classroom management with the implementation of features that allow the creation of sub-groups so that learners with different proficiency levels will find their place and feel that they become autonomous in their study. The on-line courses and the use of the Internet will help students establish the direction of their learning, and make them more responsible in their self-directed study.

Reinders (2010: 46-49) talks about five stages to improve learners' autonomy:

- identifying needs and connecting them with class activities,
- setting goals by helping learners identify realistic ones,
- planning learning and involving students in deciding what to learn and the pace of learning,
- selecting resources by providing students with the possibility to bring their own authentic materials and share,
- selecting learning strategies and allowing students to discuss and get familiarized with them,
- practicing by allowing students' to make decisions regarding activities, homework etc.,
- monitoring progress that will be recorded in a learning diary,
- providing assessment and revision by suggesting alternate forms of evaluation, checklists, portfolios, peer and self-assessment.

Building motivation is difficult to master as it requires not only thorough preparation, but also interest and dedication. According to Good and Brophy (1996: 228), "the simplest way to ensure that people value what they are doing is to maximize their free choice and autonomy."

4. CONCLUSION

As Ushioda (1997:41) states, "self-motivation is a question of thinking effectively and meaningfully about learning experience and learning goals. It is a question of applying positive thought patterns and belief structures so as to optimize and sustain one's involvement in learning". Motivation can be improved using more means, however, regardless of them, it is up teachers' decision, dedication and commitment to obtain possitive results. By creating the basic motivational conditions, generating, maintaining and protecting student motivation, and encouraging positive self-evaluation, the teacher will foster a pleasant classroom environment that will enhance and ensure learning.

Learners' autonomy will enable them to make decisions and assess their knowledge in a realistic way. The implementation of eLearning courses will provide the modern and technological environment that will suit learners who are accustomed to the demands of the information society.

Therefore, motivation is one of the most important elements of a course as it enhances and supports the fulfillment of objectives, the assessment of needs, the use of activities, and the design of a relevant classroom management by fostering a pleasant and demanding learning environment.

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THE EVALUATION OF PSYCHOSOCIAL RELATIONS IN NEUROPSYCHIATRIC REHABILITATION CENTERS

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Summary: *The specialized researches in the field of social psychology have demonstrated the importance of relating the individual to his affiliation group as a condition for an optimal social integration. Based on these results, we have found that the best predictor for the social integration of the mentally ill institutionalized persons is given by the relationship that he/she built with other ill patients integrated into the center, along with concrete ways of maintain the friendship relations. For the investigation, we aimed to evaluate the way they relate with others patients using sociometric test of personality. Taking into consideration the psychosocial uniqueness of the group, the cohesion is a sign of overall behavior improvement. We wanted not only to determine, to investigate and to observe the patients in their environment but also to develop some actions in order to improve the human condition in institutions. The benefits provided by the sociometric test helped us to propose to organize the patients in a new way in occupational therapy and in the rehabilitation center rooms (based on their preferences). We have considered that according to the relationships that they have (based on sympathy and antipathy), the therapeutic groups can become more stabile if the patients share their personal space (the room).*

Key words: *beneficiary, rehabilitation center, interpersonal relationship, interaction, cohesion.*

1. INTRODUCTION

In order to know the motivation of the preferences/rejections and certain variables of individual and group personality we have developed two instruments. The first instrument was made to investigate the motivation of the beneficiaries and it pursed their skills of answering to questions with profound reverberation for their psyche. They were asked to reflect, to introspect and to analyze the inter-affective, intercommunication and inter-cognitive relations. The first instrument is a questionnaire based upon sociometric test of Holban I, sheet A, and include 7 themes, which allow, pointing the preferences and dislikes with their motivations, a information regarding the features of the analyzed group even: friendship relations; level of solicitude; prestige of personality; the principles and discernment; attitude toward work; ability to organize; capacity to influence.

It is considered that these variables represent the main way of the individual manifestation in the group and that they express the synthetic value of the personality in terms of their psychosocial characteristics. The instrument was applied to 100 beneficiaries.

The above described instrument was a first step in sociometric investigation in order to involve the beneficiaries and knowing the motivations of all type of conducts, interactions and human relationships.

We have developed a second sociometric instrument consist of one simple item and a dual preference item for the purpose of knowing the preferences and the motivations of the beneficiaries regarding the choices made by the therapy colleagues or by

the roommates. The purpose of this tool is the optimal psychosocial integration in the rehabilitation center collectivity and then to reintegrate into society.

2. THE DEFINITI ON OF THE CONCEPTS

The beneficiaries represent a category of chronic somatic or/and mental ill patients, which taking treatments in community have not obtained a significant recovery and as a result they lost their autonomy by chronic disease and the beginning of mental and psychological disability.

The psychosocial phenomenon is a key concept from which all others arise. The beginning of the mixed, dual, binary phenomenon is based on two supports: psychological and social. In the social life there is no mental phenomenon which work isolated from those social and vice versa.

The interaction is one of the key concepts of the social psychology and it indicate phenomena that occurs not only within the psyche but also outside of it, in the miniature world of matter micro-particles as that of galaxies and meta-galaxies populating the universe (P. Golu, 1989).

The interaction is the process of the fundamental, active, mutual dependence of the individuals; the behavior of one individual are reflected in the behaviors of others (P. Golu, 1981).

Interpersonal relationship is an important concept in social psychology and it is a mixed, psychosocial relationship. It represent a direct and conscious psychic union, based on a complex, reverse link, this union include at least two people (P. Golu, 1974).

The cohesion can be considered the most important group variable because of it the group exist and operate as a coherent entity relatively self-content (P. Golu, 1971).

3. RESEARCH METHODOLOGY

3.1 RESEARCH OBJECTIVES

- Identify the conditions that can favor harmonious interpersonal relationships and creating a sanogenetic social climate close to that of a normal home for psychological recovery and rebalancing of the beneficiaries.
- Investigation of psychosocial factors which facilitate discharge and the reintegration in the social and home environment.

3.2 RESEARCH HYPOTHESIS

We estimate that the evaluation of psychosocial relations between the patients in the rehabilitation center allow us to express an accurate prognosis of the patient's successful reintegration in the society.

3.3 RESEARCH SUBJECTS

The lot of research consists of 100 beneficiaries.

3.4 RESEARCH TOOLS

3.4.1. The questionnaire adapted from sociometric personality test Holban I.

3.4.2. The questionnaire for beneficiaries consisting of a simple item and a dual preference item.

3.5 RESEARCH RESULTS

3.5.1 Sociometric test adapted f rom sociometric personality test Holban was made on the basis of similarity of the diseases suffered by patients, as follows:

- The first group consisted of those suffering of neuropsychiatric disease and it was composed of 50 members.
- The second group was composed of people with mild or severe mental disabilities and it was composed of 26 members.
- The third group was composed of 19 persons with neurological affection or involved in the center as social cases.
- The last group (5 persons) consisted of patients suffering other diseases.

The responses of the beneficiaries have been converted according to the liked characteristics of the colleagues and I placed them in seven qualitative grids: communication, cognitive abilities, emotional and instrumental support, social behavior, activity, similarity in statute, psycho-moral values, according to the table 3.5.1.

	The motivation of the preferences	**The motivation of the rejection**
Communication	He/she is an opened person, talk nice, we have the same discussion subjects, good listener	Not speaking, does not agree with me, doesn't listen me
Cognitive abilities	He/she is intelligent, smart, understand what I say	Don't understand what I say, is stupid, he/she don't know
Emotional and instrumental support	He/she help me loves me, cares me, understand me, is merciful	He/she don't care about the others, don't help me when I need
Social behavior	He/she behave nice, respectful, good, educated, disciplined, calm, friendly	He/she is unruly, beat the others, swear, stole, don't know how to behave
Activity	Skillfully, dynamic, lead the job done, have volition, diligent, has talent, good organizer	Lazy, not taking part to activities, he/she don't know to do something
Similarity in status	We are suffering colleagues, room mates	He/she is also sick as I am, he/she is more sick than I am
Psycho-moral values	He/she is honest, fair, vigilante, is reliable	Trickery, not accept me, not reliable, liar, coward

Table 3.5.1 The motivation of the preferences and of the rejection

The results expressed in percentage are found in the following figure:

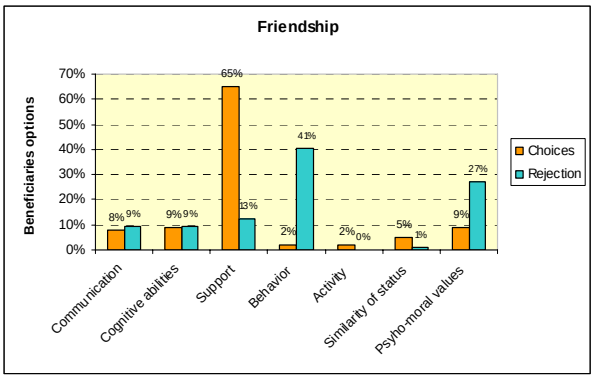


Figure 3.5.2 Friendship variable

At friendship variable 65% of beneficiaries have reasoned their preferences according to the given support. We specify that the high percentage at support category signifies a positive valorization of those beneficiaries that have the qualities and the resources that helped the beneficiaries who preferred them.

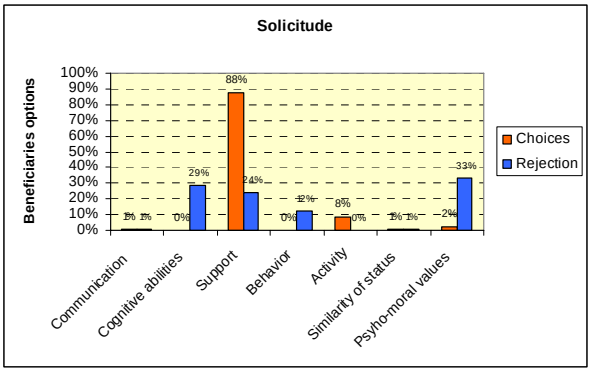


Figure 3.5.3 Solicitude variable

At solicitude variable, 88% of beneficiaries have preferred those colleagues who are able to offer their support in difficult situations. The motivation of their preferences expresses their need to get help and we specify that this need is one of the most intense and if it is impressive is because it is not satisfied in specific institutional environment.

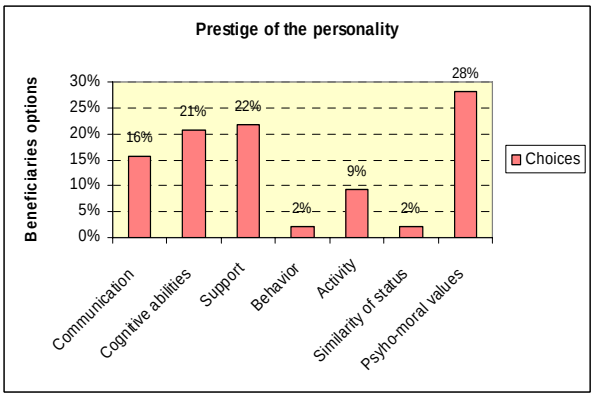


Figure 3.5.4 The prestige of the personality variable

At prestige of the personality variable we observe a relatively close dispersion of the preferences: 28% of beneficiaries with psycho-moral qualities are preferred, 22% of beneficiaries that offer support, 21% of beneficiaries with high cognitive abilities and 16% of beneficiaries that can communicate with. We consider that the choices of the beneficiaries were motivated by their need to succeed with those colleagues who are already well-liked and recognized by others.

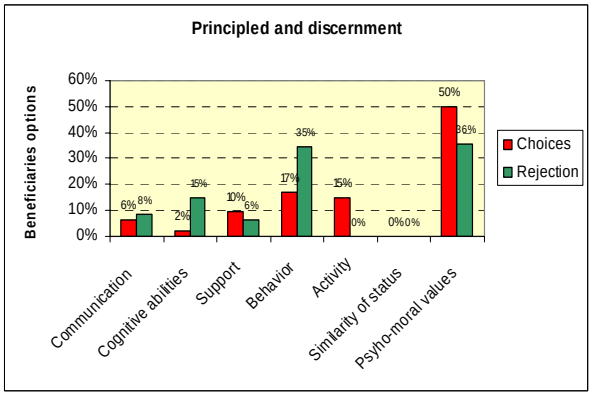


Figure 3.5.5 Principled and discernment

At principled and discernment variable they were preferred 50% of beneficiaries with psycho-moral virtue which have been characterized as vigilante and lovers of truth.

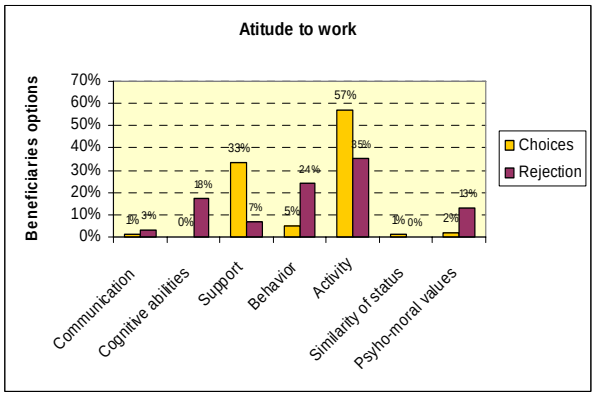


Figure 3.5.6 Attitude to work

At activity variable were preferred 57% of beneficiaries who have skills, who are active, they made appreciated products and they finish their work and 33% of those who are able to offer their help to the people who ask this. Join with recognized beneficiaries could change their social status by learning and improving work skills and the prestige.

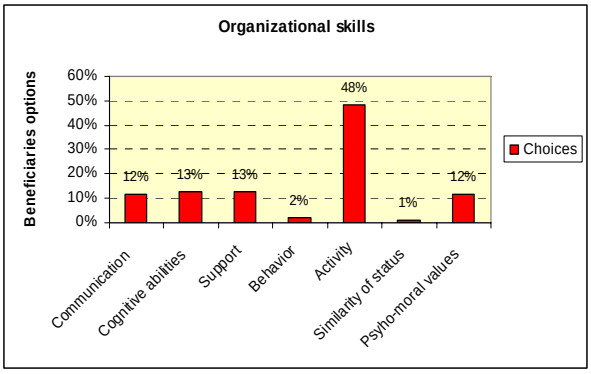


Figure 3.5.7 Organizational skills

At organizational variable, 48% of beneficiaries have preferred those generally active, with organizational skills, with team spirit and capacity of resolution.

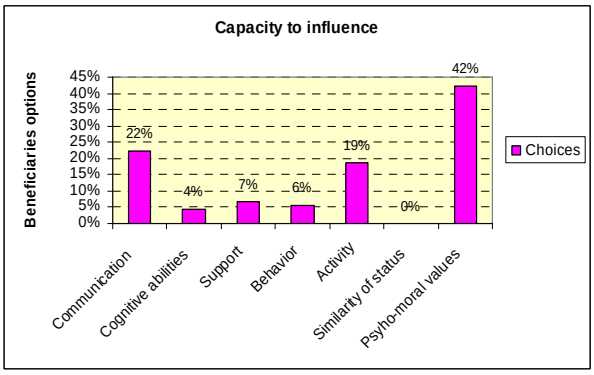


Figure 3.5.8 Capacity to influence

At influencing capacity were preferred 42% of beneficiaries possessing psych-moral values and 22% of those with communication skills, we specify that those qualities represent in their point of view an important advantage that could mobilize the group. 19% of those who are diligent and active were elected.

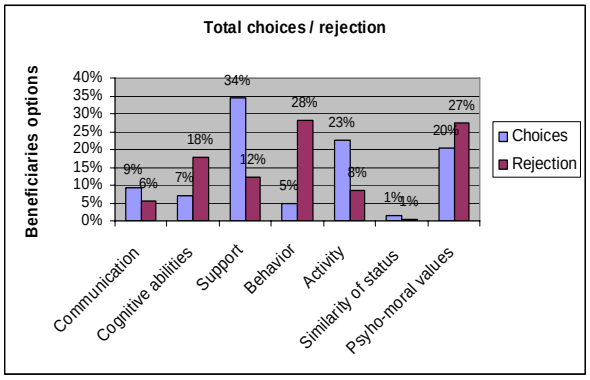


Figure 3.5.9 Total of preferences-rejections

Deepening knowledge of the group, we were interested in knowing the dominant of the group personality calculating the overall weighting of preferences and rejections of the analyzed group according to each variable. The support represents the main dominant of group personality in preferences of the beneficiaries with 34%, followed by attitude to work with 23% and by psycho-moral values with 20%. We have to note that the similarity of the statute was 99% ignored, the explanation being that the beneficiaries avoid motivating their preferences in terms of similarity of the status because of the moral pain of being institutionalized and acting this role. Based on our observation along ten years of work and research as well as based on the analyzed questionnaire, it result that beneficiaries have as a base for their relationships their need that must be fulfilled by the others beneficiaries, friends or family, such as: the need of affection, the support, the activity, psycho-moral values, communication, the desire to be heard and understood.

Proposals for improvement

• The intensification of interpersonal relation between beneficiaries – beneficiaries, beneficiaries – employees, beneficiaries – family.

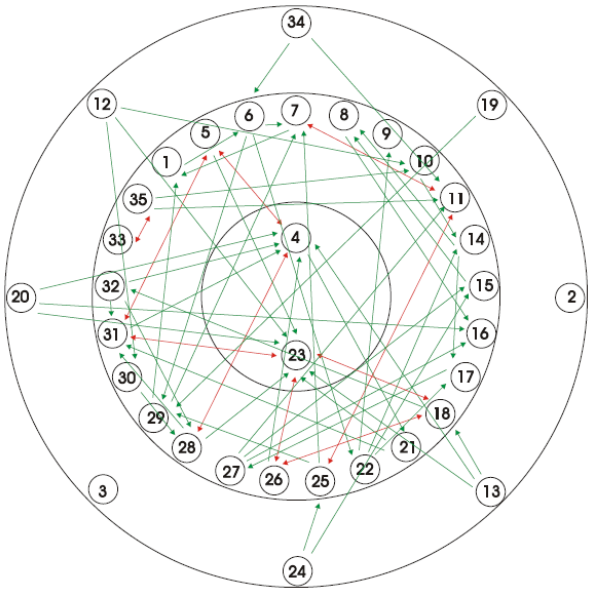
• Equip the institution with material resources in order to organize occupational therapy activities and ergo-therapy that would have the effect of stimulating the interpersonal relations and rebalancing.

• A qualified personnel to coordinate the activity of beneficiaries is an aim which increases beneficiaries' self-esteem by activity.

3.5.2. The second sociometric instrumen t was applied on a lot of 35 beneficiaries that we have selected using multistage random sampling, sample from 100 beneficiaries, initially investigated. The results of the second instrument, at the first item "Which of the therapy colleagues are your best friends?" are contained in socio-matrix where we have recorded the preferences of beneficiaries, index status and rank (M. Zlate, C. Zlate, 1982). We made the collective sociograma "target" 3.5.11 based on sociometric status index in the table 3.5.10.

Number of preferences	Number of subjects with the same number of preferences	Iss	Rank	Preferential psychosocial value
9	1	0.26	1.00	Charismatic
7	1	0.21	2.00	
5	2	0.15	3.50	Accepted
4	1	0.12	5.00	
3	4	0.09	7.50	
2	10	0.06	14.50	
1	8	0.03	23.50	
0	8	0.00	31.50	Cold

Table 3.5.10 Repartition of group members according to sociometric status index



Sociogram 3.5.11 Item 1 preferences (Which of the therapy colleagues are your best friends?)

Legend

mutual preferences

unilateral preferences

At the first item of the second instrument there are two charismatic subjects that are included in the first inner circle of group sociogram. The subject number 23 was the most favorite being situated in the first place. This beneficiary is the most appreciated member of the investigated group totaling a score of 16 points. He has medium education and he distinguished over the years by participation in psychotherapy activities being motivated for self-knowledge and for discovers his skills. With our guidance, the beneficiary has discovered his abilities for picture and drawing attending the art-therapy room. His activity was sustained by motivation and will, also he has strengthened social rules and values so today he is psycho-somatically recovered. And if he is not yet reinstated is due to the lack of family support. During the occupational therapy I gave him some tasks and he succeed to coordinate the activity of others beneficiaries when the situation demanded it. He enjoys the appreciation and the respect from both beneficiaries and employers of the institution.

The subject number 4 gathered 15 points which placed him on the second position. He was preferred by his colleagues for his socio-human qualities. He has university studies, he respects the social rules, he is divorced and he misses the support for a socio-familial reintegration. Both beneficiaries are diagnosed with schizophrenia and the reality of sociogram is the same with the reality in the institution, the two beneficiaries are the most appreciated in the group.

There are 25 members in "accepted" category; generally they are eager to socialize expressing their preferences. They are part of the second circle. At this level, there are ten mutual appreciations which lead us to consider that dyads are the most common way to express closer interpersonal relation which does not allow the other beneficiaries in their space. We can also note a triad interpersonal relationship, consisting of the subjects number 26, 23 and 18. The subjects number 2 and 3 didn't express and didn't receive any preference. Their social expansion doesn't exist. Indeed, these beneficiaries have serious integration problems in the institution. They are often offended because of the restrictive freedom; they suffer very much because of the lack of family support and losing their socio-professional status.

A number of 8 beneficiaries have no preferences and they are assigned to the third circle; they are in the category of cold or isolated beneficiaries and they are in a way at the periphery of sympathetic-affective relations and without any value in their function.

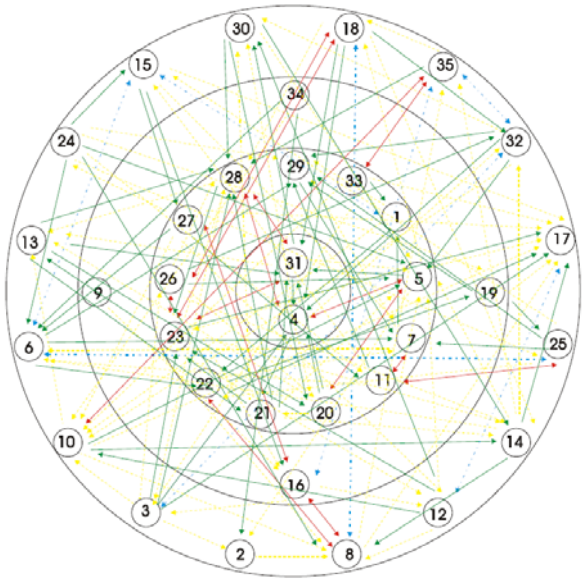
The motivation of the expressed preferences was based on the appreciation of the: social support 40%, global behavior - 37%, communication - 20%.

We further analyze the second item "Which of your therapy colleagues you would like to be/or not to be in the same room?" For this, we made the sociomatrix, we have calculated the amount of the preferences, amount of the rejections, the index of a preferential status of a member and the rank (M. Zlate, C. Zlate, 1982). In order to

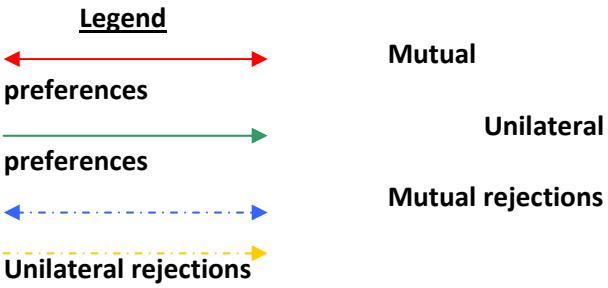
determine the nature of the relationships between the members of the group, it was necessary to draw up the collective sociogram "free" of the group 3.5.13. The most widespread form of graphical presentation is the sociogram so-called "target" based on several concentric circles containing within the group members, we have prepared the table below where we divided the group members according to their index preferential status. Based on the given data in the table 3.5.12, we concluded that we need four concentric circles.

The number of preferences	Number of subjects with the same number of preferences	Isp	Rank	Preferential psychosocial value
7	2	0.21	1.50	Charismatic
6	1	0.18	3.00	Accepted
4	1	0.12	4.00	
2	6	0.06	7.50	
1	5	0.03	13.00	
0	4	0.00	17.50	Cold
-1	6	-0.03	22.50	Rejected
-2	4	-0.06	27.50	
-3	2	-0.09	30.50	
-4	4	-0.12	33.50	

Table 3.5.12 Repartition of group members according to preferential status index.



Sociogram 3.5.13 Preferences/Rejections item 2a and 2b (Which of your therapy colleagues you would like to be/or not to be in the same room?)



Thus, the first circle will contain charismatic subjects; the second circle will contain accepted subjects; the third circle will contain the cool subjects and the fourth circle will contain rejected subjects. Forward we will highlight some aspects related to the preferential structure of the group.

There are two subjects in "charismatic" category, 31 and 4, who obtained only positive values. This suggest us the idea that the two subjects are recognized leaders of the group. They are appreciated for their balance in relations with the others and for their solicitude in the group.

As we can see both in sociogram and in sociomatrix the subject number 4 is the informal leader of the research group at the first item and at the second item. The subjects number 23 and 31 have a close preferential status index and they are placed on the second and on the third place in the expressed preferences; both 4 and 31 subjects have only positive preferences while subject number 23 have a contradictory relationship with the subject number 5 because of the struggle for position in group (incompatible pair). Although the subject number 23 is the informal leader of the group, as a result of the research the informal leader is not the same with the formal leader.

Linking this information with those from the psycho-social observation in the center along the years, we note a similarity between the results obtained with this two methods.

In "accepted" category we find 13 subjects, while in "cold" category we find 4 subjects.

We have to remark that the subject number 9 is typically cold subject, he didn't express any preference only one rejection. The subjects number 16 and 19 have 0 index of status because of the cancelation of values.

We find 16 members in "rejected" category which is a high number compared to the study group. This is an explanation of the poor cohesion of the group as we will find in the index cohesion group calculation. The sociometric analyze reveal us some interesting aspects:

- there are a total of 15 subjects with positive preferential status, 16 subjects with negative preferential status and 4 subjects with null (zero) status, which highlights the precarious situation in which is not only the subjects but the whole group;
- purely quantitative global analysis reveal us that there were 94 of preferences and 89 of rejections, so a total of 183 choices. Among them, there are 78 of unilateral preferences and 16 of mutual preferences, 81 of unilateral rejections and 8 of mutual rejections and 10 contradictions.

The inventory of the number of preferences and rejections in group is significant in the direction of providing information regarding the level of involvement of subjects in sociometric network. Also, some authors believe that the more homogenous is the distribution of preferences and rejections the greater is cohesion degree and integration of the group.

The number of the preferences in group represents valuable information in the calculation of the group cohesion index.

Sociometric index calculation (F. Sintion, 1983):

a) Calculating the limits of the positive socio-preferential intensity

Median $M = \Sigma Pv / n$, where M –median, PV – expressed preferences, n –number of members

In our case, Pv = 363, n = 35

In our case, M = 363 / 35, M = 10

Limits:

$M < 9$, inferior limit $Li = M - 3$

superior limit $Ls = M + 3$

$M > 9$ inferior limit $Li = M - 4$, our case=6

superior limit $Ls = M + 4$, our case = 14

Limits calculated on the basis of preferences expressed allow determining the

type of social expansiveness specific to each group member:

The value of preferences expressed by a certain member of the group (Pv)	Type of social expansiveness	Our case (number of subjects)
Pv ≥ Ls	Superior social expansiveness	7
Ls > Pv > Li	Average social expansiveness	23
Pv ≤ Li	Inferior social expansiveness	5
Maximum 2 expressed preferences	Solitary	13

Table 3.5.14 The way to determine the type of social expansiveness

Limits calculated on the basis of preferences received allow to determining the type of social integration specific to each member of the group:

The value of preferences received by a certain member of the group (Pv)	Type of social integration	Our case (number of subjects)
Pv ≥ Ls	Superior integrate type	10
Ls > Pv > Li	Average integrate type	13
Pv ≤ Li	Inferior integrate type	7
Receive no preference	Isolated (non-integrated)	5

Table 3.5.15 The way to determine the type of social integration.

b) Calculating the limits of the negative socio-preferential intensity is based on the rejections received:
Median M = ΣPv / n, where M –median, RV – received rejections, n –number of members
Our case, Rv = 347, n = 35
Our case, M = 347 / 35, M = 10
Limits:
M < 9, inferior limit Li = M – 3
superior limit Ls = M + 3
M > 9 inferior limit, Li = M – 4,our case = 6
superior limit Ls = M + 4, our case = 14
Limits calculated based on rejections received allow us to determine the typology of non-integrated.

The value of rejections received by a certain member of the group (Rv)	Type of social non- integration	Our case (number of subjects)
Don't receive any preference	Isolated type	6
Rv ≤ Li	Ignored type	9
Li < Rv < Ls	Rejected type	9
Rv ≥ Ls	Outcast type	11

Table 3.5.16 The way of determine the type of social non-integration

Calculation the group cohesion (F. Sintion, 1983)

In this step of processing the sociometric test group cohesion is calculated based on the intensity of the preferential relations, according to the formula:

CCG = [(Pxx0,5+Pyx1+Pzx1,5) - (Rxx0,5+Ryx1+Rzx1,5)] / N

Px – number of subjects preferred at inferior limit of intensity

Py – number of subjects preferred at average limit of intensity

Pz – number of subjects preferred at superior limit of intensity

R – received rejections at the same limit of the intensity like P

N – total number of subjects

Substituting the facts with the values in the tables 6.6.4 and 6.6.5, it follows:

Coefficient of group cohesion CCG = 0,04

The significance of CCG can have values between -1 and +1, according the standard by N.C Matei (quoting in P. Muresan, 1980):

Nr.crt.	Value CCG	Type of group
1	-1 to -0,70	Dissociated group
2	-0,69 to -0,40	Group with explosive relationships
3	-0,39 to -0,20	Group with dissentions
4	-0,19 to -0,01	Group at the beginning of decay
5	CCG = 0	Group with contradictory forces
6	0,01 to 0,20	Group with poor cohesion
7	0,21 to 0,40	Group at the start of cohesion
8	0,41 to 0,60	Group with moderate cohesion
9	0,61 to 0,80	Group with significant cohesion
10	0,81 to 1	Group with significant high cohesion (perfectly cohesive group)

In conclusion, the groups that we have investigated have a poor cohesion coefficient, which enable us to appreciate that in a psycho-social area the members of the group have certain unity.

Another formula often used for calculating CCG is that determined by Proctor and Loomis (quoting Zlate M., 1982) based on the number of the positive pairs in the group:

CCG = C / [N(N-1)/2], where C is the number of the mutual choices and N the number of the members of the group. In our group N=35 and there are 16 pair of positive preferences.

So, CCG = 0,03, poor cohesive group.

As shown, using the both calculation methods we have achieved relatively similar coefficients cohesion.

4. RESEARCH CONCLUSIONS

Hypothesis: **We estimate that the evaluation of psychosocial relations between the patient s in the reh abilitation center allo w us to express an accurate**

prognosis of the patient's successfu l reintegration in the society, has been confirmed.

We consider that the initially determined objectives had been achieved.

Sociometric investigation data showed that, psychologically, you cannot established a social reintegration program for beneficiary, in the absence of a relationship with the others beneficiaries in the center.

During our activity, the number of the interpersonal dyads increased. There where an increase of the cooperation between beneficiaries and of the group solidarity in the same time with the decline of the effects of social devaluate behaviors that they have presented before starting the psychotherapy.

Territoriality has an important role, the beneficiaries interact more with the group therapy colleagues and with the room/area mate.

The beneficiaries have expressed their wish to interact with healthy, tonic and agreeable people, which can represent a model, rejected the idea of spending the time only with the others beneficiaries.

As it is known, interpersonal relationship contains the germ of collective inter-psychology it being the smallest group possible.

If at the beginning of the research the group had a lot of dissensions, now the group has a poor cohesion and this indicate some changes in personal and interpersonal structure of the beneficiaries, this situation confirm the hypothesis that psychotherapeutic activity contributed to a relative inter-relation group homogeneity.

Given the psycho-social uniqueness of the group, the cohesion is an indicator of improving for global behavior. Group cohesion calculated at sociometric test CCG=0,04 (poor cohesion), compared with the absence of the cohesion at the beginning of the research, represent an indicator of improvement for global behavior and it is a condition for psycho-social reintegration of beneficiaries in neuropsychiatric rehabilitation and recovery centers.

Proposals

- Is recommended that patients to be placed in rooms according with their affections;
- Settlement planning in the rooms has to be done taking into consideration their affinities;
- The caring and the arrangement of the personal space has to be done based on the needs and the wishes expressed by beneficiaries;
- It is preferred like informal interaction between patients with mental illness at the same level of severity to be encouraged;
- The formal leaders of the group patients must be the persons who made progress in recuperative process.

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CHANGE AGENTS ACTING VIRAL

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Abstract: *In a world of technology, of fast access to almost any kind of information and, virtually, to anyone, one may say that change is an easy thing to do... Yet, if we take a closer look to the struggle that some organizations are doing in order to generate change we'll observe that in this new environment of high competition for resources the necessity of generating high level of trust and a viral spread of your message is vital in order to succeed. In an era of technology that is empowering the well connected ones (Zinnbauer, 2007), just a good cause and good work are not enough anymore.*
This article is a case study about the use of social networks, especially online social-networks, by one of the largest philanthropic organization in the world in order to generate trust, greater awareness and bigger founds for their humanitarian: their fighting to eradicate poliomyelitis in the world.

Keywords: *Trust, Online-networks, Social-capital, Brand Ambassadors.*

1. INTRODUCTION

Poliomyelitis, or simply put: polio is a devastating, potentially fatal disease that cripples infested children, mainly under the age of five, in Asia and Africa. The paralysis can appear within hours from the infection and it is, in most cases, irreversible. Historically, polio has been the greatest cause of disability.

Researches about polio accelerated in 1916, after the polio epidemic in New-York, USA, firs vaccine being developed in 1954 and in 1961 being developed the Oral Polio Vaccine (OPV) by Dr. Albert Sabin – which rapidly becomes the vaccine of choice for most national immunization programs in the world.

World health organization's start fighting with the virus and Rotary International join them for the first time in 1979 when Rotary clubs take on a project to buy and help deliver polio vaccine to more than six million children in the Philippines. In 1985, Rotary International launches "Polio Plus", the first and largest internationally coordinated private-sector support of a public health initiative, with an initial pledge of US$120 million. In almost 28 years, Rotary International spend more than one billion of US Dollars and help immunize more than 2.5 billion children, reduces the polio world-wide cases from more than 350.000 from 125 countries in 1988 to 223 cases from 3 countries in 2013.

The fight to end polio, under the umbrella of Global Polio Eradication Initiative, includes Rotary International, UNICEF, the U.S. Centers for Disease Control and Prevention, the World Health Organization, the Bill & Melinda Gates Foundation and governments of

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the world, with the support of many others around the globe; but the "war" is not ready yet, so Rotary International launches, what they called, "the world's biggest commercial" in order to get trust and power over the internet (Zinnbauer, 2007).

2. TRUST EQUAL MONEY

Estimations of World Health Organization are showing that stopping the anti-polio vaccine campaign without complete eradication of the disease, in a decade from now more than 200.000 children / year can suffer from paralysis. Continuing the vaccine campaign means money. A lot of money!

In order to reach any kind of objective that include spending money, either you're a company or a philanthropic organization (like, in our case, Rotary International) you need to get/raise those money. In order to raise any amount of money you need to have a good story ("way are you doing this for?"), access to the money sources (in this case: the donors) and beneficiate by a great amount of trust.

But way all of this and how those three elements are working together to generate founds?

Sociologists and economists are all recognising the dependency between social capital and wealth (Grootaert, 1998, Putnam, 193, Robinson, 1999, Zak and Knack, 2001) which means that the bigger the social capital, the bigger are the chances to have access to bigger founds.

Studies about social capital, respectively social network as part of social capital, have been developed since the beginning of the 19th century, if we consider Comte or Durkheim, but it is Moreno (Moreno, 1934) who pin-pointed a way of making this abstract tangible.

Developing and successfully using the social network means to rationalise (Parsons, 1951) the necessity of networking (Blau, 1972).

Social networks (that are generating trust – as in social capital) are working as a economic lubricant generating lower transactional costs, new ways of collaborating and business opportunities – prosperity, in general (Fukuyama, 1996), but it needs a sustainable effort in order to "establish or reproducing social networks that are going to be used on long term" (Bourdieu, 1985).

The same rule of the "weak ties" that Granovetter (Granovetter, 1973) developed to explain how people find a job applies to organizations when came to raise funds for their activities, perform better, solve a task faster, find volunteers to involve and so on.

Rotary International may be the biggest philanthropic organization in the world, but if it wants to reach its goals, it need go out of its close network and spread its message: this is the way "the world's biggest commercial" came to life!

The explanation to success of this campaign stays in the power of the network system (Uzzi and Dunlap, 2005). Networks seem to deliver three unique advantages: private information, access to diverse skill sets and power.

When taking a decision we are using two different type of information: public and private. As public information is at a click away from everyone – meaning that it is easily available from various sources – it gives, precisely because of its easiness to get character, significantly less competitive advantages in today's "battlefields" than the private information.

Private information is, in the same time, more subjective than the public information because it is not verified, validated by an independent party. This means that the value of private information is in close connection with the amount of trust existing in the network of relationship. (Uzzi and Dunlap, 2005) Trust allow partners to concentrate on getting tasks done because it acts as a "screening-off device in relation to the risk and dangers in the surrounding settings of action and interaction", a sort of "protective cocoon". (Giddens, 1991) Trust it is not in information itself or into the technology that it delivers it, but it is into the individual that is delivering it. (Fukuyama, 1996, Sztompka, 1999)

Networks give access to the other connections set of skills. Success is close to be

granted to those having the ability to transcend this limitation through others. This advantage offered by a network is in fact an exceptionally valuable resource.

Power is huge advantage offered by a correct developed network. A strongly clustered network is less valuable than a network made up from a wide range of clusters, due the strong relation between the individuals (Ilut, 1997). When an individual is linked in a limited or, extremely, only one cluster, he/she is in fact into a "family network" in Granovetter perspective.

According to the "Six Degree of Separation" principle (Milgram, 1967) everyone's contacts are as valuable as it can help him/her to reach an individual outside his/her network in as less possible steps. So, the wider the network, the easier is to rich a bigger amount of people in fewer steps.

Rotary tried, and succeeded, to use its network like leverage: it uses one/more connection(s) from inside the network to get individuals from outside the network to hear their message, to get support and resources from another part of the network. This involves a big amount of generating trust and a great capacity of crossing through a big number of clustered networks (Blau, 1972, Grootaert, 1998, Putnam, 1993, Zak, 2001).

Researchers have recently underline the importance of Internet-based linkages for the formation of weak ties (Granovetter, 1973), which serve as the foundation of bridging social capital (Putnam, 1993). Online relationships are supported by technologies like distribution lists, photo directories, and search capabilities (Vieweg, 2008), so new forms of social capital and relationship building will occur in online social network sites.

Studies are suggesting that the development of social capital into the online principally benefits those already privileged (Zinnbauer 2007), which may be the case of Facebook – the bigger social capital one's have, the bigger the chances are to have more friends and fans.

As the connection between social capital / networking and wealth is no longer questioned, this case study will try to answer another key question: how to raise the wealth through social capital?

3. FIGHTING VIRAL WITH THE VIRUS

Rotary International decided to initiate a huge viral campaign over the internet, in order to reach as many people as possible. The only goal of the campaign: to rise founds for the End Polio Project.

The main chosen channel was the Facebook network, as the biggest worldwide online social network.

Facebook statistics by continents			
#	**Continent**	**Users**	**Penetration**
1	Asia	276.031.440	6.81%
2	Europe	250.355.240	30.25%
3	North America	235.381.240	43.59%
4	South America	150.463.640	37.94%
5	Africa	52.047.640	5.11%
6	Oceania	14.521.080	39.18%

Largest Countries on Facebook		
1	United States	159.710.480
2	Brazil	70.411.620
3	India	63.868.420
4	Indonesia	48.191.160
5	Mexico	41.954.140
6	Turkey	32.817.160
7	United Kingdom	31.171.400

8	Philippines	30.565.500
9	France	25.398.580
10	Germany	25.041.020

Tab. 1 & 2. Facebook statistics.
Source: http://www.socialbakers.com

As it can be easily seen in the statistics of the United States of America, (Fig. 1) Facebook has a vast majority (round 80%) of its members aged 18 to 54 – exactly the "active" members of a society.

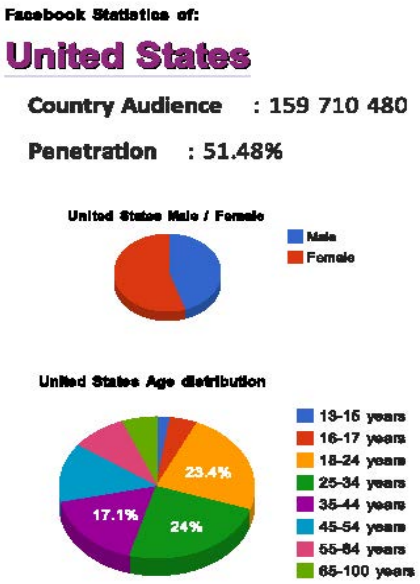

Fig.1. USA Facebook audience.

Bridging and linking social capital can eliminate poorness from communities (Szreter & Woolcook 2004), being strong social empowerment instruments (Woolcook 2001). By using Facebook's friends of friends networks the "world's biggest commercial" is generating bridging and linking connections (Woolcook 1998), which can provide access to wide informational support (Granovetter 1982).

The campaign started on Facebook was named "This Close" and is meant to show people around the world that the humanity is extremely close to eradicate for good one of the most terrifying disease: polio. One special application was created for Facebook so the users, fans of Rotary International Facebook page, could take and upload a picture with them self indicating a "space" between the left hand thumb and the index finger, picture that was further used to apply the message "We are *this close* to end polio" – with "*this close*" text being shown into that "space" between the left hand thumb and the index finger. That picture, with the Rotary International sign on it, could have been send later to friends on Facebook to promote the message. The campaign was promoted as shown in fig. 2.

Fig.2 Promoting "This Close" campaign.

Intuitively or not, Rotary International somehow knew the Zinnbauer law about benefits those already privileged (2007) so they assured themselves to have as many "privileged" supporters with them; so they convinced to join the campaign "brand ambassadors" like, beside many others, Her Majesty Queen Noor of Jordan, Jackie Chan, Ziggy Marley, Bill Gates or, the most rated star of the moment: Psy. (fig. 3)

Fig.3. Brand Ambassadors of "This Close"

Fig.3. Brand Ambassadors of "This Close"

As trust it is not in information itself or into the technology that it delivers it, but it is into the individual that is delivering it (Fukuyama, 1996, Sztompka, 1999) those public figures comes to offer trust and add value to the network of relationship that Rotary build online. (Uzzi and Dunlap, 2005)

By gathering around them highly known "brand ambassadors", Rotary managed by "likes" and "shares" they received online to reach millions of other people, which is, potentially, a huge financial success for the project.

A business-like Rotary analysis shown that from the number of people that find out about polio, round 8% are offering a donation at an average of 25 USD per person. (Information on: www.endpolio.org)

So, this the way I found out that for Rotary International, by giving them access to my network of connection on Facebook, my network worth (potentially) 836 USD. (Fig. 4)

Fig.4. Facebook connections (potential) value.

4. CONCLUSIONS

Global Polio Eradication Initiative is one of the largest public-private initiatives of its kind that succeeded to save millions of children's lives and save millions from paralysis. The cost of a single vaccine is USD 0.60 yet, the total cost is huge. Rotary International, on its own, invested more than one billion USD since 1985; and this represent just round 14% of the total amount spend to eradicate polio.

Global Polio Eradication Initiative and Rotary's International work is a "by the book" example of how the power of network was used in the attempt to reach a great objective.

"The world's biggest commercial" is a masterpiece of getting trust and power through internet the social networks (Uzzi and Dunlap, 2005) by communicating "viral" and motivating people to involve and using the resources of each member in a way that created the most privileged campaign (Zinnbauer, 2007).

Polio is still out there and, even if it looks like being so little to do until definitely eradicating it, a heavy work it still need to be done. And the major challenge is not represented by money! No, this can be solved, as had already been done. The major challenge that Global Polio Eradication Initiative is now

facing is the poorness (if not total lack) of connections, as in network, into the three remaining countries with polio cases: Afghanistan, Nigeria and Pakistan – countries devastated by wars, with totalitarian leaders and low level of trust.

Succeeding to create strong connections into those three countries and keeping good and functional relations into the rest of them is the real key in eradicating polio and generate prosperity. (Fukuyama, 1996)

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THE ROLE OF PROFESSIONAL TRAINING PROGRAMS IN CAREER DEVELOPMENT - EMPIRICAL RESEARCH

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Abstract: *At present, lifelong education represents a necessity arisen from a changing society. The forms it takes are many, and vary from one education system to another, from one country to another. Organizations must have coherent programs on human resource development by providing members with opportunities to improve organization and career advancement.*
The results of the research show that people who have participated in training courses in recent years, and have developed communication skills, had acquired information applicable to the current activity and their participation was particularly determined by their personal motivation.
The empiric research presented in this paper is aimed to analyze the effectiveness of training courses in adult education. The study's objectives adress the need to increase the participation in adult training, in order to investigate the students' motivation in training and last, but not least, how much the participants could exploit the knowledge gained in these courses.

Keywords: *adult education, training course, career development, communication skills, motivation.*

1. INTRODUCTION

The option for a society based on knowledge requires investment in human resources development, so that the employees acquire new competences and accept occupational mobility.

At the same time, quality should be promoted when new staff is employed and lifelong learning strategies must be developed, to the benefit of numerous people.

Taking into account the strategic objective set in 2000, in Lisbon, for the European Union, namely to become the most dynamic and competitive economic space based on knowledge in the world, education and professional development have acquired a particularly important role within the Occupational European Strategy. [1].

As a result, the European Committee encourages cooperation among the member states and facilitates the coordination of their action in all the domains of social politics, particularly in professional development.

In a changing society, adults provide opportunities to recover what has been done, for subjective and objective reasons.

Therefore, the development / improvement of professional human resource represent an essential element in developing and maintaining staff motivation in organizations and institutions.

Within a society that is becoming more and more globalized, continuous professional development represents an issue that should concern each and every organization, as well as a means by which this organization can adapt to the requirements of the labor market.

Each organization needs to develop formation and development programs for human resources, by which they provide the

employees with formation and career development opportunities.

2. METHODOLOGY

The present paper aims at identifying the manner in which adults attend formation courses, especially professional training courses, how effective they are in professional formation, their motivation and last, but not least, the degree of applicability of the knowledge acquired at these courses.

The survey has been used as a research method, starting from a questionnaire that contains 10 items and which has been applied to a representative sample of 50 subjects belonging to various activity domains, from the public and private activity sector, rural and urban area.

The majority of the interviewed subjects is represented by women (85%) and develop their activity in the public sector (82%).

The sample is not a representative one, as it has been constituted in order to complete the research. This is the reason why the conclusions cannot be generalized, just having the role of guidance in further attempts of developing such programs [2, 3].

The main information required by the questionnaire addressed to the respondents have taken into account the following aspects:

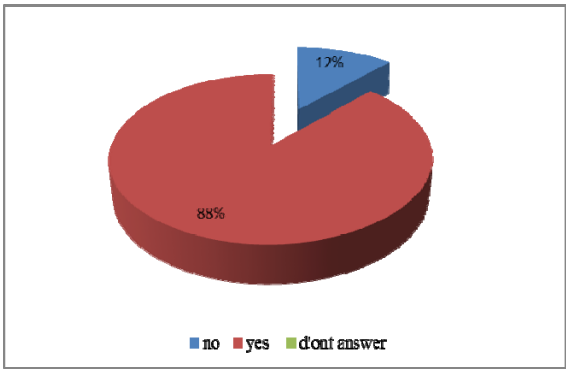
- the types of programmes which they have recently attended;
- their formation needs;
  - the type of motivation that determined their participation in the program (intrinsic/extrinsic);
  - the practical usefulness of the acquired knowledge;
  - the effectiveness of the attended courses.

The questionnaire has been distributed by contacting the 50 subjects directly. All the three questionnaires have been correctly filled in, and constitute the object of the statistic analysis.

3. RESULTS AND DISSCUTION

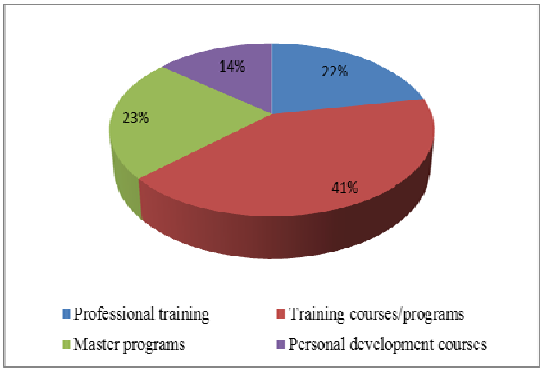
The first step of the research was represented by checking the concordance between the **present work position** and **the initial professional training**. From the total number of subjects, 88% consider that there is a concordance between their present work position and the initial professional formation, whereas for 12% their present work position is not concordant with the professional formation acquired throughout their studies (Figure 1).

Figure 1. Correlation between work and initial training



As regards **the subjects' interest in attending various formation courses**, the following conclusions could be drawn: From the total number of people who were interviewed in the survey, 46% stated that they had recently attended formation courses, out of which 24% attended master programs, 22% attended professional training, and 8% attended personal development courses (Figure 2).

Figure 2. Types of courses



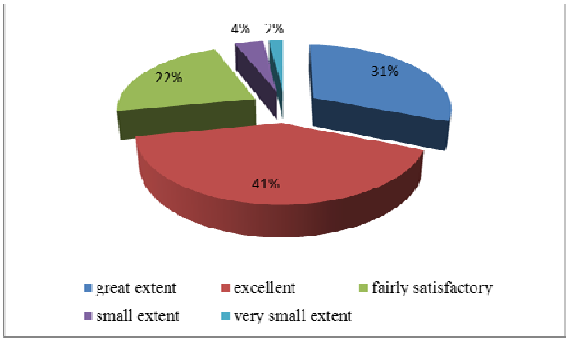
Training courses have been lately perceived as formation/specialization courses that take place within a short period, in an organizational context, and meet the

requirements of the economic environment. As a result, 41% of the subjects consider that **professional development by training courses is extremely important**, whereas 31% consider it important. A small number (2%) consider it of small importance, or attribute it no importance at all (2%).

These figures indicate the fact that the interviewed subjects consider training courses particularly important (especially at their work place).

When asked about the **extent to which the courses they attended improved their knowledge,** 31% of the subjects answered that the courses had a high contribution to their improvement , 41% of them considered that it was fairly good, 22% that it was moderate, 4% - a small extent, and 2% labeled this contribution as insignificant. It can be concluded that their effectiveness is acknowledged by a significant number of subjects (Figure 3).

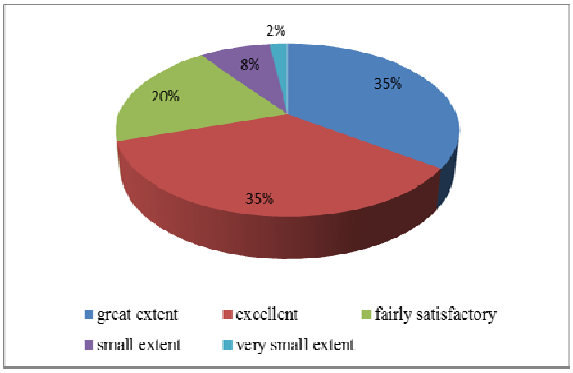
Figure 3. Improving knowledge after participation in training programs



According to the European Commission, one of the key competences that need to be developed throughout our life is the communication competence that should be acquired by the end of the compulsory education cycle and must be maintained and updated throughout our life.

Within the study that was completed, one of the questions referred to **the extent to which communication competences are developed by attending professional training**. More than 70% of the interviewed subjects consider that by attending training courses they develop communication competences to a high extent, whereas only 8% consider that communication competences are improved to a small extent , and a mere 2 % - a very small extent (Figure 4).

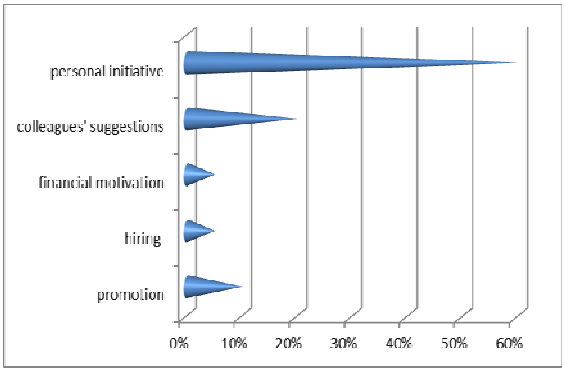
Figure 4. Improving communication skills



Another aspect under discussion referred to **the adults' motivation in attending professional formation courses.**

As a result of the subjects' questioning on this particular aspect, 60% answered that they had attended the courses because they had been aware of their formation needs, whereas 20% were influenced by their colleagues' suggestion, 5% had a financial motivation and 10% attended the training courses in order to advance their career (Figure 5).

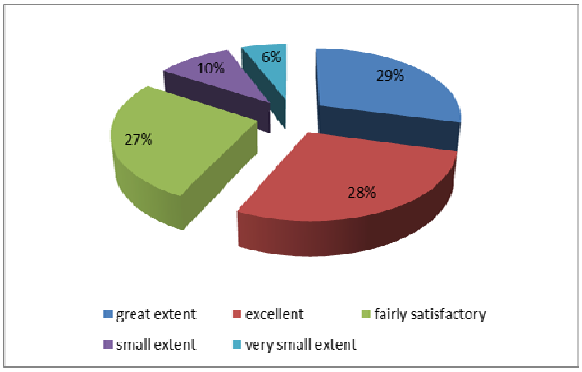
Figure 5. Motivtion of participation in training programs



One of the aspects that was taken into account in our survey was the subjects' **satisfaction level towards the most recent formation course they had attended.**

To this purpose, the subjects were asked to assess the formation program they had attended taking into account the following factors: contents, the relevance to their professional activity, the balance between the theoretical and practical preparation, the trainers' activity, the formation methods, and so on.

Figure 6. Satisfaction get through participation in the last training course

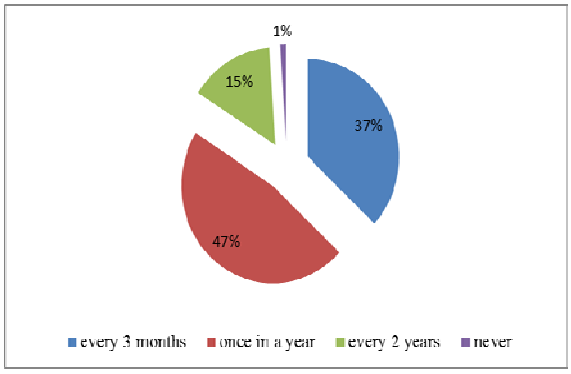


The aspects that raised the subjects' expectations were – according to the subjects' assessment: 29%- to a great extent; 28%- excellent, 27%- fairly satisfactory; 10%- to a small extent, and 6%- to a very small extent (Figure 6).

When questioned about the **usefulness of the attended courses ,** and whether they had helped them in their career, 27% of the subjects answered that the courses had been extremely useful for their career, 26% considered them useful, 29 % considered them of moderate usefulness, 14%- to a small extent, and 4%- to a very small extent.

Regarding the regularity of training sessions, the interviewed subjects stated that – in order to acquire new professional competences- an employee should attend training courses once a year, (47%), every three months (37%), or every two years (16%) (Figure 7).

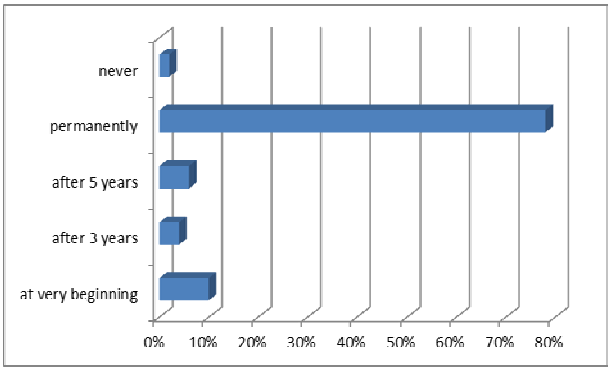
Figure 7. Training'participation frequency



Related to the previously mentioned issue, we have investigated the extent to which the competences acquired during the training programs were put into practice. 39% considered that their participation in courses had improved their performances moderately, 29%- to an important extent, 22%- to a very important extent, 8%- to a very small extent, and 2% to a small extent (Figure 8).

If we take into account the moment in their career when the training courses are particularly useful, almost 80% consider they are permanently necessary, whereas 10% consider them useful at the beginning of one's career.

Figure 8. Appropriate career period in which training courses are useful



It should also be mentioned that, within the training courses, besides the professional competences, communication and relation competences are also improved, taking into account the fact that 31% of the subjects made friends during the training courses.

4. CONCLUSIONS

As a result of the study, we have come to the following conclusions:

- a fairly large proportion of the questioned subjects work in the domain for which they have been prepared. For most of them, professional training plays an extremely important role in the career development, seen as a specialization within the organization.
- attending training courses leads to the improvement of professional competences.
- more than 70% of the respondents consider that they have improved their communication skills, after their participation in the training sessions.
- a positive aspect would be the fact that, in many cases, the respondents' motivation is intrinsic, as they are aware of the necessity of professional training, as well as the importance of career development.
- the majority of them (53%) appreciated the utility of the acquired knowledge and the necessity of attending courses, at least once a year. Another consequence of their participation in the training, alongside communication competences, is represented by the improvement of professional and relational competences.

Overall, the study points out that the people who have recently attended the training courses, have developed their communication competences. Moreover, the acquired information was applicable in their current activities, and the respondents were intrinsically motivated.

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EMOTIONAL ABUSE - DEPRESSIVE INDEX IN SCHOOL ENVIRONMENT

Maria Dorina PASCA

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Abstract:

***Aim**: the present paper work wants to outline the fact that emotional abuse may be at a certain moment one of the indexes of depression in school environment. **Methods**: observation, conversation, talk, case study. **Summary of results**: the entire structural demarche outlines the fact that, at the level of school population, in certain situation, it is exercised the emotional abuse by different persons under various forms, which determines an attitude and a special developed behavior, which may finally be found through the indexes that decode depression in educational environment, the pupil being considered in most cases vulnerable and emotional instable. **Conclusions**: centering in the near future on the necessity of involving the development factors (environment, education, and heredity) in decreasing/ eliminating the emotional abuse in school environment.*

***Key words**: child, emotional abuse, depression.*

1. INTRODUCTION

Our structural demarche has in the center of attention those elements that indicate the fact that the emotional abuse exercised on the child in general and especially in school environment, may be considered at a certain moment as forerunner of the depression state developed at this age.

Thus, if we start from the fact that by definitions:

a) – the abuse is a violent manifestation against children taking advantage from the difference of force between child and adult, coded under its form: physic, sexual, economic and emotional (psychological) Pasca M.D. (2006).

b) – depression is a morbid state more or less durable, characterized mostly by sadness and a decrease of tonus and energy; anxious, disgusted, discouraged, the depressed subject is incapable to confront with the slightest difficulty, being also lacked of any initiative, suffering because of his intellectual inability, the attention and memory being degraded, and the inferiority feeling that result from this increases more his melancholy – Larousse – The Dictionary of Psychology (1966), in their conetextuality the two attitudes, transformed in time in behaviors require an approach that determines the involvement and awareness of the resultant. In its internal structure the emotional abuse decodes distinctive forms as those that have in the center of action the child- actor, finding this one in:

a) – rejection = the adult casts away from the child, refuses to recognize his value or legitimacy of needs;
b) – isolation = the child does not have the possibility of establishing some social contacts or may be isolated in an area without social interactions;
c) – terrorizing = the child is verbally threatened, intimidated and scared with physical and psychological "weapons";
d) – degradation = the child is treated as inferior, humiliated and depreciated, deprived of dignity;
e0 – corruption = the child is encouraged and guided to develop antisocial acts that lead to criminal and social unaccepted behaviors;
f) – exploiting = the child is used in advantage and for adult's use;
g) – denial of emotional response = the adult in who's care is the child ignores of neglects the child (from an emotional point of view also).

2. METHODOLOGY AND RESULTS

Starting from the elements that define the emotional abuse, in the context of the information mentioned above, it is shaped the profile of some patients that belong to those personality types with no self-control, dominated by impulsivity and aggressiveness. Among the psychological factors that code a certain state we can enumerate those that represent parents:
a) – with rigid personality, devoid of warmth and empathy toward child;
b) – affective immature that develop mechanism of dependence toward the conjugal partner, neglecting the child;
c) – affective immature and incapable to exercise the role of parents;
d) – were put under multiple states stress (divorces, marital conflicts, deaths, residence changes);
e) – have unrealistic exercitations, oversized toward child's behaviors, developing unconsciously protections mechanisms;
f) – had attachment disorders in their childhood, becoming anxious parents;
g) – have different forms of psychopaties belonging to the category of antisocial or histrionic personalities.

We have to outline that abuse, in our case the emotional one, has extremely serious effects on the child, who will live developing his: fear, phobias, obsessive memories, insecurity and guilt feelings. We can add also: critics, fight, insults, humiliation, interdictions, obligating and threatening, found mostly in the modalities of attitudinal-behavioral expression of the actor – child found in school environment.

Under such e description of "qualities" that mark the emotional abuse, we can distinguish the profile of the child emotionally abused under the form of his manifestations like:
- somatic = by loosing appetite, sleep disturbances, nightmares;
- behavioral = develops manifestations like: apathy, isolation, avoiding relation with other, negativism, hostility and aggressiveness;
- cognitive = appear difficulties that lead to a lack of intellect, disinterest for schoolwork assignments, decreasing school performance and thus appearing school failure.

After the evolution of those former mentioned it is shaped the place where it appears as conflict state between pupils and teachers versus teachers and pupils, the emotional abuse being the school- as identity in these conditions of some concepts that exceed the normal ones of education and instruction perceived as de-facto in such a place. It came to these situations starting from the fact that using a punishment risks a physical abuse which determines the emotional involvements also, that may appear at a certain moment. It is preferable even if it is developed a conflict between the two actors – the pupil and the teacher, this should not generate abuses, mostly emotional, for the first one. Cultivating thus the emotional abuse through permanent labeling of student in school, lead to

lack of trust and self esteem, to psychic immaturity, but mostly, to developing in time the behaviors of risk that may release at the right moment the deviance arriving to juvenile delinquency and not only.

3. CONCLUSIONS

Thus, outlining the risk factors in school environment- as part of emotional abuse appearance send to:
a) – insufficient knowledge of the child's rights;
b) – perpetuation of punitive educational model;
c) – overloading of school curriculum;
d) – faulty connection between school and family;
e) – the presence in school environments of some groups with delinquency potential and lack of involvement from those responsible in protecting the pupils.

Under such circumstances it is visible the connection that may outline the emotional abuse as index of depression appearance in school environment, the compatibility being clear. Thus it is necessary to review the educational act on the child and also his existence as a being, establishing a new vision upon the quality-value evolution of this one.

Rethinking of some social-economical structures which should ensure the safety and stability of the family and of the volitional existence also will surely reduce the anomalies so frequently seen today from early ages and up to old age. Thus our logistic demarche wanted to be an alarm signal on the new behaviors of attitudinal-behavioral risk that may appear at this age in school environment.

Therefore through programs of prevention of social immaturity and instability, of reconsidering the institution of family and of redefining the educational act we will get, metaphorically speaking: "talking nice and greeting each other, allowing our kids to play on the street, showing affection towards them, loving and respecting them". Than we surely have found the way of reducing the emotional abuse in school environment and not only, making and mostly giving to our children, together with our love, the childhood that they whish to have, because they deserve it.

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EVIDENCES OF THE EXTERNAL VALIDITY OF A TESTS BATTERY USED DURING THE PSYCHOLOGICAL ASSISTANCE TO OFFICERS SPECIAL TRAINING COURSES

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Abstract:
Problem Statement: *To establish the predictive value of the selection psychological tests battery of officers candidates for special training we studied validity related of criterion.*
Purpose of Study: *The purpose of our research was to identify all predictors of an extensive battery of personality and aptitude tests for selection and psychological assistance for officers' success in the special, intensive training course.*
Research Methods: *As part of the program for psychological assistance and training, an extended and complex battery of tests, that included* ***9 tests for general and specific aptitudes and 12 tests for traits of personality,*** *was applied to the selected officers before and during special training attended (N = 42, 3 school series, average age was 35).As a source of criterion-indicators for success at the end of training: 1) the final marks given by the military instructors and teachers for the specialty subjects (evaluation by supervisor ratting); 2) the results of standardized socio-metric (SOCIO) and peer inter-evaluation tests (INTER - PE) we developed(the evaluation by peers based on composed and various interpersonal and task criterion- self-evaluation, peer inter-evaluation);3) evaluation by the psychologists (assessment by experts).*
Findings*: 15 out of 19 indicators of aptitude tests and 39 out of 40 indicators of personality tests were significantly associated with the criteria and have created a significant Spearman correlation ($p \leq .05$). External validity of personality tests was enhanced with values of correlations with selected criterion-indicators ranging from $r_s = .40$ to $r_s = .76$ ($p \leq .02$).Increased the number and intensity of evidences of the external validity of personality tests compared with cognitive aptitude tests and therefore increased the predictive value of psychological evaluation, both in the selection for such courses and probably in future promotions.*
Conclusions: *Psychological evaluation during the special training courses provided multiple evidences of high predictive capacity of the aptitude and personality tests battery used. In order to build a linear multiple regression model a cross-validation study is needed. Because classes of officer-students represent a too small group (less than 25 in a school series), caution is required.*

Keywords: *external validity, tests battery, officers special training, military psychology*

1. INTRODUCTION

The military activity in operational-intelligence area is a special, complex and stressing activity requiring high mental and personality qualities, as published studies and papers on the topic show.

One of the operational methods used to establish the predictive value of the psychological exam for the selection of officers for special (operational-intelligence) tasks is the study of validity of indicators obtained in psychological tests compared to criterion-indicators regarding performances

and behavior of the selected officers during an advanced specific training course.

Research was part of the program for psychological assistance and training we implemented during the 9 month post-academic military intelligence course. After teaching the psychological topics (6 topics in 45 hours) and after the tests are completed, the psychologist, in his capacity of military instructor, gives a final mark representing the way he evaluates student's knowledge about the topic. The final mark for psychological training is taken into account together the final marks obtained for specialty knowledge when in the military intelligence course final graduation marks calculated.

2. OBJECT AND METHOD

The psychological examination meant to select officers who are to attend the 9 month post-academic military intelligence course lasts 2 days. In the first day, the collective exams proceed and take 8 hours and in the second day individual examinations take place - 2 hour for each candidate.

Selection base is assured by recruiting twice or 3 times more candidates than the 25 available places in a lot. The candidates belong to all arms and specialties, are 27 to 45 years old and graduated military or civil higher education schools. Besides psychological examination, they go through a knowledge exam and a foreign language (English, French, German or Russian) exam. 2 student groups (2000 and 2001, N=42) were used for research. The same extended and complex batteries of tests were used for all of them, both before and during the course.

During the psychological training and assistance we provided, we applied standardized sociometric (with a form we developed) - SOCIO - and peer inter-evaluation - INTER-PE tests, all along the course and at optimal intervals. The SOCIO test periodically investigates nature of interpersonal relations and provides partial and global indicators for students' integration in the group (intensity of collective positive and negative evaluation, the total and mutual number of positive and negative evaluation relations, sociometric and reputation state of each member of the group, the positive and negative features indicated by the group as well as the individual indicators for perception of positive and negative relations in the groups' interpersonal space, etc.). The peer inter-evaluation test INTER - PE challenge group members to evaluate themselves and the others, using marks on the scale from 1 to 9, based on the criterion of their performances as far as their training (in the main specialty subjects) is concerned: operational training level, intelligence training level, discipline, physical-sportive aptitude level, creativity, theoretical knowledge, activism, etc. - as well as based on behavior in interpersonal relations and professional conduct such as: agreeableness, credibility, self-improvement spirit, emotional self-control, cooperation, tendency to dominate, diplomacy, courage, sociability, tenacity, etc. Indicators of self-evaluation and collective evaluation are thus obtained. By the help of automated data processing program - PC - derived indicators are obtained: the difference between self-evaluation and collective evaluation, dissonance or consonance of inter-evaluations for each member of the group and for each feature or criterion taken into account for self- and inter-evaluation. The results or individual raw scores obtained for both laboratory and standardized personality tests as a result of investigation of interpersonal relations within the group were transformed into T standard marks for the group in order to diminish errors which may appear when non-standard scores are used.

The initial extended and complex psychological test battery, used before and during the course for selected officer specific training as part of the program for psychological training and assistance, included: **9 general and specific mental aptitude tests** applied in a limited time as follows:

1.GI-1-GI-4 - non-verbal general intelligence (N-GI) and verbal general intelligence (V-GI) tests, translated and adapted by us in the Romanian language, after the Belgian psychologist Azzopardi G. (1993) - 30 minutes x 2 parallel versions;

2.DA - Prague distributive attention, 16 minutes;
3.CA - concentrated attention (a test taken into account for calculation and tiebreak) - 5 minutes;
4.VAM - verbal-aural memory, our own version - 7 minutes;
5.GVA - general verbal aptitudes, our own version with its subtests (GVS_1 - synonyms - 2 minutes; GVA_2 -endings - 10 minutes; GVA_3 - sentence logical arrangement - 8 minutes; GVA_4 - proverb analysis - 10 minutes; GVA_5 - foreign language decoding - 10 minutes; GVA_6 - essay analysis -10 minutes).
6.EWCI - resistance to word-color interference, resistance to stress test, STROOP - 16 minutes;
7.RIST - resistance to information stress test translated and adapted by the Romanian psychologist M Toma after W. Bernard and I. Leopold (1988) - 5 minutes;
8.PI - psychological intuition test translated and adapted by the Romanian psychologist P Popescu - 20 minutes;
9.AVT - associative-verbal test, applied in individual version to obtain 3 indicators: verbal reaction spontaneity (VRS), verbal reaction consistency (VRC), immediate memory of association (IMA); test adapted after the Romanian psychologist V Ceausu - 30 minutes.

12 personality tests:

1.FPI - G version - Freiburg multi-phased questionnaire, after Fahemberg, Sely and Hampel, 212 items, with 12 scales: nervousness (N_1), aggressiveness (A_2), depression state (D_3), emotional state (E_4), sociability (S_5), calmness (C_6), tendency to dominate (TD_7), inhibition (I_8), open behavior (O_9), extravert behavior (E_{10}), emotional instability masculinity (M_{12}) - 30 minutes.
2.14PF - multi-phas ed questionnaire with 14 scales, 173 items, adapted by us from Russian, after Melnikov and Iampolski (1985); it investigates the following factors: neurotic behavior (N_1), psychotic behavior (P_2), depression (D3), conscientiousness (C4), impulsiveness (Im5), general activism (A6), timidity (Ti7), sociability (S8), esthetic sensitiveness (Se_9), femininity (Fe_{10}), psychic instability (Pi_{11}), asocial behavior (As_{12}), introvert behavior (I_{13}), and sensitivity (S14).
3.T - temperament questionnaire translated and adapted by us from Russian, after Rusalov (1989), 105 items and 9 scales: energetic potential for activity (EPA), energetic potential for communicating (EPC), plasticity in activity (PA), plasticity in communication (PC), activity tempo (AT), communication tempo (CT), emotional behavior in activity (EA), emotional behavior in communication (EC) and tendency to lie (L) - about 20 minutes.
4.IE - internalism/externalism questionnaire after Allan and Potkey (and they adapted it after Rotter), including 25 alternative items (a, b) - 10 minutes.
5.IE-CT - internalism /externalism and resistance to rumors (R) questionnaire, including 56 items, adapted by us after the Romanian psychologist S Chelcea;
6.CHAR - character investigation questionnaire after Gaston Berger, 90 items and 9 scales: emotiveness (E), activity (A), resonance (R), conscientiousness depth (D), Mars spirit (M), avidity (A), sensorial interests (SI), tenderness (TE) and intellectual hobbies (IH) - 15 minutes.
7 TEQ - temporal experience perception questionnaire, including 80 items, adapted by the Romanian psychologist V Preda (1978); it investigates the following factors: rigidity (1R), flexibility (1F), discontinuity (2D), continuity (2C), delay (3D), programming

(3P), instability (4I), stability (4S) - about 20 minutes.

8 MBTI - Meyer-Briggs preference type indicator, G version, including 126 items; it was translated and adapted by us from English, after authors' book; it includes scales for the following types: introvert (I), extravert (E), sensorial (S), intuitive (N), feeling (F), thinking (T), perceptive (P), and judging (J); their combination results in 16 personality types (cognitive styles) - 25 minutes.

9. LBA - leader behavior analysis test; it was translated and adapted by us after the American authors K.Blanchard, R. Hambleton, D. Forsyth, D. Zigarmi (1991); it comprises 20 problem-situations and provides data about the preference for 4 leadership styles: High Directive and Low Supportive Behavior (S_1); Low Directive and High Supportive Behavior (S2); High Directive and High Supportive Behavior (S3); Low Directive and LowSupportive Behavior (S4); 2 of the indicators are synthetic and they investigate: effectiveness (Efs) and flexibility of style (Fxs) - 25 minutes.

10. L.H. - loyalty/honesty test; it is collectively applied and it provides standard conditions for *"bringing about"* a tendency to dishonesty and *"deception"* - 25 minutes.

11. R - resistance to frustration projective test; it is adapted after Rosenzweig and formed by us for collective application; it includes 24 sketches with answers from which you can choose - about 20 minutes; results are obtained for the following indicators: group conformity indicator (G.C.R.), extra-punitive reaction (E), intra-punitive (I), punitive (M), obstacle domination (OD), ego defense mechanisms (ED), need persistence (NP). **12. Anamnesis record and psychological interview** investigates the biographical data in order to qualitatively interpret them based on the psychometrical data.

We used the following criterion-data to validate all test- and non-test information:

1. **evaluation based on marks by the military instructors** as far as the main specialty topics are concerned and final graduation mark obtained at course - 7 indicators in total (supervisor ratting);
2. **INTER- PE standardized test indicators** - 20 criteria and 80 indicators (self-ratting and peer ratting);
3. **SOCIO - standardized sociometric test indicators** - 12 indicators (peer ratting, interpersonal perception);
4. **evaluation based on marks by the psychologist** as far as psychological training is concerned - 3 indicators (expert ratting).

Given that the class-groups include less than 30 students, Spearman method, correlation based on rank or correlation among classifications was used to achieve inter-correlations.

Only the validity indicators for risk threshold $p<.05$ were taken into account.

3. HYPOTHESES

H1. The psychological evaluation and assistance during the officer specific training courses may have both a formative and a diagnostic and predictive role as to the success of training process and the interpersonal behavior of graduates, provided that evidences showing the aptitude and personality test validity will increase.

H2. Improvement of validity of test-indicators used for psychological evaluation of the officers attending such specific training courses is possible by solving the issue of success criteria. It may be achieved by standardization of some methods and procedures for group interpersonal relation investigation (peer inter-evaluation test - INTER-PE and sociometric test - SOCIO) as well as by application by instructors and experts (evaluation by supervisor ratting) of partial and global evaluation indicators.

H3. As far as the officer specific training courses are concerned, the number and intensity of personality test validity evidences compared to aptitude test validity evidence is likely to increase and therefore to bring about an increase in predictive value of the psychological evaluation both for selection of officers for such courses and their future promotion.

4.RESULTS AND DISCUSSIONS

Calculation of simple linear correlation (Spearman rank based correlation method) between the 59 tests-indicators (provided by 20 aptitude and personality tests) and the 124 criterion-indicators (104 provided by INTER-PI, 12 by SOCIO and 8 by evaluation marks given by instructors) resulted in the validation of 54 tests-indicators, for a $p<0.05$. The same psycho-diagnosis and criterion-data collecting methods were used for 2 groups of students, in 2 successive years (2000 and 2001), 42 subjects in total. Validity related to criterion coefficients of psycho-diagnosis test battery covered the values ranging from r=0.42 to r=0.72. Coefficients of inter-correlation of criterion-indicators reached sometimes values of up to r=0.90 (proving a high construct validity between some external criteria). The maximum numbers of criterion-anchors (statistically significant correlation coefficients) for a test-indicator are as many as 6 (the score for the general verbal aptitude test- GVA-T, the score for lie scale- L, from temperament questionnaire- T). Also, the maximum numbers of test-indicators validated by one and the same criterion-indicator (operational aptitude level) reach the value 10 (9 test-indicators are established by personality tests) - see *Table 1.*

TABLE 1: *TESTS- CORRELATES OR PREDICTORS FOR OPERATIONAL APTITUDE CRITERION-INDICATOR LEVEL (N=42)*

No	Test-Correlates Predictors	Test and Predictor Symbol	*r*	*p*
1.	Feeling Decision Style	M.B.T.I.-F	-.60	.001
2.	Timidity	14 P.F.-Ti_7	-.57	.005
3.	Thinking Decision Style	M.B.T.I.-T	.55	.005
4.	Internalism	I.E.-I	.49	.02
5.	Effectiveness Behavior Style	L.B.A.-Ef.S.	.49	.02
6.	Tendency to Dominate	F.P.I.-$T.D._7$	-.45	.05
7.	Loyalty and Honesty	L.H.	.45	.05
8.	General Verbal Aptitude	$G.V.A._6$	.44	.05
9.	Plasticity in Activity	T-P.A.	.44	.05
10.	Mars Spirit	C.A.R.-M.S.	.42	.05

APTITUDE TESTS

15 test-indicators out of the 19 indicators resulting from 9 aptitude tests were validated; they considerably correlate with the 26 criterion-indicators (23 – INTER-PE, 2 - evaluation marks given by instructors, 1 - SOCIO). Validity coefficients have ranged from r =.44 to r =.66 and the percentage of validated indicators out of the total number of those verified was about 70%. Table 2 includes the most significant 8 predictors of aptitude test compared to soft criterion-indicators of success we used for psychological assistance and evaluation of students attending post-academic specific training course.

TABLE 2: *APTITUDE TESTS AND THEIR CRITERION-CORRELATES (N=42)*

No	Test Indicator Symbol	Psychic Attribute	*r*	p	Validity Criterion
1.	VAM	Verbal-Aural-Memory	.66	.001	Collaborative Spirit
			.50	.05	Dissimulate Capacity
2.	RWCI	Resistance to Word-Color Interference	.62	.005	Collaborative Spirit, *Self Ratting*
3.	GVA-T	General Verbal Aptitudes -Total Score	.61	.005	Collaborative Spirit, *Self Ratting*
			.60	.005	Foreign Language Mark
			.52	.02	Final Mean Graduation Mark
4.	PIT	Psychological Intuition	.59	.01	Tendency to Dominate, *Self Ratting*
			.53	.02	Collaborative Spirit, *Self Ratting*
	DA	Distributive Attention	.55	.02	Emotional Self-Control
5.	DA	Distributive Attention	.53	.02	Dissimulate Capacity
			.51	.02	Courage
6.	GI-T	General Intelligence Total Score	.52	.02	Tendency to Dominate
			.46	.02	Negative Chooses of Collective Members
7.	AVT-VRS	Verbal Reaction Spontaneity	.50	.05	Dissimulate Capacity
8.	GVA-6	Essay Analysis Aptitude	.44	.05	Operational Intelligence Level

The constructs on which measurement of criteria-variables was based - evaluation, self-evaluation and inter-evaluation of behavior and school performances in the specific interpersonal context - explain, in our opinion, the high value of r >.40 of coefficients indicating correlation between aptitude test results and behavior indicators that may be observed for this category of officer-students. Soft methods and procedures used to obtain criterion-data are applied to complex behaviors *"contaminated"* by attitude factors and considered to be synthetic features of the behavior and personality. In the military groups in special units, personality factors seem to play a more and more important role in the professional and inter-personal conduct.

PERSONALITY TESTS

39 indicators out of the 40 indicators obtained by the help of 11 eleven personality tests were validated covering 84 criterion-indicators (65 INTER-PE indicators, 11 indicators of evaluation by instructors and 8 SOCIO indicators). Validity coefficients range from r =.42 to r =.76 which indicates an increase in their number and intensity compared to aptitude test indicators. Out of the total numbers of personality test indicators verified by the help of established external criteria, 90% were validated during our research, meaning an increase of 20% compared to aptitude test validity.

The fact is surprising given that the behavior of the same person changes generally according to the situation. This is why some authors concluded that the value of personality test validity coefficient, when the tests are used to predict an action, cannot be higher than .40 (Funder, 1983).

TABLE 3: PERSONALITY *TESTS AND THEIR CRITERION-CORRELATES (N=42)*

No	Test-Indicator Simbol	Personality Attribute	*r*	*p*	Validity Criterion
1.	T-EPA	Energetic Potential for Activity	***.76***	***.001***	Dissonance among Inter-Evaluations on **Diplomat** Criterion
			.73	***.001***	Dissonance among Inter-Evaluations on Orderly Criterion
2.	TEQ-2C	Continuity in Activity Planning	***- .67***	***. 001***	Positive Choices Number Obtained in collective Collective
			- .56	***.01***	Agreeableness
3.	T-L	Tendency to Lie	***.67***	***.001***	Self Ratting Level on Creative Criterion
4.	TEQ-2D	Discontinuity in Activity Planning	***.63***	***.005***	Mean Graduation Mark of Final Paper
			.57	***.01***	Creative Criterion
5.	T-AT	Activity Tempo	***.62***	***.005***	Tendency to Overvalue Owen Physical-Sportive Skill Level in Self Ratting
6.	MBTI-F	Feeling Decision Style	***.60***	***.005***	Operational Aptitude Level
7.	LBA-S_1	High Directive and Low Supportive Leadership Style	***- .55***	***.01***	Mean Graduation Mark of Final Paper
			-.54	***.02***	Final Mean Graduation Mark
8.	IE-I	Internalism	***.53***	***.02***	Courageous
9.	LBA-S_3	High Directive and High Supportive Style	***.52***	***.02***	Mean Graduation Mark of Final Paper
10.	TEQ-3D	Delay	***-.52***	***.02***	Sociometric Status Level
11.	IE-CT-R	Resistance to Rumor	***.52***	***.02***	Final Mean Graduation Mark
12.	TEQ-1F	Flexibility	***.50***	***.02***	Sociometric Status Level
13.	R-M	Impunitive Reaction to Frustration	***.50***	***.02***	Prestige Status Level

Table 3 shows the most powerful 13 predictors (r >.50) of personality tests taking into account the criterion-indicators used for psychological assistance and evaluation of the students.

Table 3 shows the high values of validity coefficients for the 13 personality features diagnosed by the help of 6 questionnaire type test (T, T.E.Q., I.E., I.E.-C.T., M.B.T.I. and L.B.A.) and for a projective test (R=Rosensweig) and the criterion type individual values obtained by application of the standardized peer inter-evaluation tests (INTER-PI) and sociometric tests (SOCIO) and evaluation by instructors (mark for written final paper, final mean mark).

A high dissonance among inter-evaluations for **diplomatic person** (r =.76) and **disciplined person** (r=.73) criterion is

recorded for the officers who describe themselves, by temperament questionnaire (T), as having a **highly en ergetic potential fo r activity** and those officers tend to arouse controversy in the group inter-evaluations for these criteria. Also, those who describe themselves, based on time perception questionnaire -T.E.Q, as having a feeling of continuity in activity planning, enjoy a low number of positive choices in the group when sociometric test is applied (SOCIO for r = -.67) and receive low scores for **agreeable** criterion when peer inter-evaluation test (INTER-PE for r = -.56) is applied. Also, those officers who describe themselves, based on the same test, as having a feeling of **discontinuity** in activity planning (2D) are likely to have high chances to receive high scores as far as evaluation of course final paper by the instructors (evaluation committee, r =.63) is concerned, and high scores as far as peer evaluation for **creative person** criterion (r =.57) is concerned. Officers obtaining high scores for lie scale of temperament questionnaire - T (r =.67) tend also to obtain high scores for self-evaluation as far as **creative** criterion is concerned. For the same temperament questionnaire, the students describing themselves as having high activity tempo tend to overrate physical aptitudes criterion of the peer inter-evaluation test (INTER-PE, r =.62). The persons obtaining high score for internalism-externalism questionnaire (I.E. -I) are very likely to be perceived and receive high scores for **courageous** criterion (r =.53). The students describing themselves as having a mainly feeling decision style (M.B.T.I.- F) are very likely to obtain low scores at inter-evaluation test for **operational ap titudes** criterion (r = -.60). The persons giving, at the behavior style analysis test, answers that include them in **high directive and low supportive behavior style** (S1-authoritative persons) tend to receive low marks from instructors both for the written final paper (r = -.55) and the other subjects included in the final graduation mark obtained at graduation (r = -.54). On the contrary, those who, given their answers, are included in **high directive and high supportive behavior style** (L.B.A.- S3) tend to receive high marks from the instructors for the written final paper (r =.52). The high score obtained for **delay** factor -(T.E.Q - 3D) entails a low level for the **sociometric st atus** the student obtains for sociometric test -SOCIO (r = -.52). The subjects obtaining high scores for **resistance to rumors scale** of I.E.-C.T. questionnaire are likely to receive high marks from the instructor and therefore a high final mean graduation mark (r =.50). A high score for **flexibility s cale** (T.E.Q.- 1F) entails a high level for SOCIOMETRIC STATUS (r =.50). Finally, the students who are diagnosed by the help of projective test (R - Rosenzweig) with **impunitive reaction of tolerance to frustration** (M) are very likely to reach a high **prestige status** obtained by the help of the sociometric test(SOCIO, r=.50).

5.CONCLUSIONS

Our observations resulted in the following conclusions:

1. The evidences proving validity of some indicators of psychological assistance and evaluation carried out during the post-academic officer specific training course reveal and increase the list of psychical features of optimal personality profile taken into account in psychological examination of the military selected for special tasks of operational-informative type. Thus the first hypothesis we investigated during our research is confirmed.
2. Unlike other authors who found a low predictive value for personality tests and questionnaires (values of correlation coefficients was not higher than .40), we found **considerably pow erful correla tions** ranging from r =.42 to r =.76. A possible explanation for it is that the criterion -data establishing method was improved, on one hand, and that we identified and adopted the personality tests appropriate to the goal we had in mind, on the other hand (2nd hypothesis).
3. The results of standardized test for group inter-personal relation investigation (we used for data processing and application our own original versions of sociometric test - SOCIO, and peer inter-evaluation test - INTER-PE) have solved the complex problem of success in the officer intensive specific training for

special missions and at the same time they may be used as **powerful predictors o f success in operational-i nformative activ ity of the a rmed forces** (which confirms the 3rd hypothesis).

4. The conclusions of psychological assistance and evaluation during post-academic courses for officer training, together with final mean marks can be, in our opinion, **the best** (for now) **predictors fo r selection and promotion of officers for operationa l-informative type special missions**.

5. Additional studies for validation (counter-validation) of test batteries used for selection of officers for special courses and missions are needed because such courses are attended by small groups (as many as 25 students); we observed only 2 series of officer graduates (N=42); the number of subjects has to be increased by accumulation in order to calculate multiple regression equation coefficients and the test battery has to be applied in the same standard conditions for more student groups.

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SHOPPING AS DETERRENCE? INDIA'S MILITARY ACQUISITION POLICY, BETWEEN IMPROVISATION AND THE PURSUIT OF PRESTIGE

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Abstract: *As technological achievements, weapons are pursued by states not only for security reasons but as a way of enhancing prestige. On a wider philosophical frame, arms acquisition is seen by developing and third world countries as a vector of modernity. In this respect, India's postIndependence elites envisaged building up a modern military, both on conventional and nuclear terms, albeit the way to achieve such goal was not always clear. As today's most avid weapons purchaser in the world, India security policy is ambiguous. Far from showing financial prowess, Indian political and military establishment seems caught in what Stephen P.Cohen and Sunil Dasgupta label – "arming without aiming syndrome."*
Following their work, this present article will try to show that Indian military acquisition policy is fashioned by a blurry and incoherent bureaucracy and also that such martial shopping spree will channel funds from civil needs and probably create a spiral of fear in the South Asian subcontinent.
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Keywords: *India, militarization, modernization, Veblen effect, prestige, deterrence*

For the last few years India has been one of the most avid buyers of weaponry on the international market. In 2011 New Delhi has topped everyone else to become world's largest arms buyer, according to SIPRI. Between 2007-2011, Indian military equipment purchase was worth $12.7 billion, while China's only $6.3 billion, roughly a half of its southern neighbour and rival (Kumar: 2012). It is tempting to fall for the first impression and consider India as an emerging (regional) superpower on the same level with Russia, the United States, China or European Union taken as a whole. However, India cupidity may not be the sign of a healthy development but actually the incandescent symptom of bureaucratic chaos and lack of a grand strategy.

In this article we will try to argue that New Delhi's preferences towards military purchases do not necessarily stem from actual fear of China or Pakistan but as a consequence of a self narrative emphasising India's crave to take its rightful place among other systemic big players. Therefore its defense behavior is molded by a heterogeneous mix of motives.

Militarisation as modernisation

The security behavioral patterns of third world political elites after decolonization inspired a whole literature within International Relations.

Replacing former colonial empires after 1960s, a whole inflation of new states emerged across all over we have used to term the Third World.'Inflation' has not been used in a shallow way, as those new sovereign political entities were not fully mature to manage their internal affairs as one would have expected. Inheriting some shreds of Western injected modernity, decolonised embarked on a process of full fledged modernity (understood in the same Western manner). Thus military purchases had become the tool of choice for the new thiermondist elites in their effort to guarantee a monopoly of violence over their own realms, protect against neighbours and accelerate or simulate modernity.

Early XX century Thorstein Veblen had explained the consuming behavior of lower classes bent on emulating the aristocrats. Thus each class tries to imitate its better placed peers and engages in conspicuous consumption- a shopping spree necessary to boost self esteem and prestige more than factual necessities. Observing the arms race prior to WWI, Thorstein reflect on patriotism as: ..***as a sense of partisan solidarity in respect of prestige***." (Veblen, 1945: 19). Patriotism is incultacted by elites and institution to the general public: ***It is also evident from the run of the facts as exemplified in these modern wars that while any breach of the peace takes place only on the initiative and at the discretion of the government, or State, it is always requisite in furtherance of such warlike enterprise to cherish and eventually to mobilise popular sentiment in support of any warlike move. Due fomentation of a warlike animus is indispensable to the procuring and maintenance of a suitable equipment with which eventually to break the peace, as well as to ensure a diligent prosecution of such enterprise when once it has been undertaken***." (Veblen, 1945: 11)

Building upon Veblen's work, Lilach Gilady applies conspicuous consumption to the international arena. Gilady replaces prestige with power and explains how governments channeled resources to impress allies and foes alike or project an aura around public actions. Gilady's research focuses on 'Big Science Projects' (ex: Human Genome; space travels etc.) during Cold War when US-Soviet competition pitted two ideological arrangements one against each other. (Gilady, 2007:26) On the same avenue Barry O'Neill explains nuclear programs using the prestige factor. O'Neill believes that instead of perpetuating the scholarly obsessions with hard power and material portfolio we should look upon states as we do individuals- driven by imponderable desires and crave for respect. (O'Neill, 2006)

Having said that, we have only sketched a general pattern of post WWII decolonized international system but we did not asdressed peculiar behaviors which single on country from the others. Whereas Kenneth Waltz's saw a convergence towards industrialization all over the system, the proponents of strategic culture emphasize nuances and differences in each nation.

For authors such as Colin Gray and Alistair Iain Johnston reason cannot be considered an universal set of assumption and more of a cultural product. What seems right in one place acquires an opposite meaning in another. (Klare in Eidee and Thee, 1980:37) To quote Nietzsche: "Morality is one across the Pirinei and other across the Alps."

As notion, strategic culture was first introduced by Jack L.Snyder who defined it as: "*sum total of ideals, conditional emotional responses, and patterns of habitual behavior that members of the national strategic community have acquired though instruction or imitation and share with each other with regard to nuclear strategy*." (Snyder, 1977 in Johnston, 1995: 34-36)

Alistair Iain Johnston sums up the meaning of strategic culture as an integrated "*system of symbols (e.g., argumentation structures, languages, analogies, metaphors) which acts to establish pervasive and long- lasting strategic preferences by formulating concepts of the role and efficacy of military force in interstate political affairs, and by clothing these conceptions*

with such an aura of factuality that the strategic preferences seem uniquely realistic and efficacious." Beyond such definition Johnston draws attention to the methodological pitfalls which arise from not being aware of the full weight of words

implied. Otherwise put, strategic culture should be a falsifiable notion or it will end up as catchword which explains everything. The real problem is correlating strategic culture to real behavior. Here one should balance historical heritage, national narratives, organizational establishment, international pressure or public opinion and see which element has more importance in the final decision. To do justice to all these above mentioned actors Johnston reads strategic culture as a "system of symbols" made up of two parts: the first consists of basic assumptions about the orderliness of the strategic environment and the nature of the adversary; and the second consists of assumptions at a more operational level about what strategic options are the most efficacious for dealing with the threat environment, continues Johnston. First part corresponds to the imponderable while the second speaks about institutions crafted to translate philosophy into practice (Johnston, 1995: 46)

A more Clausewitzian and simpler formulation is to be found in Kanti Bajpai: "*Strategic culture consists of two parts. The first is the central strategic paradigm — the basic assumptions about orderliness in the world. Included here are assumptions about the role of war in human affairs, about the nature of the adversary, and about the efficacy of the use of force. The second part is grand strategy, or the secondary assumptions about operational policy that follow*." (Bagchi, 2012)

India and the avatars of its grand strategy

Talking about India's strategic culture and grand strategy submits a spectrum of divergent opinions ranging from those who deny the existence of a coherent strategic culture or a grand strategy to those who assert that New Delhi displays several strategic traditions. For Rahul Sagar envisages four kind of ideological philosophies, with a certain behavioral trademark towards the international scene: moralists, Hindu nationalists, strategists or realpolitikers and liberals.

1.Moralistm or Nehruvianism is the first and perhaps the most comprehensive (albeit not the most practical or coherent) modern Indian school of diplomacy. Tributary to Ghandi, Nehru took from the former an ethical Weltanschauung translated into a refusal for imperialism, spheres of influence and arms race. Non-alignment became Nehru's diplomatic enterprise to syndicalise a decolonised world against Northern superpowers (we include here USA, Western developed countries as well as the Soviet Union). Nonetheless India's first prime-minister parted with Ghandian idealism and injected a certain dose of realism in his diet: India should pursue moral aims but also she should be ready to defend its integrity as any other country on earth: "*It is true that nobody will listen to you if you are weak, but, as you develop your strength to negotiate, unfortunately the other party also goes on developing its strength*."

2.The Hindu nationalists were the first and the foremost critiques of Ghandi-Nehru principles. For them India was, is and must always remain a product of Hindu civilization in all aspects of life. Anything short of that means betrayal. Confined to the margins of parliamentary struggle until the 1980s, the Hindu ultras thrived from the fall of the Congress and peaked to power. Similar to American Jacksonians they strove for a proud and stronger India not ashamed to use hard power, to end nuclear apartheid and gain respect from other major powers. During his tenure, the BJP government of Atal Biharee Vajpaee

performed five nuclear tests in May 1998 and declared India a full fledged nuclear power.
3.Strategists share with Hindu nationalist a belief in nuclear weapons driven status, although the former may not embrace a religion and ethnic based citizenship.
Last but not least, the liberals are a younger brand to find a place after the advent of post1991 economic reforms. They tend to stress the benefits of globalization and economic interdependence. Instead of Non-Alignment their geopolitics seems poised to a poly-alignment with as many countries as possible. (Sagar, 2012: 64-72)

By no means monolithical, for Rodney Jones, India's strategic predisposition is anchored in certain religious and geographical tenets flexible to different situation but solid enough to spell perennial goals: "*India's omniscient-patrician type of strategic culture is a complex mosaic of sacred myths and legends and memories of ancient states and civilizations, with the subcontinent as a geographical frame of reference, and with a modern overlay of nationalism supporting a vision of Indian greatness and expectations that India be treated with unmitigated respect. With leadership strata that traditionally prized knowledge as a source both of natural understanding and practical power, the elite carriers of strategic culture adapted modern science and technology to their own purposes in building and fortifying an independent nation*". (Jones, 2006:27) Jones summarizes Indian political thought under the self-narrative moniker: *omniscient patrician* – expression inspired by the Sanskrit formula: " *bharat jagat guru***"** or "India: the World's Teacher". Appropriate to such label is a hierarchical view of the world. Material realm is anchored in a higher spiritual cusp whereas force as a regulator of human affairs is not entirely forbidden, only tolerated in certain circumstances. (Jones, 2006:4)

Defence bureaucracy - a godess w ith to many hands?

Strategic culture is only half of the matter without the institutional fabric which allows blueprints to become reality. In India's case bureaucracy has been and continues to be one of the most important obstacle to economic growth and efficiency. Indians themselves know their regulation system is one of the most overweighed and corrupt in the world and often use expressions such as : 'License Raj' and 'red tape', usually blaming colonial heritage for the present situation. An explanation which is partially true and highly comfortable from a nationalistic view but inaccurate. Research done by William Gould and L.Shanthakumar show that corruption within the Southasian state apparatus has been recorded since ancient times. In his masterpiece Arthasastra, Kautilya spoke about the greed of government official and urged different remedies to cure the ill. (Gould, 2011; Sunder, 2011: xxiii-xxiv)
A corrollary effect of a bloated bureaucracy is its pluralistic character: the same task is assigned to different departments poised to do identical work. Results are easy to foresee: rivalry and interference.

With regard to the defense bureaucracy this one is in good measure the result of a certain way of organising civil-military relations after the Independence. It's ironic that the very conditions that kept functional Indian democracy hamper today the defense acquisitions. Whereas in other third world countries civil institutions fell to praetorian pressure or military coup d'etats, Bhāratīya Saśastra Sēnāēn (Indian Armed Forces) were kept under a very tight civil control and allowed to enjoy only the freedom of the leash. Stephen P.Cohen and Sunil Dasgupta explain the overcivilianisation of armed forces as a consequence of India's political philosophy of restrain. In their already classical work, Arming without aiming, Cohen and Dasgupta show in thorough detail how military decisionmaking black box is actually a blockbox:
-first of all is the often unadvised interference of political factors in military affairs. This holds true especially for the procurement policies. 1987 was the legendary year of the Bofors scandal. A bid for equipping India terrestrial forces with modern artillery ended up in a bribery conundrum where both Swedish businessmen and Indian officials teamed-up. The scandal, initially discovered by Swedish media and then afterwards taken by an Indian journalist from The Hindu

brought down Rajiv Ghandi's government in the 1991 elections. Because of its heavily tarnished reputation the Congress party could only make its come back fifteen years later, in 2004.

- the second flaw is the lack of a civil-military interface, namely a coherent group/forum of defense experts who may advise the political elite. Although there are think-tanks such as IDSA (Institute for Defense and Strategic Analysis- established after 1962) their work is not seriously taken into consideration. According to one IDSA researcher the analysts may write controversial materials without fear because no one from the upper echelons other to read them, anyway.

-the third major flow it the fragmentation of military command. For example India does not posses a Joint Chief of Staff after the American model. Inter-branch communication is weak. There is no coordination between the three branches of the armed forces with the Ministry of Defense. *Jointness is noticeable by its absence* conclude Cohen and Dasgupta. Of the seventeen commands of the Indian armed forces, with the exception of the Andaman and Nicobar Command and the Joint Strategic Forces, none are in the same location. (Cohen and Dasgupta, 2010: 44)

There is overall security doctrine and no synchronization between R&D, external purchases and military needs.

-DRDO- Defence and Research Development Organization is India's highest military-technological forum. The saga of DRDO can be studied as a case in itself. Created in late 1940s the organisation has expanded to tens of laboratories and it's involved in a thousand different project, ranging from genetic engineering to nutrition and smart guided missiles. Impressive as it may seem at the first glance, DRDO hasn't bee able to produce any single major product in five decades of existence. With the exception of a sonar in the 1980s, all its achievements where returned by the brass. An anthological example is the Arjun tank. Blueprinted in 1970, Arjun's task was to offer an armored backbone to the national ground forces and replace the aging T-72 Soviet made tanks. After numerous trials and modifications Arjun got the approval to become a line equipment in the summer 2010. However the enthusiasm belonged only to the scientist and some media pundits whereas military personnel has been more reluctant to hail the new piece. For example one of the problems of the Arjun is its tremendous weight- if the seminal design hovered around 40 tones the final version increased to 59 tones. With India's lack of infrastructure such an armored column crossing fragile bridges and roads would be a curse more than a tactical blessing.

Another shameful example concerns the rifle INSAS- Indian Small Arms System. Commissioned in late 1980s by the Army it was designed by Armament Research and Development Establishment (ARDE), a branch of DRDO. After innumerable laboratory trials and changes INSAS was delivered to the infantry in late 1990s. Its first large scale combat test was the Kargil pitch in 1999 and the record was not satisfactory at all. Soldiers have complained about rifle jamming, poor calibration or cracking of the polymers parts in the weapon. Nepali soldiers, also equipped with the Indian made product voiced similar complains. In 2012 the Army decided to scrap around 500 thousand pieces of its old rifles and replace them with something new. As officers do not want to wait anymore for DRDO labels coming into production, a bid to foreign investors like Beretta, Colt, Sig Sauer

and IWI is running its course. (Bipindra: 2012; Katoch: 2013; Joseph,: 2013)

- It is hard to imagine today's international defense procurement without offset. Offsets in defense trade are industrial compensation required by a foreign government as a condition of purchase of defense articles and services. This mandatory compensation can take many forms; it can be directly related to the purchased weapon system and related services, or it can involve activities or goods unrelated to the weapon system. The compensation can be further classified as a Subcontract, Purchase, Co-production, Technology Transfer, Licensed Production, Credit Transfer, Overseas Investment, or Training. (U.S. Department of Commerce Bureau of Industry and Security: 2005) Offset policies have grown to be something common as defense agencies regard a certain deal to be the starting point of a longer collaboration and not only as an ad-hoc deal. (Russin, 1994: 106) Another subsequent reason behind offsets regards the fact that defense industry does not operate in a vacuum and it is closely linked with other branches of production. Intimate joint ventures between military output and civilian manufacturers assure the spillover effect from the former to the latter. At least in theory. The story does not end here if one adds disadvantages to the good news. Offsets are intricate operations and do not yield optimum results always. To channel this process into their benefit, governments have enacted laws to closely regulate offsets in defense business. Especially the United States refrain from offsets as they fear about loosing technological edge. (Wessner: 1999)However developing countries tend to hold offsets arrangements in higher regards as they hope to gain latest technology through military transfer from Western more accomplished defense industries.

PostIndependence India had some shreds of defense industrial capabilities left from the British: Hindustan Aeronautics Limited (HAL), which is today India's largest defense public sector undertaking (DPSU), Mazagon Docks Limited (MDL), the largest shipyard in the nation and half of dozen of other factories. The Chinese inflicted defeat from 1962 border war determined India to enmesh in close links with the Soviet supplier. Cheap, decently reliable Soviet products fed Indian laziness and hampered a coherent development of a national defense industrial base. Nonetheless Indian learned to produce MIG-21 jets under license. The real challenge came with diversification. Unfortunately New Delhi did not have an offset legislation for many years until 2005 when the first ever Defense Procurement Procedure (DPP) was established. DPP 2005 introduced a 30 per cent offset in contracts valued above Rs 3 billion under "buy" and 'buy and make" categories.

DPP 2006 was added to further fill the blanks of the first regulation and made possible joint ventures (JV) between foreign vendors and Indian firms. It also established Defence Offset Facilitation Agency (DOFA) comprising of representatives of all stakeholders, the Services, DRDO etc.

A third DPP came in 2008 to build on the experience garnered in the previous years. DPP 2008 further liberalizes the procedures for private sectors to become part of defense deal within JVs and created the possibility of FDI (foreign direct investments) for the external vendors.

There are some critics who say that the 30% cap will not encourage international companies to come in India and invest. Feeling their freedom being restrained by Indian regulation they might choose other markets where mergers and acquisition and other kinds of corporate operations are permitted. (Matthew: 2009) Out of the sixteen offset contracts concluded between 2007 and 2011 five of them did not comply with the terms of the offset policy as set out in the relevant DPP. Those five were large international firms capable of generating significant technological output. (Kumar: 2013; Spear: 2013)

On January 06, 2011 the Ministry of Defense (MoD) released the Defense Procurement Procedure 2011 (DPP-2011), which formally implements past experience and feed-backs. Although private sector participation and offset flexibility is higher than in previous years. DPP-2011 remains a peculiar middle-way compromise between old and new, says Laxman Kumar Behera from IDSA. Behera's criticism aims especially at procurement

procedures which are said to be even more complicated from now and at the regulations bringing together private and public sector. Instead of pitting one against the other in a fair competition according to the rules of the market, DPP-2011 juxtaposes private defense contractors monopoly with private ventures in such a manner that private defense players cannot really have a saying. (Behera: 2011)

Final reflections

Latest defense scam unfolded early 2013 when AugustaWestland's deal to supplement Indian Air Forces was dropped amidst rumors of bribery. In February, Italian police arrested Giuseppe Orsi former head of Finmecanica for onerous payments to Indian officials. As AugustaWestland is one of Finmeccanica's subsidiaries New Delhi authorities put everything on hold. Shortly afterwards Defense Minstry K.Anthony announced a new defense procurement policy garnered to emphasise "*aggressive indigenisation*" as the only feasible solution to "*the scourge of corruption*." (India Post: 2013)

Indigenisation, buy abroad and than again indigenisation! The saga of India's military modernisation seem to be unable to escape a loop of short-term plans, poor procedures and corrupt officials.

We have tried to argue in this article that India's security behavior is not all different from other new nation which gained their sovereignty after World War Two. For those cases especially armed forces served as nation-builders. Martial affairs were not channeled only towards practical needs but devised to instill a sense of collective pride and seldom legitimise a ruling elite. What is peculiar and ironic all the same to India is that the very qualities which renders the flavor of its ancient civilisation and keeps alive its democracy are a plague to the defense bureaucracy. In strategic matters pluralism fosters wrong decisions, unpreparedness and waste or resources. 1962 proved it. One may argue that against Pakistan India can have the certainty of victory but there are two extra worries: 1) Pakistan is not alone amongst India's rivals. An alliance with China or with a smaller neighbours might force New Delhi two fight on two fronts and surprises may occur; 2) even if India outmatches one or several of its potential enemies in South Asia it still matters the quantity of people and resources sacrifice to assure that victory. A Pyrrhic triumph speaks more about luck and superior quantity than about quality. In a postmodern environment where society itself becomes the battlefield, accuracy means more than raw fire power. Mumbai 26/11 2008 proved that to the fullest. (Roggio:2008; Patel 2009)

To do justice to the title we an ask ourselves if India's defense procurement spree has not achieved its purposes, with all the flaws deriving from here? Sometimes the possesion of a huge arsenal serves as a deterrent alone, in spite of any existing inefficience. Lakhshar-e-Taiba's terrorist attack over Mumbai in 2008 can be given as an unfortunate example supporting the fact that Pakistan did not dare fight its southern rival in an open battle and preferred indirect methods.

On the other hand defense shopping accomplished deterrence on the internal front and in an unwanted way→ If India's economy had been weaker the civil-military decision-makers would have been forced to take their time and ponder more profoundly to the real security needs of their nation and perhaps made better choice. In this second meaning, speed was a deterrent against wisdom.

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CULTURAL – SYMBOLIC DIMENSION OF NON – REIMBURSABLE FINANCING

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Abstract:. *The paper analyses from an anthropological perspective the cultural-symbolic dimension of non-reimbursable financing, having as starting point the study of the implementation of the Leader rural development model in Romania. During the research I reached the hypothesis that grants is a mirror of the values and cultural traits of the present society. Grant nuances more than the Leader philosophy itself with all its principles the vision of the present societies upon development and wealth. More than an economic mechanism, than a complete series of bureaucratic regulations, than financial flows, it brings to sight ways of thinking and acting, as well as the most intimate identitary traits of the rural communities. The question I intended to respond was: which are the cultural behaviors, attitudes and symbols that are revealed by grant about the present society? Not the „philosophy" of the Leader model gets to be interiorized by the rural communities, but a way of „solving – their - problems", of improving their life through "non-reimbursable" financing. My observations upon how people relate to non-reimbursable financing, which accesses it, what is its purpose and social and cultural impact, gave shape to the cultural-symbolic dimension of non-reimbursable financing.*

Keywords: anthropology, grant, rural development, Leader rural development model

Throughout six years I studied the implementation of Leader rural development model. After several research cycles, mainly using the method of participative observation, I reached to the conclusion that the force setting everything in motion is the *non-reimbursable financing* and not the set of Leader principles. Thus, the research objective became the cultural, anthropological dimension of the non – reimbursable financing.

Gradually applying the observation and the field work, I discovered that the non-reimbursable financing, more than all the other elements connected to the application of Leader model, is the cause and represents the "institution" on which its operation is based. More than an economic mechanism, than a whole series of bureaucratic regulations or financial flows, it highlights insight and action means, as well as the most intimate features of the human being. It is not the "philosophy" of the Leader model who is interiorized by the rural communities, but the manner used to "solve their problems", to improve their life through the strategy of non-reimbursable financing. *The question I intended to answer was: which are the cultural behaviors, attitudes and symbols which the non-reimbursable financing reveals about the current society?*

If we include the cultural – symbolic dimension of the non-reimbursable financing institution, we obtain the largest interpretative perspective, based on the Leader rural development model, about the functioning means of the society, about the nature of social reality, about the social institutions with which it interacts and which jointly represent "a

universe of the human behavior"[1]. A part of the social reality is symbolically reflected in the non-reimbursable financing.

As an anthropologist, one cannot have an objective position towards such an unlimited subject as the development. However, the reactions of all categories of social actors who were "challenged" by the non – reimbursable financing give a meaning to the significances of development, to the efforts to adapt and to the answers of the individuals to the external stimuli of that period. "According to Max Weber, in order to understand or explain an action, we have to take into account not only the objective conditions, but also their subjective interpretation by the participating individuals." [2] All the empirically observed manifestations, combined with the theory associate into an accumulation of internalized symbolic representations of the world. Throughout research, an interference process was necessary up to the point where I found the common denominator between the anthropological perspective and the Leader development model, namely the **non-reimbursable financing (grant).**

Through deductive logics, the gradually built hypotheses directed me towards a series of theories. Using the triangulation of data and information collection methods, I obtained several dimensions of reality. A series of intermediary conclusions resulted, which could not be reunited into a narration. The relevance of these conclusions was not my first concern, but the objectification of the issue, of the values and theories extracted from each of these conclusions.

One of the main principles of Leader rural development model is the "public – private partnership", known as "Local Action Group" (LAG). From the perspective of another Leader principle, "of bottom - up approach", the LAG is the answer to the question "***who implements the Leader development strategies?***"

The LAG has the task to elaborate and implement the local development strategy, to take decisions on the distribution of financial resources and to administer them. LAG's authority and autonomy degree related to the vision on the development of communities is questioned under the existence of constraint due to the financial dependency through the non-reimbursable financing. There are three main objectives financed at the level of each microregion under dependency relation, namely:

1. financing the elaboration of strategy, project necessary in order to become authorized LAG,
2. financing the LAG operational project which would implement the development strategy, and
3. implementing the development strategy, the LAG playing the role of administrator of funds, granting non – reimbursable financing within the Leader territory.

Without pretending to be a final objective of the research subject, it becomes "the following" after the analysis, *the study of the interdependency between the three actions within the context of the non-reimbursable financing.* Throughout the development of these projects, the following question appeared: is it possible that the non – reimbursable financing became extremely coercive and the preoccupation for the improvement of the life quality of rural communities remains on the second place? Everything seems to gravitate around the non – reimbursable financing.

Within the shift from the positivist paradigm towards the interpretative paradigm, I tried to decode the senses encoded in the phenomenon of the non – reimbursable financing, by studying the ***cultural – symbolic dimension of non – reimbursable financing***, where the human being is the central point. It became the main theme which founded and gave a new title to the research. The anthropological perspective is different and complementary to the other perspectives: economic, historical, political. Thus, I tried to highlight the cultural – cognitive elements of the non – reimbursable financing institution, represented by the anthropologists Geertz şi Douglas, namely: the **shared conceptions, which represent the nature of the social reality and the frameworks through which the signification is produced.** "A social reality cannot be actually studied if we only perceive it through

its material data, beyond the human being". [3] The anthropological perspective corresponds to this vision, which "is related to a certain professional way to look, perceive, understand and explain the cultural phenomena, or, in general, to provide an analysis about the "human" or "mankind" data of a phenomenon, analyzed in its particularity as part of the social – cultural reality." (Ion Highiduş) [4]

Using the comparative approach, I analyzed and interpreted the non-reimbursable financing institution, the loan, the traditional labor association institutions, the *gift institution,* whose correspondents are the fundamental values, constant and universal, however, with different valences according to the development stage of mankind, as *solidarity, welfare, power, etc.* "Under various symbolic disguises, all these forms corresponding to the eras where they manifest, hide the intrinsic to help and take care of the others, the avid seek of status, the acquisitive character, variables for mankind as a whole. [5] Apparently, due to the dynamics of the social changes and the context of the historical – cultural evolution, the *non-reimbursable financing* is not related to the above mentioned existential principles, but we actually find a part of each of them gathered therein.

The comparative approach of the theme contributed to the closer knowledge of the phenomenon studied by comparing it to other themes and theories from other regions and other periods or other particular contexts. The reciprocity, solidarity, progress and modernization are found within the *theory of gift, theory of exchange, theory of help, theory of forms without substance.* The manifestation of solidarity and the significances of gift are found in the non – reimbursable financing. Two perspectives are established: one related to accessing the non – reimbursable funds where the potential beneficiary is the protagonist and the second related to the administration of funds, where the LAG is the main actor. When attempting to understand the functioning means of the non – reimbursable financing mechanism, focusing on human aspects, we must give a maximum importance to the concepts of *reciprocity, power, status, solidarity, exchange.*

Apparently, the non – reimbursable financing is not connected to the gift granted in the primitive communities, with power, solidarity or exchange. It is a hybrid between "gift" and "goods", namely it is a gift which encourages the consumption. The non – reimbursable financing allows you and even forced you, through the requirements related to the observance of certain quality standards, to consume more. Thus, part of money return on the market. Two perspectives are established: Theoretically and at first sight, it has a costless character, but in fact it conceals the "obligation" of return, characteristic to the gift, which many people ignore. The relation financer – beneficiary is created according to the model granter – receiver, discovering the symbolic and emotional dimension which established among restrained groups, among friends, relatives, fellows, subordinates - chiefs, colleagues. We are talking about an exchange where the financer, in view of "development", grants non – reimbursable financing, and the one who wants to participates to the "development" benefits from non – reimbursable funds. But what happens when obtaining the non – reimbursable financing becomes a purpose in itself ? The relation between the LAG and the financer, the European Union through Leader – axis 4, is a formal one, based on economic growth, on efficiency and results. The financing behaves as a social formation. We

cannot see it, we cannot touch it. It can take different forms, sizes, structures. In the mechanism of the non – reimbursabl- financing, the power is transferred from th financer to the ones administering its funds- We can see the administrator, the neighbo who helps you, the one who lends you funds etc., but we cannot see the European Union. - What does it mean for people to receiv financing ? In the rural environment, the socia- status, the power, the membership to a certai- group, is modified upwards, following th award of financing for a project. It draws th- attention of the others. On one hand, it is th hazard of the individual, and on the other hand, it confirms the capacity "to get on" and the access to information and knowledge. In the first case, it can be considered hazard, because it is the same mechanism we encounter in a competition, you participate to an auction of projects in which you compete with the others, and in the second case, it is considered that the one obtaining the financing is the one who holds the material, informational, financial resources and a rich relational capital, which grants him a strategic advantage in front of the others. In the process of accession to non – reimbursable funds, the beneficiary's needs are seldom superposed to the financer's objectives. The most commonly paradigm is the one related to achievement of money: "He was lucky", "He got the money because he had money", "he got money because he always manages to get along well", "he had relations, this is why he got the money", and we encounter the paradigm of success to a lesser extent: "he finally succeeded to do what he wanted to do", "he had a successful idea", "if he searched for solutions, he found them". The issues in accessing the non – reimbursable funds draw out the "eligible" caste and they characterize at a certain point a set of values, beliefs, practices institutionalized throughout time which belong to a society. Max Weber saw the caste as being based on three factors: power, richness and prestige. There are few people in a village who hold all the three factors. Their attitude is to help the others to obtain financing, increasing their capital of power, namely recognition from the others. Some of the difficulties identified in the accession of funds:

lack of access to information of the individuals from the rural environment

complicated procedures which the applicant of non – reimbursable financial grant has to follow;

lack of money to insure their personal contribution

high costs to prepare the documentation

obligation to maintain the project objectives unmodified for five years

observance of very high standards of quality and comfort.

The non – reimbursable financing symbolizes a game of power. You pay money in order to receive in exchange power and prestige. Most of the times, you reach to the point where you sell your freedom or to return more than you received. In the gift theory, you had to return at least the amount you received, without the possibility to refuse the gift. The ancient economy of gift became incompatible with the development of the market, trade and production, namely anti –economic and it disguised under various forms throughout time. The continuous adaptation at the context of life style, the shift from the moral economy to the market economy, opened a complicated path of naming the gift up to the non – reimbursable financing, but keeping the nature of human transactions and the principles governing these transactions in the archaic societies. Through a comparative approach, we can easier explain the functioning means of our own society. In the complexity of the notion of gift, important theoretical notions are highlighted, as the reciprocity, castes, gift exchanges, obligations, total social act which integrate moral, legal, economic, religious, familial, symbolical aspects. In the non – reimbursable financing, we decode the administration intention of all the individuals involved, but not to the same extent the development will of the communities, the main objective of the financer, providing the set of instruments – Leader model. Most of the individuals want to administer the non – reimbursable financing in order to obtain personal advantages, and the beneficiaries consider a privilege or a duly right without

being forced to return. Thus, the applicants make the highest efforts before wining the financing, which provides power to the ones administering the financing, and the interest of the financer and the surveillance starts after the signature of the contract. The moral, unlike the place it holds within the gift economy, disappears, namely it is deinstitutionalized from the mechanism of non – reimbursable financing. There is a conflict and a lack of reciprocity between the efforts that the beneficiary (applicant) makes before wining the project and the rules and regulations which the financer imposes throughout the implementation of the project. The beneficiary believes that, the equivalent counter-performance in order to obtain money it fulfilled in advance, up to the reception of money, when there is no contractual relation between the two parties, and the financer only takes into consideration the project implementation. If the non – reimbursable financing is a purpose in itself, and the efforts to obtain it are very high, the beneficiary considers as an *abuse* all the rules that the financer imposes after obtaining the financing. "We have to elaborate papers if we receive the money", a beneficiary told me. In many cases, the beneficiary has no other purpose after the point where he obtained the financing, and the "cover by papers" and the "race to find supporting documents" become the basic activity of the project. From the perspective of the results, of the value added by the project, we can talk about **forms without substance**. Most of the times, the results remain only on paper. The evaluation of the results and the application means does not represent the analysis subject for our anthropological research, but it helps us to understand and interpret the aspects which are not seen, the symbols hidden behind the appearances. For instance, the unrealistic elaboration of project documentations by exaggerating and overestimating the reality, especially in terms of describing the positive impact of the project, the establishment of indices to be reached and the estimated results in order to obtain a high score, confirm, on one hand, that the will to obtain the financing is higher than the execution of the project, and on the other hand, it explains the usage of "cover only by papers" and not of the unrealistic indices. The symbolic dimension, which characterizes the Human being and not the Beneficiary, relates to the efforts which were always made by people in order to obtain power, prestige, the money being the means through which you can reach them within the current society. When the financer's control institutions perform verifications, they are only interested by the "papers", by the logics of the supporting documents. After a week since the representative of a control institution verified the project implementation, namely only the papers, he asked the project manager: "and still, what is this project about?" Thus, throughout time, a reflex – answer established for the beneficiaries, "to have all the papers ready for control", without being liable about what is effectively executed. The long –term gains are, to a high extent, the same for the individuals administering them and for the beneficiaries, even if they are not well acknowledged, namely: the increase of power and relational capital, the affirmation, the accession to a superior caste, the image capital and the insurance of a new future opportunity by "**reasoned and diligent usage of current opportunities".** [6]

From an anthropological perspective, other than the perspective of Titu Mariorescu in the theory of forms without substance which can be extracted from the analysis of the

appearances created, namely "let's pretend we are doing something", from the superficiality and artificiality of the development processes, we discover a completely different philosophy, of the "unfaithful prefect" from antiquity, which illustrates how we can use the fortune of rich people in order to share it to the others, and we will be rewarded. This paradigm releases us from prejudices and tries to make us see the things from a different perspective, the archetypal manifestations of the human being throughout two million years, namely the formation of the human being.

The concept of manager or administrator is known by the Christianity. However, they appear using other terms, as active priests, prefect, mandarin. The parable of the unfaithful prefect is a model of Christian management. Some theologians claim that it is the parable most difficult to be interpreted out of all parables told by Jesus Christ. At first sight or after a superficial reading, it may seem that the incompetence and dishonesty are praised in this parable. It is important what it is understood and not what it is told. The human self explains the behavior of people, regardless of religion, ethnic group, culture, civilization degree. There are many examples which we found in the reports on the implementation of Leader axis in all the Member States of the European Union, the ballast effect being encountered in many different countries and regions. The anthropological and religious perspectives are joint by the psychological perspective, approached by Jung, who stated that "every civilized human being, however high his conscious development, is still an archaic man at the deeper levels of his psyche". [7] Making the comparison between the biological organisms and the social man, existing a series of resemblances related to their functioning, as the biological organisms from Rommer's law, the fundamental human features do not change along with the changes occurring outside, generated by the social, cultural, political and economic context, but they adapt in order to preserve their life specific character and not in order to benefit from new opportunities.

I used the parable of the unfaithful prefect because it highlights the fact that the essence of the actual values is found beyond the superficial meanings or beyond the usual human mind. The fact that it the most difficult parable to be interpreted explains the non – compliant action of the universal man reported to the actual meaning, but especially due to this reasons it is legitimate on social, cultural plan and less on the divine plan which anyway does not belong to the world, to the human. To act in such a manner is the equivalent of non belonging to this world, with its meanings and purposes. At first side, namely in a human meaning, Jesus Christ encourages something that is contradictory to His actions and advices: ***"You shall not steal!", "You shall not lie!", "You shall not covet!"***. Actually, the one who praises, for instance, the unfaithful prefect, is the Human represented by the "rich man" and not by Jesus Christ, the superhuman. Otherwise, if he would act "fairly", the rich man, namely the master, would exclude him, he "would fire him" because he would not comply to the human order of things, but to the divine world, which does not belong to this plan of things that can be seen, but to the plan of things which cannot be seen, hard to be perceived and not understood by human in general. The evaluation made by Jesus Christ for this prefect is discovered in the expression "***unfair prefect***". Despite all these, Jesus Christ found in the praise of rich man for his prefect something useful in order to teach his disciples and the ones who were listening to Him. This man praised the cleverness of the one who cheated him because he acted in a clever manner. In essence, as a memento on a metaphysical plan, Jesus gives them an advice: "And I tell you, make friends for yourselves by means of dishonest wealth so that when it is gone, they may welcome you into the eternal homes". The unfair prefect from the parable represents the administrator (LAG team) who was assigned the funds for the development of the communities. Similar to "the spiritual and material blessings enjoyed by Israel as chosen people, in order to bring the light of the redemption plan up to the edges of the earth, they were used by themselves in order to get rich and for self –accession" [8], the ones who manage the non – reimbursable funds in view

of improving the life quality of people from the microregion use their privileged position of being the ones who share, using the benefits of the social power.

In this parable, the Savior warns us that there will come a time when we will answer for the gift we received. This is the same idea as in the giving and receiving ritual analyzed by Mauss, that keeping the gift becomes dangerous. The comparison with other times, cultures, areas helps us better understand the essential human manifestations, beyond the cultural particularities and specific features and social institutions established throughout time.

In the "business approach", when the administrators of the non – reimbursable financing firstly intend to obtain personal benefits following its management: relational capital, power and prestige in order to insure a better future for themselves and as a consequence only the benefits for the beneficiary communities, we can find elements similar to the ones from the loan institution, centered on the characteristics of money: "money is power". K. Marx stated about money that they "can buy anything. The universal character of this feature is the absolute power of its essence. Subsequently, money appears as being almighty."[9] This mercantilist idea appears throughout time, in expressions as: "the power of money", "the domination of money", "the sovereignty of the dollar", "money, the devil's eye" and in proverbs and household sayings: *When it is a question of money, everyone is of the same religion (Voltaire); I am starting to become famous: people come to ask me for money (Jules Renard); Money is the only touchstone of the human nature. (Vasile Alecsandri); When you have no money, the noble origin ends Euripide (Rhesus).*

There is another approach, according to which the non – reimbursable financing provided to the communities represents a manifestation of the solidarity spirit based on reciprocity, in which you are willing to give and to receive, also encountered in the traditional mutual aid forms, in the statutory organizational pattern of German vicinities, the theory of aid. Profoundly, both have the same motivation, but the expression forms are different, and paradoxically, the first approach represents a manifestation of fear, and the second approach is a manifestation of power. The cultural matrix built by the human being is presented to us. However, the profound manifestation in both interpretations is based on the human nature: the weakness of the human, the social being, the need of association, of recognition. Actually, it is connected to the dualist character of the human being: weakness – power, kindness – evilness, poor – rich, etc., and at the same time it can only be an active one, also existing in the other latent stage.

Thus, the two manifestations are explained. These human behaviors are connected to the ones from the principles of Leader model, related to "how" you should do the development and not to "what" you should do, to the organizational culture, to the type of management and values of the individuals with decisional power, especially the leader. Subsequently, the results and the impact are different from one LAG to another LAG, according to the "individuals populating" the LAG.

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THE IMPORTANCE OF COMPUTERS IN THE LIFE OF TEENAGERS

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Abstract:

Thanks to the rapid development of information technology, the computer has become a tool indispensable to any person, an instrument by means of which we gain access to impressive amounts of information sources, due to the large number of existing websites, digital or online libraries. However, one should also bear in mind the fact that excessive technology can be a serious danger to the health and harmonious growth of its users. Moreover, prolonged exposure to various games based on default scenarios may affect their creative and imaginative thinking as well as their social skills.
***Key Words**: computer, impact, teenagers*

1. INTRODUCTION

For the past several years we have been living times of change, of sustained progress, with giant leaps - as in the fairy tales, we grow in one year as others grow in seven. Information technology is perhaps the indicator which best reflects these changes.

In the Western countries scientists are always developing studies regarding the computer users' profile, their individual interests and problems, according to age, social status and other determinant factors, as well as researches at a corporate and market level, precisely in order to channel technological developments to meet the needs of the individual and of society, which are harmoniously developing together.

In Romania, the lack of information to this respect prevents training providers in the IT sector from making long-term predictions and from developing relevant training programs both in the education system and in the private training one.

Most experts consider that we should not be asking ourselves whether training is improved through the use of computers, but how their unique qualities, which distinguish them from other media (their interactivity, the precision of the operations performed, the ability of providing multiple and dynamic representations of various phenomena and especially the fact that they can consistently and differently interact with each student separately) can be better used.

If the first achievements in computer assisted instruction focused more on learning by checking the amount of information learnt, complex software which later emerged, which encourages the active building up of knowledge, providing meaningful contexts for learning, promoting reflection, freeing the student of many routine activities and

stimulating intellectual activity similar to that of adults when working.

2. METHODOLOGY

2.1 . OBJECTIVES

By way of structuring the underlying questionnaire, the study aims to achieve several key points for a complete understanding of the level of culture regarding modern technology of high school pupils and of college students. In order to understand the factors influencing the level of knowledge in the field, and how a high school pupil or a college student uses computers and what are their concerns related to them, several issues were taken into account: whether they have a computer at home or not, whether they use the computer and for how long they have been doing so, their own perception of their level of IT knowledge and computer skills as well as where and from whom did they learn to work with the computer; family environment - whether the parents of the pupil or student work with computers and if they are a factor influencing the decision to gain an internationally recognized attestation certifying knowledge in this area. Very important for student development in general and for computing culture in particular is the educational system - how children perceive the organization of classes, what classes require them to use computers and for what classes would they like to use them and last but not least, the relationship between them and the teacher.

2.2 . GROUP OF SUBJECTS

For carrying out this work we have created a stratified sampling by the criterion of environment of origin and level of studies in a population of 200 subjects. The percentages allocated on the basis of sex are 50 % women and 50% men.

Depending on the environment of origin we have selected 50% of subjects from rural areas and 50% from urban areas.

2.3 INSTRUMENTS EMPLOYED

For this study we have built a questionnaire consisting of 15 questions. We have used closed questions, both with dichotomous (Yes/No) answers and with various alternative answers.

3.ANALYSIS AND INTERPRETATION OF THE DATA

The obtained data was processed quantitatively, based on occurrence frequency, by the individual analysis of each item.

Our study showed that **80%** of the children have a computer at home, while 20% of subjects have replied that they do not have any computer at home.

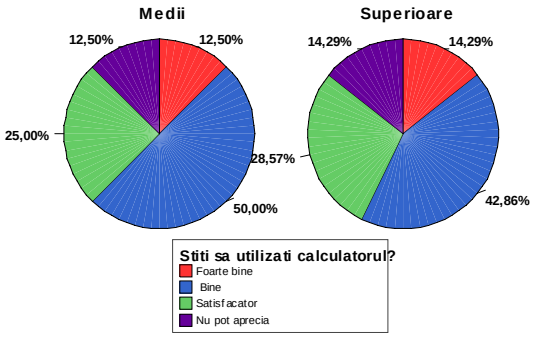

Figure 1.The structure diagram taking into account on the level of studies

Should we compare the subjects based on the level of studies, we may notice that 81,25 % of the highschool pupils have a computer at home, and 18.75 % of them do not have one. (Figure 1)

As far as those with higher education, college students, are concerned, we see that only 78,57 % of them have a computer at home, while 21,43 % of them do not have any.

It is not surprising that 46.7 % of the subjects use the computer well enough, 26.7 % consider that they are satisfied with the knowledge they have in the field. As extended use of the computers will lead to a certain degree of comfort in this respect, most students are confident with their own skills. Very few of the participants to the study (13.3 %) consider that they have a unsatisfactory level of computer knowledge and skills.

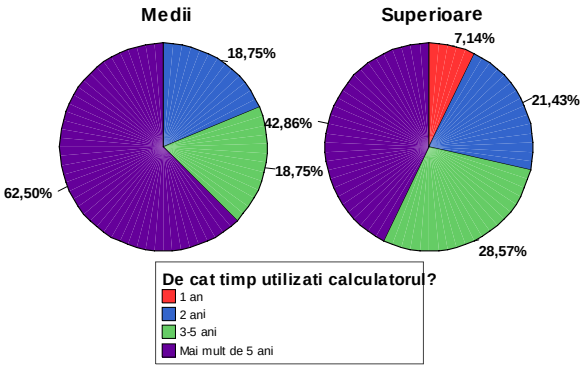

Figure 2. The structure diagram taking into account the level of studies

In figure 2 we can see the distribution of the answeres depending on the level of studies. More than half of the subjects have been using the computer for more than 5 years (53,33 %). The other subjects have been using the computer for a shorter period of time. The number of highschool pupils who have been using the computer for more than 5 years (62,50 %) is higher than that of college students (42,86 %).

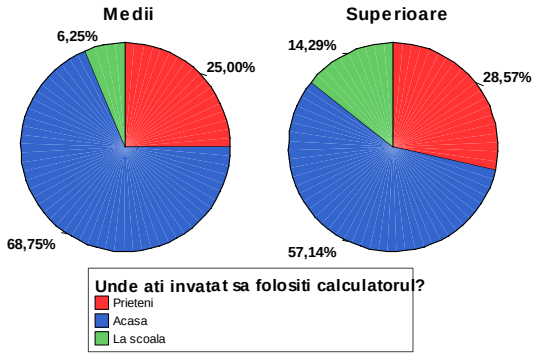

Figure 3. The structure diagram taking into account the level of studies

More Than 50% of the pupils (63,33 %) admit that they have learnt to use the computer at home. The fact that they already have a computer at home is particularly important, but even more important is the family, in particular in the situation in which the other family members are also using the computer. (Figure 3).

It is interesting to analyze what each individual understands by knowing to use the computer. If the computer is used at the school for classes and other activities teaching activities, the pupils' spare time best reflects what they understand by knowing to use the computer.

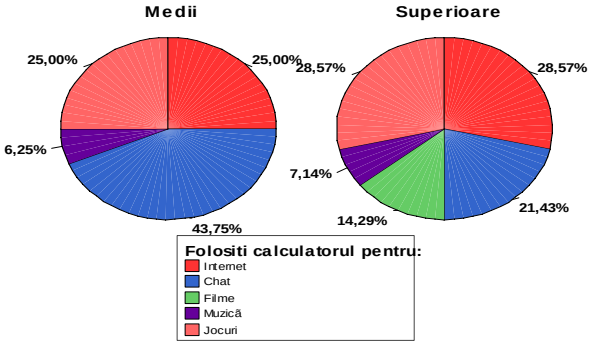

Figure 4. The structure diagram taking into account the level of studies

It becomes apparent that highschool students spend a lot of the time on the computer, immersed in the virtual world of computer games, thusly:

- 40% of the subjects spend half of their time in front of the computer playing;
- 26.7 % of the subjects use only a small part of their time for games;
- 20% replied that they do not play on the computer, especially when they have something else to do.

It becomes apparent that our subjects understand "good use of the computer" rather as using computer games (26,7 %), Internet (26,7 %) and chat (33.33 %), movies (6.67 %) and music (6.67 %). Moreover, they spend a large part of the time dedicated to using computers emerged in the virtual world of

computer games.

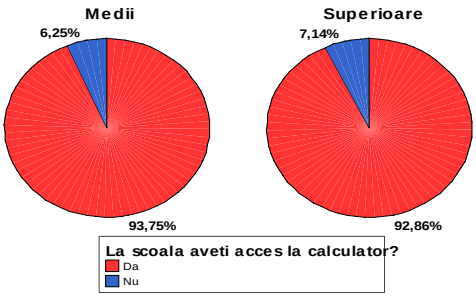

Figure 5. The structure diagram taking into account the level of studies

We may see that both the pupils and the students who were investigated in this study have access to the school computer, in particular during class hours. But they are also pupils who do not have access to the computer (6.25 %) and also students who for various reasons do not have access to computers (7,14 %) . (Figure 5).

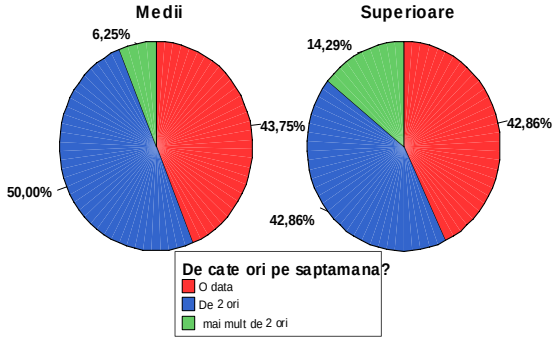

Figure 6. The structure diagram taking into account the level of studies

In view of the above, it is not at all gratifying that all subjects surveyed have at least a class/week of study in the IT laboratory. The replies of the subjects taking into account the level of studies have been:

- 50% of the pupils have access to computers 2 times a week while for students only 42.86% have access to computers 2 times a week;
- 43,75 % of the pupils stated that they use the school computers once a week, while 42,86 % of students confirmed the same frequency. (Figure 6).

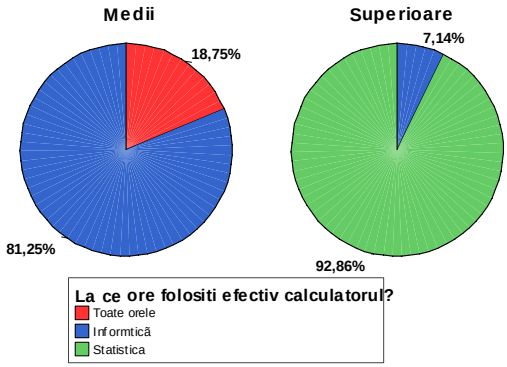

Figure 7. The structure diagram taking into account the level of studies

At present, pupils are using the computer in class to help them in the study of several subjects, namely:

- a part of highschool pupils use the computer for Informatics classes (81,25 %), while students use the computer for Statistics classes (92,96 %) but also for Informatics (7,14 %).
- 18.75 % of highschool students replied that they would want to use the computer for almost all classes (Figure 7).

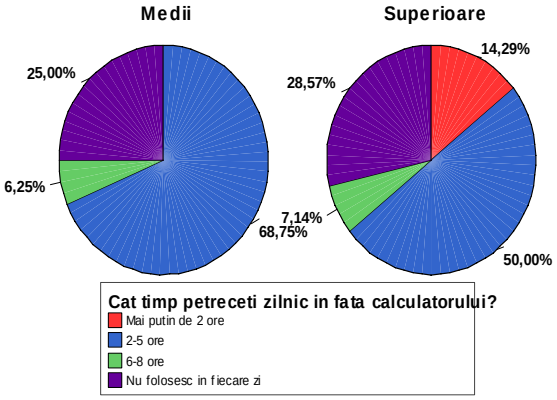

Figure 8. The structure diagram taking into account the level of studies

Most of the surveyed subjects replied that they spend between 2-5 hours/day on the computer (60 %), 26% of subjects replied that they use the computer between 6-8 hours/day and 26.7 % have replied that they do not use the computer every day (Figure 8.)

We see that pupils are using the computer more than twice a day in a higher percentage (68,75 %) than students do (50 %).

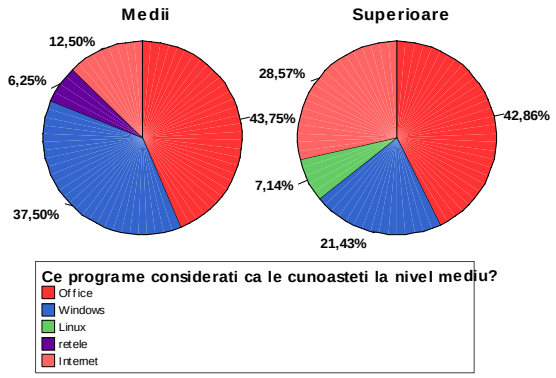

Figure 9. The structure diagram depending on the level of studies

Hours on end spent in front of the computer do not automatically imply a good knowledge of relevant and effective usage thereof.
When asked about how well they know how to use the computer, an overwhelming majority declares that the degree is more than satisfactory. The surprise is revealed when subjects (both pupils and students) are asked what are the programs that they consider they know how to use at a medium level. We find that of all these young fans on the Internet and chat, games and movies, only 30% consider that they know how to work with Windows at medium level, 43,3 % know how to work with Office and 20% know how to well use the Internet. (Figure 9).

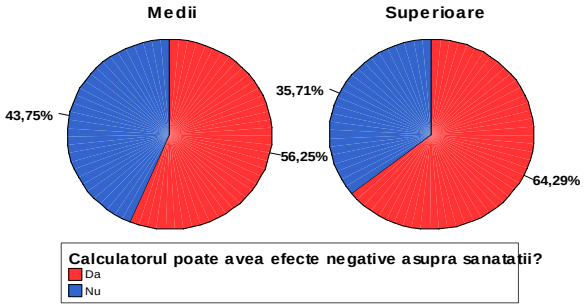

Figure 10. The structure diagram depending on the level of studies

Furthermore, when asked if the prolonged activity in front of the computer may have adverse effects on health, as much as 60% acknowledge it whereas 40% replied that they couldn't be affect in any way by the computer. (Figure 10).
Due to their lack of information, all surveyed subjects have replied that they would want to follow courses in the field, for a better knowledge of the computer.

Computer addiction has determined most of the subjects being investigated to not be able to give up using a computer, as it became a part of their lives (83,33 %). But there have also been subjects who replied that for them computers do not come first and that they could give up using them (16,67 %).

CONCLUSIONS

Whether fair or not, the family should more carefully follow what is happening to the young person in those many hours spent in front of the computer monitor; to insist more on studying, paying attention to the fact that, at this age, children are still dependent on their parents (both financially and emotionally, the parental guidance and the wishes of the parents always weighing considerably in the choices that teenagers make). It is the responsibility of the parents to steer them towards specialized courses and acknowledged certifications in order to add to their computer knowledge..
It is clear that games and computer activities in general play a very important part in the lives of young people. Their education is thus formed by means of the Internet and chats, almost not at all controlled by parents, school or competent authorities - as in other countries

there are studies and special programs for the monitoring and control of internet and game access for the minors.

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TEENAGE MOTHERHOOD. A CASE STUDY

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Abstract: *This case study covers a pregnant teenager's decision to keep the child, despite the fact that she is a student at a prestigious national college and its appearance seriously alters her future plans regarding education. The pupil's decision pupil even more surprising as she keeps the pregnancy secret from her own mother and the father of the baby is a highschool mate. The case study consisits of a semi-structured interview, an excerpt from the teenager's diary, the form teacher's characterization, her intervention in the classroom and a psychological profile. The interview had the following structure: Data on her own birth and the origin family, traditions and cultural context, social factors, education, love and pregnancy, life after giving birth, the vision of the future and what she would change ifshe started over. The purpose of this qualitative research approach is part of the desire to find answers to the following questions: Why do girls become pregnant? Why do they choose to give birth? How do pregnant adolescents feel in the role of pupils? How do teenagers who choose to give birth resist to social and family pressures? To what extent childhood influences have contributed to the state of pregnancy in adolescence? What can be done to prevent accidental pregnancies in adolescence? We do not claim that the study highlights these legitimate questions, but it certainly captures relevant aspects.*

Keywords*: adolescence, mother, decision, keeping the pregnancy*

1. INTRODUCTION

Romania is on the top of European countries in births to minors' indicator, with an upward trend especially in adolescents up to 15 years old.

Why does this happen? What are these teenagers' psychological profiles? Is sexual education of the young generation so deficient that even a student who comes from a top school is surprised by this reality? Is educational policy guilty of surprise pregnancies or is this about personality characteristics and family contexts that lead to accidental pregnancy?

This study is a qualitative approach to investigate this sad reality that post-revolutionary Romania experiences despite the fact that our country has opened from the flow of information point of view and communication technology has reached high levels.

The hypot hesis in this case is that the student's decision to keep the pregnancy is due to both sex education ignorance and the emotional problems resulting from failures of family that she grew in.

2. CASE STUDY

2.1 Semistructured interv iew. Anca. V., 17 years old, student at national college of computer studies, comming from an urban

environment, first pregnancy without abortion history, start of sexual life – at 15 years old, gave birth to a baby in the XIIth grade.

- Data on her own birth and the origin family:

A.V. comes from a dysfunctional family with two girls whose age difference is of 2 years. The family is dysfunctional because the father is an alcoholic and A. witnessed numerous acts of aggression up to 6 years old when her father disappeared from home.

He left home for work and never came back again. He left with the house documents in his pocket and the rest of the family lived for years in fear that someone will claim their apartment because they could not prove that it was theirs.

The police found a body in 2001 near the man's birthplace (somewhere in Moldavia) although he had been gone since 1999. This event did not traumatize her, she says, because she did not have pleasant memories about him.

- Traditions and cultural context

A. was born into a family with clear moral rules. The mother is deeply religious and she has internalized the idea that abortion is a sin.

- Social factors

Anca's mother made great efforts so that she and her sister have a sense of security in financial terms. She had always known that she can not afford much and had reasonable demands at home, always taking care to not burden her mother.

In the community, she is neutral. She did not want to get involved but did not feel that as a frustration and marginalization. She felt well being more secluded.

At home, the atmosphere was not really adequavate with many quarrels, tensions between girls and the mother who never seemed to be satisfied.

- Love and pregnancy

The father of the baby is a high school classmate from a parallel class. The adolescence did not use proper protection and got pregnant. She claims that her sexual education was poor, although she attends a prestigious college. He was misled by the fact that she had menstruation two months after getting pregnant. The pregnancy tests she took misled her even more as half of them indicated that she was not pregnant.

The adolescence onle realized that she was pregnant only when perceived fetal movements. Then she had a strange feeling. The father of the baby cut all ties with her. She felt disappointed by his reaction and isolated herself even more from everyone.

Time passed quickly and the teenage mother delayed telling her mother that another mouth to feed was expected to come into the world... She thought she had enough time to prepare her mother but she did not. One morning, while going to school, labour started. Only then she woke up to reality as if from a nightmare. Only then she realized that the inevitable had happened.

The teenager says she had a shock that morning, the day of birth of her child. She did not know who to call. She needed support.

After giving birth, the first text message was to the child's father saying following: „We have a boy, we need to talk ".

Her mother accepted this situation, on the one hand because she could do nothing, on the other hand because she considered the baby as a gift from God and a reward for an abortion she was forced to do by her husband. Being a very religious person, her conscience had always reproved that abortion, and this child relieved the pain of that loss and compensated for it.

- Life after birth

A big shock for the teenage mother was finding a job. That she was only a school graduate without the baccalaureate made this process much more difficult. She discovered with amazement that there were standards even for distributing leaflets. After 6-7 attempts of getting a job, she had the chance to be hired by someone she knew.

Programming and English knowledge saved her. She works in a young team of software, only the thrird shift, offering advice and solutions to U.S. customers of the company. She loves what she does, although the wages are modest, but she knows that she has no other choice as she has became the head of the family, since her mother retired with a small pension.

During this period, she face the fear that her son will attach more to her mother than to her because the grandmother takes care of him

while she is gone. Meanwhile she realized that it was not so.

Her sister, who is two years younger, was long embarrassed by the situation created, especially in front of her friends and colleagues. She did not want to be asked about this situation and was always irritated.

Paradoxically, the ones that suffered the most were her relatives, who blamed her constantly that she had disappointed her mother and brought shame on their family.

Her classmates behaved normally with her and she is aware that this is mainly due to their hearmaster who knew how to manage this situation successfully and mediated her relationship with the teachers, especially since she returned to school immediately after discharge although missed classes to breastfeed.

The relationship with the father exists, but he has not taken any steps to change the child's name into his. He wanted an expertize for establishing the paternity (more to prove to his parents that he is his son) but his parents are hostile to the idea. They will have noting to do with this kid.

- Vision for the future

The future looks increasingly bright but the teenager reports feeling chronically tired. She says that she got old, has troubles sleeping but knows that this job as it is, is the best place for her at this time.

Her greatest desire for the future is to resume her studies. The baccalaureate examination is not a problem, now that she pays for tutoring in mathematics, but she really wants to go to college.

She also believes in future she will rebuild her life with her son and another man. She does not see herself with the baby's father because he had hurt her very much through the way he had handled the situation.

- What would she change if she took it over?

The adolescent says that she would delay giving birth until after graduation because now this situation is very difficult for her. Also, she would choose to tell her mother because it turned out that she supported her. So she would not have to bear the burden of this secret.

Sexual education, says Anca, should start in the Vth grade and should be held at a steady pace. Incomplete information brought her to position to realize too late that she was pregnant. She did not have the information that menstruation may appear although being pregnant or that she could access free medical services.

2.2 From Anca's diary. " This is really happening to me and yet I do not believe it. I am holding the pregnancy tests in my hand and half of them create the illusion that I could get out of this situation but subconsciously I realize: I am pregnant and can not step back.

Months pass and my tummy is growing, and I put all the fear aside, tight somewhere deep inside, my nausea is gone; I do not behave like a lunatic anymore, trying to keep calm and go through this situation, whatever that means. It moves it legs gleefully, sometimes makes me forget everything around, but it's hard. The situation is quite difficult and I can not even tie my shoelaces anymore and time passes. Its heart beats, it moves, but how long it will have to pass to "see the light of day"?

On February 28th, at 10:50, I gave birth to a boy. Around me, everything seems chaotic, but I decided to call him Tudor, that because he's my miracle. The great battle begins now.

For the first time at my chest... He.'s so tiny and cute, I hear his heart beating and see him breath and I still can not believe it I had

him inside me so many weeks. The first time I try to hold him, I do not know how to do this, but as soon as I breastfeed him, we already know eachother. Hence, together forever, at least in thought...

Months go by without realizing it, I not get enough time to rest, I think that expenditures will exceed again the budget that we had allocated. And that's when I have to share with my mother that I need to find a job. Searching is somewhat difficult, people look at me strangely when they hear I am a mother, but somehow I will managed to get a good job and hold on to it.

I work 12 hours a day to afford everything, I do not sleep well lately. I forgot when I went out with my friends for a walk, and time with Tudor has greatly reduced. Being a mother and having a demanding job is not so easy, although at first I thought it possible. Of course, I do not think about the fact that I will sleep 5 hours a week again, it is important for us to be healthy and be able to lead a decent life. Mothers who raise their children alone should be awarded for strength and for bravery, or maybe just I think so".

2.3 Form teacher's characteriz ation. I learned that Anca V. gave birth only three days after the event. I did not suspect she was pregnant and probably for this reason I was shocked by this news. I was her form teacher and her psycho-pedagogical councillor at times when she asked me for help.

From ninth grade Anca had a contradictory behaviour: very good and conscientious at school, ambitious and enjoyable ran for class president and won the vote of her colleagues. On the other hand, she made a few surprises: the excessive makeup, a lot of black around the eyes, and during the first class trip she got so drunk that we had to call the ambulance and needed the paramedic intervention to recover.

Since the beginning of high school I learned that he did not have a father, who was declared missing. After all searches in hospitals, morgues and border customs for 2 years after the disappearance, while the mother went to see all unidentified bodies found in the city. Traumatic. The lack of money made them unable to initiate steps in court to declare the man dead, which is why the girls did not have any of the orphans' rights.

Since ninth grade, Anca started missing classes pretty much, every time with medical exemption. Her mother confirmed to me every time she had been sick and insisted that Anca was a very sickly child, had a lot of allergies and stomach problems because of not eating well.

At the beginning of tenth grade I changed her from the position of class president, because I could not collaborate with her as long as she was missing from school 3 days out of 5. Also in tenth grade, she befriended a boy from a parallel class, Bogdan with whom she began a beautiful relationship. Unfortunately, Anca's habbit of missing classes became permanent.

At the end of the eleventh grade, she had failed math and without examination in Romanian and German. In the XIIth grade, she did not miss classes and the Maths teacher always kept me up to date with Anca's progress, she said that Anca was working seriously and that she was likely to catch up with the class, although being not very optimistic.

At the beginning of the school year I learned that Anca broke up with Bogdan, without knowing why. I only found out that the boy was very upset with her and that he did not want to have any relationship with her.

In the XIIth form, in March, Anca's mother called me one morning and told me that Anca had given birth to a boy. I was shocked and stirred because I had seen her in school a few days earlier and did not notice the preganacy. Then I learned that even her mother did not find out until the day the baby was born, as well as Bogdan, who was the father; the only person who knew about the pregnancy was Anca's sister, to whom Anca had confessed that several months ago.

Anca's colleagues had a very interesting reaction: the girls were shocked and wondered what they would have done in her shoes, while the boys were very angry, because Anca told the father only when the baby was born and that she made on her own the decision to keep the baby. After a week from hearing the news, when students started to visit Anca, their opinions have changed: the boys relaxed,

while remaining consistent with the idea that Anca that ought to have consulted her partner regarding thedecision to keep the baby, and the girls became enthusiastic to the idea of having a baby. For fear of spreading of the phenomenon, we made an emergency partnership with a kindergarten, where I took my students in order to do all necessary work for taking care of a child for a few hours (taking him to the bathroom, feeding him, wiping his nose, witnessing some simple teaching activities). After this experience, the girls realized that having a child is not a game and reconsidered their position.

Regarding the fellow teachers, I urgently summoned the teachers of the class, because rumors and gossip had already started in the teachers' office about that „pregnancy will become a phenomenon in school", that „the girl made us shame", „we shoul expel her", etc. In the council, I explained my colleague teachers that there was no restriction for student mothers. I mentioned that she wanted to return to school soon and she would need help to go home during the big break to breastfeed the baby.

Anca returned to school two weeks after birth, showing a completely normal behavior. Bogdan originally wanted to recognize the newborn boy, but at the insistence of his family he never did. However, he visits Anca and the baby constantly.

Anca's family was divided between condemning her and supporting her. The close ones, mainly her mother and sister supported her decision to keep the child and helped in its care. Anca's mother retired early so that she could support her when she was busy. Other relatives however, have stopped any relations with Anca and her mother, believing that she had made a foolish thing by keeping the child, given her family history and that, in her turn, she had grown up without a father and in poverty.

Unfortunately, Anca failed to pass the baccalaureate exam in June and the one in August, too, but now she is seriously preparing not to fail the next session. Currently she is employed by a company that deals with providing telephone assistance to customers, she wishes to enroll in the Faculty of Letters ater passing the baccalaureate exam. Her dream is to become a teacher.

2.4 Psychological characteriz ation. We conducted a psychological assessment of Anca's personality, to identify her mechanisms of adaptation (coping), to identify the level of interpersonal relationships and its behavioural level.

There were administered two tests of personality, a verbal one (NEO FFI) and a nonverbal one (NPQ FF). Both are based on the five major personality factors postulated in the Big Five model (Neuroticism, Extraversion, Openness, Agreeableness and Conscientiousness).

Summarizing, Anca can be described as a sensitive person, shy and calm. Inclined to negative emotions, Anca sometimes feels anger, guilt or sadness, although she has resources to cope with stress.

Quiet, shy, withdrawn, passive and reserved, Anca is rather distant and introverted.

She offers support and help to others, often assuming the role of support when needed, avoids confrontations with others and does not express aggression, either physically or verbally.

Anca is organized, disciplined, hardworking, serious and focused on the objectives, which makes her a good employee.

Regarding mental flexibility, Anca is tempted to analyze rules from a personal perspective.

Anca's interaction style is participatory, her learning her style is painstaking, oriented to tasks methodically, rather pessimistic, with a good impulse control.

Her defensive style is more maladaptive, frequently using dysfunctional defense mechanisms such as repression and denial. Often fleeing from reality, refusing to consider or think about her own problems, with difficulties in verbalizing her emotions, even when they are of high intensity.

Regarding anger management, Anca is rather shy, having problems in managing her own emotions. Her anger is directed inward rather than toward others.

With an introverted personality, with intrapsychic conflicts arising from a difficult family situation she lived throughout her childhood, not knowing if her father is alive or dead, but that he had surely abandoned her family, Anca victimized herself, the debut of her adolescence being rebellious, as her form teacher had emphasized, with absences, drunkenness and harsh makeup to attract attention to herself.

This mental picture overlaps the lack of sexual information that made her made her aware of the pregnancy only when she perceived fetal movements.

The study is a warning regarding teenagers at maternal risk, even girls from the secure area of the elite schools.

3. CONCLUSIONS

The case study presented, that of a minor who decides to keep her pregnancy is unusual because the teenager was a student at a very prestigious school where students are selected based on their cognitive performance.

The incidence of pregnancy resolved in birth is rare in this context because these teenagers are more trained, and if they get pregnant they resort to abortion not to prejudice their career for which they work since high school.

Anca’s case, analyzed from several points of view (the researcher’s, her own’s and her form teacher’s) confirms the hypothesis of our study.

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META-STEREOTYPES CONCERNING TEEN PREGNANCY

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Abstract: *Meta-stereotypes (perception about the stereotypes the external group has towards an individual's group of origin) mark the development of adolescent personality. Negative meta-stereotypes have aversive consequences on the self and when concerning teenage pregnancies, things are even more complicated. This paper aims to highlight the existing stereotypes in Romanian society, both the negative and the positive ones, by investigating adolescents in two high-schools from a large city (where the incidence of such cases is higher), students and adults and corroborating data obtained with the ones provided by specialty literature (relatively limited).*

Meta-stereotypes such as stupidity, irresponsibility, shame, fear, loneliness, on the one hand, and love, blessing and family, on the other hand, profoundly influence the teenage mother's reintegration in the community.

The identification of adolescents' meta-stereotypes towards their pregnant colleagues, who have kept the child or aborted, may provide a basis for counselling teenagers in such a situation. Also, re-integration in the classroom can start from counselling their colleagues, using the force of negative meta-stereotypes for making them more responsible, instead of condemning and rejecting these young mothers.

The meta-stereotypes inventory was accomplished through a questionnaire completed by 106 subjects and through interviews with two pregnant teenagers. The results are their listing and building of specific action plans for counselling middle aged adults facing such a situation in their own family or class, if teachers and for individual counselling for the pupil-mother so that she can effectively adapt to her new status. We also argue for sexual education for teenagers.

Keywords: *stereotypes, meta-stereotypes, adolescent pregnancy, counselling*

1. THEORETICAL BACKGROUND

1.1 Meta-stereo types. Meta-stereotypes are defined as "beliefs regarding stereotypes that the out-group has about one's in-group", as the expectations about how one is perceived by the others (Koudenburg & Gorgijn, 2011) or how he is evaluated by the others. Not only beliefs regarding the stereotypes of the out-group must be taken into consideration, but also those on the in-group, which are embedded in the meta-stereotypes (Gomez, 2002). Stereotypes tend to polarize, into negative and positive, thus influencing the stereotyped ones, especially at ages when human beings are more easily influenced, such as adolescence.

As teenage mothers have become more and more frequent lately, it is worth investigating society's perception on them. If in the early 1900s, getting married at 16 was natural and even an expected event, nowadays it has changed. Women are expected to go to school, have a career an d fulfil their dreams before becoming mothers, or, as one of our respondents said, before "a woman's life ends". This shift in social perception is reflected in the stereotypes people have on pregnant adolescents. Even more, these stereotypes are passed on to younger

generations, creating thus a basis for their meta-stereotypes. In case they get pregnant as teenagers they tend to see themselves through the eyes of the significant ones and implicitly, appeal to meta-stereotypes.

The perceptions about the way in which members of other social groups stereotype one's own group can also influence their interaction. Thus, a pregnant adolescent will be influenced in her attitudes, behaviour and cognition by what she thinks others think about her and her condition. If negative, these meta-stereotypes can weigh big in a pregnant teen's adjustment to the world.

1.2 Teenage pregnancy . Throughout history, being a teenage parent has not always been seen as a problem; actually it was quite natural some decades ago. It was when getting married young was the standard and having a child at the age of 16 – 18 was the right thing to do. Only lately, it has been considered as a problem, a crisis (Shaw, 2010), when a woman should continue her studies and have a career before having a baby. Teenagers who choose to give birth to a child are rejected by the archaic and fundamentalist communities, public opprobrium being drawn on them. Not even in post-modern society it is easy to fight people's prejudices in this issue, although social representations related to pregnancy in this age does not seem to be so intolerant. From March to November 2009, Romanian Association of Youth with Initiative, under the "Parents inadvertently" project monitored the local press and national media institutions and sites, including archives from 2003 to 2008 to identify the most relevant articles on teenage pregnant girls and to show the dynamics of media coverage of such cases.

There has been a content analysis of approximately 1,020 articles, the main themes approached being: pregnant and abandoned teenage girl, articles on the phenomenon of teenage pregnancy, articles reflecting cases of rape, articles presenting life stories of young women who became pregnant as a teenager, articles promoting means of contraception, medical articles, cases of incest, articles presenting the phenomenon of abortion among minors, administrative measures taken by authorities to stop the alarming increase in adolescent couples become parents and presentation of abandonment in young parents. By far, the most frequently discussed topic was that related to women who became pregnant during adolescence (25% of articles), followed by cases of incest (22%) and rape (18%).

According to the articles analyzed, the pregnant minor is presented as a victim, a mediocre student, an advocate of abortion as a means of contraception or as a young rebel. Her context is rather negative, positive elements are found only in relation to her attitude to take responsibility in some cases.

The perception on the national and local media on prevention of pregnancies in adolescence and young pregnant girls' protection is heavily negative, most articles indicating an alarming increase in such kind, but also a stagnation of public policies on pregnant teens; there was no national program or even a set of strategic directions.

2. GOALS AND METHODOLOGY OF THE RESEARCH

2.1 Goals . We aimed at identifying parents', teachers', students'/pupils' stereotypes concerning teen pregnancy, at identifying pregnant girls' meta-stereotypes and at identifying some directions of counselling.

2.2 Hypoth eses. Our general hypothesis was that pregnant girls have a correct representation of the others' stereotypes towards them.

Our specific hypotheses were:

1. We expect parents and teachers (middle aged adults) to have more negative stereotypes towards teen pregnancy than pupils and students (who are experiencing early adulthood).
2. We assume that young mothers' meta-stereotypes match correctly the ones of the reference groups
3. If we identify these specific stereotypes and meta-stereotypes, we can identify the most efficient lines in specific counselling.

2.3 Sample . Our sample included 108 subjects, out of which 106 filled in questionnaires with open answers and two

were subjects to interviews (two pregnant teenagers). We questioned middle aged adults (represented by 22 parents and 29 teachers), 30 students in the early adulthood era, and 25 teenagers (pupils), categories chosen according to the classification made by Daniel Levinson (1986).

The teachers involved in this research teach at the high-school the two pregnant pupils attend. Their mean age is 38,89 and they have faced such situations during their career.

The parents' mean age is 42 and they did not experience a teen pregnancy in their family.

The students belong to the early adulthood era, their average age being 21,46. They belong to a technical faculty and a humanistic one.

The teenagers subjected to this study belong to the same class as one of the interviewed pregnant teenagers. The investigation involving them was done immediately after they found out that their colleague gave birth.

The pregnant teenagers attend two different high-schools**.** The first one**,** A.V.,18 years old, is a XII grade student at a national college in Brasov. She gave birth to a boy of 2000 g on 28th February 2012. She had not told anyone about her situation before the birth of her child. The child's father is a schoolmate; he found out that he was the baby's father after the birth. The teenager has an elder sister and they were brought up only by their mother. The pupil continues her studies, missing just one week during hospitalisation. She kept the child and her family accepted this situation. The second one, A.G., 16 years old, is a X grade student at a technical college in Brasov. She hid the pregnancy until the seventh month when it was detected by teachers. School mediated her relationship with the family and Child Protection Services, as she wanted to start the procedures for giving the baby for adoption. She gave birth to a baby of 3000 grams and he was adopted. The father was an adult, involved in another relationship; the teenager did not even want to let him know about this situation. She was not absent from school classes except for the hospitalization period.

2.4 Instruments u sed. We used a questionnaire which had five questions with open answers. The first one targeted the teachers' feelings towards the situation when a teenage student is pregnant. In the second item of the questionnaire, the teacher is required to characterize through a single word the pupil –mother's life situation. Then the teacher was asked to decide whether adolescent pregnancy was an accident or premeditated act. There is also the "I do not know" choice. Also, they had to say whether it was a mistake or not and an act of courage or not.

The questionnaires given to parents, students, and pupils were similar to the teachers' as it was intended to find out their point of view was on the same items.

There was only one interview guide for the two pregnant teenagers. They were asked what they think other significant people thought about their situation of young mothers (family, teachers, friends, colleagues and other acquaintances - neighbours, other relatives, etc.). They were also asked if their pregnancy was an accident or a premeditated act.

3. RESULTS

As meta-stereotypes represent the stereotypes we think others have on us, we started with the identification of the

stereotypes people have on teenage pregnant girls.

We identified the following categories of feeling towards a teen pregnancy, in order of their frequency: compassion, amazement, rage, lack of emotions, responsibility, fear, guilt, fear, and contempt.

A third of the respondents declared that they felt compassion as concerning a pregnant teenager, the parents having the fewest rate (18,18%) and the teenagers the highest rate (44%), possibly because the teenagers are more empathetic with their peers. The pregnancy was seen a surprise by 25,47% of the respondents, the most surprised ones being the teenagers again. However, such a condition generates rage and anger in 9,43% of the respondents.

Some of the respondents (8,49%) felt nothing as concerning this life event, the young adults being the most numerous (23,43%). Mostly the teachers (6,89%) felt responsible for such an event whereas no parent felt responsibility. Also, the teachers are the only ones who feel fear (6,89) and guilt (10,34%). Parents experience pain (22,72% of them) and one student despises such a situation.

We noticed that the most frequent answers are compassion, surprise, and rage. For the middle aged adults, a teen pregnancy is a surprise. However, parents do not feel guilt but mostly pain. Teenagers and young adults feel compassion mostly because they identify themselves with such a girl. Pupils, who had a pregnant mate, have deeper feelings, their answers being centred on only three directions: compassion, surprise, and rage.

We asked the respondents to give one word to characterize the teen pregnancy and we identified 6 stereotypes: mistake, shock, joy, responsibility, and normality and shame. More than 70% consider teen pregnancy a mistake, although use different words to say it (error, loss, problem, unconsciousness, irresponsibility, disaster, catastrophe). All the others cover less than 10 percent each, as follows: shock (8,49), joy (5,66%), responsibility (4,71%), and normality and shame share the same percent, 2,93%. Detailing on the answers, middle age adults and young adults perceive teen pregnancy as a mistake in a percent of almost 90, while only 24% of teenagers see it as a mistake.

Teenagers are shocked by such an event in a percent of 16% and parents, 13,63%. Surprisingly, two parents label teenage pregnancy as normal, natural. Also, 20% of teenagers see having a baby as a joy. Only few parents (4,54%) and pupils (8%) see pregnancy as shameful thing. Middle aged adults consider teen pregnancy as a disrupter of a normal life, mainly a mistake and a shock, while teenagers are thorn equally between mistake/shock and joy/responsibility.

As concerning the pregnant girl's intentions, 90% of the parents and students presume it was mistake; only one teenager presumes it was premeditated and 44% of the teenagers don't know how to answer.

Surprisingly, 75,47% consider having a baby an act of courage probably because the subjects follow the stereotypes that society has as concerning a teen pregnancy. Some media (through movies and music videos concerning adolescent mothers) postulated that teenage motherhood is an acceptable thing, at a certain extent (Shaw, 2010, Larson, 1996), which may influence our representations on a teenage mother.

Half of the teachers, however, consider it not as a courageous thing to do, but a serious mistake, due to unconsciousness and lack of sexual education.

As concerning the interviews, both young mothers estimated that their families supported them after giving birth. AG underlines, however, that despite this, she has forever lost the confidence she enjoyed before from her family.

Regarding friends' reaction, AV says that they were shocked but they did not judge her. She said that they thought her to be tough, which suggests that she wanted to prove it, to attract attention. As other research shows (Klein & Azzi, 2001), members of the in-group may try to modify certain meta-stereotypes to their advantage, by enhancing the positive ones or attempting to turn negative ones into positive.

As for their colleagues, it seems that the pupils from the theoretical college were

shocked, such events being extremely rare in top high schools. The teenager coming from the technical college believes that she has not heard a single bad word from her colleagues; on the contrary, they supported her unconditionally.

AV believes that her teachers were disappointed by her, though they tried not to show it, while AG believes that the teachers from the technical college supported her. In terms of other people (acquaintances, neighbours) both girls said they were shocked, that they despised them and had an attitude of discrimination against them although they did not show this openly.

Their answers showed that they had correctly depicted the meta-stereotypes towards their situation – teenage pregnant girls/mothers. This may indicate that the stereotypes concerning their group (teen mothers) are well imbedded social stereotypes. The pregnant girls correctly identified the surprise, the shock they caused in others. However, they felt despised, but only one young adult declared openly that he despised such a person. The peers' attitude was friendlier, some of them considering pregnancy a joy and a responsibility. The pregnant girls did not feel the compassion declared by the vast majority of the respondents, either. Compassion may also be a meta-stereotype identified by the out-group members as desirable towards the in-group, as other research shows, too (Klein & Azzi, 2001). The disappointment they felt from the other was well understood, even though disappointment was named in other ways by their significant ones: mistake, error, frustration, unconsciousness.

Our hypotheses were confirmed by this study: parents and teachers (middle aged adults) have more negative stereotypes towards teen pregnancy than pupils and students (who are experiencing early adulthood), young mothers' meta-stereotypes match correctly the ones of the reference groups (family, friends, teachers, neighbours).

After analysing these specific stereotypes and meta-stereotypes, we identified as efficient lines in specific counselling the following: building of specific action plans in for counselling middle aged adults facing such a situation in their own family or class, if teachers, and for individual counselling for the pupil-mother so that she can effectively adapt to her new status. We also argue for sexual education courses for teenagers.

Counselling should address firstly to the young mother as she must face both inner conflicts concerning her status, and the complex emotional states she goes through: on one hand, the baby needs her love and attention, and on the other hand, she is negatively stereotyped by adults and she feels it (these being the meta-stereotypes). Counselling should focus on efficient emotional management (most of the time the teen mother is left by the father of her baby) and efficient time management (she is still a pupil who must go to school, obey a schedule, do homework, and so on).

Middle aged adults' counselling should focus on their emotional and cognitive preparation for offering children correct information on sexual education, even from early ages. Thus, the number of pregnancies by chance may decrease. Parents should be counselled to feel more responsibility towards their children because our study showed that they do not feel guilty for failing in sexually educating their offspring.

Regarding the pupils, their counselling will cover both health and sexual education and the need for awareness of the impact a pregnancy

has in a teenager's life, because only half of the pupils we questioned saw teen pregnancy as an accident.

4. CONCLUSIONS

Society passes on stereotypes just like a heritage, meta-stereotypes following the same principle. Only if we deconstruct stereotypes and then meta-stereotypes can we attempt to a prejudice-free world.

Some other research directions identified during this study focus on identifying larger groups' stereotypes on pregnant teenagers, including older subjects and more male subjects (which are some of the down points of our research), on interviewing women who had been pregnant as teenagers in order to find out whether they are still content with the choice they had made then. Also, a study on the "scare" of pregnancy at teenagers would be very interesting.

Identifying some of the meta-stereotypes pregnant girls have on themselves may help counsellors fight against their discrimination, for their reintegration in class, for the improvement of their relationship with the family and other acquaintances.

Acknowledging the meta-stereotypes and the stereotypes concerning teen pregnancy is just the first step in accepting the need for counselling all the parties involved in the teenager's life and for counselling the teenager herself. The practical implications of this research are reflected in the contribution it brings to the field of counselling not only for the teen pregnant adolescents and their families, but also for teachers who may attempt to decrease the number of teen pregnancies or who have to deal with pupils in such situations.

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TRANSPARENCY OF THE ADMINISTRATIVE ACT AND THE CITIZEN RIGHTS

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Abstract: *Actuality of theme is the treatment of the administrative transparency as a central need for collective and administrative honesty partnership between citizens and administration, the mandatory inclusion of citizens in government activities as equal partners in governance. Bringing to the forefront the importance of citizen rights outstanding. Debating the particular right to information as a fundamental human right in general in the context of a democratic society characterized by transparency in decision-making and access to free information is considered essential desiderata for assembling them under a heading enlightening: transparency of the administrative and rights citizen.*

This paper aims to highlight and analyze the procedures of transparency in public administration in Romania and not least to address ways to improve relations public administration - citizen.

Keywords: *transparency, administrative act, citizen rights*

1. INTRODUCTION

In the period after 1989 in public life in Romania, critical changes were reported regarding the freedoms and rights fundamental, democratization of political life and the functioning of public authorities and institutions. In this context, had increased the role, the importance and the possibilities to influence our lives by the elected officials of our civil society and by the representatives of the mass-media. Given these issues it was necessary the citizens access to information in general and specifically to the public information to be fully realization

Romania's desire to align the standards of the state of law, as well as the state institutions reform of presuppose the existence of legal regulations on public information access and circulation. This triggers all the elements of transparency, fairness and accountability of public authorities with citizens.

From 1 January 2007, Romania became a member of the European Union after that date will be talking about a European public administration, which must comply with European legal principles and standards of public involvement and consultation.

The concept of transparency of of the administrative act is designed to support ever closer relationship between citizens on the one

hand, and between citizens and public institutions - central and / or local authorities, on the other hand. In this way the public interest decisions are taken in a quite open and close people. Transparency of the administrative act gives to the interested persons the opportunity to take part actively in the decision making process ensuring the legitimacy of public institutions, increasing their accountability and effectiveness. First of all, transparency is administrative support for democratic principles contributing to fundamental human rights.

The transparency represents more than a simple communication strategy: *it aims to make administration less opaque, to dispel the fog that surrounds it, to tear the veil that covers to break the wall of silence that protects, it involves removing the secrecy rule, which was the ultimate guarantee bureaucratic construction* [1]

Attenuation of the secret was, at first, the result of an administrative practice: accepting to state their intentions to explain its meaning approaches, clarify springs of its operations , the administration seeks to improve the quality of its relations with the public, and thus the the efficacy of its actions; it retains the initiative and control of retention / disclosure of information involving them.

The lack of transparency gives birth to two serious effects. First he puts into inferiority those already disadvantaged, poor and uneducated ones with great difficulty obtaining documents addressed to them but do not know how to use them. On the other hand leads to an increase of the administrative costs, encourages corruption, they are the main obstacles for attracting foreign investment and a barrier to economic growth.

Order to speak of the direct involvement of citizens in having the first contact with the administration, we must speak first of the early stages of citizen participation, namely information, or consulting the citizens. These stages are implemented through legislation, namely the Law on free access to public information and transparency in decision-making process.

In the United States and in the European Union, free access to public information and transparency in decision making, are representing the basic concepts in the administration.

The transparency includes not only the so-called government in sight, but the government explained, and free access to public information is a right enjoyed by all citizens, without taking into account the reasons that motivate them to request certain information.[2]

The transparency of the administrative act should be seen as a political instrument to achieve efficient administration of economic growth and protect the most vulnerable citizens, from the social point of view.

Although significant efforts have been made by government, yet we find a lack of trust from the citizen in some of the fundamental institutions of the Romanian state. Priority is given to the education of citizens to be able to monitor the activities of public authorities and the formal and informal structures to be involved in building a genuine democratic regime. The difference between a regime that promotes transparency in decision making and a tightly political system it is given by the Government dominante position. This should be countered by adequate information to the public. Only in this circumstance can be overcome one of the main particularly serious consequences of the former totalitarian regime - indifference, resignation and civic passivity. It requires a proactive approach by the government to ensure a minimum level of information on the decision-making process and its results, which illustrate the normality status of the Romanian society. It is visible that efforts are made both by the authorities and citizens, but this can not be done immediately, it takes time for people to learn to know that their rights are guaranteed by the Constitution and international documents. Until 1989, Romania was seen as a country with a closed political

[1] Jacques Chevallier, *Science administrative*, Ed. Themis droit P.U.F., Paris 2007, 4th Edition, p. 444

[2] Valerian Stan (eds.), participatory and transparent governance, the Institute for Public Policy, 2004, p 146,

system, after that date the Romanian citizens hat to face a new mode of governance, democratic, which implies the existence of guaranteed rights and freedoms.

If an authority or public institution operating within the standards set by Law no. 52/2003 regarding the transparency in public administration sector, which includes the citizens in the decision-making process while maintaining the efficiency of the public consultation. Compared to the legislation, this can be achieved in two ways: each authority or institution shall take appropriate measures to inform the public about the new regulations come into force and secondly, we need to support citizens in exercising their rights - in this case - the right of free access to public information.[3]

The pillars that support any European institution related to transparency of the decision are:

- support of citizen participation through a public consultation process;
- compliance of the procedures and minimum rules for systematic consultation process;
- building a consultative framework coherent but flexible enough to take account of the specific requirements of stakeholders and to establish appropriate consultation strategies for each situation;
- promote the exchange of good practice at Community level[4];

Central and local institutions should focus its activities so that public access to information concerning them, both as individuals and the broader community, and participation in decision making to be provided without discrimination and unconditionally. Only then the principles of good governance can be applied: rule of law, non-discrimination and equal treatment, proportionality, consistency, objectivity and impartiality Minimum. compliance of those mentioned above, will guarantee a high quality of public services administrative and better inform and involve the community.[5]

The idea of "openness" means that the administration is willing to accept a point of view that came from the exterior, and the transparency outlines the range of openness for an election or a check.

From the theoretical point of view these features assures to any citizen involved into an administrative procedure, the possibility to able to follow the progress of that procedure, and acceptance of the administration of an assessment coming from approved institutions or civil society.

In the European Union Treaty the transparency term is pointing out that "This Treaty marks a new stage in the process of creating an ever closer union among the peoples of Europe, in which decisions are taken as the highest possible respect for the principles of openness and closenness to thecitizens."

Regulation no. 1049/2001 of the European Parliament and the Council of 30 May 2001 regarding public access to European

[3] REGULATION (EC) No 1049/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, Official Journal of 31.5.2001 the European Communities L 145/43, available at: http://www.europarl.europa.eu/register/pdf/r1049_en.pdf, accessed in 24.03.2013

[4] European Commision – CODE OF GOOD ADMINISTRATIVE BEHAVIOUR, Relations with the Public, accesib available at: http://ec.europa.eu/civil_society/code/index_en.htm, accessed in 24.03.2013

[5] ...

Parliament, Council and Commission[6] ensures transparency in decision making within the European institutions.

3. CONCLUSIONS

Construction of a healthy regulatory framework and appropriate legal institutions - fundamental issue in a democracy - are not sufficient unless there is a correct implementation of the law. ... Transparency in governance and law-making process an the rationality precess are prerequisites for a quicker assimilation of the law by the social body.[7]

It is important to don't remain only at the stage of goal the fact that the simplifycation of the legislation will satisfy the principle of clarity of the law and the objective with constitutional value of its knowledge. Indeed, equality before the law set out by the Constitution (Article 16 (1), as a fundamental human right, may not be protected effectively if citizens do not have sufficient knowledge of what rules are applicable and no adequate means to ensure ownership and compliance with these rules.

For Romania, the transformation of public administration acquires new dimensions. Thus, it must respond to new changes in the world economy, but equally to EU structural requirements.

Public administration in Romania must adopt and implement administrative values that define European space transparency, predictability, accountability, adaptability and efficiency. These values should be reflected in the institutions and administrative processes at all levels and their application must be verified by an independent control[8]

[6] Ioan Alexandru, *European Administrative Law, op. cit*., p. 244

[7] For details please see the Emil Balan *„The principles and the normative of good administration" at* http://www.admpubl.snspa.ro/fisiere/japonia/Principiile%20si%20normativitatea%20bunei%20administrari%20-%20Emil%20Balan.pdf

[8] George Stingu, *Public administration reform in the context of European reform,* Vasile Goldis University Press Publishing House, Arad, 2006, p 154

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DEFENSE MECHANISMS IN ADJUSTING ORGANIZATIONAL STRESS IN THE MILITARY FIELD

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Abstract : *In military psychology, stress is a key concept and according to specialists, to study stress in humans, there is no better context than the military research. The way it is designed this phenomenon in the context of military-type activities, resulting a series of practical measures relating to the application of psychology in dealing with the preparations for armed struggle, command of troops in peacetime and war. The level of professional skills is an important factor in situations of threat orientation as that of the military. Increased anxiety and behavioral disruption will result when the individual's level of competence is exceeded and there is no possibility of adaptation, when the failure is of considerable subjective and there are no ways and means of protection against such a failure . Necessities to assert the possibility of expression may become pressing needs so understimulation , the monotony, social isolation, reduced communication and cooperation, produce comparable effects of stress by overstressing. The complexity of defense mechanisms in practice is continually diversifing and they are in relations with various adaptive strategies of coping mechanisms.*

Keywords: *stress, anxiety, defense mechanism, coping mechanism*

As a result of socialization, a person as individual develops strong trends of adherence to the norms and values of group that formed him, making them a measure of their own behavior. In its turn, the society considers individuals as the standard, expecting them to behave in ways consistent with the model predicted according with the cultural and normative model, with legitimate means of action. Generated by the need for changes and the social behaviour deviations according to the normative guidelines, the sociology of deviance was born as an effort of the sociologists to understand the nature of social order, the conditions that make possible and may affect also in the same time. Through it, there could be made available to specialist tools and means by which it can be read and better understand regular social changes of legislative conflict of anomy (desorganisation), during which social normative changes and gain weight the anti normative actions and conduct guidelines against the old social order.

The idea that the own defense mechamisms can perform both positive functions and negative ones is commonly known as "dual function" of mechanisms of this type and appears in numerous publications. Van Der Leeuw (1971), who notes that the defense mechanisms disrupts development of ego, but also favors, he

considers that the presence of the same mechanism shall indicate, on the one hand, the existence of a neurosis, on the other hand, the fact that this mechanism is essential for the proper functioning of the psyche of the person. Thus it was that, for example, refusal disrupts perception, but protect ego against violent reactions.

Brenner (in Plumpian-Mindlin, 1967) distinguishes two categories of defenses: pathological and pathogenic, he points out that Freud considered that the repression is pathogenic, being, in other words, a necessary precondition for the development of a disease but does not lead necessarily in the installation. As pathological defenses, features such as stiffness, strength, can identify them over generalization (using relationships with many people or in different situations). Bergeret's opinion (1972/1986) is similar, the author insisting upon the fact that it cannot be said about a topic that is sick "for use defense", but because he wears defenses usually ineffective rights can be qualified too rigid, maladaptive internal and external realities and / or exclusively of the same type. The mental functioning is uncomfortable in harmony flexibility and capacity to adapt. The diversity of cultural norms and values from one group to another and from one society to another prevents to consider deviant behavior as universal and homogeneous.

The concept of "defense mechanism" is a theoretical abstraction used to describe a work of mental functioning. Wallerstein compares this concept with others, such as assimilation and conservation (described by Piaget) - abstract formulations useful in explaining behavior would remain otherwise, the undeciphered.

Otherwise the concept, "the defense mechanism" is not aware, which may have the following meanings (Wallerstein, 1967):

- The subject is not aware of behavior manifesting defense (a thought, for example);
- The subject is not aware that his own behavior has a defensive orientation;
- The subject is not aware of instinct or emotion that triggered the respective defense.

If the defense would become aware, only the three quotes should be aware, and not the underlying psychological activity, so the defense mechanism. Once the purpose intended (defense one) or compulsion or underlying conditions become conscious, the defense concerned ceases to be useful, obscuring its function vanishing.

The modalities of evolution in time of defense mechanisms in Cramer's view (1991) could be:

1) After its emergence, the mechanism of defense is used by the child for a certain period of time after losing its importance. It may either disappear entirely or remain dormant. Later, it may be replaced by another mechanism. Once occurred, the defense mechanisms still exist in their original form throughout the life cycle, even if they are controlled or "covered" by other mechanisms that appear later.

2) A defense can develop and may be used in its original form for a certain period of time. Later, it will change, leaving a variant of the same defenses, or it will turn into a totally different defense. The possibility that each of the protection mechanism can be a development line. Thus, for refusal, the early form cleavage could have items and the highest level could present characteristics of denial and isolation. Dorprat (1985) established the ontogeny refusal identifying four stages, starting with physiological prototypes (eyes closed, for example) and ending with the thought verbalized (for example, denial).

3) It occurs as a defense mechanism to undergo a "change of its functions" as cognitive persisting thinking, but is separated from the origin of conflict can be used in new conditions in a free intellectual activity of any conflict. Beyond the stage exercising defensive function, a defense mechanism reaches its maturity under to perform other functions. So, it can become a cognitive control mechanism or to represent a general feature of character.

The authors of *DSM-IV* state that defense mechanisms are subject to some mediators of conflicts and emotional reaction to internal or external stress factors. While in the same time, they also highlight the fact that the subjects are not aware of the existence of

these defense mechanisms only when they are already enabled.

Analyzing these different definitions and some remarks or comments that sometimes accompany you, we find, on what is called a typical definition, such as proximity, that defense mechanisms are designated as: processes (psychological automatic, unconscious mental regulatory properties, operations, strategy, means (which use self; psychological mechanisms, assemblies feelings, thoughts or behaviors (occurring in the perception of physical danger, a theoretical abstraction (used to describe a mental activity, running mental, cognitive styles metaphors.)

The progress in knowledge of the human psyche made distinguish between what is innate and what is acquired. The research regarding individual development helped discredit the statements of inexorable determinism, making to impose a new being in the social world: the child. Suddenly, the adult could be designed as product of the experiences during early childhood. It opened as a new way to prevent crime: the brutal correction replaces the deviant behaviors early in the construction of personality disorder research.

Numerous and significant influence upon the character, attitudes and conduct military exercises the way in which they are conceived, organized, directed and performed all activities in the area subunit and military unit, whether it is a shooting session, an exercise or an application strategy, so on. When every action is organized and managed in strict accordance with the regulations, when they have clear objectives and require intense intellectual abilities, psychophysical moral and military, where all these are perceived as rational acts, stemming from real needs, there are certain prerequisites for a climate of order and discipline.

The reality convinces us that the teacher with the greatest formative influence is life itself, in all its dimensions military activity. The soldiers are trained in this way rather than by advice, exhortations and various explanations (and of course they are needed), but directly when each activity is organized and conducted in accordance with the regulations, when they have a well-selected content and ideas expressed. Only in such an environment they are educated, consolidated and maintained the order and the discipline, there are developed qualities such as sense of responsibility, responsible attitude to duties, respect for rules, rigor and maturity. Therefore, the commanders of subunits concern meticulously prepare and organize training sessions, they operate according to plan prepare for battle, regulations and instructions in force. The intensive use of time in the program constitutes the basic training of young people in a spirit of attitudes fair to soldiers' duties. By simply fixing a strict military work and life does not lead automatically to a forming or disciplined behavior. The execution by every military, no matter of rank, of the statutory duties incumbent to the position that the program meets the commander ordered, establishing clear responsibilities and the conduct of each activity has a great influence on military discipline. Not deeply assimilation of conduct based rigorously on the regulations imposed based by military activities, generates, inevitably, some worries and tensions, nervous consumption increases, even create some irritation. The spiritual development is based on the work order, the perfect fulfillment of the activities included in the plan preparation for battle. Therefore, the process of engaging all military training is also one of the main

ways to prevent misbehavior. From the family to the school environment and then at work or military, the human suffering a series of successive remodeling, had to give up certain habits, attitudes, values and interests to continuously acquire new ones, accepted and respected social group. Due to adaptation of interaction partners form a whole group. We can talk about the couple's marital adjustment, circle of friends, and the interaction within small social group of any type: employment, education, military, athletic, artistic, cultural, so on. The interpersonal adaptation is, in all cases, one of the levers to optimize human relationships and increase group cohesion. In the military environment we cannot speak for marginalized individuals in the true sense of the word, as all soldiers have the same living conditions and training, are subject to the same rules and the same norms. Large problems arise when a military collective isolation is caused by repeated its tendency to violate institutional rules, thereby making "dissenting opinion" to oppose the proper accomplishment of the tasks of the group.

The sequence of development of *refusal perceptive* function of which stems from the fact that things are not present do not cause suffering, comprising five stages: withdrawal of attention, refusal by avoidance; misperception; transformation and negation contrary.

The integration process is very complex and although uniform, it carries on several distinct levels - biological, physiological, the mental structures. It is about, on the one hand, the adaptation for a particular work and living arrangements (living conditions, pace and intensity of work, conditions of physical and intellectual hierarchical relations system) through the formation of skills, abilities and capabilities in line with the requirements of the new way of life and the formation of attitudes and beliefs in accordance with the requirements of the new social role provided that an appropriate adjustment is not carried out.

The contact of the young man with this disciplined company with prohibitions and frustration with authoritarian hierarchy can activate, in some cases, aggressive tendencies or signs of insubordination. The psychology of teenager recruit presents great originality, which will result for commander's particular difficulties. The independence and even opposition from parents and educational models and life down, and search their own style of life will spill over into the community that is authoritarian military. The sociological research data show that the youth in conflict with parents, girlfriend and frequency of disciplinary offenses is significantly higher. It appears that often young recruit had to drop out of school, and if he was married, to leave his wife. And if they (in terms of restructuring the economy) are added more frequently and the prospect of losing the job he was hired before incorporation, then we can say that they have accumulated enough factors to maintain an internal conflict between their interests and requirements its participation in military life.

It is a proven fact that integration in the military is even easier since there is increased motivation. Or, it appears that the world is manifested in last decades, a decrease in motivation and tolerance for youth organized social activities.

Instead of conclusions: The main function of military rules lies in their ability to guide the behavior of young people, in so far as they gave their legal system itself. The military institution has a strong normative influence on military groups, through developing specific rules and norms of behavior, shaping the personalities of individuals and makes an important contribution to the social maturation of the young generation. The defense mechanisms offers to the individual the conditions of integration in group membership, transfer on a less formal relations individual - the system and the result of socialization must submit compliance specific rules military environment.

The integration of young people in the military means adapting to a regime of specific work and life (living conditions, the pace and intensity of work, conditions of physical and intellectual hierarchical relations system) through the formation of skills, abilities and requirements under the new way life, and forming attitudes and beliefs specific

to the new social role. In cases it does not take proper integration runs the risk of deviations from prescribed behavior, the emergence of maladaptive reactions from the recruits are in such a situation. In the military environment, there cannot speak about marginalized individuals in the true sense of the word, as all soldiers have the same living conditions and training, are subject to the same rules and the same rules.

There is a concern in some military affiliation insufficiently integrated into the group to adopt rules incompatible with the standards of morality or rationality of the body military, while the character deviant behaviors occur. The main factors that lead to the emergence of defense mechanisms, are inconsistent with the values of skills that young people coming military system sometimes armed, the integration effort is not made in full, insufficient knowledge of the master subunit subordinates; restructuring army, which forms the emergence of deviant behaviors favorable conditions, some logistical shortcomings and beyond.

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INNOVATION AND ORIGINALITY OF FEUERSTEIN METHOD

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Abstract: *Reuven Feuerstein − psychology and pedagogy professor emeritus at the University of Bar Ilan, Israel, and reader at George Peabody College of Vanderbilt University in Nashville (Tennessee, USA) – elaborated* ***the theory of mediated learning****, which he operationalized in order serve educational practice, avoiding thereby the exclusion of vulnerable children from the education system, offering them opportunities for social adaptation. Professor Feuerstein provides us through his methodology and Instruments a valuable program of "learning instrumentation" used both in Romania and worldwide. The Instrumental Enrichment Program is adopted by villages throughout Europe as "complementary method to traditional education" proving efficiency in education and training of thousands of students*

Keywords: *mediated learning, cognitive potential, mediation criteria, LPAD, learning instrumentation, cognitive functions, structural and cognitive modifiability.*

1. INTRODUCTION

Feuerstein was born in Bucovina in 1921, and started his career as educator and escaped the Nazi terror in Bucharest. During World War II, Reuven Feuerstein fled into the country which was then called Palestine and began working with children and adolescents who came from refugee camps. These children, who came from Europe, Africa and Asia, were culturally deprived children. Based on their performance level - given the low level of intelligence tests and their poor schools results - many of the children were considered retarded in development. Feuerstein refused to accept the simplistic hypothesis of mental retardation of these children and found that they had a much better potential than the potential observed in tests. He attributed poor cognitive development of surviving children of the death camps to *the lack of mediated culture learning*.

After psychology studies in Piaget's lab, with Rey and Eysenck, he has developed his own theory of cognitive development of children. His theory, based on the notions of *learning potential* and *cognitive and structural modifiability*, required the development of a suitable method related to the concept of "instrumental enrichment" and a dynamic approach. In this regard, the method has been tested on very different categories of children and young persons: Ethiopian immigrants (deprived of schooling up to that moment), immigrants from different cultures (with a low degree of knowledge of the country's language) to facilitate their enrollment in school and society, children with different types and degrees of disability, military with low schooling levels, children and young persons with behavioral disorders, hardly adaptable and hyperactive. In all these cases, the educational program proposed by Feuerstein has proven useful, leading to improved adaptability of participants.

Feuerstein, together with a group of researchers developed an approach to compensate for the lack of mediated learning and cultural transmission, to modify learning and thinking abilities in a structural way. One

of the systems applied in practice, which derives from his approach, is the Instrumental Enrichment Program. (Reuven Feuerstein, Mildred Hoffman, Teacher's manual for organizing points.)

There are some questions discussed more and more extensively and to answer them, he started a process involving several disciplines "Born or become intelligent?", "Intelligence can be modified under the influence of brain development?", "What is the role of the learning experience in interpersonal relations, is there a single type of intelligence?", "What is the relationship between cognition and emotion?".

Then, the introduction and development of cybernetics brought forward, after years of recovery, the study of the mind and methods by which thought is organized with the aspiration to clarify all aspects and their identification (Michaela Minuto, Renato Ravizza, 2008).

Particularly, the revolutionary stage begins for the psychologists, Jean Piaget states: the child is not a "kid" but the child's thinking develops in different stages. Jerome Bruner emphasizes the role of the interaction with the adult and the importance to give a meaning to the experience. In the theories of Carl Rogers, Erik Erikson, Abraham Maslow (who started between the two world wars) the psychology is related to reflection on values and on the human being as individual in its uniqueness. In this period the interrupted dialogue with the Orient is reopened, bringing into the country the studies of Luria and Vîgotski highlighting the relation between thought and language, the role of social interactions as points of development, human ability to outdo itself due to cultural transmission and relationship with others (Michaela Minuto, Renato Ravizza, 2008).

Feuerstein's Instrumental enrichment method is part of cognitive education and focuses on that part of education which is mostly capable of change: the child and his teacher (J. Lebeer, 2000). The specificity of Feuerstein's idea and method is exactly the focus on adult's role in the emergence of progress in children thinking and learning abilities. The parent, the educator, the teacher or other intervening becomes, therefore, the organizer of life experiences leading to the cognitive formation and its structural changes. Mediated learning experiences explain the diversity of human nature and its modifiability.

2. UTILIT Y AND WORLDW IDE CONFIRMATION OF FEUERSTEIN'S METHOD

During the past years, the theoretical foundation of the method and its research were extended worldwide, due to The International Centre for the Enhancement of Learning Potential and to the network of people that rely on the theory of mediation in their educational work.

The International Centre for the Enhancement of Learning Potential, founded in 1993 by Reuven Feuerstein together with his son, the rabbi Raphael Feuerstein represents an operational and reference centre for all those interested in this method. The work started in Hadassah – WIZO – Canada Research Institute (HWCRI) is continued in this centre performing activities with children, their families and develop research and developing activities for new theoretical and conceptual instruments (Minuto, Michela., 2009). Feuerstein's method is investigated and implemented in this Center. The staff consists of a team of over 160 professionals - psychologists, therapists, educators and support staff - providing recovery services, interacting with children and young adults who have special educational needs or other disorders. Professional courses (trainings) are held based on Professor Feuerstein's method for teachers, psychologists and health professionals in Israel and around the world.

The centre organizes workshops on MLE (Mediated Learning Experience), LPAD (Learning Potential Assessment Device) and IE (Instrumental Enrichment). This proves to be a primary international structure to discuss training materials used in over 70 centres of more than 30 countries throughout the world. The operations are divided into 3 main parts: Direct Services, Training and Analysis, Research and Development. By a wide and updated range of programs designed to improve learning and thinking potential, Feuerstein Center contributes significantly to

the quality of life of people in Israel and many other countries.

The first step is to measure the potential of a student using The Learning Potential Assessment Device (LPAD) - a series of cognitive tests applied over several days. After conducting this assessment, individualized intervention is quantified by a professional team. The intervention takes the form of Instrumental Enrichment (IE), tasks in analytical perception, comparisons, classification, orientation in space and time and is applied by Mediated Learning.

Mediated Learning implies a strong interaction between the student and a "mediator" who interprets the external stimuli and the response to those stimuli. IE focuses on process rather than content, so that the student learns how to learn. Many of the students benefiting from Feuerstein method can later be integrated into the traditional educational system.

The method can be personalized for the specific needs and abilities of the student, including for those with:

A. Autism disorders

Autism Spectrum Disorders (ASD) include mental deficiencies, autism and other disorders.

The use of MLE (Mediated Learning Experience) for the treatment of children with autism is remarkably efficient. Since autistic persons resist the type of interaction used in mediated learning, Feuerstein Center professionals organize intensive evaluations using LPAD to discover those "islands of normality" that offer educators a window into the world of the autistic child.

B. Visual impairment and blindness

In 1993, Dr. Roman Gouzman from Feuerstein Center began to adapt IE (Instrumental Enrichment) methods and instruments for the blind persons, a category with very specific difficulties. IE includes analytic perception, orientation in space and time, compared behavior, classification and other areas, most of which were adapted for the blind persons. Braille writing system also allows the blind to work independently. IE approach within Feuerstein Center is one of the most successful programs available to blind users worldwide.

The experience of Feuerstein Centre has shown that the practice of these exercises can help a visually impaired person to obtain cognitive functions that a seeing person gets through visual perception, making integrated education a viable and effective option for blind students.

C. Brain damages

Millions of people worldwide suffer from brain damage caused by car accidents, military service or heart attacks. For many of them cognition, social interaction and movement are insurmountable. However, recent research has shown remarkable regenerative properties of the brain, and in the mid-1990s Feuerstein Center established a neural-cognitive rehabilitation program for children and young adults with traumatic brain injuries. In short: IE provides reconstruction of a life full of meaning and significance

D. Down Syndrome

Down Syndrome (DS) is one of the most common chromosomal abnormalities.

Most children with DS have average to severe learning problems and their physical, motor and speech development are slower than their peers. However, they are normally involved in cognitive structure modification program and in Mediated Learning because, generally, they interact. Such mediation is effective even at very early ages. Parental

involvement is crucial and parents are also beneficiaries, although sometimes they alienate themselves from their DS children.

E. Culturally disadvantaged persons

A group often overlooked, facing education issues, is that of emigrant children with speaking difficulties, with foreign culture and different educational expectations in their new country. Feuerstein Center uses LPAD to determine the volume and depth of atypical issues for a student and to determine whether the student is "different" or "disadvantaged". Then IE is applied: 14 paper-pencil instruments targeting the analytic perception, orientation in time and space, comparisons, classifications designed to correct deficiencies in thinking and learning skills and to provide students with the concepts, skills and techniques necessary to cope with the individual study.

The program is transcultural, placing the process above content and can be implemented both in the classroom and individually.

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FEUERSTEIN INSTRUMENTAL ENRICHMENT PROGRAM
- instrumental learning method -

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Abstract: *Mediated learning theory was operationalized through the 14 instruments of Feuerstein's methodwhich in their turn were articulated in a so-called "instrumental enrichment program" (Instrumental Enrichment, or IE). The program aims directly at some cognitive functions, often short in people with learning difficulties: the ability to compare structures, to findanalogies and differences, the ability to model and materialize, to generalize, to plan, to abstract, to orient in space and time, the capacity to establish analogic, serial numeric relationships, etc., visual and numeric memory, graphical representation capacity. By the attractive, unconventional presentation method, theinstruments motivate both children and adults to perform exercises and overcome thinking difficulties. Theinstrumentation of child's thinking with elements helping to mobilize and adjust its own thinking will aim to create its intrinsic need to use higher intellectual ways in solving its school and social problems. Child's strive to make autonomous intellectual activity will increase its degree of independence and will change its own perception of itself as autonomous cognitive personality.*

Key words*: mediated learning, cognitive modifiability, mediation criteria, learning potential.*

Mediated learning theory and the instruments developed by Feuerstein's team help to increase cognitive abilities on the one hand by increasing motivation for problem solving and on the other hand by providing a sense of expertise to persons who are subject to learning. They lead to structural cognitive changes - which appear by educating the cognitive functions, including the poor ones, and creating a system of significance and meanings specific to higher intellectual levels - as well as to some progress in intelligence.

The program proposed by Feuerstein, „Instrumental Enrichment" (**IE**), is based on the theory of cognitive structure modifiability, according to which a great part of person's modifiability is directly related to the quantity and quality of mediated learning experiences (**MLE**) to which that person was exposed (Feuerstein et al., 1986). The ability to benefit from direct exposure to stimuli, no matter how many or few they are, is contingent upon the nature of mediated learning the person was exposed to. The longer a person is exposed to**MLE**, the more he/she will be able to benefit from direct exposure to stimuli and become proficient.

MLEare not random, either in terms of content or in that of language. Only by organizing and structuring a set of events, thus making the child aware of sequencing and programming, we shall be able to influence how the child will interact with stimuli.

Based on the theories of Piaget and Vîgotski, Feuerstein is not only interested in analysing the operation of intelligence itself, but also in intelligence as a human resource that can be enriched and improved. He examines in particular how cognitive retardation might be overcome, emphasizing that the presence of a good mediator able to

develop in full the capacity of the subject could significantly reduce (sometimes even cancel) disability. The concepts of *learning potential*, *cognitive modifiability* and *mediation* represent the foundations of psychological theory of Reuven Feuerstein (D. Mara, 2009).

Learning potential represents a sum of virtual latent behaviours, which require a degree of involvement in order to be transformed into acts. However, the human mind is not limited to having a latent potential, prebuilt anyway, that may become manifest, its possibilities being far superior. By means of educator's action (mediator, as defined by Feuerstein) abilities can be formed that otherwise would not have existed.

Cognitive modifiability refers to the ability of human beings to change their own cognitive functioning structure in order to adapt to situations that occur throughout their life. Modifiability is not a simple reflex act to external stimuli, but it is a response to internal changes that, such as growth, is the result of a series of voluntary and conscious acts that can - and sometimes should - be guided by someone from outside.

Although *cognitive* aspects of modifiability are highly emphasized, Feuerstein is not ignoring at all *affective-motivational* and social aspects. Cognition and emotion are two sides of the same coin, says Piaget. Feuerstein presents cognition as "the royal road" to change individual function. Once the individual has been provided with an adequate vocabulary, accuracy and comparative behaviour, with a good hypothetical thinking and proper ways of deduction, it will be able to gain more emotional insight and other experiences. Cognition should lead to motivation. Due to mediation and mediated learning experience acquisition, "difficult children" often change their behaviour completely. Feuerstein considers that there are two ways of learning – a direct approach and a mediated one (M. Skuy, 2002):

The direct approach is based on Piaget's formula:

$$\mathbf{S - O - R},$$

meaning that the learning organism (**O**) or individual interacts directly with the stimuli (**S**) of the surrounding world and issues responses (**R**). In such an interaction with the environment, learning occurs incidentally, being considered by Feuerstein - although fundamental and necessary - not sufficient to ensure effective learning.

Mediated approach, the second type of approach, is essential, guaranteeing the efficiency of learning. Therefore, Feuerstein develops the **S-O-R** formula proposed by Piaget, interposing a human mediator between the stimuli, organism and its responses. The new formula obtained for mediated learning is:

$$\mathbf{S - H - O - H - R},$$

where **H** represents the human mediator. The mediator interferes in the relationship between the learning organism and the stimuli universe to interpret, guide and give them meaning. In such an interaction, learning becomes intentional.

Both types of relationships – direct and mediated – are necessary for optimal development.

Mediation means the intentional and active intervention provided by the teacher to people he/she interacts with, aiming at the best possible way to develop their abilities and for the persons to reach, gradually, a level of autonomy as full as possible.

In the past, a number of factors were considered responsible for the poor intellectual level of children. These included cultural differences, low socioeconomic level, poverty and other endogenous and exogenous factors. The question is, nevertheless, whether cognitive functions, pre-acquisitions for learning are impaired only when these determinants are combined with the lack of interactions of mediated learning experiences (**MLE**). Reuven Feuerstein (Feuerstein et al., 1986) called the phenomenon of "media deprivation", "cultural deprivation" because, in essence, the child which is not exposed to mediation is deprived of its own culture.

In mediated learning experience it is important for people dealing with children to be aware of their role and to act according to mediation criteria that positively determine the child's abilities to modify the structure of its cognitive potential. Here are the main criteria of mediation (M. Skuy, 2002):

a. Mediation of intentionality and reciprocity

Intentionality and reciprocity are key conditions for achieving mediated learning experience.

The mediator implements intentionality when guiding interaction toward a goal, selecting, organizing and interpreting certain stimuli;

Reciprocity is checked when there is a good response from the subject and it is demonstrated that it is responsive and involved in learning process; reciprocity is a key issue in child development because the child realizes that its actions can be decisive in action with the world;

The three elements influencing and involved in intentionality and reciprocity are:

- the mediator – whose language, rhythm, tone of voice and body language can be exploited to increase the intentionality,
- the mediated person – whose attention, interest level and availability influence reciprocity,
- thestimulus – (presentation of ideas and material) which may show variations in terms of amplitude, repeated presentation and exposure method, to facilitate both intentionality and reciprocity.

b. Mediation of meaning

The meaning is the emotional and energy principle which requires mediators to ensure that the stimuli presented to children reach them. Mediation of meaning occurs when the mediator communicates the other person the meaning and purpose of an activity.

Meaning is mediated by assigning signification, both at cognitive / intellectual and affective / emotional levels: the values and beliefs are communicated at cognitive level,the energy and enthusiasm are communicated at emotional level.

c. Mediation of transcendence occurs when the mediator acts so that the mediated learning experience emerges from the context in which it occurred and goes beyond its limits, expanding and diversifying the needs of the mediated person. Its purpose is to promote acquisition of principles, concepts and strategies that can be generalized and used in new or similar situations;

This involves:

- association of present events with events from the past or with future events,
- engaging in reflective thinking to reach deep understanding of the situation,
- collateral thinking on experience and problems.

The implementation of instrumental enrichment method may be a solution to issues raised by changes required regarding the content and aim of education. As a result, some governments like those of Spain and Belgium have introduced explicitly the "learning the skills to learn" and "learning social skills" in their educational syllabus.

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BUILDING AN END-OF-COURSE SURVEY – AN EFFICIENT MEANS OF ENSURING QUALITY

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Abstract: *In order to make a course as successful as possible, it must be constantly monitored, reviewed, and renewed. This statement is common knowledge and it applies to all types of courses, on any educational level. However, this need of finding out what a course was really like and how well all the aspects it involved were addressed is even more obvious and imperative when starting a new study program or implementing a new course. This may ensure that the course itself (goals and objectives, learning outcomes and contents, length, syllabus) as well as the manner of teaching it are appropriate and up-to-date and meet the expectations of the stakeholders. The present paper presents a few ideas about the usefulness of surveys applied at the end of any course, emphasizing the necessity of devising a questionnaire for teachers. The final part consists of a number of questions we considered of particular significance, as their introduction in such a questionnaire is meant to reveal teachers' feelings and opinions regarding the latest foreign language intensive courses.*

Keywords: *language program, assessment, end-of-course, teacher questionnaire*

1. INTRODUCTION

Generally speaking, end-of-course surveys are conducted or at least should be conducted at the end of any course or module within a study program. This always provides good opportunity for students to express their opinions on the course and the way it was taught. The results of the end of course critique or course feedback, as it is sometimes called, are, at least theoretically, used afterwards by the teacher who teaches the course, a supervisor, a member of the faculty management, or anyway, one of the decision makers regarding that course in order to analyze the overall quality of the course given by the teacher's performance and the degree in which the goals and objectives initially set were also met. Starting from these conclusions, anyone who is interested in the course and also in a position to do so will take the necessary measures to amend the syllabus, the resources used, and even the way of teaching in order to have better results in the future.

No teacher should ever be afraid of designing and applying such end-of-course questionnaires. It is well known that a good teacher teaches and learns at the same time. No matter if the teachers are new or experienced, if they have taught the course for the first time or the tenth time, evaluating their own teaching is anybody's core duty. Only thus, could they identify the strong aspects of their practice, as well as their weaknesses which may need to be solved somehow. Besides, even if the results show at a certain moment that a teacher is excellent with respect to course materials, course activities, and learning outcomes, he/she will still have to be

ready at any time to act in order to revise the course so as to suit the needs of the beneficiaries, the current circumstances, and the diversity of their students.

Usually, the end-of-course survey is centered on the following main aspects:

- standardized questions regarding students' background;
- students' feelings with respect to the degree in which the course goals and objectives were achieved;
- the relevance of the materials used and the degree in which they were adapted to the students' level, students' interests, and course goals and objectives;
- the general manner in which the course was taught with respect to issues such as the amount of time dedicated to every skill, the amount of homework given and self-study time allotted, types of activities, etc.;
- the teacher's performance, judged as objectively as possible, with respect to issues such as subject matter knowledge, course organization, classroom dynamics, class management, teaching techniques, fairness, accessibility, flexibility, enthusiasm, willingness to constantly provide feedback, positive attitude towards the students and the course contents, etc.
- the venue where the course was held, the resources available, plus any other "administrative" issues of interest to the way the course was conducted.

Any course critique is focused on two main aspects: what the students liked and what they disliked about the course. Obviously, each issue addressed may be as detailed as possible in order to provide an accurate assessment of the situation. For instance, learning activities or tasks may be listed and students may be asked to tick or circle those which were particularly useful in helping them meet the learning objectives of the course: reading materials, listening activities, pair or group work, group debates, case-studies, writing tasks, homework, etc. On the other hand, students may also be asked to specify any factor or situation that had a negative impact on the course or even impeded their learning. Moreover, students may be asked to make an overall assessment of the effectiveness of the course and the teacher, using certain scales of quantitative scores. Any course feedback usually ends by asking students open questions such as "What did you like most about this course?", "What did you dislike about the course?" end even expecting them to make suggestions in order to improve the course in the future or make it a better learning experience.

Course evaluations are an important tool for the teacher and for those in charge with the respective study program if they are designed properly. Actually, the purpose of using surveys at the end of any course, module, or study program is that of **safeguarding the quality** of that course, module, or study program. Thus, strengths and weaknesses are identified, an assessment of the degree in which goals and objectives were accomplished is made, the areas that need attention, support, revision, improvement are identified, and the strategies which may be used for obtaining better results in the future are analyzed.

Questionnaires applied simultaneously to all the teachers teaching the same course or module as part of the same study program, no matter the foreign language center in which they teach, may provide a comprehensive picture that would reflect their general opinions and can be efficiently administered in terms of time and resources. On the other hand, just as it happens with end-of-course questionnaires, the survey has to be carefully designed so as to avoid confusion and negative reactions from the teachers (if they think they are being evaluated in order to be criticized, not in order to be helped to optimize their activity or to optimize certain aspects of the course).

A first step that must be taken in designing the end-of-course questionnaires for teachers should be analyzing key aspects regarding the manner in which questionnaires are built. Research on the internet [1] revealed

interesting perspectives and significant tools to be used and thus, we considered it useful to devote the next part of the paper to the most important factors to be taken into account when designing a questionnaire.

2. USEFUL TIPS FOR MAKING A QUESTIONNAIRE

It is common practice in the business world to give questionnaires, to perform surveys, in order to gain information from a target audience. People use this tool in marketing, in media, in politics, and in various other domains. The results can lead to re-branding, decision-making and policy changes depending on the feedback. (www.wikihow.com) The types of questions asked and the style used will largely depend on the audience and the information the initiators are attempting to obtain. It is very important to design the questionnaire properly; otherwise, the results may prove irrelevant or worthless.

The first step is deciding what exactly you are interested in finding out from the questionnaire. By asking yourself how you will use the data obtained you can infer the questions you must ask and the order in which to ask them. Also, one must keep in mind that the shorter the questionnaire, the better chances it will have to be completed properly, fully, and in due time. This, however, should not lead to questionnaires which are too short or who lack certain questions that may reveal key aspects of interest to the one who designs and applies the questionnaire.

Any questionnaire should be preceded by an introduction which should be both short and comprehensive and should include the following issues (www.accesscable.net):

- The purpose of the survey and its relevance for the one who initiates it and even more so for the one supposed to complete it;
  - What may be done with the results and what possible impact the results may have;
  - Due date for response;
  - Person of contact.

In most cases, questionnaires range in design from those using open-ended questions, where the people asked are able to give their full opinions, to those using simply yes or no questions. In both cases, the questions and answers (where applicable) must be phrased using as few words as possible. Open-ended questions are relevant because they tend to bring more feedback as they are bound to offer insight from the target audience. Yet, if the goal is to obtain specific answers to questions, these may not be so useful, as people may be more guided toward answers by closed questions. The closed questions have several answers given and the respondent should tick or circle one or sometimes more than one answers. A questionnaire made up of this type of questions may be easier to decipher and interpret, but it may be less meaningful than the other type. Moreover, the list of questions needs to be quite long. It is equally true that most of times an effective questionnaire consists of both open-ended and closed questions as this is the best way to get a lot of information and in-depth feedback. Regarding the open-ended questions, plenty of space should be left for the respondents to answer, however without exaggerating, as too much space may be considered intimidating by some people who might think "oh, what am I going to fill all that space with?"

The next step is prioritizing questions: starting from general to specific, from the most important to the least important ones, or the other way around, depending on your goal and on the target audience (as long as you know its basic characteristics). The multiple choice answers can be scaled (www.ehow.com), ranging from "I fully agree" to "I completely disagree" or from "excellent" to "very poor" or complete answers such as "I learned a lot" to "I learned nothing". One should keep in mind the fact that words always tell more than numbers, so it will always be more useful to allow the respondents to answer using words rather than rating some items on a scale from 1 to 5 for instance. Still, when using ranking on a numerical scale, the instructions must be very clear with respect to what each number means.

3. CASE-STUDY – A POSSIBLE QUESTIONNAIRE FOR ENGLISH TEACHERS IN MILITARY FOREIGN LANGUAGE CENTERS

Starting the academic year 2012-2013, it has been decided to introduce a new type of study programs for foreign language learning, made up of modules and abiding by the Common European Framework. The syllabi have been designed as such and foreign language teachers have been instructed so as to carry out their teaching using them. The general idea was that, given the assumption of an adequate selection process, in order to optimize the training process, the duration of each face-to-face module should basically decrease and should necessarily be followed by an on-line module. This type of blended learning is supposed to make students reach the 2222 STANAG level at the end of the intermediate course and the 3333 STANAG level at the end of the advanced course. In order to have an overall picture of the way in which these new syllabi, as well as these new periods of instructions, and finally the program in itself are functioning, we considered it beneficial to develop a questionnaire for teachers. The questions were discussed on various occasions within the Foreign Language Department, "Carol I" National Defense University.

Considering its purposes mentioned above, this particular questionnaire should be directed less towards finding out things related to the teacher's style and strategies and more towards finding out things related to the amount of time per module versus the amount of knowledge comprised in the syllabi, as well as students' reactions viewed through their performance. This should be applied at the end of each face-to-face module and ideally should be completed by all the teachers, from all the foreign language centers in the Romanian armed forces, irrespective of the language taught. Obviously, it should be in Romanian.

Rules say that in order to receive honest answers, questionnaires should be given anonymously. However, in this particular instance, probably any teacher should have a stake in depicting the real situation and drawing conclusions which may improve in the long run the educational process. One final point to be mentioned is that in order to maximize the level of feedback received, all sorts of questions will be used (open-ended, yes/no, scaled, multiple choice).

The first few questions are meant to establish the respondent's profile:

- **How long have you been teaching?**
- **How long have you been teaching in the military system of foreign language education?**
- **What module have you completed?**

The next questions will be related to the content of the respective module:

- **How often were the following activities a primary focus of instruction for your target group (on a scale including *never, less than once / week, 1-2 times / week, 3-4 times / week, every day*)?**
    - **Vocabulary**
    - **Language functions**
    - **Reading comprehension**
    - **Listening**
    - **Grammar**

- **Writing tasks (in the classroom)**
- **Exam tasks**

- **In the module you taught (on a scale including *never, less than once / week, 1-2 times / week, 3-4 times / week, every day*) how able were you:**
  - **To communicate the subject matter appropriately**
  - **To stimulate students' interest**
  - **To motivate students**
  - **To "negotiate" course content by adapting it to students' real needs**

- **In your opinion, which is /are the most difficult sub-skill/sub-skills to acquire:**
- **In the module you taught, which was the skill you devoted the most time to? Why?**
- **In the module you taught, which was the skill you devoted the least time to? Why?**

The next questions will address students' reactions as perceived by the teacher:

- **Did students usually work hard for good results in your group?**

_ Yes
_ No

- **Were there exceptionally passive or demotivated students in your group? If so, how many?**

_ Yes ..... students out of .....
_ No

- **In your opinion, were there students who failed to reach the objectives of the module for all / at least three skills? If so, how many?**

_ Yes ..... students out of .....
_ No

- **Why do you think they failed?**

_ lack of motivation
_ health problems
_ lack of effort
_ lack of time because of job-related duties
_ lack of a previous language course
_ difference in level or of other nature from his/her colleagues
_ some other reason
Please, specify the reason:

- **How often did you assign homework and self-study activities?**

_ every day
_ 3-4 times / week
_ 1-2 times / week
_ seldom
_ never
Please, specify the reason why you never assigned homework:

- **How much time did you expect students to spend doing their self-study assignments?**

_ 30 minutes
_ 1 hour
_ 2 hours and more
_ I did not assign homework

- **How often did most of your students complete the home assignments?**

_ always
_ most of the time
_ seldom
_ never

- **How much time did you have to give feedback to students during the module you taught?**

_ after every activity
_ only after group activities

_ only after home assignments
_ never

In your opinion, w hich are the stronges t features of the w ay t he foreign language learning program is structured? Which are the strongest features of the module you taught?

In your opinion, w hich are th e w eakest features of the w ay t he foreign language learning program is structured? Which are the w eakest fea tures of the mo dule you taught?

4. CONCLUSIONS

All the questions in the questionnaire for teachers may very well reveal useful insight not only regarding the way the course went, but also regarding teachers' subjective opinions and feelings. This information can be used to modify the content of the course, be more realistic about the objectives of the course and the possibility to fulfill them over a certain period of time. In addition, the questionnaires will shed new light on the students' needs and expectations and on ways to improve their motivation and commitment. By having a more comprehensive language program, the rate of success will also increase together with students' participation and motivation.

Cumulated further on with the data resulting from the STANAG evaluation of students after the course ends, the information gathered from students' critique, and the supervisors' impressions, the decision makers may thus have an extremely useful tool for performing an overall assessment of the module and, by extension, the study program too. In the end, by analyzing the feedback, they will be able to alter or redesign the courses by polishing some of its rough edges and obtaining a better version that will meet both beneficiaries' and teachers' demands on the one hand and students' expectations on the other.

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LUDOTHERAPY FOR RECOVERING CHILDREN'S NEUROMOTOR DYSFUNCTIONS

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Abstract: *The purpose of this research was to demonstrate that the introduction of game, playing, in general, as part of the kinesthetic therapeutic treatment under the form of ludotherapy can enhance the recovery of the neuromotor dysfunctions of the research subjects. The complex, medico-psycho-kinesthetic evaluation was the starting point for the success of the therapeutic behavior. Ludotherapy increases the stability and the balance in sitting, quadrupeds and on knees and can amplify the effects of rehabilitation in subjects with neuromotor disability. The research took into consideration the children's medical records, the social investigation, focusing on their living conditions and family relationships, the conclusions and recommendations of the multidisciplinary team of specialists, the therapeutic intervention plan for each area, the anamnestic interview, the systematic, active, intentional, structured observation, the Portage Guide, the psychomotor assessment scale, testing the playful level and the functional motor level. The data were useful in order to know the child on all levels and to determine a ludotherapeutic conduct appropriate for each child depending on his mental structure, the current deficit and his level of cognitive development. The therapy aimed at developing and educating the motor skills of the children with neuromotor dysfunctions in a pleasant way, through games, by engaging the entire range of motor actions. The experiment was conducted over a period of three months, a total of four subjects, with ages between 3 and 4, with different clinical diagnoses. The therapy through games was conducted either individually, when we sought to capture attention and voluntary control for the finesse activities, the eye-hand coordination activities, or collectively for training balance and walk in different positions. The obtained results were possible due to the introduction of ludotherapy during the kinesthetic therapeutic treatment, making a positive impact on children, recording good progress meeting by meeting.*

Key words: *ludotherapy, kinesthetic therapy, motor development, progress*

The formative valences of the game focus the attention of any observer, especially when it comes to children's game. In this case, the game makes the difference, meaning life, which can flourish or degenerate, depending on how much spiritual nourishment it is able to give. A child's image may appear charming or poor, depending on the extent to which s/he benefited, at the right time, by his/her natural right to play or the extent to which s/he was deprived of this right. What games can give the child at the right time remains a valuable acquisition throughout life. What was not provided in time can never be fully recovered, no matter how many solutions one would try. The game, even in its primary form, ennobles the child's whole psychic life, humanizes him/her and it helps him/her to be harmoniously developed from a psychophysical point of view, being used as an effective therapy for various mental disorders. The term "ludotherapy", coming from two words: "ludus" (lat. game) and "therapia" (gr. care), will be a means associated with kinesthetic therapeutic techniques to reduce deficiencies and even normalize the psychomotor and mental functions of the children with psychological and neuromotor disabilities. The game is a first and fundamental source of personality development, and the attention given to it should be great. The first references to the therapeutic role of the game belonged to psychotherapy. "Based on the functions of the mental and instinctual exercise, of the integration of the reality, of the mental assimilation of events, of socializing, of downloading, the game is used as a therapy in various psychiatric disorders. Without neglecting the sanogenetic virtues of the adult's game, ludotherapy refers primarily to a psychotherapeutic technique for children" (C. Gorgos, 1988, p. 1079). The need for specialized, medical, educational, social, instructive assistance is constantly in communication and interrelations with new areas, such as ludotherapy, occupational therapy, kinesthetic therapy, speech therapy, psychotherapy, working not only to create a closed community for the children with disabilities, but to create a normal social life, in which human dignity should above all be respected. The game is a primary source of personality development; therefore, the education of the future man of action occurs, above all, while playing. In various forms and types of games, the share and the way of combination of the functions and the mental capabilities vary greatly, the ludic activities depending on the degree of development of the specific mental processes - perception, memory, imagination, thinking, motivation - and on the degree of the global personality features. Thus, the relationship between the ludic activity and the mental organization of the person takes the form of a closed circuit with bi-univocal influence, where conditioning is mutual.

Playing is the main activity, specific to childhood, and for children with disabilities it is often the only way to relate and communicate. Based on biological, psychological, pedagogical, ethnological, anthropological, etc. research, the play therapy was established as a scientific discipline, its research purpose being the "game", the "play" as a complex activity, fundamental in training and developing the human personality, especially in the early stages of ontogenesis. The cathartic function of play was presented and underlined by doctors and psycho-pedagogues who take care of children with special needs and of children with intellectual or motor disabilities. Hence, therapists studied the play further and found extremely valuable therapeutic properties in it, opening, thus, the way to a new discipline, ludotherapy or the Anglo-Saxon "Play Therapy". Currents, schools and institutions of this discipline developed worldwide, aiming at helping children with emotional, instructional, behavioral or mental health problems, dealing with the training of the parents and with the professional qualification of the specialist teachers, counselors, volunteers, psychotherapists, psychologists, therapists. Ludotherapy centered on child develops further, helping children with emotional, psychosocial and behavioral problems. Experts in child psychology believe that, by the beginning of school, playing is a form of

activity that supports mostly the mental development by involving the psychomotor, sensory, intellectual and emotional sides – at a very specific tension - presenting for the mental development and growth the same importance as the training activities of the school years.

The effects of the ludic activities may be various, being different and special when they are organized for children with some motor dysfunctions, encouraging them to overcome their inhibitions and improving their general behavior. The psychotherapeutic aspects within the "action of complex integrated rehabilitation therapy", the operationalization of the actions are guided by the system of objectives offered by the literature.

In the model of the action of the complex rehabilitation therapy integrated through game, C. Păunescu classifies the types of psychotherapy through game, setting out five such therapies: behavioral therapy, psycho-motor therapy, cognitive therapy, development therapy and group therapy. For the present research, the following are important: the motor debility therapy, the psycho-motor instability therapy and the therapy of motor disorders, recommending sets of games for each of these situations.

The research was conducted on a number of four children with different clinical diagnoses within the neuromotor disability. The subjects were from the "Arnsberg" Center from Alba Iulia. The purpose of this research was to demonstrate that the introduction of play into the kinesthetic therapeutic treatment under the form of ludotherapy can enhance the recovery of the neuromotor dysfunctions in the subjects of the research.

The complex medico-psycho-kinesthetic evaluation was the starting point for the success of the therapeutic behavior. The selection of some samples and tests easy to apply, specific to disability, gives us a true picture of the existing mental and functional deficit, facilitating the selection of the means of the therapeutic intervention. The games were structured and implemented respecting the individual characteristics of each child. The affective-emotional climate conducive to carrying out the therapy is the most important element for success, highlighting the plus the game brings to the traditional therapy.

Physical deficiencies, defined as deviations from normality in the physical form and functions of the body, disturb the normal growth and the harmonious development of the body, change the physical appearance, reduce the skills and the power to adapt to physical effort and reduce the individual's ability to work productively. They are characterized by morphological changes, more or less pronounced, produced in the form and the structure of the body and manifested through a slowdown in growth or an excessive growth, a development disorder or disproportionate development, through deviations, deformations or other structural defects, followed or preceded by functional disorders. Physical deficiencies as body invalidities weaken the strength and mobility of the body through external or internal pathological changes, localized either at the whole body or at the level of its segments. The deviations from normality produced by morpho-functional disorders lead to imbalances and the installation of disharmonious development leading to frustration and anxiety, inner conflicts and tensions, with difficulties in relationships with the others and of integration in the social and professional life.

Psycho-motor function, as a complex function, integrates and subsumes mental and

motor manifestations that determine the regulation of the individual behavior, including the participation of various processes and psychic functions that ensure both the reception of information and the proper execution of the response. With a great significance in regulating voluntary actions, the psycho-motor has the following components: body schema, laterality, basic motor conduct, organization, orientation and spatial-temporal structure, perception and representation of movement.

Body schema, essential basic element of training the child's personality, is the child's representation of his own body, being a simplified model, not so much of the form, but rather of the functions and relationships of different parts of the body, forming a stable reference for the development of posture and mobility.

Laterality refers to acknowledging the two parts of the body, left and right, and expresses the functional inequality of the left or the right side of the body as a consequence of a difference in development and of the distribution of the functions in the cerebral hemispheres. The functional dominance of a part of the body on the other causes laterality (right-handedness or left-footedness or left-handedness, etc.). This lateral predominance should be perceived as a relative functional dominance, as we cannot speak of either 100% right-handed or 100% left-handed.

Space is perceived and constructed at the mental level, as a result of the notifications of positions, directions, distances, movements. The "orientation disturbances" lead to disturbances such as dyslexia, dysgrapfia, dyscalculation, etc. The disorders of the temporal structure can manifest in four distinct symptoms: the child's inability to find the order and sequence of events, the lack of perception of intervals, the absence of a regular rhythm, the inability to organize time. All these symptoms are caused by a trinomial of causes: motor, psychomotor and psychological.

The perception and representation of movement plays a really important role in achieving adequate, accurate perceptual-motor structures. The idea-motor representations are linked forever by a previous personal experience. If the goal of the activity reflected in the brain meets the idea-motor representations of a similar experience, the action will take place more easily. Due to the conditioned character of the representations and interaction of the first system of signaling with the second, it contributes to the mental learning of those exercises for which there is a previous experience. The representations of the movements are mainly visual, especially when the child thinks of the action to be performed, when s/he memorizes the sequence of events.

The development of psychomotor is favored by several factors, the most important being: nerve maturation, learning and exercise, experience and motor behavior.

The initial evaluation of the children with neuromotor disabilities, developing individual programs of ludotherapeutic interventions and the final evaluation after the implementation of the ludotherapeutic intervention programs were the **objectives of our research**.

The **hypotheses** were based on the data from the literature, on the experience of various kinesthetic therapists and, last, but not least, on our experiences in the field of ludotherapy.

The introduction of playing under the form of ludotherapy in the kinesthetic therapy treatment for increasing stability and balance in the upright position, quadrupeds and on the knees position, can amplify the effects of rehabilitation in subjects with neuromotor disability. The movement and the emotional tonus of the games may have beneficial effects on psychological and behavioral level in subjects with disabilities.

MATERIAL AND METHOD

In order to carry out the experiment, we used the children's medical records, the social investigation, focusing on the living conditions and the family relationships, the conclusions and recommendations of the multidisciplinary team of specialists, the therapeutic intervention plan for each area, the anamnestic interview, the observation, the methods for assessing the neuromotor deficiencies. We discussed with the specialists from the center – the psycho-pedagogue, the

psychologist, the speech therapist, the social worker, the kinesthetic therapist, the physician –, and with the children's parents in order to learn as much information as possible about the children. The data were useful for knowing the child on all levels and for determining a ludotherapeutic conduct appropriate for each child, depending on his mental structure, the current deficit and his level of cognitive development. The type of observation used in research was the systematic, active, intentional observation, structured on the attitude of the child both in different fixed positions, and while walking, in various activities; the static or dynamic balance, the presence of active voluntary or involuntary motor movements such as synkineses, the children's stability in certain positions, the adoption of some characteristic positions, the present neuromotor development stage, the eye-hand coordination, the laterality, the notion of self and partner's body schema, the spatial and temporal orientation, the presence of skills, the independence or dependence on a particular person, the form of communication, the relations with the specialists and the children, the attitude toward the group. For the functional assessments of the children from the experimental group, we used specific tests, such as the Portage Guide, the psychomotor assessment Scale, tests for the ludic level and the motor functional level. Thus, we found inter-individual features in children with similar ages and diagnoses, features that will be relevant during the therapeutic intervention description.

Using the above mentioned tests, we aimed to evaluate the research subjects objectively and fully, each test having a numerical scale, according to which at different times of the assessment – initial, intermediate and final – we noticed the subjects' favorable development, their stationary situation or their regress. The evaluation was also necessary to compare the results, and to guide another conduct or to complete the previous one in later stages.

The Portage Guide includes both an inventory of skills that the children between 0 and 6 years must have and therapeutic educational suggestions for their acquisition. The Portage skills inventory is divided into 6 sections, areas of development, namely: infant stimulation, socialization, language, self-nourishment, cognitive and motor. In many cases, the skills can be found simultaneously in several areas. For example, all language skills require cognitive skills and motor behaviors. The self-nourishment skills need some motor skills and social behaviors. Some social skills require language that, in turn, requires cognition. Behaviors are lined sequential on each area from birth to the age of 6. During each year from 0 to 6 years old, there may be variations in the rate of acquisition of such skills.

The Guide served as a designing tool of a learning program rather than a mental age assessment tool, being accessible to any therapist who deals with children's education / rehabilitation. The Guide can be both a tool for assessing the children's motor acquisition, and a model for designing individual programs of recovery. In the case of the psychomotor assessment Scale, the psychomotor components were diagnosed: the identification of own and partner's body schema, Laterality, general dynamic coordination, segmental dynamic coordination, orientation, spatial organization and structure, temporal structuring and organization, posture control, movement control. The test of evaluation of these psychomotor components gives a true level of the psychomotor development, and for

the therapists from the special centers such evidence may be operational objectives included in therapeutic and educational programs, and, at the same time, may suggest specific types of activity in the form of the game, because it includes probes that aim at motor behavior specific to normal children. Testing the motor functional level included both the upper limb functional level, and the legs; each step having five categories different on age levels, and, depending on the score (normal 100% - for the upper and lower limb), the functional deficit is got both for the upper limbs and for the lower ones. To calculate the deficit a total of 30 points was considered normal for the upper limb and 20 points for the lower one. The deficit calculation was made according to the formula: M.I.= functional level x 20/100; M.S.= functional level x 30/100, the difference between the normal values and the pathological ones giving the value of the deficit.

The ludotherapy intervention strategy aimed to pleasantly address the motor development and education of children with neuromotor dysfunction by playing, by engaging the entire register of motor actions.

Adapting the program to the individuality of children was structured according to the psycho-motor development, the cognitive development, the type of communication, taking into account the permanent control of the educational intervention as well as its outcome expressed in specific conducts. The psycho-pedagogical methods used in the ludotherapeutic intervention were communication, focusing on non-verbal communication both for children with language disorders or mental delay and for the others, communication as a psycho-motor interaction encouraging the exchange of messages and motor behavior between subjects, achieving proposed specific objectives, directing and controlling the children's activity / play, positively influencing, waiting for positive reactions in the form of feedback; kinesthesia; the grips – the touches – being seen as basic facilitating elements, without which a movement cannot be stimulated in the case of subjects with central nervous system problems. The affective-emotional persuasion, the determination of the child to perform a ludic task, appealing to his feelings, emotions, represented a basic strategy of the ludotherapeutic approach. Its purpose was to guide and direct the child's conscious or unconscious motivations in the direction wanted by the therapist, but also to encourage, stimulate and convince the child of his successful acts and motor skills, to support the child "morally". During the therapeutic program, we also used the "demonstration", the "example" the "imitation", the "metaphor", taking into account the individualization of the ludotherapeutic intervention according to the present deficit, the neuromotor development level, the cognitive development level, the affective-emotional state, the needed form of communication.

The experiment was conducted over a period of three months, a total of four subjects, with ages between 3 and 4, with different clinical diagnoses. The subjects were 3 girls of 3 and 4 years old, with spastic paraparesis and moderate and mild mental delay and a girl with left rudimentary hemiparesis but normal intellect, and a 4-year-old boy with rudimentary paraparesis and normal intellect, all being part of the therapeutic program for 3 months. After selecting the sample of children, the fully somato-functional assessment, the functional diagnosis as well as the structure of the intervention strategy we started activity. The play therapy was conducted either individually, when we sought to capture attention and voluntary control for finesse activities and eye-hand coordination, or collectively for balance training and for the various motor positions: quadrupeds, on knees, the orthostatic position, the game taking place while the children were stimulated verbally or tactile. Based on the planned therapy protocols each session began with games for relaxation, both general and muscular. După relaxare, urma fie antrenarea coordonării oculo-manuale, fie stabilitatea în numite poziții. After relaxation, either the eye-hand coordination or the stability in appointed positions would be trained. All the games were selected and adapted to their age, level of

neuromotor development of the dysfunction and the mood. The game length was consistent with the child's mood: neither too short, nor too long in order not to bore the child. The therapy was achieved individually largely, but collective games were organized in order to compete between partners, taking into account the proposed objectives and the actual motor abilities available to each. If for children with neuromotor deficit, play therapy uses as learning-educational methods: the demonstration, the explanation, the sign communication, for children with neuromotor deficits associated with a mental delay the strategy is different, based more on demonstration, imitation, repetition.

The child's participation in the program of sensory stimulation before the ludotherapy sessions activated and helped the children's full participation, with fun and with speed and efficiency in performing motor acts.

RESULTS AND DISCUSSIONS

The whole ludotherapeutic approach actually wanted to educate from a psycho-motor point of view the children with neuromotor deficit. The main goal was the normalization of those children both on the motor, psycho-motor level and also behavioral, attitudinal, emotional, motivational. Therefore, the therapy focused on those components of psycho-motor that were found deficient during the somato-functional examination. Thus the ludotherapeutic intervention program there were selected games whose functions have helped to correct poor motor acts, the formation of motor skills and basic skills, the formation of appropriate conduct and behavior, some positive attitudes, the rehabilitation of breath, the education of their body schema and their partners, of laterality. In all four children the stability and equilibrium in certain positions were re-educated: sitting, quadrupeds, on knees and orthostatic position. The eye-hand coordination training was required for acquiring autonomy in their current daily activities, as well as for some manual skills.

Following the research carried out and processing the results, we draw a number of issues which highlight the effectiveness of the methodology we used for the recovery of children with neuromotor disabilities, intervening with ludic activities in the complex process of recovery. The results were possible because the ludotherapy introduced in the kinesthetic therapeutic treatment had a positive impact on children. Noticing the effectiveness of ludotherapy, we continued the complex recovery program, good progress being recorded during and after each meeting. The hypotheses from which we started are viable and ludotherapy can be successfully applied in kinesthetic therapy.

The results obtained during the recovery treatment were influenced by the degree and type of disability, the precocity of the diagnosis and the beginning of the recovery program, the consistency of participation during the treatment sessions, the conditions offered by the material base, and, last but not least, the permanent collaboration with the entire multidisciplinary team, who contributed to this experiment. Also, the role of parents in the continuation of the ludotherapeutic program at home was very important because each and every toy can be used for a particular purpose, parents being able to improvise games to encourage movement and develop the other skills. The numeric results confirmed the hypotheses and allow the assumption that ludotherapy can

help us establish some conclusive elements, with possibilities of generalization, in the recovery of children with neuromotor disorders. Ludotherapy as a specific method of rehabilitation can be used successfully for children with neuromotor disabilities, regardless of the current deficit, the play being individualized and methodically applied. The designed programs and the use of games and play to recover the neuromotor handicapped children have proven effective. The early use of this treatment by associating the means of kinesthetic therapy with types of game specific to the age of the child under treatment, led to a more efficient and shorter recovery time, helping to prevent the installation of other diseases.

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DESIGNING AND AUTOMATION OF A DATABASE WITH TECHNICAL SPECIFICATIONS FOR ACQUISITION

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Abstract: *This paper presents the designing and automation of a database with technical specifications for acquisition. Design database stages and relationships between tables are presented. It also shows how automation of database is made by expanding Excel capabilities using Visual Basic for Application.*

Keywords: *database design, VBA, Microsoft Excel*

1. INTRODUCTION

For an efficient management of technical specifications for acquisition has been created a Microsoft Excel database.

Microsoft Excel organizes data into tables: lists of rows and columns. Each row is called a record and each column is called a field. A record is a significant and consistent way to combine certain information. A field is a single item of information - an item type that appears in any record.

A properly designed database provides access to accurate and actual information.

In database designing took into account several general principles of database theory. The first principle is that the redundant information have a negative influence as they consume space and increase the likelihood of errors and inconsistencies. The second principle is the importance of the accuracy and completeness of information. If a database contains incorrect information, any reports that extract information from the database will also contain incorrect information. Therefore, any decision taken on the basis of these reports will be mislead.

2. DESIGNING OF DATABASE

Design is the process of transforming data requirement from reality, defined by the need of a user in a database structure.

The design process of a database with technical specifications for acquisition has gone through following steps:

- ***Finding and organizing the required information***. This stage involved gathering all kinds of information that would be recorded in the database, such as name of technical specifications for acquisition, the dates when were issued the requirements, structure which issued requirements etc.
- ***Dividing information in tables (worksheet)***. Elements of information divided in entities and major issues such as procurement technical specification, development stage, beneficiaries or contracting authority. Then each major topic becomes a table (worksheet).
- ***Transformation of information into columns***. We decided what information will be stored in each table. Each item becomes a field that is displayed as a column in the table. For example, *Autoritate_Contractanta table* includes

fields such as: name, abbreviation, address, manager etc.

- ***Identify primary keys***. For each table we set the primary key. A primary key is a column that is used to uniquely identify each row. For example, for the *Centralizator* table, the primary key can be quite technical specification code, which is a string of alphanumeric characters, defined uniquely.
- ***Configuring relationships between tables (worksheets)***. Once you have divided the information into tables, it takes a combination of useful information. For example, figure 1 shows relationships between *Centralizator*, *Beneficiar*, *Autoritate_Contractanta* and *Revizie* tables. Defining relationships between tables allows associating information in useful ways.

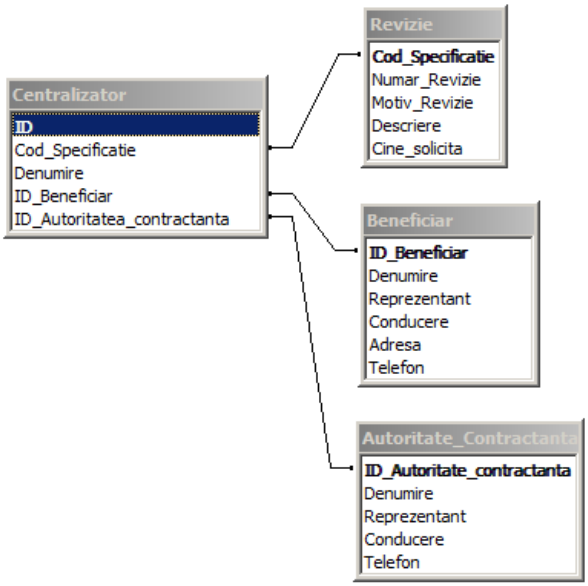


Figure 1 Relationships between tables.

One-to-many relationship. A beneficiary may have more than one technical specification for acquisition. Thus, for any beneficiary from *Beneficiar* table can have multiple specifications in *Centralizator* table. Relationship between *Beneficiar* table and *Centralizator* table is a relation of type one-to-many. In this case, the *Centralizator* table will have a *ID_Beneficiar* column that connects with data beneficiary from *Beneficiar* table. *ID_Beneficiar* column is the primary key of the *Beneficiar* table and ID_Beneficiar column from *Centralizator* table is foreign key, because is the primary key for *Beneficiar* table. This type of relationship allows storing data beneficiary once. The reports, it will extract the full data about the beneficiary and will be displayed for each technical specification.

Many-to-many relationship. This type of relationship has not been found for database with technical specifications of acquisition. Many-to-many relationship requires that a beneficiary will have many technical specifications for acquisition and one technical specifications of acquisition will have more than one beneficiary. This is impossible because one single beneficiary issued the requirements for technical specifications of acquisition. In practice, other structures can use the same technical specifications for acquisition. If the same product is intended to be purchased by other structures, coordinating structure sends to the new beneficiaries technical specification to verify the desired requirements. Subsequent changes to requirements leads to a new technical specification with a new code.

One-to-one relationships. This type of relationship was used for recording additional information about technical specifications of acquisition, information applies only occasionally or for a few products. For example, information about revision relates only to certain technical specifications of acquisition. Storage information in *Centralizator* table generate blank records for each technical specification to which they do not apply. Thus, information about revision (*Număr_Revizie*, *Motiv_Revizie*, *Descriere* and *Cine_solicită*) were stored separately in *Revizie* table. Cod_Specificație field, as in *Centralizator* table, is used with primary key role. Relationship between additional *Revizie* table and *Centralizator* table is a relationship type one-to-one. For each record in additional *Revizie* table is one recording in *Revizie* table that fits.

Refining the design. Once you have set all tables, fields and relationships between tables, the database was populated with sample data to try to work with information stored, creating queries, adding new records, generating

reports, etc. This helps to highlight potential problems (eg, you may need to add a new column or to split a table into two tables to eliminate duplication). To check whether you can use the database to get the answers you want.

Database normalization. Normalization rules were applied as a step within the design process. These rules were used to check if the tables are structured correctly. The application of the design rules database is called database normalization. Database normalization is the process of organizing the fields and tables of a database to minimize redundancy and dependency. Normalization usually involves dividing large tables into smaller (and less redundant) tables and defining relationships between them. The objective is to isolate data so that additions, deletions, and modifications of a field can be made in just one table and then propagated through the rest of the database via the defined relationships.

First normal form (1NF) assumes that there is only one value at each intersection of a row and a column in the table. A relation is in first normal form if the domain of each attribute contains only atomic values, and the value of each attribute contains only a single value from that domain. For example, there may not exist several beneficiary structures in *Beneficiar* field.

Second normal form (2NF) requires that each column is fully dependent on the primary key, not just part of the key. For database with technical specification acquisition, second normal form is respected because any column is completely dependent on the primary key. Each table in the database have the primary key consists only of a single column.

Third normal form (3NF) requires that each key column is dependent on the entire primary key, and all columns that are not keys are mutually independent. Another way of saying this is that each non-key column must be independent of the other columns. Independent column means you can change any column that is not a key, without affecting the other columns.

3. DATABASE AUTOMATION

Automation for a database with technical specifications for acquisition was done through the development and expansion of capabilities of the host application (Excel) using Visual Basic for Applications (VBA). VBA provides support for Visual Basic language, form interface, controls, objects and data access technologies. When hosted by another application, such as Excel, VBA provides the means to interact with the host application objects.

Using VBA editor, was created, edited, debugged and executed program code associated with database with technical specifications of acquisition (Figure 2).

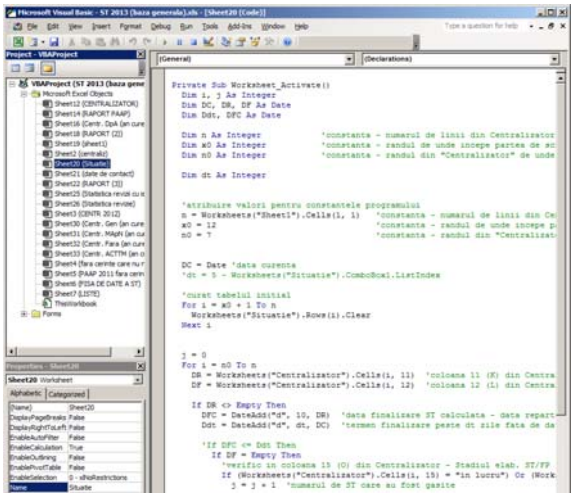
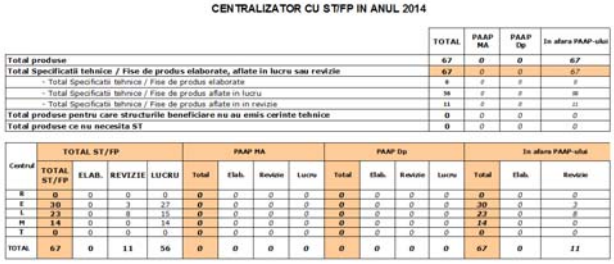


Figure 2 VBA Editor.

There have been 9 reports that automates the work with the database. The source code for each report individually run automatically

when activating the appropriate worksheet. This was possible by writing a procedure associated with activation event of the worksheet that will display the results of the report. A procedure, similar to other programming languages, means a series of instructions that are executed by one call unit.

For example, to compile the report "Centralizator cu ST/FP" has made the *Numarare* procedure associated with *Activate* event for the worksheet "*Centralizator*" (Figure 3). The *Numarare* procedure goes through the entire database and do a count of technical specifications based on their stage, they carry center and approved procurement plan.



CENTRALIZATOR CU STFP IN ANUL 2014

	TOTAL	PAAP MA	PAAP Dp	In afara PAAP-ului
Total produse	67	0	0	67
Total Specificatii tehnice / Fise de produs elaborate, aflate in lucru sau revizie	67	0	0	67
- Total Specificatii tehnice / Fise de produs elaborate	0	0	0	0
- Total Specificatii tehnice / Fise de produs aflate in lucru	56	0	0	56
- Total Specificatii tehnice / Fise de produs aflate in in revizie	11	0	0	11
Total produse pentru care structurile beneficiare nu au emis cerinte tehnice	0	0	0	0
Total produse ce nu necesita ST	0	0	0	0

Control	TOTAL ST/FP				PAAP MA				PAAP Dp				In afara PAAP-ului		
	TOTAL ST/FP	ELAB.	REVIZIE	LUCRU	Total	Elab.	Revizie	Lucru	Total	Elab.	Revizie	Lucru	Total	Elab.	Revizie
E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	30	0	3	27	0	0	0	0	0	0	0	0	30	0	3
L	23	0	8	15	0	0	0	0	0	0	0	0	23	0	8
H	14	0	0	14	0	0	0	0	0	0	0	0	14	0	0
T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	67	0	11	56	0	0	0	0	0	0	0	0	67	0	11

Figure 3 *Centralizator* Worksheet.

The browsing the database is made through a looping instruction and by accessing each cell, using references by index (Figure 4).

```
For rwIndex = 1 to n_rw
   For colIndex = 1 to n_col
      data = Worksheets("Sheet1").Cells(rwIndex,colIndex).Value
   Next colIndex
Next rwIndex
```

Figure 4 Accessing each cell in BD.

In order to count technical specifications for acquisition according to criteria established it is necessary the ramification of thread of execution after the verification of conditions. This was done using *Case* decision statement. Such a statement, found in any other programming languages, execute a group of instructions in response to comparing the same expression with multiple values different from each other. If the evaluated expression matches an item in a *Case* list, will execute the following instructions until the next *Case* statement or until *End Select* statement. Control program then passes execution to the statement following *End Select* final line (Figure 5).

```
Select Case Worksheets("Centralizator").Cells(i, 10)
  Case "R"
    Select Case Worksheets("Centralizator").Cells(i, 15)
           Case "in revizie"
                Inc(Worksheets("Centr.").Cells(x1, 8), 1)
           Case "in lucru"
                Inc(Worksheets("Centr.").Cells(x1, 9), 1)
    End Select
  Case "T"
    Select Case Worksheets("Centralizator").Cells(i, 15)
           Case "in revizie"
                Inc(Worksheets("Centr.").Cells(x1 + 1, 8), 1)
           Case "in lucru"
                Inc(Worksheets("Centr.").Cells(x1 + 1, 9), 1)
    End Select
End Select
```

Figure 5 *Case* statement.

Each of the nine reports appear automatically on the activation of corresponding worksheet.

```
Range(Cells(x0, 11), Cells(x0, 13)).Merge
Range(Cells(x0, 11), Cells(x0, 15)).Borders.LineStyle = xlContinuous
Range(Cells(x0, 11), Cells(x0, 13)).HorizontalAlignment = xlJustify
Range(Cells(x0, 11), Cells(x0, 13)).VerticalAlignment = xlCenter
Range(Cells(x0, 11), Cells(x0, 13)).WrapText = True
```

Figure 6 Text formatting.

It automatically build tables displaying the results and format text by using special functions (Figure 6).

4. CONCLUSIONS

Visual Basic for Application extended host application capabilities of Microsoft Excel, allowing automation of database with technical specifications of acquisition. VBA, through the functions it provides, reduced the time of preparation of situations and statistics, they practically accomplished automatically, accessing proper worksheet. However, through automation, were eliminated errors that may be introduced by human factor.

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ABOUT A PAIR LINEAR POSITIVE OPERATORS ASSOCIATED WITH BLEIMANN-BUTZER-HAHN OPERATOR

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Abstract. *We deal in this paper with an estimation of the difference between Bleimann-Butzer-Hahn operator and its associated operator defined according to a general method of construction of linear positive operator.*

Mathematics Subject Classification (2010): *41A36, 41A35,.*

Keywords*: positive linear operators, Bleimann-Butzer-Hahn operator, estimation.*

1. INTRODUCTION

In our paper [4] we defined and studied the approximation properties of a new linear positive operator associated with Bleimann-Butzer-Hahn operator obtained according to a general method of construction of linear positive operators.

Indeed, this method means to associate to the operator $P_n : \mathcal{L} \to \mathcal{F}(I)$ defined as

$$P_n(f;x) = \sum_{k=0}^{n} h_{n,k}(x)\ f\left(x_{n,k}\right),\ f \in \mathcal{L} \tag{1.1}$$

a linear positive operator of the form

$$L_n(f;x) = \sum_{k=0}^{n} h_{n,k}(x)\ \nu_{n,k}(f),\ x \in I,\ f \in \mathcal{L}, \tag{1.2}$$

where $h_{n,k} \in C_B(I)$, $h_{n,k} \geq 0$ so that $\sum_{k=0}^{n} h_{n,k} = 1$, exists $x_{n,k} \in I$ the barycenter of a $\mu_{n,k}$ probability Borel measures on I, $n \geq 1$, $k = \overline{0,n}$ i.e. $x_{n,k} = \int_I t\ d\mu_{n,k}(t)$ and $\nu_{n,k}(f) = \int_I f(t)\ d\mu_{n,k}(t)$, $f \in \mathcal{L}$.

We consider that, $\mathcal{L}$ is the common set of real measurable bounded functions on I for which $P_n f$, $L_n f$, $\nu_{n,k}(f)$ are well defined and $\mathcal{F}(I)$ is the space of all real valued functions defined on I. As usual, $e_i(x) = x^i$, $i = 0, 1, 2$, $x \in I$ denote the test monomial functions.

For the pair of linear positive operators (P_n, L_n) it is true the next result [5]:

Theorem 1.1. *If* $(L_n)_{n\geq 1}$, $(P_n)_{n\geq 1}$, *are two sequences of linear positive operators defined as* (1.1) *respectively* (1.2) *for* $f \in C^2{}_B(I) \subset \mathcal{L}$, *then for* $x \in I$ *we have the estimation*

$$\left|L_n(f;x)-P_n(f;x)\right| \le \frac{\|f''\|}{2}\cdot\sum_{k\ge 0} h_{n,\,k}(x)\left[\nu_{n,\,k}(e_2)-\left(\nu_{n,\,k}(e_1)\right)^2\right].$$

So, we consider that $P_n : C_B[0,\infty)\to C_B[0,\infty)$ is the Bleimann-Butzer-Hahn operator [1], [2], [3], [7], defined as

$$P_n(f;x)=(1+x)^{-n}\sum_{k=0}^{n}\binom{n}{k}x^k f\left(\frac{k}{n-k+1}\right),\quad f\in C_B[0,+\infty),\quad x\ge 0,\quad n\in N, \tag{1.3}$$

and its associated linear positive operator according to the general method of construction is the new linear positive operator $L_n : C_B[0,\infty)\to C_B[0,\infty)$ defined in [4] as

$$L_n(f;x)=\frac{1}{(1+x)^n}f(0)+\sum_{k=1}^{n-1}\binom{n}{k}\frac{x^k}{(1+x)^n}\cdot\frac{1}{B(k,\ n-k+2)}\int_0^{\infty} f(t)\frac{t^{k-1}}{(1+t)^{n+2}}dt+$$

$$+\left(\frac{x}{1+x}\right)^n f(n),\ x\ge 0,\ f\in C_B[0,+\infty)\ , \tag{1.4}$$

with $B(a,\ b)=\int_0^{\infty}\frac{t^{a-1}}{(1+t)^{a+b}}dt,\ a>0,\ b>0$ the Inverse-Beta function.

2. AN ESTIMATION ON THE DIFFERENCE $\left|L_n f - P_n f\right|$

Using the theorem 1.1 we give an estimation of the difference $\left|L_n f - P_n f\right|$. So,

$$\left|L_n(f;x)-P_n(f;x)\right| \le \frac{\|f''\|}{2}\sum_{k=1}^{n-1}\binom{n}{k}\frac{x^k}{(1+x)^n}\cdot$$

$$\cdot\left[\int_0^{\infty}\frac{t^2}{B(k,\ n-k+2)}\cdot\frac{t^{k-1}}{(1+t)^{n+2}}dt-\left(\frac{k}{n-k+1}\right)^2\right]$$

$$=\frac{\|f''\|}{2}\sum_{k=1}^{n-1}\binom{n}{k}\frac{x^k}{(1+x)^n}$$

$$\left[\frac{B(k+2,\ n-k)}{B(k,\ n-k+2)}-\frac{k^2}{(n-k+1)^2}\right]=$$

$$=\frac{\|f''\|}{2}\sum_{k=1}^{n-1}\binom{n+1}{k}k\frac{x^k}{(1+x)^n}\left[\frac{1}{n-k}-\frac{1}{n-k+1}\right]=$$

$$=\frac{\|f''\|}{2}\sum_{k=1}^{n-1}\binom{n+1}{k-1}\frac{x^k}{(1+x)^n}\left[\frac{2}{n-k}-\frac{1}{n-k+1}\right]=$$

$$=\frac{\|f''\|}{2}\sum_{j=0}^{n-2}\binom{n+1}{j}\frac{x^{j+1}}{(1+x)^n}\left[\frac{2}{n-j-1}-\frac{1}{n-j}\right]=$$

$$=\frac{\|f''\|}{2}\left[R-\sum_{j=0}^{n-2}\binom{n+1}{j}\frac{1}{n-j}\cdot\frac{x^{j+1}}{(1+x)^n}\right] \tag{1.5}$$

with

$$R=\sum_{j=0}^{n-2}\binom{n+1}{j}\frac{2}{n-j-1}\cdot\frac{x^{j+1}}{(1+x)^n}\le\frac{8x(1+x)^2}{n+2}$$

(see [4]). (1.6)

Since,

$$\frac{1}{n-j}\le\frac{2}{n-j+2},\ 0\le j\le n-2,\ n\ge 2$$

we have for the second term of (1.5) that

$$\sum_{j=0}^{n-2}\binom{n+1}{j}\frac{1}{n-j}\cdot\frac{x^{j+1}}{(1+x)^n}\le 2\sum_{j=0}^{n-2}\binom{n+1}{j}\cdot$$

$$\cdot\frac{1}{n-j+2}\cdot\frac{x^{j+1}}{(1+x)^n}\le$$

$$\le 2x\sum_{j=0}^{n+1}\binom{n+1}{j}\frac{1}{n-j+2}\cdot\frac{x^j}{(1+x)^n}$$

$$\leq 2x(1+x)\sum_{j=0}^{n+1}\binom{n+1}{j}\frac{1}{n-j+2}\cdot\left(\frac{x}{1+x}\right)^{j}\cdot$$
$$\cdot\left(1-\frac{x}{1+x}\right)^{n+1-j} = 2x(1+x)E\left[\frac{1}{n-U+2}\right] \tag{1.7}$$

Together with a result of Chao and Strawdermann [6, (3.4)] we have for the mean value of the random variable $\frac{1}{n+2-U}$ when $n+1-U$ has a Bernoulli distribution with parameters $n+1$ and $q=1-p=\frac{1}{1+x}$, that

$$E\left[\frac{1}{n+2-U}\right] = E\left[\frac{1}{1+(n+1-U)}\right] = \tag{1.8}$$
$$= \frac{1-p^{n+2}}{(n+2)q} < \frac{1}{(n+2)q} = \frac{1+x}{n+2}$$

So, using (1.5) with (1.6), (1.7), (1.8) we obtain

$$|L_n(f;x)-P_n(f;x)| \leq \frac{\|f''\|}{2}$$
$$\left[\frac{8x(1+x)^2}{n+2}-\frac{2x(1+x)^2}{n+2}\right],$$
$$|L_n(f;x)-P_n(f;x)| \leq \frac{3x(1+x)^2}{n+2}\|f''\|.$$

Theorem 2.1. *For* $n\geq 2,\ x\in[0,\infty),\ f\in C^2{}_B[0,\infty)$ *we have to relative to the pair of the operators* (1.3) *and* (1.4)

$$|L_n(f;x)-P_n(f;x)| < \frac{3x(1+x)^2}{n+2}\|f''\|.$$

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SECURING ZRP – A HYBRID AD HOC ROUTING PROTOCOL

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Abstract: *Ad hoc networks are a very promising networking concept. Given the fact that they do not need any infrastructure in order to operate, they are suited for emergency scenarios, as well as in military applications and as backup connections. The operation of such networks is assured by the routing protocol. Ad hoc routing protocols are specially designed so that each of the network's nodes acts like a router and forwards packets for all the other nodes. There are three types of ad hoc routing protocols: proactive, reactive and hybrid. The choice for one of these types is made by considering the scenario in which the network will operate. We take into consideration the scenarios in which the network is very large and the communication characteristics are not the same all over it, but it can be clustered. The best type of ad hoc routing protocols in this case would be a hybrid one. From the security point of view, research had addressed proactive and reactive ad hoc routing protocols, but very little the hybrid ones. Our aim was to research how such a protocol can be secured. For this we have chosen a very popular hybrid routing protocol, namely ZRP. Starting from an ns2 implementation of this protocol, we have secured it using asymmetric cryptography. Our new implementation provides authentication, confidentiality and non-repudiation for all the messages exchanged through the protocol regarding routing information and data also.*

Keywords: *security, ns2, ad hoc networks, hybrid routing, ZRP*

1. INTRODUCTION

The society of the present day is based on information technology in such a degree that one can say that it cannot exist without it. But information technology, in order to accomplish what is expected from it, is dependent on communication. Ubiquitous computing (all the devices that now operate independently will work together to make our life easier and safer and more joyful) takes this dependency a step further. It also depends on a way to assure communication between these devices. Distributed transient network paradigm suits very well the paradigm of ubiquitous computing. A network that can operate without any infrastructure and that is still capable of assuring communication between a very large number of nodes is perfect for what ubiquity needs. Ad hoc networks are an implementation of this paradigm that manages to assure all its characteristics.

The operation of an ad hoc network is assured by the ad hoc routing protocol that is run by each of the nodes in the network. The protocol is responsible for finding the route data must travel on in order to reach destination, and to transmit it. Finding the routes in such a network can be done in a reactive or a proactive way. For large networks and for networks that can be clustered in such a way that much of the communication is done inside the cluster, but very little between clusters, a hybrid approach must be used.

Security is also an important aspect in communication. Authenticating the nodes that

communicate routing information and data, and also assuring confidentiality and non-repudiation of the transmitted data are mandatory for any communication system. In the case of reactive and proactive routing protocols, there are many proposed secure routing protocols. But in case of hybrid routing, there are not.

Our aim was to develop a secure hybrid routing protocol for ad hoc networks. We have started from a very popular hybrid routing protocol named ZRP and we had proposed to secure it making it possible to assure authentication, confidentiality and non-repudiation. We made the implementation in Network Simulator 2 (ns2), starting from a classical non-secured ZRP implementation ([8]).

The rest of the paper is organized as follows: section 2 describes the concept of ad hoc networks and presents ad hoc routing protocols. In section 3 the ZRP hybrid routing protocol is presented. Section 4 describes the way we have secured ZRP. Section 5 presents the implementation in ns2 of our secured version of ZRP. Section 6 contains some conclusions and future research directions.

2. AD HOC ROUTING

2.1 Ad hoc netw orks. The term “ad hoc“ refers to a way of connecting wireless devices that is characterized by the following traits. The formed network is temporary because the connections between the nodes are established only for the duration of a single session. These connections do not require a main station, but each of the nodes search in its discovery area for other devices witch which to form the network ([2]). The nodes can search for devices that are beyond their discovery area by using broadcast packets that are retransmitted by all the nodes they reach. All the connections are established by multiple nodes, thus such networks are called multi hop networks ([6]). After the connections are established, the routing protocol maintains them even if the nodes move. So the nodes can enter or leave the network arbitrary, which makes the topology of the network very dynamic ([2]). The nodes communicate directly only on very small distances, so the vast majority of the data paths use intermediate nodes that route the packets towards destination. In fact, all the nodes of such networks act as routers and are equivalent with each other, all performing the same task: they route packets for all the other nodes. Such networks are highly heterogeneous, the devices that formed them being very different from the point of view of the storage, computational, communication and energy capabilities.

The advantage of such network is the fact that they do not need any infrastructure in order to operate. Rather the nodes are themselves an infrastructure of routers that assure the routing of the packets through the special routing protocols they use, named ad hoc routing protocols.

2.2 Ad hoc routing protocols. Because of the special characteristics of the ad hoc networks, classical routing protocols cannot be used ([1]). So special ad hoc routing protocols were designed that can auto-start and auto-organize them in order to offer the requested multi hop paths to the destinations. Also these protocols are scalable for very large networks and can dynamically maintain the topology of the network. And above all these, the overhead of the data transmission is very low and the memory and band wide resources consumed are fewer than in a classic routing protocol ([12]).

Based on these requests, three categories of ad hoc routing protocols were designed: proactive, reactive and hybrid. The proactive protocols establish the data paths towards all the other nodes in the network prior to any data communication. They are suited for small size ad hoc networks in which the nodes communicate with the majority of the other nodes and in which the overhead of data transmission must be very low. The best known proactive protocol is OLSR ([10]).

Reactive routing protocols are characterized by the fact that they search for that the data path for a node only when it is needed. They are suited especially for large ad hoc networks in which a node communicates only with a small number of the other nodes and in which the small delay of computing the path prior to the actual transmission is

unimportant. The best known reactive protocols are TORA ([3]), DSR ([11]) and AODV ([9]).

Hybrid ad hoc routing protocols combine the reactive technique with the proactive one in order to take full benefit of the advantages of each one of them, and also to minimize their disadvantages. The ad hoc network is split in sub networks called zones so that a hierarchical routing can be used: for communicating between the nodes inside the same zone the protocol uses a proactive approach, and for communicating between nodes from different zones it is used a reactive approach. This type of operation for hybrid routing makes it the best choice for large networks like the one that ubiquitous computing and military applications use. That is the reason for our focus on them. The best known hybrid protocols are ZRP ([4]), and CBRP ([5]).

3. ZONE ROUTING PROTOCOL

ZRP is, as we mentioned above, a hybrid ad hoc routing protocol. It splits the ad hoc network in which it operates in several routing zones and uses two different routing protocols ([4,7]): one inside each of the zones (IARP – Intrazone Routing Protocol), and the other between the zones (IERP – Interzone Routing Protocol). Also, it uses a third routing protocol (NDP – Neighbor Discovery Protocol) which is responsible for finding the neighbors for a node that belong to the same routing zone, and for finding and maintaining the topology of the routing zone to which a node belongs. We will further present each of these three routing protocols.

3.1 Neighbor Discovery Protocol. NDP is the part of ZRP responsible for finding the nodes from the same routing zone. A routing zone is defined based on the number of hopes between the nodes. If this number is bigger that a given value, then the nodes belong to different zones. Otherwise, they belong to the same zone.

NDP operates by broadcasting "Hello" beacon messages at regular time intervals. When receiving such a message, each node updates its routing table either by adding a new neighbor, if the "Hello" message is received for the first time from a certain node, either by updating the current information about that node. If after a certain period of time no "Hello" messages are received from a node, it is deleted from the routing table.

3.2 Intrazone Routing Protocol. IARP is a proactive routing protocol and operates only inside a zone. Each of the nodes maintains a routing table for its routing zone in which it has a priori stored the routes to all the nodes from the same zone.

3.3 Interzone Routing Protocol. IERP is the reactive component of ZRP and it is used when a nodes needs to communicate with another node that belongs to a different routing zone. By using bordercasting, the nodes from the border of each zone initiate an IERP path finding when they conclude that the destination node is outside of their zone.

For more details about the routing process using the three components of ZRP, please see [7].

4. SECURING ZRP

In order to create a secure implementation of ZRP, we proposed to provide the following security goals: authentication, confidentiality and non-repudiation for all the routing process - regarding the type of messages exchanged by

each component. And for this we have implemented a PKI.

The three components of the ZRP require sending some packets that contain routing information. Our implementation of secure ZRP supposes securing each component by signing the routing information for each packet sent between the nodes ([8]).

The secured routing process can be detailed as follows. Each time a new node is accepted as trusted and is granted access to the secured network, it is assigned a pair of public RSA keys. The public key is later integrated in a security certificate which is sent to the CA in order to be signed by the authority. When a node has to send a packet that contains routing information, it will sign the routing information from that packet using its own private key and it will attach the certificate to the signed message. The recipient node first validates the sender's certificate using the CA's public key and then it validates the signature of the routing information using the public key of the sender from the validated certificate. Judging the result of these validations, the recipient decides whether to act according to the routing information or not.

Given the fact that ZRP contains three different routing components (NDP, IARP and IERP), each having its own type of packets and routing technique, each of these routing components had to be secured as an individual routing protocol.

5. SECURE ZRP IMPLEMENTATION

Implementing our secure version of ZRP required the installation of the ns2 network simulator. The second step consisted of downloading the actual ZRP implementation from the Internet ([8]). After successfully simulating a routing process over an arbitrary ad hoc network using the traditional ZRP, we had to integrate the simulator with the chosen cryptographic library, namely openssl.

With the simulation environment fully configured, we started to modify the traditional implementation by altering the zrp.h and zrp.cc files that describe the routing procedure. We created the CA and Cert classes for the implementation of the CA and the used certificates, and then we altered the ZRPAgent class and hdr_zrp data structure in order to include all of the objects involved in the digital signature algorithm. Given the fact that each node receives a pair of keys and a certificate, the ZRPAgent class had to be altered accordingly, by adding the proper fields and methods to it.

In order to attach to the packets the digital signature for the routing information exchanged by the nodes, the hdr_zrp data structure also had to be completed with the proper fields.

The Cert class implements the security certificate used in our implementation in order to grant the connection between a node's public key and its identity.

The CA class represents our implementation of the Certification Authority. The main responsibility of this central authority is to store and sign the security certificate of every node so that when a node receives a signed message, it can first validate the certificate's authenticity.

For the signing and the validation processes, we decided to use the RSA algorithm. We used the C++ implementation of the methods from the openssl cryptographic library.

For the signature process, each time a new node is created, it receives a private and a public key, both encoded using the DER format so that the private key of the node can be stored and used properly when the node has to sign the routing information.

On the other side, the validation of the signature implies the following operations: first, the security certificate has to be extracted from the message. After the certificate is extracted, two validations have to be made: whether the certificate expiration date and time was not reached and whether the certificate is indeed signed by the CA. Judging upon these two validations, we can use the public key from the security certificate in order to check the signature of the routing information from the message.

Each of the three components of ZRP has its own type of packets. In order to completely secure our implementation of ZRP, we had to secure each of these types of routing packets by signing the routing information as follows.

For the NDP component, we had to secure the NDP BEACON and NDP BEACON ACK packet types by signing the source address, destination address and packet type. For the IARP component, the only packet type that contained routing information was the IARP UPDATE packet type. For this type of message, the source address, destination address, packet type and TTL were signed and validated in the corresponding methods. For the IERP component, we had three types of packets to secure: IERP REPLY, IERP REQUEST and IERP ROUTE ERROR. For each of these packets, the source address, destination address and packet type were signed and validated in the corresponding methods.

After recompiling the whole ns2 simulator with the new version of ZRP, we created a simulation scenario that would use all of the ZRP components in order to test that each type of message is correctly signed by the sender and that the signature is correctly validated.

6. CONCLUSIONS & ACKNOWLEDGMENT

In this paper we presented how we secured the ZRP hybrid ad hoc routing protocol in order to assure authentication, confidentiality and non-repudiation: authentication and non-repudiation for the routing information, and authentication, non-repudiation and confidentiality for data. We started from an ns2 implementation of ZRP and modified it by using a PKI-like infrastructure with a central CA and each of the nodes having a public-private key pair. Then the packet exchange between the nodes was modified by signing/encrypting the contents of the packets so that the security objectives are achieved. The manipulation of the packets at the moment of receive was also modified, by adding validations for the computed signatures.

ZRP is the most popular hybrid routing protocol and we expect that a secure version of it will have a high impact on research. We have proposed to make our secure implementation accessible on the Internet as soon as we complete our research. We are in the process of conducting quantitative measurements over our secured implementation and over the classical one. We want to establish what is the overhead added by our implementation and thus to compare it to the classical one. Our aim is to perform this evaluation both in a simulated environment (ns2), and in a real implementation.

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HIGH-FREQUENCY WAVES. THE EQUATION OF THE DISPLACEMENT VECTOR.

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Abstract: *In this paper we study the high frequency wave propagation and we find the displacement vector for every material point* (x_1, x_2) *of a thin plate, at time t, except for a constant factor A.*

Keywords: *35L05, 35L10, 35P30.*

1. INTRODUCTION

In order to verify the accuracy of material design is usually carried out non-destructive test. This is achieved by applying a high-frequency wave propagation theory. In this paper we present the theory of high frequency wave propagation in elastic, isotropic and homogeneous, and we obtain the dispersion equation. Dispersion equation is determined from the solution of nonlinear generalized eigenvalue problem and eigenvectors.

The Lamb waves correspond to a particular case of propagation of elastic waves by an infinite solid that occur when a plate is infinite solid bounded by two parallel faces off. In this case, very often reflections of waves occur along plate faces and therefore change propagation direction. Wave propagation in this case is known where guided.

2. PROBLEM FORMULATION

We assume homogeneous and isotropic elastic plate bounded by two parallel planes located at a short distance *2h*, and want to find the vector displacement. In Figure 1 are shown the plate and axes considered. The $x_2 = \pm h$ is the free faces of the plate equations and the plane (x_1, x_2) called the sagittal plane containing the normal x_3 and the direction of wave propagation.

In the case of thin plates in which longitudinal waves *L* and vertical transverse waves *TV* are propagated in its vertical plane (x_1, x_2), with successive reflections on its free surface $\pm h$, it appears that this propagation is a coupling between the material displacements and these plane.

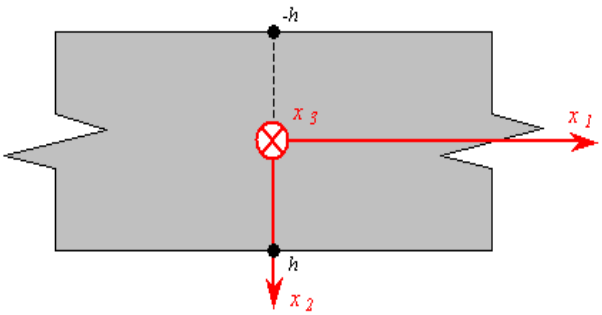

Figura 1: The coordinate axes in an isotropic and homogeneous medium

These waves are called guided waves. However, the transverse waves *TH* contained in the horizontal plane x_2 are propagated only in the horizontal plane of the plate, because their polarization is not modified by any reflections and refractions. Guided waves are

also known as Lamb waves and they can be classified as follows: the first waves which are propagated in the sagittal plane (x_1, x_2) are the Lamb waves L_2 and decoupled and polarized waves are propagated in the plane (x_1, x_3) are the *TH* wave Lamb.

3. PROBLEM SOLUTION

In the following we consider the normal guided Lamb waves. These waves appear in a plate of thickness $2h$ comparable with the wavelength, due to coupling between the components longitudinal *L* and the transverse components of the wave *TV*. Thus, two types of wave Lamb can be produced. Symmetric waves depicted in Figure 2, where for each side of the middle of the plate, the longitudinal components are equal and the transverse components are opposite and antisymmetric waves from Figure 3, where for each side of the middle of the plate, the transverse components are equal and the longitudinal components are opposite.

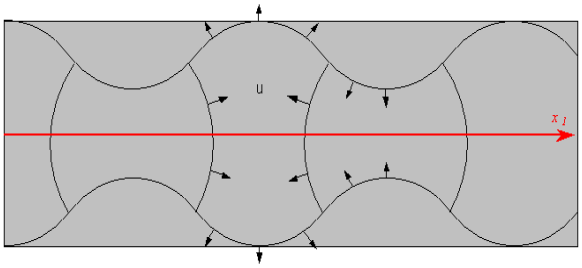

Figura 2: The symmetric Lamb waves

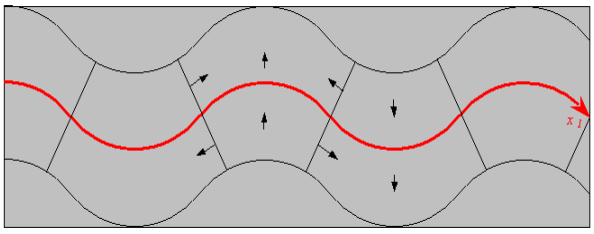

Figura 3: The antisymmetric Lamb waves

In the case of wave propagation in a continuous, isotropic and homogeneous medium, the displacement vector **u** of a material point can be obtained from a scalar potential φ and a vector potential ψ, so that we can write the following relation

$$\mathbf{u} = \nabla\varphi + \nabla\times\psi \tag{1}$$

In expression (1) the two potential should verify the following two equations of wave

$$\nabla^2\varphi - \frac{1}{v_L^2}\frac{\partial^2\varphi}{\partial t^2} = 0, \tag{2}$$

with

$$v_L = \left(\frac{c_{11}}{\rho}\right)^{\frac{1}{2}} = \left(\frac{\lambda+2\mu}{\rho}\right)^{\frac{1}{2}},$$

and

$$\nabla^2\psi - \frac{1}{v_T^2}\frac{\partial^2\psi}{\partial t^2} = 0, \tag{3}$$

with

$$v_T = \left(\frac{c_{44}}{\rho}\right)^{\frac{1}{2}} = \left(\frac{\lambda}{\rho}\right)^{\frac{1}{2}},$$

where v_L and v_T are the phase velocities of the longitudinal and transversal waves, but λ and μ are the Lame's parameters. The elastic constants $c_{\alpha\beta}, \alpha, \beta = 1,2,...,6$ are defined as functions of Young's modulus *E* and Poisson ratio ν, as follows:

$$c_{11} = c_{22} = c_{33} = \frac{(1-\nu)E}{(1+\nu)(1-2\nu)}, \tag{4}$$

$$c_{12} = c_{23} = c_{13} = \frac{\nu E}{(1+\nu)(1-\nu)}, \tag{5}$$

$$c_{44} = c_{55} = c_{66} = \frac{E}{2(1+\nu)} = \frac{c_{11}-c_{12}}{2}, \tag{6}$$

in which the remaining terms $c_{\alpha\beta}$, with $\alpha \neq \beta$, are null.

Suppose the wave Lamb travels along the axis x_1 and the diffraction in x_3 is ignored. For an isotropic, elastic and homogeneous solid, the scalar and the vector potentials are trigonometric functions of time *t*, with the same frequency ω.
However, they can be expressed as follows, with the wave number *k*:

$$\begin{aligned} \phi &= \phi_0(x_2)e^{i(\omega t - kx_1)}, \\ \psi &= \psi_{0j}(x_2)e^{i(\omega t - kx_1)}, \quad j = 1,2,3. \end{aligned} \tag{7}$$

A limit wave problem can be defined of wave equations for each function of potential and boundary conditions $\sigma_{2i}=0,\ i=1,2,3$ on free faces $x_2=\pm h$. For the limit this problem can have a nontrivial solution it is necessary that the frequency ω and wave number k to satisfy the following dispersion relation:

$$\frac{\tan(qh+\alpha)}{\tan(ph+\alpha)}=-\frac{4k^2pq}{\left(q^2-k^2\right)^2}, \tag{8}$$

with $\alpha=0$ and $\alpha=\frac{\pi}{2}$, where the constants p and q are defined as follows:

$$p^2=\frac{\omega^2}{v_L^2}-k^2,\qquad q^2=\frac{\omega^2}{v_T^2}-k^2, \tag{9}$$

and the constant angle α can take the values 0 and $\frac{\pi}{2}$ depending on the type of symmetry of the wave.

If the relation (8) is satisfied, then we can find the potential functions, except for a constant factor and their expressions are:

$$\begin{aligned}&\phi=B\cos(px_2+\alpha)\exp\left[i(\omega t-kx_1)\right],\\ &\psi_1=\psi_2=0,\\ &\psi_3=A\sin(qx_2+\alpha)\exp\left[i(\omega t-kx_1)\right],\end{aligned} \tag{10}$$

in which constants A and B must satisfy the following system of homogeneous linear equations:

$$P\cdot\begin{pmatrix}A\\B\end{pmatrix}=\begin{pmatrix}0\\0\end{pmatrix}. \tag{11}$$

where P is the following matrix

$$\begin{pmatrix}\left(k^2-q^2\right)\cos(ph+\alpha) & 2ikq\cos(qh+\alpha)\\ 2ikp\sin(ph+\alpha) & \left(k^2-q^2\right)\cos(qh+\alpha)\end{pmatrix}$$

Because now we know the functions $\varphi(x_1,x_2,t)$ and $\psi(x_1,x_2,t)$, we can apply the formula (11) and we find the displacements at time t, for any point material of the plate (x_1,x_2), except for a constant factor A, using the following expressions:

$$\begin{aligned}u_1=qA\Big[&\cos(qx_2+\alpha)-\\ &-\frac{2k^2}{k^2-q^2}\frac{\cos(qh+\alpha)}{\cos(ph+\alpha)}\cos(px_2+\alpha)\Big]\cdot\\ &\cdot\exp\left[i(\omega t-kx_1)\right],\end{aligned} \tag{12}$$

$$\begin{aligned}u_2=ikA\Big[&\sin(qx_2+\alpha)-\\ &-\frac{2pq}{k^2-q^2}\frac{\cos(qh+\alpha)}{\cos(ph+\alpha)}\sin(px_2+\alpha)\Big]\cdot\\ &\cdot\exp\left[i(\omega t-kx_1)\right].\end{aligned} \tag{13}$$

3. CONCLUSIONS

In this paper we use high frequency Lamb waves in an elastic, isotropic and homogeneous medium and we find the displacement vector for every material point (x_1,x_2) of a thin plate, at time t, except for a constant factor A. This is useful in carrying out tests on homogeneity, the determination cracks or tears of a structure.

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AN ATTEMPT TO STANDARDIZE THE COMMUNICATION SOFTWARE OF NEW KNOWLEDGE

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Abstract: *Standardization of educational software of logical project for new knowledge communication presumes identifying the defining characteristics: compliance with curriculum (school program), accuracy of scientific content, compatibility with characteristics of target population, highlighting achievement of operational objectives/derived competencies, doing individualized interaction, sequential feedback and formative assessment. Essential steps refer to the process as the adaptation of science content to the characteristics of target population, by alternate presentation form of scientific content in the three forms: image, sound and text. It follows to achieve an attractive aesthetic design for presentation of scientific content, a suggestive image representation for fundamental objective of the lesson, image that expresses the essence of scientific content. The next step will be split into paragraphs of scientific content to realize the feedback sequence, following the highlighting central scientific content elements of the lesson, strengthening progressive and selective retention. These objectives of the project are sustained/supported by identifying learning situations and setting scenario for unfolding of their teaching scenario. The moments of the lesson which target/track formative assessment, requires selecting content features that make the subject of assessment, selection and formulation of scenarios related items and solving problem statements generated by them. Another element which concerns the implementation of the lesson teaching scenario is related by storyboarding practice situations by operational the contents. Dynamic and attractive presentation contents should be the main feature that capture and maintain student attention on presenting scientific content. Our intention is to develop a progressive algorithm to achieve these features.*

Keywords: *educational technology, feedback communication, knowledge acquisition, learning systems, standardization*
Mathematics Subject Classification Code: 97U50, 97Q60

1. INTRODUCTION

An attempt at standardization a logical design of educational software for communication of new knowledge is conditioned by the defining characteristics of educational software:

- the characteristics of pedagogical nature, with normative role, which ensures compliance with the curriculum, correctness scientific contents, highlighting achievement of operational objectives/derivative skills;
- particularities of content and characteristics of the target population and
- individualized nature of interaction, implementation of feedback and formative assessment[1].

Essential steps aim formulation and processing science content in order to adapt at the characteristics of target population,

through alternate forms of presentation such as image, sound, text and their mutual support.

2. PRESENTATION OF SCIENTIFIC CONTENT

2.1 Formulating and processing of scientific content. Achievement of a aesthetically and attractive design presentation of scientific content, is the guarantee of successful realization of the lesson of the first time, capture attention, and expressing and placement of the center of attention, such as suggestive image of the fundamental objective of the lesson, which play synthetic the essence of scientific content, maintain the interest for attending the lesson content. Naturally, these goals are subordinate to target population characteristics[4].

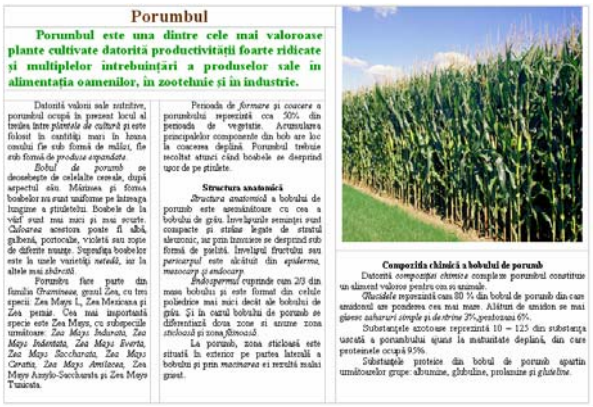
Without make a fragmentation of the lesson, a delineation of the lesson content into paragraphs, built around the essential elements of scientific content, is essential to make the moment of achievement sequential feedback. We identify two directions of standardization; first into the terms of presentation to scientific content and which regards takeover manual features and a second that regards teaching scenario, structured by lesson moments and materialized through sequence learning situations, corresponding of content elements.

2.2 Formulating and processing of scientific content. Scientific content associated of a educational software must be in accordance with normative documents, of regulative type, which constitute the formal or official curriculum. Designing learning programs must subordinated to the organizational forms of teaching, seen from the perspective structural and processual. Therefore, the educational software must be designed to be used both as auxiliary teaching in classroom and such as informatic product for student training, able to reproduce the learning experiences followed by the student in the classroom and constitutes a guide during the individual study of student's at home.

The first element of standardization consists in adapting the scientific content (taken over even of the manual), to the particularities of target population. Included science must emphatically reformulated in phrases or short sentences, clear, unambiguous, balanced in terms of rigor at specialized language, but with a progressive note for its formation. Sometimes, textbooks don't excels in having this quality of the message. Compliance with programmatic documents is essential.

Next level of standardization refers to the structuring of the content into paragraphs, established around the essential elements of scientific content. Scientific content of a lesson is based on the several key elements of content (major ideas of the lesson) that constitute the core of paragraphs. Crossing related scientific content of a paragraph require necessarily, achieving the feedback. Remains to establish how it can be triggered feedback when achievement the end of paragraph by the student[4].

2.3 Positioning of the scientific content in page. One way to layout, recommended to several disciplines and content related of target population for secondary curricular cycle and neighboring areas is presented in the picture.


Porumbul

Porumbul este una dintre cele mai valoroase plante cultivate datorită productivității foarte ridicate și multiplelor întrebuințări a produselor sale în alimentația oamenilor, în zootehnie și în industrie.

Datorită valorii sale nutritive, porumbul ocupă în prezent locul al treilea între *plantele de cultură* și este folosit în cantități mari în hrana omului fie sub formă de *mălai*, fie sub formă de *produse expandate*.

Bobul de porumb se deosebește de celelalte cereale, după aspectul său. Mărimea și forma boabelor nu sunt uniforme pe întreaga lungime a știuletelui. Boabele de la vârf sunt mai mici și mai scurte. Culoarea acestora poate fi albă, galbenă, portocalie, violetă sau roșie de diferite nuanțe. Suprafața boabelor este la unele varietăți *netedă*, iar la altele mai zbârcită.

Porumbul face parte din familia *Gramineae*, genul Zea, cu trei specii: Zea Mays L., Zea Mexicana și Zea perniz. Cea mai importantă specie este Zea Mays, cu următoarele *varietăți*: *Zea Mays Indurata, Zea Mays Indentata, Zea Mays Everta, Zea Mays Saccharata, Zea Mays Ceratia, Zea Mays Amilacea, Zea Mays Amylo-Saccharata* și *Zea Mays Tunicata*.

Perioada de *formare* și *coacere* a porumbului reprezintă cca 50% din perioada de vegetație. Acumularea principalelor componente din bob are loc la coacerea deplină. Porumbul trebuie recoltat atunci când boabele se desprind ușor de pe știulete.

Structura anatomică

Structura anatomică a bobului de porumb este asemănătoare cu cea a bobului de grâu. Învelișurile seminței sunt compacte și strâns legate de stratul aleuronic, ce prin înmuiere se desprind sub formă de pieliță. Învelișul fructului sau *pericarpul* este alcătuit din *epiderma, mezocarp* și *endocarp*.

Endospermul cuprinde cam 2/3 din masa bobului și este format din celule poliedrice mai mici decât ale bobului de grâu. Și în cazul bobului de porumb se diferențiază două zone și anume zona *sticloasă* și zona *făinoasă*.

La porumb, zona sticloasă este situată în exterior pe partea laterală a bobului și prin *mezocarpul* ei rezistă mult grauri.

Compoziția chimică a bobului de porumb

Datorită *componenței chimice* complexe porumbul constituie un aliment valoros pentru om și animale.

Glucidele reprezintă cam 80 % din bobul de porumb din care amidonul are ponderea cea mai mare. Alături de amidon se mai găsesc *zaharuri simple* și *de stocare* 2%, pentozani 6%.

Substanțele azotoase reprezintă 10 – 125 din substanța uscată a porumbului ajung la maturitate deplină, din care proteinele ocupă 95%.

Substanțele proteice din bobul de porumb aparțin următoarelor grupe: albumine, globuline, prolamine și *gluteline*.

1. The layout of page

Scientific content, presented as text, is placed on the columns (four in this case), respecting the "golden rule of typographers" which says as a row should be no longer than 65-70 characters, including spaces. The length of row creates for the reader, the appropriate comfort to reading the text. Recommended font is Times New Roman, 11 or 12, regular, without background (white).

An essential element in capturing the attention and introduction the student in the context of the lesson is the representation of fundamental objective of the lesson as image and placing it in the top right corner of the screen, in an area of maximum visual interest. This area will allow by temporary display of scientific content, depending on learning situations for teaching scenario, being the main area of interest for student. Is the portion of the screen which create of educational software rhythm, dynamics and consistency.

Presentation of the fundamental objective of the lesson as picture has a multiplier effect in presentation of the scientific content of lesson. It is the first element which attracts student attention and through visual effect allow instant introduction of the student in the context of the lesson. Image has an aesthetic, attractive and stimulating effect[4]. The immediate reaction of the student, after consumption of scientific content information provided by the image is to confirm the information perceived by reading the title of lesson.

This reaction is a task assumption for student, without this being explicitly formulated and constitutes the feedback form for capture attention moment. The immediately following text makes an summary introduction in the context of the lesson, clarifying the student of the content which will be addressed and constitutes, at the same time, one of finality enunciation, expressed through the operational objectives or derivative skills, associated with the teaching project.

Be observed the chromatic association between image, lesson title and introduction text. This is another element which confers to the initial moment of impact student-soft, attractiveness and aesthetic effect.

2.4. Identification of learning situ ations. So far, the impact of student with educational software is similar to the student impact with manual. Static character of the presentation is dominant.

It requires a student-soft activation interface by supporting the static image and text information as video or audio recordings. Obviously, student will receive learning tasks as audio recordings. But equally important is that after completing the introductory text, student to be present introductory information or relevant synthesis for scientific content form of a sequence of images or video sustained by audio record or movie subtitles. It is necessary to remarked negative effect of subtitles, which constitute a disturbing factor in the assimilation the information presented video. Image support is made by audio recording[2].

Once exceeded this time of lesson which follows the capture attention, student task must be directed to reading of scientific content, presented as text. Text is generally unattractive and stationary presentation form for a significant sample of the target population. Therefore, the presentation of the scientific content as text must be sustained by the creation of learning situations to boost and to make attractive the presentation.

This shall be done through the identification of words in the text, called below links, that expresses essential elements or special scientific content. The links will appear italics in text, and the student, authorized user of educational software, will move mouse instinctively, triggering specific learning situations. Identification of links and establishing scenarios for learning situations, constitutes the essence of teaching scenario for educational software and is a measure of

teaching mastery for team design of learning program.

The determining word link are based on the premise that the student must be submitted to all the scientific content in a form as close to its capacity of understanding and before it placed in a situation of doubt. Therefore, any element of scientific content may create an opportunity for clarifying the ambiguities, by replay of the presentation of content elements in a more permissive for student, to trigger of learning situations enabling objectives or skills training established by the draft lesson.

3. TEACHING SCENARIO

In principle, range of learning situations triggered by a link is a great diversity, which requires a considerable variety of scenarios.

3.1 Establishment of s cenario related of teaching learning situations. You can intuit some learning situations which generates standard scenarios:

a) explanation of the meaning of some terms or presentation of synonyms. In these situations, scenario may require the display a rectangular window of a short explanation text up to 4-5 words;

b) presentation of definition, eventually from the Explicative Dictionary. In these cases scenario may require a normal opening a window, usually in the area of display picture (top right), over the image wich suggests the primary objective of the lesson, that displays explanatory text or pictures sustained by text or audio recordings;

c) an extension by scientific content. In this case opens a window that can display text, images sustained by text, films sustained by audio explanations, sketches, drawings or sequences of images, eventually subtitled;

d) a resumption of scientific content elements, with greater or less difficulty degree. Presentation of is made in a window in which can present scientific content in a form required by the particularities of the target population;

e) evaluation elements. In the window is displayed items sequentially. Window should cover the portion of text that are subject to assessment.

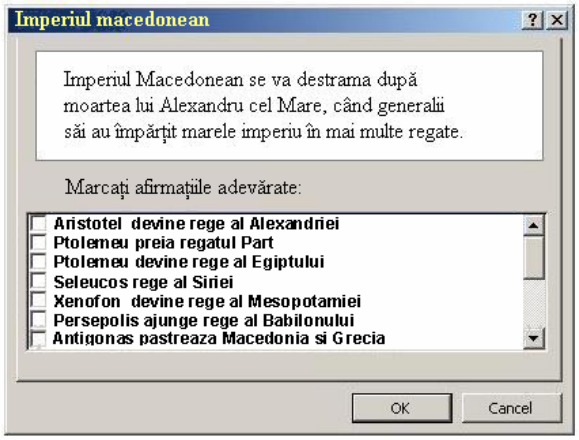
In the scenario is provided the time interval in which the window is open and modalities to resume the learning situation[3].

3.2 Achieving of feedb ack and formative assessment. The division of the scientific content in paragraphs, established as part of major ideas associated with content, permit the achievement of sequential feedback, at the time when student reaches to the end of paragraph. In terms of the scenario produces a learning situation everything triggered by a link, the portion of text representing the content of the paragraph disappears from the screen and in the free space so formed are displayed successively objective, semiobjective or subjective items, imposed by the moment and purpose of. assessment. Problem solving situations, for each item, generates a scenario subsequence.

These moments of the class require the selection of content features being evaluated, choice of the type of items recommended by the assessment situation and formulation of items and scenarios for solving situations problem.

2. Presentation of items

Equally important is the graphics presentation of items, which must include the student family interface elements. In general, I have recourse to interface elements its own to operating systems and applications commonly used by students and that are friendly to it. In the figures below presents examples of graphical representation of items.



3. Presentation of items

What should be stressed is that the scenario for the learning situation associated with an item should to guide the student to find the correct answer and did not show it, in a situation where he is in difficulty. In moments a lessons in which uses exercise method, the scenario of exercise situations in order to operational the contents, use also to items. In the image below, is used an completion item, where a student is in a situation to exercise the counting[5].

Teaching scenario describes the sequence of learning experiences for the student crossed, to solve the problem situation. In every stage generates a number from 1-10 and select an image from a database. Numbers reflect the degree of difficulty of the learning situation and is elected by the student correct answer in the previous stage. Selected image is displayed, for chosen number of times. The student hears in speaker:

4. Image from scenario

If the student counted and write the correct number, a animated sequence is displayed with graphic element from the image (in our case with teddy bear). If the student does not respond correctly, heard in speaker:

- „Let's count together!". The speaker is heard: one, two, three ... and at each step the image with spoken number is highlighted now (discrete zoom, a box highlighting or blinking) after which the student is allowed to complete in box the number. If the student completed correctly is displayed animated graphic sequence of images, as in the previous case. If the student does not respond correctly or second time, heard in speaker:

- „Let's count again!". The speaker is heard: one, two, three ... at which time said number is written large on the image, then the student is allowed to complete in box the number.

Obviously, must be discussed and situation in which the student would answer incorrectly again. In this situation must imagine a animation that can lead number on the last picture the response box. On the correct answer, scenario repeats previous statements. Note that the student is gradually led to the discovery of correctly response and never the solution is required. As an additional element, student responses are stored and a statistic wrong responses lead to a higher frequency for numbers that repeat mistakes.

4. CONCLUSIONS & ACKNOWLEDGMENT

Dynamics and the attractiveness of presentation contents shall be the main feature to capture and maintain student attention on presenting scientific content. These elements constitute the essence of the teaching scenario which allows students to repeats, to other coordinates, lesson moments performed in classroom. It is desirable that, during the teaching scenario, subordinate of educational software, the student to receive tasks with be constituted in the "homework"[6].

Systematically and rigorously developing to portfolio of learning tasks, constituted as generic title "homework", is an important attribute of learning programs. This allows us to provide a wide learning experiences, progressive in difficulty and various in coverage area and disciplinary. All these approaches converge to achieving of the operational objectives or the skills training, outlined in the preamble to educational project.

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UPGRADING MOBILE NETWORK USING FUZZY LOGIC METHODS

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Abstract: *The electronic processes managed by mobiles telecom networks are very shortly, about several hundred milliseconds. The average duration of a voice call is larger, about 2 minutes, and the granularity of the network counters needs more time, tens of minutes. This paper focuses on the need of taking into account this time scale difference and the evolution of the parameterization. The optimization of the data throughput for the services is one of the major objectives of the 3G mobile network operators. The data rate management feature has to be matched to bearer according to the needed throughput. A best rendered service could be obtained by optimization of such mechanisms without wasting network capacity and resources. This task is not easy one because there is a strong the interaction between radio parameters in uncertainly conditions. A new model of optimization parameters based on the fuzzy logic method is described in this paper. The crisp values of the three of most important parameters involved in the data rate management were fuzzyfied (averaging period, number of averaging window and upgrade threshold). The fuzzy-based parameters are designed to provide data required by the selection procedure. The uncertain data are represented as linguistic values which are fully dependent on the user's preference. This paper focuses on the selection of the defuzzyfication method to discover the most appropriate parameters for obtaining crisp values which represent uncertain data.*

Keywords: *mobile network, fuzzy logic, membership function*

1. INTRODUCTION

The mobile network dimensioning and parameterization is done by making deep analysis of the network evolution. The analysis is using counters and indicators provided by the network. The usual granularity of the network indicators is one hour and aggregation to a higher scale is done in order to have an easier approach during the analysis. Once defined, the radio parameters allow the normal or, usually, the optimal way of working of a network. But for this approach of "fixed parameters" is no more adapted to the actual conditions: commercial area crowded during the week-end, area near highway needs a more adaptive parameterization. This paper wants to address the needs of a newest approach in term of adaptive radio parameterization, which may be solved by using fuzzy logic approach.

2. MATERIALS AND METHODS

The handover procedure is the key factor in supporting mobility in UMTS network. In UMTS there are four different types of handover currently in use [1, 2]. Softer handover involves the UE communicating with two sectors on the same cell site using a common carrier frequency. Eventually the UE

changes from its original sector to the new sector. When two or more NodeB forming different cells communicate simultaneously via a common carrier frequency with a UE as it roams between cells, then a soft handover is said to be in process. The process ends when the UE is communicating with a single cell of a NodeB. Sometimes a UE entering a different cell has to have its carrier frequency changed or even to go to the GSM network. This handover procedure is called a hard handover and we will not focus on this.

The management of the handover process at the UE is facilitated using three sets of cells. First, there is the handover monitoring set that contains a list of all the cells the UE should monitor while it is in an active connection. This list is provided to the UE by the network via the BCCH and may contain details of nearby UTRA TDD and GSM cells [3]. The second set is the active set listing the cell or cells that are currently being used in the active connection. Should the UE be in a softer or soft handover, the active set will contain the identities of the sectors or cells, respectively the active set can only contain UTRA cells. The third set is the handover candidate set. This set contains the identities of cells that are not in the active set, but which measurement information suggests that they could support an active connection if required. The names of these cells are reported to the network by the UE. These cells can be on the same or different frequencies, and may contain UTRA TDD cells or GSM cells. The set contents can be changed by using different procedures. The radio link addition procedure, called event 1A, is where a cell is added to the active set and the UE commences transmission with that cell. The radio link removal procedure, called event 1B, is where a cell is removed from the active set and the UE ceases communications with that cell. The combined radio link addition and removal procedure, called event 1C, results in a cell in the active set being substituted by a different cell. A prerequisite to forming sets is making measurements [4,5].

The primary measurement quantity is the ratio E_C/I_0 of the primary CPICH. These measurements are made in every frame on the CPICH from cells in the active set (every 10 ms). Other measurements that may be evoked are the downlink path loss, the down-link transport channel BER and the block erasure rate (BLER), and the time difference between the signals from the target cell and the serving cell. Measurements on cells not in the active set are made less frequently.

The UTRA specifications define the format of the measurement information delivered by a UE to the network. It is up to the equipment manufacturers to decide how the network will use the reports to determine whether a soft handover should be performed, i.e. the soft handover algorithm is not in the UTRA specifications. However, these specifications do offer the following suggestions for a soft handover algorithm. There are four parameters:

- an active set threshold ($Thresh_{AS}$)
- an active set hysteresis ($Hyst_{AS}$) level for entry to or removal from, the active set
- an active set replacement hysteresis ($Hyst_{AS\_REP}$) value required for one cell to replace another in the active set
- the trigger time (ΔT) that sets the time between a trigger event occurring and the report sending to the network.

The algorithm utilizes these parameters as. A cell is removed from the active set if its E_C/I_0 falls ($Thresh_{AS} + Hyst_{AS}$) below that of the best active cell. Alternatively, a cell is added to the active set when its ratio E_C/I_0 exceeds the trigger level which is set at ($Thresh_{AS} - Hyst_{AS}$) below the ratio E_C/I_0 of the active cell. Should the active set be full and the best non-active cell is better than $Hyst_{AS\_REP}$ above the worst active cell, then the latter is replaced by the former cell. Figure 1 shows the variation of E_C/I_0 as a function of time for three cells. Observe that a report will be send to the network only if the condition is verified during ΔT. After report, the action command will be send by the network.

The UMTS standard call the addition to the active set as E1A event, the removing as E1B event and the replacement as E1C event. Usually, the time to trigger values are different for each type of active set changes and the values recommended by the vendor are between 120 ms till 640 ms [2].

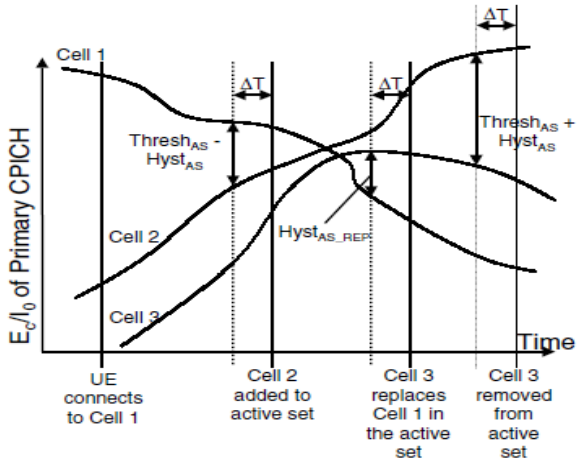

Figure 1. Example of the soft handover algorithm to illustrate changes in the active set

In order to manage the network, counters are implemented at all the levels of the network: NodeB, RNC, MSC etc. The principle is simple: each process is led by a defined protocol and the completion or the fail of certain event inside the process will increase a counter associated to that specific event.

3. OPTIMIZATION OF HANDOVER PROCESS

In UMTS, the utilization of multiple cells in active sets improves the mobility of the subscriber, but increases the waste of resources by using them from each cell. In certain situation, i.e. people inside a stadium, this situation must be avoided in order to have available resources. In plus, people in that case are static, so the usage of several cells in the active set is not anymore necessary. A deeper analysis of the situation of the behavior of the cell reveals this type of situation.

Based on these inputs, an optimization campaign was done and for the handover the optimization was declined in three steps:

- reference – the network evolution was monitored before making any changes
- phase 1 - increasing the value of the Cell Individual Offset parameter (a neighbor based parameter) which must delay the entering in the active set of a new neighbor
- phase 2 - deactivating the handover to the neighboring cells, by assuming that the mobility in that area is not needed and the resource availability driving the optimization process table traffic, less handover events. The histogram graph shows the decrease of the active set size too (Figure 2).

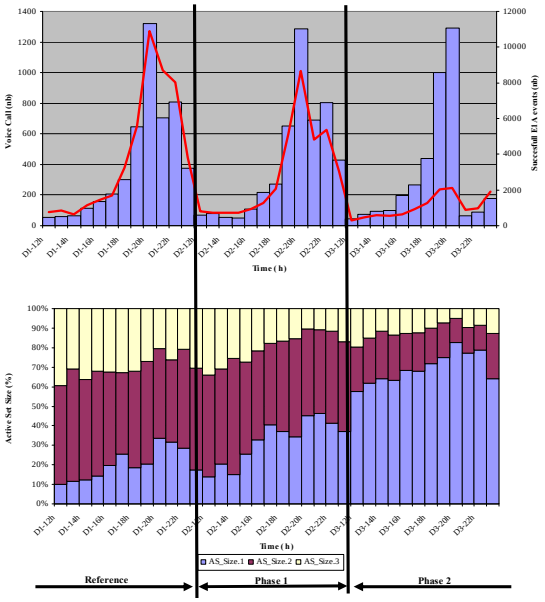

Figure 2 Handover optimization results

These results confirm that in order to improve the network response in case of critical situations, it's suitable to have adaptive parameters templates drive by the network itself. The choice of the suitable template is done by comparing the on-going situation with a collection of situations profile stored in a knowledge database. The build of such knowledge database may be done in an efficient way by using the experience of

optimization trials and the completion or the fail of certain event inside the process will increase a counter associated to that specific event [6,7].

In order to implement this concept is need the knowledge database. This will offer a collection of situations with the description of the inputs (in order to realize the identification) and the parameters set to be activated. The knowledge database and the associated template to be built up will be made on analysis done over the existing granularity period, usually one hour due to details needed. But the problem of unpredicted situation or the suitable values for the parameters set still remain.

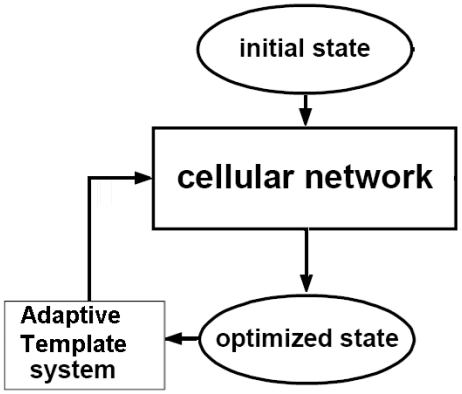

Figure 3. Reconfigurable network structure

In order to answer to such constrain a good approach is to use fuzzy-based parameters for solving these problems where demands are uncertain. The crisp values of the important parameters involved in the process to be optimized must be fuzzified. The fuzzy-based parameters must be designed to provide data required by the selection procedure. The uncertain data will be represented as linguistic values which are fully dependent on the user's preference.

4. CONCLUSIONS

The actual mobile networks are using parameterization templates which are fixed or "statics". The time scale differences between the managed processes and the counters demands an evolution to a reconfigurable network. In order to model and to predict the network behavior, an easy and relevant method is offer by the fuzzy-logic techniques. The authors start to focus on the selection of the defuzzification method to discover the most appropriate parameters for obtaining crisp values which represent uncertain data.

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MICROWAVE THERMAL EFECT EVALUATED ON A GENERIC MODEL OF THYROID GLAND

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Abstract: *The rapid diffusion of wireless communication systems has caused an increased concern for the potential detrimental effects on human health deriving from exposure to electromagnetic field. It penetrates the body and acts on all the organs, altering the cell membrane potential and the distribution of ions and dipoles. The thyroid gland is one of the most exposed vital organs and may be a target for electromagnetic radiation. This paper presents the computed temperature and specific absorption rate inside to a generic model of a human thyroid using signals radiated by an antenna operating in the 2450 MHz band and the power density levels up to 10 W/cm². Calculations were carried out using the Finite Difference Time Domain method for the solving of two coupled differential equations, Maxwell and Pennes. The results show that the temperature can rise up to very dangerous levels, i.e., 46 ^{0}C, in a very short time. The estimated temperature distribution in the human thyroid due to exposure from microwave signals can be used to design the dangerous aria for personal working around high power emitted antenna and for medical applications.*

Keywords: *microwave thermal efect, thyroid, bioheat, specific absorbtion rate, microwave antenna*

1. INTRODUCTION

In the last 20 years, the modern industrial society has known an exacerbation of environmental pollution by substances that have a high level of danger, by non-ionising radiations, mainly in the microwave spectrum, and by a large amount of data leading to an informational intoxication [1].

By 1990, radio frequency band was occupied mainly by several radio and TV transmitters, located in remote areas and in places somewhat higher. After the introduction of wireless communications, electromagnetic contamination in cities has increased greatly. The investigated experiments of the effects of electromagnetic radiation on living organisms are complex because of the large number of existing variables which has to be controlled. Non-thermal effects are difficult to be determined because they are nonlinear [2].

In this generic framework of the electromagnetic smog, that becomes less and less friendly, it is necessary to perform theoretical and experimental studies on the possible field levels that are currently applied to certain body parts.

People have the ability to physiologically regulate their inner environment to ensure stability in response to fluctuations in the outside environment and the weather as a

result of homeostasis process. They maintain a near-constant body temperature, about 37 ^{0}C, by thermoregulation. The limits of medical emergency are 32^{0}C and 41^{0}C. Death usually occurs when the temperature values are less than 24 ^{0}C or higher than 44 ^{0}C. Usually, these values are possible when the subject is under a dangerous environment. Hyperthermia occurs when the body produces or absorbs more heat than it can dissipate. This is usually due to excessive exposure to heat. Hyperthermia can also be produced artificially by medical devices and it may be used as a therapeutic method to bring about an artificial rise in temperature in certain types of cancer tissues, such as skin cancer.

Electromagnetic fields penetrate the body and act on all the organs, altering the cell membrane potential and the distribution of ions and dipoles. These alterations may influence the biochemical processes in the cell. It has been shown that microwaves produce a temperature and energy distribution in living tissues [3]. Temperature is an important factor in the regulation of the release of endocrine hormones. For example, cold temperature increases the activity of thyroid hormones; acute psychological stress increases TSH secretion from the pituitary, and increases the release of T3 and T4 from the thyroid.

The thyroid gland is one of the most exposed vital organs and may be a target for electromagnetic radiation; it is apt to be a region of high SAR at microwaves. The thyroid hormones (T2, T3, and T4) provide energy and fuel to the body and also regulate the body's temperature by controlling the body's metabolism. The thyroid hormones affect brain function, heart health, and they improve the function of the immune system. It has been established that even a small change in circulating thyroid hormone levels is sufficient to alter the brain functions [3, 4].

However, there are only few published papers reporting the effect of microwave radiation on thyroid [5]. The aim of the present study was to assess the temperature rise of thyroid gland situated in an intense microwave field radiation emitted by an antenna located on a maritime ship.

2. METHODS AND MODELS

The wave equation models the electromagnetic field propagation, i.e., for electric component:

$$\nabla \times \left(\nabla \times E_r \right) - k^2 E_r = 0 \qquad (1)$$

where k is the wave number defined by: $k = k' - jk'' = \omega\sqrt{\mu\varepsilon}$. The wave number of free space k_0 is defined as $k_0 = \omega\sqrt{\varepsilon_0\mu_0} = \frac{\omega}{c_0}$, where c_0 is the speed of light in vacuum. From theoretical point of view, a generic model of thyroid was designed and situated in far field aria of a transmitted antenna. The electromagnetic field radiated from antenna is propagating as a plane wave having the two components, electric and magnetic field intensities [5]:

$$\overline{E_r} = E_r \exp(-\gamma r)\bar{r} \qquad (2)$$

$$\overline{H_z} = \frac{E_r}{377}\exp(-\gamma r)\bar{z} \qquad (3)$$

When a plane wave propagating in a homogenous medium encounters an interface with a different medium, a portion of wave s reflected from the interface while the remainder of the wave is transmitted. The reflected and transmitted waves can be determined by enforcing the electromagnetic field boundary conditions at media interface.

The feed point is modeled using a port boundary condition with the level of the power density between 0.1 and 100 W/cm^2. As a result of microwave radiation, the thyroid temperature will be grown up with

some degrees. The bioheat equation describes the stationary heat transfer problem, Pennes equation [4], as:

$$\nabla \bullet (-k\nabla T) = \rho_b C_b \omega_b (T_b - T) + Q_{met} + Q_{ext} \quad (4)$$

where k is the liver's thermal conductivity, ρ_b represents the blood density, C_b is the blood's specific heat capacity, and ω_b denotes the blood perfusion rate. Further, Q_{met} is the heat source from metabolism, and Q_{ext} is an external heat sourc. This model neglects the heat source from metabolism. The external heat source is equal to the resistive heat generated by the electromagnetic field:

$$Q_{ext} = \frac{1}{2}\mathrm{Re}\left[(\sigma - j\omega\varepsilon)\overline{E} \bullet \overline{E}\right] \quad (5)$$

This example models the heat-transfer problem only in the neck domain.

3. RESULTS AND DISCUSSION

A simplified model for the the thyroid consists from two ellipsoids, corresponding to two lobes, and by one horizontal ellipsoid for isthmus. The neck aria with thyroid is modeled by a cylinder placed in a block, fig. 1. In order to reduce memory volume, the coupled equations, (1) and (5), the simulation was done on a half of block, fig. 2.

A TEM wave with 2.45 GHz frequency was applied to a face of block, fig. 1. As a result of the finite conductivity for neck and thyroid regions, their local temperatures will be modified [5].

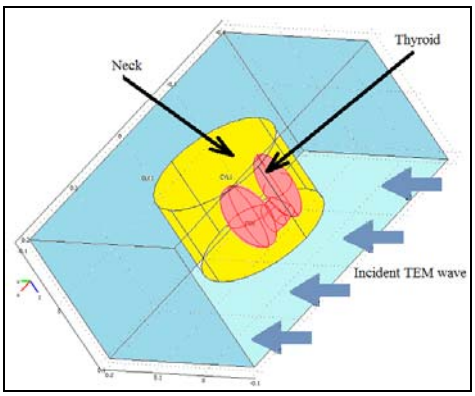

Fig. 1 Generic model of thyroid and the used structure for testing

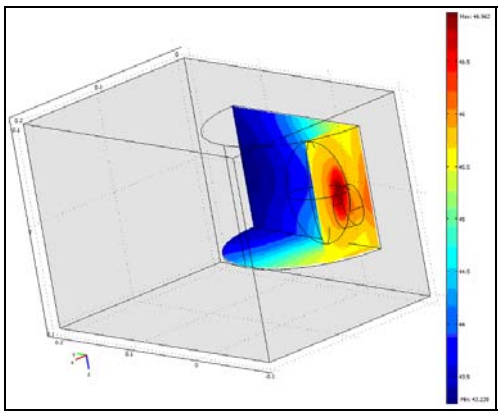

Fig. 2 The temperature variation inside the thyroid generic model

The temperature variation inside of neck region is illustrated on fig. 2 for 100 W/cm^2 power density applied at the input. It can be seen that the thyroid will have a higher temperature than neck area. The maximum value depends on the input power density level. The initial thyroid temperature was 37.0^{0}C. If the power density is less than 100mW/cm^2, the temperate does not exceed 37.1^{0}C. When the power density is increased, then the temperature will be increased, as well. The thyroid temperature variation is shown in the fig. 3 when microwave power density grows up from 0.1 to 100 W/cm^2. For each power

density applied at the input, two temperatures are shown, representing minimum and maximum temperatures inside the thyroid model.

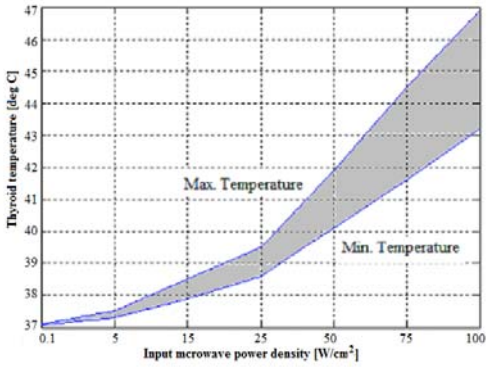

Fig. 3 Thyroid temperature versus microwave power density input level

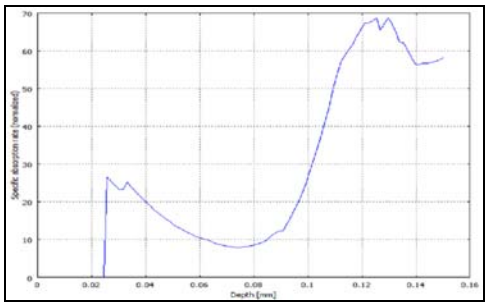

Fig. 4 SAR versus depth in thyroid, for 1 g of tissue

One of the most interested parameter for operator protection is specific absorbtion rate, SAR. On the fig. 4 it is shown the SAR values for 100 W/cm^2 microwave power density at the input device. Although a temperature elevation in the human is a dominant factor due to microwave exposure, the relationship between incident electromagnetic fields absorbed by human being and temperature elevation was not well experimental quantified because the dosimetric techniques were not well established.

4. CONCLUSIONS

Public or occupational exposure limits at microwave field vary with frequency in a complex way. Countries set their own national standards for exposure to average level of electromagnetic fields. There are several international guidelines recommending limits on exposure. The new ship antenna system operates on short pulses but with high power, and operators work in their vicinity. New researches are necessary for the high power and short pulse conditions.

Thyroid is very sensitive tissue to electromagnetic radiation and operators working near transmitting antennas are at high risk. Usual powers of tens of watts can cause on certain directions an increase power density and thyroid temperature will rise by several degrees.

Detailed knowledge of how microwave radiation interacts with biological material is required to account for the various deleterious effects of microwaves which have been. Elevated temperature (1-2 ^{0}C) resulting from energy absorption is known to be a dominant factor inducing adverse health effects such as heat exhaustion or heat stroke.

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PARALLEL ITERATIVE ALGORITHM FOR SOLVING POISSON'S EQUATION

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Abstract: *One of iterative methods for solving linear systems Ax=b is iterative SOR method (success Overrelaxation). The paper proposes a new algorithm of the SOR method for solving Poisson's equation based on partitioning the domain, resulting a parallel algorithm for solving a large linear system, algorithm with superior performances serial SOR method.*

Keywords: *parallel, iterative, mesh, processor*

1. INTRODUCTION

Let the system of linear equations

$$Ax = b, \quad A \in K^{I \times I}, \quad b \in K^I \qquad (1.1)$$

The system has the solution for any $b \in K^I$ if matrix A is regular.

Definition An iterative method is a function (linear or nonlinear)

$$\phi : K^I \times K^I \to K^I$$

characterized the relations:

$$x^{(0)}(y,b) = y;$$

$$x^{(m+1)}(y,b) = \phi(x^{(m)}(y,b),b), m \geq 0 \qquad (1.2)$$

where x^0 is the initial value of the string of iterations.

Definition An iterative method ϕ is called linear if $\phi(x,b)$ is linear in x and b, there is the matrices M and N such that

$$\phi(x,b) = Mx + Nb \qquad (1.3)$$

The matrix M is called the **iteration matrix** of ϕ. An iteration of the form (1.3) represented as:

$$x^{(m+1)} = Mx^{(m)} + Nb \qquad (1.4)$$

is called the **first nor mal for m** or **normal form one**.

Theorem 1.1. [5] A linear iterative method $\phi(x,b) = Mx + Nb$ is convergent if and only if $\delta(M) < 1$ where $\delta(M)$ is the spectral range of the matrix A. $\delta(M)$ is called the **convergence rate** of iterations ϕ.

2. ITERATIVE METHOD SOR

SOR method is an iterative method in which an iteration is defined by:

$$x_i^{(m+1)} = \left[\begin{array}{l} \omega\left(b_i - \sum_{j=1}^{i-1} a_{ij} x_j^{(m+1)} - \sum_{j=i+1}^{n} a_{ij} x_j^{(m)} \right) \\ + (1-\omega) a_{ii} x_i^{(m)} \end{array} \right] / a_{ii},$$

$$i = 1,2,...,n$$

where:

a)if $0 < \omega < 1$ the method is called *underrelaxation method*;

b)if $\omega = 1$ the SOR method coincides with *method Gauss – Seidel*;

c)if $\omega > 1$ the method is called *overrelaxation method;*

The string vector x (0), x (1), x (2), ... build with the normal form SOR converges to solution x if:

$$\max_i \frac{1}{|a_{ii}|}\sum_{\substack{j=1\\ j\neq i}}^{n}|a_{ij}| < 1 \text{ şi } 0<\omega<2$$

For paralleliz ation SOR me thod w e propose a solution based on partitioning the domain, re sulting a n ew method w hich w e call parallel iterative method.

3. PARALLEL ITERATIVE METHOD FOR POISSON EQUATION

We consider the model problem (Poisson equation) in the space of two dimensions, defined by:

$$\Delta u(x,y) = f(x,y) \text{ for } x,y \in \Omega = (0,1)\times(0,1)$$
$$u(x,y) = \varphi(x,y) \text{ on } \Gamma = \partial\Omega$$

For simplicity we consider the case $u(x,y)=0$ on Γ. Discretizing differential equation, the domain Ω is covered with a grid $(n+1)\times(n+1)$ with grid size $h = 1/(n+1)$.
Each point of the grid has coordinates $x = ih, y = jh \quad (0 \le i,j \le n+1)$. If $u(i,j)$ is solution approximated in $x = ih$, $y = jh$, then an approximation of the Poisson equation is given by the 5 points formula:

$$4u(i,j) - u(i-1,j) - u(i+1,j) - u(i,j-1) - u(i,j+1) = b(i.j)$$

where:

$$b(i,j) = -f(ih,jh)h^2$$

Linear equation above is true for $1 \le i,j \le n$ and so we have $N = n^2$ equations with N unknown number of interior points of the grid.
Poisson equation discretized with 5-points formula lead to the following linear algebraic system: $4u_{ij} - u_{i-1,j} - u_{i+1,j} - u_{i,j-1} - u_{i,j+1} = h^2 f_{ij}$ în Ω_h

$$u_{ij} = 0 \text{ pe } \partial\Omega_h$$

which can be written as matrix

$$AU = F$$

SOR method using natural ordering on line with an initial value $u_{ij}^{(0)}$ and a real number $\omega \in (0,2)$ is defined by a sequence of form:

$$u_{ij}^{(k+1)} = (1-\omega)u_{ij}^{(k)} + \frac{\omega}{4}\begin{pmatrix} h^2 f_{ij} + u_{i-1,j}^{(k+1)} + u_{i,j-1}^{(k+1)} \\ + u_{i+1,j}^{(k)} + u_{i,j+1}^{(k)} \end{pmatrix}$$

SOR method with red-black ordering, called method R / B, defines first the iterations in the red points by:

$$u(i,j)^{(k+1)} = (1-\omega)u(i,j)^{(k)} + \omega\begin{bmatrix} u(i-1,j)^{(k)} + u(i+1,j)^{(k)} + u(i,j-1)^{(k)} \\ + u(i,j+1)^{(k)} + h^2 f_{ij} \end{bmatrix}\Big/4$$

.
Then iterations in black points by:

$$u(i,j)^{(k+1)} = (1-\omega)u(i,j)^{(k+1)} + \omega\begin{bmatrix} u(i-1,j)^{(k+1)} + u(i+1,j)^{(k+1)} \\ + u(i,j-1)^{(k+1)} + u(i,j+1)^{(k+1)} + h^2 f_{ij} \end{bmatrix}\Big/4$$

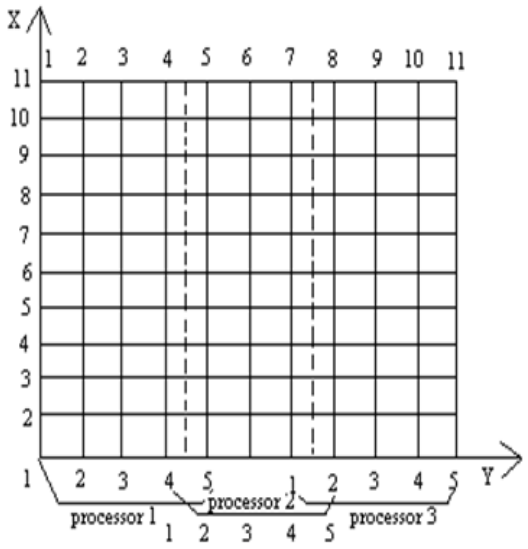
To implement the parallel method on p processors, the mesh Ω_h is decomposed into p disjoint subgrid meshes $\Omega_{h,\nu}$ such that $\Omega_h = \bigcup_{\nu=1}^{p} \Omega_{h,\nu}$.

For simplicity, each subgrid mesh $\Omega_{h,\nu}$ is assumed to be a strip comprising the node points on $(n-2)/p$ consecutive horizontal (or vertical) grid lines, where $n-2$ is assumed to be divisible by the positive integer p. The nodes adjacent to each strip are used as the boundary nodes of the strip and thus the reference to a strip will be made to strip together with boundary nodes and will be called extended strip.

As each strip has one or more common grid lines with extended neighbor strip. Each extended strip will be assigned on one processor. The lines common grid at two extende strips represent the communication between 2 processors. Thus if the strip ν is assigned to the processor ν, the new iterations

associated with points on the first line of the grid domain $\Omega_{h,\nu}$ are send to the processor $\nu-1$ by the processor ν, $2 \le \nu \le p$, as soon as they are calculated. Iterations send by the processor ν, to processor $\nu-1$ used by the processor $\nu-1$ in iterations associated with points on the last line of the strip associated with him.

A exemple with p = 3 and n=11 is illustrated by next figure:



Each strip comprises three grid lines, and has two interior boundary grid lines. Thus, each extended strip consists of five grid lines, wich have been locally numbered in Y-axis. For example, strip 2 comprises grid lines 5, 6, and 7, and grid lines 4 and 8 are its interior boundary. So, the second extended strip comprises five grid lines; grid lines 4,5,6,7 and 8. Grid lines 5 and 7 in strip 2 also serve as the right boundary of strip 1 and the left boundary of strip 3, respectively. Hence, when the iterates on grid line 5 are updated and immediately sent to processor 1, wich is equivalent to updating the right boundary condition of strip 1,they will be in updating the iterates on grid line 4 at processor 1.

To get the iteration expressionof the parallel method for Poisson equation, we need to decompose each strip $\Omega_{h,\nu}$ into three sub-strips $\Omega_{h,\nu} = \Omega^1_{h,\nu} \cup \Omega^2_{h,\nu} \cup \Omega^3_{h,\nu}$, where $\Omega^1_{h,\nu}$ and $\Omega^3_{h,\nu}$ contain the mesh points on the first and the last grid lines of the strip $\Omega_{h,\nu}$, respectively, and $\Omega^2_{h,\nu}$ contain the remaining part. Then the parallel iterations are defined by:

$$u_{ij}^{(k+1)} = \frac{\omega}{4}\left(\begin{array}{l} h^2 f_{ij} + u_{i-1,j}^{(k)} \\ + u_{i,j-1}^{(k+1)} + u_{i+1,j}^{(k)} + u_{i,j+1}^{(k)} \end{array}\right) + (1-\omega)u_{ij}^{(k)}$$

pe $\Omega^1_{h,\nu}$

$$u_{ij}^{(k+1)} = \frac{\omega}{4}\left(\begin{array}{l} h^2 f_{ij} \\ + u_{i-1,j}^{(k+1)} + u_{i,j-1}^{(k+1)} + u_{i+1,j}^{(k)} + u_{i,j+1}^{(k)} \end{array}\right) + (1-\omega)u_{ij}^{(k)}$$

pe $\Omega^2_{h,\nu}$

$$u_{ij}^{(k+1)} = \frac{\omega}{4}\left(\begin{array}{l} h^2 f_{ij} + u_{i-1,j}^{(k+1)} \\ + u_{i,j-1}^{(k+1)} + u_{i+1,j}^{(k)} + u_{i,j+1}^{(k+1)} \end{array}\right) + (1-\omega)u_{ij}^{(k)}$$

pe $\Omega^3_{h,\nu}$

where $\nu = 1,2,\mathsf{K}\,, p$ and $u_{ij}^{(k)}$ represents the k-th iterate at mesh point (x_i, y_i).

Each of the three subprobleme is resolved with SOR method by each processor.

4. NUMERICAL EXAMPLE

Applying the parallel algorithm in solving Poisson's equation on a grid of 200×200 was obtained:

a) Cost calculation / iteration: close to 0(N).

b) communication cost: $0(N^{1/2})$.

Number of processors	Tolerance error	Number iterations	Execution time
1	6E-3	216	5.7
2	6E-3	216	4.0
4	6E-3	216	2.7

5. CONCLUSION

In the parallel algorithm each processor execute k iterations of algorithm in parallel.

Defining:

b=block size of matrix A and vectors $x, r = b - Ax$ on each node

p=number of processors

T_{comp1p}=total time to update blocks of vectors on each processor

T_{comp2p}=total time to compute and comunicate A and (r, r)

T_{comp3p}=total time for the computation of the inner products and global communication

T_{comp4p}=total time to compute scalars

Here T_{comp1p} is the total time for 3 computation to update the vectors. It is observed that when matrix A is very sparse (density less than 5 percents), time exceeds the computation time. Thus, T_{comp2p} is taken equal to t_{comm}, the time to communicate a block of size b across p processors. T_{comp3p} involves time for global communication and computation. It is t_{glb}. Then:

$$T_{par} = T_{comp1p} + T_{comp2p} + T_{comp3p} + T_{comp4p}$$

where:

$$T_{comp1p} = 3 * b * k * t_{comp}$$

$$T_{comp2p} = t_{comm}$$

$$T_{comp3p} = 2 * b * k * t_{comp} + t_{\mathrm{glb}}$$

$$T_{comp4p} = 2 * k * t_{comp\alpha}$$

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4. ENGINEERING SCIENCES

4.1 ELECTRICAL AND ELECTRONICAL ENGINEERING. RENEWABLE ENERGY AND ENVIRONMENT

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ASPECTS REGARDING ELECTROMAGNETIC FIELD PROTECTION

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Abstract: *Electromagnetic field effects on life are important because people live in the fields of increasing intensities. In the military field, the problems are even greater, because of the possibility of attacks with electromagnetic weapons and information theft by electromagnetic fields emitted from telecommunications equipment. The paper presents a method of simulation of Neuron and effects of disturbing voltages and also a method for the simulation of composite materials that can be used in electromagnetic shielding.*

Keywords: *Electromagnetic Compatibility, simulation, composite materials*

1. INTRODUCTION

Official statistics show that in Romania there are now 232 phones per one thousand inhabitants. Mobile and fixed service stations mounted on blocks concern among the population. Increasingly more people are looking for answers to questions about the effects of electromagnetic radiation on physical and mental health of the individual.

In the military field, the problems are even greater, because of the possibility of attacks with electromagnetic weapons and information theft by electromagnetic fields emitted from telecommunications equipment.

An official report of the World Health Organization (World Health Organization, the WHO), [1] shows that there are a huge number of mobile and fixed stations serving mobile telephony. Mobile phones emit powers between 0, 2W and 3W and fixed stations up to 100W in the range of 800-1800 MHz frequencies. Electromagnetic energy is absorbed in the human body and produce heat, but the self-system of regulating body keeps a constant temperature. In general, there was an increase in the number of cases of cancer in the world over the past decade in the world, where the number of mobile and fixed stations has skyrocketed, what is already a serious statistical evidence that electromagnetic radiation causes cancer. There were, however, put the biological effects (other than warming) in cell cultures (increases) or invertebrates (increasing fertility) so that the studies can continue and it is recommended that samples of the population growth that are tests.

WHO carried out the research on the effects of electromagnetic waves and mentioned in the report [2] that there was no connection between the exposure through the use of mobile phones and cancer. Studies go further in this direction, but in others such as changes in brain activity, reaction times, etc. However, investigations are not finalized and it is premature to draw a conclusion, so that WHO recommends caution with mobile phones, especially for children, shortening the calls, the use of system calls ' hands free ' etc. For fixed stations, measures must be taken to limit the access of antenna in the vicinity of where the energy radiated is great.

The report published in the Netherlands and taken over by WHO [4] confirms the results of the WHO. WHO carried out the research on the effects of electromagnetic waves and mentioned in the report [2] that there was any connection between the exposure through the use of mobile phones and cancer. Studying further in this direction, but in others, such as changes in brain activity, reaction times, etc. However investigations are not finalized and it is premature to draw a conclusion, so that WHO recommends caution with mobile phones, especially by children, shortening, use system calls ' hands free ' etc. For fixed stations, measures must be taken to limit the access of antenna in the vicinity of where the energy radiated is great.

On the WHO website are punctual research results published on the effects of electromagnetic radiation emitted by mobile phones and the organization proposes new directions of research. In [3] are the results of a study on 550 thousand people in Denmark who carried out the incidence of cancer and did not register an incidence increased to mobile phone users. Generally, there was no increase in the number of cases of cancer in the world over the past decade, where the number of mobile and fixed stations has skyrocketed, what is already serious statistical evidence that electromagnetic radiation doesn't cause cancer.

However, biological effects (other than warming) were highlight in cell cultures (increases) or to invertebrates (increasing fertility) so that the studies can continue and it is recommended that samples of the population should grow for tests. The report published in the Netherlands and taken over by WHO [4] confirms the results of the WHO.

2. THE NEURON

Using the cell phones close to the brain makes a great deal of research to be directed over the electromagnetic radiation influences on the brain.

The neuron is the basic unit of the nervous system, situated mostly in the brain. A conceptual drawing of the neuron is given in Figure 1.

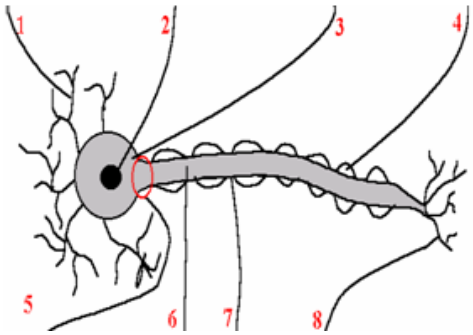

Fig. 1. Neuron structure

The main body of the neuron - soma connects externally through the dendrites branched structure 1, forming a tree. The nucleus of the neuron 2 is located in the soma. Inside, the neuron contains the intracellular fluid and the extra cellular fluid is located external. The membrane of the neuron is 3.

When the neuron is excited with a greater level than the potential action, a signal along the axon 6 is send. The axon starts with a swelling 5 and ends with a filament 8 that connects with the dendrites of another neuron with a connection called a synapse. Signal reception is cumulative, each momentum impulse potential is added to previous pulse potential. The signals are received and additive processed in the soma.

The electrical signal is generated by the difference potentials of each side of the membrane due to the Ionic concentration of chemical elements (potassium, sodium and chlorine). Potential difference is expressed by the relation:

$$V_t = \frac{k \quad T}{q} \quad \frac{N_{in}}{N_{ext}}, \qquad (1)$$

where N_{in} are N_{ext} are the ion concentrations inside and outside, k is the Boltzmann constant, T the absolute temperature and q is the ion constant loading.

Axon terminal can be regarded as an electrical transmission line. Axon terminal electrical resistance of is great, but axon terminal is wrapped in a myelin sheath that improves performance of the transmission. The myelin sheath is suspended, 7, forming the nodes of Ranvier which behave as signal amplifiers.

To be able to simulate electrically a neuron has been defined a standard neuron. This definition will be useful for simulating an axon terminal through a transmission line. In table 1 are given parameters for a neuron with the myelin sheath of 8 μm diameter at 300^0K.

Parameter	Value
Characteristic impedance	8500Ω/m
Parallel capacity	4.4E-10 F/m
Series capacity	3.22E-2 H/m
Reference potential	65mV

Table 1

3. NEURON SPICE SIMULATION

A simple SPICE model was used to study the axon terminal behavior when there is an electromagnetic disturbance or not. A Matlab model is presented in [5]. Model with electronic components is given in Figure 3.

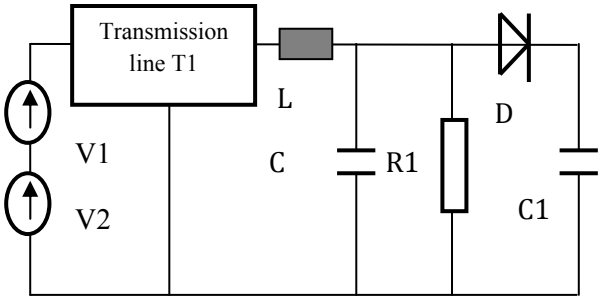

Fig. 2. Spice model with the transmission electrical axon components

Voltage source V1 is simulating a repetitive form of stimulus as a rectangular signal, having the amplitude of the order of the cell potential, dozens of mV, 10ms period and a 20% fill factor. The voltage source V2 simulates a disturbance - a 1 GHz frequency rectangular signal.

In the simulation, the T1 transmission line axon characteristic impedance was taken from the Table 1 and the series inductance and parallel capacity values corresponds to the 1mm axon length. The load resistance R1 simulates the axon terminal. For a correct interpretation of the results, was simulated the receiver located in the next neuron that receives then cumulative by a circuit with diode and capacitor C1.

The model is valid for one segment of the axon with myelin sheath set between 2 nodes of Ranvier. The results of the simulation of an electromagnetically non-disturbed axon are given in Figure 3. neperturbat sunt date în figura 3:

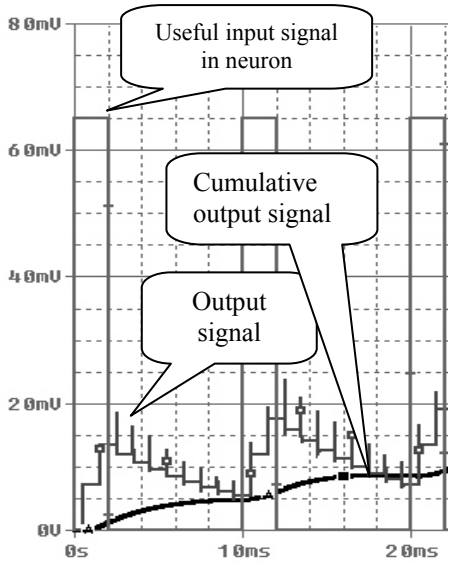

Fig. 3. Simulation results for an electromagnetically non disturbed axon terminal

It can seen in the Figure 3 the decrease in amplitude due to the axon terminal resistivity and the need for the nodes of Ranvier.

The Graph for simulating a disturbed axon terminals by a 1GHz frequency rectangular signal having the amplitude equal to the useful signal is given in Figure 4. It can be seen on

the graph the 1 GHz pulses superimposed to the input signal and a serious deterioration in the form of the output signal of the axon. The cumulative signal is identical in shape and is close to the unperturbed values.

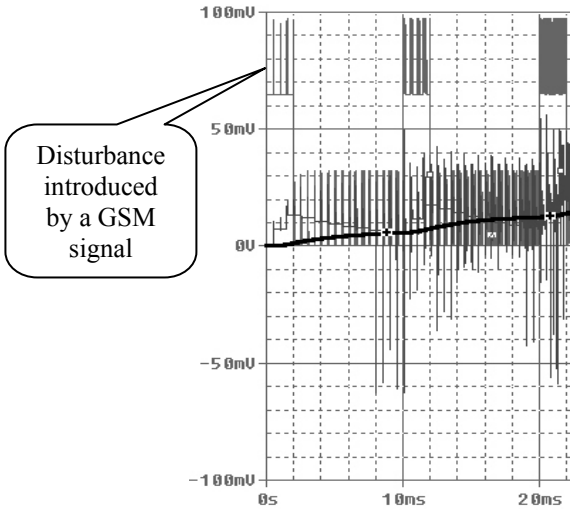

Fig. 4. Simulation results for the behavior of an axon terminal disturbed with an 1GHz rectangular signal

4. SPICE SIMULATION FOR SHIELDING EFFECTIVENESS EVALUATION APPLIED TO COMPOSITE MATERIALS

Late twentieth century is considered by many experts as age materials. These materials with properties superior to traditional materials programmable entered the top technology fields such as microelectronics, aerospace technology, nuclear technology, medical implants construction technique, but also in the automotive industry, shipbuilding, chemicals, furniture, construction materials industry, sports.

Composite conductive structures can be used as electromagnetic shields, repeated reflections on structure planes providing a greater attenuation.

The proposed approach consists in a Spice model using transmission line model to simulate the attenuation introduced by a material characterized by the macroscopic parameters ε, μ, σ.

The method has been validated for copper [6], the results obtained being compared with theoretical results published by White [7].

Simulation conditions require that the electromagnetic radiation source be placed at a certain distance from the shield. This simple method enable to obtain a quick shielding effectiveness evaluation for new materials only by knowing their macroscopic properties ε, μ, σ.

The capability of a shield can be expressed using Shielding Effectiveness, that can be computed by the relation (1) [8, 9].

Simulation of electromagnetic shield through a transmission line is suggestive represented in Figure 5.

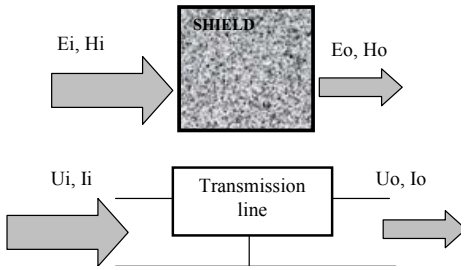

Fig. 5. Loss less Transmission line model showing material properties

$$SE_{dB} = 20 \lg \frac{U_i}{U_0} \quad (2)$$

Layered composite materials have the main advantage the economic one and qualitative reasons, because their use is by saving important quantities of expensive materials or deficient, improving at the same time, the qualities of products and increasing the duration of their operation in conditions of high performance.

Composite material structure, reveals itself in the fabrication, electrical characteristics of layers containing components, i.e. electric conductivity σ, the electric permittivity ε and the magnetic permeability μ is represented in Figure 6.

For simulation have been used the following model, Figure 7, where T1 is the line transmission model for Si material, T2 is the line transmission model for SiO2 and T3 is the line transmission model for the last conductive layer in the analyzed composite material.

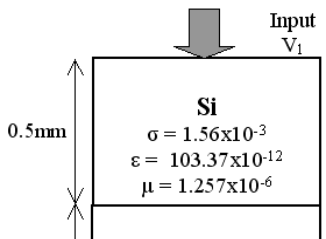

Fig. 6. About the composite material structure

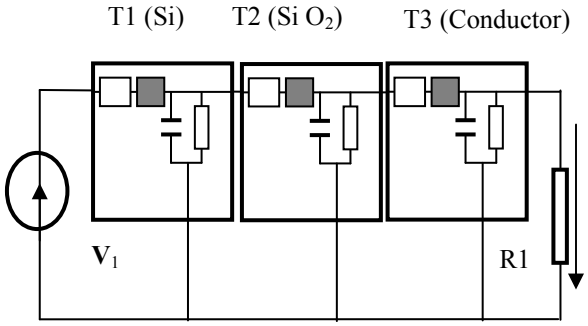

Fig. 7. Layered composite material transmission line model

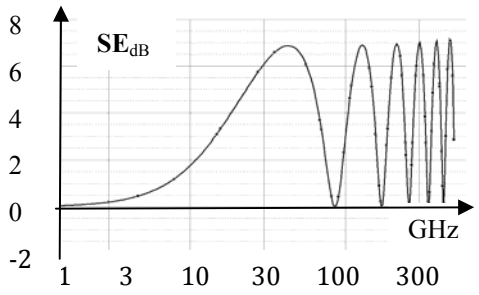

Fig. 8. The material attenuation in the frequency range of 1GHz - 500GHz

After the simulation made in the frequency range of 1GHz - 500GHz, Figure 8, it can be seen that till 3GHz the electromagnetic waves attenuation is low, for all frequencies.

The results obtained by simulations have compared with experimental determinations at 10GHz. The composite material capability to attenuate the electromagnetic waves, expressed by the shielding effectiveness, is around 2dB and was computed by relation (2) after simulations.

5. SHIELDING EFFECTIVENESS EVALUATION WITH SIMULINK SIMULATION

Based on the transmission line mode Simulink simulations have been made for the composite material, Figure 9.

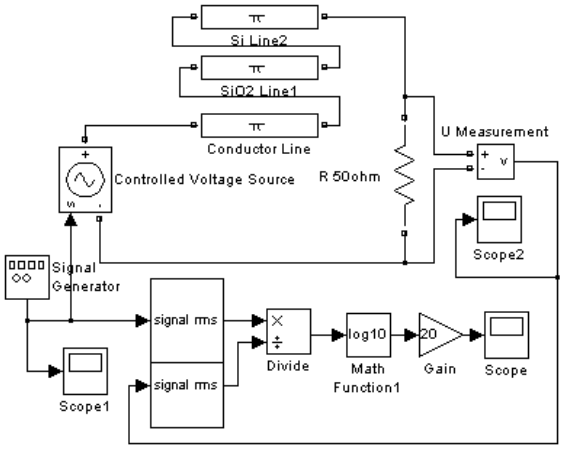

Fig. 9. Simulink simulation model for advanced composite material

The shielding effectiveness (simulated at 10GHz) is shown in Figure 10, calculated with relation (2). Comparing the simulation results obtained with different programs it can be seen that the attenuation introduced by the composite material at a frequency of 10GHz are in the range of (1.5dB-3dB).

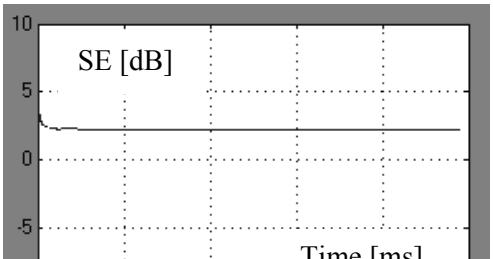

Fig. 10. Simulink simulation results

6. EXPERIMENTAL RESULTS

For the composite material attenuation measuring in the field of radiofrequencies, was used the substitution method, known to be of high precision. Measuring scheme is given in Figure 11.

For experimental determinations was used a wave guide system with an Gunn oscillator at a frequency of 10 GHz, as stated above. The result obtained through the mediation of several determinations is around SE_{dB} = 3dB. Comparing the value obtained with the simulations at the same frequency SE_{dB}= (1.5dB-3dB), it reveals a good precision, which means that the simulations made for the composite material are correctly made.

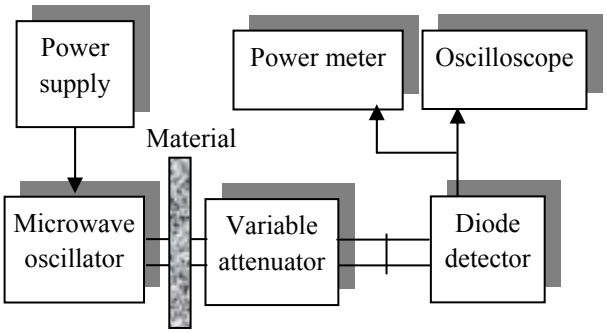

Fig. 11. Block diagram for experimental determinations

7. CONCLUSIONS

The proposed transmission model via axon terminal confirms that a disturbing signal with amplitude of 10% of the useful signal does not have visible effects on the transfer of data. The Neuron's receptor cumulative voltage from the simulation is 12,44E-3V if there is no electromagnetic disturbance and 12,81E-3V if there is one, which means a difference of 3%, so the neuron transmission reduced the disturbance. However, if the disturbance is comparable to the useful signal useful shielding measures must be taken.

The future can bring big surprises on the border areas where composite materials will be used. In addition, the simple method of simulation presented in this paper offers to the manufacturer the possibility to pre-choose the dimensions and the combination of materials in order to get superior performance of the composite material.

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COMPARISON OF ELECTRIC MOTORS USED FOR ELECTRIC VEHICLES PROPULSION

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Abstract: *At present, interest in electric vehicles road reached a very high level. Undoubtedly, these vehicles will be part of the main means of transport of the future but for them to dominate the market of road vehicles, there is still much research efforts dedicated to this purpose. Also, new industries will be created and will have trained many professionals in the fields of electric propulsion systems and components of these systems. Rotary motors are the main components of electric propulsion systems of road vehicles (scooters, cars, buses). There are several types of electric motors can be used in vehicle propulsion systems: DC motors, synchronous motors with permanent magnets or electromagnetic excitation, switched reluctance synchronous motors, squirrel cage induction motors. Performance of these engines, with performance electric batteries or other energy storage mobile units, largely conditions techno-economic performance of electric vehicles, which require careful consideration of their choice. In this paper we present a comparative analysis of electric motors that are currently used in road vehicle propulsion systems.*

Keywords: *electric vehicles, propulsion systems, rotary motors.*

1. INTRODUCTION

Electric vehicle was converted mainly from the existence of an internal combustion vehicle by replacing the internal combustion engine and fuel tank with an electric drive motor and a battery unit while retaining all other components as shown in Figure 1. Disadvantages such as heavy load, reduced flexibility, and performance degradation caused electric vehicle using this type of use out of. In its place, modern electric vehicle is deliberately built models based on the original frame and body. This unique structure satisfies the requirements of the electric vehicle and makes use of a more flexible electric propulsion.

A modern electric drive system is conceptually illustrated in Figure 2. Drive propulsion system consists of three major subsystems: propulsion electric motor, power supply, and auxiliary. Electric propulsion subsystem consists of vehicle controller, electronic power converter, electric motor, manual transmission and driving wheels.

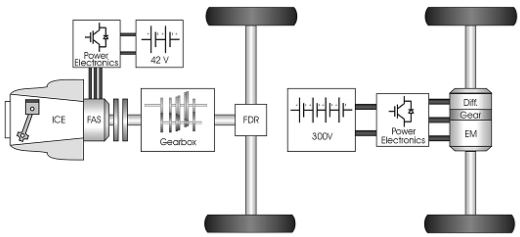

Figure 1. Primary propulsion system of the electric vehicle [8]

Power supply subsystem includes: power supply, power management unit, and unit energy recharge. Auxiliary subsystem consists of drive power steering, climate control room and auxiliary power unit.

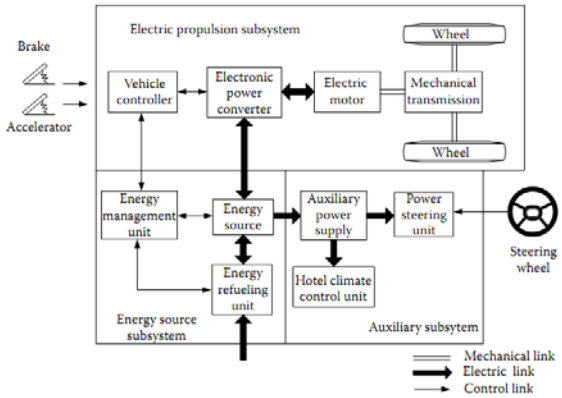

Figure 2. Conceptual illustration of the general configuration of an electric vehicle [2]

2. ELECTRIC PROPULSION SYSTEM

It consists of electric motors, power converters, and electronic control (Figure 3). The electric motor converts electrical energy into mechanical energy for propulsion of the vehicle or vice versa, to enable regenerative braking or charging energies to generate electrcitate stored on board. Power converter is used to power the electric motor with the proper voltage and current. Electronic controller can be further subdivided into three functional units: sensor interface circuits and processor.

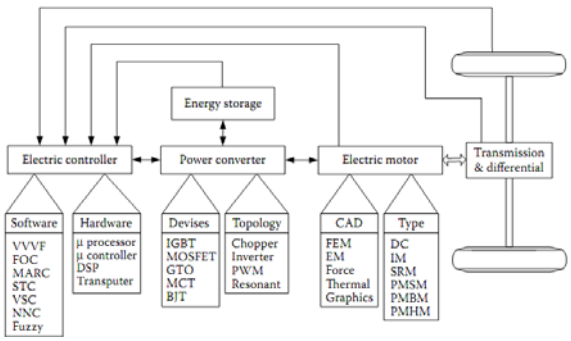

Figure 3. Functional block diagram of a typical electric propulsion system [2]

The sensor is used to translate the measured quantities such as voltage, current, temperature, speed, torque, and flow in electrical signals through interface circuits. These signals are conditioned to the appropriate level before being introduced into the processor. Processor output signals are usually amplified through interface circuits act of power semiconductor devices power converter. Energy source refers to batteries, fuel cells, ultracapacitor, flywheel, and different hybrid sources. Drive motors for electric and hybrid vehicles can be classified into two main groups, namely switching engines and motors without commutation, illustrated in Figure 4. Switching engines are basically traditional DC motors, including excitations series, shunt excitation, excitation compound, separate excitation and excitation permanent magnet motors. DC motors switches and brushes need to enter armature current, thus making them less reliable and unfit for maintenance-free operation and high speed.

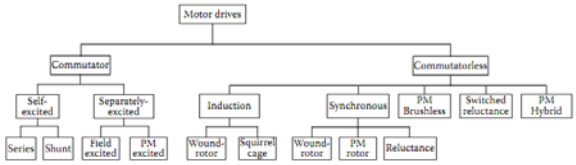

Figure 4. Classification of motor units for electric and hybrid vehicle applications [2]

Recent technological developments have pushed electric motors without switching into a new era. Benefits include increased efficiency, increased power density and low operating costs. They are also more reliable and maintenance-free compared with switching, so those without switch became more attractive. Induction motors are widely accepted as a type of engine without switching to electric vehicle propulsion. This is due to the low cost, high reliability and maintenance-free operation. However, conventional control of induction motor such as variable voltage, variable frequency can not provide the desired performance. With the advent of power electronics and microchip age, principle as field oriented control or vector control of induction motor have been accepted to overcome the complexity of control because of their nonlinearity. However, these control methods suffer from low efficiency in light load and limited range of operating at constant power. By replacing the field winding permanent magnet synchronous motor classic, permanent magnet synchronous motors can remove conventional brushes, slip rings, and field copper losses (Figure 5). In fact, the permanent magnet synchronous motors are

also known as brushless motors with permanent magnet or permanent magnet sinusoidal AC and brushless configuration (BLDC). Variable reluctance synchronous motors (SRM) were recognized to have great potential for applications in electric and hybrid vehicles (Figure 6).

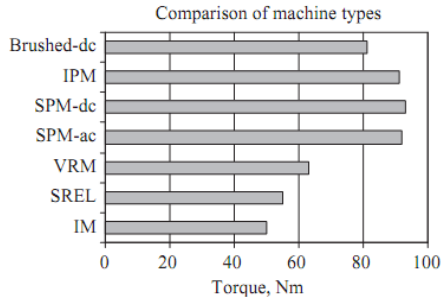

Figure 5. Relative ranking based on maximum torque at the same volume [1]

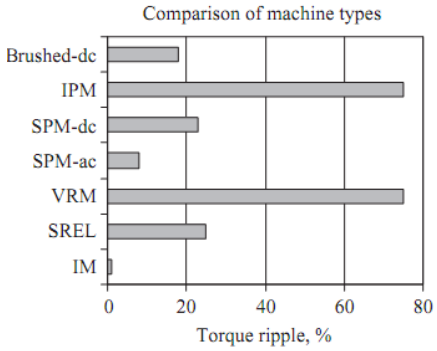

Figure 6. Comparison based on cutting torque ripples at the same volume [1]

3. ADVANTAGES AND DISAVANTAGES OF VARIOUS TYPES OF ELECTRICAL MACHINES

Selection traction motors for hybrid propulsion systems is a very important step that requires a special attention. In fact, the automotive industry is still searching for the electric propulsion system suitable for hybrid vehicles and even electric vehicles. In this case, the key features are efficiency, reliability and cost. Choice of electric propulsion systems for electric vehicles depends primarily on three factors: expectations driver, vehicle constraints, and energy source. Among the various types of electric motor drives, different types are considered viable powertrain electrification, namely those with DC motor, induction motor (induction motor), wound rotor synchronous motor, switched reluctance motor and motor brushless permanent magnet (Figure 7).

	DC motor	Asynchronous (induction) motor	Synchronous wound rotor machine	Synchronous permanent magnet machine	Synchronous permanent magnet machine	Switched reluctance machine
Field orientation	Radial	Radial	Radial	Radial	Axial	Radial
Torque	+	-	-	++	++	+
Efficiency	-	-	+/-	++	++	+
Max speed	-	+/-	-	+/-	+/-	+
Cooling	-	-	+/-	+	-	+
Field weakening	+	+	+	+/-	+/-	+/-
Reliability	-	+	-	+	+	+
Economic potential	+	++	-	-	+/-	+

Figure 7. Overall comparison of different types of motors for traction propulsion system [8]

Given the above table, topology selection electric machines for traction vehicles was restricted inside and concentration flux permanent magnet synchronous motors with radial flow but also axial flux machines with permanent magnets. Permanent magnet machines are becoming more common in traction applications due to high power density, compactness and current availability of power electronics needed for effective control. Despite recent increases in the price of permanent magnets, they are still profitable. Machines axial flux permanent magnet, axial length have particularly short, which could be a considerable advantage to incorporate machine drive system of the vehicle. Moreover, axial flow impellers machine can replace the engine flywheel and flywheel housing is available in the engine. Induction machines are also selected because they are recognized as a mature technology and is widely accepted in traction applications (Figure 8). DC machines were excluded from the selection list for the well known problems associated with mechanical switching. Switched reluctance machines also have been considered a candidate

for electric vehicle applications. However, they are less common and therefore are not considered in this study. The same observation can be made on the wound rotor synchronous machine. This machine is not selected for now, because copper losses rortor difficult to extract, but it would be relevant in the future for a car that does not use permanent magnets, and is profitable for future applications (Figure 9).

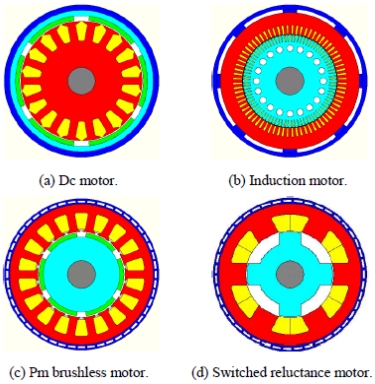

Figure 8. Industrial engines and traction [10]

For the applications drive electric cars, multiphase system could meet the potential demand for electric drives great power, which are both robust and energy efficient.

Propulsion Systems / *Characteristics*	DC	IM	PM	SRM
Power Density	2.5	3.5	5	3.5
Efficiency	2.5	3.5	5	3.5
Controllability	5	5	4	3
Reliability	3	5	4	5
Technological maturity	5	5	4	4
Cost	4	5	3	4
Σ Total	**22**	**27**	**25**	**23**

Figure 9. Systems evaluation of electric propulsion [10]

High number of phases drives have several advantages over 3 phase drives such as: reducing the amplitude and increasing the frequency of torque pulsation, reducing rotor current harmonics, reducing the current per phase without increasing the voltage per phase, reducing the DC link current harmonics, a increased reliability and greater power in the same frame. In a multiphase system drive the car more than three windings are located in the same state of electric machine, and the machine phase currents is thus reduced.

All multiphase variable speed drives share a number of common features:

- For output power of the machine time, the use of more than 3-phase power split to allow a greater number of connections to the inverter, allowing use of semiconductor switches at low levels.
- Due to a larger number of phases, multiphase machines are characterized by a much better fault tolerance than the phase.

Independent control of flux and torque requires means for independent control of two currents. This is impossible in a car if a phase-phase becomes open circuit, but does not present a problem for a multiphase machine as long as no more than three phases are not defective.

TABLE 1α. HPO Machines Having Multiple of Three Phases (ϑ=3)

PHASE BELT ANGLE DEGREES (β)	120	60	60	40	30	30	20	20
NUMBER OF PHASE BELT PER POLE(q)	1.5	3	3	4.5	6	6	9	9
NUMBER OF STATOR TERMINALS (MINIMUM)	3	3	6	9	6	12	9	18
CONNECTION NAME	THREE PHASE	SEMI SIX PHASE	SIX PHASE	NINE PHASE	SEMI 12-PHASE	12-PHASE	SEMI 18 PHASE	18-PHASE
SCHEMATIC DIAGRAM OF STAR CONNECTION & VOLTAGE PHASOR DIAGRAM (MESH CONNECTION MAY BE USED ALSO)								
ALTERNATE DIAGRAM OR COMMON NAME		THREE PHASE						

Figure 10. Multiphase machine models [9]

3. ACKNOWLEDGMENT

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CONSIDERATIONS REGARDING THE LAST 3-5 YEARS HYDRO METEOROLOGICAL CONDITIONS FROM THE BAIA MARE AREA

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Abstract: *The present paper is based on the fact that the boundaries of hydrometeorology are not clear-cut and the conceptual delimitation of its characteristics invoke numerous and varied knowledge, specific to environmental sciences as well as statistics, analysis and informatics. Much more, the hydrometeorological problems, on a global view, overlap with those of the climatologist, the hydrologist, the cloud physicist and the weather forecaster, and nowadays, even with those of the informaticians.*
Our proposal for this paper is limited to the use of the G.S. Surfer 9.0 software in analyzing the variations of the climatic elements recorded in Baia Mares urban area in the last 3-5 years. Through the use of the modern data processing software, the case study underlines a specific evolution for the air temperature, relative humidity, wind speed, cloud coverage and the solar radiation, the presented results from the 2008-2012 giving the possibility to know better the Baia Mare microclimate.

Keywords: *hydrometeorological conditions, Baia Mare microclimate, data processing software*

1. INTRODUCTION

The meteorology with its relative applications in different domain of interest has made strong progress over the last decade at the European and worldwide level. In these conditions appear new modelling tools, processing methodologies and observational data, all these being affected by the application of information systems and environmental sciences. The recent European efforts in developing a platform for e-science provide an ideal basis for the sharing of complex meteorological data sets and tools.

Since May 2008 at the North University Centre from Baia Mare is running an Oregon Scientific WMR 100 type weather station which follows continuously the weather conditions from the interurban region of the city [2]. The variables which are measured by this weather station are various, starting from the basic temperature and humidity to a more complex heat index, rain, wind and others [2].

The most important value measured is the temperature because these influences the human condition in the first time and according to this the weather station is set to record automatically this parameter minute by minute. The paper presents the evolution of the temperature during a the period May 2008 December 2012 [3]. We choose this period because of the accuracy of the data's recorded and because this period is the most illustrative since the weather station is functioning.

The data is represented detailed by seasons and the extremes are analyzed according to the cause which determined them, there is also

represented the evolution of this parameter during the whole period and the results are given graphically.

2. METHODOLOGIES, MATERIALS AND EQUIPMENTS USED

The discussion starts with a description of the system, that have been called meteorological station Oregon Scientific WMR-type 100, which operates in the North University Centre of Baia Mare - Technical University of Cluj-Napoca from May 2008, in order to identify and pinpoint the shared attributes of this system and other specific aspects. The weather station considered is used for continuous monitoring of weather conditions and weather data in order to create a specific hydro meteorological database.

Fig. 1. The Oregon Scientific weather station

The purpose of this relative long monitoring activity of 5 years is to continue to issue monthly and annual reports on weather and hydro meteorological conditions, which are useful in environmental and socio-economic projects, or to describe and understand the urban microclimate (for our case, the Baia Mare microclimate).

Regarding the positioning of the weather station, this station was placed on the roof of the North University Centre of Baia Mare and is located at an altitude of 250 m.

The main console is located in an office on the 7th floor of the building and placed in the same proceeding with a PC connection [2].

Oregon Scientific Weather Station WMR 100 is a professional weather station equipped with a rotating central control system which facilitates immediately access to information on the console.

This unique console includes a sensor that registers the temperature and humidity, also the weather station measures a broad spectrum of meteorological variables and allows wireless connection of 10 different types of sensors along the sensors included in the console.

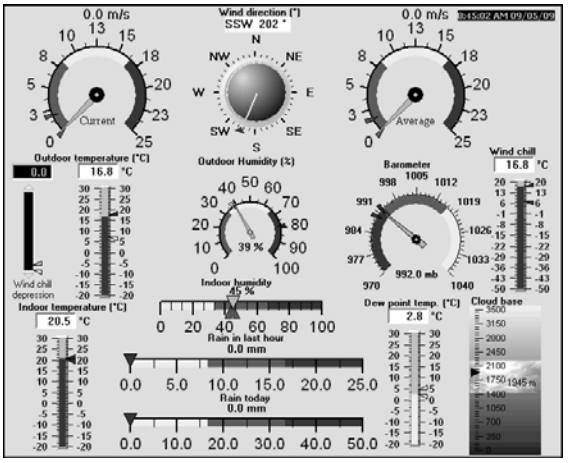

Fig. 2. The Oregon Scientific Weather Display® software interface

Weather station equipment includes a full outdoor sensor consisting of a thermo-hygrometer, an anemometer with vane, a rain gauge and a barometer. Console base is provided with an atomic clock that adjusts itself automatically.

Data processing can be done in several ways, depending on the urgency and need for information [2]; in this case the fastest processing software offers a computer programme which is used for recording data arrays, Weather Display®, besides providing information on current weather conditions and monthly and annual reports. Weather Display Software® files are created in a so-called "diary", containing all the data recorded by the meteorological station in the rough.

3. WORK METHOD, RESULTS AND DISCUSSIONS

Information obtained from the meteorological station is stored as strings of data. These strings of data as type of

environmental information containing information on atmospheric parameters, with a frequency of one digit per minute, allow their interpretation with high precision and getting a detailed picture of the weather conditions.

Table 1. ***The averages for the month in Baia Mare urban area (December 2012)***

Average temperature	3.0°C
Average humidity	66%
Average dew point	3.2°C
Average barometer	1011.0 mb
Average wind speed	0.6 m/s
Average gust speed	0.8 m/s
Average direction	340° (NNW)

Strings of data can be stored in the computer system of gross state indefinitely, given the small size of these files, or can be processed and interpreted. If a clearer picture of the meteorological parameters is needed, then the data can be processed by using Microsoft Excel.

For a calendar month, a log files containing 43.000 rows of data with values for the following parameters: temperature, relative air humidity, atmospheric pressure, wind speed and precipitations [3].

In the present paper we use Surfer - powerful contouring, gridding, and 3D surface mapping software for scientists and engineers.

Surfer's sophisticated interpolation engine transforms your XYZ data into publication-quality maps. Surfer provides more gridding methods and more control over gridding parameters, including customized variograms, than any other software package on the market. Virtually all aspects of your maps can be customized to produce exactly the presentation you want. Generating publication quality maps has never been quicker or easier; so not only the hydrologists, engineers, geologists, archaeologists, oceanographers, biologists, geophysicists, medical researchers and climatologists see G.S. Surfer as a great potential application in their activities.

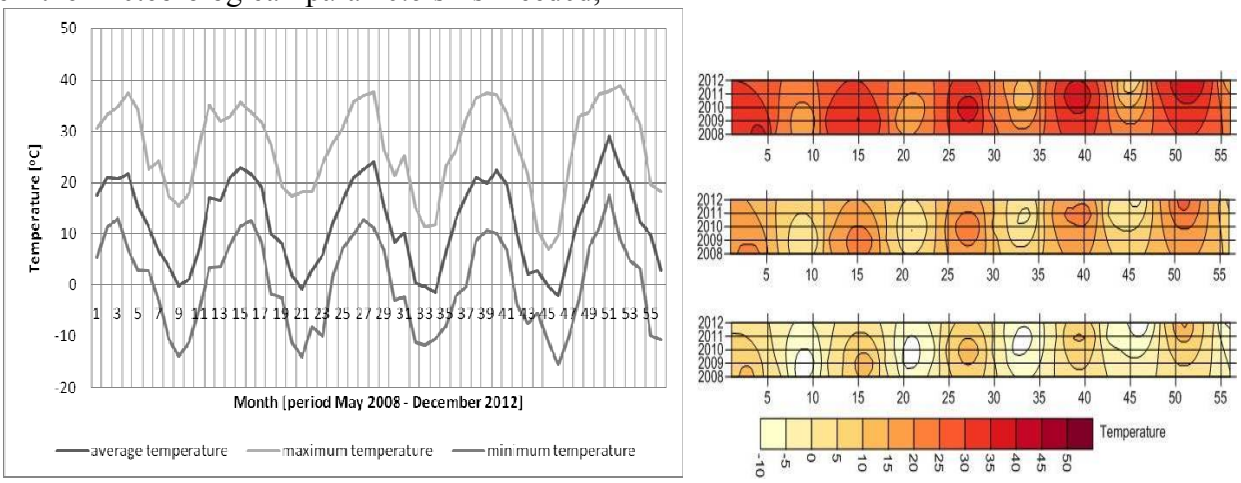

Fig. 3. ***The evolution of Baia Mare urban area temperature (May 2008-December 2012)***

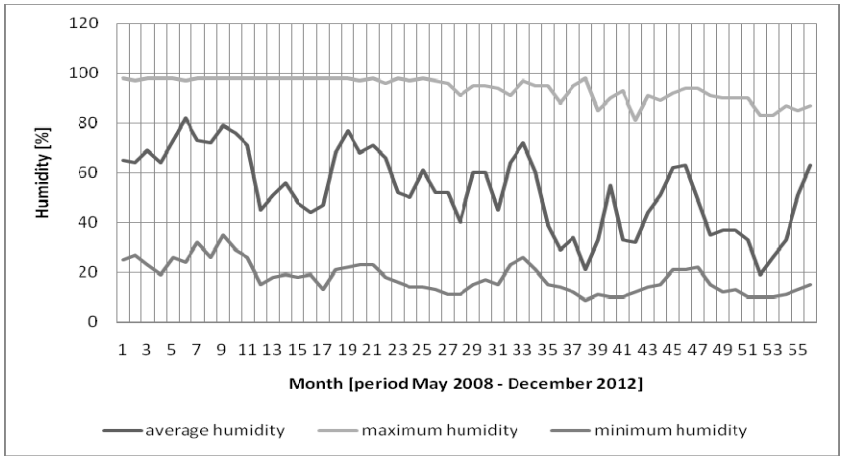

Fig. 4. ***The evolution of Baia Mare urban area air humidity (May 2008-December 2012)***

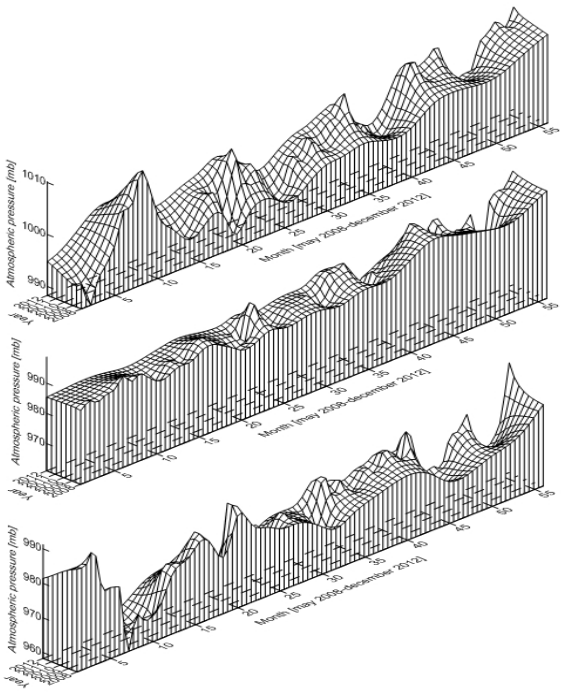

Fig. 5. ***The evolution of atmospheric pressure (May 2008-December 2012)***

4. CONCLUSIONS

The perspective of Environmental Information Systems (EISs) especially in solving many environments problems in accordance with this work paper - prediction, prognoses, modeling and simulation models for evolution and dynamics of hydro meteorological conditions presented in Baia Mare urban area, brings the idea that all this aspects must be integrated with the environmental information elements related to sustainable development of local and regional communities. Meteorologists, hydrologists and engineers have long recognized the value of hydro meteorological data [1] and more importantly the application and analysis innovative methods for meteorological data.

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ENVIRONMENTAL INFORMATION SYSTEMS: SOLUTIONS AND EMERGING CHALLENGES FOR MODERN STRATEGIC DEVELOPMENT OF ROMANIAN LOCAL COMMUNITIES

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Abstract: *Ever since "the environment" gained its place in the public international and national agenda, if we reffer to the environmental legislation, sustainable development concept or even disaster, resources and waste management, it has been bundled with data, information, knowledge and very powerfull multi-integrated informatic systems known, in the scientific literature, as Environmental Information Systems.*
In order to find new possibilities or solutions for solving the complex problematic covered by the research, engineering and environmental protection fields, more and more people are preoccupied to know how to use the Environmental Information Systems (EISs); in this sense, we understand that EISs are considered to have a major role in environmental protection, planning, management and decision making, for international and national threats, as well as for regional and local communities problems.
In the actual development context, we try to give a brief and non-exhaustive description of how could EISs help at the strategic development of Romanian local communities. The present paper explores the typology of EISs and examined the common definitions of them in the light of following major issues: the concepts of data, information and knowledge in EISs, the connection between EISs and EI, the problems and obstacles to the development of EISs and finally, the emerging demand for public access via EISs and EI to environmental information and environmental protection, engineering and research.

Keywords: *local community, strategic development, environmental challenges, modern vision*

1. INTRODUCTION

Science is at the base of everything that mankind has accomplished for the last century. Nowadays society would have had probably another development background without human considerable scientific activities. As time went by a numerous scientific revelations helped reshape our culture and society progress throughout the world. Scientific knowledge of the world has developed gradually through small steps and giant steps. Thus over time many successive scientific discoveries have contributed to the cultural heritage and progress of the local or regional communities.

Most scientific elements are listed in the archives of humanity as routine observations and records contained in research reports and communications, each with its own importance in the mechanism of human knowledge.

The importance of discoveries (such as Artificial Intelligence or Environmental Information Systems) is evaluated by its impact on the economic situation of the states or by the benefit that brings for a large number of people by fulfilling their challenges.

One of the greatest challenges in our industrialized and informative societies has remained the development of our communities in accordance with the protection of our environment. This challenge is addressing politics, economy as well as information, technology and research. In these case it is more than evident that the various problems in environmental protection, environmental planning, research and engineering can be only solved on the ground of a comprehensive and reliable information basis.

Because the state and dynamics of the environment are described by biological, physical, chemical, geological, meteorological, or social-economic data, and all this data is time and space dependent, it seems that the processing and the production of meaningful information on the environment needs innovative and sophisticated applications. Therefore environmental problem solving is mainly an information processing activity handling a wide range of environmental data.

2. ENVIRONMENTAL INFORMATION SYSTEMS - CONCEPT AND CHARACTERISTICS

Due to the facilities offered by new information and communication technologies in all sectors of society and in all activities undertaken were imposed phrases such as "information society", "information age", "communicational society", to refer in fact at one and the same reality, but from a different perspective, a new existential reality that prevails access to information and environmental information culture formation.

In today's society, defined by this new reality, the success and survival of many communities, many categories of institutions or individuals with political or social responsibilities depend on their ability / efficiency to locate, analyze and use effectively information resources.

The efficiency to which we refer is directly related to achieving the goals of information, documentation or knowledge, and the existence of specific situations making certain decisions, optimize processes and application of methodologies for others.

Living in a context of modernization of all aspects of daily life, the time and space in their social dimensions are not insurmountable obstacles, I got to deal with a multitude of socio-economic aspects of life and not only issues generates documentation needs of increasingly particular and also becoming more complex, more accurate. Users by intrinsic need documentation always requires a far wider range of sources of information and documentation resources.

In agreement with the extraordinary development of the means of access to information, training documentary lies in the center of the global movement to form a "culture of information" regardless of the area of interest. Formation documentary, even the specific environmental sciences and individuals closely involved in this vast area, targeting use and better understanding of the tools and techniques of information and documentation. Moreover, the formation documentary was defined as "learning techniques of gathering documentation integrated into a set of steps of research procedures".

Since the Stockholm Conference (1972) in which were laid the foundation of the United Nations Environment Programme - UNEP (conference that coincided, moreover, with the entry into the international agenda of the term "environment") - became increasingly evident that the collection and analysis of environmental data are of vital importance for humanity:

"We have to rely on science and technology, in their contribution to economic and social development, to detect, avoid or limit the hazards that threaten the environment and to solve environmental problems posed for the good of humanity; It is essential to provide education in environmental issues both younger generations and adults, taking due account of the less fortunate in order to develop the foundations necessary to establish public opinion and give individuals, institutions and sense of local responsibilities regarding safeguarding and improving the environment in all his human size; Will be

encouraged in all countries, especially developing countries, scientific and technical activities in the context of environmental problems, national and multinational. In this regard will be encouraged and facilitated the free movement of the latest information and experimental data to help solve environmental problems...".

3. FROM EISS TO THE PRACTICAL PERSPECTIVE OF THE STRATEGIC DEVELOPMENT OF ROMANIAN LOCAL COMMUNITIES

Following the development of spectacular science information, including artificial intelligence, on the one hand, and environmental sciences, on the other hand, appeared at the confluence of two science of human-environment with IT&C, generically called "Environmental Informatics" (EI).

It has become unimaginable impulses which paved the way for unexpected perspectives, raising and restoring the current, on a higher plane and with a more comprehensive environmental issues that need appropriate solutions today.

Classifications and definitions are objective requirements of any science, including Environmental Informatics, which often have reviewed and updated periodically. Classification and definition of concepts related to SIM and IM were conducted early in the study of environmental systems using computing environment, reflecting general level of knowledge about the subject matter at a time and purpose during research.

In this respect, the first classification criteria were based on the structure and role of different types of card, how IT environment could be employed and supported various research areas specific environment. Some of the EISs definitions abound in cascade, are presented below, exposing and source for complete examination and exhaustive exploration of the subject.

"Environmental Information Systems is an umbrella term for all related systems: Monitoring, data storage and access, description and response to disaster assessment studies environmental impact reports on the state of the environment, planning and environmental strategies, simulation, modeling and decision making. "

(International Symposium on Environmental Software Systems)

"Environmental Information Systems are computer systems using a variety of tools and technologies to facilitate the management and use of environmental data and information".

(ESSA Technologies)

It is therefore apparent from the above definitions that there is a wide range of SIM Information Processing Systems Environment that can be differentiated due to the nature of information processing, according to which we have the following typology / taxonomy:

- **monitoring and control systems** (MCSs) - interact closely with environmental processes, such monitoring systems are used to perform automated measurements and control regarding water quality, air and soil, respectively noise and radiation exposure, while control systems aimed at directly involved in industry in monitoring and evaluation of working conditions and the evolution of technological parameters;
- **conventional information systems** (CISs) - are of interest for entry, storage / storage, structuring, integration, saving and presenting various types of environmental information in terms of documents, formal, semi-formal and

informal, such as environmental regulations and reference literature;

- **analysis and assessment information systems** (AAISs) - environmental supports data processing methods making use of complex mathematical and statistical analysis and modeling techniques specific. This category includes, among others, various scenarios and forecast of the evolution / dynamics of environmental factors;
- **planning and decision support systems** (PDSSs) - directly supports the decisions taken by third parties by offering alternatives evaluation criteria and justification of decisions viability, assuming schemes and eco-management audit;
- **integrated environmental information systems** (IEISs) - can not be uniquely associated with a single class of simple systems, demonstrating an affinity towards multidisciplinarity. Integrating a whole an impressive variety of concepts, issues and computer components specific purposes latter category serves as varied as they are many, enjoying such great appreciation for distributed systems environment.

Starting with the "90 was born a new research area for studying and developing new and competitive card, known as Environmental Informatics, a universally accepted definition of Environmental Informatics can be seen as follows:

"Environmental Informatics is the field of research that deals closely with the development and management of Information Systems Environment" as a shortened version of the definition given by Avouris and Page in 1995: "Environmental Informatics is a special field of applied computer science which develops and uses information processing techniques for the protection, research and environmental engineering ... all the basic methodology and specific applications across an extensive and complex issues and aspects, including monitoring, databases and information systems, GIS, software modeling, environmental management systems, knowledge-based systems and data visualization environment..."

4. THE CONTOURING OF THE ENVIRONMENTAL INFORMATION CULTURE

Information and communications technologies have produced unprecedented changes in society in all its aspects, comparable perhaps with transformations of the invention and widespread use of pattern, tending towards a transformation of economic life, social life and cultural transformation, mentality and, not least, the daily life of each individual, information mediated by new information technologies has penetrated directly, with or without our will.

The magnitude universe of informational activities, many forms of expression, diversity of instruments and information environment technologies have produced major changes in the way people communicate, learn, do business, solve various problems and to relate to others and the environment.

Educational institutions are designed to provide graduates and minimal luggage not only knowledge and information skills that enable them to be efficient labor market and integrate professional and social information society. Regarding environmental specialists working in this or related fields, we can say that they need a large number of information and knowledge at each stage of the management and evaluation of specific processes. Also to develop a project and its implementation, they need to know and understand the conditions under which these processes take place.

Analysis should be based on the best data and methods available techniques (BAT) and the knowledge gained from personal experience or come from other specialists.

Traditionally, this kind of information and knowledge are obtained, as required by time, by direct access to databases, reports and documents, the transfer of information and knowledge between professionals (managers, practitioners, researchers, teachers) and through contacts at rates training, workshops, congresses, conferences and symposia.

One of the modern trends of education in general and the protection and environmental engineering in particular, is to address training of future specialists in environmental matters and legal system based on domain-specific policies so that future professionals can make decisions and action based on knowledge and experience.

To improve management capabilities and environmental assessment specialists is necessary to be able to manage and implement concepts for effective and efficient environment that can be achieved through information software environment. Also must have knowledge and access to current information enabling them to take the best decisions. Given the above, information technologies act as fundamental and indispensable support for all components of basic and applied scientific research in the field of environmental protection, using the numerical simulation of complex interdisciplinary processes for monitoring and process control experimental laboratory facilities, and and all applications in information transmission environment.

Environmental Informatics applies methods and information technologies for the collection, analysis, interpretation, distribution (dissemination) and use of the information environment. It also includes a wide range of disciplines that can be used to understand the specific problems related environment: artificial intelligence, neural networks, geographic information systems, global positioning systems, remote sensing, surveillance and mapping services, data storage technologies (databases), software engineering, mobile technology and the Internet.

In Romania, although the activities to highlight the subject of informatics leaning towards the environment are just beginning, it is noted interest alignment with international standards in the field, have set up a computer lab in the Faculty of Environment Energy - University Politehnica of Bucharest and purchased a computer system at the Western University of Timişoara, where the specialists, closely interested by the Environmental Information System development want to create an Institute for Environmental Advanced Research.

All this effort, worth appreciated, are dedicated to building understanding and application of information technology to solve possible environmental national problems.

The main goal of Environmental Advanced Research Institute in Timisoara is the creation of a research infrastructure strategic excellence to international standards to ensure the following requirements related to the integration of research projects in key areas of academic and research activities:

- environmental sciences;
- computer sciences, chemistry, biology, mathematics and physics with related fields of research;
- social and human sciences.

Research carried out in the Laboratory of Environmental Informatics focuses on the monitoring and determine the impact it has on human health, have as main objective the implementation of new approaches, innovative problem solving targeted focus using information systems environment.

5. CONCLUSIONS

Each decade brings new challenges and new problems in the environmental protection politics and community development.

Solutions to our environmental problems and local community development strategies

are strongly dependent on the quality of accessible information sources.

Certainly, qualified information is a very critical factor in making decisive political actions and in changing people's attitudes on the environment. This information on environmental aspects is just as important for decisions on actions in environmental protection as for gaining knowledge in environmental research.

Nowadays, artificial intelligence systems particularized by EISs in the environmental research, protection and engineering plays a specific well defined and vital role in the lives of people all around the world, in all areas of activity: production, service, management, monitoring, research, public involvement in decision making, and in almost all countries.

It has revolutionized, in a practical sense, the way we are used to live. Now, it has made its mark on every fact of the world one cannot, now imagine a world without computers, without information technology, when in fact every field of human activity, may it be his daily life, official life, everything is how influenced under the cover of Information Technology. It made things happen really wonderful. It gave a virtual world itself, where there are no barriers for communication, information sharing, idea sharing etc.

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MICROCONTROLLER BASED SYSTEM FOR ACCELERATED RELIABILITY TESTS FOR ELECTRONIC EQUIPMENT

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Abstract: *The paper presents an embedded system that command an accelerated reliability test applied for electronic recording equipment, which is plugged into the network. Before using an electronic device in a military application it has to be tested in conditions of maximum demands or beyond the maximum demands. The proposed system can generate programmable cycles of power and temperature variations. The novelty is that the system can couple and decouple the voltage in controlled moments of time to ensure the worst case for the device to be tested. The system is bi-directional Internet connection making it possible to work remote. The test of voltage coupling at the maximum instantaneous value is heavily disturbing, so the paper analyse also a network filter structure.*

Keywords: *embedded systems, circuit simulation,, electromagnetic compatibility, power filters*

1. INTRODUCTION

Nowadays, embedded systems have permeated various aspects of industry. Therefore, we can hardly discuss our life or society from now on without referring to embedded systems. For wide-ranging embedded systems to continue their growth, a number of high-quality fundamental and applied researches are indispensable [1].

Embedded systems give us the ability to put increasingly large amounts of capability into ever-smaller devices. Electrical and computers engineers working with embedded systems contribute to all aspects of the development process from planning and design to manufacturing and marketing [2]. "We don't build these things just to have a good time, but to solve important business problems" and "each embedded system is unique, and the hardware is highly specialized to the application domain"[3].

The authors propose an embedded system for the command of a reliability test that should be applied to any electronic device used in military applications. The system generates variations of power and temperature in desired programmable cycles. The testing system can be used for network-supplied equipments. The proposed system provides connecting and reconnecting at power network in controlled moments to ensure the worst case for equipment testing.

The first achievement of the authors in this area was in 1995 when it was made a test stand of the commutated voltage source for selecting the sources with the highest reliability.

The reliability problem is important in the military field, especially if the missiles have to be kept in long time conservation. The paper [5] analyzes the risks that electronic devices do not function when you use.

The issue of reliability of electronic devices that equip guided missiles is set in [6] where it proposes a method of software analyzing from which emerges the necessity of selection methods.

Paper [7] analyses the effect of interruptions in supply voltage in accelerated reliability tests. It said in the paper that voltage sags or power failure can cause earlier malfunctions.

The paper [8] refers to the standard 9592A, "Performance Parameters for Power Conversion Devices" which includes description of Highly Accelerated Stress Tests. The paper said that tests type Burn-in are not sufficient and that the tests should be accelerated.

2. ACCELERATED TESTING SYSTEM DESCRIPTION

The block diagram of the accelerated reliability testing system is given in Figure 1.

The test unit is supplied by a transformer with secondary trap which can be switched by the microcontroller with relays. Switching sockets provide both higher and lower voltage than the nominal one.

Microcontroller performs a test configuration on which overvoltages and undervoltages succeed; their duration, the number of repetitions and the sequence is programmable.

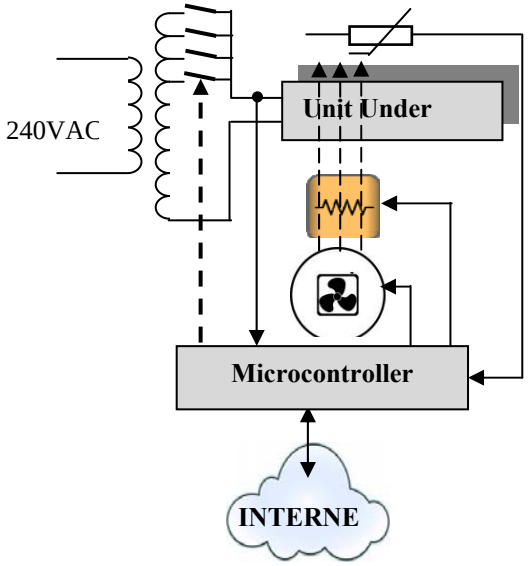


Fig. 1. Block diagram of accelerated test system

Usually, typical test parameters for voltage amplitude variation according to EN 61000 and DIN VDE 0160 are of +/-8% or +/-16% for periods of 2-3s, then 3-7s nominal amplitude, Figure 2.

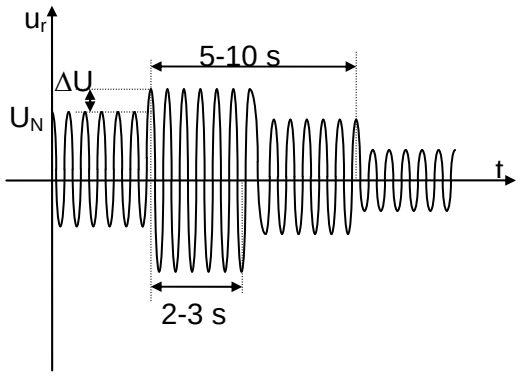


Fig 2. Voltage amplitude variation applied to UUT (unit under test)

The test temperature is ensured through heating and cooling cycles. A fan ordered by the microcontroller provides ventilation and a heating resistance provides heating. Heating and cooling cycles succeed regularly and their duration is programmable. A thermistor measures the temperature inside the device to track the process.

Another test that can be done is not to short dips. Power failure and reconnection can be scheduled to take place at any point in the sinusoidal voltage power network. Basically, the program allows the choosing of the transition moment through zero, through the amplitude and an intermediate point on the sinusoid wave. (0, 45, 90, 135, 180, etc.)

The proposed system is an embedded system based on a PIC microcontroller [9, 10], Microcontroller interrupts are determined always at mains network voltage zero-crossings, thus allowing for voltage coupling time setting and control of the execution element.

Two versions of the device were tested; one provided with a triac the other with a relay as execution elements [11].

A triac provides superior performance since it assures a more precise coupling time, yet the fact that turn-off time is uncontrollable and for certain types of loads the switching is unsafe represents a drawback. The relay eliminates the disadvantages of the triac but whenever a relay is employed, the specified closure and release times must be considered and fine adjustments should be applied after repeated trials. After testing both versions, the relay version was selected for its additional

advantages and is presented herein.

To provide phase control, mains voltage zero crossing is signaled to the microcontroller through an interrupt. The problems arising in this case relate to a certain zero-crossing detection delay and the time needed by microcontroller routine execution to generate a priming impulse. These two processes introduce a priming delay to the triac [12].

Evaluation of mains voltage, as well as setting the accurate timing for coupling and decoupling is achieved through timer interrupt, which is initialized for every supply voltage zero crossing. Receiving commands from the web server is accomplished through reception interrupts for the RS232 interface.

Similar achievements that include switching mains voltage to the load at given times are widely used in UPS devices. When the mains supply voltage is restored, the UPS applies the load a voltage of identical polarity on the rising front of the pulse slope like the voltage provided by the DC-AC converter during the absence of the mains voltage.

A switching control algorithm is described in [13] and the hazards related to the occurrence of a short switching interval when the voltage is supplied both by the mains as well as by the DC-AC converter are described in [14].

Internet connection is made with the Site Player .The Site Player is a web server that handles Ethernet packets. The Site Player has a programmable IP such as 193.123.23.200. The communication between the Site Player and the host microcontroller is accomplished over an RS232 interface. The Site Player has eight I/O lines and a serial port. In order to configure an I/O line, the Site Player can be programmed over the Ethernet. The Web page contains a report with the coupling and decoupling times as well as the coupling and decoupling commands.

3. NETWORK FITERS

For the microcontroller based system were selected non-linear consumers that generate low-amplitude higher harmonics during operation. To reduce them were used network filters for the testing platform. The electric diagram of the filter is presented in Figure 3.

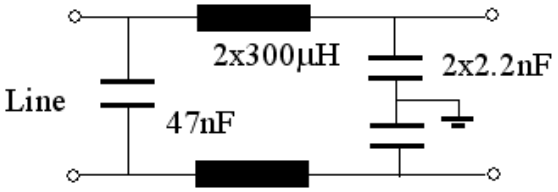
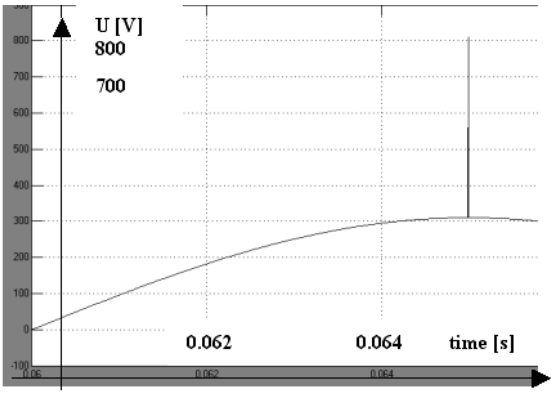


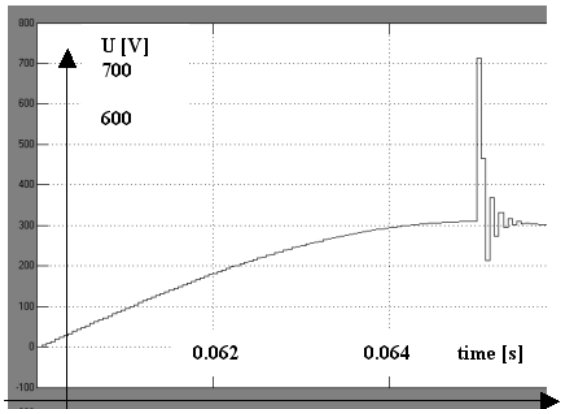
Fig. 3. Power Line filter electric diagram

Simulations were made to verify the effect of power line filter. It can be noticed that the filter diminishes the impulse amplitude to about 100V but increases its length. The same diagram was used to perform a PSPICE simulation.

The simulation waveform is shown in Figure 4 and Figure 5. As can be seen, the two simulations provided close results.



a.



b.

Fig. 4. Line filter SIMULINK simulation; input impulse (a) and output impulse (b).

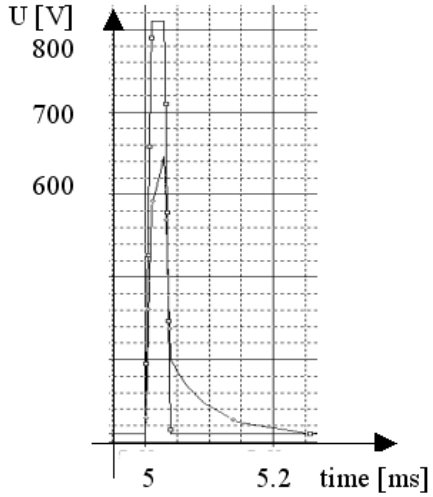


Fig. 5. PSPICE simulation waveform

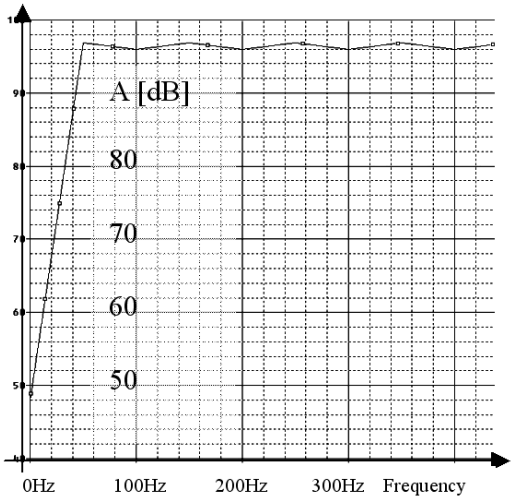


Fig. 6. PSPICE line filter characteristic

Plotting the phenomena versus time is associated with a plot versus frequency, while were simulated the frequency characteristic of the filter. Figure 6 shows a PSPICE frequency characteristic.

3. EXPERIMENTAL RESULTS

The system for accelerated reliability test was used to test several types of electronic devices. As reference, tests were done for purely resistive loads, when the waveform is completely disturbance-free. The waveform of the voltage applied at its peak value (90 degrees phase shift) as displayed on an oscilloscope screen, is shown in Figure 7.

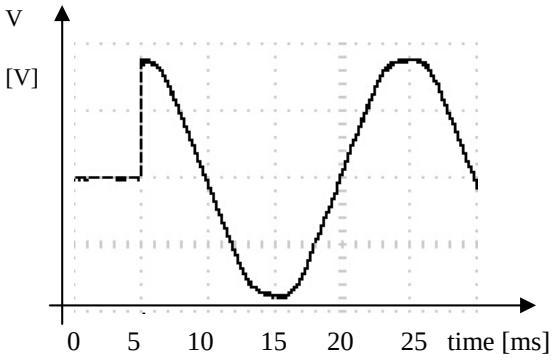


Fig. 7. Main voltage waveform for a resistive load (linear consumer)

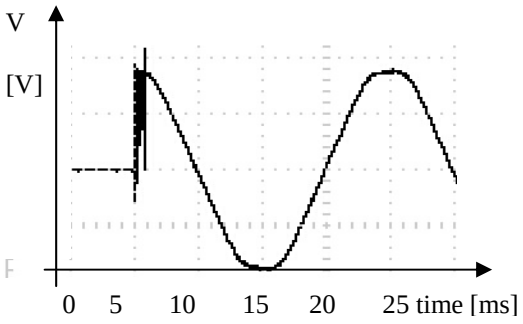


Fig 8. Voltage waveform when connecting a nonlinear consumer

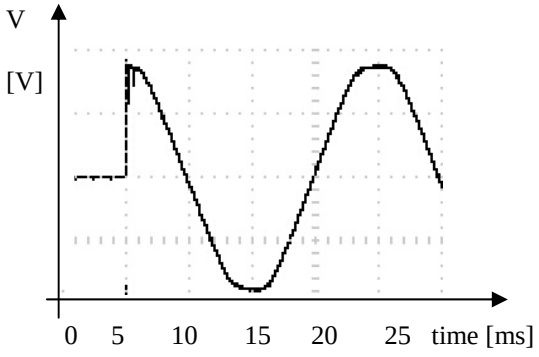


Fig. 9. Voltage waveform when connecting a nonlinear consumer over power line filter

When the consumer generates a high amount of disturbances, as nonlinear electronic

equipment, the voltage waveform is presented in Figure 8. To reduce the disturbances generated in the network supply, filters were used. The effects of the network filter from the testing platform are presented in Figure 9.

4. CONCLUSIONS

Testing may arise in two ways:
- If the UUT can detect an error, then the microcontroller stores the number of errors at the end of the test reports it;
- If the device cannot detect the error, then, after carrying out the test, must check if the device is still operational.

The importance of reliability in military applications is undeniable. The usefulness of the proposed system may be highlight in:

1.The choice before purchasing a certain type of device, by testing several options and choosing the most reliable model;

2.Testing apparatus for specific applications that require greater security in operation and the choice of those who pass the reliability test.

The system can also be used as laboratory platform for familiarizing students with the basics of electromagnetic compatibility, testing, reliability, accelerated aging of the electronic components, embedded systems, transient state, etc.

With this system have been tested many types of devices and the results have been good. It has highlighted the difference in reliability between several types of electronic devices for fluorescent bulbs.

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QUANTITATIVE EVALUATION OF IDENTITY BASED CRYPTOGRAPHY IN AN AUTHENTICATION SCENARIO

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Abstract: *Identity based cryptography is a particular case of asymmetric cryptography in which the public key is chosen so that it uniquely identifies its owner. This information can be any identifier of a person or a system, like the e-mail address, the IP address, and so on. This way there is no need for certificates, because such public keys can be managed very easy. This certificate less operation of identity based cryptography has obvious advantages over classical asymmetric cryptography because it eliminates all the validations required by the use of certificates. But can this advantage be quantified? Asymmetric cryptography is very popular, and, even with all the research conducted in order to promote the use of identity based cryptography, it is still used only in a limited number of applications. Our purpose is to quantitatively evaluate the difference between these two types of asymmetric cryptography in order to have a formal way of comparison between them. For these we have chosen an authentication scenario, giving the fact that authentication is used in the vast majority of security applications. In order to obtain the quantitative results we have implemented Needham-Schroeder protocol using both classical asymmetric cryptography and identity based cryptography. Then we measured the time needed for the authentication of the two parties in each of the case. The results suggest that, at the setup phase, identity based cryptography is slower than traditional asymmetric cryptography, but that after it, it is faster.*

Keywords: *security, identity based cryptography, simulation, ns2, Needham-Schroeder*

1. INTRODUCTION

Identity based cryptography is a special case of asymmetric cryptography. Its particularity is given by how the public-private key pair is computed. In the classical asymmetric cryptography the key pair is generate by the Hardware Secure Module (HSM) of the client. The two keys two very large numbers with no special meaning. The public key is then sent to the Certification Authority (CA), where the certificate is build and signed, thus connecting the key pair owner with the public key, through the CA.

But in the case of the identity based cryptography, the aim is to eliminate the need of using certificates. This is accomplished by choosing the public key so that it is bounded uniquely to the user ([10]). Then, the private key is computed based on the chosen public key.

Because the certificates are no longer needed, identity based cryptography eliminates all the operations required for them: management (certificate store and lookup), validation (time, revocation, and issuer), and renewal. This would suggest that using identity based cryptography would be faster than using traditional asymmetric cryptography. But this informal way of drawing that conclusion could me misleading. So our purpose was to evaluate the two types of cryptography from a quantitative point of

view so that the comparison would be more reliable.

In order to make this evaluation we used a simulation environment, namely Network Simulator 2 (ns2). We have implemented Needham-Schroder authentication protocol ([5]) in two ways: using classical asymmetric cryptography and using identity based cryptography. Then, in a very simple communication scenario, we measured the time taken by the authentication of two nodes using the two versions of the protocol. The results allowed us to make a more reliable comparison between the two types of cryptography.

The rest of the paper is organized as follows: section 2 presents identity based cryptography in a briefly manner and its main differences from classical asymmetric cryptography, as well as Needham-Schroeder authentication protocol. Section 3 describes the two implementations made for ns2. In section 4 we gave the simulation scenarios and the obtained results. Section 5 contains some conclusions and future research directions.

2. THEORETICAL ASPECTS

2.1 Identity based cryptography. Identity based cryptography (IBC) is a type of asymmetric cryptography in which the public key is computed starting from an arbitrary string of characters ([10]). In its main application, as the name suggests, this string represents the identity of the owner of the key, thus being bound directly to it. This string must be unique for each of the users of the cryptographic system. In the simplest implementation of IBC, this string represents a single identifier of the owner, but in complex applications it is better to be formed from more than one identifier. As we already highlighted, the public key is directly connected to its owner ([7]), so there is no longer the need for a trusted third party to certify that a certain key belongs to a certain entity ([13]). And this is the main advantage of IBC systems.

Still there is a need for a trusted third party, but it has another function. In traditional PKI an entity computes its own key pair and uses the CA to certify that the public key really belongs to it. But in IBC system this is no longer possible. Each user of the system computes its public key starting from the identity or the identities that are used. But this means that it can also compute the keys of all the other users. This is normal, because the public key is public. But the users must not be capable of computing the private keys. If a user could compute its private key, it could compute the private key of any user. So a trusted third party is needed for the purpose of computing the private keys of each of the users of the system so that they are really private. And this is the main disadvantage of IBC: the fact that the private keys are known by a central authority ([3]).

Given this explanation, IBC operates as described below ([1], [6]). The trusted third party responsible for generating the private keys is called Key Generation Center (KGC). It computes the public parameters of the system that must be known by all the users in order to compute the public keys and to perform the cryptographic operations. Each of the users of the system receives these public parameters from the KGC and computes its public key and the public keys of the users it wants to communicate with. Then, it requests its private key from the KGC. The KGC computes the private key for each of the users starting from the public key of a user and using the private parameters that correspond to the public ones made available to all the nodes. Each node must receive the private key from the KGC on a secure channel, so that no eavesdropping is possible ([3]).

This way each of the users has the following elements: the public parameters of the KGC, the public key and the private key. Also it can compute the public key of any other user. The cryptographic operations are conducted using this elements in a similar way to those in a PKI system, so we will not present them here ([8]).

To summarize, IBC has two main advantages: there is no need for certificates, and the KGC is no longer needed after all the users obtained their private key, so it can be eliminated, thus eliminating the central point of failure of this cryptographic system.

Because there is no need for certificates, all the validations necessary for their use in a PKI

are eliminated: time validity, revocation status and signature of the CA over the certificate ([11], [3]). Also certificate management for the users is eliminated too. From a practical point of view these eliminations mean that when a user wants to perform a cryptographic operation (signature, encryption, decryption, and signature verification) it can perform the operation right away, without the need to do additional computations. So it should be obvious that IBC assures a faster operation than PKI.

What we wanted to research in our work was to compare IBC and PKI from the point of view of these cryptographic operations, ignoring the advantage given by the elimination of the certificates and to view which type of cryptographic system is faster. For this evaluation we chose RSA asymmetric key algorithm for classic asymmetric cryptography, and Boneh-Franklin identity based encryption scheme for IBC ([2]).

2.2 Needham-Schroeder protocol.

Needham-Schroeder is a mutual authentication protocol between two nodes ([5]). In order to explain how the protocol works, let us consider two nodes A and B that want to authenticate each other. Each of the nodes has a key pair formed by a public key pub(node) and a private key priv(node). In the first step of the protocol, node A generates a nonce N(A), encrypts it with the public key of B and then sends it, together with its own public key to node B. The public key of A is also encrypted with the public key of B. Of course this first step assumes that A has somehow received the public key of B. How it is obtained it is not important for the run of the protocol.

In the next step of the protocol, node B receives the encrypted message from A and decrypts it using its private key. Then B generates a nonce of its own, N(B), and sends back to A the received nonce N(A) and the generated nonce N(B), both encrypted with the public key received from A.

In the final step of the protocol, node A will decrypt the two received nonces and will compare the nonce N(A) received from B with the nonce it has generated for the first step of the protocol. If the two match, it means that B was authenticated by A. Then A sends the nonce N(B) received from B back to it, encrypted with B's public key. B receives the nonce, decrypts it and then compares it with the one it has generated in the second step of the protocol. If the two match, A was authenticated by B. And thus the mutual authentication was successful.

This is the original version of the protocol. Over the years that have passed from its proposal, it was proved that it is insecure and other secure versions of it were proposed. But for the purpose that we have set, this has no importance at all.

3. PROTOCOL IMPLEMENTATIONS

The purpose of our work was to make a quantitative comparison between the two types of asymmetric cryptography, as we talked above. We chose to do the evaluation in a simulation environment. And we used Network Simulator 2 (ns2). Ns2 allows the implementation of a communication protocol at any layer of the TCP/IP protocol stack. Needham-Schroeder is an application layer protocol and was implemented in order to be used for the mutual authentication of two nodes that belong to the same network in an ns2 scenario. For details on how to implement a protocol in ns2, please see ([12], [9]).

We have developed two implementations: one version that uses classical asymmetric

cryptography, and another version that uses identity-based cryptography. We will further present the key aspects of these implementations.

For the implementation of the cryptographic operations necessary in the protocol we used a library called MIRACL ([4]) which implements both RSA and Boneh-Franklin IBC encryption scheme ([2]).

3.1 Needham-Schroeder p rotocol classical asymmetric cryptograp hy implementation. In this version of the implementation we used RSA asymmetric cryptography algorithm in order to implement the encryptions necessary in the protocol. Because we did not want to include in our evaluation the operations performed for validating the certificates, we did not implement a CA. Each node, at the initialization of the protocol, generates for itself a public-private key pair needed for RSA. Then, at each step of the protocol, each node uses RSA to perform the necessary encryptions.

3.2 Needham-Schroeder identity-based cryptography implementation. Because in IBC a node cannot generate its own private key, in this second implementation it was mandatory to implement a KGC responsible for generating the private keys for each of the two nodes. So, at the initialization of the protocol, the node that represents the KGC generates the public and private parameters necessary for the encryption scheme that will be used. Then, each of the nodes requests from it a private key. The public key used is the IP address of the node. The KGC responds to each of the nodes with the public parameters of the scheme and with the private key that corresponds to the IP address of the node. We have presumed that this communication between a node and the KGC is done over a secure channel. This presumption does not influence the actual run of the Needham-Schroeder protocol, neither is affects our evaluation.

After each of the two nodes has obtained its private key, the KGC is disposed and the protocol starts running. As we stated above, the algorithm used for the necessary encryption is based on the Boneh-Franklin IBC encryption scheme ([2]).

4. SIMULATION AND RESULTS

The scenarios in which the tests were performed are very simple. The network is composed of only two nodes in the case of classical asymmetric cryptography, and three nodes in the case of IBC (the two communicating nodes, and the KGC). After the initialization phase takes place, we start measuring the time needed until the protocol is completed and the authentication succeeds. The results obtained are these: the protocol run takes 13.1 milliseconds in the case of the version that uses classical asymmetric cryptography, and 16.6 milliseconds in the case of the version that uses IBC. The computer that we used for the tests had a Intel Dual Core processor at 2 GHz, 2 GB of RAM and ran openSuse 11.

5. CONCLUSIONS & ACKNOWLEDGMENT

We have proposed to offer a quantitative comparison between asymmetric cryptography and identity-based cryptography from the point of view of the cryptographic operations. We targeted RSA for classical asymmetric cryptography and Boneh-Franklin IBC encryption scheme. The scenario used for the simulations in which we did the actual evaluation was an authentication scenario based on Needham-Schroeder protocol. We measured for the two versions of the protocol that were implemented how much time is needed for a protocol run.

The obtained results showed that RSA is faster than the Boneh-Franklin scheme. And this is due to the fact that the generation of the public parameters and the generation of the private keys for IBC takes more time than the generation of the public-key pair that is done at each node in case of classical asymmetric cryptography.

The conclusion is that if the certificates are eliminated, IBC is slower than classical asymmetric cryptography so we have to be very careful when choosing between one and the other. The scenario in which cryptography will be used is very important in making this choice: if the certificates can be eliminated

than PKI is a better choice from performance point of view. But if the certificates are mandatory, than IBC will be the best choice.

As future work, we want to extend this evaluation by comparing other asymmetric cryptography algorithms and other IBC schemes ([COCL01]). Also it would be interesting to make this evaluation not in a simulation scenario, but using a real implementation.

We would like to thank to engineer Florin Vladescu who made the ns2 implementations in C++ and Tcl for the two versions of the protocol in the work for his diploma paper.

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OBSERVED WIND CLIMAT OF REPUBLIC OF MOLDOVA

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Abstract: *Increasing electricity demand and reducing the amount of fuel in the world are two reasons that led to the rapid development of renewable energy; and one of the most important and developed is wind energy. To choose where to place a wind turbine or a wind farm and to predict the amount of energy that will be produce, you need to know the wind energy resources in this region. And this because the wind power density is proportional to the cube of wind speed. Same knowing the wind energy potential leads investors to invest or not to build a wind farm in a certain region. That's why the goal of this work is to obtain the wind climatology statistics of the weather stations of Republic of Moldova as a result of historical wind processing data for a period of 22 years. Have been analyzed data of 18 weather stations located on the entire territory of Republic of Moldova for the period 1990 to 2011 and were built variations characteristics: annual, monthly, diurnal and winds rose.*

Keywords: *observed wind climate, WAsP program, wind speed, wind direction, weather station.*

1. INTRODUCTION

Extensive use of renewable energy sources (RES) is a vital necessity for Moldova, which imports about 95 percent of energy necessary resources. In our case one of the easiest and most pronounced renewable energy sources for Moldova is wind energy.

The wind energy development requires knowledge of wind potential at different levels starting with area where we want to install a turbine and finished with the country and the neighboring countries level. To estimate the production of electricity in a day, a month or a year is necessary to know the variations in wind speed measured at different heights. These variations are obtained as a result of the processing of data series measured for large periods of time either on the Hydrometeorological service (usually at a height of 10 m above ground level), either in the specialized measurement campaigns.

The main goal of the study is the

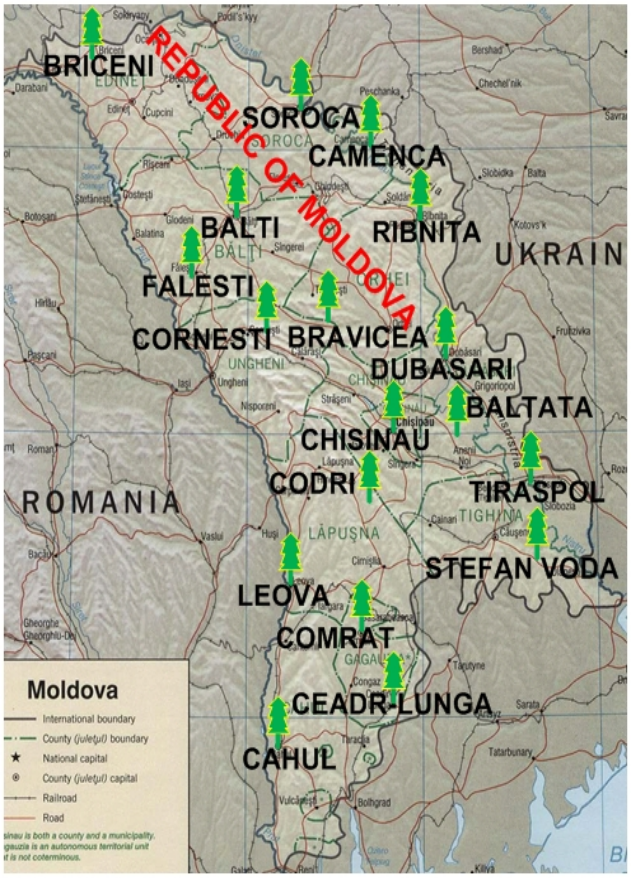


Figure 1. The location of meteorological stations

presentation of the results of measurements of characteristics of wind from eighteen whether station located on the entire territory of Republic of Moldova.

2. THE GEOGRAPHY OF MOLDOVA

Located in southeastern Europe, Moldova is bordered on the west by Romania and on the north, south, and east by Ukraine, figure 1. Most of its territory lies between the area's two main rivers, the Dniester and the Prut. It lies between latitudes 45° and 49° N, and mostly between meridians 26° and 30° E (a small area lies east of 30°).The total land area is 33,851 km^2.

The relief of the country represents a hilly plain sloping from the northwest to the southeast and having an average elevation of around 147 m above the sea level. The central part is occupied by Codrii woods, the most elevated topographical region with the maximum altitude of 429.5 m at Hill Balanesti and a terrain strongly fragmented by valleys and dales. The other important plateaus are: the plateau of Moldova situated in the Nord with maximum altitude 320 m, the plain of the South of Moldova with maximum altitude 250 m, the Tigheci heals situated in the South with maximum altitude 301 m. In the North-East is situated the part of the Podolia tableland, on the left part of the river Dniester, with maximum altitude 275 m.

3. THE CLIMATOLOGY OF MOLDOVA

Moldova's proximity to the Black Sea gives it a mild and sunny climate.

Moldova's climate is moderately continental: the summers are warm and long, with temperatures averaging about 20 °C (68 °F), and the winters are relatively mild and dry, with January temperatures averaging −4 °C (25 °F). Annual rainfall, which ranges from around 600 millimeters (23.6 in) in the north to 400 millimeters (15.7 in) in the south, can vary greatly; long dry periods are not unusual. The heaviest rainfall occurs in early summer and again in October; heavy showers and thunderstorms are common.

4. DESCRIPTION OF THE METEOROLOGICAL STATIONS

Currently in Moldova are located 18 meteorological stations, presented in Table 1. Geographical location is given in Figure 1. For each station indicate the name, geographical coordinates, altitude above sea level and average wind speed during the 22 years.

For all weather stations were used raw data during 1990-2011, stored in the Hydrometeorological Service archive.

Wind speeds are obtained as a result of systematic measurements every three hours, respectively, at 0^{00}, 3^{00}, 6^{00}, 9^{00}, 12^{00}, 15^{00}, 18^{00} and 21^{00}. Wind speed for each period of three hours is considered average speed determined within 10 minutes, i.e. between 0^{00}-0^{10}, 3^{00}-3^{10} etc.

The wind speed is measured by cups anemometers and wind direction-by vane. These data, stored in the archive Hydrometeorological Service, are called raw data. For Energy Projects purposes is recommended to analyze the raw data for a period of 20 years [2], in our case - 22 years.

Table 1. Moldova's Historical Wind Measurement Sites

Nr.	Name	Lat	Lon	Elev	From	To	AWS
1	Briceni	48,35213	27,10206	261	01/1990	12/2011	2.19
2	Bravicea	47,37218	28,43831	78	01/1990	12/2011	1.4
3	Balțata	47,05538	29,03615	79	01/1990	12/2011	2.45
4	Bălți	47,77462	27,95065	102	01/1990	12/2011	2.7
5	Cornești	47,36717	27,99398	232	01/1990	12/2011	2.51
6	Cahul	45,89924	28,21345	196	01/1990	12/2011	3.71
7	Comrat	46,30286	28,62947	133	01/1990	12/2011	2.52
8	Ceadîr-Lunga	46,03558	28,85220	180	01/1990	12/2011	3.98
9	Camenca	48,04352	28,69812	154	01/1990	12/2011	2.55

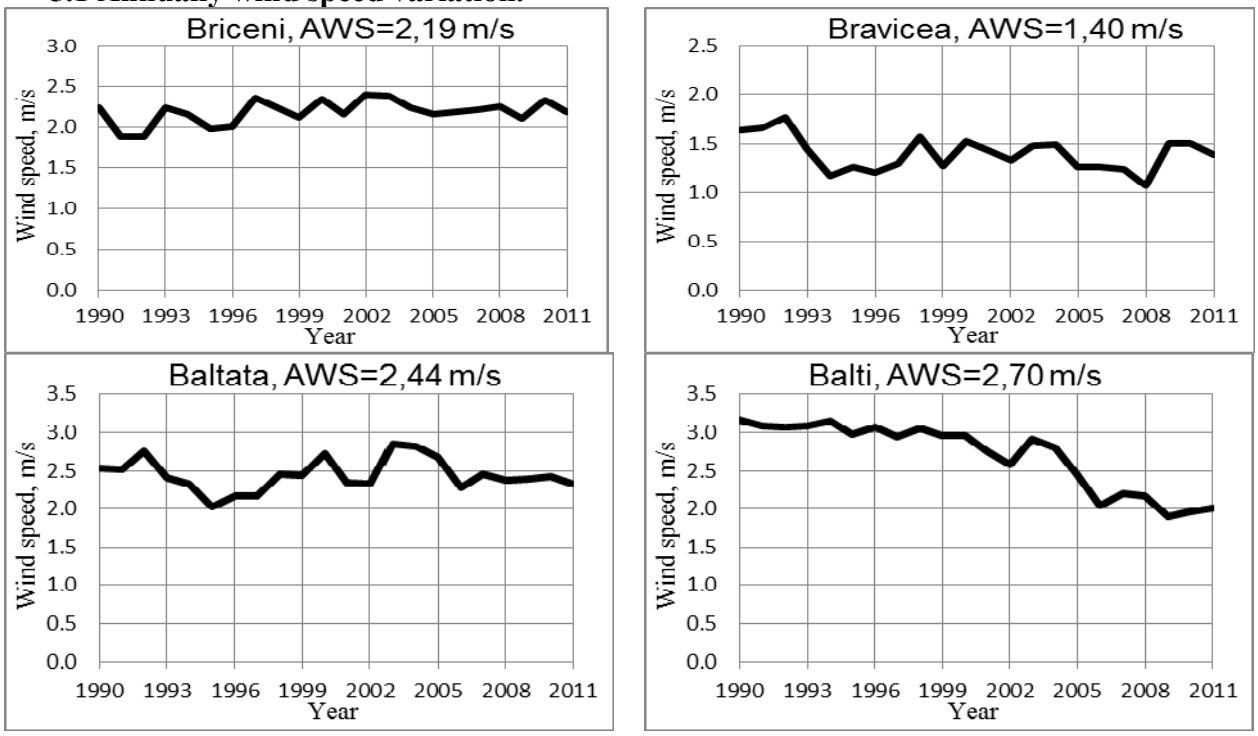
10	Chişinău	46,97169	28,84828	173	01/1990	12/2011	2.28
11	Dubăsari	47,28971	29,12363	40	01/1990	12/2011	1.94
12	Făleşti	47,58341	27,70487	162	01/1990	12/2011	2.11
13	Leova	46,48842	28,28340	156	01/1990	12/2011	2.55
14	Rîbniţa	47,77253	29,01650	119	01/1990	12/2011	2.02
15	Soroca	48,19849	28,31189	173	01/1990	12/2011	2.83
16	Ştefan-Vodă	46,52788	29,65116	173	01/1990	12/2011	2.37
17	Tiraspol	46,83431	29,61699	40	01/1990	12/2011	2.84
18	Codrii	47,1117	28,36667	157	01/1990	12/2011	1.28

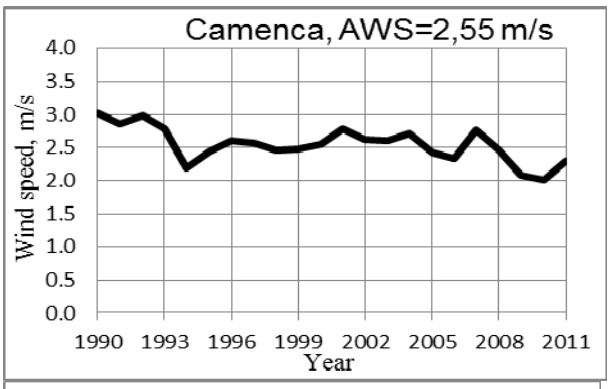
Where :
Lat is the latitude in grades, N;
Lon is the longitude in grades, E;
Elev is the elevation in meters above sea level;
From/To is the period of record in yr/mo;
AWS is the average wind speed in m/s.

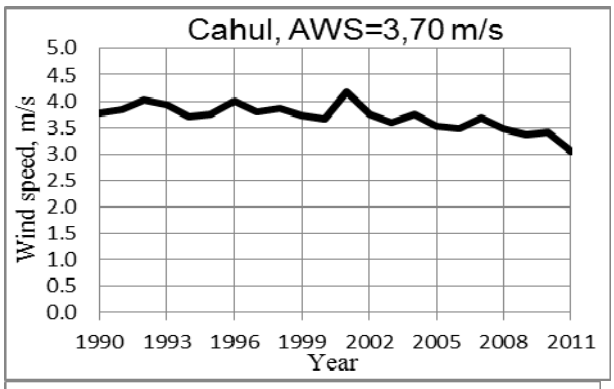
5. THE OBTAINED RESULTANTS

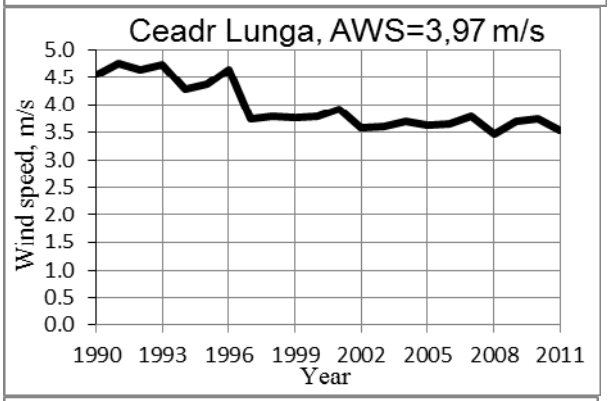
The annual wind speed variation provides confidence in the availability of wind energy in the future because it will show as the trends of wind speed. At this stage of the study raw data were processed in Excel and were obtained the graphics presented in Figure 2. In Figure 3 is presented the average wind speed of all meteorological stations.

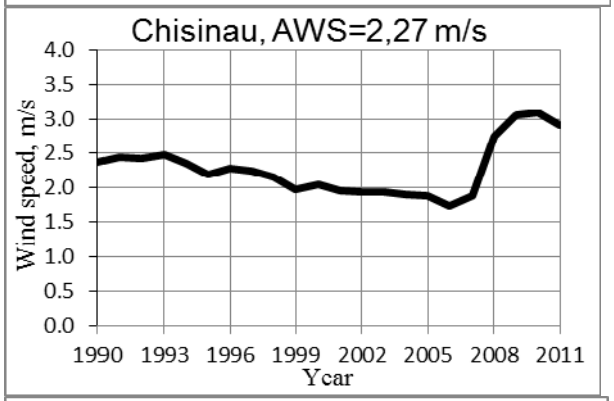
5.1 Annually wind speed variation.

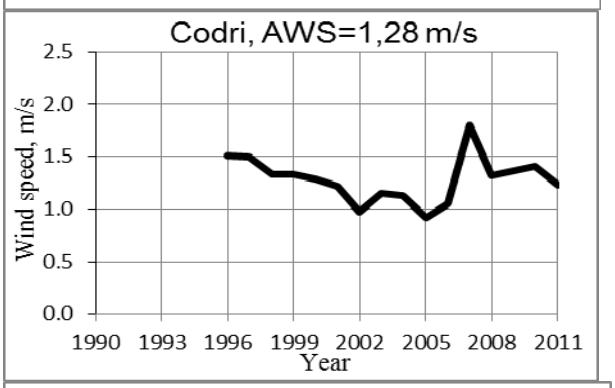


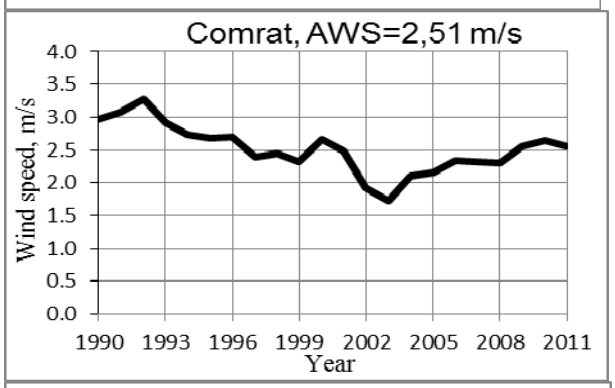

Camenca, AWS=2,55 m/s
Wind speed, m/s
Year

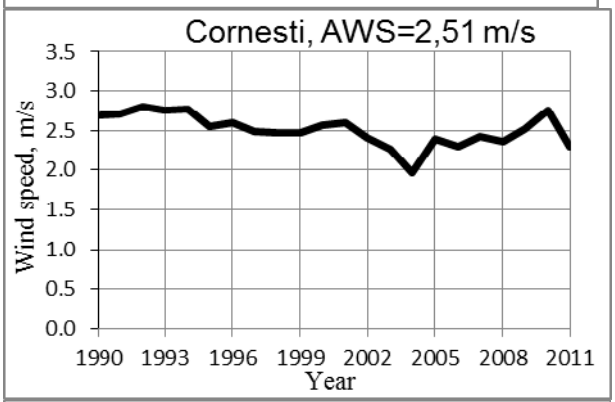

Cahul, AWS=3,70 m/s
Wind speed, m/s
Year

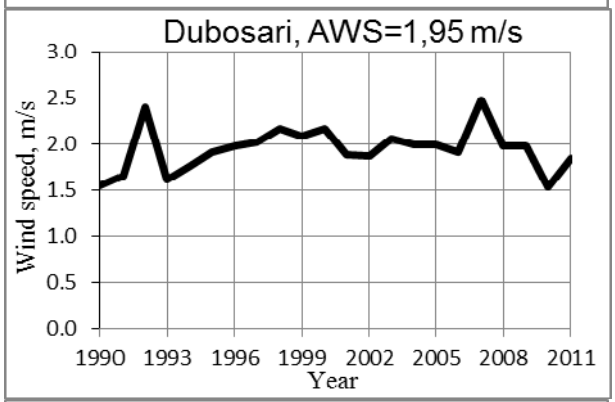

Ceadr Lunga, AWS=3,97 m/s
Wind speed, m/s
Year

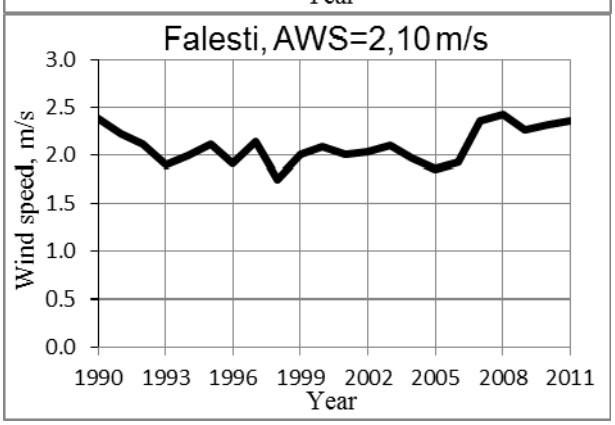

Chisinau, AWS=2,27 m/s
Wind speed, m/s
Year

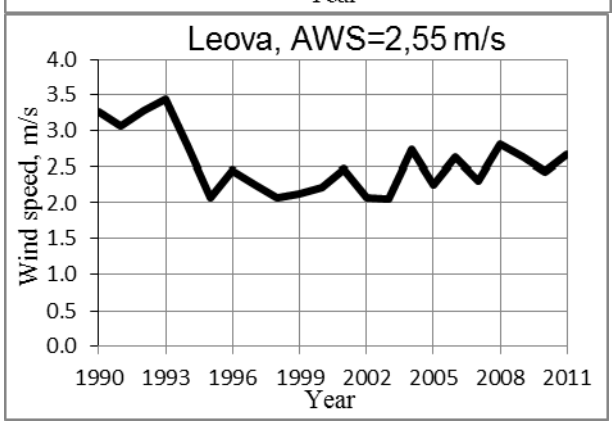

Codri, AWS=1,28 m/s
Wind speed, m/s
Year


Comrat, AWS=2,51 m/s
Wind speed, m/s
Year


Cornesti, AWS=2,51 m/s
Wind speed, m/s
Year


Dubosari, AWS=1,95 m/s
Wind speed, m/s
Year


Falesti, AWS=2,10 m/s
Wind speed, m/s
Year


Leova, AWS=2,55 m/s
Wind speed, m/s
Year

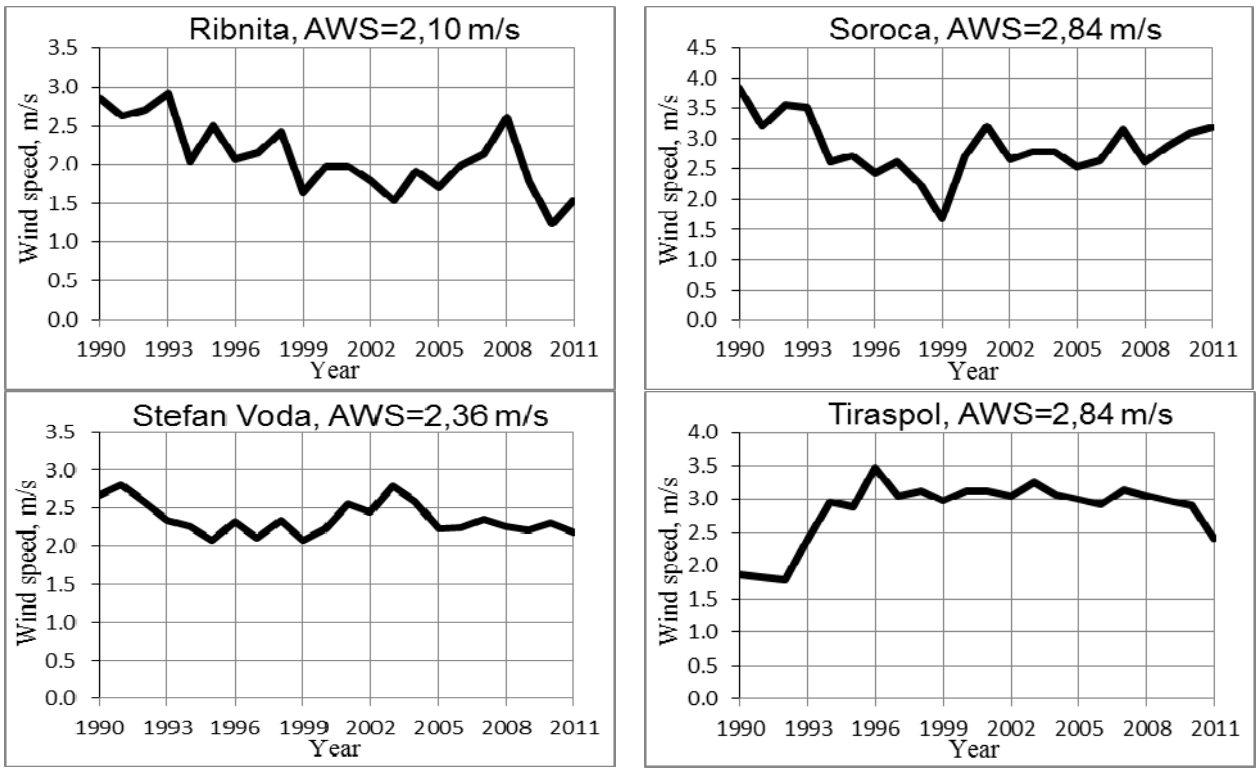


Figure 2. Annually wind speed variation

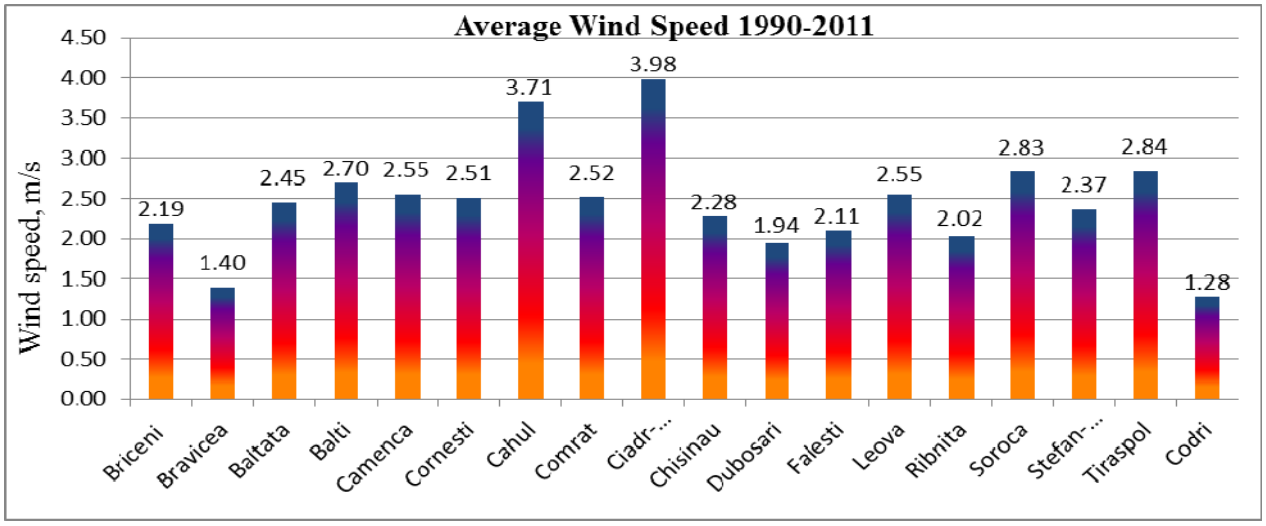


Figure 3. Annually average wind speed for all stations

From figure 2 we can easily see that practically all weather stations wind speed decreases, and this is due to the fact that in recent years around weather stations appear homes or roughness factor increase with is caused by the growth of trees and vegetation, except Tiraspol and Chisinau weather stations. The first was moved to a site with fewer obstacles in 1992 and the second - in 2008. In both cases the annual average wind speed

increased by 33 %. This phenomenon is encountered in most countries and is called "death wind" [1]. Also we can see that for all whether stations the average wind speed is between 2 and 3 m/s, which is due to the shading effect of the weather station.

5.2 Monthly average w ind speeds. Monthly variation of wind speed knowledge provides confidence in wind energy availability in different months. Figure 4 shows an example of monthly average wind speeds at a height of 10 m for a period of 22 years for five meteorological stations in south of Moldova. For all location the maximum speeds are in the cold season in February and March but the minimum speeds were recorded in summer in July and August [3].

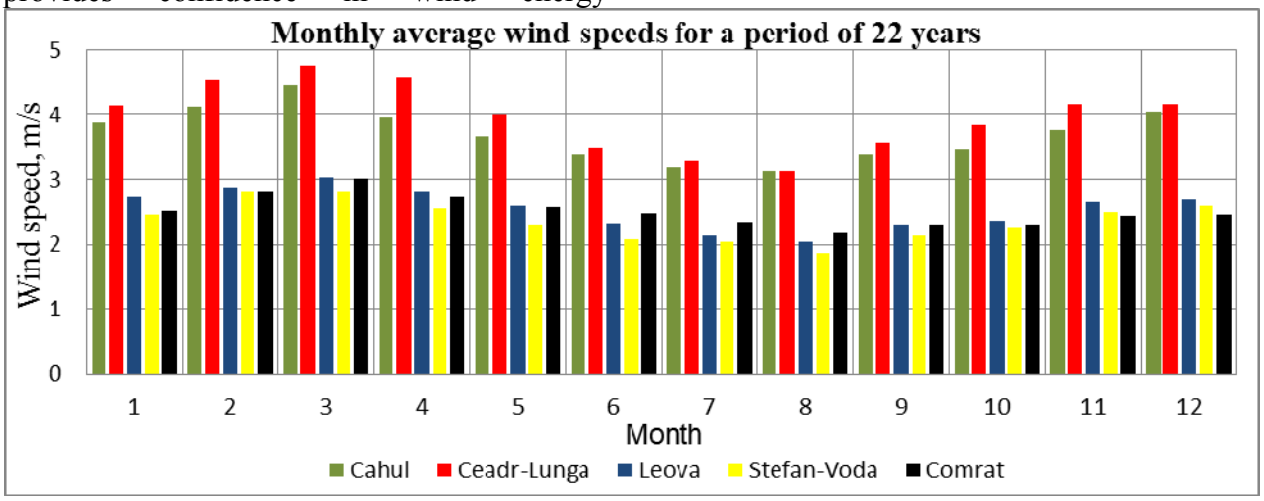


Figure 4. Monthly average wind speeds

5.3 Diurnal variation of wind speed. Wind speed is related mainly different air warming [1]. Daily and seasonal evolution can be influenced by turbulent exchanges and local orography conditions [2]. In the adjacent layer wind speed increases during the day especially since the land surface warming is more intense. Character diurnal variation, as a rule, is the one simple oscillation, with a maximum in the afternoon and a minimum night to morning. As an example, in Figure 5 is presented diurnal variation of wind speed for 4 weather stations over a period of 22 years.

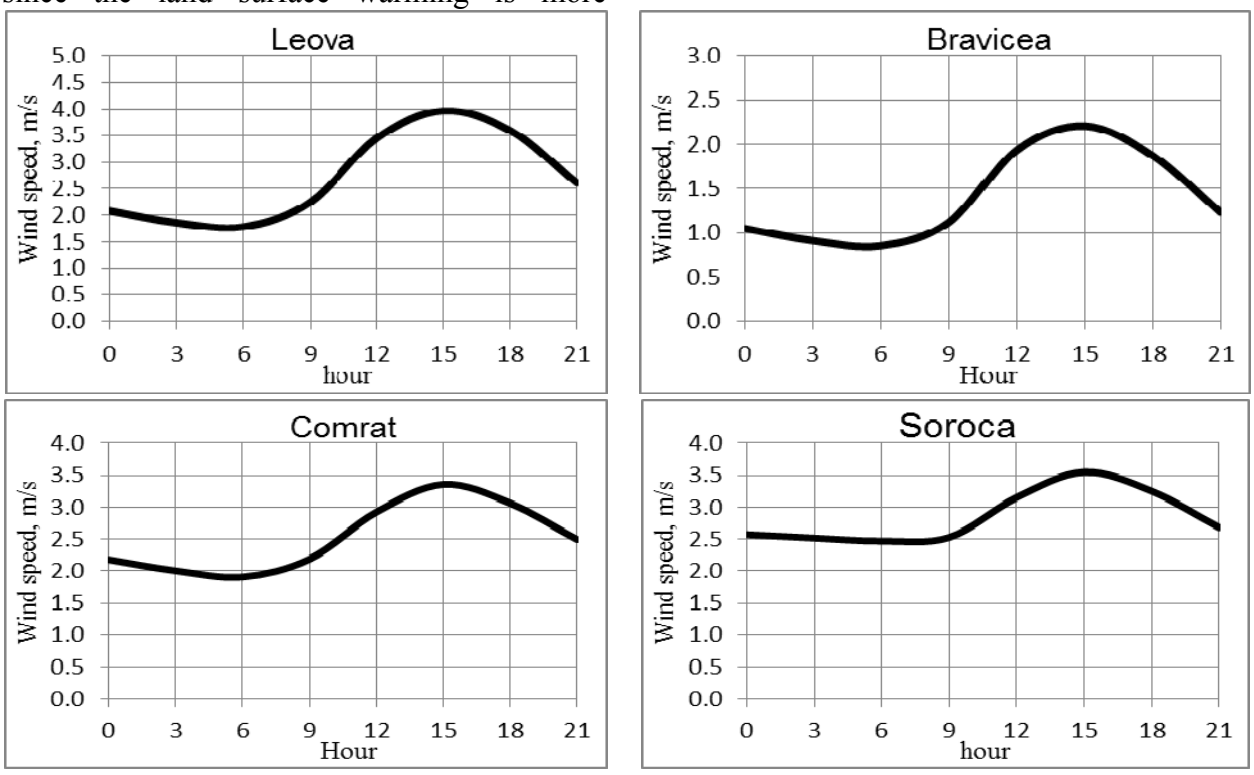


Figure 5. Diurnal variation for Leova, Bravicea, Comrat and Soroca weather stations

5.4 Weibull distrib ution and directions. Weibull distribution is often used to model wind speed, including the analytical approximation of the histograms of measured wind speed. In Figure 6 is shown the wind speed histograms, Weibull approximation and wind rose for 8 meteorological stations.

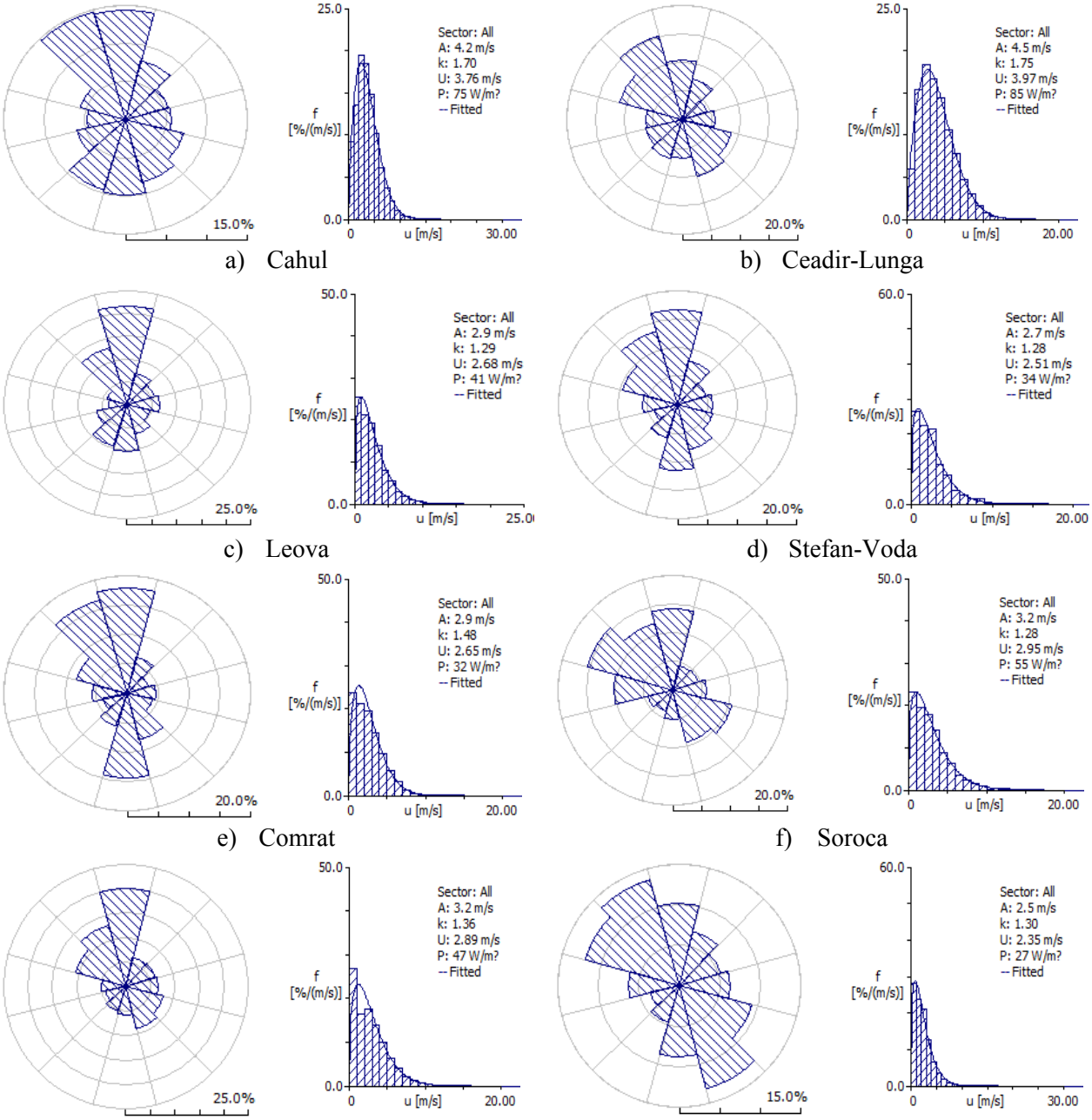


Figure 6. Wind rose and Weibull distribution

6. CONCLUSIONS

Following the analysis, the research and the processing of data from Moldova's meteorological stations were formulated the following conclusions:

1. Wind speeds are low because the height of meteorological stations, where the speeds are measured, is low and also as a result of shading phenomenon of the anemometers.

2. Practically at all weather stations (excepted Tiraspol and Chisinau) wind speed decreases and this is due to the fact that in recent years around weather stations appear obstacles or roughness factor increase with is caused by the growth of trees and vegetation. This phenomenon is encountered in most countries and is called "death of the wind".

3. For all location the maximum speeds are in the cold season in February and March but the minimum speeds were recorded in summer - in July and August.

4. Prevailing wind directions are N, NE, NW, S and SE and vary from one station to another which also tells us that it is influenced by obstacles and terrain orography.

5. The diurnal variation, have a maximum oscillation in the afternoon and a minimum in the night to morning.

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AIR SHOCK WAVE VELOCITY ANALYZE OF EXPERIMENTAL EQUIPMENT FOR NUTS HARVESTING IN SMALL FARMS

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Abstract: *The paper presents experimental modular equipment for nuts harvesting in small farms. The main operating part of the equipment consists in a special shock wave generator that realizes impulsive air shock wave able to replace high velocity wind blast. The described procedure is a non-contact method, with no damage effect of the tree trunk/ branches (well-known on tree vibration shaking system). The paper describes the mathematic modeling method calculus for the configuration and geometric dimension of the shock wave, and the results obtained for shock wave velocity during the experimental analyze.*

Keywords: *air shock wave velocity, high speed camera, nutty fruits harvesting, small farms*

1. INTRODUCTION

The nuts gradually reach maturity and the fruits fall with or no pericarp. The rain, cool nights and wind accelerates the nutty fruits falling. The harvest has to be begun in the moment when the nut is reaching full maturity and has optimal alimentary and commercial value. In Romania and in other Eastern European countries, in principle, the harvest is made manually, as the unique method available both in case of single trees or organized plantations. The harvest is realized by shaking with a long stick, method that determine up to 30% broken branches, that cause the crop decreasing for the following years. Considered as unproductive, this harvesting method is no more recommended.

Large plantations should use the mechanized harvesting method which requires special machines and very expensive devices consisting of hydraulic or mechanical shaking vibrators. Depending on the size and productivity, these kinds of specialized machines are very expensive. Such a harvesting system is efficient only for nut or hazelnut plantations of 40-60 ha [1].

To harvest middle size orchards with drop fruits (apples, pears, plums, cherries, walnuts) Mechanic Rope Shaker Device is used. This device can be easy assembly at front or rear PTO on every tractor (power starting from 15HP) with tree-point linkage category 1 (Figure 1). Compared to the conventional ladder principle, tree shaking is more than 50% faster when using the patented telescopic handle for fixing the rope onto a branch.

For middle or large size orchards a Hydraulic trunk shaker for half standard trees (Figure 2) is widely recommended. To operate this modular equipment minimum tractor power 60HP is necessary. Suspended by 2 chains, the shaker head is independent from the tractor frame; two support points of the shaker head are mounted on a parallelogram so it reaches a maximum 2,5m swerve; the tightening of the tree's trunk can be modified from 0,3m to 1,3m high. It is possible to shake trees with a

wide range of diameter, the adjustment being done by the operator, depending on orchard specifications [8].

Figure 1. Mechanic rope shaker device

Figure 2. Hydraulic trunk shaker for half standard trees

For larger orchards is recommended Hydraulic Telescopic Shaker (Figure 3). To operate this modular equipment a tractor with minimum power 60HP is necessary. Suspended by 4 chains, the shaker head is independent from the tractor' frame; the vibration masses are driven by two hydraulic engines which offers a full dynamism at the starting up. The telescopic shaker drives straight down the tree row shaking each tree as it goes, this provides more efficiency and avoids damaging the field [8, 10].

Figure 3. Hydraulic Telescopic Shaker

For each modular equipment or specialized machine described above, a harvester umbrella must be a necessary accessory (Figure 4) [8].

Figure 4. Umbrella harvester with shaker

2. EXPERIMENTAL EQUIPMENTS FORNUTTY FRUITS HARVEST BY IMPULSIVE AIR SHOCK WAVE

During harvesting with these machines, the vibrations cause severe damage of the roots of the tree, and the scratching of the tree trunk causes the premature drying of the tree. An important role in nuts harvest is held by wind action, whose intensity determines the falling of the nuts [1].

An ecological and unconventional nut harvesting method was proposed to replace wind blasts effect by *impulsive air shock wave* with adjustable intensity and direction, which are similar with the velocity and orientation of strong wind blasts.

To harvest large size nutty orchards, *Modular equipment for nuts harvest by pneumatic impulses-MEHPI* (Figure 5) was special design and made by Unconventional Equipment and Technlg. for Agricultural - Food Industry Laboratory, within the Faculty of Horticulture in Craiova. *MEHPI* is mounted on a rigid metallic support placed on the front side of a tractor U650M, that permits operator' to control and to correct the tractor's position to the trees that must be harvested [5].

The *MEHPI*'s main operational component is represented by 4 *pneumatic impulses device -PID*, whose relative direction can be modified according to tree's branches position [5].

The *MEHPI* prototype tests realized in middle and large size nutty orchards proved this experimental equipment can *replace the effect of strong winds blasts, with orientated impulsive air shock waves*.

This experimental equipment realizes nuts harvest by branches shaking *with no direct contact with the tree* [5].

Figure 5. Modular Equipment for Nuts Harvesting by Pneumatic Impulses – *MEHPI*

For small nutty farms and irregular nutty orchards, within Unconventional Technologies and Equipment for Agricultural - Food Industry Laboratory, a *Portable modular equipment for nutty fruits harvesting – PEHPI* was made. *PEHPI* consists in a metallic frame and a pneumatically shock wave generator.

The *metallic frame* is special designed to resist both statically loads during transport and positioning stages, and during harvest operation when impulsive dynamical occurred. For nutty harvest in irregular orchards, *PEHPI*'s mobility is realized due to two small wheels (Figure 6).

For middle nutty orchards, the metallic frame can be mounted on a 9-15 HP moto-cultivator, or on a small tractor structure. On the metallic frame can be mounted the pressured gas supplying device (small motor-compressor or pressured gas vessel). *Pneumatically shock wave generator - PWG* realizes impulsive air shock wave that replaces high velocity wind blast. *PWG* is composed in: pressured gas supplying device; a modular compressed gas command circuit; two special *PID*.

In figure 6 is presented *PEHPI* with an independent compressed gas source consisting in CO_2 pressured vessel, and pressure reductor that realize low pressure supplying up to 5 bar.

It must be noticed that during the equipment testing, due to CO_2 detention, the pressure redactor could freeze.

Thus, pressured CO_2 supplying device has to be utilized with special precautions.

Therefore, for *PEHPI*' safety operation, recommended pressured gas supply device are motocultivator or small tractor end shaft, and an independent 6 bar moto-compressor.

Figure 6. Portable modular equipment for nutty fruits harvesting – *PEHPI*

Modular compressed gas command circuit consists in 3/2 pneumatical valves which are able to command the *PID* in less then 20ms, thus to realize the fast discharge of the *PID*'s vessel in sonic velocity range.

MEHPI's main operational component is composed in 4 *Pneumatic Impulses Device – PID*. In principle, each *PID* (figure 7) consists in 8dm^3 mettalic vessel with a special *Fast Pneumatic Valve - FPV* due to the compressed air (initially stocked in the vessel) is discharged with sonic velocity.

The *MEHPI*'s *PIDs* operation needs 3…10bar compressed air supply source (up to 10bar tractor's compressor or supplementary motor-compressor). [5]

Figure 7. PID with metallic vessel

PEHPI's main operational component is composed in two new designed *PID*, that consists in a plastic material small capacity vessel, and a special *FPV* (Figure 8). To increase *PEHPI*'s maneuverability during harvest operations, *PEHPI* needs lighter weighting of the compressed gas vessel. There are well-known the mineral uncarbonated water bottles made in PET. An innovative idea consists to recover and to recycle any type of mineral water bottles, to be used as compressed gas storage vessel for this experimental equipment *PID*. During the tests, four vessel capacity (5, 6, 7, 10 dm^3) were pressurized to determine the maximum pressure and maximum cycles filling that can be supported.

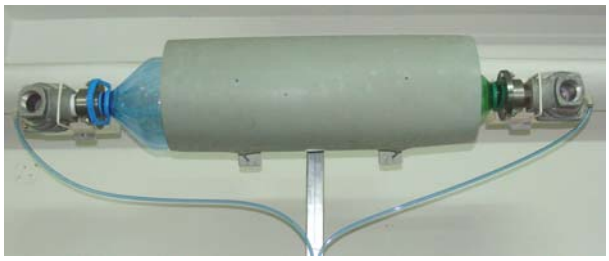


Figure 8. PID with plastic material vessel

According to the wall thickness, bottle shape and producer' PET specifications, there are types of bottles that resist up to 9bar, and more than 200 cycles with compressed air filling.

To optimize the harvest process and to avoid dangerous dynamic bending of the tree' branches, the velocity of *impulsive air shock waves* have to be precisely determined and controlled.

3. THEORETICAL CONSIDERATIONS CONCERNING SHOCK WAVE VELOCITY

Usually called air cannon / air blaster, *PID* is based on the effect of the compressed gas wave shock discharged with high velocity from a storage vessel [9,12]. During this fast process, the gas flow is characterized by high rate pressure variation; therefore there is no heat exchange with the outside environment, and the flow process can be considered adiabatic. For compressible fluids, the Bernoulli equation for adiabatic process is:

$$\frac{v^2}{2}+\frac{k}{k-1}\cdot\frac{p}{\rho}=\frac{v_0^2}{2}+\frac{k}{k-1}\cdot\frac{p_o}{\rho_o}, \qquad (1)$$

where p_o and ρ_o are the initial parameter of the gas; p and ρ are the final parameter of the gas; k is the adiabatic coefficient; v_o is the initial gas velocity (in the storage vessel v_o= 0).

In slow / static adiabatic transformations, which are isentropic (the entropy S is constant) [3, 4, 5].

The dynamic adiabatic transformations are irreversible (the entropy increase due to the internal heat stored in gas due to viscosity forces). Neglecting the viscosity force, this motion can be considered isentropic (admissible hypothesis for gas blaster discharge phenomena) [3, 4, 5].

When the compressed gas is discharged from a storing vessel (initial parameter p_o, ρ_o, T_o) through a nozzle in the atmosphere (final parameter p_{at}, ρ_{at}, T_{at}), the gas velocity is determined with relation [3, 4, 5]:

$$v=\left\{\frac{2k}{k-1}\cdot\frac{p_o}{\rho_o}\cdot\left[1-\left(\frac{p_{at}}{p_o}\right)^{\frac{k-1}{k}}\right]\right\}^{1/2} \qquad (2)$$

Because the ratio (p_{at} / p_o) < 0,5283, in the minimum cross section of the convergent nozzle/pipe the critical regime is realized, and the maximum flow that is obtained (passing

through this cross section) Q_{max} can be determined with relation [3, 4, 5]:

$$Q_{max} = 0,04042 \cdot S_p \cdot p_o / \sqrt{T_o} \qquad (3)$$

where S_p is cross section area of the convergent pipe / nozzle (in the example presented in this paper the convergent nozzle / pipe D_p = 44mm).

Considering the initial and the final parameters of the gas (p_o = 3 -10 bar; p_{at} = 1 bar; $T_o = T_{at}$ = 293°K; k = 1,4), the velocity v of the pressured air discharged from the storing vessel, and the maximum flow Q_{max} passing through the cross section S_p are given in Table 1.

Knowing that the compressed air mass in the storage vessel (C_v - vessel capacity) is $m_{vo} = C_v \cdot \rho_o$, and using the Q_{max} values given in table 1, the vessel's discharging time values t_{disc} = 0,0265 s confirm the impulsive phenomenon [3, 4, 5].

Table 1. Velocity and maximum flow of the discharged air

p_o [bar]	ρ_o [kg/m^3]	v [m/s]	Q_{max} [kg/s]
3	3,57	398,1	1,077
4	4,76	438,5	1,435
5	5,95	465,7	1,795
6	7,14	485,5	2,153
7	8,33	500,9	2,512
8	9,52	511,8	2,871
9	10,71	523,6	3,230
10	11,89	532,7	3,590

This theoretically discharging time values t_{disc} is equivalent with the FPV fast discharge characteristic [11].

The theoretical considerations concerning the gas discharge from the stocking vessel take into account the similitude with the flow process into round free jet. Qualitative and quantitative evaluation of characteristic dimensions of the round free jet permit to determine the main dimensional parameters of convergent - divergent nozzle / pipe that is able to be directioned to tree's branches: b - distance from the jet pole; x_o - length of initial zone; α - angle of jet action (Figure 9) [3, 4, 5].

The velocity in the jet's axe v_x depends on the initial velocity v_o and by the distance (for $x < x_o$, the velocity $v_x = v_o$, and for $x > x_o$ the velocity v_x depends of distance x).

The velocity in the transversal jet section v_y is the velocity at distance x and at the level y, depends by the velocity v_x and level y

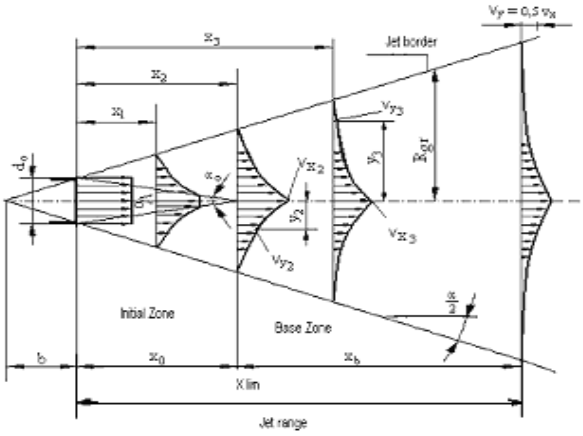


Figure 9. Circular jet geometry

$$v_y / v_o = \left[1 - \left(y / R_{gr} \right)^{3/2} \right]^2, \qquad (4)$$

where R_{gr} is the jet's radius limit for $x > x_o$ [3].

Due to the symmetric axial jet law, the impulse has the same value in any section. Using the notation v_y the velocity in a certain point, I the impulse, and m_o the masse passing through an elementary surface of the jet's section in the unit of time, it obtained [3, 4, 5]:

$$I = 2\pi \int_o^{R_{gr}} \rho \cdot v_y^2 \cdot y dy = \pi \rho_o \cdot v_o^2 \cdot R_o^2, \qquad (5)$$

where the jet's radius limit R_{gr} is obtained with the relation [3, 4, 5]:

$$R_{gr} = 3,3 \; R_o \left(v_o / v_x \right), \qquad (6)$$

where R_o is the jet's source radius ($R_o = d_o/2$).

The medium velocity of jet v_m is determined knowing that the medium flowing

velocity in a section A is obtaining from the continuity equation [3, 4, 5]:

$$v_m = Q / A = Q /(\pi R_{gr}^2) . \quad (7)$$

Because in the initial section the velocity value is obtained with rel. $v_o = Q / A = Q /(\pi R_o^2)$, using relation (7) we can obtain

$$v_m / v_o = 0,2 \cdot (v_x / v_o) \quad (8)$$

Using these relations (that take into consideration no gas viscosity effect and no shock wave effect), for initial compressed air pressure p_o = 3 ÷ 10 bar in the storage vessel, were obtained theoretical results for: medium speed in the jet transversal section v_m = 16,6 ÷ 55,5 m/s (equivalent velocity 60 ÷ 200 km/h); jets range x_{lim} = 0,7 ÷ 2m; enlarging jet border angle $\alpha = 53^o \div 67^o$. [3, 5]

4. EXPERIMENTAL CONSIDERATIONS CONCERNING SHOCK WAVE VELOCITY

In order to determine the shock wave velocity a first method that take into consideration the dynamic pressure produced by the *PID* was designed. In principle, the experimental device, consists in a conical nozzle (h = 250mm; $Ø_{max}$ / $Ø_{min}$ = 300/50mm).

The size and the dimension of the conical nozzle were designed according to the values determined with the presented theoretical method (jet range x_{lim}, conical jet border angle α, jet diameter D_{gr} for jet range).

The large base of the conical nozzle is closed with a rigid metallic round flange that permits three Vishay pressure transducers connection.

The pressure transducers are connected with an amplifier device to a data acquisition system. [6]

The small base of the conical nozzle is in direct connection with the *FPV*'s circular nozzle.

The *FPV*'s discharging time (the period between the initial trigger's time of *FPV*, and the moment when the discharged pressure is maximum) was measured [7, 9].

In figure 10 and Figure 11 is presented the dynamic pressure evolutions and the discharging time (shock wave duration) obtained for an initial pressure p_o = 4 bar, and . p_o = 5 bar, respectively.

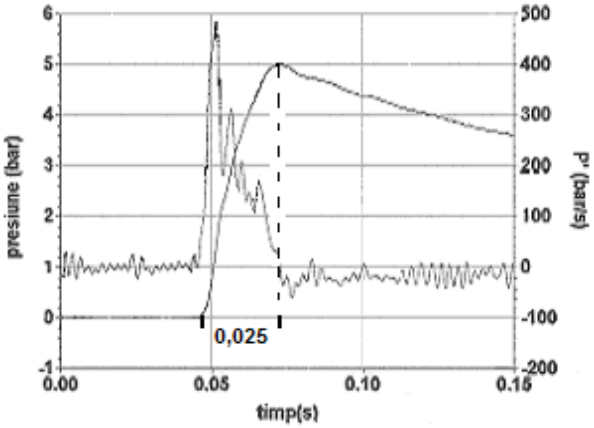


Figure 10. Discharging time for an initial pressure p_o = 4 bar

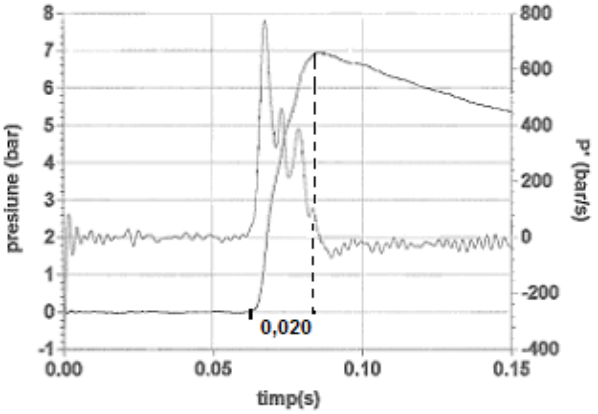


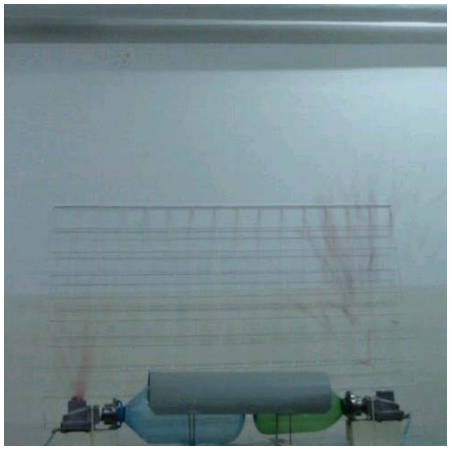
Figure 11. Discharging time for an initial pressure p_o = 5 bar

Table 2. Discharging time, shock wave velocity and equivalent wind velocity

p_o [bar]	t_{dish} [s]	v_{sw} [m/s]	$v_{eq\text{-}w}$ [km/h]
3	0,027	8,82	31
4	0,026	9,26	33
5	0,025	10	36
6	0,022	11,1	40
7	0,020	12,5	45
8	0,017	14,7	53
9	0,013	19,4	70
10	0,010	25	90

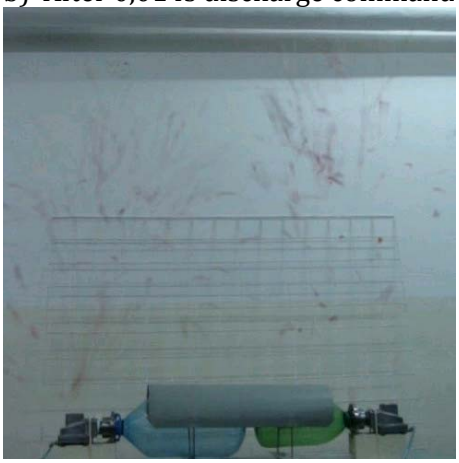
The second method proposed to determine the shock wave velocity using high speed camera Fastec Imaging type [8].

To determine the shock wave velocity (initial pressure p_o = 3…10 bar), paper pieces contrast colored were introduced into *FPV*'s convergent nozzle (Figure 12). A white panel with 0,1×0,1m horizontal and vertical grids was used.



a) After 0,009s discharge command

b) After 0,014s discharge command



c) After 0,017s discharge command

Figure 12. Shock wave velocity evolution by using high speed camera

According the shock wave velocity value', the image capturing sequence was set for 250 frames per second, and 320x240 sensor resolution. The high speed camera MiDAS 4.0 Express Control Software start was simultan triggered with *FPV* [7].

The values for shock wave velocity obtained by using high speed camera are 5…10% smaller then those obtained in the previous presented method.

In the previous method, the conical nozzle concentrates the shock wave to the large base, into a high velocity laminar flow.

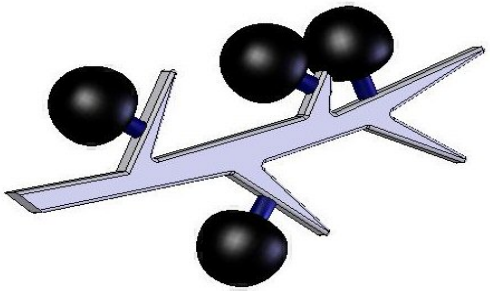
In high speed camera method, in the front and at the border of the shock wave, due to viscosity force, the turbulent flow determines the decrease of shock wave velocity.

A theoretical method that considers the viscosity effect and the shock wave effect is very difficult to approach.

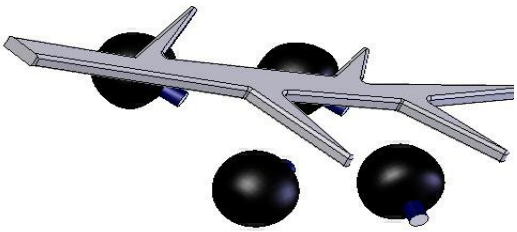
To optimize the nutty fruit harvest using pneumatically impulses, FEM simulation it was used. For FEM simulation it was necessary to determine the compressed air's shock wave velocity that takes into consideration all the simultaneous effects. FEM simulation of the shock wave influence to the tree branches, produced by one *PID,* had considered initial pressure p_o = 3 – 5bar [2, 4].

The *PID* were positioned at 0,7 - 1,2m to the tree branches, the jet range x_{lim} = 1,1 - 2,3m and jet diameter $D_{g\,r}$=1,4 - 2,4m.

In figure 13 is presented FEM simulation of 5bar shock wave effect after 0,1s (a), and 0,4s (b), respectively, toward 4 nut type fruits placed on an elastic branch; the distance between the *PID* position and tree branch was x_{lim} = 1,3m and the shock wave diameter was D_{gr} = 2m.



a) Shock wave effect after 0,1s actuation



b) Shock wave effect after 0,4s actuation

Figure 13. FEM simulation shock wave effect obtained with 5bar initial pressure

5. CONCLUSION

Air shock wave velocity obtained by using experimental equipment for nuts harvesting can be determined both with theoretical method, and experimental methods, too. Due to air fast discharge, there are many variable parameter could determine just aproximative velocity values. Due to their high accuracy, Vishay pressure and velocity traducers offer the precise values, only in the shock wave center, with no indicative values for the conical angle and dimensions of the shock wave border. High speed camera method accuracy is comparable with results obtained by using Vishay traducers, and in the same time permit to determine all the shock wave parameter to optimize the nuts harvesting experimental equipment.

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SOME CONSIDERATIONS REGARDING THE DIAGNOSIS OF THE THREE-PHASE SQUIRREL-CAGE INDUCTION MOTOR COMPONENTS

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Abstract: *The main mechanical problem of the electric motors is given by the vibrations developed during the work. Their level and frequencies can leads to faults of different electrical motors parts especially when frequencies value reach the natural frequencies. This is the reason why, natural frequencies determination is very important. This determination can be done by two different ways: based on finite element method (FEM) and experimental modal analysis. In the present paper it is presented a study of the modal analysis of a three-phase squirrel cage induction of 1.5 kW for three parts. There are presented some results obtained from the analytic method of FE comparing with experimental tests.*

Keywords: *modal analysis, finite element method, vibrations*

1. INTRODUCTION

Mechanical vibrations, as behaviour of a mechanical system, are generated by the continuous transformation of kinetic and potential energies of different moving components, or by different external excitation sources.

A reduced level of vibrations means, in the same time, a safety work, reduced level of noise and optimum working regime.

Due these considerations, both vibrations control and decreasing vibration level are essential elements for performance maintaining.

Theoretical dynamic analysis of the mechanical systems is based on mathematical models. The complexity of such models depends on the data and characteristics needed to define the main four parameters: components inertia (mass), systems structure (damping and stiffness), vibration sources, and boundary conditions.

In the case of any electric motor and particular for three-phase squirrel-cage induction motor one of the important problem in their working regime is the detailed knowledge of the natural vibrations (natural frequencies) of different components.

Extracting accurate natural frequency by analytical and experimental methods offer an image of the future possible complex faults that are developed during mode operations.

2. NATURAL FREQUENCIES DETERMINATION

2.1 Bearing frequencies. A long time good operation involves a continuous process

of monitoring and diagnosis of electrical motors.

Researches on diagnosis, prediction and identification of the faults were done being high light the main fault sources [3, 6, 7].

One of the main mechanical sources of failure is represented by the bearings. Generally, the main problems connected with the bearings refer to: inner ring rotation, bearing balls rotation yield to the inner or outer rings considered fixed.

In the literature there are presented some relationships used to find the frequencies tied with the bearings [4, 5, 8, 9]:

- for inner ring:

$$f_{in} = \frac{n}{60}\,[Hz] \tag{1}$$

- for ball holder yield to the outer fixed ring

$$f_{ofr} = \frac{n}{120}\left(1 - \frac{D_w \cos\alpha}{d_m}\right) \tag{2}$$

- for ball holder yield to the inner rotating ring

$$f_{ifr} = \frac{n}{120}\left(1 + \frac{D_w \cos\alpha}{d_m}\right) \tag{3}$$

- for ball holder yield to the outer fixed ring

$$f_{bof} = \frac{n\,d_m}{120\,D_w}\left[1 - \left(\frac{D_w \cos\alpha}{d_m}\right)^2\right] \tag{4}$$

- fault frequency on the ball race

$$f_t = \frac{\pi\,d_m\,n}{2\,b}\left[1 - \left(\frac{D_w \cos\alpha}{d_m}\right)^2\right] \tag{5}$$

where, n is the shaft angular speed given in rot/min, D_w is the ball diamenter [mm], d_m is the medium bearing diameter, α is the contact angle, and b is the fault length on the ball race, in [mm].

Based on these relationships one can identify, in the recorded vibration diagram, the frequencies associated with the main components of the bearings.

2.2 Parts frequencies. The natural frequencies of different parts of the electric motor can be found using both analytical methods, as finite element method (FEM), or by modal experiments [1, 2].

The finite element model is based on the assumption that the electric motor consists in several main parts that are connected by different elements and boundary conditions. The authors considered a three-phase squirrel-cage induction motor of 1.1 kW power and 1500 rpm, manufactured by the company Electroprecizia from Sacele, Romania.

The assembly of the electric motor was considered to be done of seven main solid parts: the frame, the stator, the rotor, the fore and back cases, and the two bearings. For each part was done both analytic and experimental determination of the natural frequencies.

The analytic determination was done using the ABAQUS FEM soft and for experimental tests it was used the Brüel&Kjær PULSE platform.

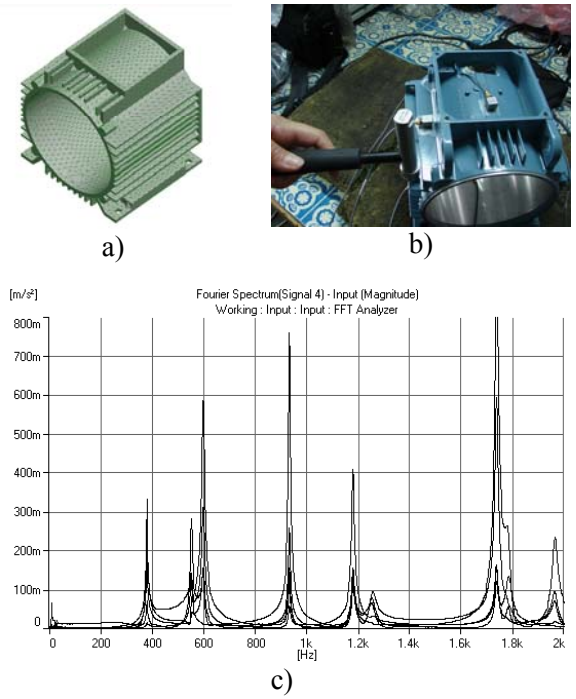


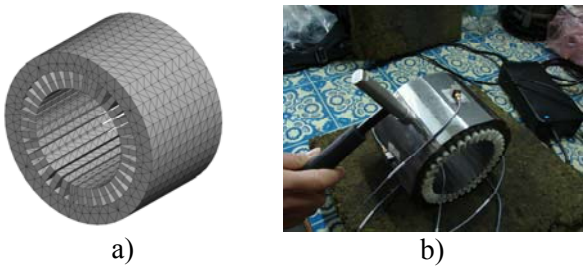
Figure 1 Electric motor frame: a) finite element model; b) modal testing; c) modal response for all five accelerometers.

The equipment used consists of an impact hammer (Brüel&Kjær type 8206-003), five accelerometers (Brüel&Kjær type 4507B), data acquisition platform PULSE 12 (Brüel&Kjær) and dedicated soft for signal processing in time and frequency domains. For the beginning it was analyzed the frame (Figure 1). A particularity of the frame

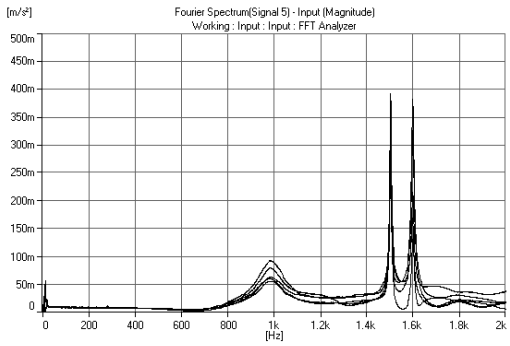
consists in its geometry (holes, cooling ribs, different geometrical shapes, etc.).

The complexity imposed to be chosen for the FEM a free mesh with tetrahedron elements (8327 nodes and 27605 elements).

The modal test was done according with the prescriptions presented in the literature [2].



a) b)



c)

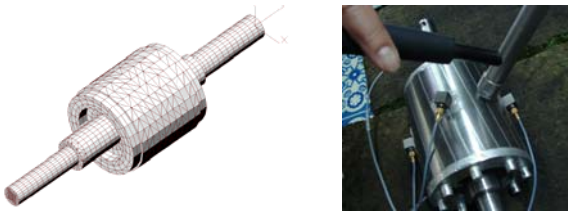
Figure 2 Electric motor stator: a) finite element model; b) modal testing; c) modal response for all five accelerometers.

In case of analytical determination, there were found as main natural freqencies: f_{em1} = 37.661 Hz, f_{em2} = 74.661 Hz, f_{em3} = 134.40 Hz, f_{em4} = 323.64 Hz. Based on experiments there were obtained the following main natural frequencies: f_2 =7.5 Hz, f_{e2} = 378 Hz, f_{e3} = 547.5 Hz, f_{e4} = 596 Hz, f_{e5} = 931.5 Hz, f_{e6} = 1179 Hz, f_{e7} = 1734 Hz.

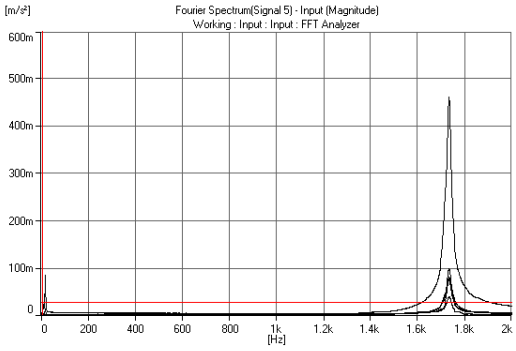
The next analysed part was the stator (Figure 2). The complexity imposed to be chosen for the FEM a free mesh with tetrahedron elements (4964 nodes and 9794 elements).

Based on finite element method there were found the following natural frequencies of the stator: f_{em1} =121 Hz, f_{em2} =168.26 Hz, f_{em3} = 226.78 Hz, f_{em4} = 278.84 Hz, f_{em5} = 344.18 Hz, f_{em6} = 377.79 Hz, f_{em7} = 401.207 Hz, f_{em8} = 534.82 Hz, and f_{em9} = 542.29 Hz. The experimental modal analysis shows four natural frequencies in the range 0 ÷ 2 kHz: f_2 = 10 Hz, f_{e2} = 986.5 Hz, f_{e3} = 1500 Hz, f_{e4} =1597 Hz.

Another important part analysed was the rotor (Figure 3).



a) b)



c)

Figure 3 Electric motor rotor: a) finite element model; b) modal testing; c) modal response for all five accelerometers.

The model of finite elements consists of 6471 nodes and 15792 elements. Using finite method there were found as natural frequencies: f_{em1} = 20.58 Hz, f_{em2} = 99.746 Hz, f_{em3} = 124.53 Hz, f_{em4} = 138.84 Hz, f_{em5} = 195.84 Hz, and f_{em6} = 208.94 Hz. Experimental modal analysis shows as main natural frequencies f_2 = 10 Hz, and f_{e2} = 1732 Hz.

3. CONCLUSIONS

The diagnoses of electrical motor faults involve the knowledge of both natural and the loads frequencies.

In this paper, a modal finite element analysis and a modal test were presented subjected some parts of an electric motor.

The structural complexity of the parts imposes the use of finite element method as general numerical method for natural frequencies determination.

The finite element model is a pure mathematical model subjected to some assumptions as the material characteristics considered the average values that are given by the soft material library. Another assumption is tied with the boundary conditions that some times are not equivalent between finite element model and real modal testing.

The finite element method induces errors but based on it one can find a global behaviour of the modal phenomenon.

The values that were found by both methods are appreciatively the same. The differences are generated by the values that are considered for the material constants: Young's modulus and density). Both values are direct influence in stiffness and in mass. The future work will be concentrated on making an equivalence between the real model and the finite element model.

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MESUREMENTS OF ELECTRICAL AND MAGNETIC FIELDS ON BOARD CONTAINER SHIPS

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Abstract: *In this paper we present measurements made on a container ship on radiation levels posed to crew members working on different decks of the ship, with charts showing that electromagnetic radiation exist and therefore merchant navy crews are exposed to radiation produced by the electric field. After the measurements on different decks of the ship, analyzing the observed values, we drew conclusions which are going to be presented and analyzed in accordance with national and international regulations requiring certain permissible radiation limits levels, so within the national and international legal framework to which Romania is part through the Ministry of Transportation as a member of the European Community and as a member of NATO [1,2,3,4,5,6]. This paper aims the necessity of further research in order to obtain means to protect the crew of a ship, against these radiations due to modern equipment used.*

Keywords: *screen material, radio-absorbent, mitigation, electric field intensity, exposure rate, frequency band.*

1. INTRODUCTION

Electromagnetic waves or electromagnetic radiation are generally natural physical phenomena, which consist of an electric field and a magnetic field in the same space, which generates eachother as they propagate. Electromagnetic fields: is all electric and magnetic fields that oscillate and generate eachother. Electromagnetic waves are an electromagnetic field which propagates [7].

Electromagnetic waves were predicted theoretically by "Maxwell's equations" and then discovered experimentally by Heinrich Hertz. Variation of an electric field produces a changing magnetic field, which at the same time it transfers energy. In turn, the changing magnetic field generates an electric field that takes this energy. In this way energy is transformed and constantly alternating from one form to another and repeat the process leading to the spread of this couple of fields.

With the existence of electromagnetic radiation also face merchant navy crews. Radiation sources are antennas of the transceiver stations, existing onboard, the GMDSS console that provides ship-to-ship communications as well as the ship-to-shore communications made both by direct wave or/and by satellite [8,9,10,11].

To achieve the measurements of electromagnetic field on the vessel, corresponding to this phase, we selected a merchant container vessel and chose 3 points (locations) with enhanced concentration of the radiation i.e.: -E deck; -outside the bridge; -inside the bridge. At each location we performed basic measurements and measurements with different broadcasting stations in various ranges of frequency (AM-amplitude modulation and FM-frequency modulation) based on sensors currently available.

Measurement configuration is shown in the figure below:

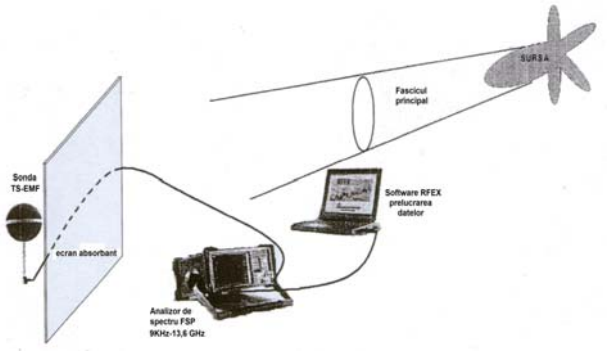

Fig.1. Configuration for measuring electromagnetic radiation

2. DATA FROM MEASUREMENTS. REPRESENTATION TABULAR AND GRAPHICAL

Measurements on the ship led to obtain data on:
-intensity of the electric field E [V / m] for different frequency ranges;
-the level of the electric field [dBμV / m];
-the rate of exposure;
-limit of the field intensity, L [V / m];
-the measurement-error, RE * 1000 [‰];
-the flux-density of electromagnetic power, PD [μW/cm2];
-total field strength (RMS) [V / m].
-the maximum singular-value [V / m].

For each set of measurements values were indicated and also the initial fund value of electric field strength.

For magnetic field data are proportionally smaller than Z_0 times in free space, where Z_0 is the wave impedance in vacuum.

2.1 *Background measurements on ship deck*

The outside of bridge *Deck*

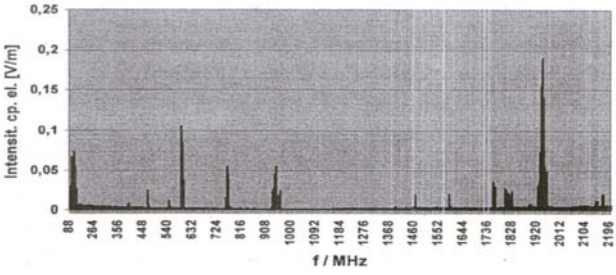

Fig.2. Environmental noise measurement on the outside of bridge

Tab.1. The main values measured

Frequency [MHz]	Electric field intensity E[V/m]	Electric field level [dB μV/m]	Power density [μ W/m^2]	Power density [μ W/cm^2]
97,0000	0,2480	107,8891	163,1420	0,063
99,0000	0,1511	103,5879	60,5965	0,0061
104,0000	0,3808	111,6140	384,6399	0,0385
106,0000	0,1863	105,4039	92,0546	0,0092
1925,0000	0,1837	105,2831	89,5293	0,0090
1932,0000	0,1415	103,0121	53,0722	0,0053
1934,0000	0,1575	103,9454	65,7958	0,0066
1936,0000	0,2167	106,7155	124,5126	0,0125
1939,0000	0,2197	106,8384	128,0839	0,0128
1942,0000	0,1454	103,2501	56,0621	0,0056
Total rate of exposure			3390,6864	0,3391
Total electric field intensity (RMS)	1,130614			
Maximum measured value	0,3808			

The inside of bridge *Deck*

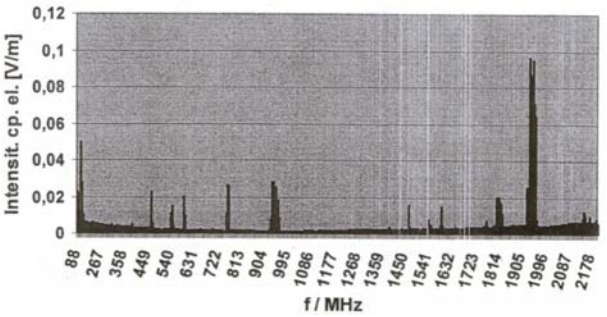

Fig.3. Environmental noise measurement on the bridge (inside)

Tabelul 2. The main values measured

Frequency [MHz]	Electric field intensity E[V/m]	Electric field level [dB μV/m]	Power density [μ W/m^2]	Power density [μ W/cm^2]
104,0000	0,0496	93,9117	6,5287	0,0007
1935,0000	0.0670	96,5181	11,8978	0,0012
1937,0000	0,0803	98,0922	17,0952	0,0017
1939.0000	0.0868	98.7707	19,9860	0,0020
1940,0000	0,0662	96,4141	11,6164	0,0012
1943,0000	0.0594	95,4716	9,3501	0,0009
1946,0000	0,0593	95,4608	9,3270	0,0009
1948,0000	0,0749	97.4845	14,8629	0,0015
1950,0000	0,0687	96,7406	12,5232	0,0013
1955,0000	0,0713	97.0581	13,4730	0,0013
1959,0000	0.0438	92,8296	5,0888	0,0005
Total rate of exposure			412,4174	0,0412
Total electric field intensity (RMS)	0,394311			
Maximum measured value	0,0966			

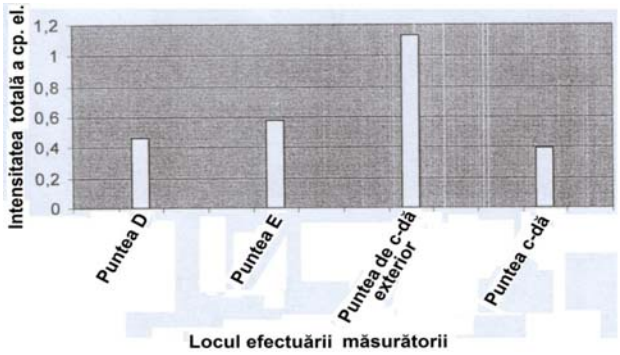

Fig.4. Representation of total intensity level of the electric field of the fund measurements at the different measuring points

In further study, we performed measurements on the same points but using a screen absorbent material made from wire mesh, with the purpose of mitigating the disruptive effects of electromagnetic radiation emitted by the equipment on board.

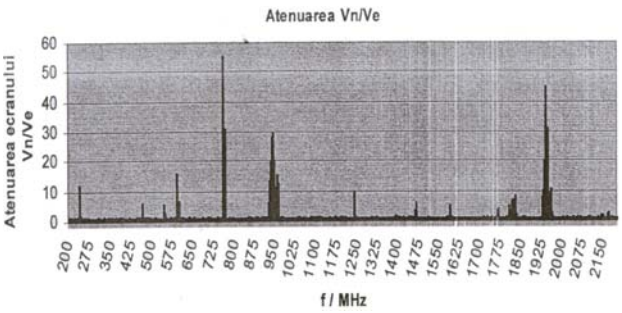

Fig. 5. Representation of attenuation due to a screen made of radioabsorbant material

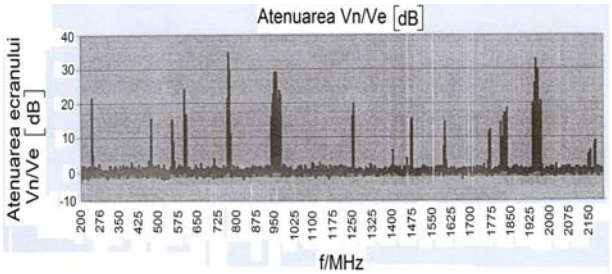

Fig. 6. Representation of attenuation due to a screen made of radioabsorbant material

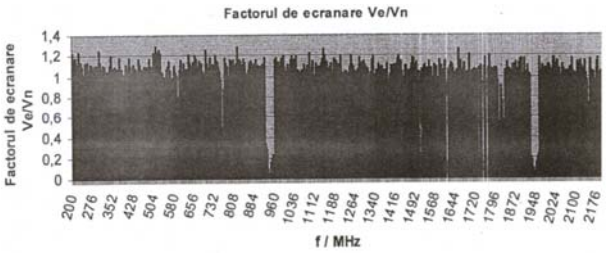

Fig. 7. Representation of shielding factor due to a screen made of radioabsorbant material

From Fig.6 it is observed that the attenuation values were obtained as above unit and subunit values (negative) of the shielding factor. Also, there is a large dispersion of these quantities in the frequency band in which measurements were made.

For detailing, figures are drawn above, for the 100 significant amounts of electric field intensity, attenuation and shielding factor measured in the absence and in the presence of the screen.

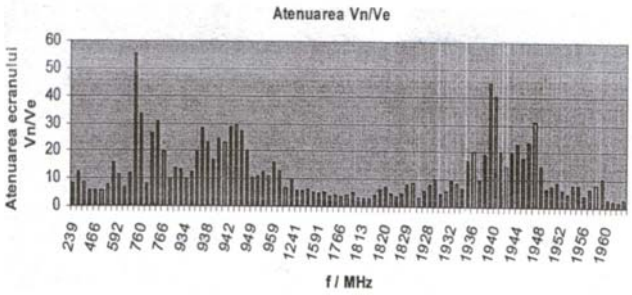

Fig.8. Representation of attenuation done by screen of radio-absorbent material for the first 100 values of electric field strength.

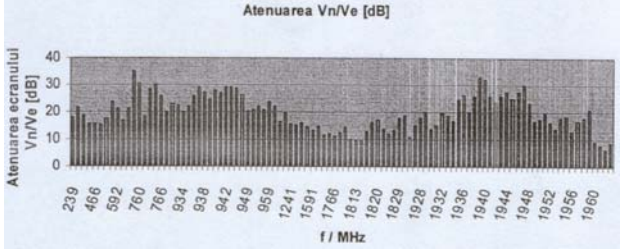

Fig.9. Representation of attenuation done by screen of radio-absorbent material, in dB, for the first 100 values of electric field strength.

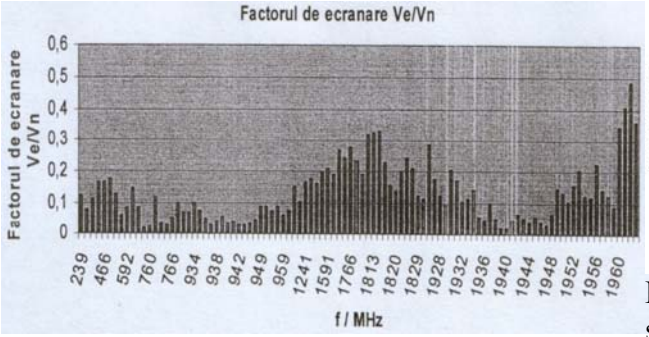

Fig.10. Representation of shield factor done by screen of radio-absorbent material for the first 100 values of electric field strength.

By analyzing graphs above it is apparent that the attenuation done by screen is not constant in the frequency band analyzed. The truth is that the screen attenuation and attenuation factor are sizes that can efficiently characterize the performance of screen when measurements are made under laboratory conditions, i.e. when the intensity radiated of the electromagnetic field (in this case the electric field component) remains constant in the entire frequency band.

For a more effective screen performance measurement in real conditions, I propose to introduce a new value quantity called attenuation / relative difference compared to the incident field, Df, defined by the relation:

$$Df = \frac{Vn - Ve}{Vn} \cdot 100 \qquad (1)$$

Obviously, when the attenuation / relative difference approaches 100%, the screening is better.

From the analysis it is observed that the relative attenuation values remains at over 80%, tending to over 95% for most measurements of the band, which highlights the special qualities of the material used for shielding.

E Deck

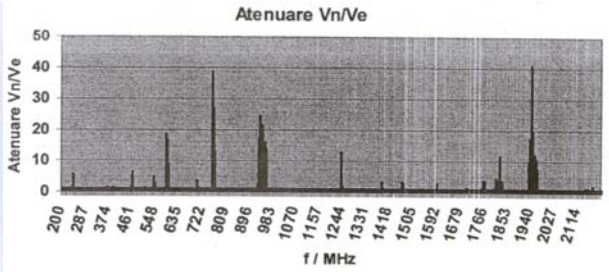

Fig.11. Representation of attenuation due to a screen made of radioabsorbant material on E Deck

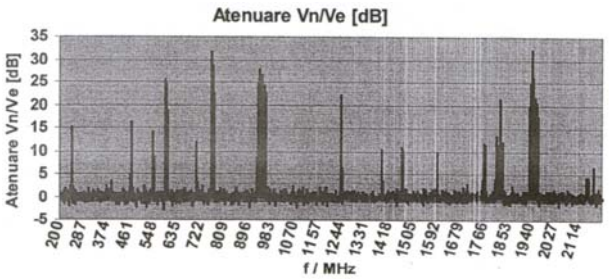

Fig.12. Representation of attenuation due to a screen made of radioabsorbant material on E Deck

Outside Bridge deck

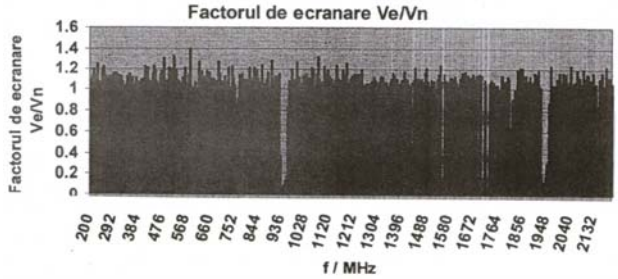

Fig.13. Representation of attenuation due to a screen made of radioabsorbant material on outside of Bridge Deck

Inside Bridge deck

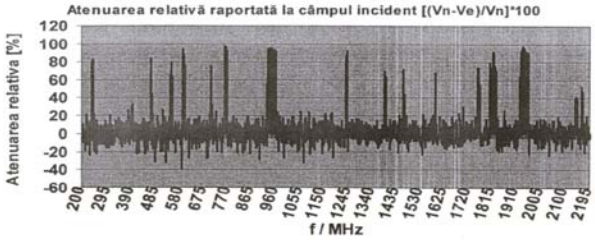

Fig.14. Representation of relative attenuation due to a screen made of radioabsorbant material on inside of Bridge Deck

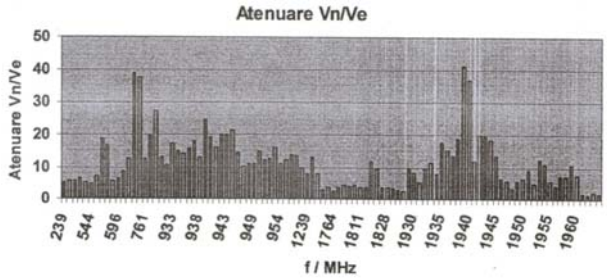

Fig.15. Representation of attenuation done by screen of radio-absorbent material, in dB, for the first 100 values of electric field strength on E Deck

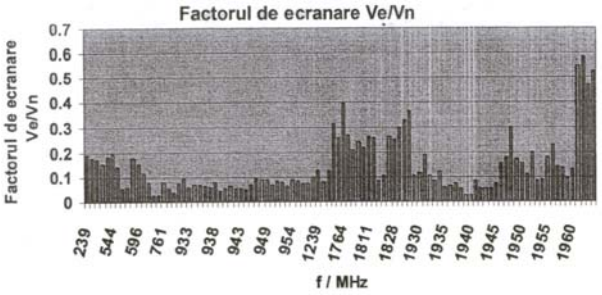

Fig.16. Representation of shield factor done by screen of radio-absorbent material for the first 100 values of electric field strength on inside Bridge Deck

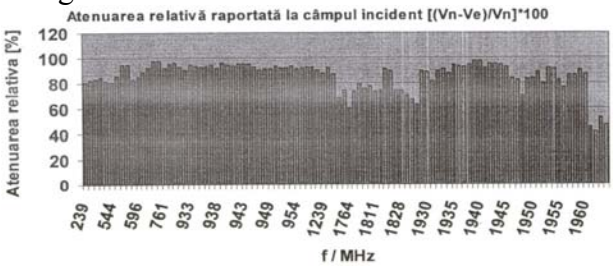

Fig.17. Representation of relative attenuation done by screen of radio-absorbent material, in dB, for the first 100 values of electric field strength on outside Bridge Deck

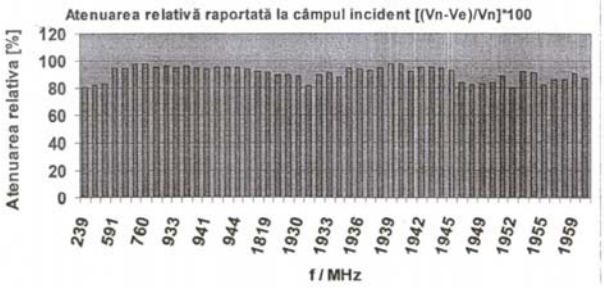

Fig.18. Representation of relative attenuation done by screen of radio-absorbent material, in dB, for the first 100 values of electric field strength on Boath Deck

Inside Bridge Deck, 240 MHz AM, 100W

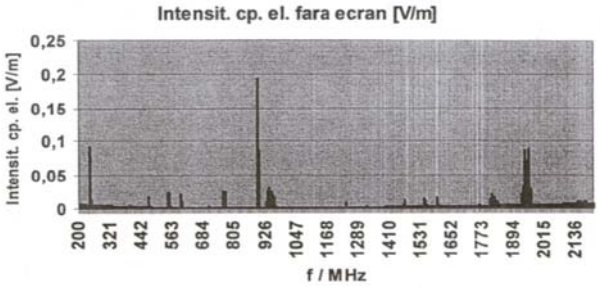

Fig.19. Representation of intensity level of the electric field in the presence of HF maritime station emission, on the frequency of 240 MHz, AM-100W, on Brige Deck without shielding.

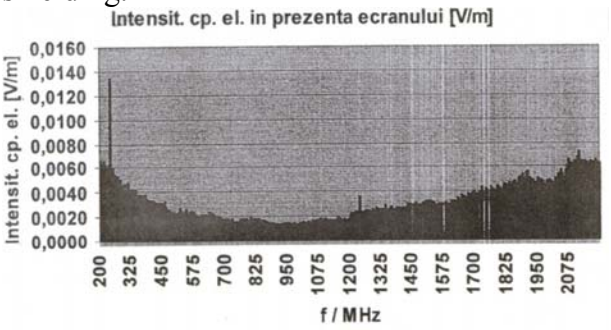

Fig.20. Representation of intensity level of the electric field in the presence of HF maritime station emission, on the frequency of 240 MHz, AM-100W, on Brige Deck with shielded probe.

The measured values show that electromagnetic field lines pass through the screen.

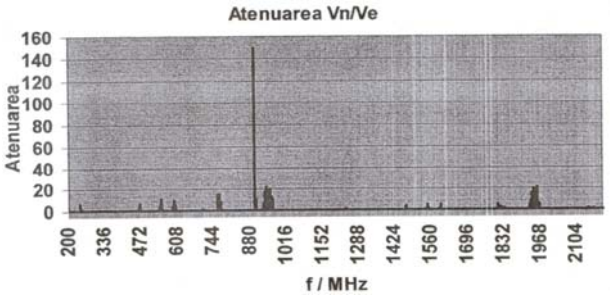

Fig.21. Representation of measured attenuation due to a screen made of radioabsorbent material on E

It is noted that the frequency range between 800 and 1016 attenuation is higher than at other frequencies. So attenuation being small, it means that magnetic field radiation passes through radio-absorbent material.

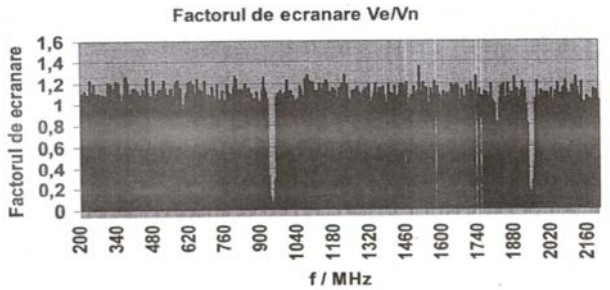

Fig.22. Representation of measured shield factor due to a screen made of radioabsorbant material on outside of Bridge Deck

We have a pretty high intensity of the electromagnetic field, due to its proximity to broadcasting antennas, and also which leads to increased shielding factor.

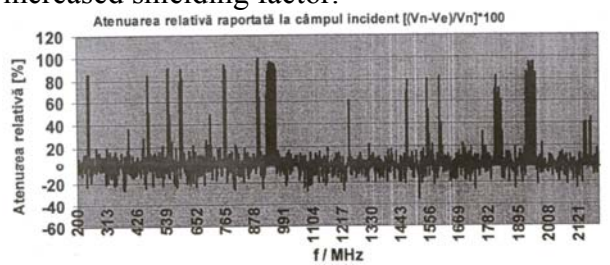

Fig.23. Representation of relative attenuation reported to incident field of a screen made of radioabsorbent material with maritime HF station transmission frequency of 240 MHz AM-100W, measurement performed on the outside Bridge Deck.

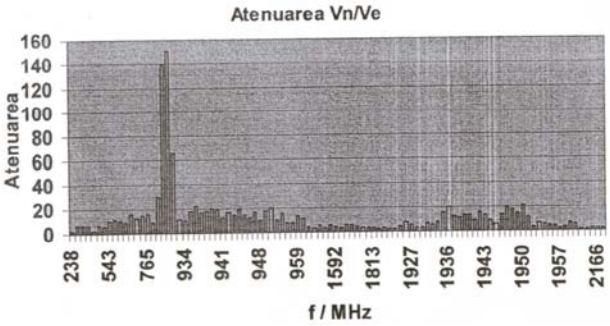

Fig.24. Representation of attenuation done by screen of radio-absorbent material, for the first 100 values of electric field strength measured on inside Bridge Deck

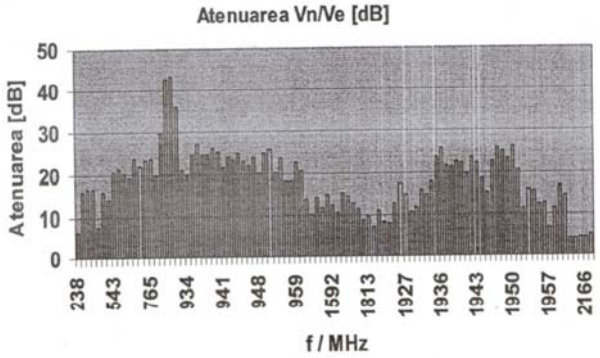

Fig.25. Representation of relative attenuation done by screen of radio-absorbent material, in dB, for the first 100 values of electric field strength on outside Bridge Deck

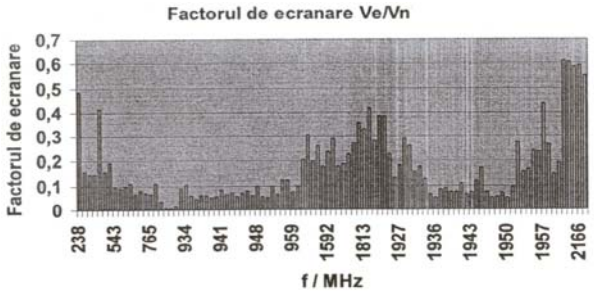

Fig.26. Representation of shield factor done by screen of radio-absorbent material, in dB, for the first 100 values of electric field strength measured on outside Bridge Deck

It is noted that at high frequencies above 2000 MHz radiation passes through the radioabsorbent material.

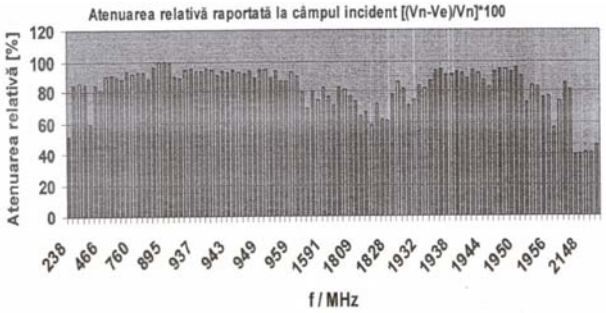

Fig.27. Representation of relative attenuation reported to incident field at screen of radioabsorbent material for the first 100 values of electric field strength.

Observed values of shielding factor are relatively very high as a result of the existence of electromagnetic radiation.

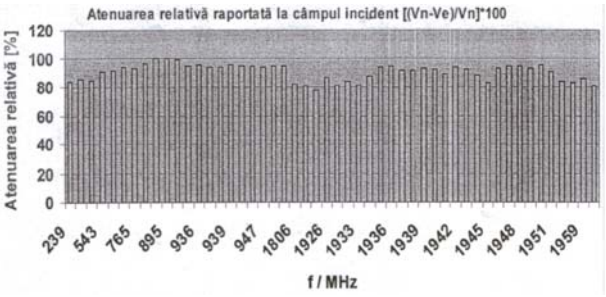

Fig.28. Representation of relative attenuation reported to incident field at screen of radioabsorbent material for the first 50 values of electric field strength.

Tabelul 3. The main values for measurements made on inside Bridge Deck, at the frequency of 240 MHz, AM, 100W

Frequency [MHz]	Measured values in absence of a screen			Measured values in presence of a screen		
	Electric Field Intensity [V/m]	Electric Field Level [dBµV/m]	Power density [µV/m^2]	Electric Field Intensity E[V/m]	Electric Field Level [dBµV/m]	Power Density [µV/m^2]
239	0,0598	95,5286	9,4736	0,0096	79,6125	0,2426
241	0,0621	95,8562	10,2159	0,0092	79,2834	0,2249
894	0,1828	105,2403	88,6515	0,0013	62,3933	0,0046
896	0,0857	98,6640	19,5010	0,0013	62,3417	0,0045
1935	0,0723	97,1833	13,8671	0,0046	73,3126	0,0569
1937	0,0557	94,9129	8,2214	0,0047	73,3845	0,0578
1939	0,0655	96,3291	11,3911	0,0047	73,4948	0,0593
1942	0,0710	97,0302	13,3869	0,0046	73,2956	0,0567
1946	0,0607	95,6600	9,7646	0,0044	72,8724	0,0514
1948	0,0772	97,7531	15,8113	0,0043	72,7435	0,0499
1950	0,0880	98,8898	20,5418	0,0043	72,5855	0,0481
Total exposure rate			576,3028			58,0850
Total Electric Field [dBµV/m]	0,4661			0,1489		
Max. Measured [dBµV/m]	0,1941			0,0135		

Tabelul 4. The main values of attenuation and shielding factor for measurements on inside Bridge Deck, at the frequency of 240 MHz, AM, 100W

Frequence [MHz]	Attenuation Vn/Ve	Attenuation Vn/Ve dB	Shield Factor	Relative Difference
239	6,248934	15,9161	0,160027	83,99727
241	6,73966	16,5728	0,148375	85,16246
894	138,7872	42,8470	0,007205	99,27947
896	65,48106	36,3223	0,015272	98,47284
1935	15,61477	23,8707	0,064042	93,59581
1937	11,92394	21,5284	0,083865	91.61351
1939	13,85846	22,8343	0,072158	92,78419
1942	15,37194	23,7346	0,065054	93,49464
1946	13,78405	22,7875	0,072548	92,74524

Frequence [MHz]	Attenuation Vn/Ve	Attenuation Vn/Ve dB	Shield Factor	Relative Difference
1947	19,55823	25,8266	0,051129	94,88706
1949	14,99734	23,5203	0,066678	93,33215
1951	10,80149	20,6697	0,09258	90.74202
Total rate of exposure	9,8002	19,8247	0,102038	89,79617
Total Electric Field intensity RMS)	3,130533	9,9124	0,319434	68,05656
Maximum measured value	14,40444	23,1699	0,069423	93,05769

3. CONCLUSIONS

It is worth a special attention to be paid to the values recorded around the 894-896 MHz frequency band for which there has been relative attenuation values reported to incident field close to 100%. Following table values is observed that during the measurements without shielding sensor measurement in this frequency band have recorded the highest values of electric field strength, power density respectively, values much higher than those for that emitted by radio station frequency (240 MHz). Analyzing the values obtained for the measurements with shielded measuring sensor is found that at the frequency band of 894-896 MHz were obtained normal background values for this band (0.0013 V/m).

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THE IMPORTANCE OF DEVELOPING SKILLS IN THE FIELD OF RENEWABLE ENERGY RESOURCES

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Abstract: *By this paper we want to emphasize that training and improving workforce in renewable energy can be achieved by supporting both researchers and the formation of networks between universities, research centers and industry to promote innovation and the knowledge economy[4].*

One of the steps taken in this directions is obtained by questionnaires addressed participants at the workshop organized individuals Naval Academy "Mircea" RES-Constanta - October 2011 have obtained information such as those related to individuals by category age [5].

Keywords: *renewable energy resources, Romanian-Bulgarian cross-border area, higher education*

1. INTRODUCTION

The stringent need to reduce pollution, global warming and saving the planet are the primary problems of human existence. The special attention given to environmental protection has led to the development of a new industry segment dedicated to:"green" jobs. Studies show that within Europe there are over 20, 000 occupations in this field [1].]. It is clear that in such a context, in Romania, the phenomenon of expansion of investment in renewable energy resources and development departments dedicated to the effective management of human resources involved in this field has resulted in large companies and will continue to increase the number of much needed jobs. The labor market shows that there are few specialists in human resources at this point involved in the process of employment, and they are convinced that the future belongs to those who choose to train to become true professionals in a field that aims to protect the business environment. Therefore, "green" jobs represent a true rescue bridge from this time of great crisis and provide a powerful job market not only in Europe but also throughout the world.

In the progress of society as a whole, a vital composition generating a number of major concerns is the energy and how it is produced, especially in the situation we are in; to reduce resource exploitation is the primary reason for increased demand effort to improve the use of renewable energy.

2. THE FIELD OF RENEWABLE ENERGIES A CHANCE FOR EVERYONE

The security of supply, access to competitive energy prices and environmental sustainability are the three pillars of the EU's integrated approach in terms of climate policy and energy policy. Among the objectives of the European Union are those consisting of lower, with 20% of energy consumption

compared to projections for 2020 and used until 2020, renewable energy to 20%.

It is intended that in 2007-2013 to increase the use of renewable energy promoting them at the same time as drivers of innovation and growth. It is well known that the European Regional Development Fund and the Cohesion Fund can support trans-European energy networks in order to improve security of supply, the internal market, the integration of environmental and renewable energy development.

Activities focused on renewable energy have great potential in terms of stimulating economic development in the EU regions, creating new jobs and stimulate social development. This is clearly found that funds were allocated through cohesion policy, renewable energy for the period 2007-2013, exceed five times those for the period 2000-2006 objectives "Convergence" and „Regional competitiveness and employment ".

It is really necessary to point out that the Framework Programs for 2007-2013, 4.8 billion has been allocated for projects renewable (wind, solar, biomass, hydro and geothermal), € 4.2 billion for energy efficiency, cogeneration and energy management and 1.7 billion investment in traditional energy sources, of which 674 million for investment in trans-European electricity and gas [2]

3. RES-OP-DEV

One of the problems Europe is to affirm the knowledge society and to face competition in the most efficient global economy. This is and will be possible by showing the existence of an extensive offer high quality education and training. Education policy is determined by each individual Member State. However, EU countries agree on common goals and share best practices and ideas in the field.

EU policy is to fund programs that allow citizens to build better opportunities for personal development and economic potential of the EU - through the study of the formation of continuous or volunteering in other countries [3].

The problem lies in the use of renewable energy among subjects approached of programs financed by the European Union, which is the theme that we have developed in our project "Romania-Bulgaria Joint Cooperation for sustainable development and long-term human resource young energy technologies sources, in order to overcome socio-cultural barrier and opening of joint opportunity or find a job and employment in the border area "with the National Research and Development Institute for Electrical Engineering ICPE-CA, as coordinator, University of Rousse "Angel Kanchev" Association "Municipal Energy Agency - Rousse" as partners. This project was among those activities and active information, lectures and thematic views, arguments and discussions of broad interest, targeted or general presentations of successful projects in this field, always insisting on the benefits, but considering the conditions development initiatives for improvement, with clear economic, social and environmental, short and medium term clearly proving that there is interest and opportunities in this field.

The project is part of the Cooperation Program Romania-Bulgaria 2007-2013, "Common borders. Common solutions "and is co-funded by the European Union through the European Regional Development Fund. The contracting authority in Romania is the Ministry of Regional Development and Tourism.

Duration of the project was for a period of 18 months, from July 8, 2011 till January 7, 2013.The total project value was EUR 945,837.18, of which financial assistance grant of Romanian and Bulgarian state amounts to 122,958.84 Euros and the contribution of the partners was worth 20,619.25 euros.

The target groups were represented by SMEs, universities and research centers with concerns and renewable energy activities but also individuals. A total of 240 people were be covered by the end of the program training courses in renewable energy.

The objectives of the project were:

i) Cooperation of specialists from Romania and Bulgaria to achieve a common educational curricula and training programs for staff in SMEs, skills and knowledge to young human

resource in the field of renewable energy technologies to create and strengthen the advantages and opportunities getting a job along the border area;

ii) Transmission of information on employment opportunities in the border area and the new evolving labor market in renewable energy technologies;

iii) Development in the border area of specific training for human resource hiring young labor market for renewable energy technologies;

iv) Developing links and cross-border exchange of experiences between educational centers and training centers.

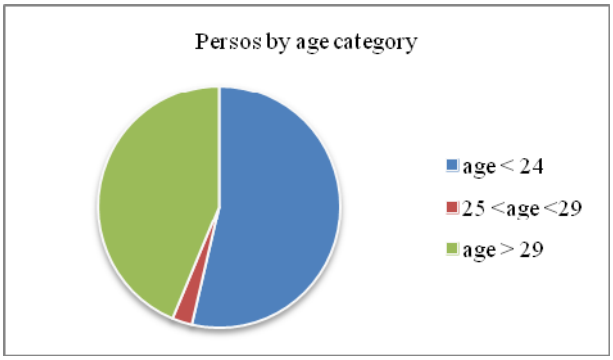
4. THE IMPORTANCE OF THE DEVELOPING SKILLS IN THE FIELD OF RENEWABLE ENERGY RESOURCES

Development of people, their skills and talents is essential to ensure long-term competitiveness of Europe in the field of renewable energy. It is also a key element in promoting social cohesion, helping all citizens to receive a job offer more and better in this new field. The EU has a comprehensive set of policies aimed at addressing specific issues of professionalism and competitiveness. Many of these systems are designed to improve higher education and training in renewable energy, improve field workforce and strengthen the links between these new service providers, and industry training to ensure that skills taught are those who require companies working in the field, both currently and in the future.

Training and improving workforce working in renewable energy can be achieved by supporting both researchers and the formation of networks between universities, research centers and industry to promote innovation and the knowledge economy [4]. One of the steps taken in this direction is obtained by questionnaires addressed participants at the workshop organized individuals Naval Academy "Mircea" RES-Constanta - October 2011 have obtained information such as those related to individuals by category age.

Total	Percentage age <24	Percentage 25 < age < 29	Percentage age >29
123	52,84%	4,06%	43,08%

age <24	25 < age < 29	age >29	Total
65	5	53	123

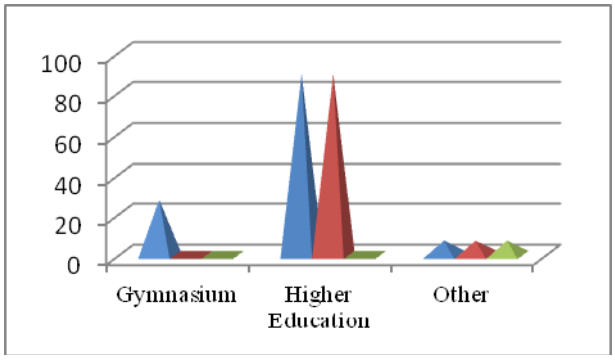


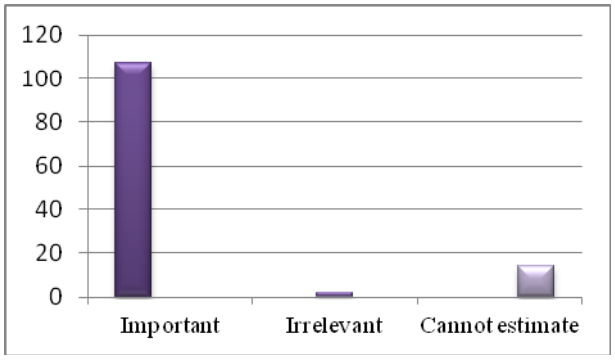
The second type of questionnaire was dedicated to the individuals belonging to the categories having completed research studies.

Gymnasium	Higher Education	Others	Total
27	89	7	123

Total	Percentage Gymnasium	Percentage Higher Education	Percentage Others
123	21,95%	72,35%	5,69%

The diagram for these results is:





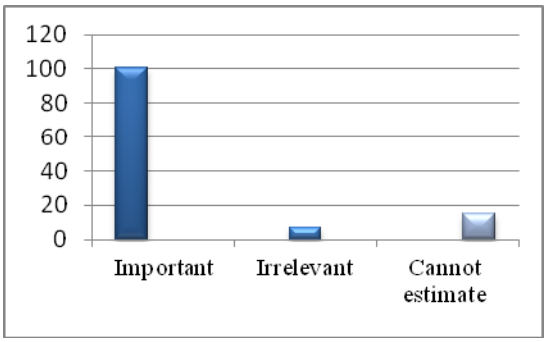
Next type the relevant questionnaire was related to the role of new technologies:

What role do new technologies related to renewable energy play in creating opportunities for creating new jobs?

The answers are:

Important	Irrelevant	Cannot estimate	Total
101	7	15	123

Total	Percentage Important	Percentage Irrelevant	Percentage Cannot estimate
123	82,11%	5,69%	12,19%



Another questionnaire was devoted to determining the role of professional reorientation and we have centralized the answers in the table below:

Important	Irrelevant	Cannot estimate	Total
107	2	14	123

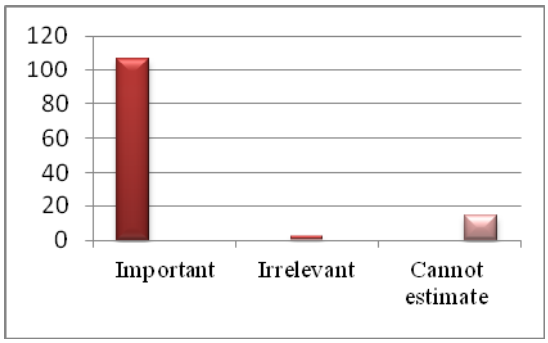
Total	Percentage Important	Percentage Irrelevant	Percentage Cannot estimate
123	86,99%	1,62%	11,38%

This time, too, we emphasize the results using by the next diagram:

Another questionnaire was devoted to determining the role of professional reorientation which has given us the next information:

Important	Irrelevant	Cannot estimate	Total
107	2	14	123

Total	Percentage Important	Percentage Irrelevant	Percentage Cannot estimate
123	86,99%	1,62%	12,19%

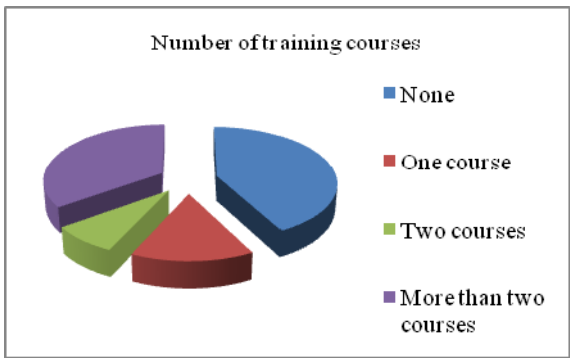


We have not overlooked important courses so the question: How many training courses attended after graduation? They responded according to data recorded below.

None	One course	Two courses	More than two courses
52	18	10	43

Total	Percentage None	Percentage One course	Percentage Two courses	Percentage More than two courses
123	42,27%	14,63%	8,13%	34,95%

For this questionnaire we have obtained the next diagram.



5. CONCLUSIONS

The study showed that renewable energy shows an interest increased among higher education graduates, i.e. 72.35% of respondents are graduates of higher education institutions.

The importance of new technologies related to renewable energy in creating opportunities for the development of new jobs has reached a rate of 82.11%.

Regarding the importance of professional reorientation we have to achieve a rate of 86.99%.

These results are the strengths of the research conducted on a sample consisting of a total of 123 people who have expressed interest in training and specialization which means so important in the field of renewable energies.

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The present article is the result of research of the authors, members of the project team, " Romanian – Bulgarian cooperation for long-term and sustainable development of young human resources in the field of renewable energy technologies with the aim to overcome the social and cultural barrier and find new job opportunities in the trans-border zone" "RES-OP-DEV № .2 (3.I) -3.2-4 MIS-ETC CODE 222.

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MEANS OF EXTENDING VISION FROM VISIBLE TO INFRARED SPECTRUM AND PRACTICAL IMPLEMENTATION

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Abstract: *This paper intends to make a brief introduction to the principles of infrared light exploring at the same time capabilities of harnessing the new technologies. The paper approaches the design, explanation and construction of an infrared vision capable webcam. Several comparisons are made though out the paper highlighting the benefits that the proposed design brings. Finally after a MATLAB and a XARA process a possible working design is offered.*

Keywords: *infrared, pixel, capture, spectrum, webcam.*

1. INTRODUCTION

In order to understand infrared vision, it is important to understand something about light. The amount of energy in a light wave is related to its wavelength: Shorter wavelengths have higher energy. Of visible light, violet has the most energy, and red has the least. Just next to the visible light spectrum is the **infrared** spectrum [1].

Infrared light can be split into three categories:

- **Near-infrared** (near-IR) - Closest to visible light, near-IR has wavelengths that range from 0.7 to 1.3 **microns**, or 700 billionths to 1,300 billionths of a meter.
- **Mid-infrared** (mid-IR) - Mid-IR has wavelengths ranging from 1.3 to 3 microns. Both near-IR and mid-IR are used by a variety of electronic devices, including remote controls.
- **Thermal-infrared** (thermal-IR) - Occupying the largest part of the infrared spectrum, thermal-IR has wavelengths ranging from 3 microns to over 30 microns.

The key difference between thermal-IR and the other two is that thermal-IR is **emitted** by an object instead of reflected off it. Infrared light is emitted by an object because of what is happening at the **atomic** level.

2. PROJECT DESIGN

In the project there were used two web cameras in order to capture images. One was left unmodified (UW) and the other (MW) (see figure 1). An visible light filter and a set of 10 LED's with infrared light were attached in order to be able to see at night.

Figure 1. Modified Webcam

The circuit had to be adapted to 5 volts which is the USB output. In order to have a functional configuration, each LED was stringed with a 68 Ω resistance that makes the

circuit functional. The circuit's electrical design is presented in figure 2.

What this system brings new is the fact that different risk factors can be stored in a memory and whenever the system has a live streaming it can automatically compare the image with the risk factors that were stored and decide the course of action which at first would be signaling the presence of a potentially dangerous factor in the surrounding's.

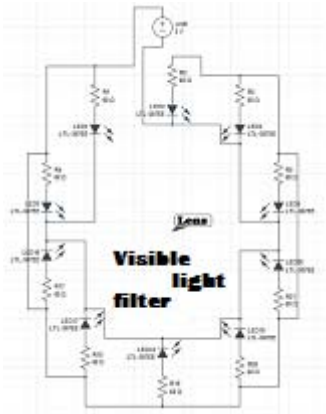

Figure 2. Electrical design.

In order to prove the efficiency of such a system the fallowing experiment was carried out:

Captured images with the two webcams were used to highlighting the advantages that the modifications brought.

In the images captured with the UW we can see the light but can't identify the source or the objects near it. In the pictures with the MW we can clearly see what is next to the flame of the candle. See figure 3 and 4.

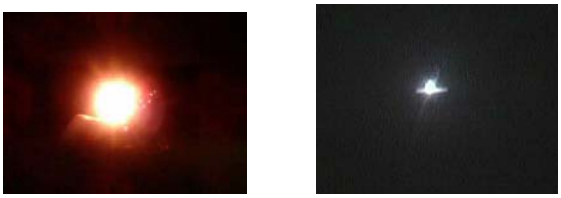

Figure 3. UW and MW image

This principle can be applied to any devices that captures images with light emitting sources.

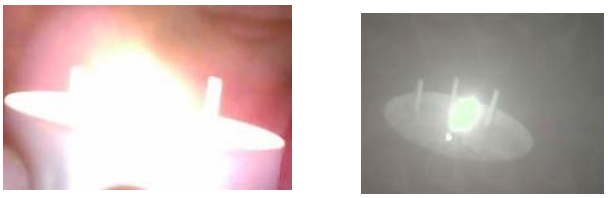

Figure 4. UW and MW image

Here is an example of night vision of this system in which with the UW nothing can be seen but the MW can easily see the infrared filter leaving the full image to be seen (see figure 5).

Figure 5. UW and MW image

3. MATLAB PROCESSING

In the image captured with the MW you can spot a human (figure 6) form in night vision. This image was processed [2] in MATLAB and the form was added to a database in order to be recognized. This can be done based on recognizing the group of pixels that make up whatever it's in the database. If we add a variable number of pixels [5] to any image we can enlarge the range that system recognizes a form.

Figure 6. UW and MW image

An image can be displayed (in MATLAB) as a matrix starting from the fallowing representation for a digitized image function (1).

$$f(x,y)=\begin{bmatrix} f(0,0) & \dots & f(0,N-1) \\ f(1,0) & \dots & f(1,N-1) \\ f(M-1,0) & \dots & f(M-1,N-1) \end{bmatrix} \quad (1)$$

The right side of this equation is a digital image by definition each element of this array called image element, picture element, pixel or

peel. The terms image a pixel will be used in the fallowing discussion to denote the image and its elements.

A digital image can be natural represented as a MATLAB matrix [3] (2).

$$f(x,y)=\begin{bmatrix} f(1,1) & \dots & f(1,N) \\ f(2,1) & \dots & f(2,N) \\ f(M,1) & \dots & f(M,N) \end{bmatrix} \quad (2)$$

Displaying the image you have just read is achieved by simply typing: **image(x)**

This will open a Figure Window and plot the image on the axis. If you have read the JPEG image above, **image** will readily accept the 3-D array and display the RGB images. Notice that the same plotting considerations of relative axis scale arise here as well; you might wish to use **axis equal** to correct the perspective. If the image you read is an indexed image, i.e., a 2-D index array with a corresponding Nx3 color map, you will need to use the **color ma p** function to get the correct coloring of the plot. At the website you can download the indexed image usflag.dib (Windows device-independent bitmap).

Once you have that file you can read it, then view it with:

```
[x,cm]=imread('usflag.dib','bmp');
image(x)
```

Writing the contents of a Figure Window to an image file is just as simple as reading one. The **imwrite** function[4] provides a means to create image files. The general form of **imwrite** is:

imwrite(A,filename,fmt)

where *A* is the image, either grayscale if NxM, or truecolor if NxMx3,

filename is a string containing the name of the file to be created, and *fmt* is a

string indicating one of the write formats indicated in MATLAB documentary.

For the case of an indexed image, i.e., one containing an image and colormap, **imwrite** takes the following form:

imwrite(X,C,filename,fmt)

By indexed we mean that the image is created from information in two arrays: the first is an array of indexes into the second, which is a three-column array containing the red, green, and blue contributions for each pixel. The following code will load an image of a clown and display it in a Figure.

Window, looking like that shown in figure 7.

```
load shape
image(X)
colormap(map)
```

Figure 7. Image window

When we load image.mat the arrays *X* and *map* were placed in the MATLAB workspace. The array *X* is an array of indices; row indexes actually, specifying which row from *map* (an 81x3 array) the pixel color is to be taken from.[3]

Looking at a few pixels from the upper left corner, we see in figure 8.

Each element is a number corresponding to a row in the color map. We can find the color

(figure 9) components for each of these pixels by:

- Map (unique(X(60:40,60:40)),:)

```
ans =

     2     2     2     2     2
    61    69    69    69    69
    69    61    69    61    69
    61    69    61    61    56
    69    55    61    44    61
```

Figure 8. Pixels

```
ans =

    0.1250         0         0
    0.8672    0.4141    0.1250
    0.8672    0.5781         0
    0.8672    0.5781    0.1250
    0.9961    0.5781    0.1250
    0.9961    0.7031    0.1250
```

Figure 9. Color code

The **unique** function returns only one instance of an element, and orders the results, so the first row here corresponds to an index value of 2, the second 44, the third 55, etc.. We can see these first few pixels, shown in figure 10, with the following code [4].

```
image(X(60:40,60:40))
colormap(map)
```

Figure 10. Graphic pixel display

Based on those functions all the pixels that are different from black were selected. And after a further process with XARA resulting in a database form (figure11):

This is an example of shape that can be stored in a system memory in order to compare live streaming with it.

Figure 13. Database form

3. CONCLUSIONS & ACKNOWLEDGMENT

After the experiment we can state that implementing such a design in modern surveillance systems could make a difference because they could be set to inform appropriate personal about the existing of a possible threat. Thus optimizing resources.

Applying an infrared filter to a camera refines the image that is captured making it more easily to see all the elements of the image excluding possible false threats and giving the image processing a better analyzing perspective.

The infrared LED's offers substantial extension to the capabilities of the camera and because they emit in infrared they can't be spotted and the surveillance camera is not unmasked.

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COMPLEX CONTROL SYSTEM FOR A JET ENGINE WITH AFTERBURNING AND MULTI-RAMP FUEL SYSTEM

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Abstract: *This paper deals with a complex control system for an aircraft engine with afterburning. The paper is based on other papers, which have studied individually some control systems. Engine's mathematical model was built from VK-1F engine, which was considered as using an afterburning system with multiple fuel injector ramps. The embedded control system uses also three controllers (for engine's speed, for the exhaust nozzle and for afterburner's fuel injection). The author has performed some simulation, based on the combined mathematical models of system's main parts, concerning system's quality (system time behavior for throttle position step input). The simulation results were presented as graph(s); several useful conclusions were drawn, regarding system's behavior. System's mathematical model and its time behavior, as well as the conclusions, may be useful in similar further studies.*

Keywords: *afterburning, fuel, control, throttle, turbine, exhaust-nozzle, jet-engine, speed*

1. INTRODUCTION

One of the most efficient aircraft engine's thrust augmentation method is the after-burning, which means the controlled fuel injection and burning in a special kind of combustor, mounted after the engine's gas turbine, before the exhaust nozzle, called "afterburner".

Gas-dynamic principles and the equations, for both of the basic jet engine as well as the afterburning system, are presented in [4], [5] and [9]. Meanwhile, the basic single-spool single jet engine and the afterburning system as controlled objects are depicted in [7], [9] and [10]; a possibility for the afterburner's fuel pump automatic control was presented by the author in [12] and a similar simplified system in [10]; a complex integrated system (engine-afterburner) was also presented by the authors in [13].

This paper has as main purpose to identify the embedded system (single-spool jet-engine and afterburning system, also called EAS, with specific controllers) as controlled object and to determine its simplified mathematical model, as well as its time behavior.

One can affirm that EAS is an inter-connection between two propulsion systems, the basic engine and the afterburning, both from gas-dynamic and control point of view. Both of EAS main parts are supplied with the same fuel type but by different pumps; these pumps are driven by the basic jet engine's shaft, through an appropriate gear, so each pump speed is proportional (sometimes equal) to the engine's speed n, which is the engine's most frequently controlled parameter; between these two fuel-systems there are several principles differences, such as input and output parameters, as well as control type and equipment.

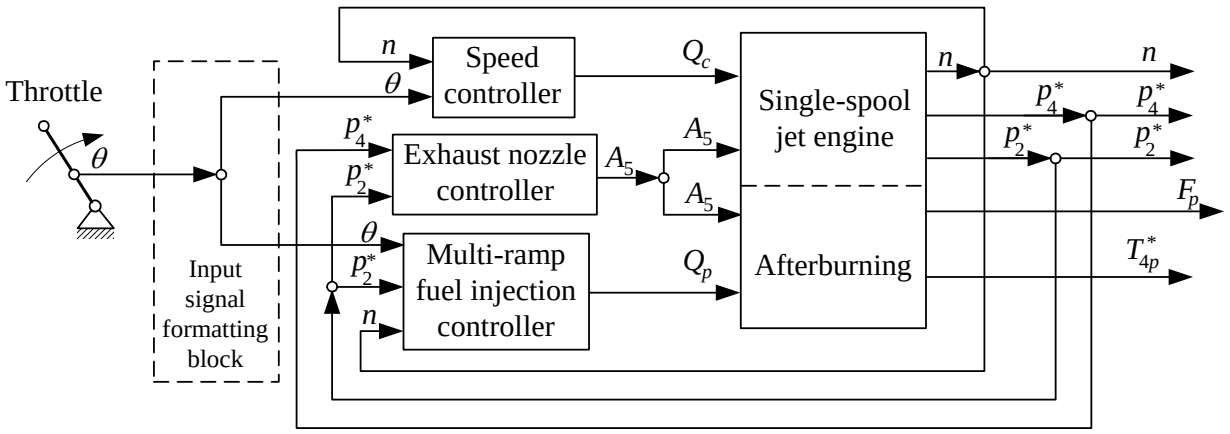


Fig. 1. Single-jet single-spool jet engine with afterburning operational block diagram

Aircraft jet engines as controlled objects are depicted and studied in [8], [9] and [10], where the authors have identified, amongst a multitude of parameters, possible control parameters (inputs), possible controlled parameters (outputs), as well as several command laws. As input parameters, one has identified only three: a) the combustor fuel flow rate Q_c (for all engine types); b) the exhaust nozzle's opening A_5 (for engines with variable-area nozzles); c) the afterburner fuel flow rate Q_p (for engines with afterburning systems).

However, aircraft pilots have at their disposal only the throttle (as single possibility to control the engine/propulsion system). Consequently, the throttle has to generate somehow, by its displacement, the input signals formatting, which means that EAS input parameters should be determined as some other control sub-systems' outputs.

2. SYSTEM'S PRESENTATION

Fig. 1 presents an operational block diagram of an EAS, assisted by three controllers, each one giving an EAS input parameter, respectively Q_c, A_5 and Q_p.

One can observe that A_5 is involved both in the basic single-jet engine control and in the afterburning control, while the fuel injection operates separately for each one of the EAS sub-systems.

Main output parameter of the above-depicted EAS is the total thrust F_p (that means the thrust of basic engine and afterburning operating simultaneously). Total thrust depends on air flow rate Q_a and on specific thrust F_{sp_p}, which depends on afterburner's temperature T_{4p}^*. One can assume, according to [4] and [5] that between basic engine specific thrust and afterburning specific thrust there is a mathematical relation (being proportional to the square root of the temperature ratio). Consequently,

$$F_p = Q_a F_{sp_p} \approx Q_a F_{sp} \sqrt{\frac{T_{4p}^*}{T_4^*}}, \qquad (1)$$

where F_{sp} is basic engine specific thrust.

As secondary output parameters may be considered engine's speed n, engine's combustor temperature T_3^*, afterburner's temperature $T_{4_p}^*$, as well as any other parameter involved in a control scheme.

One has chosen a control scheme, which uses two independent fuel control systems and an exhaust nozzle control system. As far as EAS may have only a single input, which is throttle's displacement, it is compulsory to include a complex input signal-formatting block; its essential role is to establish the reference or input parameter(s), with respect to throttle position, for the control systems which use throttle's positioning in their structure. Consequently, for this EAS, one uses:

a) a fuel injection control system for the basic engine, which operates as engine's speed controller;
b) a multi-ramp fuel injection system for the afterburning, which operates as follower system, with respect to the

throttle's position, in correlation with air (or burned gases) flow rate;

c) an exhaust nozzle opening control system, which operates with respect to the engine's turbine pressure ratio (in order to keep it constant and keep the basic engine stable, even when the afterburning is operating).

Furthermore, both fuel pumps are driven by the engine's shaft, so engine speed becomes an inner feedback parameter (as fig. 1 shows). Consequently, during EAS dynamic regimes, all input parameters are modifying.

One has chosen, for a quantitative study, as EAS a VK-1F-type engine, as speed controller a system with constant pressure chamber [11], as afterburning fuel injection system a multi-ramp fuel injection follower system [14] and as exhaust nozzle controller a constant turbine pressure ratio system [2]. Embedded system (consisting of EAS and controllers) should be modeled and studied as controlled object.

3. SYSTEM'S MATHEMATICAL MODEL

Embedded system mathematical model consists of joined mathematical models of the above-mentioned main parts: EAS, input formatting block, speed controller, exhaust nozzle controller and afterburning fuel injection controller.

3.1. Jet engine with afterburning model

EAS linearised adimensional mathematical model is expressed by a matrix equation (as determined in [7] and [9])

$$A \times u = b, \tag{2}$$

where A is the engine's matrix, u – controlled parameters vector and b – control parameters vector, as follows

$$A = \begin{bmatrix} \tau_1 s + \rho_1 & -k_{1T3} & -k_{1p2} & -k_{1p4} & 0 & 0 \\ k_{2n} & -k_{2T3} & k_{2p2} & 0 & 0 & 0 \\ 0 & -1 & -k_{3p2} & k_{3p4} & 0 & 1 \\ 0 & k_{4T3} & k_{4p2} & k_{4p4} & -k_{4Tp} & 0 \\ k_{5n} & k_{5T3} & k_{5p2} & 0 & 0 & 0 \\ 0 & k_{6T3} & k_{6p2} & 0 & k_{6Tp} & k_{6T4} \end{bmatrix}, \tag{3}$$

$$u^{\mathrm{T}} = \left(\overline{n} \quad \overline{T_3^*} \quad \overline{p_2^*} \quad \overline{p_4^*} \quad \overline{T_{4p}^*} \quad \overline{T_4^*} \right), \tag{4}$$

$$b^{\mathrm{T}} = \left(0 \quad 0 \quad 0 \quad k_{4A}\overline{A_5} \quad k_{5Qc}\overline{Q_c} \quad k_{6Qp}\overline{Q_p} \right), \tag{5}$$

where the involved coefficient forms are those presented in [7].

Amongst the output parameters there are several of them usable in the control schemes, or important as output parameters, such as $\overline{n}, \overline{p_2^*}, \overline{p_4^*}$ and $\overline{T_{4_p}^*}$. Their expressions will be determined solving the matrix equation by the Cramer method.

Particularly, for VK-1F engine with afterburning,

$$A = \begin{bmatrix} 0.83s + \\ +3.15 & -0.5 & -2.25 & -1.2 & 0 & 0 \\ 3.1 & 0.5 & -1.9 & 0 & 0 & 0 \\ 0 & -1 & 0.25 & -0.25 & 0 & 1 \\ 0 & -0.5 & 1 & -1 & -1 & 0 \\ 3.1 & 1.8 & -1.17 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & -1 \end{bmatrix}, \tag{6}$$

and the input parameters' coefficients are

$$k_{4A} = 1, k_{Q_c} = 1, k_{Q_p} = 1. \tag{7}$$

After applying the solving Cramer method, one has obtained, in the case of VK-1F (considered at engine maximum operating regime) for the above-mentioned parameters the following expressions

$$\overline{n} = \frac{3.402\overline{A}_5 + 2.3837\overline{Q}_c + 3.402\overline{Q}_p}{2.9413\mathrm{s} + 13.486}, \quad (8)$$

$$\overline{p}_2^* = \frac{4.836\overline{A}_5 + (0.5187\mathrm{s} + 5.7633)\overline{Q}_c}{2.9413\mathrm{s} + 13.486} + \\ + \frac{6.3182\overline{Q}_p}{2.9413\mathrm{s} + 13.486}, \quad (9)$$

$$\overline{p}_4^* = \frac{1}{2.9413\mathrm{s} + 13.486}\left[-(2.3531\mathrm{s} + 0.9942)\overline{A}_5 + \right. \\ \left. + (0.1452\mathrm{s} + 7.5263)\overline{Q}_c - (2.3531\mathrm{s} + 0.9942)\overline{Q}_p\right] \quad (10)$$

$$\overline{T}_{4p}^* = \frac{1}{2.9413\mathrm{s} + 13.486}\left[(0.5883\mathrm{s} + 6.2936)\overline{A}_5 - \right. \\ \left. - (0.6121\mathrm{s} + 5.3263)\overline{Q}_c + (2.3531\mathrm{s} + 7.1188)\overline{Q}_p\right] \quad (11)$$

One can observe that each output parameter is a function of input parameters, but they have a different dependence.

In terms of total thrust, it shall be treated by the same method. According to [7] and [10], one can assume that $Q_a = Q_a\left(p_2^*\right)$, respectively $F_{sp} = F_{sp}\left(T_3^*, p_2^*, T_4^*\right)$; applying the same linearisation method for Eq. (1), one obtains

$$\overline{F}_p = k_{FT3}\overline{T}_3^* + k_{Fp2}\overline{p}_2^* + k_{Fp4}\overline{p}_4^* + k_{FT4}\overline{T}_4^* + \\ + k_{FTp}\overline{T}_{4p}^*. \quad (12)$$

Finally, one has to complete *A*-matrix with a seventh line, given by Eq. (12) and with a column given by vector (5), where the coefficients are keeping their expressions. It results, for the last line

$$\begin{bmatrix} 0 & -1.2 & -0.13 & -2.2 & 0.5 & 0.5 & 0 \end{bmatrix}, \quad (13)$$

which completes *A*-matrix in (6). It results, for the total thrust

$$\overline{F}_p = \frac{-(4.4883\mathrm{s} + 1.3816)\overline{A}_5 + 2.1196\mathrm{s}\,\overline{Q}_c}{2.9413\mathrm{s} + 13.486} + \\ + \frac{24.7434\,\overline{Q}_c + (6.0591\mathrm{s} + 6.3248)\overline{Q}_p}{2.9413\mathrm{s} + 13.486}. \quad (14)$$

Equations (8), (9), (10), (11) and (14) are the EAS linear mathematical model.

EAS has a single input, which is throttle's position θ. One can affirm that throttle's positioning has two operation intervals:

- from "idle" to "maximal" (or "full"), when it controls the basic engine's speed, θ being proportional to the speed reference n_{ref};
- beyond "maximal", into afterburning domain, when θ is conceived to be proportional to F_p total thrust. In fact, it can be assumed as proportional to Q_p (consequently, to T_{4p}^*).

Such a throttle assisting system (input signal formatting block) is presented in [3]; a similar system is described in [10], but operating after a different command law, $A_5 = A_5(\theta)$.

3.2. Engine speed controller model

Fuel system for the basic engine consists of a fuel pump with constant pressure chamber, pump's actuator and fuel valve (commanded by the throttle); a correction with the flight regime ($\overline{p}_1^*$) may be used, if a capsules system is added. This kind of fuel system is the speed controller and it was studied in [11]; its simplified mathematical model is reduced at a single equation, as follows

$$\overline{Q}_c = \frac{0.683\,\overline{\theta} - (0.125\mathrm{s} + 0.836)\overline{p}_1^*}{0.078\mathrm{s}^2 + 1.813\mathrm{s} + 5.3068} + \\ + \frac{(0.9065\mathrm{s} + 2.4795)\overline{n}}{1.6183\mathrm{s} + 6.308}. \quad (15)$$

The fuel flow rate (supplied by the engine's main pump) depends on the throttle's position, on the flight regime, as well as on the effective engine's speed. If one assumes the flight regime as constant, the term in (15) containing the air inlet pressure parameter $\overline{p}_1^*$ becomes null.

3.3. Exhaust nozzle's controller model

For EAS', no matter their constructive solution were, it is compulsory that exhaust nozzle has variable exhaust area.

Exhaust nozzle's effective area is both an engine input parameter and an afterburning input parameter, but it is also a controlled parameter, from its controller point of view.

During afterburning operation, fluid pressure and temperature behind the turbine may significantly increase, which leads to an engine speed decrease; in order to keep it constant, exhaust nozzle must be open. Consequently, exhaust nozzle's control law has to be engine's turbine pressure ratio

constancy; in order to "separate" the basic engine operation from the afterburning operation, more precisely, to keep the basic engine at maximum regime, no matter the afterburning regime were.

Such a controller was depicted and studied in [2] (and partially in [13]). It works with respect to the gas pressure before and behind the turbine ($\overline{p}_3^*$, respectively $\overline{p}_4^*$), but because of the very high gas temperature before the turbine, one has to use the air pressure behind the compressor $\overline{p}_2^*$ instead of $\overline{p}_3^*$, those two pressure values being close enough to make possible this replacement.

Exhaust nozzle's simplified mathematical model is

$$\overline{A}_5 = \frac{0.2524s^2 + 1.6634s + 1.5816}{(0.81s+1)(0.187s+1)(0.23s+5.17)} \times \times \left(\frac{0.234}{0.187s+1}\overline{p}_4^* - \overline{p}_2^* \right), \quad (16)$$

which is a 3-rd order system, but a stable one, because of characteristic polynomial's roots, which are all real and negative (as the denominator in Eq. (16) shows).

3.4. **Afterburning multi- ramp fuel in jection contro ller** was depicted and studied in [14]. Fuel injection controller is a follower system, which operates with respect to the throttle's position, fuel flow rate Q_p being correlated to the air flow rate (air pressure behind the compressor), in order to assure an optimum air-fuel mixture.

Simplified mathematical model, determined in [14] as particular system for a VK-1F type engine, has the following form

$$\overline{Q}_p = \frac{4.957}{s^4 + 15.01s^3 + 88.93s^2 + 172.11s + 119.94} \times \times \left[0.448\overline{\theta} - 0.397\overline{p}_2^* + \left(0.023s^2 + 0.062s + 0.076\right)\overline{n} \right], \quad (17)$$

where the term containing $\overline{n}$ may be neglected, if one considers that afterburning fuel pump is driven at constant speed, or if the fuel supplying is made through a constant pressure valve.

Embedded system's mathematical model consists of Eqs. (8), (9), (10), (11), (14), (15), (16) and (17).

4. EMBEDDED SYSTEM"S QUALITY

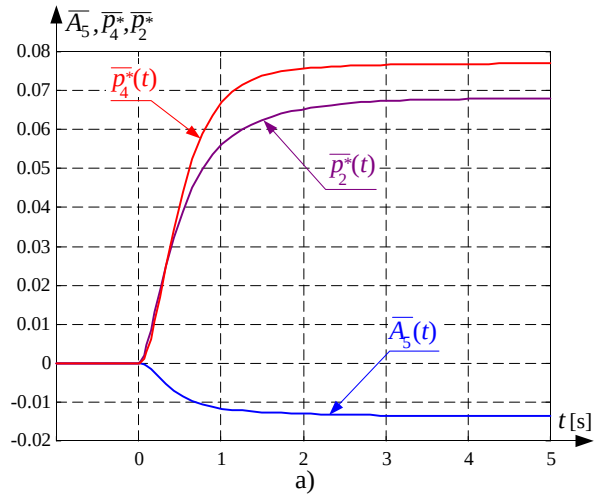
System's quality study consists of system's step response analysis, for a step input (step throttle displacement). One has considered as studied regime the maximal engine's operating regime (full thrust regime), when afterburning may be switched on.

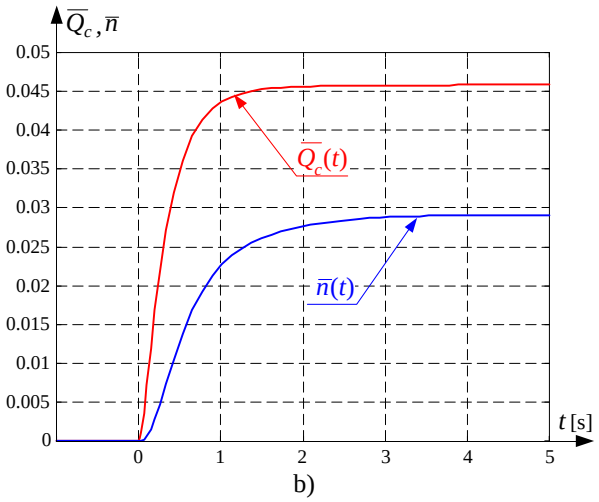
Most important output parameter is total thrust; although, one has also studied some other important input/output parameters behavior (such as speed, fuel flow rates, exhaust nozzle's area, turbine's pressures).

As presented in section 1 and 2, EAS effective inputs are exhaust nozzle's area and fuel flow rates; main output is total thrust (as well as afterburner's temperature), while secondary outputs are engine's speed and turbine pressures, which are used as inputs or feed-back in controllers' operating block diagrams.

System's quality (its time behavior) was studied in two different cases:

a) constant flight regime ($\overline{p}_1^* = \text{const.}$) and throttle step input;
b) constant throttle position ($\overline{\theta} = \text{const.}$) and step input for $\overline{p}_1^*$ (flight regime).





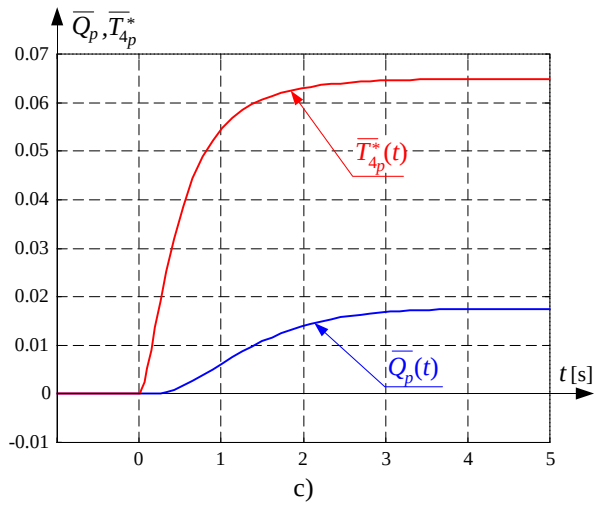
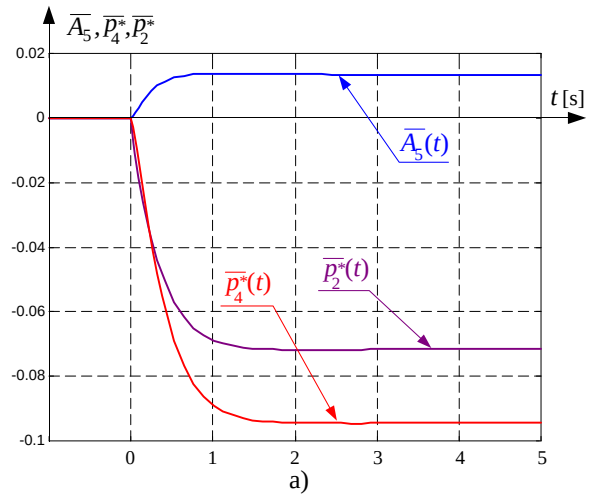
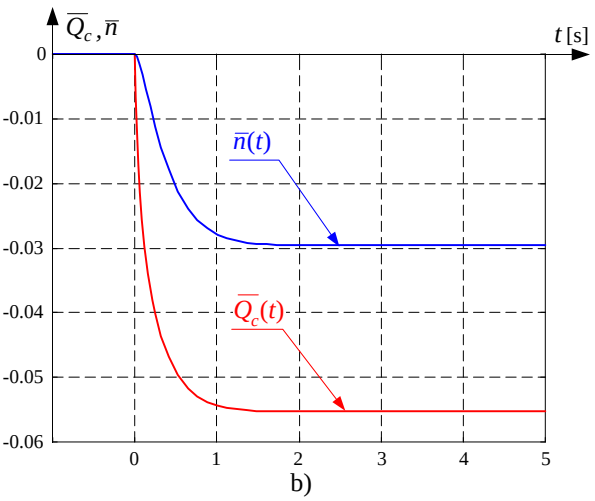


Fig. 2. System step response for $\overline{\theta}$ throttle position parameter step input and constant $\overline{p}_1^*$ air pressure parameter





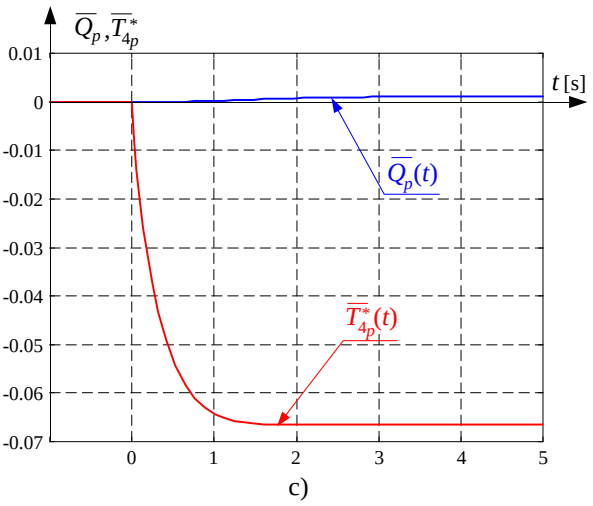


Fig. 3. System step response for $\overline{p}_1^*$ air pressure parameter step input and constant $\overline{\theta}$ throttle position parameter

System behavior for the throttle's position step input is presented in fig. 2.

Fig 2.a shows the exhaust nozzle's opening parameter behavior, as well as turbine pressures' parameters behavior. All of the studied parameters have an asymptotic stabilization, which is an appropriate behavior, but with static errors. Although both of pressures' parameters have large positive static errors (7% to 8%), exhaust nozzle's opening has a very small, but negative, static error (-1.4%). In terms of response time,

pressures' stabilization is realized in 3 to 4 s, while exhaust opening response time is around 2.5 s.

Basic engine's speed $\overline{n}$ parameter's behavior, as well as main engine's input parameter $\overline{Q}_c$ are shown in fig. 2.b, both of them having aperiodic behavior and acceptable static errors (4.6% for $\overline{Q}_c$ and 2.8% for $\overline{n}$), as well as acceptable response times (around 3 s).

Afterburning characteristic parameters' behavior (fuel flow rate $\overline{Q}_p$ and afterburner's temperature $\overline{T}_{4_p}^*$) are presented in fig. 2.c. Both of studied parameters are asymptotic stable, with acceptable static errors (1.8% for $\overline{Q}_p$ and 6.3% for $\overline{T}_{4_p}^*$), but with a little large response times, $(3 \div 4)$ s.

EAS main output parameter, total thrust $\overline{F}_p$, has also asymptotic stability with static error (4.4%) and a short response time (2.2 s), as fig. 3.a shows.

Second studied case, when engine's throttle is held fixed and flight regime is considered as step input, is presented in figures 3.a, b, c and 4.b. One can observe that flight regime's involving (through the air pressure parameter $\overline{p}_1^*$) is effective only for basic engine's fuel flow rate, as shown in Eq. (15). Furthermore, as far as $\overline{Q}_c$ is an input parameter, one can observe different levels of influence above the rest of parameters.

Thus, most of all parameters have negative static errors, having an opposite behavior than in the other studied case. Static errors, as well as response times, are very near to the other case; static errors are larger and negative, excepted exhaust nozzle's area and afterburning fuel flow rate. In terms of $\overline{Q}_p$, one can observe an insignificant positive static error, which means that aircraft (and engine) flight regime has no influence on it.

Total thrust, as fig. 4.b shows, makes no exception, being asymptotically stable, but with a negative larger static error (5.2%). One can affirm that flight regime (given by $\overline{p}_1^*$) has contrary influence than engine's regime (given by $\overline{\theta}$) and generates larger static errors.

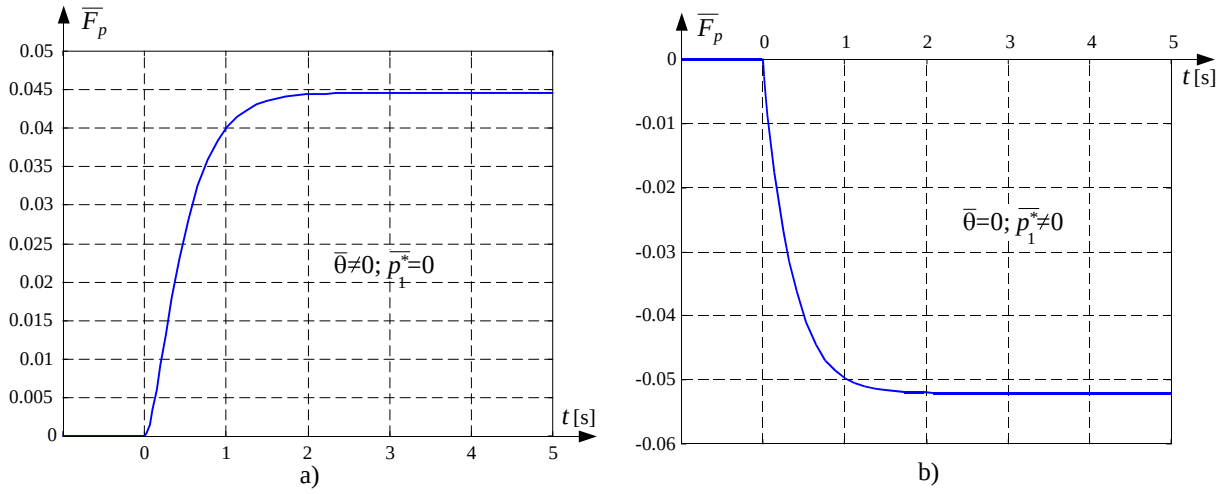


Fig. 4. EAS total thrust time behavior

5. CONCLUSION

This paper has studied an aircraft jet engine with afterburning as controlled object. Jet engine VK-1F was considered as basic engine and three controllers were theoretically adapted to it. Control laws were established in order to keep the embedded system stable running, no matter its operation regime and/or flight regime were. Those control laws were determined and verified for different cases and presented in some other papers.

Afterburning must be switched on only when basic engine has reached its maximal regime and should operate without influence above the basic engine's regime. Therefore, one has emphasized the inner feedback involving in the exhaust nozzle opening control, as well as in other main input parameters generating.

Some simulations were performed, using the mathematical model(s), for each system part, as well as for whole embedded system; two cases were studied, respectively the engine operation influence and the flight regime influence. Based on it, one has established system's quality, which has proved itself to be a stable one.

One also has considered the afterburning fuel pump driven by the engine's shaft. If one chooses to neglect it (because of its small speed variation range), one obtains insignificant differences, as shown in fig. 4.a, where the dashed line corresponds to this new situation.

The paper subject and used method can be extended for multi-spool jet engines with afterburning, as well as for further improved studies, concerning other engines, with different coefficient values.

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MULTI-RAMP FUEL INJECTION SYSTEM AUTOMATIC CONTROL

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Abstract: *This paper deals with a fuel injection system with multiple injector ramps. Fuel distribution (injection) is progressively achieved, being controlled by the injection pressure. The automatic control system operates as a follower system, realizing a proportional correspondence between throttle's position (displacement) and the injection fuel flow rate, as well an injection correction with respect to the air flow rate (air pressure behind the compressor). The author has determined a linearised adimensional mathematical model for the studied system and has built its block diagram with transfer functions; system's time behavior was also studied, based on some preformed simulations. A compared study was also discussed, between system's basic model and its simplified form, from the time behavior point of view. This kind of fuel system is useful for afterburning fuel systems, so it can be used for further studies concerning improvement possibilities, as well as for studies concerning its framing into more complex jet-engine control systems.*

Keywords: *fuel, injection, afterburning, control, pressure, jet engine, fuel-pump*

1. INTRODUCTION

Aircraft jet engines, as controlled objects, are multi-variable systems (multi-input and multi-output). The most important control parameter (input) is the fuel flow rate, both for basic engine and its afterburning system.

Fuel injection system is the most important control system, because it's accomplishing the engine's speed and/or combustor's temperature control and, eventually, engine's thrust control. Fuel injection control systems, based on different principles, are presented and studied in [8,9,10] and a fuel injection controller with correction sub-systems is studied in [11]. This kind of systems are meant to control, finally, engine's speed, using different feed-back methods and components, so fuel flow rate's level were established in order to accomplish the desired speed level, imposed by the throttle's position.

For an afterburner injection system the above-presented control possibilities are useless, because no speed-feed-back is possible and it is very difficult to design an appropriate control system and to build a reliable control scheme; afterburning system has as output parameters total thrust and afterburner's temperature, which are proportional to the fuel flow rate level; consequently, for the afterburning control, one has to use follower systems, in order to correlate the throttle's position with the desired thrust/temperature.

This paper deals with such a follower system, which establishes the correlation between the throttle's position and the injection fuel flow rate, corrected with the available air (burned gas) flow rate assure by the basic engine.

2. SYSTEM'S PRESENTATION

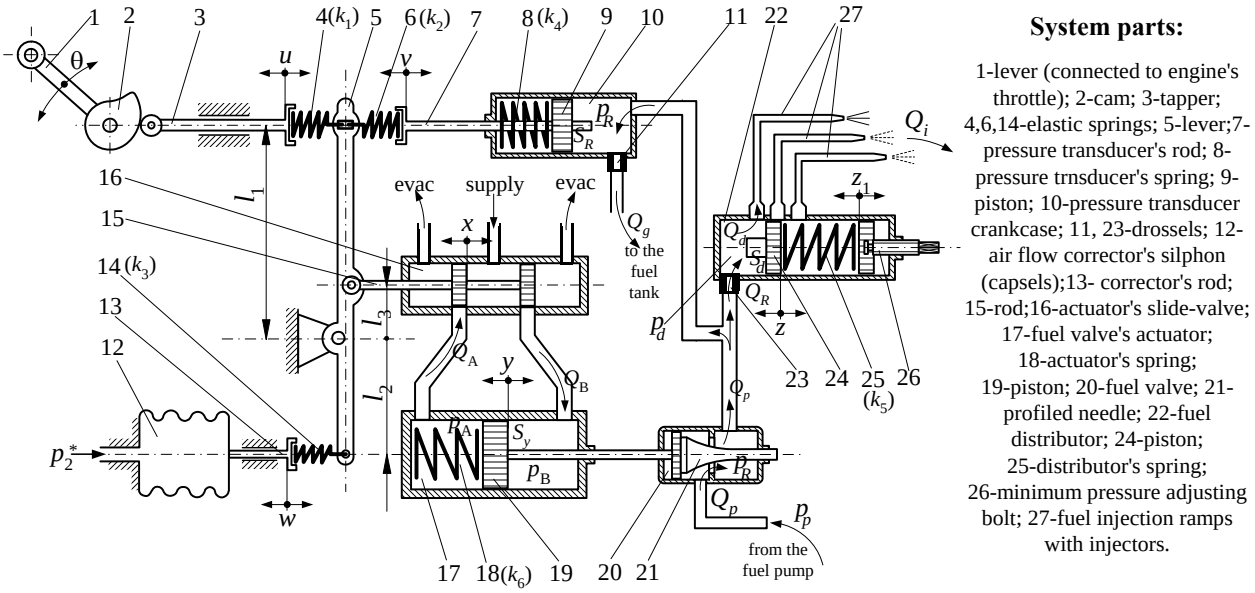

Fig. 1. Multi-ramp fuel injection automatic control system

A possible fuel injection system for an afterburner is shown in fig. 1. System's main parts are: a) throttle position transducer; b) air pressure corrector; c) fuel valve; d) fuel pressure transducer; e) fuel distributor with multi-ramp injection system.

The injected fuel flow rate is determined by the throttle's position and it's corrected with respect to the air flow rate (i.e. to p_2^* pressure behind engine's compressor); fuel's distribution is commanded by the distribution pressure p_d, which gives both the injection pressure p_i and the injection effective area A_i (i.e. number of active injectors / ramps with injectors).

Fuel valve's opening is commanded by the 17-actuator, which slide valve's positioning is the result of the balance between throttle's command, air flow correction and pressure feed-back (all of them acting on 5-lever).

Fuel supply is achieved by a fuel pump, driven by engine's shaft; behind the fuel valve, the pressure p_R is proportional to the input parameters' level (θ and p_2^*), while fuel injection is double-commanded by the 22-distibutor's pressure p_d. Fig. 2 shows how fuel flow rate Q_i and injector effective area A_i depend on distribution pressure. As the distribution pressure increases, more injectors (injection ramps) are consecutively supplied, so the flow rate is continuously increasing. One has also estimated an equivalent (corrected) flow rate behavior $(Q_i)_{\text{cor}}$, useful for further studies, also presented. Minimum distribution pressure value $(p_d)_{\min}$ is preset, during the ground tests, by the 26-adjusting bolt, which realizes a proportional pre-compression of the 25-spring. So, minimum value of the distribution pressure is

$$(p_d)_{\min} = \frac{k_5 z_1}{S_d}, \qquad (1)$$

where z_1 is spring's pretension. This minimum value is necessary to ensure an appropriate fuel jet shape (spreading and spraying).

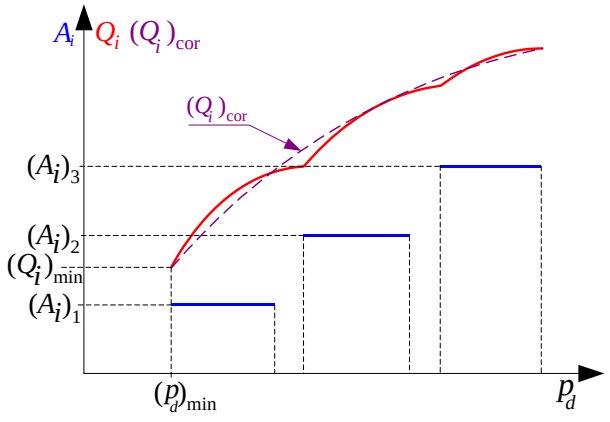

Fig. 2. Fuel flow rate versus distribution pressure

3. SYSTEM MATHEMATICAL MODEL

For each main system part one has to identify the motion equations, which are to be

processed, in order to bring them to an optimal form to be used for further studies.

3.1. Transducer's model

Input parameter transducer consists of:

- lever-cam-taper block;
- air pressure corrector block;
- fuel pressure feed-back actuator.

Their motion equations are

$$u = f(\theta), \tag{2}$$

$$v = k_s\sqrt{p_2^*}, \tag{3}$$

$$l_1(k_1u - k_2w) - l_2k_3v = l_3\left(m_{15}\frac{\mathrm{d}^2x}{\mathrm{d}t^2} + \xi\frac{\mathrm{d}x}{\mathrm{d}t}\right) \tag{4}$$

where u – taper's displacement, with respect to 2-cam's profile $f(\theta)$, v – air pressure corrector's rod displacement, w – feed-back's rod displacement, k_1, k_2, k_3 – springs' elastic constants, l_1, l_2, l_3 – 5-lever arms' length, x – actuator's slide valve's displacement, m_{15} – slide-valve's mass, ξ – viscous friction coefficient; k_s – silphon's (capsels') elastic constant, p_2^* – air pressure behind engine's compressor.

In order to make these equations more accessible for further operations, one has to linearise them and then bring them to non-dimensional forms, using finite differences method (as depicted in [6,8,9,10,11]). Equation system can be linearized based on the small perturbation hypothesis, considering formally any variable or parameter X as $X = X_0 + \Delta X$ and $\overline{X} = \frac{\Delta X}{X_0}$, where ΔX – parameter's deviation, X_0 – steady state regime's value and $\overline{X}$ – non-dimensional deviation.

Introducing the new form of each parameter into the above mentioned equation system and separating the steady state regime terms, one obtains a new form of the system, which becomes

$$\overline{u} = k_{\theta u}\overline{\theta}, \tag{5}$$

$$\overline{v} = k_{p2v}\overline{p_2^*}, \tag{6}$$

$$k_{ux}\overline{u} - k_{wx}\overline{w} - k_{vx}\overline{v} = s(\tau_x s + 1)\overline{x} \tag{7}$$

where the used annotations are

$$k_{\theta u} = \frac{\theta_0}{u_0}\left(\frac{\partial f}{\partial\theta}\right)_0,\ k_{p2v} = \frac{k_s\sqrt{p_{2_0}^*}}{v_0},\ k_{ux} = \frac{l_1k_1u_0}{\xi l_3x_0},$$

$$k_{wx} = \frac{l_1k_2w_0}{\xi l_3x_0},\ k_{vx} = \frac{l_2k_3v_0}{\xi l_3x_0},\ \tau_x = \frac{m_{15}}{\xi}. \tag{8}$$

3.2. Fuel valve actuator's model

As presented in [9], simplest actuator consists of a hydraulic cylinder commanded by a slide valve; its mathematical model is

$$\overline{y} = \frac{1}{\tau_y s + \lambda_y}\overline{x}, \tag{9}$$

where

$$\tau_y = \frac{S_y}{\mu_s b_s}\frac{y_0}{x_0}\sqrt{\frac{\rho_h}{p_{hs}}},\ \lambda_y = \frac{k_6y_0}{2S_yp_{hs}}, \tag{10}$$

S_y – actuator piston's area, μ_s – flow rate coefficient, b_s – slide valve's slots width, k_6 – actuator spring elastic constant, ρ_h – hydraulic fluid density, p_{hs} – hydraulic supply pressure.

3.3. Fuel valve equations

Fuel valve's profiled needle's positioning determines both the flow rate through the valve and the pressure p_R behind it, which is used in the feed-back actuator (pressure transducer 10). Valve's model, together with pressure transducer's model, consists of

$$Q_p = \mu_v A(y)\sqrt{\frac{2}{\rho}}\sqrt{p_p - p_R}, \tag{11}$$

$$Q_R = \mu_{23}\frac{\pi d_{23}^2}{4}\sqrt{\frac{2}{\rho}}\sqrt{p_R - p_d}, \tag{12}$$

$$Q_g = \mu_g \frac{\pi d_g^2}{4}\sqrt{\frac{2}{\rho}}\sqrt{p_R}, \quad (13)$$

$$Q_p - Q_R - Q_g = \beta V_{R0}\frac{\mathrm{d}p_R}{\mathrm{d}t} + S_R\frac{\mathrm{d}w}{\mathrm{d}t}, \quad (14)$$

$$S_R p_R = m_9\frac{\mathrm{d}^2 w}{\mathrm{d}t^2} + \xi\frac{\mathrm{d}w}{\mathrm{d}t} + k_4 w, \quad (15)$$

where Q_p – fuel pump flow rate, Q_R – distributor's input flow rate, Q_g – discharge flow rate, μ_v, μ_{23}, μ_g – flow coefficients, d_{23}, d_g – drossels' diameters, ρ – fuel density, β – compressibility coefficient (assumed as null for fuel), S_R – transducer's piston area, m_9 – transducer's piston+rod mass, k_4 – transducer spring elastic constant, $A(y)$ – fuel valve effective area, depending on 21-profiled needle shape.

Introducing (10), (11) and (12) in (13), after same method applying, one obtains

$$\overline{w} = \frac{k_{wR}}{T_w^2 \mathrm{s}^2 + 2\omega_0 T_w \mathrm{s} + 1}\overline{p}_R, \quad (16)$$

$$\overline{p}_R = k_{Ry}\overline{y} + k_{Ra}\overline{p}_p + k_{Rd}\overline{p}_d - \tau_w \mathrm{s}\overline{w}, \quad (17)$$

where

$$k_{wR} = \frac{S_R p_{R0}}{k_4 w_0}, T_w = \sqrt{\frac{m_9}{k_4}}, \omega_0 = \frac{\xi}{2\sqrt{m_9 k_4}},$$

$$k_{yy} = \left(k_{pp} + k_{Rp} + k_{gR}\right)p_{R0}, k_{Ry} = \frac{k_{py} y_0}{k_{yy}},$$

$$k_{Ra} = \frac{k_{pp} p_{p0}}{k_{yy}}, k_{Rd} = \frac{k_{Rp} p_{d0}}{k_{yy}}, \tau_w = \frac{S_R w_0}{k_{yy}},$$

$$k_{py} = \mu_v\sqrt{\frac{2}{\rho}}\left(\frac{\partial A_y}{\partial y}\right)_0\sqrt{p_{p0} - p_{R0}},$$

$$k_{pp} = \frac{\mu_v A_{y0}}{\sqrt{2\rho\left(p_{p0} - p_{R0}\right)}}, k_{gR} = \frac{\mu_g \pi d_g^2}{4\sqrt{2\rho p_{R0}}},$$

$$k_{Rp} = \frac{\mu_{23}\pi d_{23}^2}{4\sqrt{2\rho\left(p_{p0} - p_{R0}\right)}}. \quad (18)$$

3.4. Distributor mathematical model

Multi-ramp fuel injection distributor's motion equations are

$$Q_d = \mu_d b_d z\sqrt{\frac{2}{\rho}}\sqrt{p_d - p_i}, \quad (19)$$

$$Q_R - Q_d = \beta V_{R0}\frac{\mathrm{d}p_d}{\mathrm{d}t} + S_d\frac{\mathrm{d}z}{\mathrm{d}t}, \quad (20)$$

$$S_d p_d = m_{24}\frac{\mathrm{d}^2 z}{\mathrm{d}t^2} + \xi\frac{\mathrm{d}z}{\mathrm{d}t} + k_5 z, \quad (21)$$

$$Q_i = \mu_i A_i(z)\sqrt{\frac{2}{\rho}}\sqrt{p_i}, \quad (22)$$

$$Q_d = Q_i. \quad (23)$$

where μ_d, μ_i – flow rate coefficients, b_d – slot width, z – distributor's piston displacement, S_d – distributor's piston area, p_i – injection pressure, m_{24} – distributor's piston mass, k_5 – distributor's spring elastic constant, $A_i(z)$ – injectors' effective area.

Fuel distributor linearised adimensional mathematical model becomes

$$\overline{p}_d = k_{di}\overline{p}_i + k_{dR}\overline{p}_R - k_{zp}\left(\tau_z \mathrm{s} + 1\right)\overline{z}, \quad (24)$$

$$\overline{z} = \frac{k_{zd}}{T_z^2 \mathrm{s}^2 + 2\omega_1 T_z \mathrm{s} + 1}\overline{p}_d, \quad (25)$$

$$\overline{p}_i = k_{id}\overline{p}_d + k_{zz}\overline{z}, \quad (26)$$

$$\overline{Q}_i = k_{Qi}\overline{p}_i + k_{Qz}\overline{z}, \quad (27)$$

where $k_{ii} = \left(k_{ip} + k_{dp}\right)p_{d0}$, $k_{di} = \frac{k_{dp} p_{i0}}{k_{ii}}$,

$$k_{dR} = \frac{k_{Rp} p_{R0}}{k_{ii}}, k_{zp} = \frac{k_{dz} z_0}{k_{ii}}, \tau_z = \frac{S_d}{k_{dz}},$$

$$k_{zd} = \frac{S_d p_{d0}}{k_5 z_0}, T_z = \sqrt{\frac{m_{24}}{k_5}}, \omega_1 = \frac{\xi}{2\sqrt{m_{24} k_5}},$$

$$k_{id} = \frac{k_{dp} p_{d0}}{k_{ii}}, k_{zz} = \frac{\left(k_{dz} - k_{iz}\right)z_0}{k_{ii}}, k_{Qz} = \frac{k_{iz} z_0}{Q_{i0}},$$

$$k_{Qi} = \frac{k_{ip} p_{i0}}{Q_{i0}}, k_{dp} = \frac{\mu_d b_d z_0}{\sqrt{2\rho\left(p_{d0} - p_{i0}\right)}},$$

$$k_{dz} = \mu_d b_d\sqrt{\frac{2\left(p_{d0} - p_{i0}\right)}{\rho}}, k_{ip} = \frac{\mu_i A_{i0}}{\sqrt{2\rho p_{i0}}},$$

$$k_{iz} = \mu_i\left(\frac{\partial A_i}{\partial z}\right)_0\sqrt{\frac{2 p_{i0}}{\rho}}. \quad (28)$$

Fuel injection control system's linear adimensional mathematical model consists of equations (5), (6), (7), (9), (16), (17), (24), (25), (26) and (27). Based on these equation, one has built system's block diagram with transfer functions, as fig. 3 shows.

4. SIMPLIFIED MATHEMATICAL MODEL. TRANSFER FUNCTIONS

Assuming that both friction effects and inertial effects are insignificant, so negligible,

one has obtained some simpler forms for the equations, which contain terms involving mass, friction coefficients and compressibility coefficients. New forms are

$$k_{ux}\bar{u} - k_{wx}\bar{w} - k_{vx}\bar{v} = s\bar{x}\,, \tag{29}$$

$$w = k_{wR}\bar{p}_R\,, \tag{30}$$

$$\bar{z} = k_{zd}\bar{p}_d\,. \tag{31}$$

System's model becomes simpler

$$\bar{Q}_i = \frac{k_{si}\left(k_{\theta i}\bar{\theta} - k_{p2i}\bar{p}_2^*\right)}{a_4 s^4 + a_3 s^3 + a_2 s^2 + a_1 s + a_0}\,, \tag{32}$$

so, system transfer functions are

$$H_\theta(s) = \frac{k_{si}k_{\theta i}}{a_4 s^4 + a_3 s^3 + a_2 s^2 + a_1 s + a_0}\,, \tag{33}$$

$$H_{p2}(s) = -\frac{k_{si}k_{p2i}}{a_4 s^4 + a_3 s^3 + a_2 s^2 + a_1 s + a_0}\,; \tag{34}$$

coefficients' expressions are very complicated, but this new form of the mathematical model is much more accessible and usable for further applications and studies.

An observation should be made, regarding the term which contains p_p. One has assumed the pump pressure as constant, being created by the fuel pump which operates at constant regime. However, if one takes into account that the fuel pump is driven by the engine's shaft, as well as the fuel pump characteristic (dependence between engine-pump speed and supplying pressure), the transfer function must be completed with a term containing engine speed parameter, as follows

$$\bar{Q}_i = \frac{k_{si}\left[k_{\theta i}\bar{\theta} - k_{p2i}\bar{p}_2^* + \left(b_2 s^2 + b_1 s + b_0\right)\bar{n}\right]}{a_4 s^4 + a_3 s^3 + a_2 s^2 + a_1 s + a_0}\,. \tag{35}$$

5. SYSTEM'S QUALITY

Based on system's mathematical model, as well as on the above presented block diagram with transfer functions, one has performed some simulations in order to establish system's

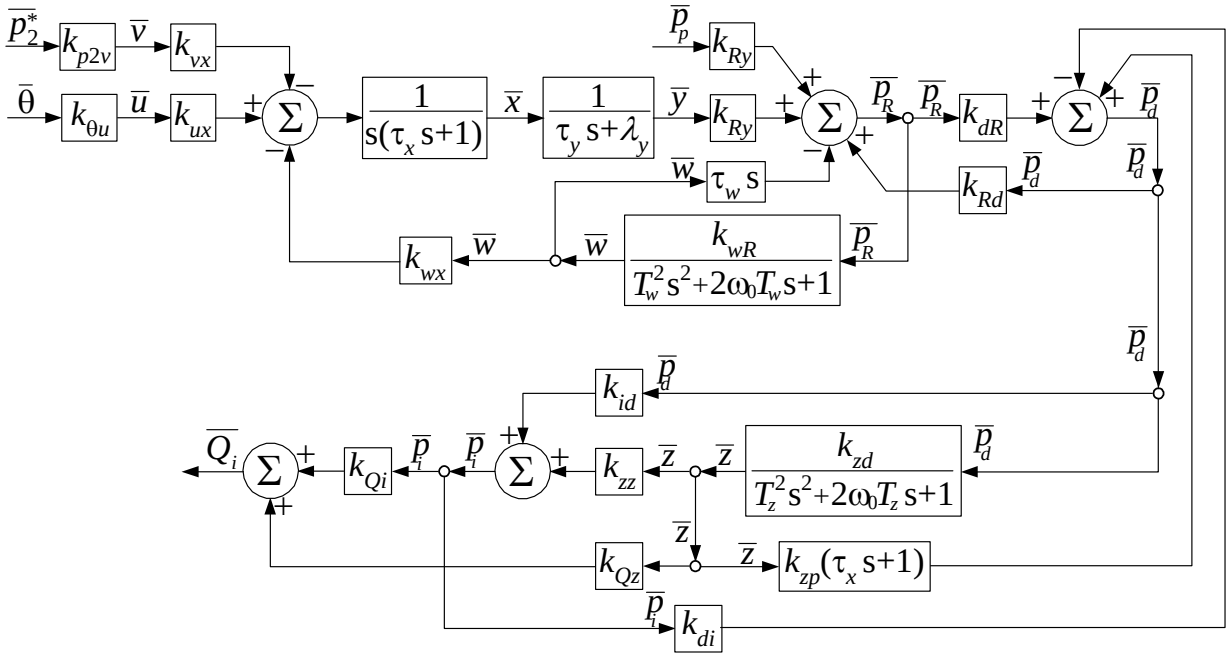

Fig. 3. System's block diagram with transfer functions

time behavior for step input(s).

Equations' coefficients were calculated for a hypothetically usage of the fuel system on a VK-1F type jet engine and implemented in the simulation scheme based on the above-presented block diagram with transfer functions. For this simulation one has neglected the fuel pump influence, considering that fuel pressure is kept constant (e.g. by using a constant pressure valve), so $\overline{p}_p = 0$.

The simulation was performed in two cases

a) step input for throttle's position and constant air flow (air pressure);

b) step input for air pressure and fixed throttle position.

Main output parameter is the fuel flow rate $\overline{Q}_i$, but one has also studied secondary output parameters, such as transducer lever dis-

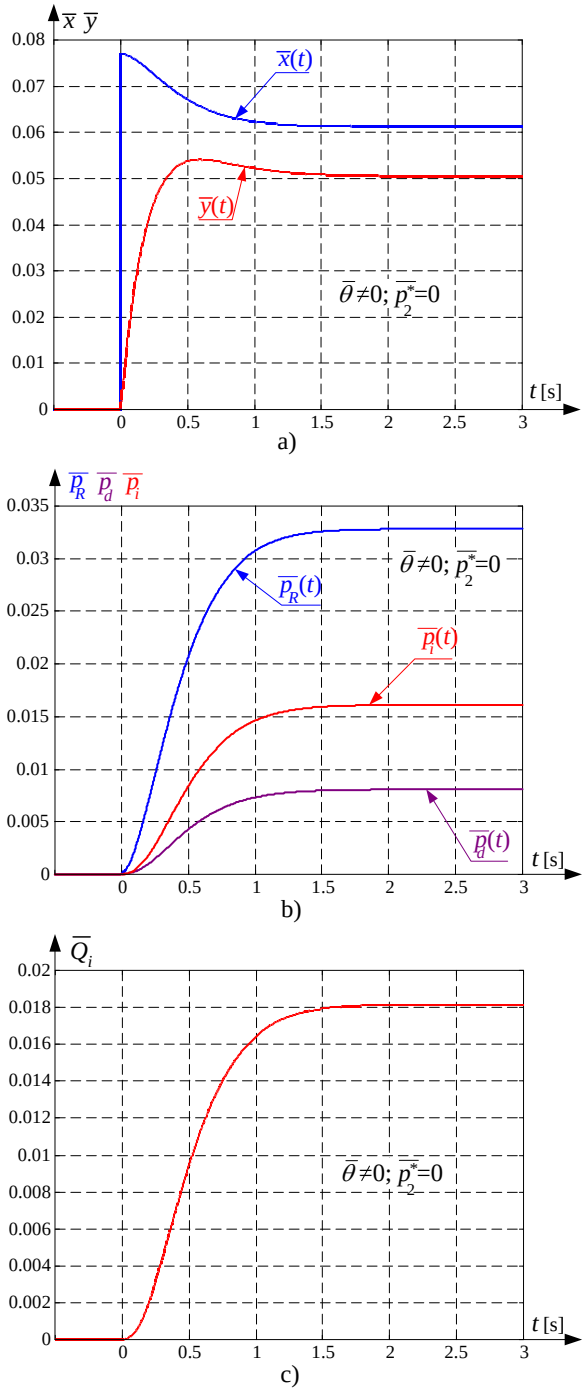

Fig. 4. System step response for $\overline{\theta}$ throttle position parameter step input and constant $\overline{p}_2^*$ air pressure parameter

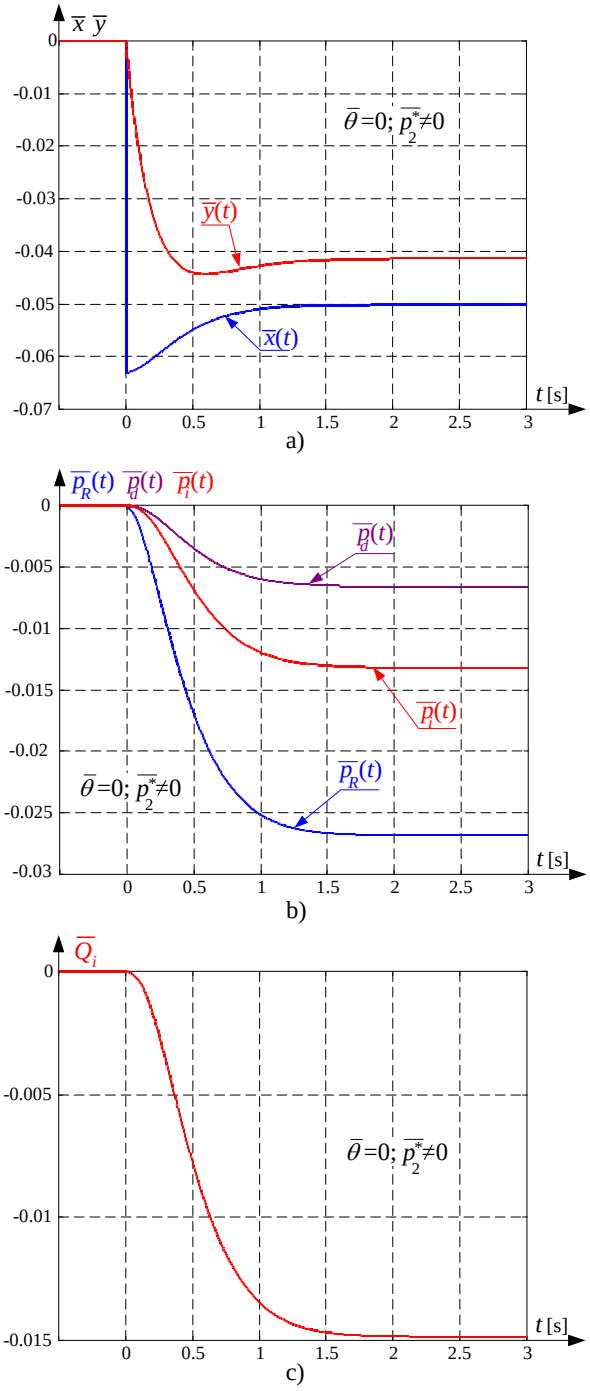

Fig. 5. System step response for $\overline{p}_2^*$ air pressure parameter step input and constant $\overline{\theta}$ throttle position parameter

placement $\bar{x}$ and profiled needle displacement $\bar{y}$, as well as fuel pressures $\bar{p}_R, \bar{p}_d$ and $\bar{p}_i$.

Simulation results, based on system's mathematical model, are presented in fig. 4 (case *a*) and 5 (case *b*), containing step responses for all the above-mentioned parameters.

As fig. 4.a and 5.a show, both $\bar{\theta}$ and $\bar{p}_2^*$ step input determine similar behavior for $\bar{x}$ and $\bar{y}$; after an initial "jump", transducer's lever displacement $\bar{x}$ asymptotically stabilizes with an important static error $(5\% \div 6\%)$; fuel valve's profiled needle's displacement $\bar{y}$ asymptotically stabilizes (static error between 4% and 5%), but after a small initial override. Response time, for both parameters and for both of cases is around $(1.5 \div 2)$ s, which is an acceptable value.

Fuel pressure parameters, as fig. 4.b and 5.b shows, have aperiodic behavior and very small static error values (between 0.5% and 3.2%), especially for the distribution pressure parameter; response times, acceptable as values, are the same, between 1.5 s and 2 s.

Main parameter's $\bar{Q}_i$ behavior, in both of studied cases, is aperiodic, with acceptable

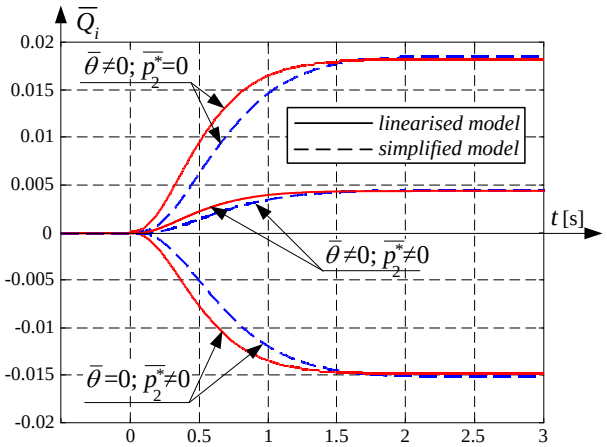

Fig. 6. Fuel flow rate behavior given by the complete model and by the simplified model

static errors (around 1.8%) and acceptable response time values (1.5 to 2.5 s).

In order to facilitate system mathematical model for more complex control schemes simulation, one has determined system's simplified model. A comparison between the complete model and the simplified model was realized, from their time behavior point of view. The simulation results were presented in fig. 6.

Simplified mathematical model expression, determined for the above-mentioned condition, which was used for the graphics in fig. 6 is

$$\bar{Q}_i = \frac{4.957\left(0.448\bar{\theta} - 0.397\,\bar{p}_2^*\right)}{s^4 + 15.01s^3 + 88.93s^2 + 172.11s + 119.94} \tag{36}$$

Time behavior for the simplified system is also presented in fig. 6 (dashed line), while time behavior for the complete model is presented with continuous line.

Some observations can be made, concerning the situation in fig. 6. One has studied system's quality for both already discussed situations (first $\bar{\theta}$, second $\bar{p}_2^*$ step input), as well as for a combined step input of $\bar{\theta}$ and $\bar{p}_2^*$. No matter the situation were, system's time behavior is a stable one; the difference between the static errors is insignificant and the dynamic regime in either case is very similar. Consequently, the simplified mathematical model provides sufficient accuracy to be used instead of the complete model.

When the fuel pump influence must be revealed, instead of eq. (32) (particularly (36)), one has to use eq. (35) as follows

$$\bar{Q}_i = \frac{4.957}{s^4 + 15.01s^3 + 88.93s^2 + 172.11s + 119.94} \times \left[0.448\bar{\theta} - 0.397\,\bar{p}_2^* + \left(0.023s^2 + 0.062s + 0.076\right)\bar{n}\right] \tag{37}$$

The above-presented form is useful for embedded engine control system studies.

CONCLUSION

This paper has presented a fuel injection system, working as follower system, with respect to the engine's throttle's position and being assisted by an air pressure corrector. Fuel injection is assured by a fuel distributor with multiple injection ramps, which are progressively activated as distribution pressure grows and distributor's piston forwards.

One has built system's mathematical model, which was linearised and brought to an adimensional form, appropriate for further studies. Based on it, system's block diagram with transfer functions was built. Assuming some simplifying hypothesis, a much simpler system form was issued, more appropriate for study and for further similar applications.

The performed simulations have shown an appropriate system quality, which means asymptotic output parameters' stabilization, small static errors and small response time.

This fuel system can't be implemented for jet engines control, because its lack of an effective speed feed-back possibility, but it's recommended for afterburning control; it may be included in a more complex control system, for example for an embedded propulsion system (jet engine+afterburning).

The employed method and some of the obtained results could be extended for similar further studies (such as follower systems, complex fuel injection systems, embedded jet engine control systems etc.).

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IMAGE FUSION BASED ON WAVELET TRANSFORM

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Abstract: *Image fusion is based on a series of methods in order to integrate images from more of one sensor in to one image, more suitable for human eye or computer sequential processing. This article presents few theoretical methods for image fusion. The results of experimental image fusion, using algorithms developed by the research team revealed advantages like increase of spectral domain, and difficulties regarding image fusion process.*

Keywords: *image, fusion, transform, wavelet, Haar.*

1. INTRODUCTION

In nature, the concept of multisensor data fusion is hardly new. Humans and animals have evolved the capability to use multiple senses to improve their ability to survive. For example, it may not be possible to assess the quality of an edible substance based solely on the sense of vision or touch, but evaluation of edibility may be achieved using a combination of sight, touch, smell, and taste. Thus multisensor data fusion is naturally performed by animals and humans to achieve more accurate assessment of the surrounding environment and identification of threats, thereby improving their chances of survival.[1]

2. DEFINITION OF FUSION

With the development of multiple types of biosensors, chemical sensors, and remote sensors on board satellites, more and more data have become available for scientific researches. As the volume of data grows, so does the need to combine data gathered from different sources to extract useful information. Since early 1990's, "Data fusion" has been adopt and widely used. The definition of data fusion/image fusion varies:

- Data fusion is a process dealing with data and information from multiple sources to achieve refined/improved information for decision making (Hall 1992) [1];
- Image fusion is the combination of two or more different images to form a new image by using a certain algorithm (Genderen and Pohl 1994) [3];
- Image fusion is the process of combining information from two or more images of a scene into a single composite image that is more informative and is more suitable for visual perception or computer processing. (Guest editorial of Information Fusion, 2007) [4].
- Image fusion is a process of combining images, obtained by sensors of different wavelengths simultaneously viewing of the same scene, to form a composite image. The composite image is formed to improve image content and to make it easier for the user to detect, recognize, and identify targets and increase his situational awareness. 2010.[5]

Simultaneous with de recent developments in multisensor systems area used in different

domains like medicine (diagnostics), security, defense, the quantity of data available increased significant. Image fusion is an alternative for decreasing date information volume and extraction of most usefully information for source images.

Data generated from many sensors represent complementary information about surveyed region. Fusion give an efficient method to reduce the volume of data by creating compatible images with perception capability of human operator by completing image processing tasks like: image segmentation, object detection or target recognition.

Multi-sensor images often have different geometric representations, which have to be transformed to a common representation for fusion. This representation should retain the best resolution of either sensor. A prerequisite for successful in image fusion is the alignment of multi-sensor images.

Image fusion does not necessarily imply multi-sensor sources; fusion images can be obtained using one sensor, and can be used in application like intrusion detection. [10]

3. IMAGE FUSION PROCESS ARCHITECTURE

Data fusion technology for multisensor systems is rapidly evolving. There are a lot of research into the development of new algorithms and improvement the old ones for understanding how their will be use in methods of fusion for various applications. [1]

The most mature image fusion process is the processing of Level 1 (JDL model) using data from multi-sensor systems for detection and identification of various properties of different objects or entities. [1]

A special problem in the processing of Level 1 is the development of robust systems in terms of identification of the targets on the basis of the characteristics or attributes determined. Currently, object recognition is dominated by methods based on shapes that are used in relationship with a database of known objects.

Processing level 2 or 3 (JDL model) currently are not fully mature, the systems are being implemented in the state of prototype or experimental model stage. The main challenges in this area are represented by a set of rules or methods that provide support to the process of assessing the situation and threats. [1]

4. FUSION PROCESSES BASED ON WAVELET TRANSFORM

Discrete wavelet transform decompose the image into a set of coefficients which records image information and then can be combined in order to obtain fusion images. The key method for using the wavelet transform image fusion is the combining of coefficients to obtain high quality image. The simplest method is the use of fusion in the reconstruction process of the average image fusion coefficients fused images. [8]

According to [9], the fusion aim to obtain a high spatial resolution and also high quality spectral information of from two types of images provided by the sensors or to obtain high spatial resolution with a single spectral band.

The first discrete wavelet transform was invented by Alfred Haar for the case of an input represented by a string of 2^n numbers. Haar transform groups input values recorded using forward differences and sums. This process is repeated recursively grouping amounts to give the following scale. Finally, are determined 2^n-1 differences and a final sum.

Another intensively used transform is the Daubechies wavelet which is based on a recurrence relation that generates progressive functions, fine copy of mother wavelet, each resolution is two times lower than the previous one.

Other forms of discrete wavelet transform include Dual-Tree Complex Wavelet Transform, Newlan transform, wavelet transform complex etc

For Haar wavelet transform decomposition process can be represented using a decomposition tree (Figure 1).

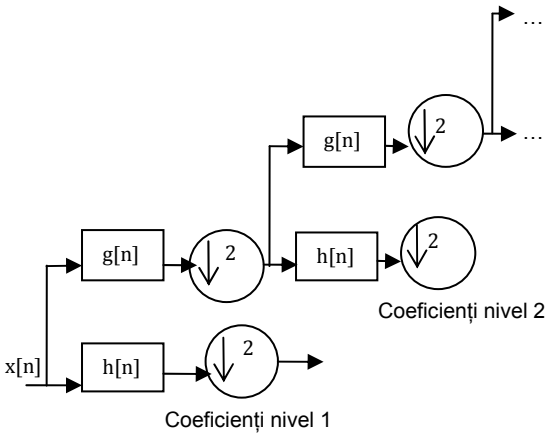

Figure1 Level 2 decomposition process

From the point of view of image processing algorithm, experimental results were obtained using it theory of Haar wavelet transform. Following the scheme presented in Figure 2, it can be separated into five sections: image data acquisition, image transformation, wavelet transform coefficients fusion, image inverse transformation and image display.

Analysis of the experimental results allowed drawing a series of conclusions regarding the ways of achieving fusion with emphasis on methods of combining decomposition and transform coefficients, with implications for the geometric approximation image and resolution and in the future research directions that involve the development of additional algorithms designed to improve the detection and identification of targets.

Geometric harmonization process is very important in order to obtain quality image fusion. It grows in complexity with fusion images structure differences and with objects representation. Reducing the complexity of the approximation can be made from the level sensors and related optical systems.

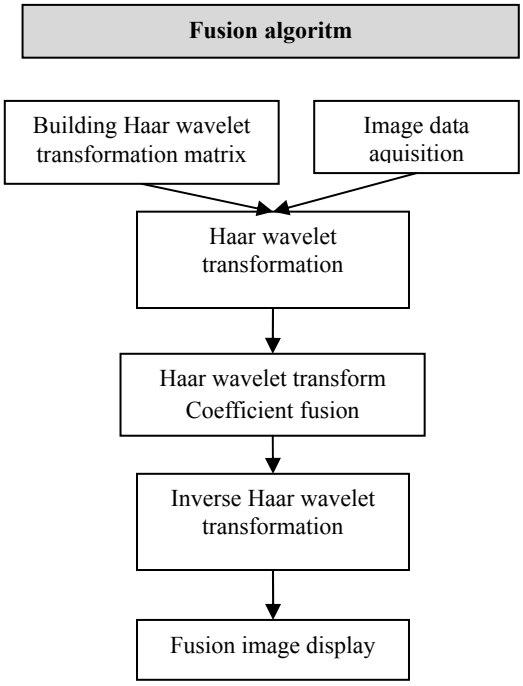

Figure 2 Image fusion algorithm

For high quality image fusion and to avoid errors in assessing the relative position between the constituent objects of the scene, it is necessary, before the fusion, the two images to be related from the point of view of the geometrical parameters. For considering geometric similarity are taken mainly three criteria: size, orthoscopy (likeness) and images alignment.

4. CONCLUSIONS

For observation and surveillance systems, image fusion quality requirements are not very high, detection and recognition of targets can be achieved also in case of imperfect representation overlapping of objects in different spectral ranges. For other applications such as medical diagnosis, aiming and tracking systems, mapping systems, is required a judicious harmonization of

geometric shapes to allow detection, recognition and identification with high accuracy. [10]

Experimental results analysis generated conclusions about method of fusion, focusing on methods of decompositions and combining for transform coefficients, with implications in image geometric preprocessing and resolution changes, and also about future research directions which involve development of supplementary algorithms for improving detection and identification.

In order to obtain high quality fusion images, is very important to preprocess geometrically the images for fusion. Preprocessing became more complex with the differences between structure and representation of the same object. Reduction of preprocessing can be made from the level of sensors and deserving optical systems. [10]

Using Haar wavelet transform has allowed, through an easy to use method, the study of fusion process in laboratory condition using unspecialized video/photo systems. The result were very important in the process of construction of an experimental and theoretical expertise from the point of view of signal processing, fusion algorithms construction and optical designing.

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REAL-LIFE RELIABILITY AND RADIO FREQUENCY IMMUNITY TEST LIMITS

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Abstract: *Any product manufacturer is trying to create more reliable equipments, to reduce warranty costs and to have satisfied customers. It has to be properly assessing the real-life electromagnetic environment in which the equipment will operate and think proper testing procedures. The EMC Directive 2004/108/EC is supporting manufacturers by establishing a set of standard immunity tests, considered minimal, which products must pass. Passing standard immunity tests, no matter how strict and comprehensive, even military or automotive ones, does not guarantee perfect functioning in the real-life electromagnetic environment. It is imperative to always consider immunity standards limits. This article deals with the limits of standard SR EN 61000-4-6 "Immunity to conducted disturbances induced by radio frequency fields", relative to real-life electromagnetic environment.*

Keywords: *radio frequency, disturbances, immunity, reliability, limits*

1. INTRODUCTION

Environment, in terms of electromagnetic compatibility (EMC), is a electromagnetic disturbances environment. Disturbances can be classified by different criteria in: narrow and broadband; low and high frequency; continuous or transient; conducted or radiated; common or differential mode. They may be conducted into or out of apparatus, in differential or common mode, as continuous RF or transients, on either or both of the mains supply and signal ports [1,2,9].

There are two ways to report the disturbance to a reference, common mode when the signal is seen as reported to a common reference (PE-Protective Earth often) and differential mode when the signal is the difference of electric potential between two ports of the equipment.

In Figure1 top, common and differential mode voltage is defined, bottom the voltages waveforms is shown, V_1 and V_2 are sinusoidal voltages.

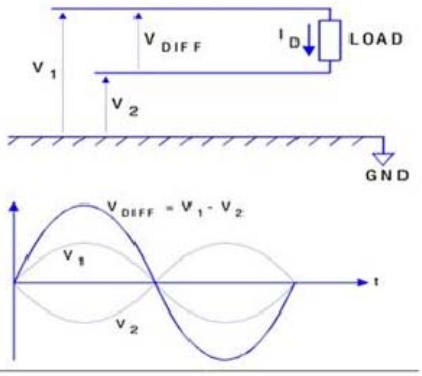

Fig. 1. Common and differential mode voltages definition

For two systems connected by lines L_1 and L_2, with a common reference plane common and differential mode currents are shown in Figure 2.

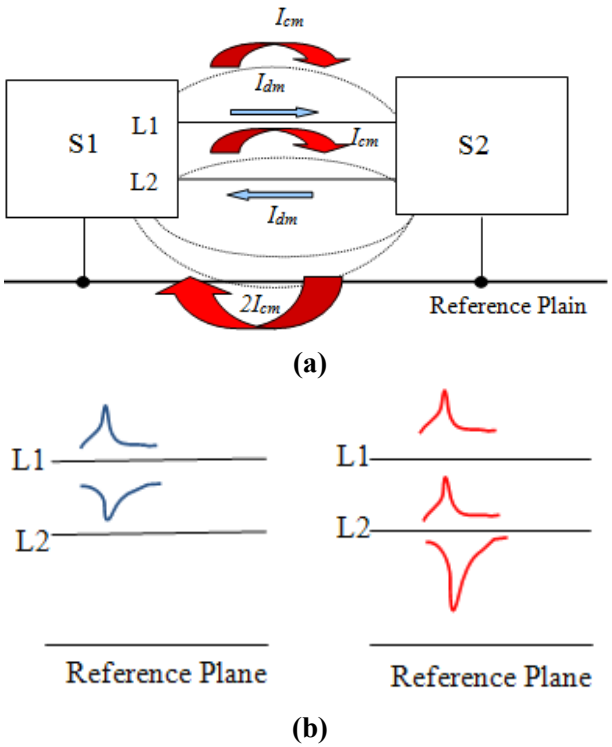

Fig. 2. Comuun and differential mode currents loops (a), Current pulse shape (b)

The standard SR EN 61000-4-6, works with common mode voltages in 150 kHz- 80 MHz frequency range

2. COUPLING PATH AND INTERFERENCE MECHANISM

The presence of mobile phones , Wi-Fi and Bluetooth devices in the vicinity of various electronic equipments, is common place, and it is a fact that cannot be predicted and entirely avoided [8]. Most of electric and electronic equipments fit in a cube with sides of 40 cm. They are small relative to the RF disturbances wavelengths.

Cables connected to ports, with lengths of several meters (mains cables - 1.5 m, communication cables - 2-10 m, interface cables - 1.5 - 5 m) act as more or less effective receiving antenna networks. So, an ordinary mains cable, with length of 1.5 m, becomes a $\lambda/4$ or $\lambda/2$ receiving antenna, for disturbances of 50 MHz, respectively, of 100 MHz, according to equation $f = c/\lambda$.

Cable networks, connected to equipment, as receiving antennas, generate at their ports common mode voltages, as a potential difference between a port and the protective earth.

There are three interference mechanisms [7]:

- Direct interference: RF disturbance frequency is close enough to a electronic circuit digital signal frequency or one of its harmonics.
- Rectification/Demodulation: A semiconductor has a non-linearly, a square law response to low voltages, such as disturbances, so that positive –going part of the disturbance is significantly greater than negative-going part, and a d.c. offset is generated with a level related to disturbance's level. This is the so called Rectification. An amplitude modulated RF disturbance, creates a variable d.c. offset, and results a demodulated signal, Figure 3.

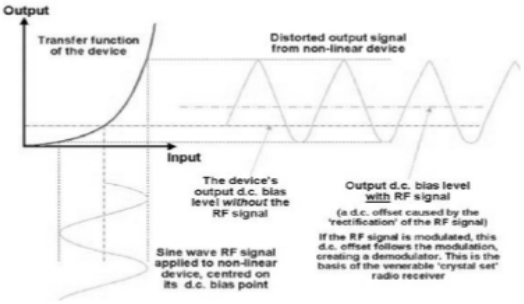

Fig. 3. Disturbance rectification

- Intermodulation: the same time presence of two disturbances, having the frequencies f_1 and f_2, generates f_1-f_2 and f_1+f_2 disturbances, Figure4.

The number of intermmodulation disturbances greats significantly if there are more frequencies implied; e.g.: if three initial frequencies, than eight intermodulation children are born.

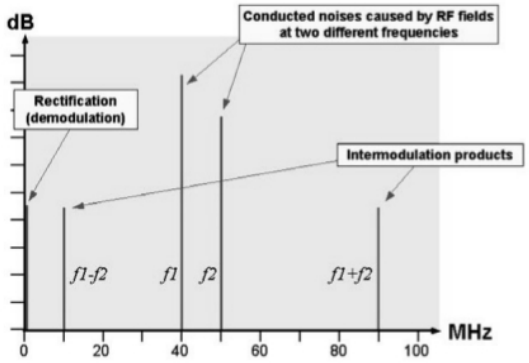

Fig.4. Disturbance intermodulation

3. IMMUNITY TEST LIMITS

The immunity testing method regulated by SR EN 61000-4-6:2009 standard defines electromagnetic environment types, and accordingly, voltage test levels: Level 1- 1V, Level 2- 3V, Level 3- 10V, Level X- Special.

SR EN 61000-4-6:2009, imposes parameters and wave shape for RF disturbances. Frequency range is 150 kHz – 80 MHz. The disturbances are sinusoidal un-modulated signals and amplitude modulated ones, depicted modulating signal has 1 kHz, in the range of an intelligible human conversation (between 1 kHz and 2 kHz). During the test, disturbances are coupled to mains cables by Coupling Decoupling Network (type CDN M3), having common mode impedance of 100 Ω. The CDN, on one hand, injects, by a RC network, common mode disturbances to Equipment Under Test (EUT), and on the other hand, rejects by a high impedance RF disturbances from the mains

Regarding the standard SR EN 61000-4-6 limits, relative to real-life electromagnetic environment they refer to the way disturbances are applied: only to one port, than, in turn, to all the others. In fact, the RF disturbances enter simultaneously on all ports. But taking into account the difficulties and costs of applying by CDNs, disturbances to all ports simultaneously, this is the regulated procedure.

Another limit refers to 150 kHz-80 MHz frequency range. There are many types of equipment, such as switch-mode converters working below 150 kHz, many transmitted signals are modulated by frequencies below 150 kHz. Meanwhile, GHz order disturbances may generate intermodulation products below 150 kHz.

Disturbance signal modulation, only at 1 kHz, as regulated by standard, is an unrealistic approach of real-life electromagnetic environment, characterized by the simultaneous existence of multiple modulation frequencies, none of 1 kHz. May be used a modulating frequency range, according to the electromagnetic environment the equipment will work.

The standard SR EN 61000-4-6, uses only common mode disturbances, so the case of differential mode disturbances, generated by switch-mode power converters, working below 10 MHz is inaccessible.[7]

3. CASE STUDY

The frequency at which a equipment has high susceptibility, correlated with the real-life electromagnetic environment in which it will work, is of prime importance for its reliability. A PC switching-mode power supply, a ubiquitous subassembly, a essential part of a computer is very suitable to be tested in terms of susceptibility to radio frequency disturbances.

The general view of test set-up is shown in Figure 5 and the mounting diagram according SR-EN 61000-6-4 is shown in Figure 6.

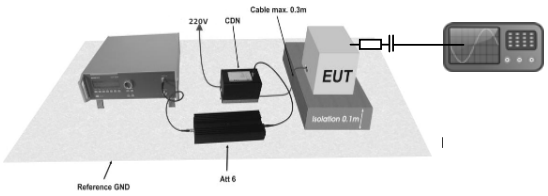

Fig.5. General view of test setup

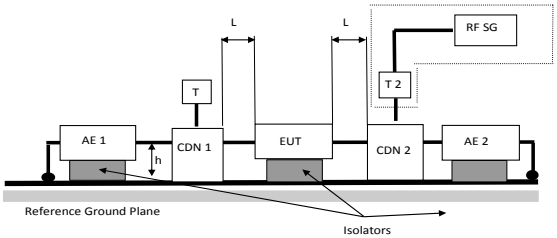

Fig.6. Mounting diagram, according SR-EN 61000-6-4 (0.1m<L<0.3m; 30mm<h<50mm)

The results of the test with un-modulated sinusoidal disturbance, Level 1 of 1 V, in 150 kHz-80 MHz range, injected into the mains cables of the EUT (the switching power supply), by the generator, through a 6 dB attenuator, and then by a CDN-M3 [15], are shown in Figure7.

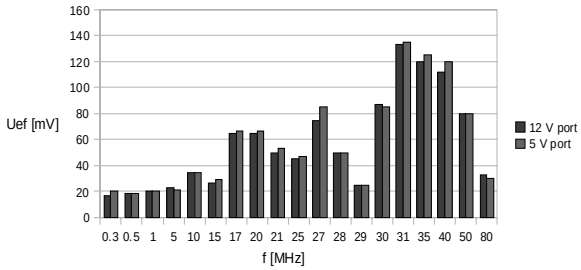

Fig.7. Switching-mode power supply frequency response

It can be underlined that the Power Supply has high susceptibility in 30 – 40 MHz range, but output disturbances do not exceed 3 % of the output voltage, less than 150 mV, at the 5 V output.

5. CONCLUSIONS

Passing standard immunity tests, even military or automotive ones, does not guarantee perfect functioning, we have to consider their limits. This article highlights the limits of the standard SR EN 61000-4-6, relative to real-life electromagnetic environment. It's regulations, regarding the way electromagnetic disturbances apply to equipment's ports, disturbance's mode (common mode), frequency range, the frequency of the modulating signal (1 kHz), are giving standard's limits too. The standard is only partially suitable for a more nuanced reality.

The EMC expert has to properly assess the real-life electromagnetic environment in which the equipment will operate, to find and remove susceptibilities, to achieve safety and reliable products.

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4. ENGINEERING SCIENCES

4.2 MECHANICAL ENGINEERING MATERIALS AND TECHNOLOGY

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INVESTIGATION OF THE POSSIBILITIES TO IMPROVE THE DYNAMIC PERFORMANCES OF DAC 2.65 FAEG LIGHT OFF-ROAD ARTICULATED VEHICLE

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Abstract: *A light off-road articulated vehicle is a vehicle with maximum weight less than three tones and consisting of two equal vats connected to each other through a central pivoting bearing which allows moving both parts around the vehicle longitudinal central axis. This type of vehicle is very rare. Generally, it has stayed at a prototype stage. One of these type of prototype is DAC 2.65 FAEG which were made in Brasov, Romania and it is studied inside of the laboratories from "Henri Coandă" Air Force Academy. At the beginning of 90s the prototype DAC 2.65 was the subject of systemic tests organized in civil and military areas as we can see in some pictures which were kept and taking into considerations some sayings of witness who were present at those events. Unfortunately the documents made on those occasions have not been found. From the careful visual examination of the disassembled components and from the discussions with some enthusiasts who have continued to use the operational vehicles which worked in different periods of time, some important ideas and conclusions have been drawn. These ones will be presented.*

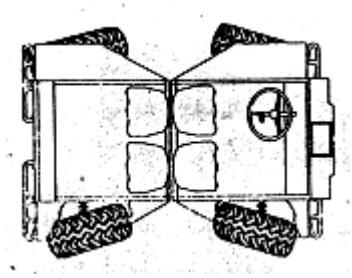
Keywords: *light off-road articulated vehicle, DAC 2.65 FAEG, dynamic performances*

1. INTRODUCTION

A light off-road articulated vehicle is a vehicle with maximum weight less than three tones and consisting of two equal vats connected to each other through a central pivoting bearing which allows moving both parts around the vehicle longitudinal central axis (Fig. 1).

In the late 80's, the designing engineers from the National Institute of Road Vehicles (INAR) and ROMAN/DAC Truck Factory conceived a light off-road articulated vehicle named DAC 2.65 FAEG. It was made in some variants depending on the existing subassemblies.

Fig. 1 A light off-road articulated vehicle



From the five vehicles which were made (plus another two that remained at the body stage), two of them had Wankel engine (maybe identically with the CROCO/RHINO engines), one of them had a Fiat Panda 1.4 liter engine and two vehicles had Dacia 1.4 liter, 65 HP engines. Only one from the last

two ones is still functioning and all the following details will refer to this model (Fig. 2).

Fig. 2 DAC 2.65 FAEG

2. THE LIGHT OFF-ROAD ARTICULATED VEHICLES MADE UP TO NOW

This type of vehicle is very rare. Generally, it has stayed at a prototype stage. It was suggested to be used in the military field but until now we do not have the information that it has been implemented.

The main technical characteristics common to the majority of these vehicles that have been made so far are:

- off-road utility vehicle consisting of two vats connected with a "Center Rotational Articulation"; the first vat has the power unit (the most part) and the driving control point and the second vat is empty and it could be used for special equipment;
- no suspension but center articulation - 45 degrees of travel;
- amphibious vehicle using only the wheels or combining wheels/propeller system;
- 4 Wheel Drive;
- 4 Wheel Power Steering.

The **advantages** of this type of vehicles are:

- remarkable crossing capacity due to 4x4 system and to the central pivoting bearing which allow the vehicle to follow the ground conformation permanently, by keeping all the wheels in contact with land; moreover, the vehicle has enormous approach and rear overhang angles which allow it to attack very high obstacles;
- very good maneuverability (swiveling radius less 10 m) due to the possibility of steering using all the wheels;
- very good stability due to very low center of gravity;
- the theoretical impossibility to be stuck in the mud due to very wide wheels which determine a very high upward force, the wheels which are acted directly from a covered body and due to the simple conformation of the "belly" of the vehicles which allow it to crawl without any problems on the muddy ground;
- simple and robust construction;
- it could be equipped as a amphibious vehicle (optional) because it is calculated to move on the water by using the wheels alone or combined with a propeller or a system of propellers which are trained by a power take-off from the rear axle differential.

The **disadvantages** of this type of vehicles are:

- little ground clearance which could make problems when the obstacles are attacked between the front wheels; the obstacles have to be attacked only by one wheel at a time;
- finding an engine capable to move the vehicle because this one must have a small volume, high power and it has to be easily maintained at the nominal temperature; it is working into a tough, not ventilated environment (into the first vat);
- the necessity of an automatic transmission which is going to work into a tough, not ventilated environment as well;
- the lack of suspension which could create comfort difficulties for the occupants of the vehicles;
- the lack of a covered body (because of the necessity to decrease the total weight) which can cause discomfort to the passengers.

From the patterns made so far, according to [1], we can enumerate:

- **Croco** was an amphibious light off-road articulated vehicle equipped with Terratires, created in 1981 at Croco Company, Switzerland. They were manufactured in Karslruhe but the Company belonged to TAG (Techniques d'Avant Garde) directed from Ryad by Akram Ojjé, sponsor of William race cars of F1 in 1982. In 1983, manufacture of the Croco was stopped. 57 vehicles were stocked in containers and it seems Swiss Army and also Saoudian Army brought a few tens copies. In the early 90s, the stock was bought

by M. Richard of MS Transaction, Scy-Chazelles, France, to sell them.

- **Rhino** of VMB VESTA Mashinenbau GmbH & Co manufactured from the mid-80s at Rheinstetten near Karlsruhe replaces Croco until mid-2000. Nowadays, it is named the „Alligo Cross Country Vehicle".

- **Coot** 2, 2004. The original Coot was built from 1968 to 1982. A new Coot, the Coot2, marketed from 2004 is manufactured by Globalnet Industries Inc, Fairview, Illinois. Nowadays, Coot 2 is the only "Center Rotational Articulation" off-road utility vehicle in its class produced by a specialized company.

The technical details of these three models are presented in table 1.

Tabel 1 Technical details

Item	Measure unit	Value/type		
		CROCO [2]	RHINO [3]	COOT2 [4]
Weights and dimensions				
Overall length	m	2,70	3,05	2,49
Overall width	m	2,00	2,13	1,47
Overall height with hood	m	1,95	2,08	2,00
Ground clearance	m	0,28	0,25	0,324
Wheelbase	m	1,62	1,62	1,60
Track	m	1,65	1,65	-
Unload vehicle weight	kg	900	1250	726
Gross vehicle weight	kg	1 400	1750	1294
Engine				
Type	-	CROCO rotary engine (NSU-Wankel license), single rotor	4-cylinder Diesel engine, turbocharged	KOHLER V TWIN
Displacement	cc	440 (equiv. to 880)	800	800
Compression ratio	-	7.6	23	-
Maximum output	HP(kW)/ rpm	30(22)/5500	28(21)/ -	27(37)/3600
Maximum torque	Nm/rpm	45/3600	60/2800	-
Weight	kg	32	73	-
Remarks	-	oil-cooled rotor, engine air-cooled by centrifugal blower	water cooled	-
Transmission				
Type	-	Belt-drive torque converter + 2(+1) speed gear box	4+2 speed from 2 mechanical synchronized gearboxes	hydrostatically
Differential transaxles	-	automatic locking device.	jointed shaft to worm-geared	-

			differentials	
Wheels and tires				
Type	-	low-pressure flotation tires	low-pressure flotation tires	-
Size	-	31x15.50 – 15	31x15.50 – 15	28x9 – 12
Wheels	-	aluminum	aluminum	steel
Inflation pressure	at	0,5	0,5	-
Maximum speed				
land 1st gear	km/h	25	23	-
land 2nd gear	km/h	50	72	32
water (with the wheels)	km/h	4		-
water (with outboard motor)	km/h	8		-
Other features				
Range	km	500		-
Petrol consumption	l/h	6	4,5	-
Body	-	2 mm steel plate	2 mm steel plate	-
Carrying capacity	-	2 - 6 occupants or 500 kPa payload	500 kg	4 occupants

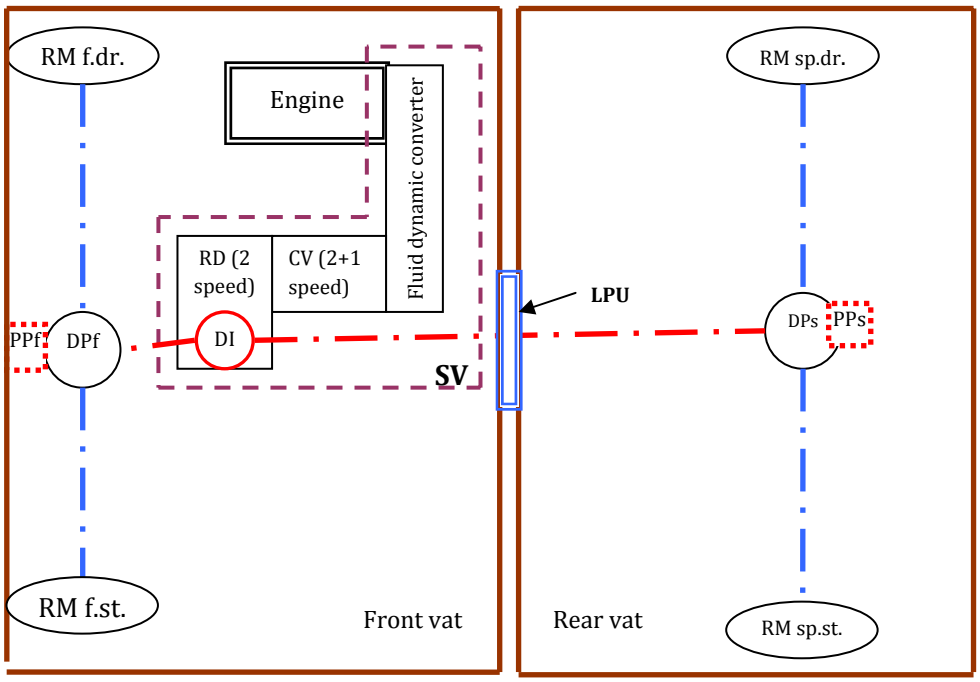


Fig. 3 The power unit scheme of studied DAC 2.65 FAEG

3. THE LIGHT OFF-ROAD ARTICULATED VEHICLE MADE IN ROMANIA- DAC 2.65 FAEG

The studied DAC 2.65 FAEG vehicle (the power unit scheme in figure 3) has a power unit conception and a body identical to CROCO/RHINO vehicles. The declared performances are similar to CROCO/RHINO, too. Apart from this issue, there are no other similarities because the used components were from the serial automotive industry production at that time.

In figure 3:

- planetary shaft
- cardan shaft

CV – gear box
RD – distributor and reduction gear
DI – front rear splitter unit
SV – gearshift
DP f(s) – front (rear) differential
RM f(sp)st(dr) – front (rear) left (right) live wheel

LPU – central single pivoting bearing
PPf(s) – front (rear) power take-off

4. POSSIBILITIES TO IMPROVE THE PERFORMANCES OF THE DAC 2.65 FAEG PROTOTYPE VEHICLE

First of all we have to say that at the beginning of 90s the prototype DAC 2.65 was the subject of systemic tests organized in civil and military areas as we can see in some pictures which were kept and taking into considerations some sayings of witness who were present at those events. Unfortunately the documents made on those occasions have not been found.

From the careful visual examination of the disassembled components and from the discussions with some enthusiasts who have continued to use the operational vehicles which worked in different periods of time, some important ideas and conclusions have been drawn. These ones will be presented.

We can see that some important ways will result in order to optimize the performances of the vehicle.

The engine unit

The vehicle's engine is Dacia model, 1398 cmc capacity, 65 HP. It is an engine quite efficient and unpretentious. It has a good power per volume unit and it is adapted to the disposal space from the front vat. Its power and torque engine are theoretically enough for the necessities of the vehicles. There were not done endurance tests.

There were technical problems with the cooling of the engine during overloading and summer time. This phenomenon happens due to the unsuitable place where it works and the weak ventilation from front vat. The radiator of the engine cooling system is placed outside the vehicle's body but the cooling liquid subway has a complicated architecture. Furthermore, for approximately 60 cm, one of the cooling liquid pipes is close to the muffler (3-4 mm). Thereby a supplementary heating of the cooling liquid is made.

The position of the ventilator, placed in front of the engine inside of the front vat is really improper. This one does not have the possibility to absorb fresh air in order to cool the engine directly (to ventilate it) because there is not a hole in front vat. This one is almost hermetically covered with a metal floor. The ventilator only "carries" the hot air from the front to the rear space inside the front vat.

The cooling system radiator was initially cooled by using two electrical fans which were engaged by thermocouples. They were replaced by a single bigger electrical fan which has the air supply output really superior. Furthermore, a sufficient wide hole in the front wall of the front vat was cut in order to allow an optimal fresh air ventilation of the engine (Fig. 4).

The cooling of engine oil is made by two oil radiators placed outside the body of the vehicle, too (Fig. 4).

Fig. 4 The radiators of the vehicle

The air filter is undersized for an off-road vehicle because it is a half of a normal Dacia car air filter. Furthermore, it is placed into an

inadequate position, below the passenger from the right of the driver (co-driver seat).

Possibilities to improve the engine performances

The best method to improve the engine performances is to… change the engine with a modern, small and powerful one, using the "trendy" method of "downsizing". These requirements are better satisfied by the Otto engines. Moreover, these ones have the advantage of the easy starting during the cold period of year.

The next operations are necessary to be done in order to solve the technical problems which were reported until now in the case of keeping the Dacia engine:

- both electrical fans will be changed with at least another bigger power electrical fan (executed work);
- a hole will be cut into the front surface of the front vat in order to assure a good air ventilation of the engine (executed work);
- the architecture of the exhaust gases subway will be modified so that the exhaust system will not supplementary heat the engine (its cooling liquid); thermal insulating materials will be used in order to cover the exhaust system and to protect the passengers of the vehicle;
- the air filter will be changed with another bigger one (a wet air filter could be used) and its position will be modified in order to make the access of the fresh air to the engine easier.

The gearshift

The vehicle has a fluid dynamic converter paired with a gearbox (2+1 velocity unsynchronized stages) plus a manual locking front rear splitter unit. All this system has a common oil bath. The gearbox/splitter unit ensemble has an extra reduction gear in two steps and a distribution gear to the front and rear axles. There were not reported technical problems with this part of the vehicle. Still, there was one exception: in case of overloading, the fluid dynamic converter overheats. The transmission oil could be expired. This one will be changed and some endurance tests are going to be done.

In order to completely describe the transmission, the differentials of the axles are limited to slip type with worm and wheel gearing.

5. CONCLUSIONS: POSSIBILITIES TO IMPROVE THE GENERAL CONFORMATION OF THE VEHICLE

As we can easily notice in figure no. 3, the vehicle has two power take-off (PTO) units corresponding to the front and rear axle's differentials (Fig. 5). In the original project, the PTOs were designated to act the capstan (the front one) and the propeller and the group of propellers (the rear one).

An original solution for the military area can consist in using the rear PTO to act an electric generator with multiple possibilities to be used. The space for it is not a problem because the rear vat is almost empty and it is at the users' disposal. In case of the electric generator placed into the front vat, this one can generate electrical power from the position which normally is used by the co-driver (the passenger from the right of the driver).

A very interesting project could be done to design a hybrid vehicle. In this case, the electric engine can be placed into the rear vat coupled on the rear PTO. The necessary batteries could fill the rear vat. In this situation the vehicle could use the combustion engine in order to march to the conflict area and, after this, it is going to approach quietly the enemy by using the electric engine.

But all these ideas could be developed in the future depending of the financial resources taking into account that the electric engines and mainly the batteries are very expensive…

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A STUDY ON FATIGUE WEAR CRACKS OF A 40Cr130 COATING IN DIFFERENT LUBRICATION CONDITIONS

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Abstract: *This paper analyses the contact fatigue behavior of a 40Cr130 coating deposited in electric arc on an 18MnCr11 base material. The samples were subjected to contact fatigue on the AMSLER installation in limit and mixed lubrication conditions and analyzed on the LEICA DMI5000 M microscope. A finite element analyses was made on CAD models of the samples to assess the stress distribution. The FEM analyses was done using the ANSYS 13 software. From the finite element analyses resulted where and how cracks appear in the sample. The coating had the purpose to improve the contact behavior of cams from the point of view of wear. The sample with coating subjected to fatigue wear in mixed lubrication conditions had the best behavior.*

Keywords: *ANSYS, contact stresses, 40Cr130*

1. INTRODUCTION

Internal combustion engines are composed of different parts subjected to wear due to the friction between contact surfaces. [1]

There are different types of wear which occur on these parts: adhesive wear that can lead to scuffing, abrasive wear, corrosion wear and fatigue wear. [3]

The camshaft is an important part in an internal combustion engine. His role is to command the fluid distribution in the engine. [2] To do this the cam law must be very precise and any imperfections on the cam surface can lead to the engine malfunction. [6]

The cam is influenced by all the wear types presented above. Improving the cams surface resistance to wear is an important aspect and can be achieved by different means. [4]

This paper analyses the way how a metallic deposition on the cam surface would improved its wear behavior. The materials used in the analyses are 18MnCr11 alloy steel for the sample and 40Cr130 for the coating deposited in electric arc on the sample. Fatigue wear tests were performed on both coated and uncoated samples and microscopy was used to assess the results.

Contact fatigue is highly influenced by the stress distribution. A finite element analyses was done on CAD models of the samples to highlight the stress state of the material and compare it to the results obtained from the fatigue wear tests.

2. MATERIALS, METHODS AND INSTRUMENTATION

In this paper is presented a method to enhance the contact behavior of sliding surfaces. This method consists of an electric arc coating deposition. The material used for

the coating is a 40Cr130 wire steel alloy deposited using the Smart Arc 350 installation from Sulzer Metco on an 18MnCr11 base material. This layer has the purpose to enhance the fatigue, adhesive and abrasive wear resistance.

The 18MnCr11 samples, on which the deposition was performed, are of disc shape with a diameter of 49 mm and the thickness of 5 mm.

In table 1 are presented the deposition parameters used for the electric arc deposition using the Smart Arc 350 installation.

Table 1: Technical parameters

Smart Arc 350	40Cr130
U	28V
I	252A
Air pressure	60PSI

The samples were mounted on the AMSLER installation, presented in Fig. 1, to achieve the fatigue test.

Fig. 1. The AMSLER installation

In the test one of the samples is static and other one has rotational movement. For the test different combinations of contact materials were used: base material sample – base material sample and coated sample – base material sample.

The lubrication regimes used in the test were limit and mixed. The oil used for lubrication has a SAE 5W-30 (9,3 – 12,5 cSt) viscosity which is specific for modern internal combustion engines. The duration of the fatigue test was 30 hours, the loading force had a value of 177 N and the velocity of the moving sample was 375 turn/min.

To highlight the results after the test the samples were analyzed with the LEICA DMI 5000 M microscope which is presented in Fig. 2.

Fig.2. Microscopul optic LEICA DMI5000 M

The CAD models of the samples were made in Solidworks and imported in the Static Structural module from ANSYS 13.

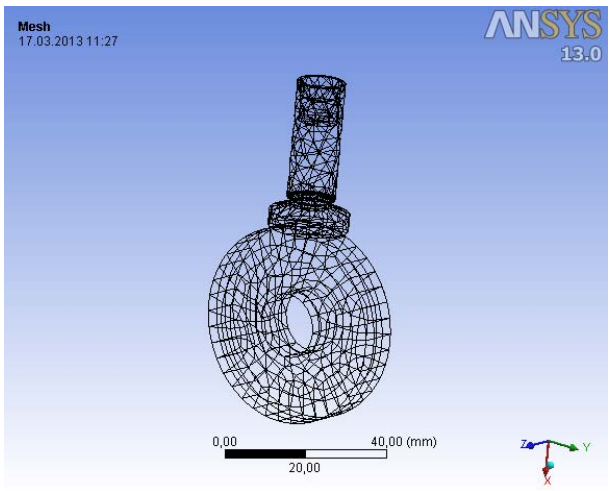

Fig. 3. The mesh of the model without coating

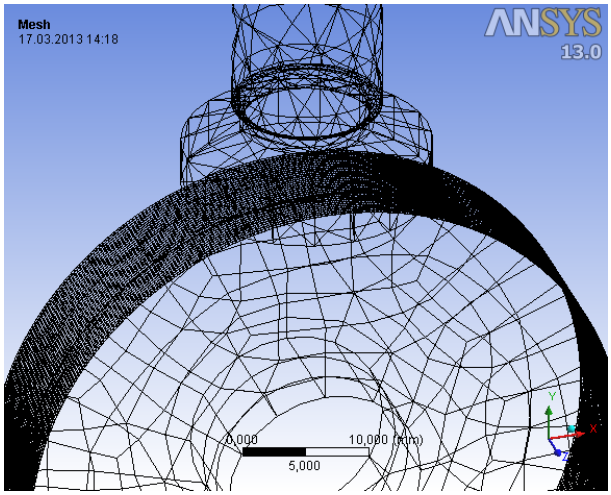

Fig. 4. The mesh of the model with coating

The mesh of the model without coating is made of 6166 nodes and 2459 elements (Fig. 3.) and the mesh of the model with coating 118706 nodes and 18263 elements (Fig. 4.). The disc is supported by a cylindrical clamping with the tangential direction free. The follower applies a force of 177 N to the

disc surfaces. The disc has a rotational velocity around its axis of 375 turn / min. The material properties of the components were defined in the Data Engineering module from ANSYS 13.

3. FINITE ELEMENT ANALYSES RESULTS

3.1. The stress distribution for the model without coating.

Fig. 5 presents the equivalent stress distribution in the sample. The stress is calculated with the Von Mises equivalence theory. As can be seen from the image the sample shows a Hertzian stress distribution with the maximum value of 10,916 MPa on the side edges of the sample.

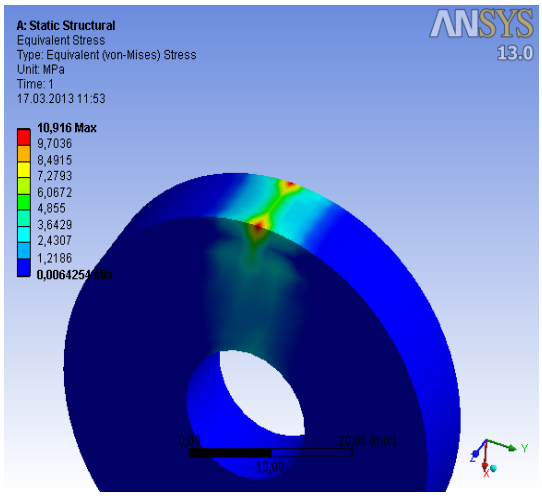

Fig. 5. Equivalent stress distribution of the sample without coating

The equivalent stress has two components: the normal stress and the tangential stress. The normal stress has two components: one downward to the surface σ_1 and one perpendicular to it σ_2. If the friction force between the surfaces is 0, σ_1 is normal to the surface and σ_2 is tangential to it. The components σ_1 induces a compression in the sample and σ_2 traction. In Fig. 6 is presented the normal stress distribution. The components σ_1 has a value of 8,4845 MPa and σ_2 2,1903 MPa.

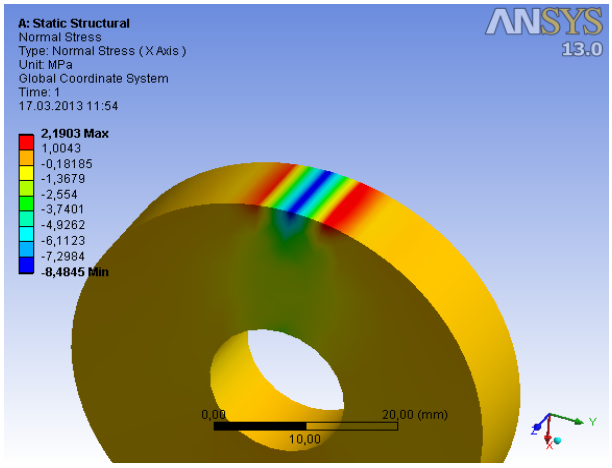

Fig. 6. Normal stress distribution in the sample without coating

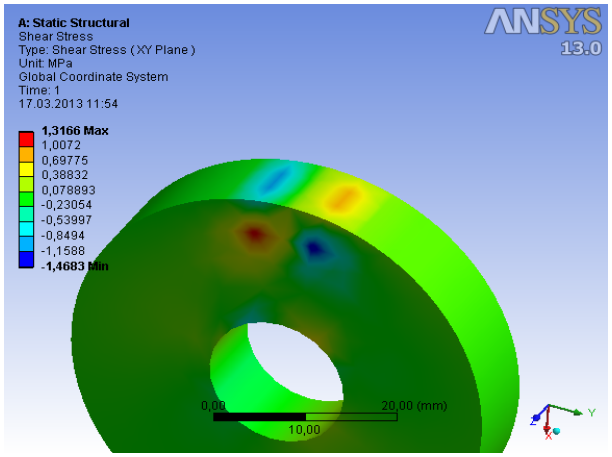

Fig. 7. Tangential stress distribution in the sample without coating

The tangential stress is in a plane at 45º then the normal stress direction. Fig. 7 shows the tangential stress distribution in the sample. The values of the maximum tangential stresses in the two 45º planes are: 1,3166 MPa and 1,4683 MPa.

3.2. The stress distribution for the model with coating.

Fig. 8 presents the equivalent stress distribution in the sample without coating. The maximum equivalent stress happens in the base material and has value of 28,877 MPa. The maximum equivalent stress on the coating surface has a value of 21,659 MPa.

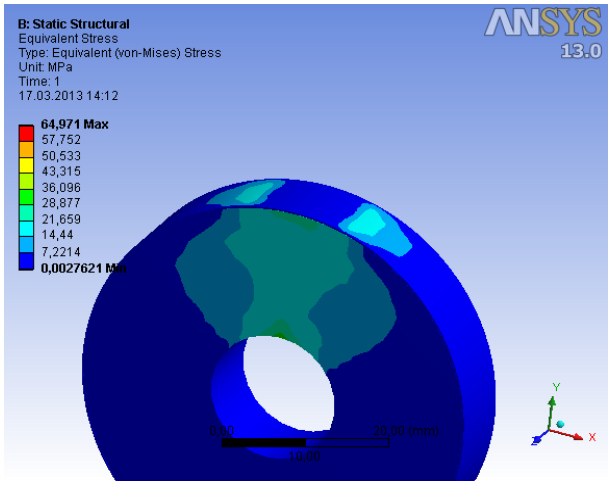

Fig. 8. Equivalent stress distribution of the sample with coating

In Fig. 9 is presented the normal stress distribution. The σ_1 component has the maximum value of 10,993 MPa. The σ_2 component has a value of 9,9623 MPa on the coating surface. Only the normal component affects the base material.

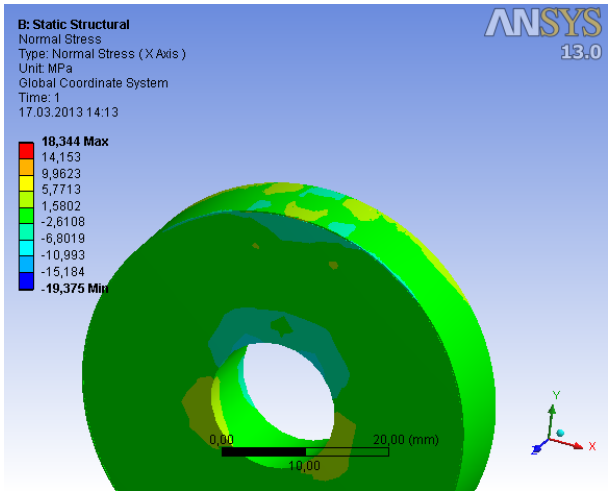

Fig. 9. Normal stress distribution in the sample with coating

The tangential stress increases due to shear stress at the interface between the base material and the coating. As can be seen in Fig. 10 the maximum tangential stresses in the two 45º planes are: 10,633 MPa and 10,359 MPa.

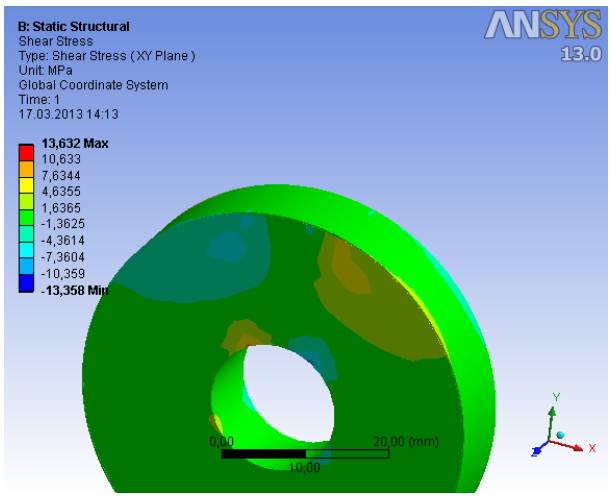

Fig. 10. Tangential stress distribution in the sample with coating

Contact fatigue usually leads to the appearance to pitting and spalling which are caused by cracks. There are two types of cracks depending on the location of the crack initiation. The cracks caused by the normal stresses initiate at the surface and propagate downward in the material and ramify, eventually reaching the surface again and causing a spall. The cracks produced by the tangential stresses initiate in the maximum shear stress zone and propagate almost parallel to the surface.

From the finite element analyses results that in the case of the sample without coating the maximum stress is the normal one and in the microscope analyzed sample, surface initiated cracks should appear. In the sample with coating both types of cracks should appear because of the high normal and shear stresses.

4. MICROSCOPY ANALYSES

4.1. Microscopy analyses of the sample in limit lubrication conditions

Fig. 11 shows a microscope cross section image of the sample without coating subjected to contact fatigue in limit lubrication condition. As can be seen in the image, surface initiate cracks are much highlighted. This sample was affected by scuffing during the test.

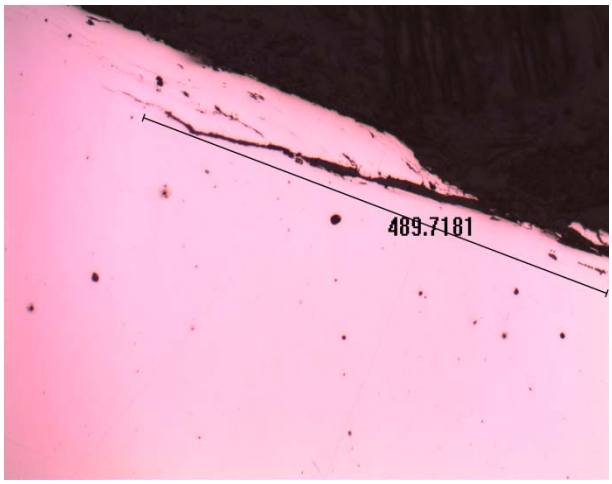

Fig. 11. Cross section microscope image of the sample without coating in limit lubrication conditions

In the cross section of the sample with coating, cracks initiated at the surface and at the interface between the base material and the layer are present (Fig. 12 and 13).

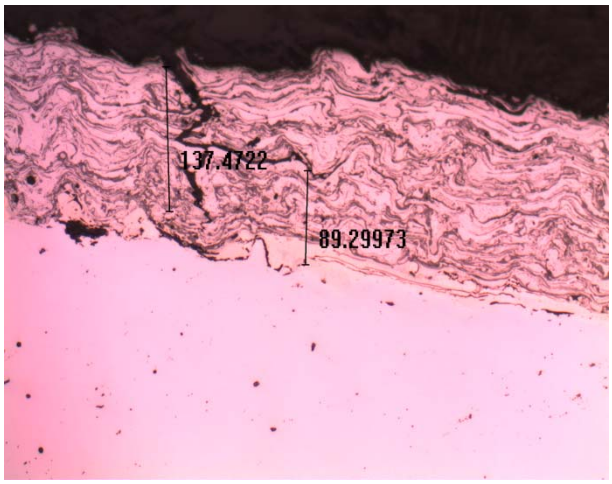

Fig. 12. Surface initiated crack in the sample with coating in limit lubrication conditions

For this sample no scuffing appeared during the test.

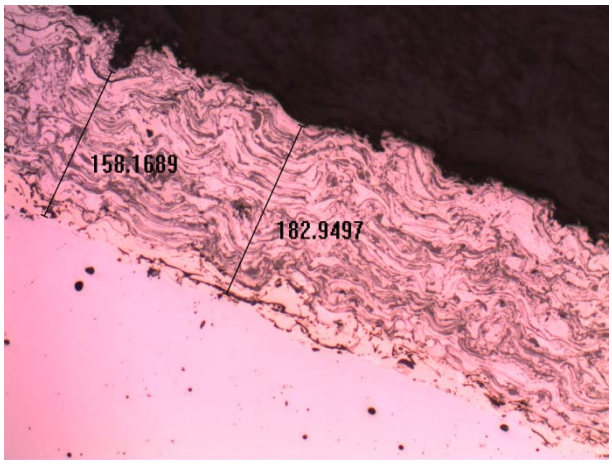

Fig. 13. Crack at the interface in the sample with coating in limit lubrication conditions

4.2. Microscopy analyses of the sample in mixed lubrication conditions

The samples subjected to contact fatigue in mixed lubrication conditions behaved better. In Fig. 14 is presented a cross section of the sample without coating from which results that still surface initiated cracks are present.

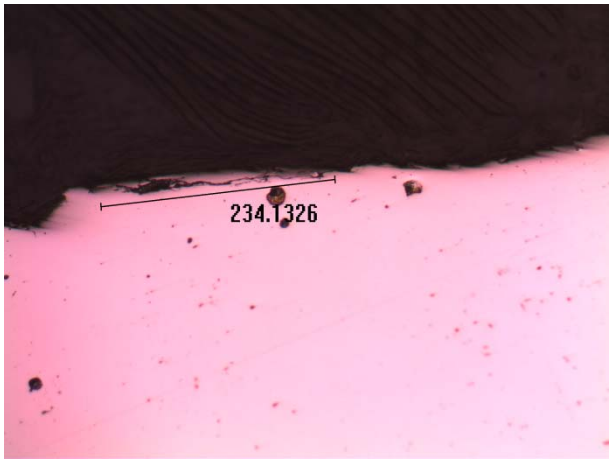

Fig. 14. Cross section microscope image of the sample without coating in mixed lubrication conditions

The sample with coating in mixed lubrication conditions had the best fatigue behavior. No major cracks are present on the

surface in the material. Fig. 15 shows a cross section in the sample with coating.

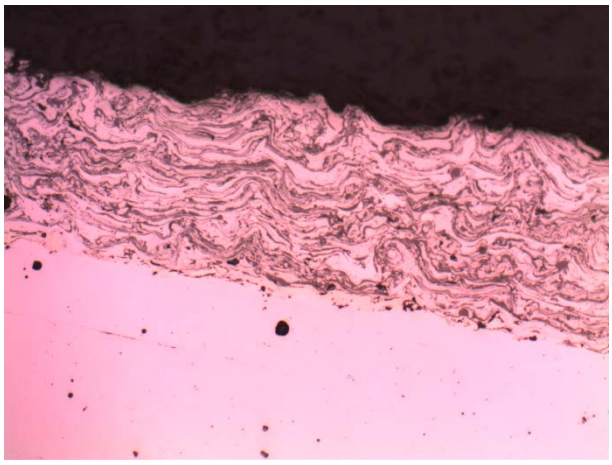

Fig. 15. Cross section microscope image of the sample with coating in mixed lubrication conditions

5. CONCLUSIONS & ACKNOWLEDGMENT

The stress distribution has a great influence on contact fatigue as otherwise was highlighted in the paper and correlated to the microscope analyses.

Even if the stresses were higher the coating improved the behavior of the sample due to its good adherence, hardness and high yield strength.

To use the coating at its highest capacity a good lubrication is needed so the high stresses don't cause cracks.

Acknowledgment: We thank to SC Plasma Jet SA for the support in the plasma jet deposition of the analysed layer from this paper.

I give thanks to the Faculty of Mechanics for the support and for making available the science of materials and Materials Science laboratories for performing the necessary tests for the paper.

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STRUCTURAL, MORPHOLOGICAL AND ADHERENCE ASSESSMENT OF A 40Cr130 COATING DEPOSITED IN ELECTRIC ARC

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Abstract: *Electric arc thermal deposition, unlike other methods (D-gun, plasma spraying, flame spraying, laser surfaces alloying), induce reduced structural changes in the base material due to lower temperatures in the deposition process. The samples analyzed in this paper were obtained by electric arc deposition with the Smart Arc 350 installation from Sulzer Metco. This paper presents structural and morphological analyzes of the obtained coatings and also analyses the adherence of the coating to a 18MnCr11 steel alloy base material. For highlighting the results electron microscopy analyses were made with the QUANTA 200 3D DUAL BEAM electron microscope. The XRD analyses helped to establish the phases and constituents of the electric arc deposited coating. The adherence of the layer was assessed using the scratch method with the UMTR 2M-CTR micro tribometer.*

Keywords: *40Cr130, scratch, SEM*

1. INTRODUCTION

The quality of electric arc deposited coatings can be assessed by: adherence, roughness, thickness and deposition efficiency etc., aspects which can be influenced by the technological parameters specific to the deposition method. [1]

One of the most important characteristic of a deposited coating is its adherence to the base material to which it was deposited. [2]

Adhesion is a molecular or atomic interaction phenomenon acting on the contact area between two solid state material surfaces. [3]

This process is obvious when one of the two solid layers in contact is thin or has a small size. Also the adherence between surfaces is very strong when no lubricant, grease or oxides are present between the contact surfaces. When the contact area of the surfaces is large, the real contact points will represent only a small part of the total area; therefore the specific adhesion of these points will be weak, related to the entire surface of the bodies. [3]

The materials plasticity has an important influence on adherence. With the increase of plasticity, the adhesion between the layers will be stronger [4] The thermal state of the contact materials is another crucial factor to obtain a strong adhesion between layers. A high temperature regime for two sliding surfaces can led to the scuffing phenomenon. [1]

2. MATERIALS, METHODS AND INSTRUMENTATION

In this paper is presented a method to enhance the contact behavior of sliding

surfaces. This method consists of an electric arc coating deposition. The material used for the coating is a 40Cr130 wire steel alloy deposited using the Smart Arc 350 installation from Sulzer Metco on an 18MnCr11 base material. This layer has the purpose to enhance the fatigue, adhesive and abrasive wear resistance.

The 18MnCr11 samples, on which the deposition was performed, are of disc shape with a diameter of 49 mm and the thickness of 5 mm.

In table 1 are presented the deposition parameters used for the electric arc deposition using the Smart Arc 350 installation.

Table 1: Technical parameters

Smart Arc 350	40Cr130
U	28V
I	252A
Air pressure	60PSI

The Quanta 200 3D electron microscope was used to perform secondary electron images and EDS analysis, working in the High Vacuum module at a pressure of $1{,}65x10^{-3}$ Pa and using the ETD detector (Fig.1).

Fig. 1. Quanta 200 3D electron microscope

In order to perform a more complete analysis in terms of structural changes due to the deposition process, the metallic layer was analyzed using X-ray diffraction with the X'Pert PRO MRD installation presented in Fig.2.

Fig. 2. X'Pert PRO MRD X-ray diffraction installation

The scratch test conducted on the UMTR 2M-CTR type tribometer uses three methods to detect the coatings failure (Fig. 3). Firstly, a load cell is used to measure the change of the friction force value, secondly the acoustic emission made by the cracks are detected and thirdly, after the test is complete, the scratch channel can be viewed using an optical or an electron microscope, to see how the crack has propagated.

The intensity of the acoustic emissions is dependent on the type of failure suffered by the coating during the adhesion test: cracking, chipping or delaminating. [5]

For this reason is important to view how the coating had failed after the adhesion test and to confirm the critical load by analyzing the failure with a microscope.

Fig. 3. CETR UMT-2 tribometer

The method used to assess the analyzed layer in this paper is the progressive loading method (PLST - Progressive Load Scratch Test) and consists of applying a force gradually (from 0 - 19N) over the indentation for a defined period of one minute. The speed of the indentation is 10 mm/min. The indenter used is a DFH-20 Dual Friction/Load Sensor, which has been mounted with a micro blade with a peak radius of 0.4 mm.

3. EXPERIMENTAL RESULTS

3.1. Structural analyses using SEM

In Fig. 4 and 5 are presented SEM images of the coatings surface which shows pores, micro cracks and its roughness. The cracks presented on the surfaces are produced by the stresses which occur during the cooling process of the coating. The stresses are generated by the different rates of cooling between the coating material and the base material from which the sample is made of.

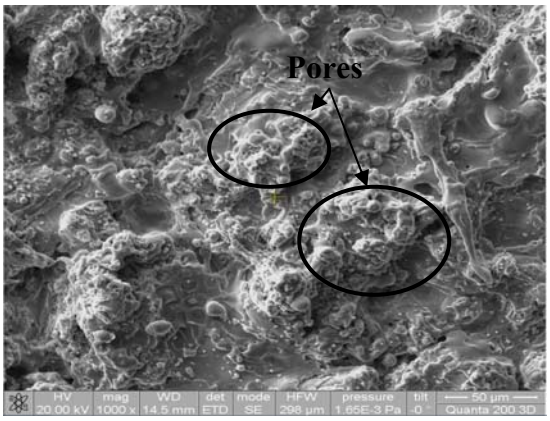

Fig.4. SEM image of the coatings surface at a magnification of 1000X

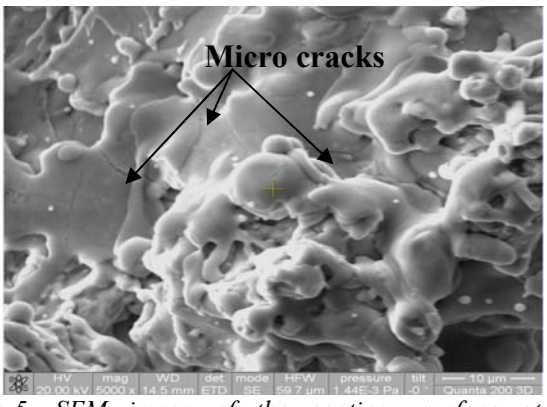

Fig.5. SEM image of the coatings surface at a magnification of 5000X

Fig. 6 shows the topography of the surface presented in Fig. 4.

In Fig. 7 is presented the elementary chemical analyses of the coating. From the analyze results that the coating has the same composition as the 40Cr130 wire used for the deposition.

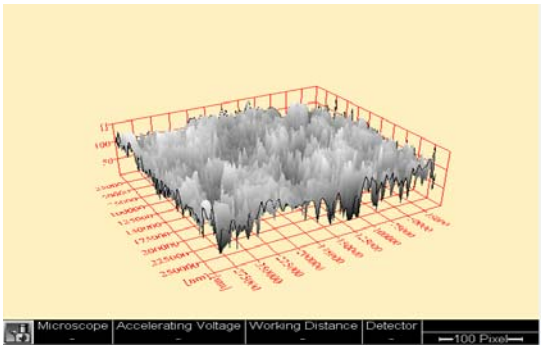

Fig.6. Coating surface topography

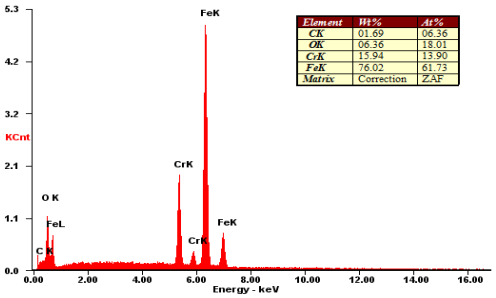

Fig.7. Elementary chemical analyses EDAX.

To highlight all the chemical elements present on the layer surface a distribution map of the elements was made on which the specific elements of the coating are presented (Fig. 8).

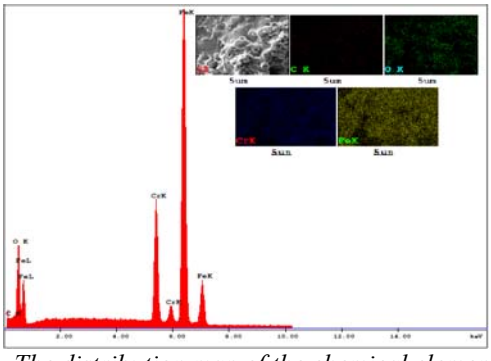

Fig.8. The distribution map of the chemical elements

Also, by using electron microscopy, measurements were made in the cross section of the coating. The purpose of the measurements was to determine the thickness of the coating. The thickness of the layer varies from 43 - 60 μm as can be seen in Fig. 9.

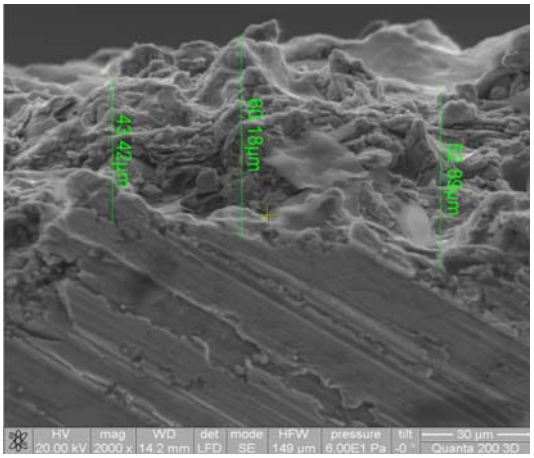

Fig.9. SEM cross section of the coating with thickness measurements

The layer presented in Fig. 10 is characterized by a lenticular structure specific to electric arc deposited coatings.

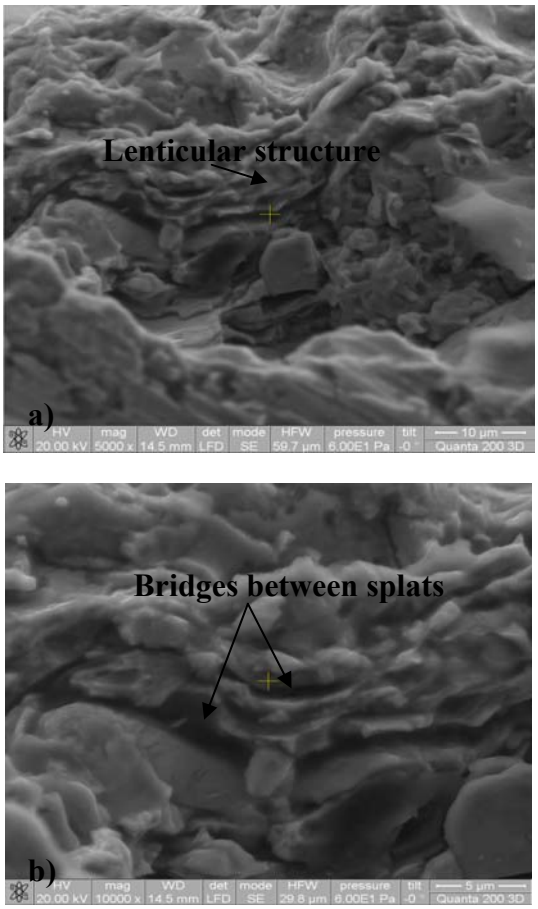

Fig.10. SEM microstructure in the cross section: a) 5000X and b) 10000 X

The splats have a small dimensional structure. The interface between splats and pores is very well highlighted. The inter-splat pores are dominant in the layer (Fig. 10-a). At high magnification bridges between splats can be observed (Fig. 10-b).

3.2. Structural analyses using X-ray diffraction The X-ray diffractometer is equipped with a X-ray anode tube made of Cu kα, λ = 1.54 Å, to which a voltage of 45 kV with a current of 40 A has been applied, at an angle of diffraction (2θ) ranging from 30 to 120º. X-ray diffraction analysis was performed in order to observe and highlight the structural composition of the coating (Fig. 12).

The wavelengths of the X-ray diffraction are: K Alpha 1 [Å]: 1.54060, K-Alpha 2.1,54443, K-Beta [Å]: 1.39225, K-A2 / K-A1 Ratio: 0.50000.

Structural analysis were performed using a dedicated software (Xpert High Score Plus) thought which the crystallographic parameters were identified (lattice type, network constant values a, b and c, angles of the elementary cell alpha, beta and gamma, elementary cell volume, density) and the possible compositional parameters. For the precise choosing of the stoichiometric compositions.

The steel alloy deposited coating has a martensitic structure with a tetragonal crystalline lattice (a = 2,8560 Å, c = 2,9600 Å si β = 90,0000°).

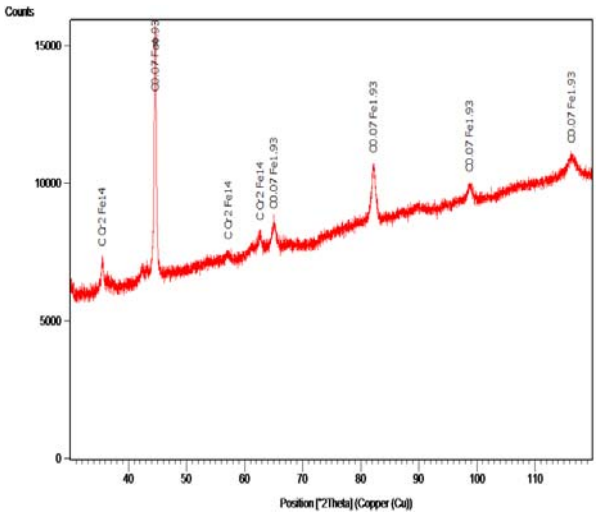

Fig.11. XRD spectrum of the layer

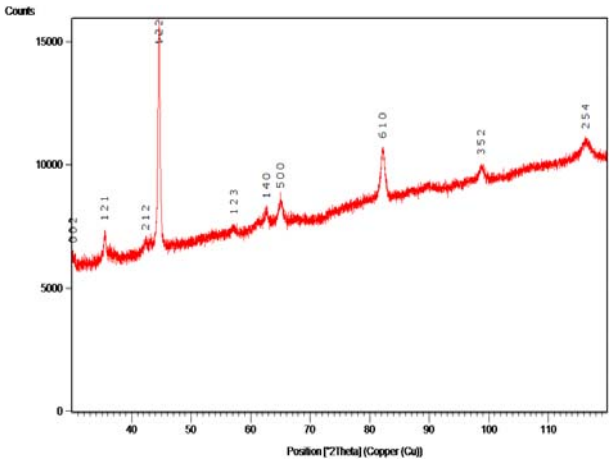

Fig.12. X-ray diffraction of the *40Cr130 coating at a diffraction angle of 2θ=30…120°*

3.3. The scratch method used to determine the adhesion of the layer There are three characteristic zones of the scratch indentation: the initiation zone (corresponding to the application of force from 0 N to 8 N), an intermediate zone (8-13,5 N) and the final (13,5 to 19 N). These zones were used to observe the behavior of the coating at progressive loading. After the scratch testing on the first samples it can be observed that the destruction of the layer starts from the final zone (corresponding to approximately 13 N of force after approximately 45 sec.). This can be seen in Fig. 13 on the SEM images and especially using the energy - dispersive X-ray spectroscopy performed on the final scratch, as can be observed in Fig. 14.

The third analysis performed is drawing the profilometry of the initial segment (Fig. 15) and final segment of the scratch (Fig. 16). It can be seen that the destruction of the layer has a width of 1.2 mm and a depth of 35 µm (Fig. 16).

By using the data from the chart presented in Fig. 17, calculations were carried out from which resulted that the exfoliation begun in the 45 second which corresponds to a force of 13,5 N.

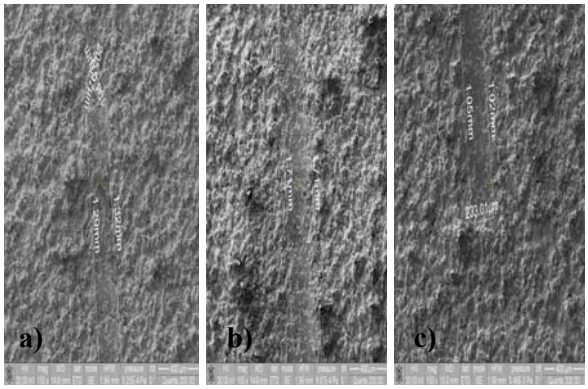

Fig.13. SEM imagines of the scratch marks on the sample: a) initial zone (0 – 8 N), b) intermediate zone (8 – 13,5 N) and c) final zone (13,5 – 19 N)

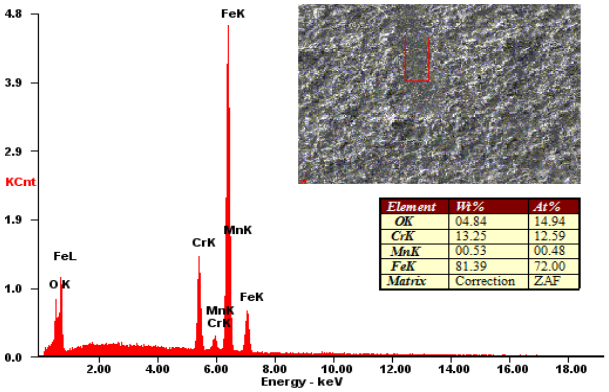

Fig.14. Spectral analyses of the final mark of the scratch

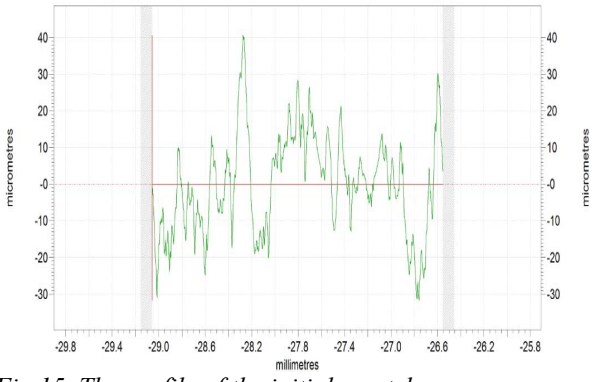

Fig.15. The profile of the initial scratch

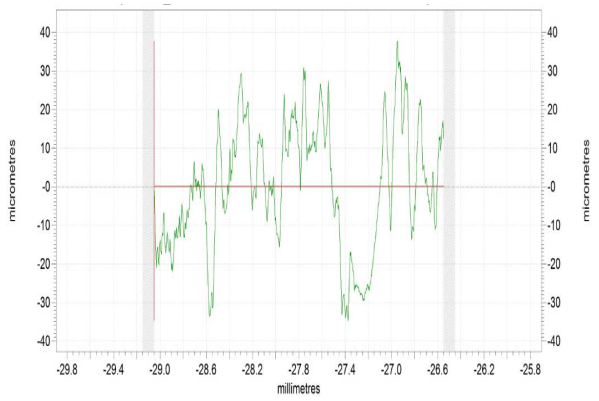

Fig.16. The profile of the final scratch

On the same chart high variation of the friction coefficient are observed. The maximum value of the friction coefficient is 0,179. The variation of the friction coefficient is due to the porosity of the layer and the leticular stratified structure of the material. The friction coefficient drops to the value of 0,06 when the indenter reaches the base material.

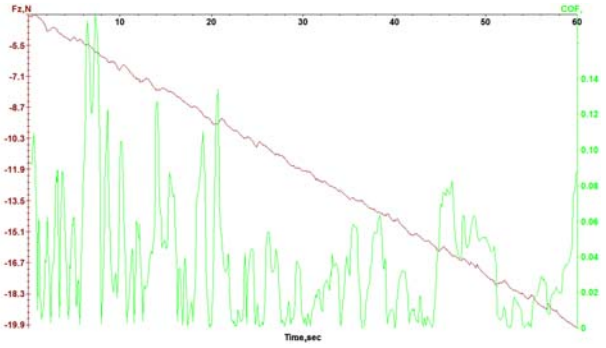

Fig.17. The variation of the friction coefficient due to the progressive applied force

4. CONCLUSIONS & ACKNOWLEDGMENT

The 40Cr130 deposited coating has a leticular structure with high porosity and a tetragonal crystalline lattice.

At the technological parameters used for the electric arc deposition the coating has an average thickness of 50 µm.

From the SEM images results that no oxidation zones appear at the interface between the metallic coating and the base material.

The coating adhesion testing was performed with the scratch method. The obtained results were conclusive regarding the adhesion of the layer and its minimal thickness. It is recommended that the deposited coating have a thickness greater than 50 µm.

Acknowledgment: We thank to SC Plasma Jet SA for the support in the plasma jet deposition of the analyzed layer from this paper.

I give thanks to the Faculty of Mechanics for the support and for making available the science of materials and Materials Science laboratories for performing the necessary tests for the paper.

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A STUDY ON FLUE GAS CORROSION AND WATER VAPORS SORPTION ON A $ZrO_2/20\%Y_2O_3$ PLASMA SPRAYED COATING FOR TURBINE BLADES APPLICATION

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Abstract: *This paper presents a concept of thermal barrier coating which consists of a $ZrO_2/20\%Y_2O_3$ ceramic top layer and a NiCrAlY bond layer, both deposited by atmospheric plasma spraying (APS) on a Ni based super alloy. Atmospheric plasma spraying (APS) is a widely used deposition method for obtaining variable thickness coatings on surfaces with different degrees of complexity. The analyzed samples were obtained by thermal deposition with the METCO 7 MB plasma jet installations. The corrosion test followed the chemical influence of the flue gas on the deposited coating. This test is important because the turbine blades are corroded by the flue gas during operation, so the chemical behavior of the ceramic coating is an important aspect for a safe service. Due to the significant amount of water vapors in the flue gases the sorption capacity of the coating is assessed. The highlighting and interpretation of the structural and chemical changes caused by the high temperature flue gas were made by using modern methods of structural analysis.*

Keywords: *$ZrO_2/20\%Y_2O_3$, flue gas, corrosion*

1. INTRODUCTION

This paper analyzes coatings deposited by atmospheric plasma spraying on a Ni based super alloy material used in the manufacturing of turbine blades. Thermal barrier coatings used in the manufacturing of turbine blades are meant to isolate the components of a gas turbine aircraft engines which are exposed to severe regimes of temperature, thereby ensuring a good and safe functioning. [1] That would otherwise not be possible due to excessive heating of the material from which they are made. [1] TBC layers permit lowering the temperature of the "hot parts" targeted in the energy industry and aeronautics with 100-200°C. [2] The high temperature flue gas also causes corrosion to the base material of the blades. For this reason the deposited ceramic coating also has the role to protect de base material from corrosion. [3]

The obtained quality for thermal spray coatings can be assessed by: roughness, thickness, strength and porosity. [4] These aspects can be influenced by the technological parameters used for the adopted spraying methods. Another parameter is the chemical stability of the ceramic material so it can withstand high working temperature without the appearance of oxidation and corrosion. [4]

Because there is a significant amount of water in the flue gases (water vapors from intake air and water vapors resulted from the combustion process) it is important to assess

the sorption capacity of the deposited ceramic coating. [5]

2. MATERIALS, METHODS AND INSTRUMENTATION

The protection layers were obtained by successive deposition of the bonding and ceramic top layer by air plasma jet method on a 7MB METCO type installation. The parameters used for the plasma spraying deposition are presented in Table 1.

Table 1: Parameters of deposition

Technological parameters	NiCrAlY	ZrO_2/ 20%Y_2O_3
Spray distance, (mm)	120	120
Injector	1,8	1,8
Plasma gas intensity, (A)	600	600
Arc voltage (U)	62	65
Speed of rotation (rot/min)	55	55
Argon flow (m^3/h)	50	40

The samples used for the test were made from a Ni base super alloy of rectangular cross section with the dimensions 30x8x2 mm. The ceramic coating deposited on the samples has different thicknesses. The coating thickness for the three samples is: 100µm, 200µm şi 400µm. The samples were placed in the exhaust pipe of a boiler. The AV00 boiler uses diesel fuel and the gas circulation is forced (the flue gases are discharged by a fan) (Fig.1). The excess air coefficient has the value of 1,5.

Fig.1. The placing of the samples in the exhaust pipe of the AV00 boiler

The Quanta 200 3D electron microscope was used to perform secondary electron images and EDAX analysis, working in the Low Vacuum module at pressures ranging from 50 to 60 Pa and using the LFD (Large Field Detector) detector. The voltage used to accelerate the electron beam had the value of 30kV and a working distance varied from 12 to 15 mm, Fig.2.

Fig.2: Quanta 200 3D electron microscope

The water vapors sorption capacity of the analyzed samples was measured at 25°C in the relative humidity domain of RH=0-90%. The test was done using the IGAsorp equipment. This equipment is fitted with a ultrasensitive microbalance which measures the mass changes of the studied material along with the change of humidity in the sample chamber. The temperature in the chamber is kept constant with the help of a thermostat.

3. STRUCTURAL ANALYSES OF THE LAYERS SUBJECTED TO CORROSION IN FLUE GASES

The samples were placed in the exhaust pipe of the boiler. The clamping of the samples in the exhaust pipe is presented in Fig.1.

The corrosion test followed the chemical influence of the high temperatures flue gases on the ceramic layer deposited on the samples. The coating was subjected to gravimetric analyze and elementary chemical analyze (EDAX).

Following the gravimetric analyses for the three samples subjected to corrosion a loss of mass was measured. For the samples with the layer thickness of 100 µm the loss of mass is greater than in the case of the other two samples. This happens due to the exfoliation of the layer. The 100 µm coating has a weaker adherence to the base material then the other two coatings. On the other two samples no exfoliations marks are present and the lost of

mass is due only to the evaporation of volatile matter.

In Table. 2. are presented the results of the gravimetric analyses.

Table 2. The results of the gravimetric analyses

The layer thickness	The mass of the sample before the test [g]	The mass of the sample after the test [g]	The mass los [g]	The mass los from the initial mass [g]
100 µm	3,49	3,48	0,01	0,28
200 µm	3,143	5,14	0,003	0,06
400 µm	5,108	5,10	0,008	0,16

After the corrosion test the sample with the layer thickness of 100 µm shows macroscopic marks of exfoliation. This fact is presented in Fig.3.

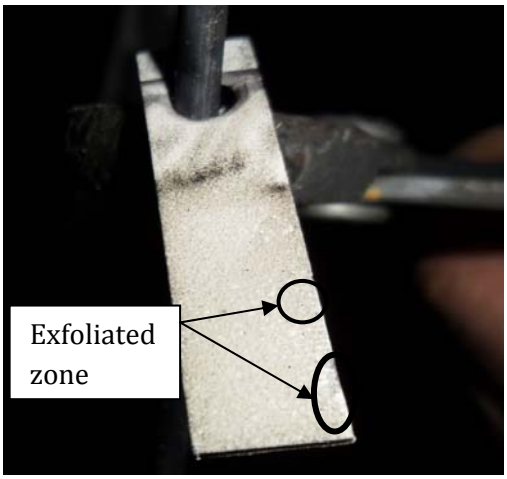

Fig.3. The sample with the coating thickness of 100 µm after the corrosion test.

In the SEM imagine from Fig. 4-a it can be observed that the layer structure is made of elongated grains, separation surfaces and pores of different dimensions. In Fig. 4-b a crack in the coating is visible. The crack is produced by the exfoliated tendency of the layer due to the velocity the flue gas and the high working temperature. The elongated grains preserve their shape and no corrosion is present.

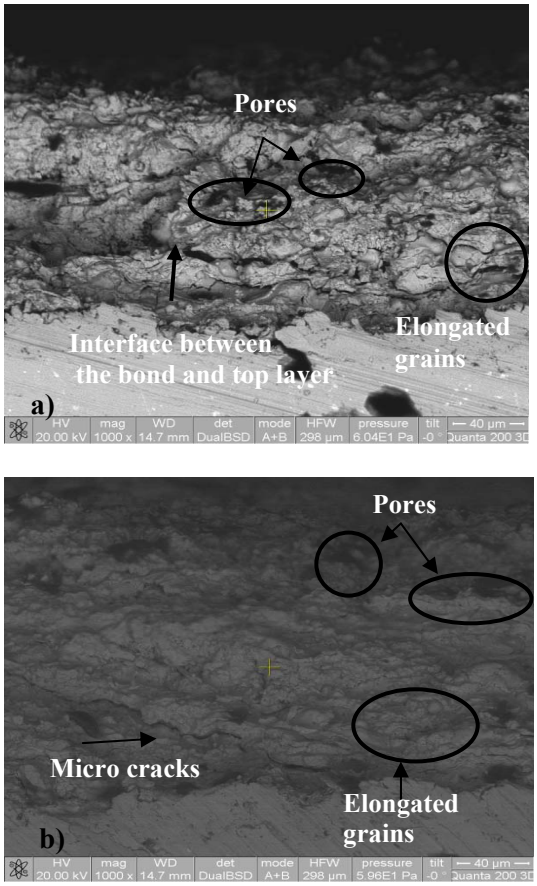

Fig. 4. Cross section SEM images of the ZrO_2/20%Y_2O_3 coating with the thickness of 100 µm: a) before the corrosion test and b) after the corrosion test.

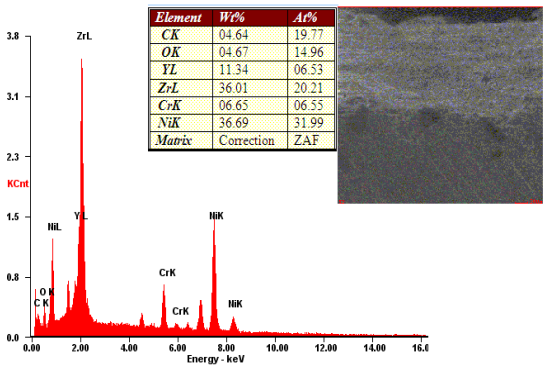

Fig. 5. EDAX of the ZrO_2/20%Y_2O_3 ceramic layer after the corrosion test

From the elementary chemical analyses results that some chemical changes occurred due to the fact that traces of carbon are present

on the coating. The carbon comes from the chemical composition of the flue gases (Fig.5).

In Fig. 6 are presented cross section SEM imagines of the sample with the layer thickness of 200 µm, before and after the corrosion test. The bond layer shows a structure composed of elongated grains. [7] These grains are elongated due to the high kinetic energy of the sprayed plasma which converts to energy of variation of the shape. In the coating pores of different dimensions are also present (fig. 6-a). After the corrosion test it can be observed in Fig. 6-b that no significant changes appear in the coating. The grains have the same elongated shape, the pores tend to combine (coagulation) to the surface areas of the layer. Also some micro cracks are present in the layer.

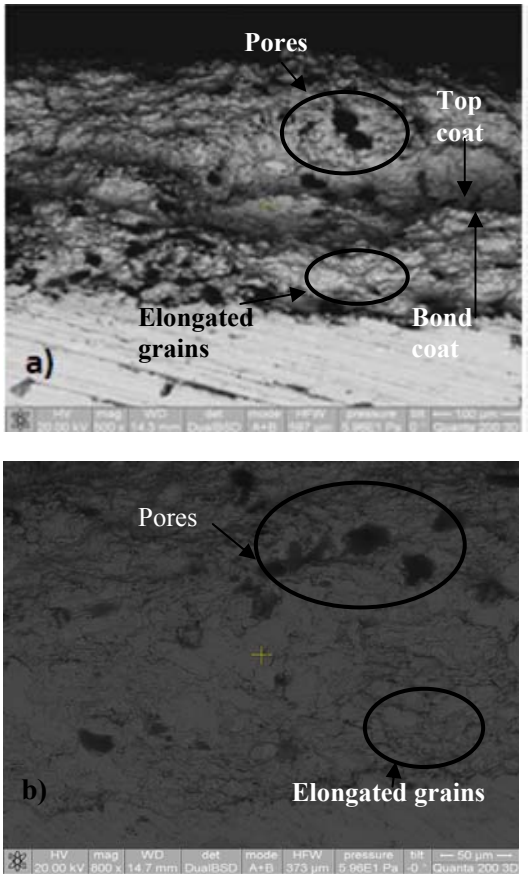

Fig. 6. Cross section of the ZrO_2/20%Y_2O_3 layer with the thickness of 200 µm: a) before corrosion test and b) after corrosion test

From the EDAX analyses carbon traces are present on the sample surface from the composition of the flue gas (fig. 7). [8]

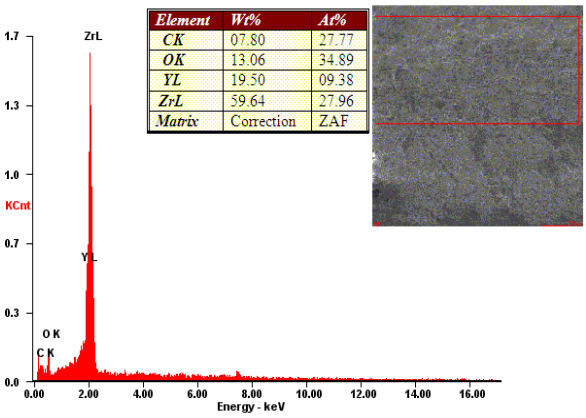

Fig. 7. EDAX chemical analyses of the 200 µm ZrO_2/20%Y_2O_3 ceramic layer

In Fig. 8 are presented SEM cross section images, before and after the corrosion test, of the sample with the layer thickness of 400 µm. The ceramic layer before corrosion test is presented in Fig. 8-a. The structure of the layer is uniform with pores of different dimensions with different orientations. After the corrosion test different dimension pores are also present, the bond layer is made of elongated grains and no corrosion zones are present at the interface between layers (fig. 8-b). [7]

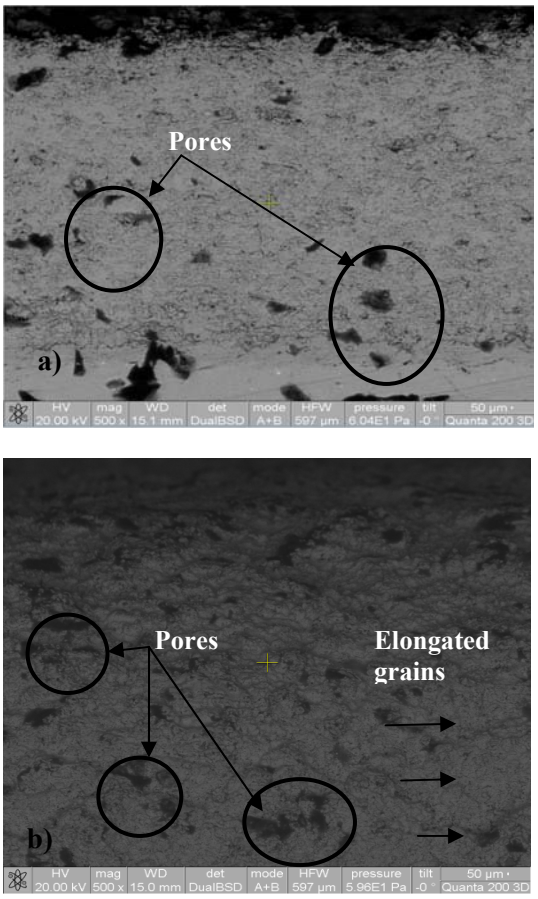

Fig. 8. SEM imagines of the 400 µm layer in cross section: a) before corrosion test and b) after corrosion test

Also in this case the EDAX analyses shows traces of carbon on the coating due to the flue gas composition (fig. 9).

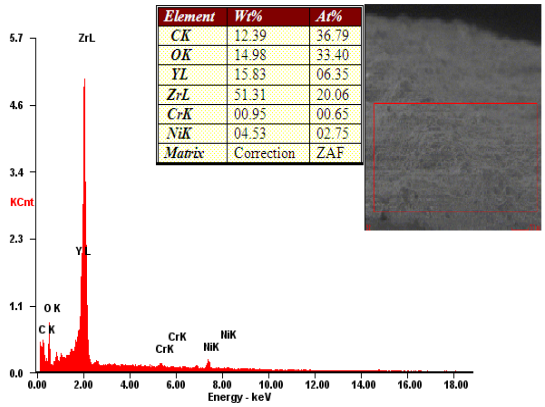

Fig. 9. EDAX chemical analyses of the ceramic layer with the thickness of 400 µm after the corrosion test

4. THE DINAMIC SORPTION CAPACITY OF WATER VAPORES

The vapore pressure in the sample chamber was made in steps of 10% humidity, each step having an equilibrium setting of 20-30 minutes. At each step the absorbed or lossed mass is recorded when equilibrium is reached.

Before the sorption - desorption isotherm mesurament, the drying of the samples is done using nitrogen flow (250 mL/min) at a temperature of 25°C untile the sample mass reaches a constant value at a relative humidity smaller then 1%. In Table 2 is presented the sorption capacity of the three samples.

Table 2. The sorption capacity of the samples depending on the coating thickness

Sample (µm)	Sorption capacity (%)
100	0.2996
200	0.1252
400	0.3398

The thin coating (100 µm) has a sorption capacity of around 0,3% and to drops in the case of the sample with the coating of 200 µm to the value of 0,125%, which implies a greater compactness of the layer. The layer with 400 µm thickness, due to a successive disposition of the splats with micro cracks between them, shows a greater sorption capacity of around 0,34%. The sorption/desorption isotherms recorded in this conditions are shown in Fig. 10, Fig. 11 and Fig. 12.

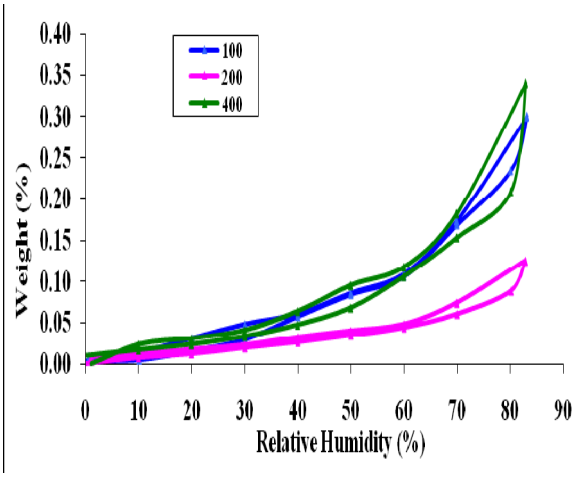

Fig. 10. Comparative representations of the sorption/ desorption isotherms

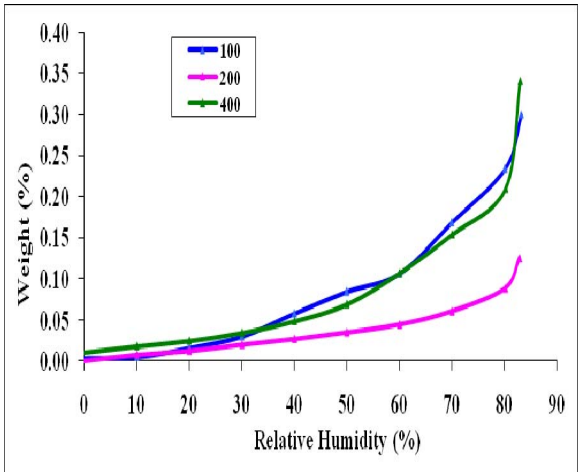

Fig. 11. Comparative representation of the sorption isotherms

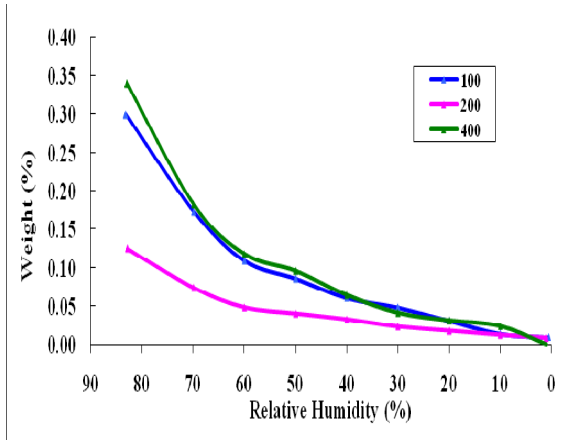

Fig. 12. Comparative representation of the desorption isotherms

5. CONCLUSIONS & ACKNOWLEDGMENT

The corrosion test is relevant because the turbine blades are corroded by the flue gases and the chemical behavior of the deposited ceramic coating is very important. The samples with the ceramic layer thickness of 200 µm and 400 µm behaved very well to the corrosion test and are recommended for deposition on turbine blades. The coating with the thickness of 100 µm was strongly influenced by the flue gases and presents exfoliation marks.

The low values of the water vapors sorption capacity for the studied samples prove their hydrophobic nature. The shape of the sorption/desorption isotherms for all samples can be correlated with type V according to the IUPAC classification. The hysteresis happens due to the different speeds for which the two physical processes take place. Also it can be concluded that the desorption speed is lower than the sorption one.

The sample with the layer thickness of 200 µm behaved better than the other two from the point of view of water vapors sorption. This is due to the greater compactness of the layer. It can be concluded that the layer with the thickness of 200 µm is recommended for turbine blade deposition from the point of view of water vapors sorption.

Acknowledgment: We thank to SC Plasma Jet SA for the support in the plasma jet deposition of the analyzed layer from this paper.

I give thanks to the Faculty of Mechanics for the support and for making available the science of materials and Materials Science laboratories for performing the necessary tests for the paper.

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A STUDY ON THE ENHANCED PROPERTIES OF A $ZrO_2/20\%Y_2O_3$ CERAMIC COATING BY THERMAL TREATMENT FOR TURBINE BLADES APPLICATION

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Abstract: *The material subjected to the analyses was chosen from the usually used materials in the manufacturing of turbine blades, which enter in the class of Ni base super alloys materials. The material used for the manufacturing of MIG 21 TUMANSKY R-13 turbine blades is of russian provenience. The thermal barrier (TBC) type coating used for turbine blade deposition consists of two layers. The firs layer is relatively thin and named bonding layer and the second one is sprayed over the first and has the role of thermal barrier. The bonding layer is made from a MCrAlY ceramic-metal alloy. The purpose of this layer is to protect the base material from oxidation and corrosion and to increase the adherence of the thermal barrier to the base material. The usually used material in the aeronautics industry as thermal insulator is zirconium oxide stabilized with yttrium oxide. Both layers were deposited on the samples with the 7MB METCO installation from Sulzer Metco. The material used for the thermal barrier deposition is the $ZrO_2/20\%Y_2O_3$ powder. This paper analyses how the samples behave to heat treatment from the point of view of structural changes. After heat treatment the surfaces were analyzed microstructuraly and morphologically by electronic microscopy, and in terms of the phase composition by X-ray diffraction.*

Keywords: *heat treatment, $ZrO_2/20\%Y_2O_3$, SEM, X-ray diffraction*

1. INTRODUCTION

The thermal treatments applied to superficial layers obtained by plasma jet spraying have the purpose to induce structural changes and the removal of defects induced by the spraying process. The usage of thermal treatments follows to acquire better mechanical, chemical and technological properties. [1]

The purpose of this paper is to present the results obtained after the thermal treatments and to define how the performance of the coating would improved or how high temperature could lead to the coatings failure.

The heating of the coating leads to a compression of the ceramic material. The temperature gradients make the outer "fibers" of the ceramic to expend but are constrained by the cooler inner "fibers". [5] This leads to a state of compression in the material which tends to buckle the coating. [2] Therefore thermal fatigue accumulates after some thermal cycles which lead to the compressive failure of the coating. [3] Also this type of compressive stresses can develop on cooling due to thermal expansion mismatch between the ceramic and metallic layer. [5] The normal stress produced by the compression combined with the shear stress at the interface amplifies the coatings failure. [5]

2. MATERIALS, METHODS AND INSTRUMENTATION

The protection layers were obtained by successive deposition of the bonding and ceramic top layer by air plasma jet method on a 7MB METCO type installation. The parameters used for the plasma spraying deposition are presented in Table 1.

Table 1: Parameters of deposition

Technological parameters	NiCrAlY	ZrO_2/ 20%Y_2O_3
Spray distance, (mm)	120	120
Injector	1,8	1,8
Plasma gas intensity, (A)	600	600
Arc voltage (U)	62	65
Speed of rotation (rot/min)	55	55
Argon flow (m^3/h)	50	40
Layer thickness	39-45µm	200 µm

The thermal treatment applied to the specimens was done with the electric furnace presented in Fig. 1. The furnace is made of a refractive ceramic tube with a length of 500 mm and a outer diameter of 100 mm. The furnace was heated by three nickeline electrical resistances of 100 Ω each, which are parallel connected.

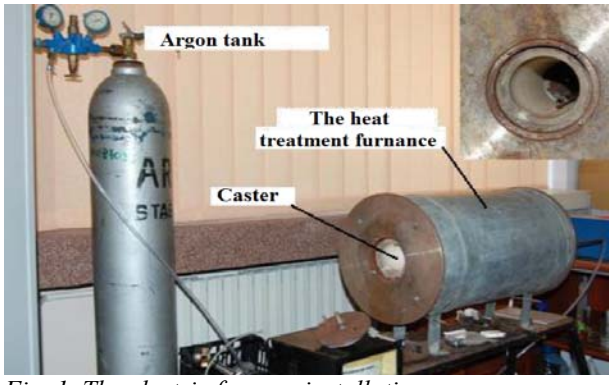

Fig. 1. The electric furnace installation

The Quanta 200 3D electron microscope was used to perform secondary electron images and EDAX analysis, working in the Low Vacuum module at pressures ranging from 50 to 60 Pa and using the LFD (Large Field Detector) detector. The voltage used to accelerate the electron beam had the value of 30kV and a working distance varied from 12 to 15 mm, Fig.2.


Fig. 2. Quanta 200 3D electron microscope

In order to perform a more complete analysis in terms of structural changes due to thermal shock, the ceramic layer was analyzed before and after the test using X-ray diffraction with the X'Pert PRO MRD installation presented in Fig.3.


Fig. 3. X'Pert PRO MRD X-ray diffraction installation

3. EXPERIMENTAL RESULTS

In this paper are presented the thermal treatments applied on coatings obtained by plasma jet spraying. The samples were heated to 1000ºC for a period of 5, 10 and 15 hours and cooled in air jet at a pressure of 100 bar. After the first 10 minutes the heating of the furnace had a rate of 20ºC at every 10 minutes until it reached 1000ºC.

The purpose of the heat treatment was to analyze the sintering effect from the point of view from the point of morphological changes and phase transformations. After the heat treatment the surfaces were analyses by electronic microscopy and to highlight the phase composition by X-ray diffraction.

3.1. Electron microscopy structural analyses of the deposited coatings subjected to thermal treatment Fig. 4 shows a SEM image of a deposited coating before thermal treatment. In the image two constructive areas

are revealed, the bond layer made of NiCrAlY metallic powder and thermal barrier layer made of $ZrO_2/20\%Y_2O_3$ ceramic powder. Between the two layers a transition interface is presented. The metallic layer shows a structure formed of elongated grains. These grains get their shape during the spraying process due to the conversion of the high kinetic energy of the sprayed plasma in energy of variation of the shape. [5]

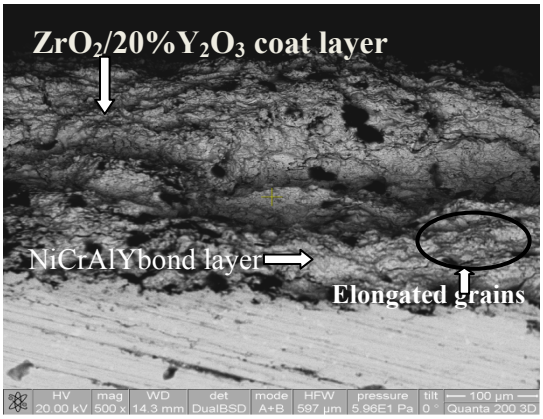

Fig. 4. SEM cross section of the $ZrO_2/20\%Y_2O_3$ coating layer with the thicknesses 200µm without heat treatment

Appling the heat treatment at a temperature of 1000°C for 5 hours led to the increase of the initial pores which resulted in a change of the density value of the material with respect to the analyzed surface (fig. 5). The SEM image also shows the formation of separation surfaces as a result of the oxidation phenomenon.

After the 10 hours heat treatment cracks appeared at the ceramic layer level opened to the outer surfaces. These cracks formed due to the separation of the splats because the weak bond between them (fig. 6). The pores grow even larger with a combine tendency and a more pronounced oxidation phenomenon at the splat limits.

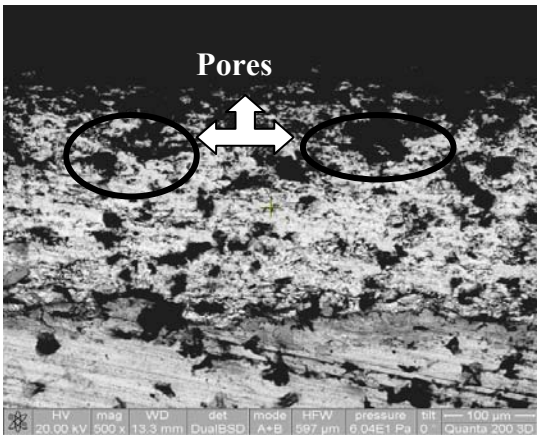

Fig. 5. Microstructure SEM of coated layer in the cross section after the 5 hour heat treatment

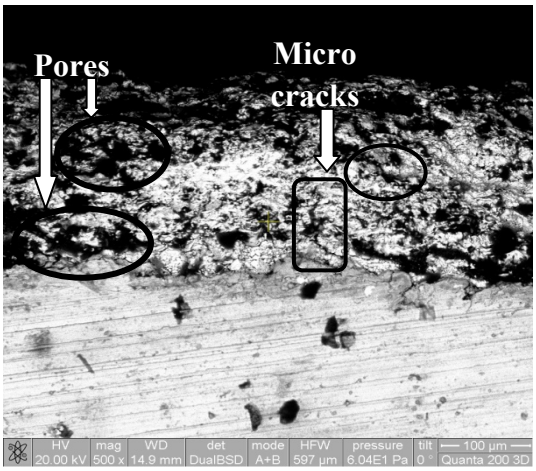

Fig. 6. Cross section of the layer after the 10 hour heat treatment

Increasing the heat treatment duration led to the structural uniformity of the two layers due to the diffusion process. In the SEM image of the coating after the 15 hour heat treatment separation surfaces appeared due to the oxidation phenomenon (fig. 7). The development of these surfaces was differentially produced at the grain limits. The surfaces also tend to show ramifications.

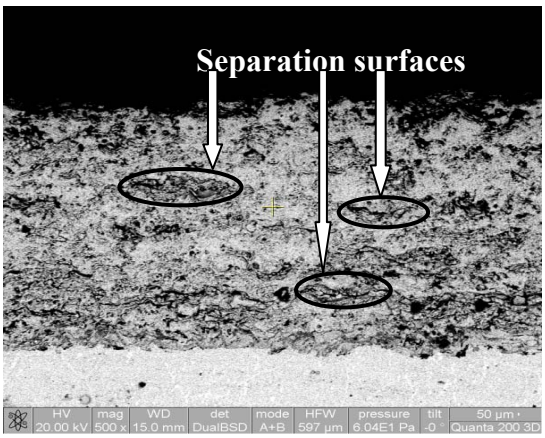

Fig. 7. SEM cross section of the layer after the 15 hours heat treatment

At high magnification, the limits between neighboring splats can be observed with the interlamellar cracks and pores of diferent dimensions (fig. 8)

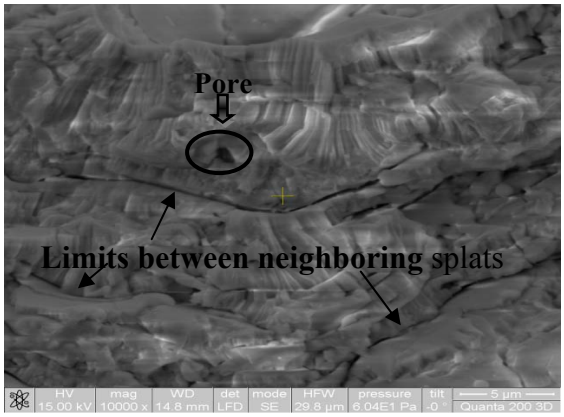

Fig. 8. High magnification cross section of the ceramic layer

After the 5 hour heat treatment at the temperature of 1000ºC the splats from the grains tend to divide and the successive disposition of the splats disappears. The structure of the layer is of brick wall type (fig.9).

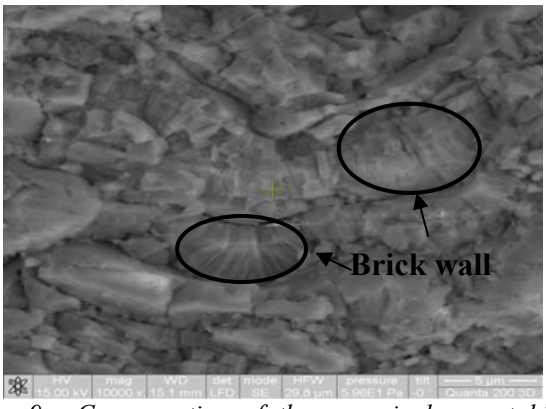

Fig. 9. Cross section of the ceramic layer at high magnification after the 5 hour heat treatment

After the 10 hour heat treatment the separation between the splats is more obvious and the layer prevails with intra splat pores (fig.10).

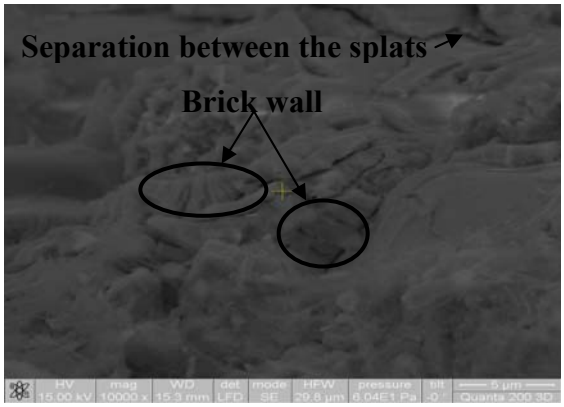

Fig. 10. High magnification of the cross section after the 10 hours heat treatment

After the 15 hour heat treatment at the interface between the ceramic layer and bond layer a sintering of the material was produced (fig. 11). The micro cracks between the splats highlight the brick wall structure of the layer. In individual splats the grains maintained their columnar shape.

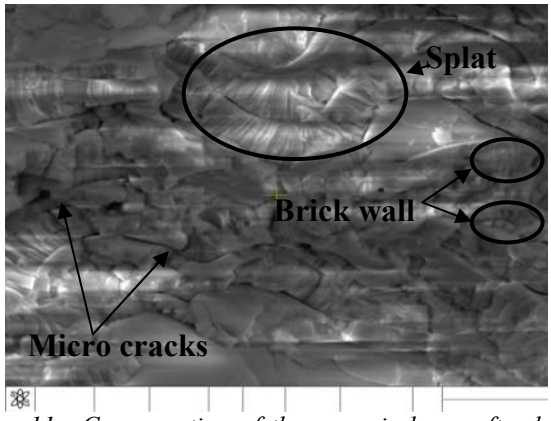

Fig. 11. Cross section of the ceramic layer after heat treatment for 15 hours

3.2. Structural analyses using X-ray diffraction The X-ray diffractometer is equipped with a X-ray anode tube made of Cu kα, λ = 1.54 Å, to which has been applied voltage of 45 kV with a current of 40 A, at an angle of diffraction (2θ) ranging from 25 to 130º. X-ray diffraction analysis was performed in order to observe and highlight the structural changes depending on the number of hours applied to each treatment compared with the phases that were highlighted on the untreated samples (Fig. 12). [1]

Wavelengths are: K Alpha 1 [Å]: 1.54060, K-Alpha 2.1,54443, K-Beta [Å]: 1.39225, K-A2 / K-A1 Ratio: 0.50000.

Structural analysis were performed using a dedicated software (Xpert High Score Plus) thought which the crystallographic parameters were identified (lattice type, network constant values a, b and c and angles elementary cell alpha, beta and gamma elementary cell volume, density) and the possible compositional parameters. For the precise choosing of the stoichiometric compositions.

On the cumulative diffractogram was also inserted the specific one for the initial powder. Since the initial powder is a mixture of Zr, Y, O, peaks for all the specific crystallographic planes are present. The XRD patterns of the samples have a smaller number of peaks, on one hand due to the formation of new compounds with new types of crystallographic networks, on the other hand due to the reduced exposure of some crystallographic planes, mainly due to the influence of the substrate and texturing [3].

The determination of the elementary cell parameters is showing the appearance on the substrate of a modified network from the original zirconium oxide. The changes are due to the inclusion in the network of yttrium atoms from the stabilizer.

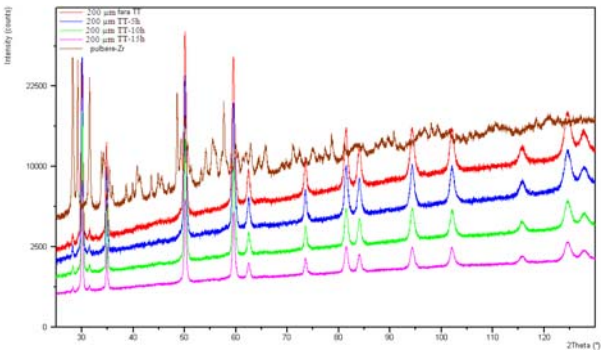

Fig. 12. The X-ray diffractogram for the $ZrO_2/20\%Y_2O_3$ deposited layer, at an diffration angle of 2θ = 25…130°

The zirconiu oxide original micro cristalin network maintains after the heat treatment. The network parameters of the original powder are: a=5.1240 Å and c=5.1770 Å. After the plasma spraying the network parameters are: a=5,1507Å, c=5,3156Å and β=99,1960° (fig. 13). After the heat treatments the network parameters are presented in table 2. It can be observed that the zirconium oxide picks changed from the monoclinic to tetragonal.

Table 2. Parametrii cristalografici

Parametri	Grosimea stratului de 200 µm		
	Tratament termic 5 h	Tratament termic 10 h	Tratament termic 15 h
a (Å)	3,6400	3,6120	3,6260
b (Å)	3,6400	3,6120	3,6260
c (Å)	5,2700	5,2120	5,2350
Alfa (°)	90,0000	90,0000	90,0000
Beta (°)	90,0000	90,0000	90,0000
Gama (°)	90,0000	90,0000	90,0000

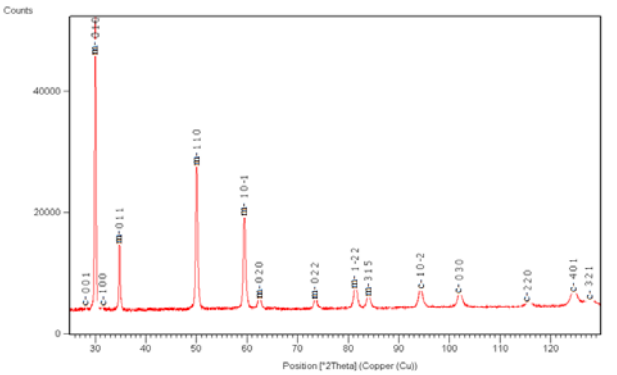

Fig. 13. The X-ray diffractogram of the layer at an diffration angle of 2θ = 25…130°

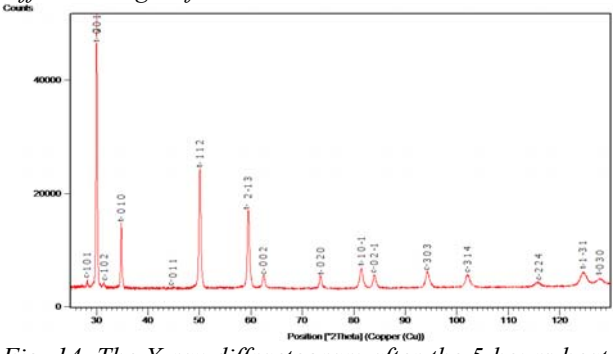

Fig. 14. The X-ray diffractogram after the 5 hours heat treatment, at an diffration angle of 2θ = 25…130°

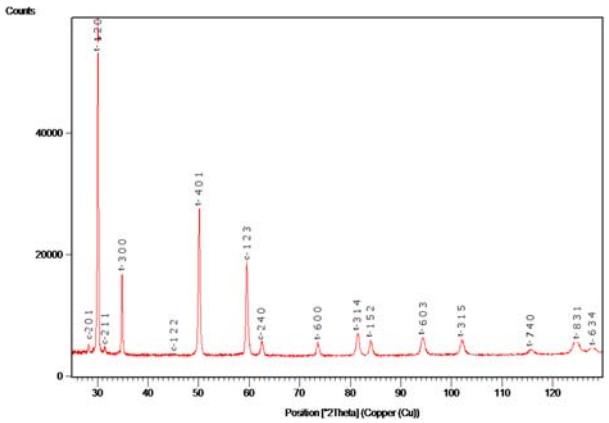

Fig. 15. The X-ray diffractogram after the 10 hours heat treatment, at an diffration angle of 2θ = 25…130°

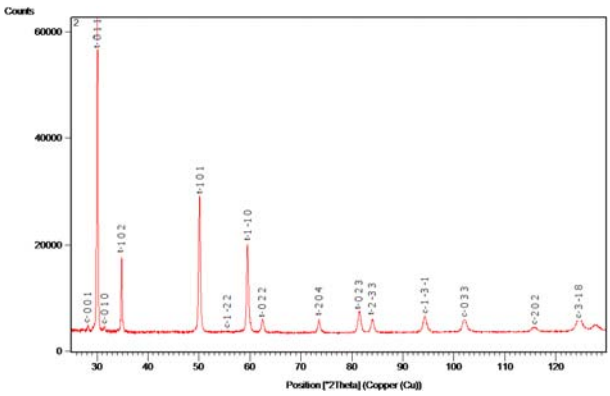

Fig. 16. The X-ray diffractogram after the 15 hours heat treatment, at an diffration angle of 2θ = 25…130°

4. CONCLUSIONS & ACKNOWLEDGMENT

After the heat treatment at a temperature of 1000 ºC the material matrix becomes more compact. The superficial grains dimension increases due to the forming of bridges between neighboring splats which has a closing effect on the initial micro cracks.

The structure obtained after the thermal deposition have the splats oriented on the direction of the thermal gradient. The heat treatment relaxes the structure and produces an oriented columnar structure of brick wall type. The adherence of the bond layer and thermal layer isn't influenced by the thermal treatment.

After the X-ray diffraction analyses was concluded that by plasma jet deposition the obtained ceramic coating has a multiphase structure. The analyses made after the heat treatment highlighted the changes produced to the multiphase system. The produced grains have a tetragonal structure, stabile at room temperature, which is recommended by the literature for its good mechanical properties for technological applications.

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OPTIMIZING TOP PISTON RING IN IC ENGINES FOR HIGH SEALING PERFORMANCE CONCOMITANT TO IMPORTANTLY REDUCED FRICTION, WEAR, OIL CONSUMPTION AND HARMFUL EMISSIONS

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Abstract: *This paper work is part of a comprehensive research work comprising analysis of the assembly cylinder-piston-piston ring tribology aiming significant reduction of friction, wear, of fuel and oil consumption to minimize harmful emissions with highly efficient internal combustion engines. In-here presented paper work is dealing with the conformability of compression piston ring to the distorted cylinder liner to improve sealing performance and to reduce friction losses within the power cell unit.*

Keywords*: piston ring, conformability, cylinder liner/bore, gas pressure, friction, wear, oil consumption, particulate emission.*

1. INTRODUCTION

Worldwide environmental concern is leading internal combustion engines designs. International legislation is establishing milestones to achieve vehicle emission goals. To meet emission targets, main development directions are new exhaust gas after treatment, systems, combustion strategies and improvement of engine mechanical efficiency. When it comes to reduce engine friction power losses, the power cell unit, especially the piston rings pack, presents great potential. It is already well known that the cylinder-piston-piston rings assembly accounts for 37% of the engine friction loss; its perfecting could lead to a reduction of fuel consumption up to 5%.

The challenge to develop future power cell unit mainly consists of reducing friction power losses and weight while maintaining functionality of gas sealing, oil control and durability. This might require some compromise in component design and only a system approach (involving tribology, material science, simulation, testing, and manufacturing) together with a full understanding of interactions in the engine will lead to best decisions.

Many of the present and future intended major engine technological evolutions influence significantly the operating conditions of the power cell unit and have to be considered as additional constrains in the continuous efforts to reduce the friction power losses within the ring pack.

Engine downsizing and increased power density generate greater thermal and mechanical loads that require higher ring material and coating durability to stand increasing cylinder pressure. Higher thermal and mechanical loading means higher deformations of piston grooves and lands (especially on lightweight designs), as well as more important deformations of the cylinder bores (particularly of lightweight blocks with limited cooling capacities) needing better ring conformability.

Thus specific ring features are needed to guarantee the optimum management of gas and oil in the ring belt area to improve engine blow-by, reduce oil and fuel consumption, harmful emission, and ensure increased durability.

2. SOLUTIONS TO IMPROVE SEALING PERFORMANCE WITHIN THE PISTON RING-CYLINDER LINER CONTACT

2.1 Piston ring conformability to the distorted cylinder liner:

The ring capability to follow the shape and deformations of the cylinder liner is far from perfect. Conformability of the ring to the liner is proportional to the cylinder diameter, and influenced by the type of the block cooling and the displacement of the cylinder head assembling points.

Also depending on the position of the ring gap, the sealing is not along the entire circumference of the ring. Oil escaped through the ring gap during operation of the engine is significantly influencing the oil consumption and the amount of the particulate emissions.

For this reason, at the stage of engine designing, special attention has to be paid to the **thermal dilatations** of the elements of the cylinder-piston-piston rings couple at operating temperatures. The cylinder inner diameter, the outer diameters of piston and rings, the dilatation of piston grooves, and especially the ring gap clearance under thermal stress have to be considered. The **dynamic ring gap area** is 1.5…6 times the static ring gap clearance (the later one measured at room temperature) and is bigger at higher level of thermal stress, generating ring axial movement in its groove [7].

To obtain minimum oil consumption, the static gap between the cylinder liner and piston has to be designed to ensure minimum gap at operating temperatures.

2.2 Theoretical analysis of ring conformability considering reduced friction and improved sealing effect:

For a highly efficient engine design, it is of high importance an accurate prediction of tribological condition of the piston compression ring-cylinder liner contact in reversal through Top Dead Center (TDC), between 300˚ and 400˚ crank angle, which accounts for a significant portion of overall friction losses in engine cycle.

As in real situation, there exists a bore out-of-roundness, during piston ring-bore fitment this leaves a non-uniform gap between ring and bore because of which the minimum oil film varies in circumferential direction. A conformability analysis is required to estimate these irregularities in the liner-ring sliding contact to find best minimization solutions.

The minimum ring-bore gap is function of the ring geometry and tension, combustion gas pressure and bore shape.

To compute the radial deformation of a classical compression ring that is considered an incomplete circular ring, it is assumed that its deflection is the one of a curved beam fixed at the point opposite to the free end.

In an operating engine, is needed a balance of the lubrication reaction force with the resultant of the gas force and elastic pressure force. Imbalance decides the regime of lubrication and may lead even to metal-to–metal contact. For an accurate analysis, most suitable is a mixed lubrication model based on the average Reynolds equation and considering the double-honed liner inner surface roughness value into the pressure estimation [8].

The usual free end gap of the compression ring of 7…10 mm is reduced to 0.1 mm when fitted in situ.

Fig. 2.2.1 shows measurements of ring-liner conformability realized on a coordinate measuring machine.

Measurements of bore and outer ring radii (the doted lines) are made with an accuracy of 1.5 μm [8], the full lines being the mean of these radii. To represent the outer ring radius, its inner radius is measured in situ, and both of its inner and outer radii were initially measured in its free state, determining its variable depth. It was assumed that no significant deformation in the depth of the ring would occur during its fitment. Thus, its outer radii can be calculated at each circumferential position when fitted. The difference between the outer ring and the bore radii, χ, accounts for the gap between the deformed compressed

ring and the out-of-round cylinder liner. This gap varies around the circumferential direction from nearly no gap tom approximately 10 μm, ring-bore conformance being asymmetrical as would be expected.

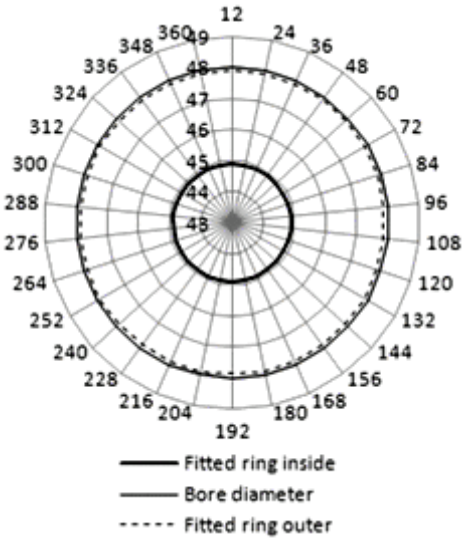

Fig. 2.2.1 Ring-bore conformability: fitted ring-bore gap

Conformability represents the ability of a ring to conform to the bore surface and it is function of gas pressure force (**Fg**), elastic pressure force (**Fe**), the ring and bore geometries and material properties.

Equation (1) shows the mathematical form of the **conformability factor**:

$$\xi_{ni} = \frac{3(F_e + F_g)R_b^2(2R_b - \kappa)^2}{2\pi E_t r_0 b \kappa^3 (n^2 - 1)^2} \quad (1)$$

3. Chosen solutions to improve piston ring conformability to cylinder liner:

More uniform distribution of the pressure force and conformability may be achieved by new constructive solutions for the ring.

3.1 Magnetic piston ring:

Magnetic piston ring (**Fig. 2.2.1**) comprises a magnetic joint made of three sections of 120-degree arc, the radii of the three arcs being the same, as well as the magnetism at the contacted positions of the arcs [9]. This solution has the beneficial effects of a better bonding property between the magnetic ring and the cylinder sleeve and more uniform than that of an elastic single opening ring. Therefore, the cylinder sleeve is not easy subdued to an elliptical deformation. After a period of ring and cylinder liner wearing, the overlapped parts can automatically extend to fill the gap, and thus no leakage is taking place. Such a solution is improving the tightness, delaying the lubricating oil aging, prolonging the service life of the engine parts and is improving the efficiency of the engine in its whole.

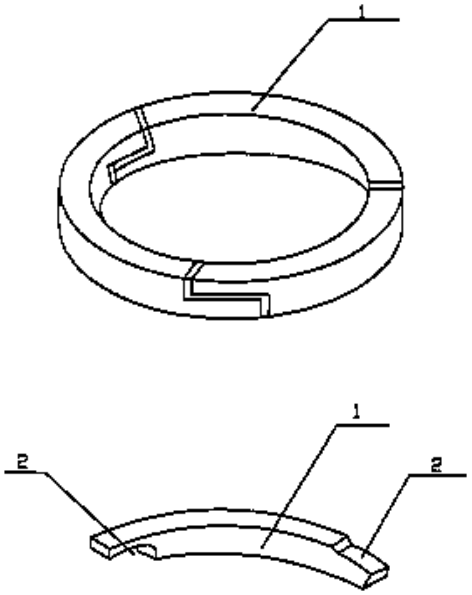

Fig. 3.1.1 Magnetic piston ring: **1** – section; **2** – joint

3.2 Asymmetrical complementary-close piston ring:

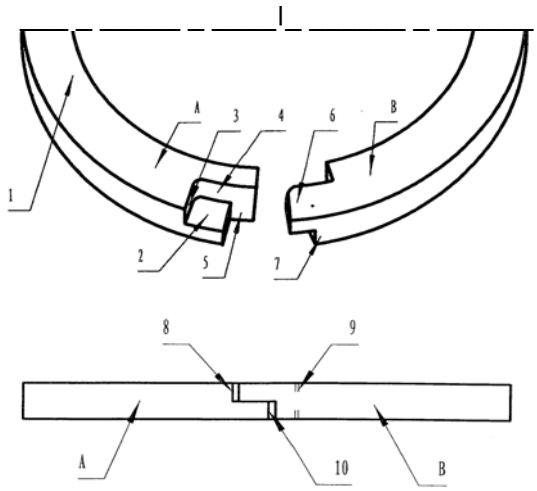

Fig. 3.2.1

End-unsymmetrical complementary close-type piston ring (**1**), including a concave semi-step (**2**), a concave semi-step upper side wall (**3**), an upper closure side wall (**4**), and a lower closure side wall (**5**) which are on the end (**A**) of one side of the piston ring, and a convex semi-step (**6**) and a semi-step (**7**) which are on the end (**B**) of the other side of the piston ring. **8**, **9** and **10** are designed dilatation gaps in the closed (mounted) state of the ring.

In mounted state, the ends of this type of compression ring are processed to realize a continuous chain of surfaces in contact, thus ensuring perfect sealing also at the ends of the ring [10].

The pressured gas inside the cylinder will no longer leak from the joint of the two ends of the notch of the piston ring during the compression stroke and working stroke of the internal combustion engine, meanwhile the piston ring will not clog due to the high temperature.

Furthermore, the sealing is improved and the operating time of the piston ring is increased, the heat evacuation rate is efficiently improved, and the output power of the internal combustion engine is increased.

This type of ring close is wear resistant; it automatically expands to compensate wear so that it ensures long-term stability of the engine power and reduced oil and fuel consumption.

3.3 Piston ring with variable geometry to conform perfectly to the cylinder liner shape:

To reduce friction and improve the sealing effect of the ring pack through better conformability of the compression ring to the cylinder liner, a solution is a piston ring having variable width along its circumference to compensate liner distortions [11]. In non-deformed state (before mounting), it has a circular outer circumference, and an inner non-circular circumference, the inertia momentum of its cross section being function of the cube of the ring width, **d**, for the respective section: **$M= f(d^3)$.** Ring flexibility is higher for lower width.

Conjugation of cylinder liner with deviations from circular shape (cross-section) with a ring having a circular outer circumference often gives important fluctuations of the radial pressure between the ring and liner along its circumference.

Under adverse operating conditions, peaks of radial pressure may alternate with lower values of the radial pressure causing significantly increased wear and even the apparition of a gap between the cylinder wall and the ring that will be increased by the gas force action, this worsening the sealing function of the ring.

To solve the gap by increasing ring pressure upon the liner is not acceptable because this is causing increasing of friction force and fuel consumption and lowers engine performance.

The ring with variable geometry is ensuring more uniform distribution of the radial pressure force acting between the ring and the liner. The radial pressure fluctuations have to be less than 20%, better within 10%.

Maximum designed flexibility of the ring is at its ends, to minimize radial pressure force peaks. Greater ring flexibility corresponds to the areas where liner has most important deformation, to ensure better conformability.

The ring is designed to comply with the specific cylinder liner distortions (pre-estimated), mounted on the designed position and indexed with the help of an anti-torsion system realized in piston (**Fig. 3.3.1, 3.3.2**). Such type of ring is designed in pair with the

cylinder it will make a tribological couple. Variation of ring width along its circumference is of few tens of mm.

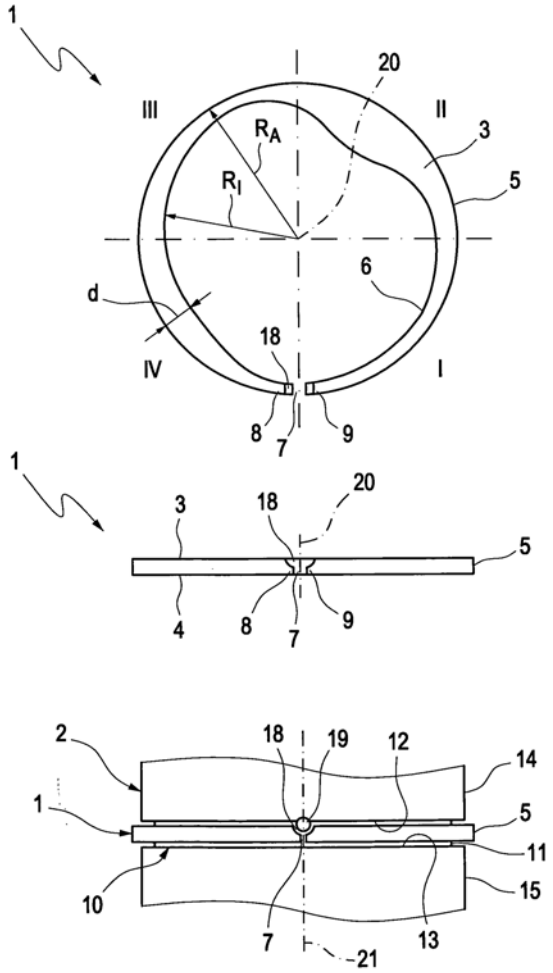

Fig. 3.3.1 Piston ring with variable geometry:
Top - schematic top view of a piston ring for a piston of an internal combustion engine in the un-deformed state (before mounting);
Middle - side view of the piston ring (before mounting);
Down - side view of the piston ring after insertion into a circumferential groove of the piston (mounted).
1 - piston ring;
2 - piston;
3 - upper side of the segment;
4 - lower side of the segment;
5 - circular outer circumference of the ring;
6 - inner non-circular circumference of the ring;
7 - gap at the ends of the segment;
8 and **9** - ends of the ring;
RA – radius of the outer circumference of the un-deformed ring (before mounting);
RI - distance from the ring axis to the inner non-circular circumference of the un-deformed ring;
10 - ring groove in piston;
11 - inner ring groove wall in piston;
12 - upper side of the ring groove in piston;
13 - lower side of the ring groove in piston;
14 - piston outer surface above the ring groove;
15 - piston outer surface under the ring groove;
17 - radial pressure of the deformed ring (mounted);
18 and **19** - ring anti-torsion system;
20 - ring axis.

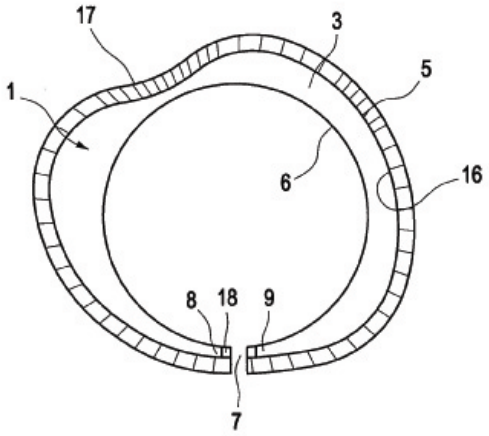

Fig. 3.3.2 Top view (schematic) of the deformed ring, mounted into its groove in piston, and radial pressure distribution along the ring-cylinder liner contact during engine operation.

1 - ring in deformed state;
3 - ring upper side;
5 - outer circumference of the ring;
6 - inner circumference of the ring;
8, **9** - ends of the ring;
16 - cylinder bore (deformed);
17 - radial pressure distribution;
18 - segment ends processed in the form of a circle arc, for anti-torsion mounting.

4. CONCLUSIONS

Friction, blow-by and blow-up, fuel and oil consumption and oil aging time through the power cell unit, and finally the whole engine durability and efficiency, are significantly influenced by the sealing performance of the rings pack determined, on its turn, by the compression ring capability to conform to the deformed cylinder liner.

Bore deformation is depending on the engine size, block type and its cooling capacity, on the block head mounting design, as well as on the temperature gradients in the cylinder during engine operation.

To improve piston ring conformability to the cylinder liner, new solutions have to be chosen to ensure adequate sealing effect.

Maximizing compression ring conformability will lead to reduced friction, wear, oil and fuel consumption and higher durability of the power cell unit and will contribute significantly to achieve the emission targets with a modern engine. It gas to be applied together with the other technical solutions to improve the tribological behavior of the cylinder-piston-piston rings system such as: perfecting the liner and ring surfaces in sliding contact regarding shape, material, texturing, coating, finishing ([1], [4], [5], [6]).

The main author of in-here presented research work intends (within her PhD studies) to continue the optimization process of the cylinder liner and especially of top piston compression ring to meet the main goals of this research: minimizing the frictional losses, wear, oil and fuel consumption, as well as the particulate harmful emissions with high performance internal combustion engines.

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IMPROVING THE EXPERIMENT PROCESS BY USING VIRTUAL LABORATORY IN THE EDUCATIONAL PROCESS

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Abstract: *Information and communication technologies provide powerful tools to support the shift to student-centered learning and the roles of teachers and students. Information technology can make teaching and learning more effective and efficient. In a constructivism learning environment, students construct their own knowledge by testing ideas and approaches based on their prior knowledge and experience, applying these to new tasks, contexts and situations, and integrating the new knowledge gained with pre-existing intellectual constructs.*

Keywords: *knowledge, laboratory activities, educational process, educational information technologies, laboratory experiments, educational process improvement.*

1. INTRODUCTION

Knowledge it can define as the power of capturing and understanding the essence of facts, the valorizing of information and certitude obtained in the form of experiences and lessons.

Miriam Webster dictionary defines knowledge, learning, erudition, and scholarship as synonyms: "mean what is or can be known by an individual or by humankind". Knowledge, "applies to facts or ideas acquired by study, investigation, observation, or experience".

Knowledge Society has been recognized as a new stage of the information age, the Information Society. In the "Report of the United Nations Commission for the Development of Science and Technology" published in 1998, the concept of Knowledge Society is presented as follows: "Knowledge Society recently the term has been used to focus on the role that information and communications technology (ICT) has evolved from a tool for technological change in an instrument that offers new potential result of combining the information embedded in ICT systems the creative potential of people to develop their knowledge."

The role of computers in educational activities as a storage of well-structured information and relatively easy access to that information have shifted the emphasis in education objectives from the need to memorize large amounts of study material to an ability to retrieve and understand information and to determine what kind of information is necessary for resolving educational and applied professional tasks.

Redistributing knowledge between the computer and the human being, represent an important problem of developing student's knowledge, skills and abilities. Using information technologies in the military higher educational system, must be oriented towards the achievement of a strategic goal: to train not only specialists prepared to carry out orders, but also creatively thinking and creatively acting individuals capable of constant self-improvement and self-development.

When we develop theories (add explanations to facts, concepts, and principles) and laws (empirically validate principles and theories) we accomplish the highest goal of science-to control the variables we are studying.

Constructivist learning theory asserts that knowledge is not simply transmitted from teacher to student, but is actively constructed by the mind of the learner through experiences.

Founded in developmental psychology, constructivism suggests: (a) the learner should be an active organism within the environment, not just responding to stimuli, but engaging and seeking to make sense of things; (b) knowledge is best generated internally, not absorbed from an external source; and (c) the motivation for learning should be intrinsic.

To facilitate such learning by discovery, the teacher and instructional environment must allow repeated, prolonged experiences with the materials and events associated with the topic to be learned.

Computer – assisted training practice represents the basic for individual training programs, with a conversation type unfolding as a mean feature; it allowed a gradual and sequential introduction of information with the more complex programs, advance into the matter being governed by the results obtained at the intermediate, program – imposed tests. The graphic layout, the correlation between the mathematics with the physical phenomena and their simulation on the computer ensured a favorable welcome of this modern method, along with the disappearance of repulsion towards the "simulator", a feeling which had occurred due to the excessive emphasis laid on the simulators' importance compared to the actual sortie hours.

2. BACKGROUND

A new approach of the mechanical behavior laboratory it should be implemented at the Department of Fundamentals Sciences that will contribute to develop the student's abilities to analyze mechanical behavior of structures, to design experiments, and to develop student's professional skills.

The selected system must provide opportunities for the students to apply the spectrum of the mechanical behavior knowledge, including the fundamental principles of mechanics structures.

An integral part of the curricula is sequence of three hours mechanical behavior courses each week. The course, Mechanics and Materials Strength includes two hours of lecture and one hours of lab each week. Laboratories are offered to sections of about fifteen students.

The actual activity of laboratory experiment process is shown in fig. 1.

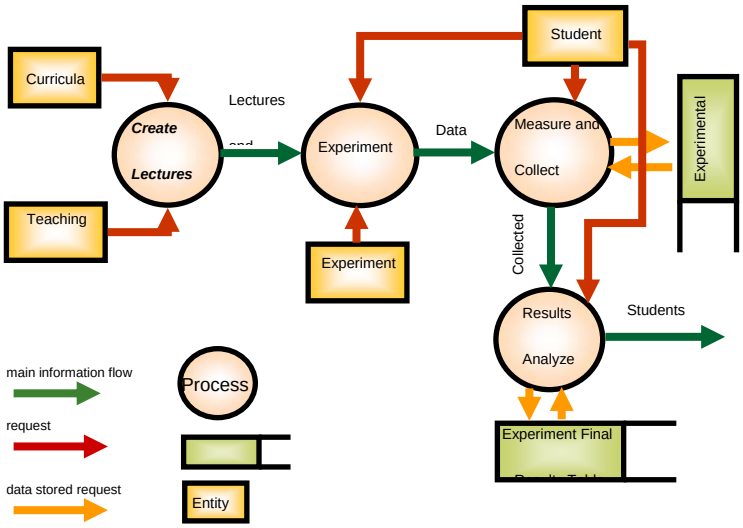

Fig.1 Laboratory Experiment Process "As Is"

The laboratory has only one set of instrumentation, at the level of complexity required in the course.

Experiments use fixed apparatus for investigation. This educational equipment gives students an appreciation of measure of stress and strains, second moment of area, the neutral axis, torsion and bending equation. Strain gauges measure the strain. The experiment is supplied with a student guide and instructions for use.

The students complete the experiment using suggested conditions, run an experiment, measure and collect experimental data, evaluate the results and write a report. Because students went from one unrelated experiment to another throughout the semester, they did not have the opportunity to develop the "system level" perspective necessary to analyze and understand complex mechanical behavior.

The Mechanical lab activity requires to be upgraded so as to take advantage of using information and communication technologies in teaching. Computers have to be used for creating virtual laboratory experiments, data acquisition, calculation, graphing, report preparation, and teaching via built-in tutorials.

3. MOTIVATION AND CONTEXT FOR PROCESS IMPROVEMENT FOR LABORATORY ACTIVITY

The improvement of the educational process in the mechanical laboratory is shown in fig.2. As part of that process, it was determined that the new approach of Mechanics and Materials Strength should support several of the program's outcomes, including:

- students shall have the ability to analyze, design and realize mechanical behavior of structures.
- students shall have the ability to use contemporary computation techniques and tools.
- students shall have competence in design of experiments, experimental practices and data interpretation.
- students shall have the ability to apply statistical methods to analyze and interpret data.
- students shall have effective oral and written communication skills.
- students shall have the ability to plan, schedule and execute experiments.

It is clear that a new approach for the laboratory activity was required to accomplish the goal of supporting these student outcomes. The students have to perform an integrated sequence of laboratory experiments with a new system. As the students progress through the series of experiments, they are increasingly involved in experimental design. In this way, the students will develop a systems approach to engineering problems, the ability to design and conduct experiments, and professional skills. It was determined that the important skills to develop should be related to the design of experiments. In the context used here, physical design of experiments deals with identifying a problem and solving it. It includes the determination test variables and data requirements, the selection and the design of the instrumentation system.

An important and relatively unique aspect laboratory design is the use a Structures Virtual Experimentation Pack that includes the software simulations of all Structures teaching experiments that enables a range of computer simulated experiments for mechanical and structural engineering, students studying the

principles of mechanical behaviors of structures. It uses a variety of delivery methods including computer software, textbooks and user guides.

The software includes simulations of each experiment module. The laboratory experiments and lecture material presented throughout the semester are designed specifically to develop student's ability to design experiments. The experiment modules enable students to explore subjects such as bending moments, torsion, shear, deflection of frames, beams and cantilevers, stresses and strains and investigate various structures.

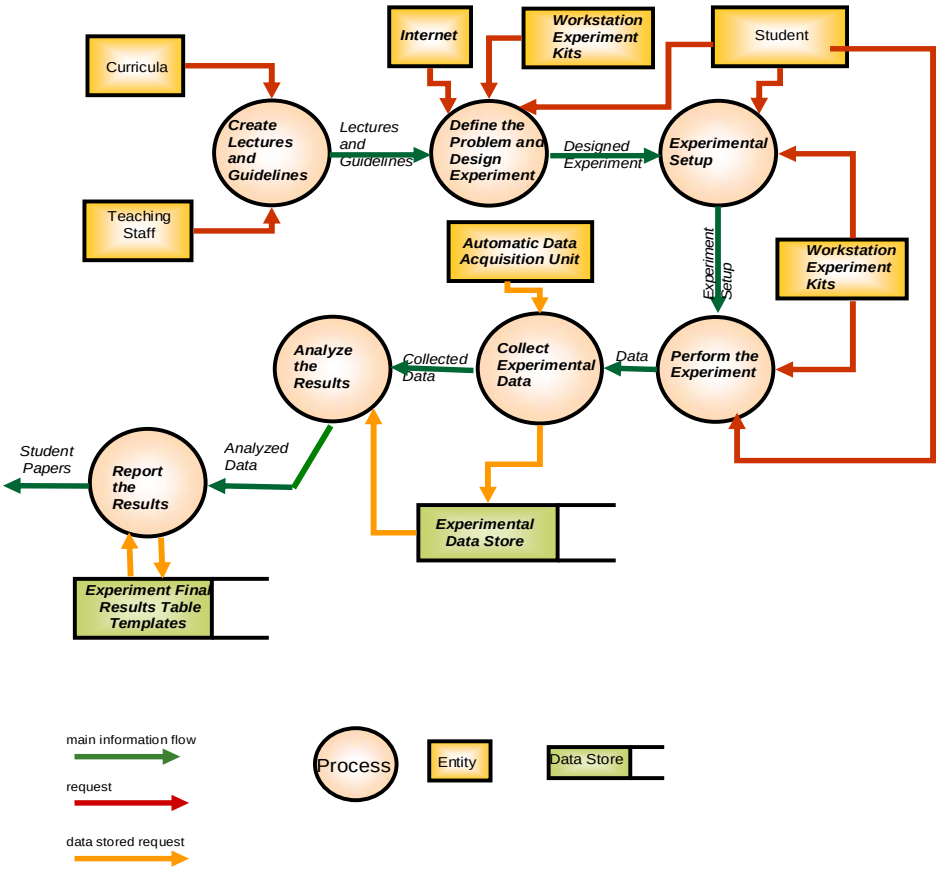

Fig. 2 Improved Mechanical Laboratory Experiment Process "To Be"

Laboratory content:

• structures laboratory including virtual (simulated) experimentation;

• 9 workstations;

• 15 students.

Laboratory has to include 9 workstations each consisting of 1 set of virtual experimentation, 1 computer (networked), 1 projector, projector and whiteboard controls, 2 networked printers (including server), 1 interactive board.

By concentrating on student understanding and learning efficiency, the laboratory kit range allows students to test structure models for themselves and get first-hand experience of how different structures behave:

- automatic data acquisition;
- the use of computer software means students learn efficiently and make the best use of laboratory time;
- simulation software;
- flexibility and modularity.

Powerful simulation software allows virtual experiments to be conducted for the complete range of structures experiments, with or without the hardware. A key feature of this range is flexibility.

The experiment modules and instrumentation simply fix to an ergonomic frame. They are easily removed and swapped for another experiment, making sensible use of laboratory space and time. One experiment can show several principles because the range is modular. Structures range meets the needs of

academic courses and the demands of modern education.

The new approach for the laboratory activity and the process improvement laboratory experiment are important for student's learning process because provides:

- affordable, effective method for students to quickly learn the principles of structures mechanical behavior;
- authentic virtual experiment options;
- easy understand for students;
- safety for students use;
- comprehensive, versatile and powerful combinations, interchangeable experiment modules;
- quick and accurate data collection using automatic data acquisition;
- realistic and verifiable experimental results;
- best use of laboratory time – makes result taking more efficient;
- convenient tabulation and graphing of experimental results.

4. CONCLUDING REMARKS

Used at academic levels, this educational equipment will give students an appreciation of converting principles to results. By using various media in support of the experiments, student interest is maintained and learning becomes more effective.

Using IT for studying, it should be that students being educated in IT to be able to make full use of:

- word processing; presentations; communication tools; collaborative work;
- internet information access; electronic mail and file transfer;
- numerical processing spreadsheets, statistics;
- programming;
- graphic design;
- database analysis & management;
- control of equipment & instruments, data capture;
- desktop publishing;
- integrated work environment;
- conferencing;
- gateway to information & data banks.

In parallel with the development of computer-assisted training, the need occurred for a development of self-training, an activity meant not to only acquire intellectual and practical skills, but also to consolidate previously acquired abilities.

The use of virtual laboratory in the learning process is a natural consequence of what might be called the 4th revelation in the didactic science, and it corresponds to the natural trends of refining both the methodologies and the conceptual system, used in comprehending the internal mechanism of learning.

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COMPATIBILITY ANALYSIS OF THE OPTICAL SYSTEMS CHARACTERISTICS USED IN IMAGE FUSION

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Abstract: *Development of optoelectronic observation systems based on obtaining image fusion includes, inter alia, adequately solve geometrical compatibility of individual images. The paper presents the characteristics of the optical system defining these images formats geometrically and qualitatively, and assumptions about ways to harmonize these features from perspective of obtaining image fusion.*

Keywords: *Fused images, field of view, image size, resolution, distorsion*

1. INTRODUCTION

A new direction for the development of optoelectronic systems used for night vision is based on fusion images from different spectral sensitivity sensors. When these images are combined in an optimal way, the resulting image is a powerful tool, and can provide more details of the scene than any of the constituent monospectral imaging. With such systems, can achieve a significant increase in the performance of scene in conditions of limited visibility, so combining images from different spectral ranges is lately used mostly in military applications.

Below are described some ways for obtaining fusion images and constructive considerations to optimize the benefits of the fusion multispectral images.

2. IMAGE FUSION METHODS

Image fusion methods are divided, generally, in two major categories: direct fusion and digital fusion.

2.1 Direct image fusio n. The most basic form of direct image fusion is *physiological fusion* in which one eye is using, for example, a 1x night vision monocular, other eye is capturing directly the image of the scene.

Fig.1 Physiological direct image fusion

Advantage of simple construction, is attenuated by fusion physiological limitations and constraints that may be accompanied by undesired effects, such as binocular rivalry. [1]

The optical direct fusion is one in which to the same eye of the observer they are simultaneously presented two images overlaid on optical path. A form already widely used is the HMD transparent displays mainly used in aviation, where the pilot can see, superimposed on the direct image of the scene, a virtual image from an optoelectronic system projected through a semi reflective visor.[2]

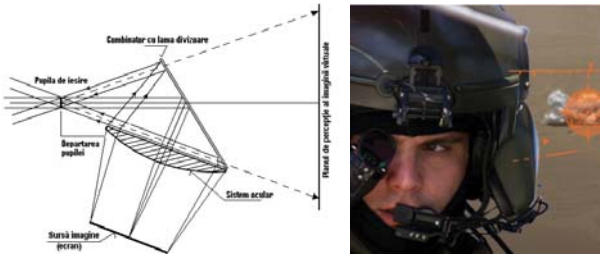


Fig. 2 The optical direct fusion imaging system

A more complex form of the optical direct fusion is that performing simultaneous display of two images formed with different optoelectronic systems and in different spectral ranges, without any further processing of these images. These may come, for example, from a night vision scope –VIS, and from an infrared camera –IR. So, as illustrated in Fig.3, images taken by the two optoelectronic systems is each one displayed on screen and simultaneously presented of the observer eye, are overlapping via an combiner eyepiece equipped with a optical beam splitter.

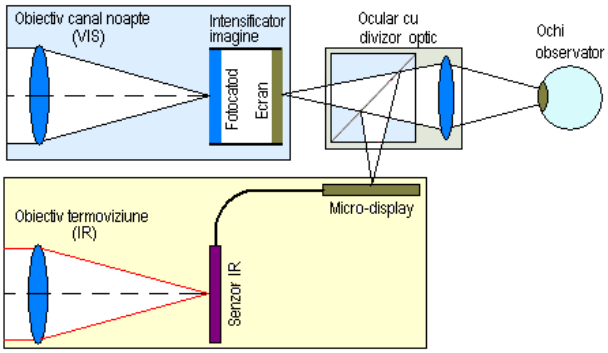


Fig. 3 The direct fusion imaging VIS / IR system

2.2 Digital image fusion.

For night vision equipments, an important direction of development is the digital image fusion. This is achieved using sophisticated fusing algorithms by video signal from two distinct pathways, equipped with image intensifier as VIS sensor and micro bolometer as IR sensor. The figure below shows block diagram of such a system that makes image fusion in VIS and IR ranges by processing of appropriate video signals in the electronic module. In some applications, fused image display mode contains a display of dimensions such that it allowing direct observation, without eyepiece.

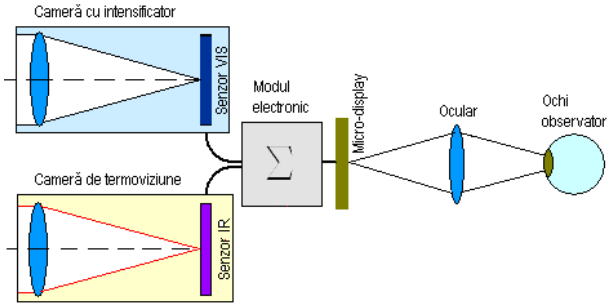


Fig. 3 The digital fusion imaging VIS / IR system

This means of fusing two pathways with complementary spectral ranges and specific sensors combines the advantages of both systems, namely the detection capability in low atmospheric transparency conditions or complete darkness, specific for thermo vision systems, respectively higher resolution even in low light conditions and reduced thermal contrast of the scene, specific in the case of image intensification system.

Towards direct fusion systems, by using the digital fusion algorithms of video signals, images can be produced showing all the advantages of direct fusion to which is added:

- possibility of emphasis by increasing local brightness or coloring of details on targets of interest that are highlighted by IR channel, thus facilitating their rapid detection;
- harmonization by electronic means, easier to achieve, optical-geometrical characteristics of the two images to increase fused image clarity;

3. BASIC CHARACTERISTICS OF OPTICAL SYSTEMS USED FOR IMAGE FUSION

In the following we propose to analyze the main features of optical imaging systems, exclusively prepared for optoelectronic devices that use telephoto lenses to capture images, military-specific applications, in which case working distance is virtually infinite, and the image plane in which the sensor is positioned virtually coincides with the focal plane of the lens.

3.1. Angul ar field of view FOV is the maximum angle in object space that can be seen. The field of view of an optical system is limited by the diameter of the lens aperture of that system. Dimensional, the diaphragm field is defined by the inside diameter of the mount existing in the focus image plane.

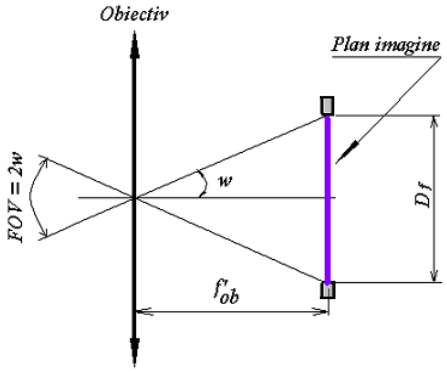


Fig. 4 Explanatory diagram of FOV

According to Fig.4, visual field subtends angle *2w* and is given by the relation (1):

$$FOV = 2w = 2arctg\left(\frac{D_f}{2 \cdot f'_{ob}}\right) \quad (1)$$

If the sensor shape is circular, relation (1) is directly used, but usually the sensor shape is rectangular. A camera's field of view is so limited on the sensor matrix dimensions *a, b*. Therefore, field of view has different values in the two directions, horizontal and vertical, corresponding at the two dimensions *a, b* of the sensor matrix, according to the relation:

$$FOV = 2arctg\frac{a}{2f'_{ob}} \quad (2)$$

In addition, the field of view can be expressed in terms of pixel size p and the number of pixels N in that direction. Therefore, equation (2) becomes:

$$FOV = 2arctg\frac{N * p}{2f'_{ob}} \quad (2)'$$

3.2. The image siz e in sensor plan e Y' in the focus plane depends, as illustrated in Fig.5 and relationship (3) on the angular size of the object u and on the focal length f'_{ob} of the camera lens.

$$Y' = tg(u) * f'_{ob} \quad (3)$$

Where: - u, is the angle that subtends an object Y size of the scene.

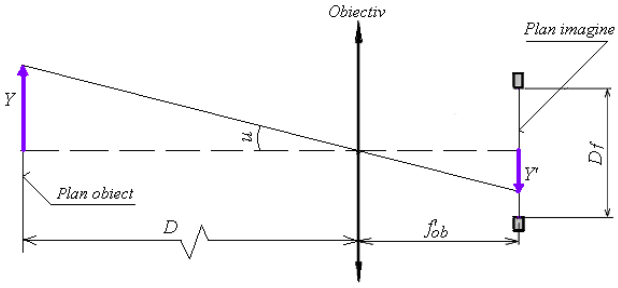


Fig. 5 Explanatory diagram image formation by a telephoto lens system

Relation (3) can be written also in the form:

$$Y' = \frac{Y}{D} * f'_{ob} \quad (3)'$$

Where: - Y, is the object size;
- D, is the distance to the object plane (> practical infinite).

Image size can be expressed in number of pixels N_p that it takes on the corresponding direction according to pixel size p, according to relations (4):

$$N_p = \frac{1}{p} * \frac{Y}{D} * f'_{ob} \quad (4)$$

3.3. Image distortion. From relation (3)' it follows that image size Y' depends linearly on the object size Y. The Y'/Y report is defined as an transversal magnification β of an objective optical system, so with the expression:

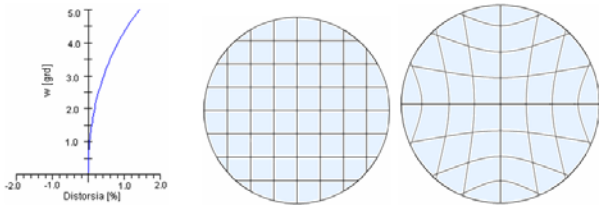
$$\beta = -\frac{Y'}{Y} = -\frac{f'_{ob}}{D} = const. \quad (5)$$

An optical system, whose transversal magnification β is not constant, possesses geometric *image distortion* aberration, thus manifested by transversal magnification in field changes. Distortion D is expressed as a percentage and has the form:

$$D[\%] = \frac{\Delta Y'}{Y'} * 100 \quad (6)$$

Where: $\Delta Y'$ is the deviation from the nominal image size Y' that result from the relationship (3)'.

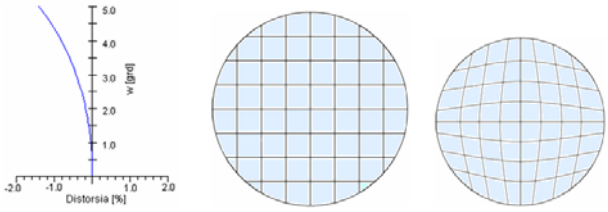
Distortion increases in absolute value with increasing angle of beam emerging, therefore with increasing object size. Image distorsion increase from zero, on optical axis, up to a maximum value at the edge of field, is nonlinear, and may have a "+" or "-" sign. Fig.6 show the positive distorsion diagram (a) and the "pillow" deformation of a grid image specific to this type of distortion (b).



a) b)

Fig. 6 Positive image distortion

Fig.7 show the negative distorsion diagram (a) and the "barrel" deformation of a grid image specific to this type of distortion (b).



a) b)

Fig. 7 Negative image distortion

If optical lens system would not cause image distortion, ratio of any image element *y'* and object element conjugate *y* would be constant in the entire field of vision. An optical system that satisfies the condition β = *constant* is called *orthoscopic*.

3.4. Image resolu tion of a system represents the threshold separation angle (minimum), also is the angle under which two adjacent elementary objects can be seen. The resolution characteristics of an image tell us the ability of the optoelectronic system to view small details on an image with high contrast. The resolution of the optoelectronic system is give mainly by the camera resolution, the display resolution being, usually, larger. Generally, the parameters, which represent the ability of the thermal camera to view small details (resolution), can be divided into four categories:

a) Parameters based on the specification for FPA (detectors numbers, pixel size).
b) MTF (Modulation transfer function) and derived parameters.
c) Parameters based on the camera response to point or linear sources.
d) Parameters based on the operators ability to view some details.

Of interest for our subject is the first criterion for the evaluation of the resolution, based on the sensor's matrix of characteristics. In the case of optoelectronic systems, the number of detectors, lines number or pixel size have influence on the camera's ability to view small details. The total numbers of detectors is used to describe the resolution of the camera with detector matrix (ex. 320x240 pixels or 640x480 pixels). The resolution can be also given as a inverse of the "separation" in cycles (cy) or lp/mrad. The sensor resolution expressed in lp/mrad is calculated with the relation:

$$R_S = \frac{1}{2 * p}[lp/mm] \quad (7)$$

Where: p is the dimension in *mm* of a pixel of the sensor in case of a digital output, or a TV line in case of an analogical output.

The maximal resolution R of a optoelectronic system is given by the *relation*:

$$R = f'_{ob} * Rs * 10^{-3}[lp/mrad] \quad (8)$$

In relation (8) R is achieved in lp/mrad, when the focal length of the camera's lens f'_{ob} is in *mm* and the sensor resolution R_S is given in *lp/mm*.

4. ASSUMPTION REGARDING THE COMPATIBILIZATION OF MAIN CHARACTERISTICS OF OPTICAL SYSTEMS USED IN IMAGE FUSION

As shown in Section 2, fusing two images means to overlap them in one image. In order that the fused image to be as clear as possible and/or to avoid errors given by relative position appreciation of different objects from the scene, it is necessary that before fusing the two images, they must have similar values for the geometrical parameters. For the appreciation of geometrical similitude of the two images, 3 criteria must be taken into account: size, orthoscopic and image alignment.

In the case of direct fusion, the geometrical similitude of the images is done only by the opto-mechanical systems of the two-

monospectral cameras. The performances of the fused images depend by the degree of similitude of the two images and their resolution.

In the case of digital fusion, the geometrical similitude of the two images is done electronically, either automatically, which complicates fusion algorithms, either manual calibration, the electronic box having adjustment buttons.

Next, we will discuss about the geometrical harmonization of the images as a final purpose for obtaining optimal images for fusion, unconcerned by the chosen method: direct fusion or digital fusion.

4.1. Fused images visual field s correlation. An accurate superposition of two individual images that make up the image fusion is only possible if both channels displayed the same area of the scene. This means that both images must have the same linear field of view, both horizontally and in the vertical plane. According to the scheme in fig.4 and relation (2) follows that to take the same field of view, if the homologous sizes of the sensor to the two channels are a_1 respectively a_2, then the focal lengths f_1 respectively f_2 of the two subsystems, must be in the report k_0 given by relation:

$$\frac{f_1}{f_2} = \frac{a_1}{a_2} = k_0 \qquad (8)$$

Obviously, the matrix homologous sides of the two sensors must meet the same report k_0 in both directions, ie the two sensors must be the same size (for example 4:3).

Of course, there may be situations when the two images are different format, but then we talk about fused image only on area of intersection of the two images. In such circumstances, fully fused image may contain at most one-component images. Partial overlap of two individual images is also possible if the sensors have the same format but have different fields of view values. This fusion possibility can occur when perfect equalization to separate fields of view is not possible or when the equalizer is not an end in itself, image fusion optimization is priority. In this working hypothesis, ratio of the lens focal lengths of the two subsystems will not follow equation (8) them being in a relationship $k \neq k_0$. Closer the value k of the ratio of the focal lengths to k_0, the image for fusion will have a greater part in the displayed image.

4.2. Possibilities for li nking the siz e of fusionable images. The main difference between the errors image size introduced by deviations of focal length and distortion, is that in the first case image deformation is constant in field, whereas distortion causes nonlinear image deformation in field. A deviation from the nominal value of the focal lengths ratio of the two constituent imaging systems can be compensated by optical or digital zoom applied to one of the two images. Distortion deviation is more difficult to compensate due to nonlinearity of this lens geometric aberration. Therefore, the compensation of the effect on image size cannot be achieved by changing the focal length (zoom function) for the entire visual field, but only for a single field value. Diagrams of Fig.7 show the situation offsetting a -1.6% negative distorsion at the edge of a lens field with a deviation of -1.6% of the other lens focal length. According to the chart, at the edge of the field sizes of the two images are equal but at 0.65 of the field, the maximum size difference between them is 0.45%, which leads to a maximum difference of 1.8 pixels for a sensor with 640x480 pixels.

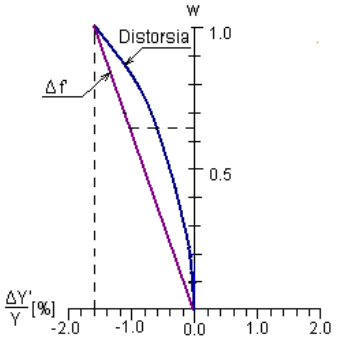


Fig.7 Distorsion – Δf' compensation at the limits of the field of view

A higher minimization of displacement caused by distortion can be realized by zoom, only if dimensional compression for fusion images is made at a value of the field determined, considering that displacement between the two images is minimum in the interest area of the field and maximum in image corners. Using data from previous example, for a distortion of -1,6% optimal compensation using zoom is made by focal length variation with -1,15%. Furthermore, total compensation for distortion is made at approximately 0.8 from the field of view, which causes a displacement of 0.75 pixels at 0.4 and 0.9 of field and of maximum 1.8 pixels on the extremities of the field, as show Fig.8.

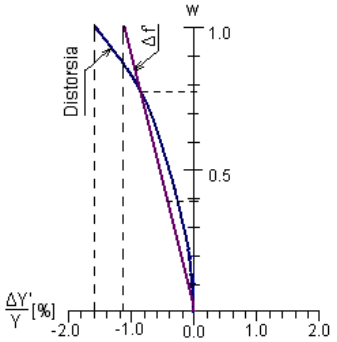


Fig. 8 Distorsion – Δf' compensation at 0,8 of the field of view

4.5. The tr adeoff betw een field of view and resolution. Some combinations of wavelengths have the potential to produce images whit high differences for field of view and resolution. For example, VIS sensors are easy to obtain in large format and with small dimensions for pixels (< 5μm). By contrast, IR technology, despite that it increased thermal images popularity, offers sensors with low dimensions and high dimensions for pixels (> 15μm). Despite the fact that technological advances are determined for reducing pixel dimension and increasing sensor resolution, the rice remains constantly high. By comparison, if it considered a fusion between a image from a VIS sensor an a image for IR micro bolometer and if it admitted that both paths have the same focal length, then the resolution ration of both images can be equal with 3÷5 for VIS sensors. If the images are superimposed, high differences between resolutions can cause low quality images [1]. An acceptable compromise in this sort of situations is to reduce field of view of the IR path up to 1/3.

5. CONCLUSIONS & ACKNOWLEDGMENT

In order to benefit from fusion complete advantages of two images fusion, it must be take in to consideration a series of relations and constraints. Therefore, if a high quality of the two overlapping images cannot be achieved, the result will have a low quality. Many factor of influence must be taking into consideration by the system designer for the development of a system based on image fusion, from which correct superimpose, differences between sizes and distortion, and the level of performance imposed. In addition, a special importance must be accorded to entire field of view and for the resolution of each optical path, between the must not exist high differences. Sure, digital fusion, despite it can assure high performance, allows by using high complexity fusion algorithms electronic compensation for imperfection produced by optical systems.

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EXPERIMENTAL RESEARCH ON THE SUPERCHARGING OF THE COMPRESSION IGNITION ENGINES WITH PRESSURE WAVE COMPRESSOR DRIVEN BY ELECTRIC MOTOR

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Abstract: *The compression ignition engine (CIE), as an important propulsion source must be developed in a fast rate so that the highest requirements regarding to power and economy energetic performances to be satisfied. These performances, can be ameliorated if the efficiency of the combustion process improves, by using supercharging compressors which provide in each operation regime of the engine, the optimal quantity of the intake air. A powerful supercharging compressor, characterized by an efficiency comparable to the turbocharger's one, is the pressure wave compressor (PWC). This, still has a great development potential because in our days it is driven by the crankshaft, which involves limited running performance. The solution proposed in this article, to improve the PWC performances and also the one of the CIE, is to drive this compressor trough a DC electric motor, with revolutions not depending on the supercharged engine's one. Applying this new driving solution is possible because driving the PWC requires in average, relatively low power consumption (300-400 W). As result of the experimental researches carried out on the engine testing bench, in this article is presented the degree of energetic performance improvement of a CIE, due to supercharging it, with PWC driven by an electric motor.*

Keywords: *pressure wave compressor, driven, energetic performances*

1. INTRODUCTION

Between the main imposed requirements for the vehicle's propulsion systems are found the ones related to power and economy energetic performances improvement of compression ignition engines (CIE).

These performances can be improved if the quantity of heat, released in the engine's cylinders increases due to burning the fuel injected per cycle (Q_0). According to the thermal balance equation (Equation 1), the heat Q_0 is equivalent to the sum of heat converted into effective mechanical work Q_1, the heat released to the exterior through the cooling system Q_2, the heat released through the exhaust gases Q_3, heat lost due to incomplete combustion Q_4, heat transferred to the oil through the lubrication system Q_5 and residual heat that we do not take in account through the other components of the thermal balance Q_6. [2]

$$Q_0 = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 \quad (1)$$

Analyzing this formula it can be affirmed that the power and economy energetic performances can be improved if CIEs are equipped with supercharging compressor which use the energy stored in the exhaust gases (Q_3) for intake air compression. In this way, through improving the filling process the

heat quantity Q_4 caused by the better efficiency of the burning process will be reduced, thus maintaining the same fuel quantity, the heat Q_o will be increased. [3]

A powerful supercharging compressor, characterized by an efficiency comparable to the turbocharger's one, is the *pressure wave compressor (PWC)*. But this presents the disadvantage of difficult synchronization with the supercharged engine, at all speed and load range. This disadvantage is exclusively caused by the way the compressor is driven nowadays, driven by the crankshaft of the engine through a belt. [5, 6]

Due to these considerations this article proposes to highlight the benefits of a new driving system that permits this compressor to provide the proper air quantity for the supercharged engine, regardless to the engine speed and load regimes at which it operates.

2. THEORETICAL ASPECTS

The CWP (figure 1) compresses the fresh air at a pressure that depends mainly on the pressure of the burned, exhausted gasses. This is possible because the exhaust gases and the fresh air enter in each channel of the rotor of the PWC and after the pressures are equalized the gasses leave the compressor on different paths.

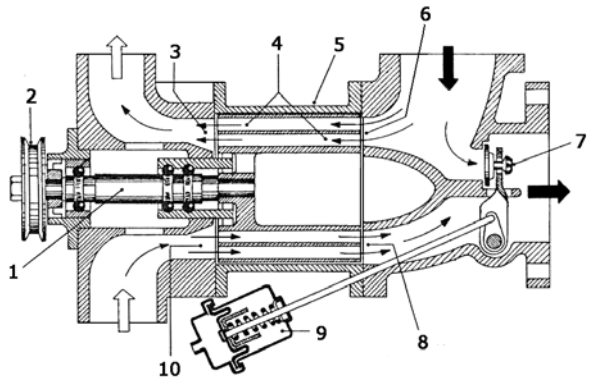


Fig. 1. The components of the PWC [1, 4]: 1-drive shaft; 2-drive pulley; 3-compressed air exit port; 4-rotor channels; 5-rotor case; 6-exhaust gas intake port; 7-wastegate valve; 8-exhaust gas exit port; 9-wastegate valve actuator; 10-air intake port.

Therefore, the compressed air leaving the PWC, enters in the CIE often at a pressure close to that of the exhaust gasses. This, having a high pressure even at low engine loads and speeds of the CIE, enables in optimal conditions the supercharging process in all operating regimes of the engine.

Besides the geometric dimensions of PWC, a parameter that essentially influences the quality of supercharging process is represented by the speed with which the compressor is driven. The period while the exhaust gases are in contact with the fresh air are depending directly to the value of this speed. This time through which the process of pressure equalization of the two fluids in the rotor of the PWC, decisively influences the value of the: intake air pressure, flow of the compressed air for the engine and the degree of compressed air contamination with exhaust gasses. [5]

Of course, a high quality supercharging process involves a good correlation between geometric dimensions and speed of the PWC on one hand and the operating regime of the CIE on the other hand. But, in our days, it is difficult to realize this optimal correlation, because the PWC being driven by the crankshaft, (with a speed dependent on the CIE's one) it can't be driven at speeds that allow it to compress the intake air at the needed level for each operating regime of the supercharged engine.

All these aspects lead us, taking in account the maximal exploitation of the PWC performances, to a new driving system, which ensures a rotational speed that is not dependent on the rotational speed regimes of the CIE.

3. EXPERIMENTAL RECONFIGURATION AND VALIDATION OF THE PWC's DRIVING SYSTEM

3.1 Electrical driving of the PWC. The proposed solution, in order to make the PWC more efficient, is that to drive it with a DC electric motor, having an electronically modified speed, according to the speed and load regimes of the CIE.

Taking in account the role of the PWC's rotor which is the working fluid's distribution, it implies a reduced driving power, the electric motor will have smaller dimensions, fact that

doesn't present difficulties mounting it on the supercharged engine.

It will be also facilitated the positioning of the PWC on the CIE, because the compressor is no longer driven by the crankshaft.

Considering the acceleration response time of the engine, supercharged by the PWC driven by the electric motor, due to the electronic control, this time will remain comparable with the time had in case of driving it with the crankshaft.

3.2 Experimental research of a CIE supercharged with a PWC. To prove that the driving solution of the PWC with an electric motor improves the performances of the supercharging process, experimental researches were done on a supercharged CIE engine. [5]

The experimental researches were performed in two stages. During the first stage of the experimental researches, the CIE was supercharged with a turbocharger type compressor (version, offered by the manufacturer) and in the second stage of the research, the CIE was equipped with a PWC of Comprex type driven with variable speed by an electric motor (modified version).

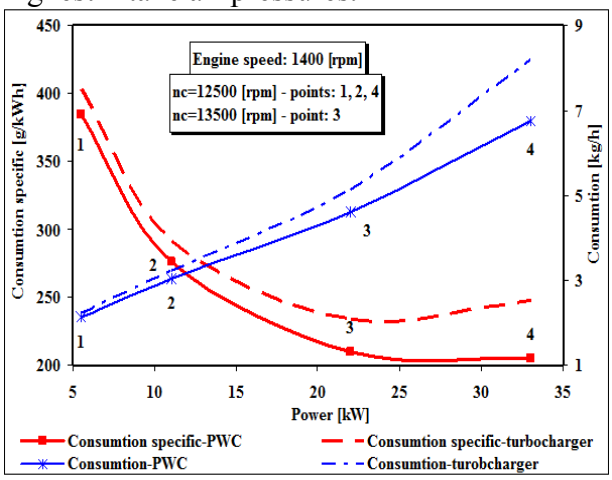
This PWC model is capable to supercharge engines having effective power in the range of 40-80 [kW] and support driving speeds up to 8000 [rpm].

Going through these two stages it made possible the energetic performance's comparison of the experimentally researched CIE, obtained during the two supercharging variants.

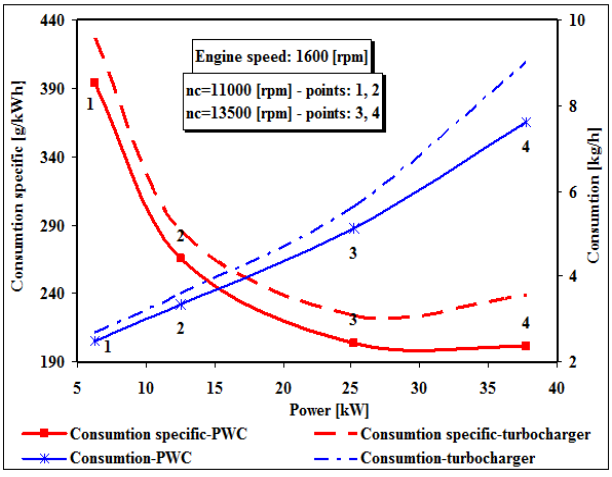
Because the CIEs work mostly in regimes, characterized by partial loads, below are presented the load characteristics of the experimentally researched engine.

In this way there are highlighted the changings of economy energetic performance as function of the supercharging version.

When the load characteristics are obtained (figure 2) for the CIE supercharged in modified version, the PWC was driven in each operating regime, with speed (n_C) giving the highest intake air pressures.

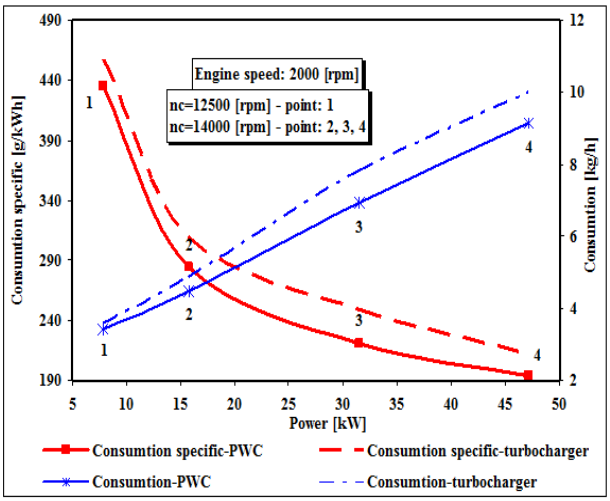


a.

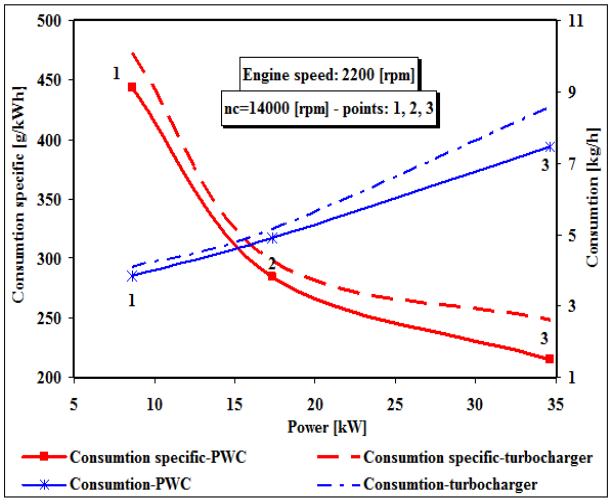


b.

Fig. 2. Load characteristics of a CIE supercharged with a *PWC driven by an electric motor* (continuous line) and with a *turbocharger* (discontinuous line) at low engine speeds of: a. 1400 [rpm]; b. 1600 [rpm].



a.



b.

Fig. 3. Load characteristics of a CIE supercharged with a *PWC driven by an electric motor* (continuous line) and with a *turbocharger* (discontinuous line) at medium engine speeds of: a. 2000 [rpm]; b. 2200 [rpm].

Analysing the overall load characteristics of the experimentally researched CIE it can be stated that the obtained energetic performances in case of supercharging with PWC of Comprex type driven by electric motor, are sensitively improved in comparison to those obtained in the case of supercharging with turbocharger.

It should be mentioned that in all regimes presented in Figure 2, the intake air pressure at the output of the Comprex type PWC was permanently higher than the intake air pressure at the output of the turbocharger.

Taking into account the flexibility of the new driving system of the PWC, capable to offer for each operating regime of the supercharged engine optimal values for the intake air pressure, it can be stated that the increase the energetic performances of CIE, mounted on the testing bench, is due mainly because of the more efficient air-fuel mixing process and hence combustion process.

3. CONCLUSIONS

The PWC can provide for the CIE's intake air a high pressure even at low speeds and loads. This is due to its operating principle, which involves a dependence of the intake air pressure to burned gas pressure and not to the flow of them, how it happens in the case of the turbocharger.

Driving the PWC with the help of a DC electric motor whose speed can be electronically modified according to the speed and load regimes of the CIE, represents a viable solution which confers the CIEs increased energetic performances.

Also, because the PWC is not anymore driven by the crankshaft, it will be facilitated the positioning of the compressor on the supercharged CIE.

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DESIGN METHOD FOR ELASTIC SYSTEMS USED IN THE CONSTRUCTION OF THE SMALL AND MEDIUM CALIBER ANTIAIRCRAFT GUNS

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Abstract: *The antiaircrafts cannons guns housing is endowed by a helical compression spring, which have the function to accumulate the recul energy, energy used to reposition a reculant part. In this case the helical compression spring loads are dynamic, a fatigue-stress situation exists in the spring. In this paper is presented an method to optimization designing for this helical compression springs.*

Keywords: *helical compression spring, antiaircrafts cannons, recul energy, reculant part.*

1. INTRODUCTION

Mechanical system pipes are composed of antiaircraft guns coil springs compression springs known as recovery. Springs can be round section where antiaircraft guns small caliber (Fig. 1) or rectangular for medium caliber (Fig. 2).

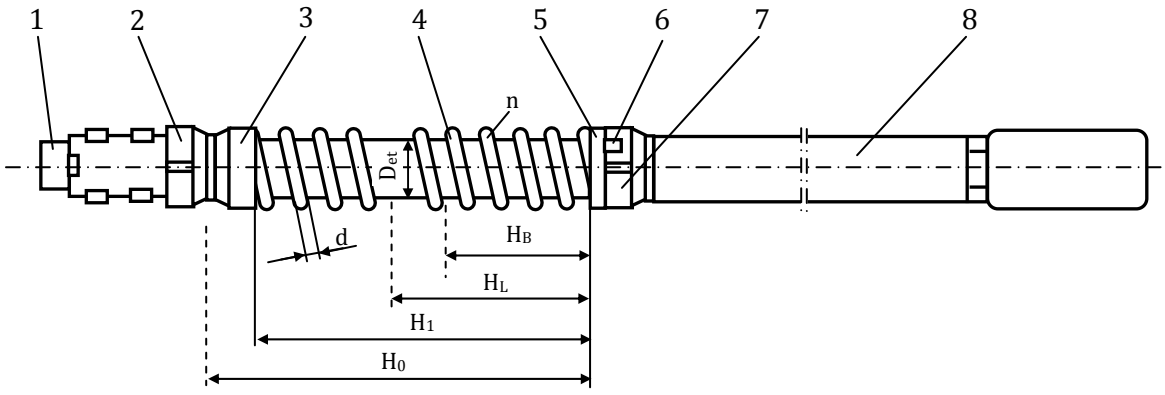

Fig. 1. Barrel overall automatic antiaircraft gun
1 - lainer, 2 - nut, 3 - socket, 4 - spring recovery, 5 - spacer;
6 - safety; 7 - nut, 8 - barrel itself

These functional building blocks are designed to store a part of the recoil energy, energy used for restoring the original position recoil mass. Spring design methodology is adopted based on constructive version adopted by the working of their application type (static or dynamic). In the general case the initial data of the problem of an spring design are overall dimensions, maximum deflection, maximum load taken by bow and rigidity.

After the choice of material that will make up the spring, depending on type adopted will

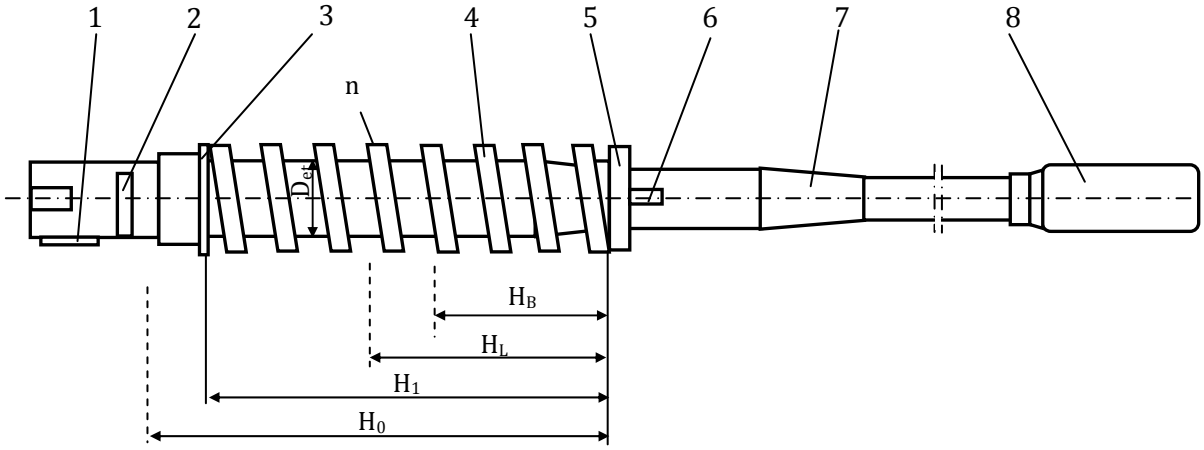

Fig. 2. Automatic antiaircraft gun barrel assembly
1 - safe plate, 2 - bearing plate, 3 - washer, 4 - spring recovery;
5 - threaded bush, 6 - removable tube, 7 - barrel itself; 8 - brake mouth

determine the geometric parameters of stress and strain conditions, determining the deformation and mechanical work. Must also set the degree of nonlinearity of this feature.

2. DESIGN METHOD OF RECOVERY ELASTIC SYSTEM

In that case, the spring recovering from antiaircraft guns barrels, requested by variable load, aiming at the natural frequency of oscillation of longitudinal vibration foj take maximum values in order preântâmpinării occurrence of resonance phenomena. Own frequency values helical compression spring, when running drawdowns are calculated with [1], [2]:

$$f_{oj} = \frac{\omega_{oj}}{2\pi} = j\sqrt{\frac{c/m}{2}} \qquad (1)$$

where: $j \varepsilon N^*$,

c - representing stiffness spring:

$$c = \frac{Gd^4}{8nD_m^3} \qquad (2)$$

G - transversal modulus,

d - wire diameter,

Dm - average diameter of the spring,

$$m = \frac{\pi^2 d^2 D_m n\gamma}{4g} \qquad (3)$$

Making substitutions, equation (1) becomes:

$$f_{oj} = j\frac{d}{n(D_{et} + d + j_0)^2}K \qquad (4)$$

where: j = 1, whereas maximizing their lowest frequency and the coefficient $K = \sqrt{Gg/8\pi^2\gamma}$ is dependent on the mechanical properties of the material of the spring considered known. For the analyzed springs, K = 3.63 · 104 MPa [1].

To find the maximum function possible given the relation (5), must be identified and fixed boundary conditions in terms of constructive-functional:

1. Overall conditions are given outside diameter of the barrel D_{et}, and work strain $\Delta H = H_L - H_1$, this reflected in the number of active coils in the spring:

$$D_{m\,min} = D_{et} + d + j_0 \le D_m \le D_{m\,max} \qquad (5)$$

$$D_{m\,min} = d \cdot i_{min} \qquad (6)$$

$$D_{m\,max} = d \cdot i_{max} \qquad (6')$$

where:

j_0 – is the clearance between the outside diameter of the barrel and the inside diameter of the spring coil (j_0 = 4…6 mm);

i – spring index; i = 4…16 (cold coiled springs), i = 4…10 (hot coiled springs);

Specific case it is advisable to take minimum average diameter.

2. Number of active coils of spring recovery is limited by:

$$n_{min} \leq n \leq n_{max} \quad (7)$$

where: n_{min} - minimum number of turns [2]:

$$n_{min} = 5 \quad (8)$$

n_{max} - maximum number of turns [2]:

$$n_{max} = \frac{H_0 - \delta_L}{d} n_r \quad (9)$$

n_r - number of turns for support;

Relation (9) can be written as:

$$d \prec \frac{A_1}{n_i + A_2} \quad (10)$$

where the coefficients:

$$A_1 = H_0 - \delta_L, \text{ and } A_2 = n_r \quad (11)$$

2. The condition for avoiding the phenomenon of buckling springs recovery is performed, although they are mounted on the gun barrel itself and are supported at both ends.

The spring length H_F has not yet appeared buckling phenomenon is given by the expression [2], [3]:

$$\frac{H_F}{D_{et} + d + j_0} \prec \frac{2,62}{\nu} \quad (12)$$

resulting from this condition:

$$d \succ \frac{H_F \nu}{2,62} \quad (D_{et} + j_0) \quad (12')$$

This calculation is performed to prevent the friction forces between the pipe and the outside diameter of the spring turns. When factor analysis is slender case $\lambda \geq \lambda_{critic}$, the arrow spring $\delta \leq \delta_{critic}$.

4. The condition of the spring stiffness is given by:

$$c_{min} \leq c \leq c_{max} \quad (13)$$

where the relation for calculating the stiffness is:

$$c = \frac{Gd^4}{8nD_m^3} \quad (14)$$

Using relation (10), the condition of rigidity expressed by the relation (9) can be written as:

$$\frac{Gd^4}{8c_{max}} \prec n(D_{et} + d + j_0)^3 \prec \frac{Gd^4}{8c_{min}} \quad (15)$$

Relation (15) can be write as:

$$\sqrt[3]{\frac{B_1 d}{n_i}} \prec \frac{D_{et} + j_0 + d}{d} \prec \sqrt[3]{\frac{B_2 d}{n_i}} \quad (16)$$

where the coefficients:

$$B_1 = G/8c_{max}, \text{ and } B_2 = G/8c_{min} \quad (17)$$

5. Resistance provided at the request of torsion spring:

$$\tau_{t\,max} \leq \tau_{at} \quad (18)$$

where the maximum torque voltage is determined by the relation [1], [2], [3]:

$$\tau_{tmax} = \frac{8kF_nD_m}{\pi d^3} = \frac{8kF_n(D_{et} + d + j_0)}{\pi d^3} \leq \tau_{at} \quad (19)$$

Relation (19) can be write as:

$$\frac{D_{et} + j_0 + d}{d} \prec \frac{C_2}{C_1} d^2 \quad (20)$$

where the coefficients:

$$C_1 = 8kF_n \text{ and } C_2 = \tau_{at}.$$

Pairs of values n, d that satisfy stringent conditions and maximize function (4) is a curve that can be considered optimal curve of variation of the number of turns of the coil spring depending on the diameter d.

To determine this curve was applied the following strategy [4]:

1. The range of the number of turns was divided into a number of intervals n_1, n_2,…n_i, .. n_k.

2. For each value we restrictive conditions turned the curve in relation to the variable d.

3. Of behavior maximized function, that function is increasing, so the corresponding value of (n_i, d_i), i = 1 ... k be the largest value of d, which satisfies the boundary conditions simultaneously.

4. We obtained a set of values (n_i, d_i), i = 1 ...k. These values have enabled tracing function d = f (n), optimal function.

To illustrate the method used in obtaining, fig. 3 shows how we value d_i for n_i chosen. It use the following notations:

$$F1_i := \sqrt[3]{\frac{B_1}{n_i} d_i} \quad (21)$$

$$F2_i := \sqrt[3]{\frac{B_2}{n_i} d_i} \quad (22)$$

$$F3_i := \frac{60 + d_i}{d_i} \quad (23)$$

$$F4_i := 0.036 d_i^2 \quad (24)$$

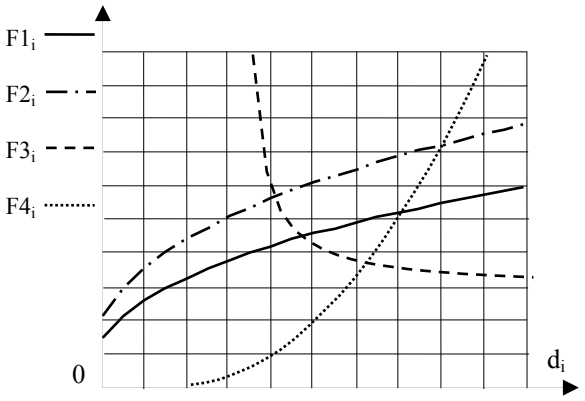

Fig.3 Representation of restrictive conditions in relation to variable d

In fig. 4 is presented graphically optimal curve obtained. Given a value for n, resulting from the curve corresponding value for the spring wire diameter d plotting graphs and mathematical modeling was performed using Professional MathCad 7 utility [5].

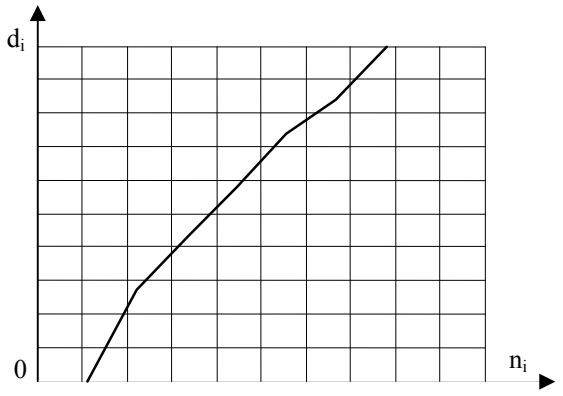

Fig.4 Representation optimal function d = f (n)

4. CONCLUSIONS

The method presented in this paper can be applied in individual cases running of elastic systems, both for their design, or test cases. Also, following the same steps of calculation, the method presented is applicable to other variants of elastic systems.

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DUPLEX STRUCTURES, CERAMIC, MICROSTUCTURATED, ON THE BASIS OF PARTIALLY STABILIZED ZIRCONIA WITH CERIUM OXIDE

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***Abstract**: Protection systems type thermal barrier (TBC) is widely accepted solution for increasing performance and endurance of the "hot parts"(combustion chambers, ducts, vanes, adjustable nozzles, diffuser, etc.). Thermal Barrier Coatings (TBC) are known to play a critical role in the working behavior of high temperature components of turbo engines, co generative systems, metallurgy, etc. In this sense the development of new TBC coatings resistant at high temperature, thermal shock, erosion, corrosion, etc. is proposed in this papers.*

There are known many theoretical studies and experiments that aim the phase transformations of ceramic materials based on zirconia, during the processes of heating and cooling, especially occurring routinely during the flight of aircraft and in particular the special conditions - take-off, in-flight engine stop, landing failure, etc. The cooling processes of ceramic layers are associated with phase changes from tetragonal to mono-clinic zirconia in relation to the intensity of the processes (time, gradient) and consequent exfoliation of TBC. For stabilization of tetragonal and cubic structures at room temperature, to zirconia are added metallic oxides such as CaO, MgO, ScO_3, Y_2O_3, or other dopant type Yb_2O_3, Er_2O_3, Gd_2O_3 or Nd_2O_3.

In the paper we present experimental results and investigations related to the formation of a duplex structures made of refractory Nimonic alloy type of TBC, duplex structures with bonding layer of type MeCrAlY and a ceramic coating on the basis of stabilized zirconia with CeO_2 and co-doped with Y_2O_3.

In this paper are presented techniques and associated parameters to obtain the duplex structure as well as the scanning electron microscope (HRSEM) investigations achieved.

***Key words:** TBC, duplex, ceramic, zirconia, APS, HRSEM*

1. INTRODUCTION

During the last decades one of the main research topics related to the turbo engine efficiency was the increase of the temperature in the gas turbine inlet. In order to achieve this goal, a high performance and long life time hot parts components are needed since the supper alloys has reached their upper thermal limit. In this respect one could increasing the specific core power (SCP)parameter of the gas turbine by arising the turbine entry temperature (TET) (Fig.1). The limit for the TET in an engine is related to the materials used in its hottest parts [1].

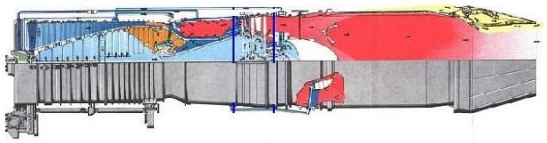


Fig.1 Thermal fields in a turbo engine. Blue-cold section; red-hot section

Usually the exhaust gas temperature (EGT) for commercial aircraft exceeds 1200 °C. In this respect, modern gas turbines blades and vanes are air cooled since the surrounding gas temperatures are close to the melting point of the super alloy used. So, higher TET need more component cooling but this fact will involve the reduction of engine efficiency so there is a limit beyond which efficiency increases cannot be achieved by cooling. Additionally, extreme functional conditions of turbo engines such as take-off thrust, in-flight engine stop, landing failure, etc. could occur leading to sudden changes of temperature. Furthermore, wear factors such as pyrolyze particle erosion caused by sulfur compounds contained by hot gas, at velocities above 3 Mach, chemical corrosion and adhesion in the adjusted nozzles will act simultaneously along with the extreme functional conditions challenging the life time of the turbo engine mechanical components. The most disturbing wear factor is the thermal shock [2], so the durability of components exposed to high temperature and high cooling-heating rates can be extended by protecting their surfaces with different types of coatings.

The use of thermal barrier coatings (TBC) for the „hot parts" of a turbo engine is the generally accepted procedure because it acts as a thermal barrier, lowering the temperature of the substrate and thus making it possible to raise the TET of an engine and hence achieving the objective of increasing the engine efficiency. TBCs can also be used to extend component life by improving the creep behavior and service life of the substrate.

The configuration of a multilayer TBC (fig. 2) consists of a ceramic top coat which lowers the temperature of the substrate by 150÷200°C, a thermal grown oxide (TGO) layer mainly composed of alumina whose thickness extends as the temperature is raising and an MCrAlY (where M=Ni, Co) bond coat deposited directly on the substrate alloy whose main characteristic is to provide a better chemical bond between the top coat and the substrate.

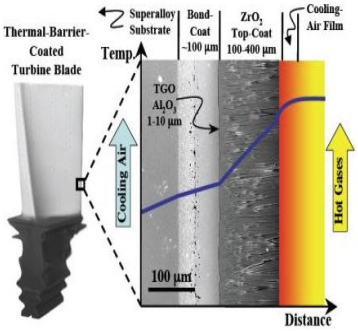


Fig. 2 Basic configuration of a TBC multilayer system from a turbine blade [3]

The main goal of this paper is to present the significant structural characteristics of the ZrO_2-CeO_2 ceramic. These data are part of an thermal shock experiment preparation which was performed in order to characterize the thermal properties of this type of coating.

2. PHASES IN CERIA-ZIRCONIA BINARY SYSTEM

Zirconia based oxides have influenced the direction of many research investigations and technology solutions due to its high temperature resistance. It is well known that for pure zirconia (ZrO_2) the tetragonal-monoclinic transformation is a problematic issue since it occurs at a temperature in the range of the service temperature in gas turbines. The tetragonal→mono-clinic transformation is martensitic in nature and involves a 5÷7 % volume increase that induces internal stresses which compromise the the structural integrity of the ceramic. One method to solve this issue is by adding to zirconia a stabilizing oxide such as CeO_2. It already has been reported that the cerium doped Ce-TZP (tetragonal zirconia polycrystal) shows an improvement of the thermal stability and a high toughness [4]. The thermal stability is due to a non-transformable tetragonal phase *t'*

formed by rapid cooling during coating deposition and ranges from the room temperature to approximately 1200°C (fig.3). At temperatures higher than 1200°C the mono-clinic phase is unstable and will change to the tetragonal phase *t*.

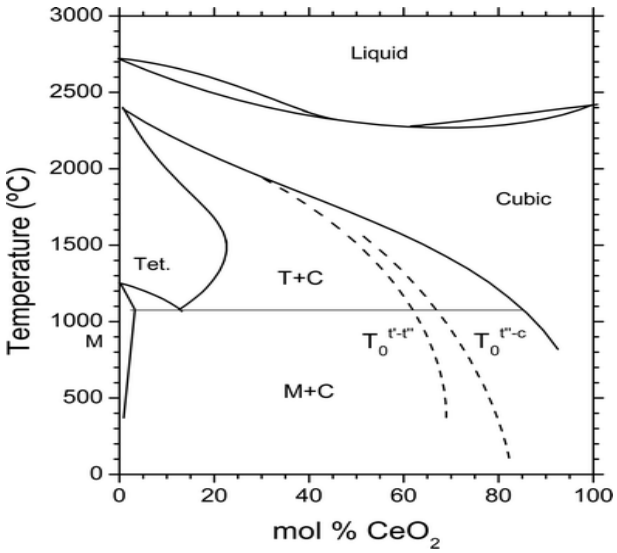


Fig.3 Phase diagram of ZrO_2-CeO_2 binary system [5]

3. MICROSCOPIC INVESTIGATIONS

The samples which have been investigated were made of a sandwich-type structure consisting of:

-substrate, Ni-Cr-Co alloy, NIMONIC super alloy

-bond coat layer NiAl, deposited by high-velocity oxy-fuel method (HVOF)

-ceramic zirconia based layers doped with cerium for thermo-resistant structures deposited by air plasma spray technique (APS).

Micro-structural investigations were performed by a high resolution scanning electron microscope (HRSEM) equipped with a field emission gun (FEG) and an energy-dispersive detector (EDS) EDAX type (fig4.a).

Results for three investigated points in the sample are given below (Tables 1-3).

For the Ni base alloy substrate the composition field is given in table 1 (% weight):

Table1

Field	AlK	TiK	CrK	FeK	CoK	NiK
Sb 1	2.72	3.02	19.2	1.36	16.45	57.25
Sb 2	2.68	3.01	19.65	1.38	16.14	57.15
Sb 3	2.71	2.95	19.12	1.28	16.94	57.00
Avr.	2.70	2.99	19.32	1.34	16.51	57.13

For the Ni-Al bond coat the composition field (% weight) is given in table 2:

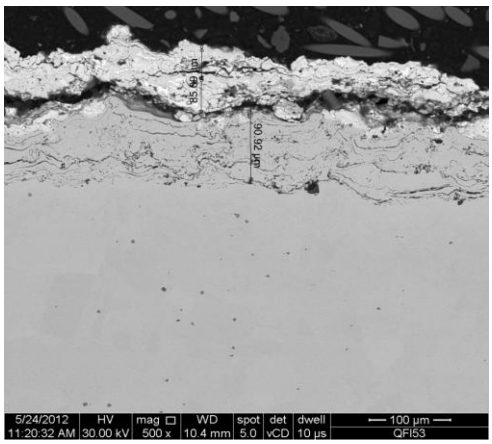
Table 2

Field	AlK	NiK
Bc 1	1.84	98.16
Bc 2	3.3	96.7
Bc 3	2.34	97.66
Average	2.49	97.51

For the O-Zr-Y-Ce top coat, the micro structural composition data (% weight) revealed two types of regions: poor (zone 1) and rich (zone 2) Ce region respectively (fig 4.b).

Table 3

Field	OK	AlK	CeL	NiK	YK	ZrK
Zone1	12.57	1.47	21.99	2.1	6.55	55.32
Zone2	11.94	1.69	44.58	1.9	5.42	34.46



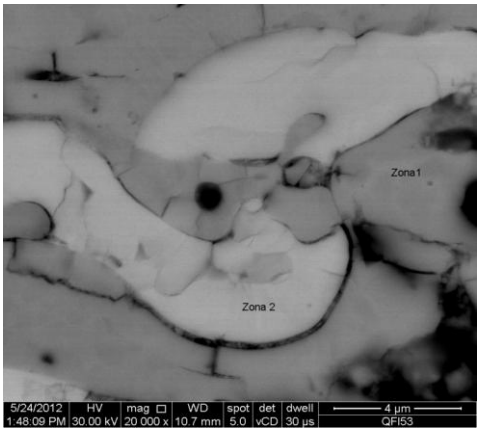


Fig 4. Back scattering elections image of N71 sample: (a) general view-magnification x500; (b) top coat image revealing by contrast in brightness the different Ce content-magnification x20000

From the frame of assembly of composition investigation (tab. 1, 2, 3), back scattering electrons images (fig. 4), the EDS specter in the substrate, bond coat and top coat (fig. 5) and especially the distribution images in surface of relative intensity of X radiation (fig. 6), we present the following observations:

-substrate, nickel based alloy presents a compositional uniform repartition

-the bonding has a non homogeneity structure of Ni-Al, shows frequent films of aluminum oxides at base material

-ceramic layer shows the separation in the adherence zone, micro fissures, the relative inhomogeneity of, zirconia and punctual concentrations of cerium

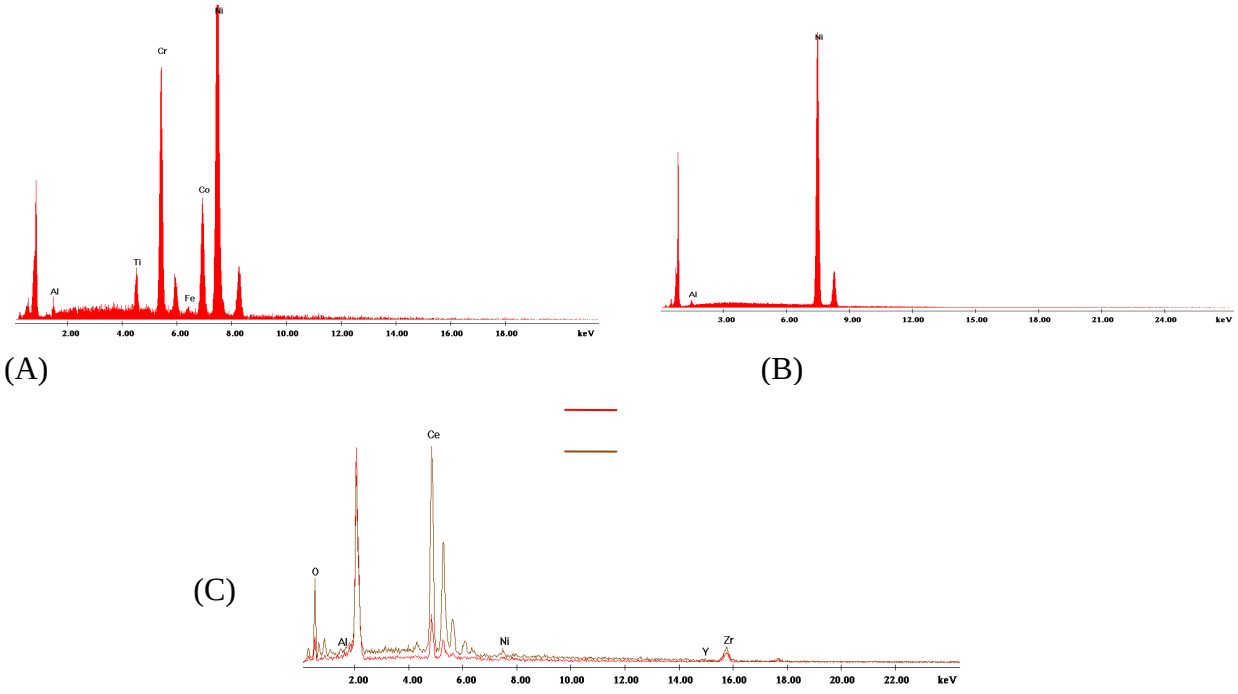


Fig. 5 EDS spectra of the substrate (A), bond coat (B) and top coat (C)

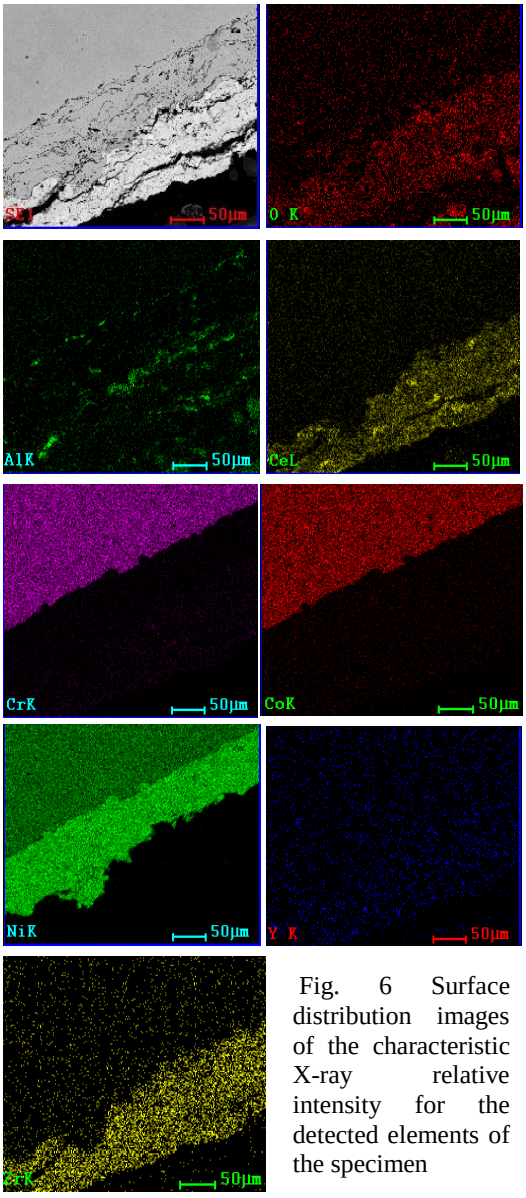


Fig. 6 Surface distribution images of the characteristic X-ray relative intensity for the detected elements of the specimen

4. CONCLUSIONS

The „hot parts" of turbo engines as well as of co-generative systems from power industry are severely subjected to wear factors occurring due to the extreme functional conditions and the surrounding thermo-chemical factors.The thermal fatigue associated to the thermal shock acts the most disturbing on the TBC protective coatings. Better compositional TBC solutions are expected to increase the life time of hot parts. Investigations of electronic microscopy (HRSEM) on TBC based on zirconia doped with cerium oxide reveal, thanks to evidence of some inhomogeneity in duplex structures the need to improve in technology APS assigned to this complex type composite ceramic powder. Micro structural characteristics of the partially stabilized zirconia with cerium oxide duplex system are revealed through a scanning electron microscopy method. Between the bond coat and the top coat one can notice the thermally grown oxide layer (TGO) which was formed due to oxidation of the bonding layer. The specimen is intended to be tested at thermal shock in order to be compared to other ceramic coatings in terms of thermal endurance [6]. During this thermal testing the TGO is getting thicker leading to ceramic delamination after a certain number of heating-cooling cycles. This kind of experiments are worth for the coating selection and developing of delamination mode models.

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PILOTS' PERFORMANCES IMPROVING IN DUAL STREAM ENVIRONMENT: VERTICAL COMPONENT OF VIRTUAL FLIGHT AND PHYSIOLOGICAL PROFILE

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Abstract: *The main goal of this paper is to provide the latest developments in high level integrating of two different sides of pilots' performances improving. First one focuses on the assessment of the contribution of the vertical component of the virtual flight in the performance optimizing process. The other one is oriented to model the contribution of physiological profiling data in performance improvement. This goal is a complex one, meaning that two different approaches need to be considered: one concerning the dedicated system able to carry out the all the tasks required by performances improving and other in charged with modeling the data showing the contribution of the vertical component of the virtual flight assisted by physiological data in performance improving process. The main source for all acquired and processed data is an entirely new specially designed expert system for high precision assessments of aircraft piloting abilities. It is based on a multi-stream data acquisition and processing system, able to integrate the simulated flight environment with virtual flights and physiological and behavior data. As a direct result of these integrated improving processes, new models of the piloting abilities are implemented. Even more, a solid basis for the decision-making process for setting the pilots' and candidates' hierarchy for admittance to specific flight training programs is provided. Data analyzed and results emerge from the system recorded performance parameters based on measuring the differences between vertical components of the ideal trajectories according to assigned missions and the real trajectories in simulated flights.*

Keywords: *pilot's performance improvement, flight simulators, virtual flight environment*

1. GENERALITIES

As a general approach, the expert adaptive system is intended to perform as a complex and parametric set of tools. The engine of the assessment process is also dual: a hierarchical set of specific flying stimulus and a complex physiological profile, both weighted in the pilot's performances models. The virtual environment hosts not only all the subjects' flights, where specific visual, sound and tactile information are provided in a cockpit specific form. It also hosts the frame necessary to acquire the physiological data used to build the profile. A library of basic and generic tasks is the basis for generating the dynamic complex scenarios acting as mission assignment, according to the pilots' training level; each flight situation is enriched by considering the stimulus hierarchies (one stimulus category at one time – visual, flight, navigation and environment integration) and the associated physiological profile. The main tasks are distributed in few well defined sub-systems: the simulation sub-system for the virtual environment management, the flight

simulation sub-system and the multi-stream data acquisition sub-system for data integration in simulated flight and for physiological and behavior data management. Separate, a sub-system for processing, structuring and correlative analysis of all the information provides the decision making sub-system with all profiling data. The data acquisition stream rate is variable, but for academic purposes the rate of 2 samples per second proved to be satisfactory. Each of these variables is processed afterwards so that a set of performance data can be synthesized (e.g.: average values, symmetry and form of distributions). All the information operated by the expert adaptive system is stored in secured relational databases: the basic scenario database, the complex scenario database, the subjects' database and the results database.

2. ASSESSMENT FRAME

The current requirements of the flight security challenges need a direct answer. Alongside with the quality of pilots' training process, the intelligent system [1] comes to provide this particular answer: approaching of high precision assessments of aircraft piloting abilities by taking into account two different streams: vertical component of flying in virtual environments and physiological data. It can also provide the specialized staff with assistance in the decisional processes of pilots' selection.

The subjects' performances improving process is based on a hierarchical structure in a staged approach: subject identification; subject accommodation with the session requirements; subject's theoretical training module; subject's theoretical knowledge assessment; simulator controls training module; main simulation session; optimization module; data processing; final decision stage.

The expert system implements few important capabilities: building the specific flying stimulus set [2]; building the stimulus hierarchy; weighting the stimulus types in flying performances [3]; building the different flight simulations based on the current stimulus hierarchies; building the flying tasks set, so that the most important psychical processes involved to be covered [4]; the simulation's scenarios manipulation; the relevant parameters set elaboration for the flying capacity optimization; building the relevant psycho-physiological set of parameters (EEG, EKG, FC, pressure on the controls, brain signals, visual focus, pulse, blood pressure, local temperature and local resistance – see Fig.1) which best describes the tested subjects general panel; working with complex models for the acquired data, aiming to minimize the dimension of the information universe without losing content.

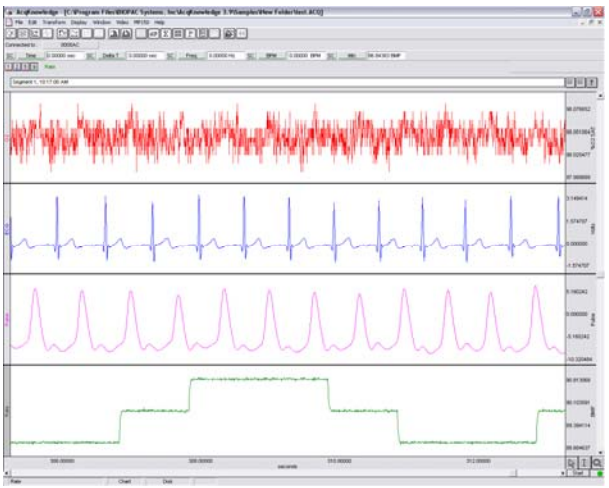

Fig. 1: Physiological stream data processing

Block scheme of physiological stream data acquisition and processing is shown in Fig.2.

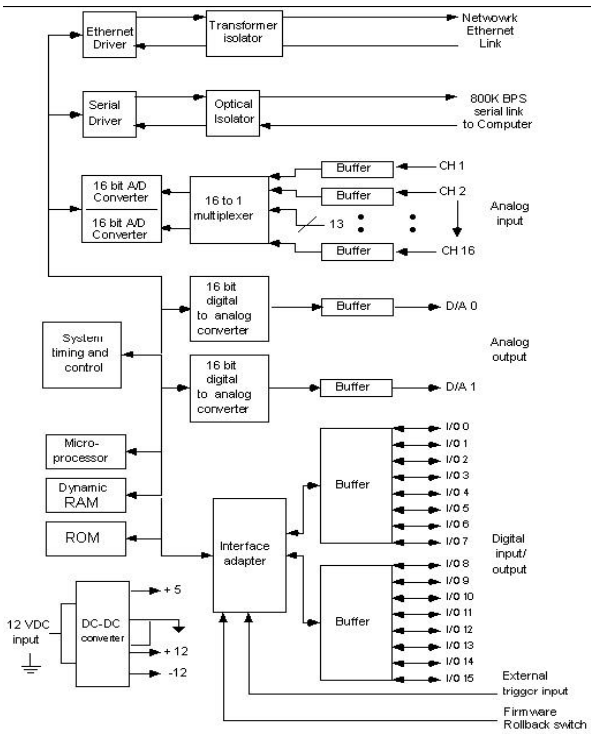

Fig. 2: Physiological stream block scheme

The acquired data processing models are statistic. The deviations are acquired in the simulated flight process, in the form of differences between the vertical components of the real trajectory and the imposed specific mission trajectory (see Fig. 3). Also, an analysis of the candidate behavior related to the statistical group to which he belongs can be performed. Three-dimensional viewing models of the real and imposed trajectories are implemented both at mission assembly level and primary components level, with the possibility to dynamically modify the observer's position related to the trajectory. In addition, all relevant deviations are displayed, too. The statistic analyzing models are also applied to all candidate controls (stick, rudder and throttle).

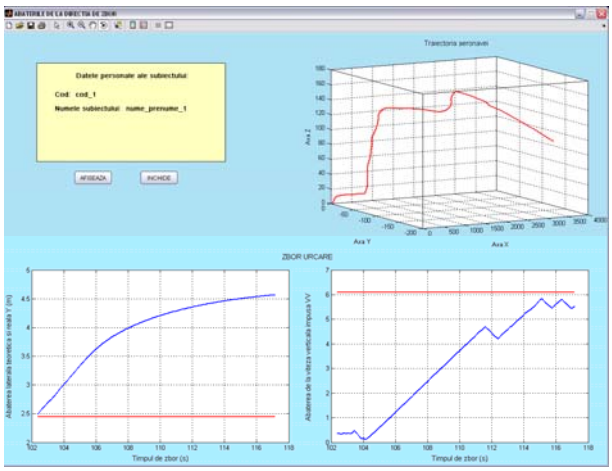

Fig. 3: Post flight global and vertical component contribution to flying performance

3. METHOD AND RESULTS

The current release used entered the operational stage of the Integrated Adaptive System for pilot performance assessment in a standard flight scenario: climbing or descending flight, with fixed flight path data (initial flight altitude, final flight altitude, glide/slope angle, indicated speed). In order to provide the new dimension in pilots' performances hierarchy, all subjects hold the same experience on training aircrafts. There also exist recordings of pilot performance assessments in real flights for each one.

The system recorded the performance by measuring the differences between the vertical components of the ideal trajectories according to the assigned missions and the vertical components of the real trajectories in simulated flights. These differences were measured actually in 3D space, but for this paper will be retained only the data of vertical channel – Oz axis. The data acquisition stream rate is 2 samples per second. Each of these variables is processed afterwards so that a set of performance data can be synthesized (e.g.:

average values, symmetry and form of distributions).

For a thorough analysis of the data issued by the system, the following concepts were used:

- central trend (typical values), representative for the whole data distribution;
- variation pointers, pointing to the modeling of the distribution displacements;
- distribution shape pointers, pointing to the modeling of the distribution shapes.

Behind the first concept stands the mathematic formula of averaging a data distribution:

$$m = \frac{\sum_{i=1}^{N} X_i}{N} \quad (1)$$

X denotes the focus variable (differences between the vertical components of the ideal trajectories data according to the assigned missions and the vertical components the real trajectories data in simulated flights – for each chart the variable X is defined), N denotes the number of variable entries in current distribution.

Behind variation and distribution shape pointers stand:

Dispersion s^2:

$$s^2 = \frac{\sum_{i=1}^{N} (X_i - m)^2}{N} \quad (2)$$

Standard deviation s:

$$s = \sqrt{\frac{\sum_{i=1}^{N} (X_i - m)^2}{N}} \quad (3)$$

Skewness:

$$\frac{\sum_{i=1}^{N} (X_i - m)^3}{(N-1)s^3} \quad (4)$$

Kurtosis:

$$\frac{\sum_{i=1}^{N} (X_i - m)^4}{(N-1)s^4} \quad (5)$$

The following charts show the results of analyzing the contribution of vertical component of the virtual flights on subjects' performances (on Oz axis):

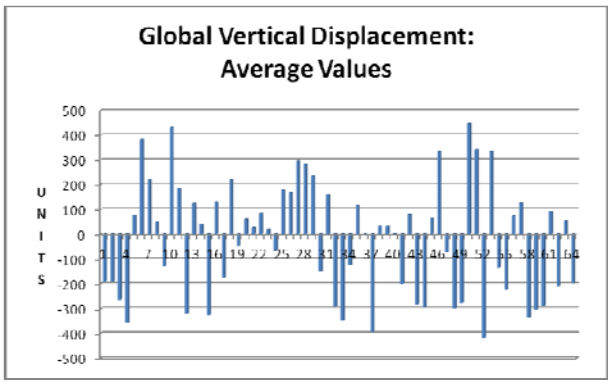

Fig. 4: Global vertical displacement (on Oz axis): average values

Average values of global vertical displacement (on Oz axis) is the part of the mechanism which models the subjects' ability to maintain a proper position in the flight plan, according to the mission assigned, focusing on the average values issued by the system during the differences generation between the real and the theoretical trajectories. This type of data offers a global vision of how close the subjects respect the vertical component of the flight plan (exposing the extreme points of the path envelope). Ideally, the envelope should be as tight as possible. Small variations around zero are acceptable (the sign is irrelevant in performance, showing only the side of the ideal vertical trajectory – above or below – the current subject keeps the aircraft during the flight).

In this chart (Fig. 4) units represent the performance indicator of virtual distances, based on the metrics of the virtual space where the simulated flight takes place. Lower values are better.

In this population of subjects, numbers 4, 6, 10, 12, 15, 33, 37, 46, 50, 51, 52, 53, 58 and 59 show large variations in average differences, which draw special attention to their low performance level. A possible future exclusion of these subjects from the flight training program can be expected. A definite trend to exclusion goes to subjects 10, 37, 50 and 52, who are far from the flight plan.

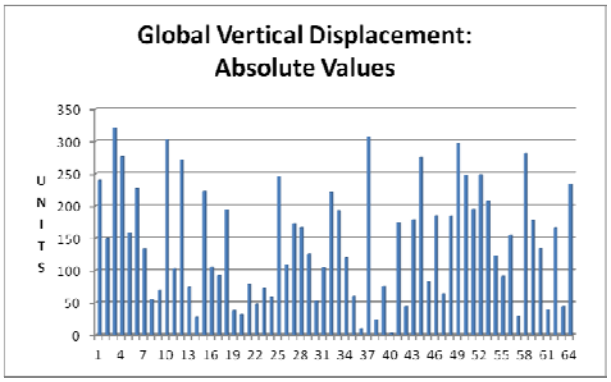

Fig. 5: Global vertical displacement (on Oz axis): absolute values

For a local analysis of global vertical displacement the system uses absolute values of this variable. In this population of subjects, numbers 3, 4, 10, 12, 37, 49 and 58 show large variations in absolute differences, which draw special attention to their low performance level. A possible future exclusion of these subjects from the flight training program can be expected. A definite trend to exclusion goes to subjects 3, 10 and 37, who are far from the flight plan.

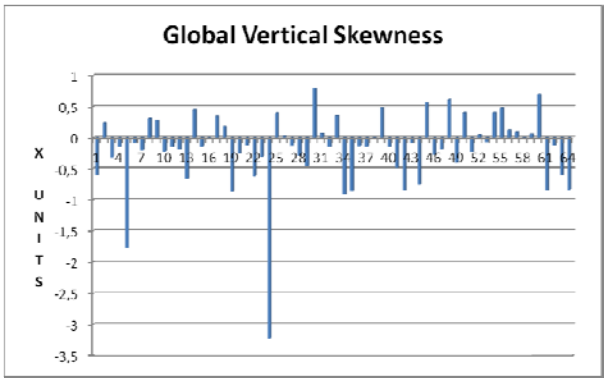

Fig. 6: Global vertical Skewness (on Oz axis)

The vertical component of the global skewness (on Oz axis) is a part of the mechanism pointed to model the contribution of the distribution shape pointers in the decision making process. The sign of this component provides information about the density of the distribution data related to the average values. The chart in Fig. 6 shows the fact that the distribution is quite even related to the flight plan, meaning that the deviations in the vertical plane show two main data: first – the subjects position the plane relatively symmetrical above and below the ideal trajectory, meaning that the subjects hold the same experience in flight; second – there are subjects in this population with lower performances: 1, 5, 13, 19, 22, 24, 30, 34, 35, 42, 44, 45, 48, 60, 61, 63 and 64. A definite trend to exclusion goes to subjects 5 and 24, who are far from the flight plan. The symmetry of the distribution is affected: four subjects keep the plane above the imposed trajectory; 13 subjects keep the plane below the ideal trajectory.

In this chart (Fig. 6) X units represent the non-dimensional performance indicator which encodes the data distribution shape of the computed parameter of the differences between the theoretical and the real trajectories on Oz axis, based on the metrics of the virtual space where the simulated flight takes place. Lower values are better, meaning that a narrow distribution shape shows better performances.

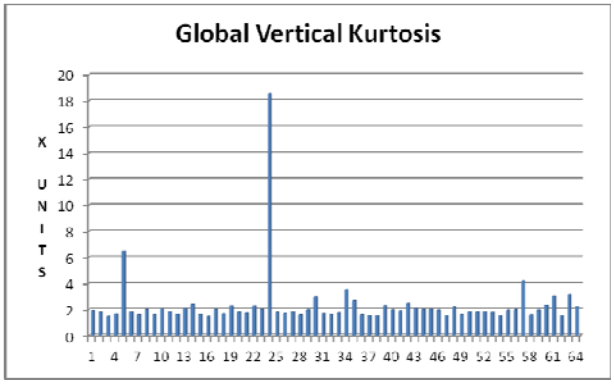

Fig. 7: Global vertical Kurtosis (on Oz axis)

The global vertical Kurtosis is another important part of the distribution shape pointers pointed to assess the symmetry of the data distribution. It is a component of the global kurtosis which is the part of the mechanism charged with modeling the contribution of the distribution shape pointers in assessing the behavior of population of subjects concerning the flight plan. The sign is not relevant. The important thing is the consistency of the distribution shape, the chart above showing that most subjects behave symmetrically related to the average values. Subjects 5, 24 and 57 are exceptions, showing abnormally high values. These data are to be correlated with the variation pointers.

In this chart (Fig. 7) X units represent the non-dimensional performance indicator which encodes the symmetry of the data distribution shape of the computed parameter of the differences between the theoretical and the real trajectories on Oz axis, based on the metrics of the virtual space where the simulated flight takes place. Lower values are better, meaning that asymmetrical data distributions with lower Kurtosis values show better performances. In flight terms, the subjects control the aircraft mostly by applying only one type of corrections to the real trajectory (ascends or descend), not evenly distributed corrections (up and down).

4. CONCLUSIONS

The performance parameters exposed by intelligent system indicators were correlated with real in flight performance and with the results of coordination in multi-tasking test (Double Maze Bonnardel).

The results of Kendall correlations confirmed a significant association for differences between ideal and real trajectories on Oz axis (differences in horizontal plane), in all three stages of flight: first third ($r = +0.45$, $p = 0.025$), middle third ($r = +0.55$, $p = +0.005$) and final third ($r = +0.64$, $p = +0.002$). Also, the average global variation on Oz axis positively correlated with real in flight performance ($r = +0.61$, $p = +0.0006$). The multiple regression coefficient calculated for the four predictors is $R = 0.81$ ($F = 7.68$, $p = 0.002$).

The correlation with performance in Bonnardell shows moderate associations, taking values around 0.3÷0.4, with the ones between performance at simulator indicators and the number and duration of test errors [5, 6].

All results are thoroughly analyzed, as well as their psychological meanings and consequences for future releases of intelligent system.

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RESEARCH ON SUPER – GLUED SURFACES OF THE PLATES SINTERED

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Abstract: *Need metalworking cutting through procedures as quick and efficient, and while cheap as measured by economic tools necessary to create hard and superhard materials with good mechanical properties . At high finish surfaces of the tools provided with bonded hard alloy plates are used currently in the process of cutting, diamond powders. They are used both as powder as well as pasta, which improves cutting through the processed surface roughness. High finish operation applies to the tools provided with hard-alloy plates stuck on the cutting tool body, because all surfaces by stripping their assets to obtain the desired quality. This paper presents a new method for super-active surfaces of tools provided with soldered carbide plates, leading to decrease the roughness processing, improved surface finish and geometry processing margins decrease from 0.5 mm to 0.2 mm.*

Keywords: **:** *high finish, abrasive stones, continuous improvement*

1. INTRODUCTION

The objectives of processing procedures by high finish active surface of tools provided with hard alloy plates attached are: increasing quality by reducing surface roughness, improving the surface geometry, dimensional precision increase, improvement of voltage layer see figure 1.Processing procedures to remove fine material ensures high quality machined surfaces, resulting in roughness Ra = 0.4 ... 0.02 μmm.

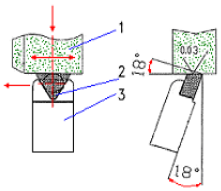


Figure 1. High finishing machining with abrasive stones. 1- abrasive stone; 2- metal working assembly; 3- knife support

Reducing the size of deformed layer from previous processing and the existence of micro bumps that serve as lubricant deposits contribute to increased wear resistance surfaces. The procedure can be applied to any surface, using appropriate devices mounted on the universal machine tools, or machines using specialized tools. High finish can be used after any finishing operation, but it is recommended to be used after correction, taking into account the economic factors.

2. PERFORMING HIGH FINISH

Mentioned in many papers that the main problem of finishing operations creates abrasive tool, abrasive body use what is true of high finish.

By high finish machining means for processing very thin surface, with one or more bars straight-abrasive alternative performing rapid movements with small amplitudes,

combined with advanced movements, performing a song slow motion across the joint direction of two movements.

Because not as we mentioned the piece that we have high finish flat interior, exterior - between peaks and without centers, the penetration and passage or profile. In general, high finish is performed using devices high finish and only for processing large numbers of machines used for high finish.

Port tool head movement and sound are established for each case processing in part based on the geometric shape of the surface to be processed, the high finished device we have, and the processing is done in the presence of a lubricant.

High finish processing takes place in three phases. The first phase occurs abrasive contact between the bar (3) and track (2), the top micro roughness work piece and abrasive grain tip (1), see figure 2. Phase follows the contact between wheels and track bar occurs only on top of grain without their overlap with micro bumps play. In the last phase, micro bumps are all almost completely processed, contact area is large enough so that the product of the size of contact area and pressure lubricating agent (4) gives a force which tends to balance the load force exerted by bar press abrasive.

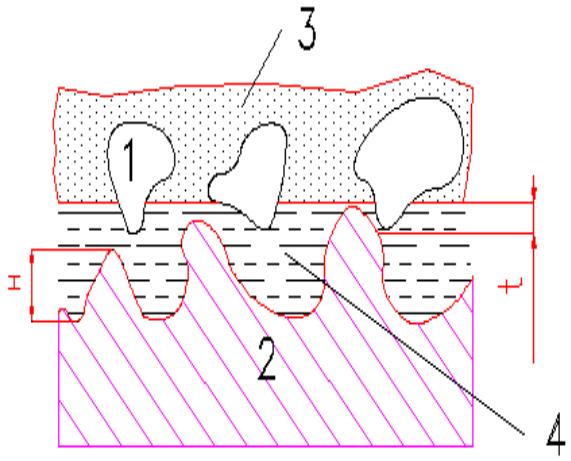


Figure 2. Contact between the abrasive bar and workpiece. 1-abrasive grains ; 2-piece; 3-bar abrasive; 4-lubricating agen

During the process of honing (see figure 1), the surface plate should completely match high finished stone surface.

This ensures a perfect coincidence excellent straight and allow a better surface roughness correction plates subjected to superior finishing.

High finish in case of processing large number of active surface of the tools provided with hard alloy plates stuck on a machine running the latest finishing technology ASM-500 ZR / ZRT KOYO (see photo 1).

Photo 1- Machine for high finish ASM-500ZR

High finish rectilinear motion is a superposition of oscillating abrasive tool with a very fine grain, with an advance movement of the piece, in the presence of a special lubricant.

Head movements and clamping piece is set for processing each case, depending on the machine tool which is processing, geometric shape and surface processing device according to available car high finish [2] .

High finished construction machines are very different, depending on their destination. Use working speeds 2 ... 5 m/s, pressures of 50 ... 150 daN/cm^2 and added 10 ... 25µ mm processing. Stone grit abrasive used high finished cars must take into account the nature of the material to be machined, the surface obtained from previous processing and surface quality to be obtained.

In Photo 2 shows the pneumatic device for active surface high finish tools provided with carbide inserts glued, one of the most

important assemblies that make the machine ASM-500 ZR / ZRT KOYO.

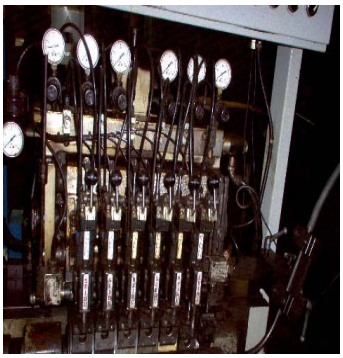


Photo 2- Pneumatic tools for High finish active surface provided with carbide inserts glued.

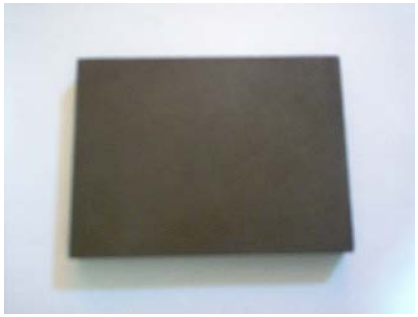
In photo 3 is represented the three types of stones used for cutting tools provided with pills high finish carbide bonded [4].

In photo 4 is represented an eccentric bushing which is part of the device provided with tools high finish alloys bonded and has a role to achieve a very low roughness (Ra = 0,0348μm).

To obtain very low roughness tools equipped with hard alloy plates glued to eccentric bush we use e = 0.25 mm (photo 4). Abrasive stones are made of abrasive grains and binder.

Abrasive grains are of the following materials: corundum, and silicon carbide carburant. Binders used are: clay, feldspar, kaolin, bake lite, shellac, rubber.

Photo 4. Main component eccentric bushing device from the superfinishing tools provided with hard-alloy glued plates.



a.

b.

c.

Photo 3. Type High finish stone tools used for bonded abrasives fitted with carbide insert: a) EK1-600-06-135VKH;b) SC9-NAS 1000-60; c) N-600.

Abrasive stone structure has the following groups: very thick, dense, medium rare, very rare and porous.

The added layer removal of the previous operation (fine grinding) which can be added up to 25 μm, we use the rough bush High

finish eccentric with e = 2 mm. Thus the new method applied to the tools provided with hard alloy plates welded and mechanically fixed plates of hard alloys improve sustainability in exploitation tool and addition processing executed parts decreases from 0,5 mm to 0,2 mm. It aims to reduce the addition of processing operation for rectification.

In production processes, the need for processing of metal cutting processes as quick and efficient, cheap and equally economically imposed the creation of tools from hard and superhard materials with good mechanical properties. So besides bonded sintered plates were created removable plates, all made from tungsten carbide material mineral - metal ceramic materials – ceramics.

It should be mentioned general orientation towards parallel with the development of hard carbide alloys and metallic compounds, minerals and hard materials branch ceramice. This shows that the economic benefits are much cheaper than metal carbides, for which particular interest, especially for construction cutting tools. For example tool applications are knives, drills for machining and grinding wheels with a wide range of practicality in various branches of production materials, consumer goods, and the construction of certain parts for the industry. The problem is of interest because these hard materials, metal plates are parallel to users fully sintered carbide and in some cases can be combined with them.

CONCLUSIONS

New method for active surface high finishtools provided with metal carbide inserts attached, the following advantages:

- achieve accuracy improving execution rate
- shortens the manufacturing cycle of a benchmark by reducing the number of work operations (phases)
- increasing quality by reducing surface roughness;
- geometry-improving surface finish;
- allowance made parts decreases from 0,5 mm to 0,2 mm;
- reduce transition time from one part to another;
- improve cycle processing capability for the first part done.

In the current and future program we intend to get new technologies high finish tool equipped with hard alloy plates bonded with special material properties which enhance the durability and wear resistance.

These plates were obtained by sintering wich is a process of agglomeration of solid polydispersity under prelonged action of heat and pressure to lower the melting temperature.

Sintering involves replacing the interface solid/gas by high energy solid/solid interface energy lower. This total energy reduction at the interface is the driving force for sintering process. A sintered material is always some porosity which decreases with sintering time. Grain growth, which has a detrimental effect on mechanical properties can also occur during sintering so that a compromise must be reached between maximum density and minimum grain growth.

ACKNOWLEDGEMENT

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PROCEDURE USING GMAW-STT APPLIED AT MAIN PIPELINES WELDING

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Abstract: *The Lincoln Electric Company is the first and only welding company to hold a patent on revolutionary new welding process called Surface Tension Transfer. High productivity welding processes are continuously improved to ensure quality connections that bring required safety factor at our new standards. Welding process MIG / MAG is by far the most productive, is constantly improved.This ensures good penetration and low heat input control. It is ideal for welding joints with open root, on gaps or on thin material with no burnthrough. The paper makes a comparison between the weld root by manual arc welding process and welding GAMW - STT root layer where steel L 245 NB - Grade B, X 42 and X 52 in that run pipelines.*

Keywords: *GMAW – STT, welding processes symbolized, steel- pipe.*

1. INTRODUCTION

This paper aims to study the root welding using GMAW process - STT. Make a comparison between mechanical test results of samples that root welding was done by tubular cored metal arc welding with active gas shield and gas-metal-arc welding shielding.

Unlike standard CV GMAW machines, the STT machines has no voltage control knob Procedure STT uses current controls to adjust the heat independent of wire feed speed, so changes in electrode extension do no affect heat. The STT process makes weld that require low heat input much burning through, and distortion is minimized. Spatter and fumes are reduced because the electrode is not overheated-even with larger diameter wires and 100 CO_2 shielding gas. This gas and wire combination lowers consumable costs.

2. EXPERIMENTAL RESEARCH

Experimental tests were performed with equipment manufactured de firma Lincoln Electric Power Wave 445M/STT/Power Feed TM 10 M dual. This is a digitally controlled inverter power source capable of complex, high-speed waveform control. It is designed to be part of a modular, multi- process welding system. This product features Lincoln Electric's STT process for applications in which heat input control, minimal distortion, reduced spatter and low fumes are essential.

In the study we used steel for pipelines for the transport of natural gas:
Parent Material:

- Steel pipelines L 245 NB (group 1.1 acc. EN 15608) - Grade B;
- Steel pipelines L 290 NB (group 1.2 acc. EN 15608) - X 42;
- Steel pipelines L 360 GA (group 1.2 acc. CEN ISO / TR 15608) - X 52.

Were chosen to study 3 welding processes symbolized according to EN ISO 4063 which

establishes reference numbers welding processes:
111 - manual arc welding with coated electrode;
135 - Arc welding electrode active gas burnt in the environment; MAG welding;
136 - MAG welding with tubular wire [1].
Welding positions are according to ISO 6947:
PF - vertically upward;
PG - vertically downward;

Certification tests were performed accordance to EN ISO 15614-1: 2005/A1/ 2008.

In all samples was processed welding point V, opening 60^0 (Fig. 1).

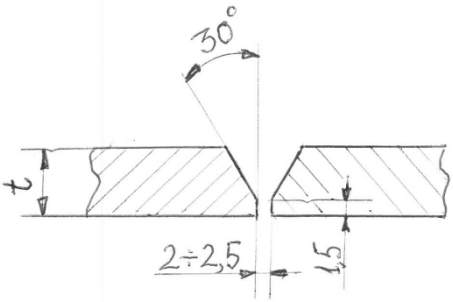

Figure 1. Welding joint geometry

Legend for Hardness Test charts:

.

2.1 Sample I.

Welding process: 136 + 111.

Joint type – butt weld (Foto 1).

Parent Material Specification EN 10208/2: L 245 NB Grad B (group 1.1. acc. EN 156080), outside diameter Φ= 88,9 mm, material thickness, t=6 mm (API – 5L) [2].

All weld metal:

Root : procedure 136 (Tubular cored metal arc welding with active gas shield), welding cored wire type HYUNDAI Supercored 70 NS (E70C-6M acc.AWS A5.18).

Filler : procedure 111 (Metal arc welding), covered electrode type FRO SANBAZ (E 42 5 B 42 H5 acc.EN 2560-A).

Shielding Gas: CORGON (M21 acc. EN 439).

Type of Welding Current: DC^+.

Welding positions: PF.

Interpass Temperature: 200^0 C

Gas Flow Rate-Shielding:15 – 20 l/min [3].

2.1.1 Details of weld test.

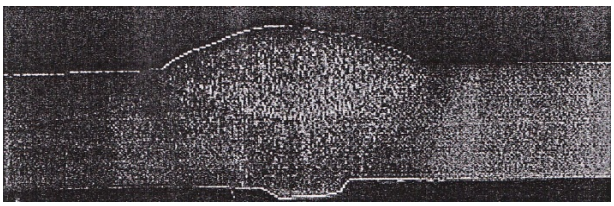

Foto 1. Sample 1. Material L 245 NB Grad B.

2.1.2 Hardness test HV 10

		Root	Filler	Top L.
1	BM	148		147
2	BM	146		145
3	BM	149		144
4	HAZ	197		196
5	HAZ	193		191
6	HAZ	194		192
7	WM	209		203
8	WM	207		206
9	WM	210		204
10	HAZ	196		193
11	HAZ	198		192
12	HAZ	197		194
13	BM	149		148
14	BM	150		146
15	BM	148		143

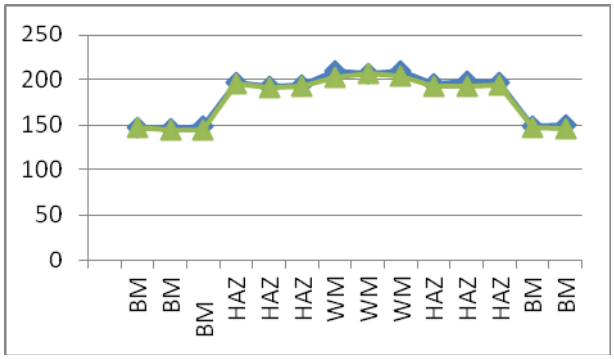

Figure 2. Hardness variation for L 245 NB

2.2 Sample II

Welding process : 135(PG)+111(PF)

Joint type – butt weld (Foto 2).

Parent metal: L360 GA (group 1.2. acc. CEN ISO/TR 15608) - X 52, outside diameter Φ=508 mm, material thickness, t=8,8 mm (API – 5L).

All weld metal:

Root : procedure 135; (Gas-shielding metal-arc welding), welding wire type SUPRAMIG(ER70S-6 acc. AWS A5. 18-93.

Filler: procedure 111; (Metal arc welding), covered electrode type SANBAZ (E 7018-1H4R acc. AWS A5.1).

Shielding Gas: CO_2 =99.99% (C1 acc. To EN 439). Type of Welding Current: CC+.

Welding positions: 135(PG)+111(PF).

Interpass Temperature: max. 200^0 C.

2.2.1 Details of weld test

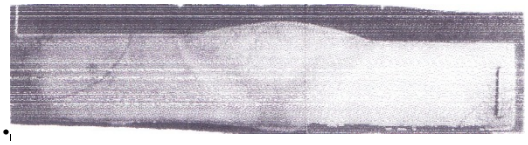

Foto 2. Sectiune cusatura X 52

2.2.2 Hardness test HV 10

		Root	Filler	Top L.
1	BM	180		
2	BM	182		
3	BM	185		
4	HAZ	209		
5	HAZ	207		
6	HAZ	205		
7	WM	215		
8	WM	213		
9	WM	216		
10	HAZ	202		
11	HAZ	206		
12	HAZ	208		
13	BM	184		
14	BM	181		
15	BM	180		

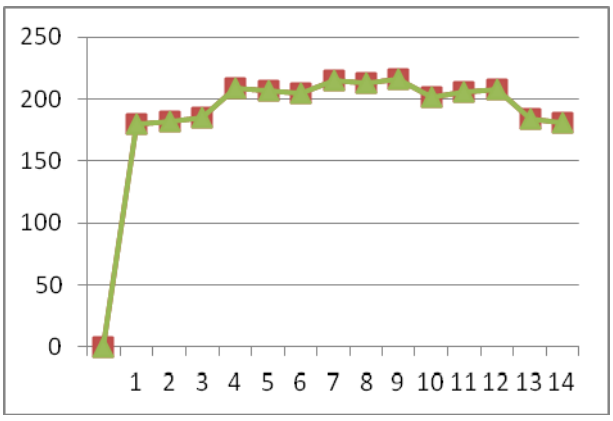

Figure 3. Hardness variation for X 52.

2. 3 Sample III

Welding process: 111

Joint type – butt weld (Foto 3).

Parent Material Specification EN 10208/2: L 290 NB (group 1.2. acc.EN 15608) - X 42, outside diameter Φ=323,9 mm, material thickness, t=12,5 mm (API – 5L).

All weld metal:

Root: procedure 111 (Metal arc welding), covered electrode type FOX EV PIPE (E 42 4 B 12 H5 acc. EN 2560-A).

Filler: procedure 111 (Metal arc welding), covered electrode type FRO SANBAZ (E 42 5 B 42 H5 acc. EN 2560-A).

Welding position: PF;

Type of Welding Current: DC^+.

Interpass Temperature: 200^0 C

2.3.1 Details weld test

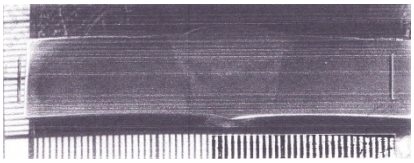

Foto 3. Sample 3. L 290 NB - X 42

2.3.2 Hardness test HV 10

		Root	Filler	Top L.
1	BM	144	140	142
2	BM	142	141	144
3	BM	140	143	141
4	HAZ	163	164	166
5	HAZ	158	164	165
6	HAZ	164	162	165
7	WM	175	186	180
8	WM	177	189	182
9	WM	173	185	185
10	HAZ	168	164	165
11	HAZ	173	166	170
12	HAZ	171	165	169
13	BM	139	145	141
14	BM	140	140	145
15	BM	142	144	142

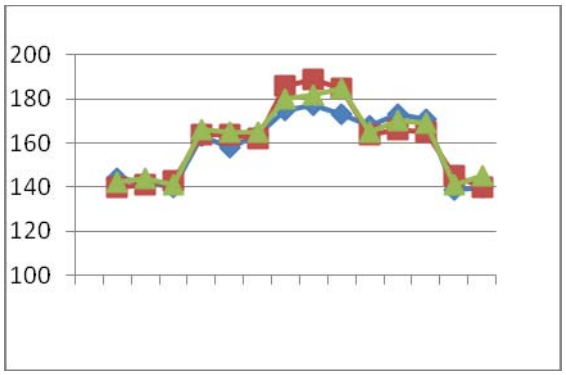

Figure 4. Hardness variation for X 42.

3. CONCLUSIONS & ACKNOWLEDGMENT

Of experiments and the interpretation of results of root layer improves hardness values. microhardness we conclude that the process of shielded gas welding GMAW – STT root layer improves hardness values (Fig.2,3 and 4).

Since the quality depends on the quality welding seam root this study justified the application welding process referred to mentioned welding root welding layer [4],[5].

Hardness test HV 10 shows the hardness values HV GMAW welding process - STT can be applied widely in automated welding pipelines. Following this research the following conclusions are drawn:

- modified short arc with the amperage and voltage changed based upon the results of the arc;
- low heat input;
- controlled heat input;
- all position welding;
- handles poor fit up;
- minimal spatter;
- can use a larger wire size;
- minimal smoke;

The STT also makes welds that require low heat input much easier – without overheating or burning through, weld distortion is therefore minimised. Good penetration at low heat input also makes it ideal for open roots, gaps or thin material. Spatter and fumes are also reduced as the electrodes are not overheated, even with larger wire diameters and 100% CO_2 gas – which in turn reduces consumable costs, the current is controlled to achieve optimum metal transfer.

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NUMERICAL MODEL OF SUSPENDING SOLID PARTICLES BY MEANS OF MIXING RADIAL TURBINES

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Abstract: *The random distribution of two or more phases (liquids, solids and/or gases) initially separated in order to form a homogenous phase is a process of special interest for industry. The equipment used to mix the phases are called agitators or mixers. The paper describes the numerical simulation of forced convection of one solid phase (titanium dioxide) through a fluid one (water) by an open mixing radial turbine. Using the Eulerian multiphase flow model one can gain an in-depth view of the mixing process allowing for the optimization of turbine's characteristics in order to minimize the time and power required to mix the separated phases into the homogenous one.*

Keywords: *mixing radial turbine, suspension, multiphase flow.*

1. INTRODUCTION

Mixers and agitators are simple tools used commonly in the chemical industry to mix initially separated phases using forced convection. A variety of mixer designs is available and one broad basis for classification is the viscosity of the phases.

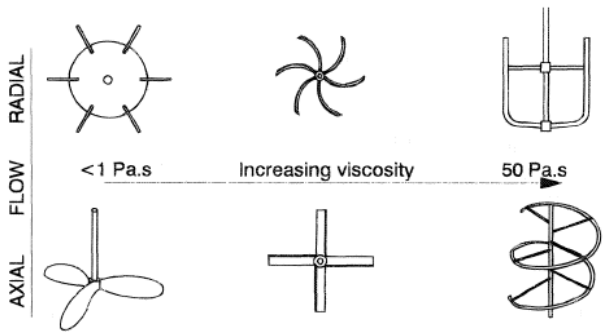

Figure 1 Flow based classification of turbines

Low viscosity phases are typically processed using small turbines while high viscosity phases will require larger designs. Other sources of classification are the way in which the turbine generates flow (shear stress or pressure) and the flow pattern they produce (axial, radial or tangential).

The paper describes the mixing process of titanium dioxide (TiO_2) with water using a low viscosity open mixer with 6 bladed radial turbine. The vessel diameter is D_t=240mm, equal to the water height H=240mm, the turbine is mounted with a bottom clearance E=24mm and its diameter is D_a=105mm. The blade's geometry (n=6) has W=40mm and l=15mm.

The 3D discretization of the computational domain consisted of three regions: one region filled with the secondary phase (titanium dioxide) at the bottom of the mixer with approx. 40000 tetrahedral cells, one region filled with the primary phase (water) with approx. 450.000 hexahedral and tetrahedral cells and one region around the turbine with 235.000 tetrahedral cells. This split allows us to use a rotating reference system for the

turbine region and to initialize the layer of TiO_2 at the bottom of the vessel.

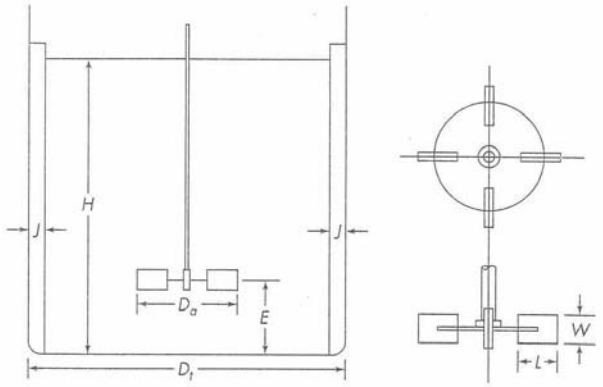

Figure 2 Measurements of the simulated mixer [1]

2. MULTIPHASE FLOW MODEL

Since we are interested in the time history of the mixing process we have chosen to compute the unsteady solution using a sequential solve for the flow equations. The Eulerian-Eulerian multiphase flow model used with the two phases (one liquid and one solid) uses a single pressure field for all phases and solves momentum, enthalpy and continuity equations for each phase and tracks volume fractions.

The volume fractions represent the space occupied by each phase and are defined by:

$$V_q = \int_V \alpha_q dV \text{ where } \sum_{q=1}^{n} \alpha_q = 1$$

The effective density of the phase q is:

$$\hat{\rho}_q = \alpha_q \rho_q$$

The conservation of mass equation for the phase q is:

$$\frac{\partial}{\partial t}\alpha_q \rho_q + \nabla \cdot \alpha_q \rho_q \vec{u}_q = \sum_{p=1}^{n} \dot{m}_{pq} \qquad (1)$$

where $\vec{u}_q$ is the velocity of phase q and $\dot{m}_{pq}$ is the mass transfer from phase p to phase q.

The conservation of momentum equation for phase q is:

$$\begin{aligned} &\frac{\partial}{\partial t}\alpha_q \rho_q \vec{u}_q + \nabla \cdot (\alpha_q \rho_q \vec{u}_q \otimes \vec{u}_q) = \\ &-\alpha_q \nabla P + \nabla \cdot \alpha_q \bar{\bar{\tau}}_q + \alpha_q \rho_q \vec{F}_q + \\ &+ \sum_{p=1}^{n} (R_{pq} + \dot{m}_{pq} \vec{u}_{pq}) \end{aligned} \qquad (2)$$

where $\bar{\bar{\tau}}_q$ is the phase q tensor given by:

$$\begin{aligned} \bar{\bar{\tau}}_q &= \alpha_q \mu_q (\nabla \vec{u}_q + \nabla \vec{u}_q^T) + \\ &+ \alpha_q (\lambda_q - \frac{2}{3}\mu_q) \nabla \cdot \vec{u}_q \bar{\bar{I}} \end{aligned} \qquad (3)$$

Here μ_q and λ_q are the superficial viscosity and the viscosity of phase q.

The conservation of enthalpy equation for phase q is:

$$\begin{aligned} &\frac{\partial}{\partial t}(\alpha_q \rho_q h_q) + \nabla \cdot (\alpha_q \rho_q \vec{u}_q h_q) = \\ &-\alpha_q \frac{dp_q}{dt} + \bar{\bar{\tau}}_k : \nabla \vec{u}_q - \nabla . \vec{q}_q + s_q + \\ &+ \sum_{p=1}^{n} (Q_{pq} + \dot{m}_{pq} h_{pq}) \end{aligned} \qquad (4)$$

where h_q is the specific enthalpy of phase q, $\vec{q}_q$ is the heat flux, s_q is a source term and Q_{pq} is the phase heat change intensity.

The Eulerian multiphase flow model was closed with the *k-eps* turbulence model and in the regions near the vessel's walls we applied the standard functions to avoid a finer discretization. Since the Stokes number is much smaller than 1 and the phase densities ratio is approx. 4, the kinetic energy of TiO_2 particles will be close to the water's kinetic energy allowing us to use the multiphase model of turbulent dispersion to the general *k-eps* model.

The gravitational effect was also considered by the definition of a $9.82 m^2/s$ acceleration about the -z axis.

3. RESULTS AND DISCUSSIONS

The mixing of the two phases was simulated with two different concentrations for the homogenous solution: 15% and 20%. The diameter of secondary phase particles was chosen 50μm, the superficial viscosity was

computed with the Syamlal-Obrien model and the granular viscosity with the Lun model. Given the agglomeration coefficient of 0.7 and the concentration of the secondary phase, we could calculate the height of the TiO_2 layer as 10mm for 15% and 16mm for 20%. The semi-empirical drag law model of Gidaspow was imposed for the interaction of the two phases.

The boundary conditions posed no problems for the vessel walls but a special treatment was applied to the fluid region around the turbine. To simulate the rotational effect, this region was defined in to a rotational reference system imposing 500rpm for the 15% concentration and 1000rpm for the 20% concentration.

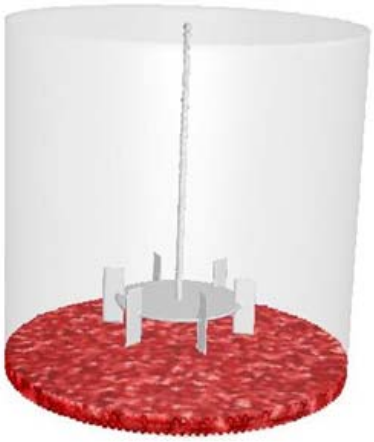

Figure 3 TiO_2 pigment layer at initialization

The unsteady solution was computed after the initialization of the stratified secondary phase: the fluid region from the bottom of the vessel was initialized with a 0.7 volume fraction of TiO_2.

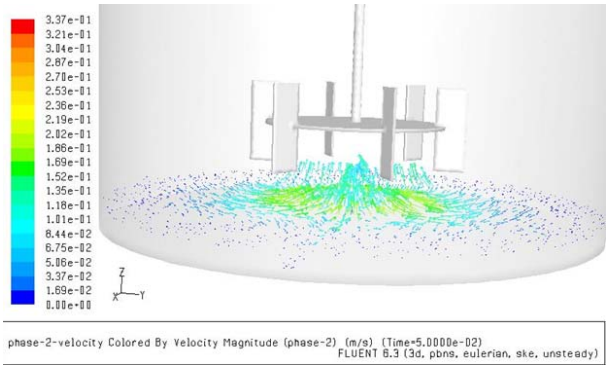

Figure 4 Velocity profile of water phase colored by velocity magnitude (t=0.05s)

The time step used to advance in time was chosen equal to 0.005s for the first 100 steps in order to avoid the divergence of the solution. Every 10 time steps, the solution was saved for post-processing. After the initial 100 steps, the time step was increased to 0.05s and the solution was monitored and saved every 2 time steps until homogenization.

In both cases, 15 seconds were sufficient for the total mixing of the phases. At 0.5 seconds after initialization one can visualize the particles of TiO_2 as they begin to mix with the water. The tangential motion of the water due to the radial turbine combined with the ascending current stir the TiO_2 layer and mixes it.

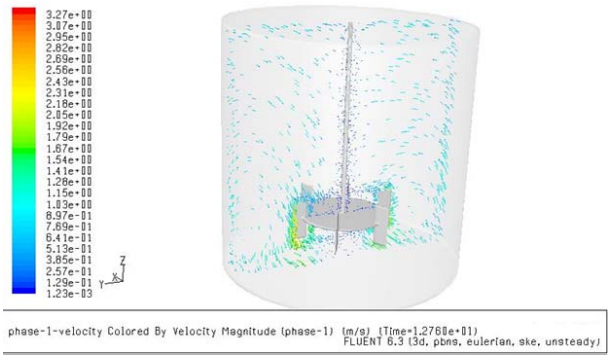

Figure 5 Velocity profile of TiO_2 phase colored by velocity magnitude (t=12.7s)

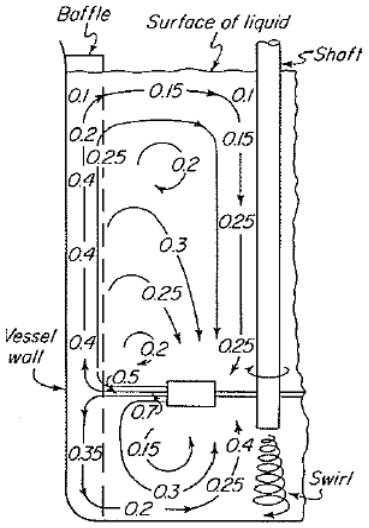

Figure 6 Velocity patterns in a turbine agitator [1]

In Figure 5 one can see that the volume of fluid circulated by the turbine is sufficient to sweep out the entire vessel in a reasonable time. Also, the velocity of the stream leaving the turbine is strong enough to carry the currents to the remotest parts of the vessel. The velocity of the fluid at any point has three components: the radial component acts in a direction perpendicular to the shaft of the turbine, longitudinal component acts in the direction parallel to the shaft and rotational component acts in a direction tangent to a circular path around the shaft. The components that provide the flow necessary for the stirring action are the radial and the longitudinal ones.

Comparing Figure 5 with the velocity patterns in a turbine agitator published by Morrison (Figure 6), one can see that they are in good agreement.

Figure 7 shows the velocity pattern of liquid flowing radially from the blade. The radial velocity is a maximum in the plane of the middle of the blade and decreases towards the upper and lower edges. Computing the volumetric flow rate q with the formula:

$$q = K\pi^2 D_a^2 nW\,(1\text{-}k)\tan\beta_2' \tag{5}$$

one can obtain the flow number N_Q defined as:

$$N_Q = \frac{q}{nD_a^3} \tag{6}$$

For a standard flat-blade turbine N_Q may be taken 1.3.

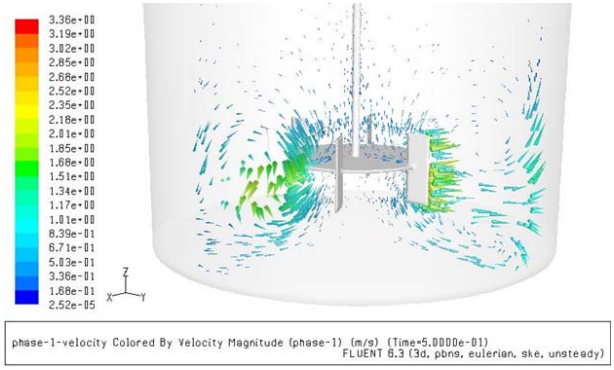

Figure 7 Velocity profile of TiO_2 phase colored by velocity magnitude (t=0.5s)

An important consideration in the design of a mixing vessel is the power required to drive the turbine. When the flow is turbulent, the power requirement can be estimated from the product of the flow q produced by the turbine and the kinetic energy E_K per unit volume of fluid. These are:

$$q = nD_a^3 N_Q \tag{7}$$

and:

$$E_K = \frac{\rho(V_2')^2}{2g_c} \tag{8}$$

In dimensionless form, the power requirement is given by the power number N_P:

$$N_P = \frac{Pg_c}{n^3 D_a{}^5 \rho} \tag{9}$$

For the standard six-bladed turbine N_P=5.2.

To conclude, the numerical model described above can be used to design new tanks and turbines for the mixing processes. At the same time one can optimize the design by visualizing the flow pattern, the quality of the mixing and by minimizing the time and the power needed to homogenize two or more separate phases.

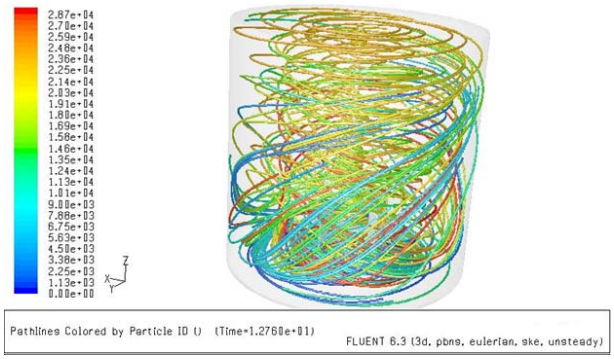

Figure 8 Pathlines colored by particle ID (t=12.7s)

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SATELLITES MOVEMENTS DECAY

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Abstract: *Drag, by definition, will be opposite to the velocity of the satellite relative to the atmosphere. The calculation of the drag force on satellites will be made by two methods: one, based on experimental observations, similar to the calculations of the incompressible flows, the second based on the Newtonian Theory of movement of the molecules. The importance of these calculations is given by the fact that the atmospheric drag is involved in the length of the life of satellites and is implicated, like other perturbations, in the movement of those. We show how this implication works, alone or in combination with other factors.*

Keywords: *drag, satellites, high altitude*

1. INTRODUCTION

The problematic of movement of satellites is one with a great importance, given the constant support of our day by day life. Communications, transportations and more depends of the utilization on a large scale of satellites and theirs support. So knowing better how long a satellite will stay in orbit and how we can prolong its life is a big necessity.

2. ATMOSPHERIC DRAG

2.1 Drag , by definition, will be the opposite to the velocity of the satellite relative to the atmosphere. The perturbing force F is given by:

$$F = \frac{1}{2m} C_D A_e \rho v^2 \qquad (2.1)$$

Where:

C_D=aerodynamic drag coefficient

A_e=average cross-sectional area of the satellite

ρ=air density

m=satellite mass

v=satellite velocity relative to the rotating atmosphere.

The aerodynamic drag coefficient C_D is approximately 1 when the mean free path of the atmospheric molecules is small compared to the satellite size, although the exact value depends upon the satellite shape, the nature of its surfaces, and its attitude.

C_D takes value between 2 and 3 – dependent on the shape of the satellite – when the mean free path is large compared with the dimensions of the satellite. Exact values are best determined by actual flight test, but a value of about 2.2 will give a good, slightly conservative result.

2.2 Atmospheric density

The complicating factor in the calculation of drag, is the variable nature of the atmospheric density.

For heights between 0 and 100 km, the U.S. Standard Atmosphere of 1962 can be used.

A good approximation is the following simple exponential law:

$$\rho = \rho_0 \exp\left[-h / H\right] \qquad (2.2)$$

Where:

h=altitude above sea level in km

ρ_0=sea level density at 288.15K = =1.225kg/m^3

H="scale height"=6966 km

However, for greater heights, the atmospheric density exhibits variations with respect to altitude and latitude. There are large day-to-night variations, a 27-day cycle due to ultraviolet radiation, and an 11 year cycle due to the solar flux. The table below gives average values for the atmospheric density for three representative values of solar activity (based on the Jacchia 1964 model).

Tables of Atmospheric Density (kg/m^3) as a Function of Altitude.

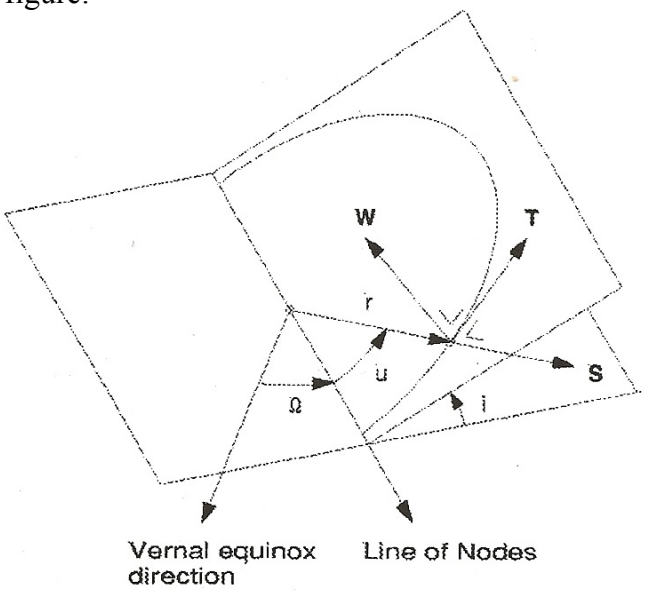
Altitude(km)	Quiet Sun
150	7.4 E-10
200	1.7 E-10
250	5.5 E-11
300	1.7 E-11
350	5.9 E-12
400	2.3 E-12
450	7.4 E-13
500	3.0 E-13
550	1.2 E-13
600	5.7 E-14
650	2.5 E-14
700	1.2 E-14

Altitude(km)	Average Sun
150	7.4 E-10
200	2.4 E-10
250	1.0 E-10
300	3.8 E-11
350	1.7 E-11
400	7.4 E-12
450	3.3 E-12
500	1.7 E-12
550	8.0 E-13
600	4.1 E-13
650	2.3 E-13
700	1.3 E-13

Altitude(km)	Active Sun
150	7.4 E-10
200	3.0 E-10
250	1.3 E-10
300	5.5 E-11
350	2.6 E-11
400	1.3 E-11
450	6.9 E-12
500	3.8 E-12
550	2.1 E-12
600	1.2 E-13
650	7.4 E-13
700	4.8 E-13

2.3 Computations.

The drag is calculated like in the next figure:



Where:

S is the component along the radius vector

T is the component perpendicular to S in the orbital plane

W is the component perpendicular to the orbital plane

Before the acceleration F in expression can be used in the Variation of Parameters Method, it is necessary to resolve F into two orthogonal components S and T:

$$S = -F\sin B = -F\frac{e\sin v}{\sqrt{1+2e\cos v+e^2}}$$

$$T = -F\cos B = -F\frac{1+e\cos v}{\sqrt{1+2e\cos v+e^2}}$$

Where v is the flight path angle, i.e. the complement of the angle between velocity v and r.

The figures 1 and 2 illustrate the influence of atmospheric drag on life time of a satellite in low orbit. In both examples, a satellite of 450 kg and A_e of 25 m^2 is in 400 km circular

orbit. The first case relates to average solar conditions; the second case is for an active sun.

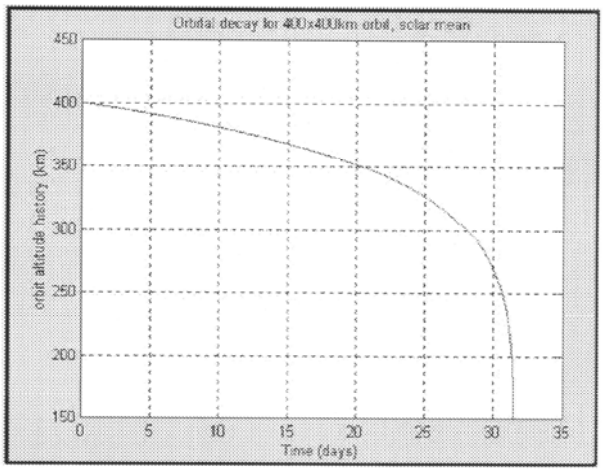


Figure 1. Orbit decay for a 450kg satellite, Mean Sun

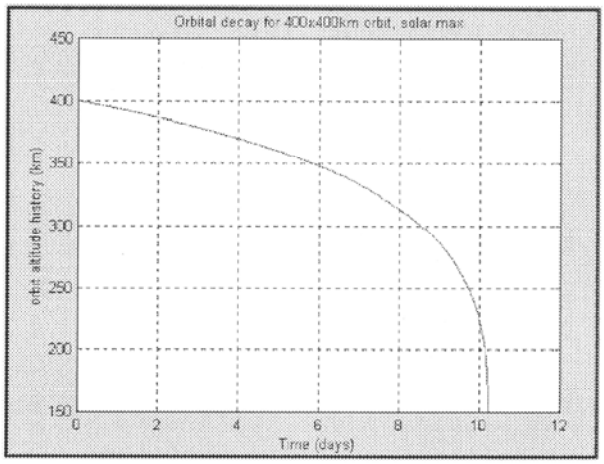


Figure 2. Orbit decay for a 450kg satellite, Active Sun.

We can see the life span decreased from about 32 days at about 10 days, only taken in consideration the sun activity.

3. OTHER MOVEMENTS ANOMALUES

3.1 Electrical Charging.

One of the most common anomalies caused by radiations hazards is satellite electrical charging. Charging can be produced three ways:

- by an object's motions through a medium containing charged particles (called "wake charging"), which is a significant problem for large objects;
- directed particle bombardment, as occurs during geomagnetic storms and proton events;
- solar illumination, which causes electrons to escape from an object's surface (called the "photoelectric effect").

The impact of each phenomenon is strongly influenced by variations in an object's shape and materials used in its construction.

An electrical charge can be deposited either on the surface or deep within an object, resulting in two types of charging:

- Surface charging-low energy electrons attach to the satellites causing different charges on parts of it, leading to an electrical arc discharge on the surface. Solar illumination and wake charging are surface charging phenomena;
- Deep electric charging-high energy electrons penetrate through the shielding of the satellites and build up inside.

3.2 Single event upsets.

Single Event Upsets are caused by very high energy particles which penetrate he shielding. The high energy particles have two sources: cosmic rays, which are a slow steady flux of high energy, sometimes of heavy particles and solar proton emissions of very large fluxes from solar flares.

In fact, a single proton or cosmic ray, can (by itself) deposit enough charge to cause an electrical upset.

3.2 Radiations hazards.

Total dose effects-radiation from galactic cosmic rays and solar proton events can cause cumulative radiations disruptions. Both low and high-orbiting satellites are subject of radiations hazards.

3.3 Disorienting magnetic fluctuations and discharges.

Some satellites that use the Earth's magnetic field to help orient themselves can lose orientation during a magnetic storm. Many satellites rely on electro-optical sensors to maintain their orientation in space. They can cause disorientation in the star tracking devices or misreading in sensors, causing the satellite to lose altitude lock with respect to Earth.

3.4 Radio interference.

A satellite's telemetry may be masked by a solar radio frequency burst when the Sun is aligned with satellite and the ground antenna. Radio propagation problems through and within the ionosphere are caused by space weather, and affect nearly all satellites to a greater or lesser extent.

4. CONCLUSIONS

The natural trade-off between the needing to build a big, robust satellite capable of resisted space weather caprices and the drag force makes a difficult choice. Increased mass and surface conduct to an increased drag and shortened the life span of the satellite.

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A CONCISE ANALISYS ON COMPOSITES MACHINING TECHNOLOGIES

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Abstract: *Composite materials offer the benefits of part integration and thus minimize the requirement for machining operations. However, machining operations cannot be completely avoided and most of the components have some degree of machining. Machining operations are extensively used in the aerospace industry. Machining of metals is very common but machining of composites poses some very specific difficult. In the paper is presented a concise analyze on composites machining. Conventional and non-conventional machining is presented with their technical requirements, advantages and disadvantages.*

Keywords: *composites, conventional machining, turning, milling, drilling, non-conventional machining, abrasive water jet, laser machining, ultrasonic machining*

1. INTRODUCTION

There is no universal definition of composites. In general, a composite material is a heterogeneous material system consisting of two or more physically distinct materials. It is made by combining two or more materials to give a unique combination of properties. The above definition is more general and can include metals alloys, plastic co-polymers, minerals, and wood. Fiber-reinforced composite materials differ from the above materials in that the constituent materials are different at the molecular level and are mechanically separable. In bulk form, the constituent materials work together but remain in their original forms. The final properties of composite materials are better than constituent material properties.

The main concept of a composite is that it contains matrix materials. Typically, composite material for aircraft parts is formed by reinforcing fibers in a matrix resin. The reinforcements can be fibers, particulates, or whiskers, and the matrix materials can be metals, plastics, or ceramics. The reinforcements can be made from polymers, ceramics, and metals. The fibers can be continuous, long, or short [3].

Composites are made with a polymer matrix which can be thermoset or thermoplastic resins.

Composites have been designed and manufactured for applications in which high performance and light weight are needed. They offer several advantages [2, 3, 4]:

- design flexibility, complex parts, which are sometimes not possible with metals, can be fabricated without welding or riveting the separate pieces or can be replaced by a single composite component;
- high specific stiffness;
- very high specific strength;
- the fatigue strength (endurance limit) is much higher than steel and aluminum alloys;
- high corrosion resistance.

During the process in the raising of a composite parts, there are four main steps

which are **forming**, **machining**, **joining**–a**ssembly** and **finishing**.

In figure 1 is presented a very concise schema of composites manufacturing.

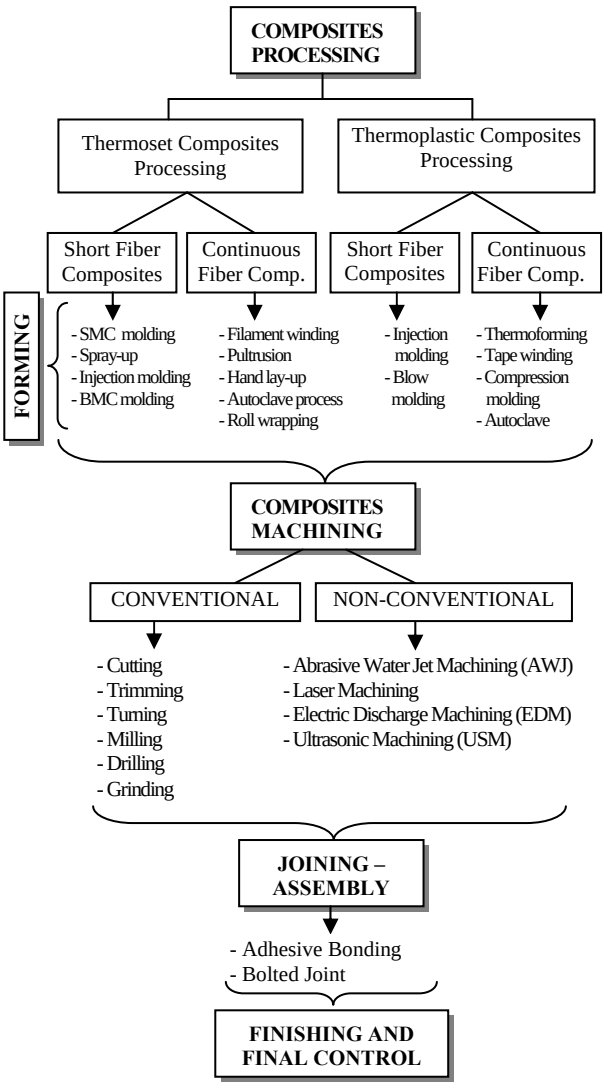

Fig.1 Composites Manufacturing Schema

2. CONVENTIONAL MACHINING

Composite materials offer the benefits of part integration and thus minimize the requirement for machining operations. However, machining operations cannot be completely avoided and most of the components have some degree of machining. Machining operations are extensively used in the aerospace industry.

The processes used to manufacture composite structures generally require that trimming and other machining operations be performed prior to assembly. Machining processes are required to produce accurate surfaces and holes to allow precision fitting of components into an assembly. Due to shrinkage during the curing stage of the composite structure it is not practicable to place holes in the part during the molding stage, therefore milling, cutting, drilling etc. are considered a post cure operation.

The tool used for the composite machining are generally the same whit the tool used in metal machining. A large database of machining information for various high speed steel and carbide cutting tool materials exists for machining metal, wood and some thermoplastics. But much of this data cannot be applied to machining modern composites. Each modern composites have their own machining characteristics. Composites are not homogeneous or isotropic, therefore the machining characteristics are dependent on the tool path in relation to the direction of the reinforcing fibers. Metals or metal alloys have nearly homogeneous properties throughout the workpiece, but each material in a composite retains its individual properties.

Machining of metals is very common and is easily performed but the machining of composites poses some difficult very specific:

- Machining of composite creates discontinuity in the fiber and thus affects the performance of the part.
- The temperature during cutting should not exceed the cure temperature of the resin for thermoset composites to avoid material disintegration. Glass and Kevlar fibers have poor thermal conductivity and such high temperature may lead to localized heating and degradation.
- Machining exposes fibers to chemicals and moisture.

2.1 Conventional turning. The turning of composites is utilized to produce round surfaces that need to mate with either metal or composite parts. Depth of cut will vary depending on the thickness of the part and the amount of material to be removed.

Advantages: Computer numerical controlled lathes (CNC) can be used to machine simple to very complex rotational parts. CNC machining produces accurate parts at a high production rate.

Disadvantages: Delamination (Fig.2) can also occur on a lathe, therefore the part may require a finish cut moving from the largest diameter to the smaller diameter.

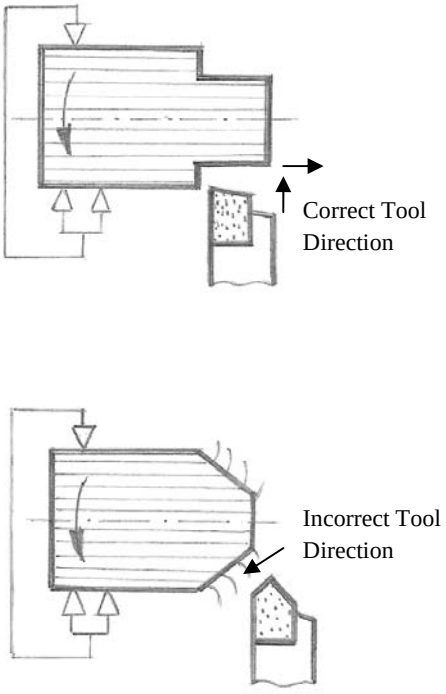

Fig.1 Turning composite parts on a lathe

Machining parameters:
- Rotational speed
- Direction of rotation
- Angle
- Traverse rate
- Initial diameter
- Final diameter
- Depth of cut.

Machining requirements (dependent variables):
- Turned diameter
- Surface finish
- Machining time.

Recommended milling parameter is [4]:
-cutting speeds range can be over 300 m/min.

2.2 Mechanical Drilling. Drilling holes in composites can cause failures that are different from those encountered when drilling metals. Delamination, fracture, break-out and separation are some of the most common failures. Delamination (surface and internal) is the major concern during drilling composite laminates as it reduces the structural integrity, results in poor assembly tolerance, adds a potential for long term performance deterioration and may occur at both the entrance and exit plane. Delamination can be overcome by finding optimal thrust force (minimum force above which delamination is initiated). Figure 2, a) shows delamination at exit because at a certain point loading exceeds the interlaminar bond strength. Figure 2, b) shows peel-up delaminating at entrance because the drill first abraded the laminate and then abraded material away along causing the material to spiral up before being machined completely. This type of delamination decreases as drilling proceeds since the thickness resisting the lamina bending becomes greater. Among the variables to be considered for tool selection include the thickness of material, diameter of hole, tolerance requirements, hole finish requirements and the composite material being drilled.

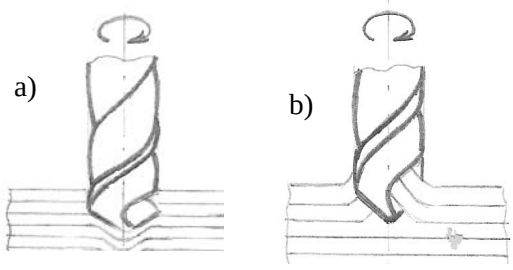

Fig. 2 Delamination during drilling composite

a) push-out at exit
b) peel-up at entrance

Machining parameters:
- Angle
- Traverse rate
- Standoff distance
- Dwell time
- Pressure profile
- Material thickness.

Machining requirements (dependent variables):
- Diameter
- Drilling time
- Hole shape.

Recommended drill cutting parameters are [4]:
-feedrates range from 0.025 mm/rev to 0.063 mm/rev;
-cutting speeds range from 30 m/min to 460 m/min;

2.3 Conventional milling. The surface roughness is a function of fiber orientation, cutting direction and the angle between cutting direction and fiber direction. When taking heavy milling cuts there is a greater tendency to break comers as the tool exits the material so it is advisable to first machine a step on the edge perpendicular to the final pass. A four fluted end mill will reduce cutting pressure on the laminate and keep it cooler. Climb milling helps prevent the fibers separating from the matrix bond material.

Advantages: improved surface finish unless part surface was directly in contact with the mold surface, machined surfaces provide accurate surfaces for parts to be assembled.

Disadvantages: controlling the dust particles, confining them to a small area and having an adequate collection system and controlling the outer layers of the composite so that the fibers will shear instead of lifting up under the force of the cutting action and leaving extended fibers beyond the cut surface (when cutting perpendicular to the lay of composite fibers, edge break-out can occur).

Machining parameters:
- Traverse rate
- Number of passes
- Number of sweeps.

Machining requirements (dependent variables):
- Volume removal rate
- Depth control.

Recommended milling parameter is [4]:
-cutting speeds range from 250 m/min to 760 m/min.

2.4 Grinding of composites. The grinding process has been used extensively for finishing composite parts. The grinding of polymer matrix composites has a number of problems. For example in the case of thermoplastic matrix, the surface of grinder becomes covered with melted thermoplastic. In the case of aramid fiber it is hard to get a clean cut surface because the grains cannot abrade the aramid fibers cleanly. Abrasive belts have been used on aramids with some success but dust collection has been a major problem.

Recommended grinding parameter is [4]:
-surface speeds range from 1200 m/min to 1800 m/min.

For all conventional machining, high cutting speeds can burn the matrix material and reduce bond strength between the composite material and the matrix material. So, a water soluble coolant forced through a cold air blast unit is recommended when machining most composite materials. If the composite is hydrophilic, a cold air blast unit in combination with dust or vacuum collection system should be used.

3. NON-CONVENTIONAL MACHINING

3.1 Abrasive water jet (AWJ) machining - is used for linear profile cutting, turning, milling and drilling operations in composite materials.

Conventional tool machining is affected by fiber or particle reinforcements rather than the matrix material while AWJ machining is not.

Water jets without abrasive are also used for cutting soft composites.

Advantages offered by AWJ are:
- suitable for wide range of composites;
- can perform many operations like turning, drilling and milling;
- no thermal stresses;
- omnidirectional machining;
- process can be automated;
- optimal range of parameters available to prevent delamination, loading and splintering;
- it can be drilled fine holes (0.5 mm).

Disadvantages:
- dimensional accuracy is low;
- temperature rise in cutting region may be observed;
- not suitable for hydrophilic materials.

AWJ machining parameters are [4]:
- Pressure
- Water jet diameter
- Mixing tube length
- Mixing tube diameter
- Abrasive material
- Abrasive size
- Abrasive flow rate.

3.2 Laser machining of composites. Lasers are used in various industrial applications such as drilling, cutting, welding and heat treatment of metals, etc. In composites, polymer matrix materials are most suited for laser cutting. Laser cutting is a non-contact ablation process in which efficiency is determined by thermal properties of the workpiece material. Two types of laser have been used in industry [1]: Nd-YAG solid state laser and CO, gas laser. The Nd-YAG laser operates in the near infrared (IR) region of the spectrum while CO, gas laser operates in the far infrared region. The Nd-YAG (IR region) wavelength is not absorbed by glass and many plastics, while the CO (far IR region) wavelength is. It has been determined that the Nd-YAG laser is very effective in cutting composite materials. The high power short pulses achieved with this laser vaporizes both the fibers and matrix before the epoxy resin can be overheated.

Advantages:
- superior quality edges due to high temperatures;
- vaporization of the material in cut zone;

Disadvantages:
- beam divergence after its focal point;
- material thickness of 10 mm is the maximum that can be cut with 1500W;
- Varying dimensions of heat affected zone.

3.3 Electric Discharge Machining (EDM) - Advanced composites can be cut by EDM as there is no physical contact between the electrodes or workpiece and the tool. In order to EDM a composite, it should have an electrical resistivity of less than 1-3 ohm/m. Polymer matrix composite manufacturers can add a small amount of copper in the matrix of the product to allow shaping by EDM.

EDM can be used with conductive silicides, borides, carbides etc. The EDM process is more accurate than AWJ machining. Small holes of 0.25 mm diameter can be drilled in composites. The EDM process is found to be slow for many production applications [4].

3.4 Ultrasonic machining (USM). This technique incorporates a tool vibrating at 20 kHz and abrasive in a slurry to perform impact grinding of brittle materials. This technique is particularly useful for machining of ceramic matrix composites that are difficult to process by conventional methods. USM is a mechanical material removal process best suited for machining brittle materials like glass, ceramics, graphite and ceramic matrix composites. The process is limited to workpieces of size below 100 mm because of the limitation on the size of the tool [4]. Some of the variables that influence USM for close tolerances are follows: abrasive type and size, sonotrode (tool) material, ultrasonic vibrations, surface area.

USM is used in applications like drilling aerospace cooling holes in ceramic matrix composite turbine blades, slotting, irregular configurations in ceramics and composites, machining of radar components, superconductors, wire draw and extrusion dies.

Advantages:
- conductive and nonconductive materials can be machined;
- material hardness is not important;
- there are no chemical or electrical alterations in the workpiece;
- 3D and complex shapes can be machined easily and quickly;
- no heat affected zone.

Disadvantages:
- amplitude of ultrasonic vibrations are very important for proper machining;
- limited sizes can be machined.

4. CONCLUSIONS

In today's highly competitive global economy, the need for new materials with high properties to meet the demands of design, environment, durability and economics is growing. Composite materials, with their high strength and stiffness-to-weight ratios, have many advantages and are a desirable engineering material.

In a composite material system, the individual materials exhibit their unique properties and the composite as a whole shows properties that are different from its constituents. The properties of composites depend on the form and structural arrangements of the constituents and the interaction between the constituents. Composites consist of two components, a matrix and reinforcement. The matrix functions as the body constituent, serving to bind the reinforcement together and giving the composite its bulk form. The reinforcements are the structural constituents, providing high strength to the internal structure of the composite.

The composite parts manufacturing consist in four main steps which are forming, machining, joining–assembly and finishing. In the paper it is considered some aspects about composites conventional and non-conventional machining.

If composites are not homogeneous or isotropic, therefore the machining characteristics are dependent on the tool path in relation to the direction of the reinforcing fibers.

There is no accurate method of determining the operating modes, only general recommendations, most experimentally determined. Each modern composites have their own machining characteristics.

Composites machining have some difficult very specific such as creating discontinuities in the fibers arrangements and exposes fibers to chemicals and moisture (the performance of the parts are affected).

In the same time, the temperature during cutting can burn the matrix material and reduce bond strength between the composite material and the matrix material

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ANALYSIS SOLICITATIONS INJECTION SYSTEMS OF HIGH AND VERY HIGH PRESSURE USING MULTI DOMAIN SIMULATION

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Abstract: *An important role for the implementation, in the cylinders of compression ignition engines, of an efficient combustion process, is represented by the mixing process of intake air and fuel. The efficiency of this process in turn depends to a great extent on the quality of fuel injection. A high quality fuel spray requires high finesse of the fuel jet, which requires the highest possible injection pressure. Because pressure increase modifies the stress values, in this article is presented the dependency of some forces by injection pressure. The analyzed forces stress some components of the Common Rail injection system high pressure pump, allowing a fuel pressure increase without design complexity. Analysis of these forces was possible by modeling the radial piston pump, using 1D multi-domain software LMS AMESim (Advanced Modeling Environment for Performing Simulation of Engineering Systems).*

Keywords: *injection pressure, radial piston pump, stress*

1. INTRODUCTION

The quality of the combustion process in compression ignition engine cylinders depends directly on the quality of the fuel spray, or more precisely its degree of smoothness. The greater the smoothness the more homogenous is the mixing, resulting in a more efficient combustion process. [1]

Improving fuel spraying can be achieved both by increasing injection pressure and by a suitable choice of the spray holes geometry. Given the short time in which the injection must take place to ensure the entire quantity of fuel required for the combustion process, diminishing the spraying hole sections should be done at the same time with a significant increase in the injection pressure. [3]

In addition, a high injection pressure will ensure a high energy of the jet fuel. This situation is imposed partially by the increasingly higher density of the air in the compression ignition engines' cylinders, equipped with high pressure superchargers.

However, when the injection pressure increases so do the forces stressing the system, so optimizing intensity levels of the stress on the injection system components with the injection pressure value becomes a necessity.

Given the above and the foremost role of the high pressure pump in the injection system, in this paper is outlined, through a simulation model, the influence of the injection system pressure on certain components of the Common Rail injection system high pressure pump.

2. GENERALITIES

Common Rail injection system offers the advantage of high pressure injection, obtained

independently from the injection itself and from engine load.

In this system a low pressure pump transports the fuel from the tank to the high pressure injection pump, which has a fuel flow control system. This control system allows only the necessary fuel quantity for the injection process to be compressed.

The high pressure pump from the Common Rail injection system is a radial piston pump, like the one shown in Figure 1. Through an eccentric shaft, driven by the crankshaft, the pistons perform a translational motion, ensuring the injection pressure. Permanent contact between the piston and eccentric shaft is ensured by a spring. Inlet and outlet of the fuel in the pump cylinders is made through check valves.

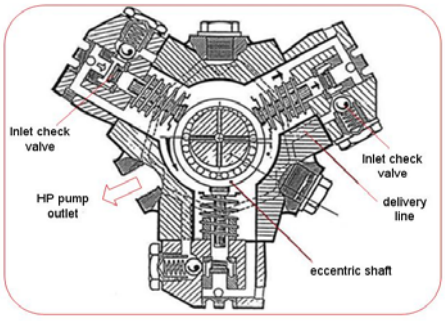


Fig. 1. The scheme for radial piston pump [4]

Thus, the high pressure pump only serves to transmit the fuel to the pressure accumulator and finally to the injectors with enough pressure to ensure a satisfactory injection process.

Compared to classic injection systems, where design complications would occur, the Common Rail injection system can be improved by increasing the injection pressure, due to its working principle. [2]

3. AMESim SIMULATION PROGRAM

The simulation model of the radial piston pump used in the Common Rail injection system, was conducted using 1D multi-domain software from LMS, AMESim (Advanced Modeling Environment for performing Simulation of engineering systems). With this program one can model most of the technical systems that work on different physical principles.

Representation of the components in these systems is done using standardized ISO symbols used in engineering. Graphical User Interface of the software is shown in Figure 2.

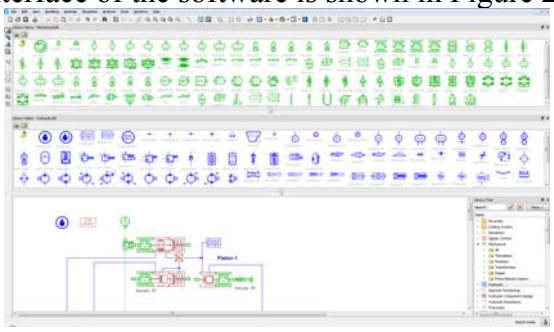


Fig. 2. Graphical User Interface of the AMESim simulation program

The software allows multi-domain simulation models of different physical systems to be created by assembling and validating models from the database (libraries). The database contains mathematical models that can be customized according to user requirements.

The mathematical model of the system is resulted by analyzing the steady state and the dynamic behavior of the system. The mathematical model can be resulted in the form of differential equations, partial differential and algebraic.

4. SIMULATION MODEL

The making of the radial piston pump's simulation model (Figure 3) involved the use of components from hydraulic and mechanical libraries of the software.

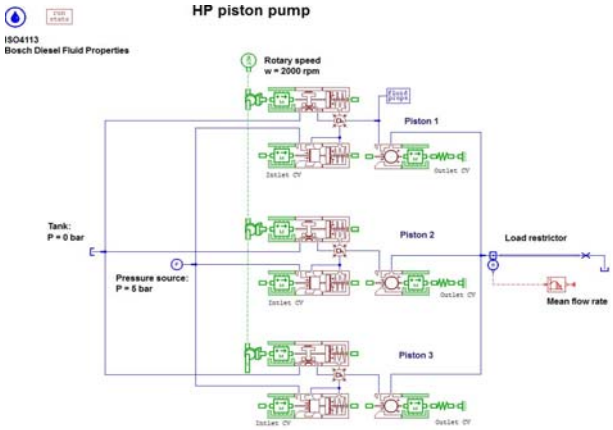
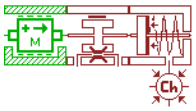
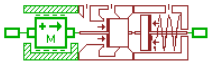
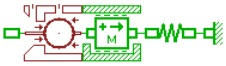


Fig. 3. The simulation model of radial piston pump

The meaning of the symbols used in the simulation model of the high-pressure pump with radial piston, are described in Table 1.

The signification of the main symbols used for building the simulation model

Table 1

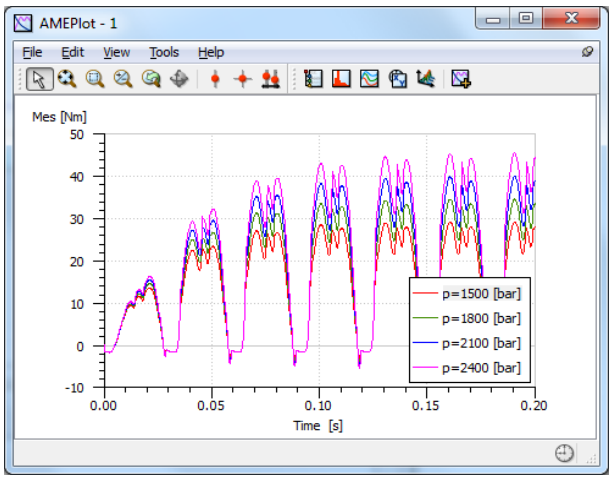
Symbol	Signification
	Piston and cylinder assembly
	Inlet check valve
	Outlet check valve

The studied pump's modeling and the simulations in AMESim were realized according to the following steps: the building up of the model using the symbols from the mentioned libraries of the software, the selection of the sub models with the proper mathematical model, the insertion of the parameters, and the simulation itself.

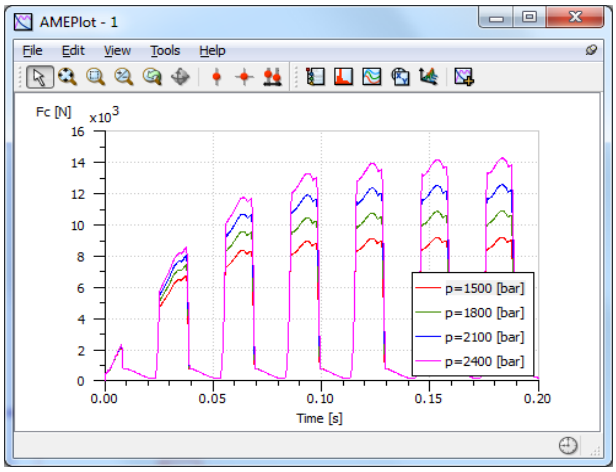
Following these steps made possible, using the results, to describe the behavior of the radial piston pump which operating at different values of injection pressures.

5. THE SIMULATION RESULTS

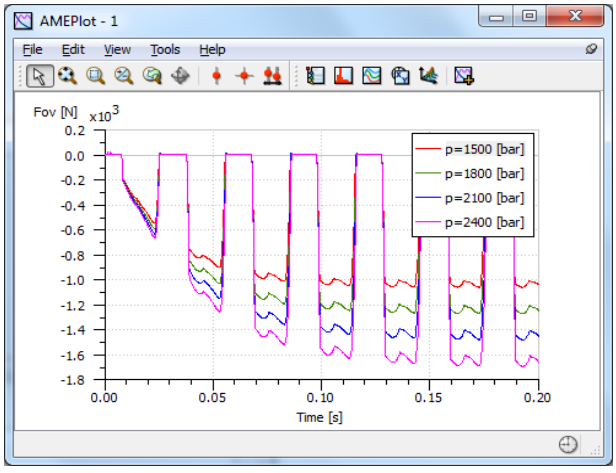
As mentioned above, simulations purpose was to identify the influence of the fuel pressure in the injection system on the stresses that occur in the high pressure pump's components. In Figure 4 is shown for one piston of the high pressure pump: *the torque of the eccentric shaft* (M_{es}), the *contact force between the eccentric and the piston* (F_c) and *the force in the outlet check valve* (F_{ov}).



a.



b.



c.

Fig. 4. The evolution of stresses in a piston of a high pressure pump

In Figure 4 one can observe the dependency between the fuel pressure and the stress increase. The highest stresses occur in the contact area between the eccentric shaft and piston.

The evolutions of these stresses are represented in case of four maximum injection pressures: **1500**, **1800**, **2100** and **2400** [bar]. Figure 5 illustrates, for each of the three pistons, evolution injection pressure of 1500 [bar]. By adding the pressures in each piston, as shown in Figure 6, we obtain the evolution of the injection pressure at the high pressure pump's output.

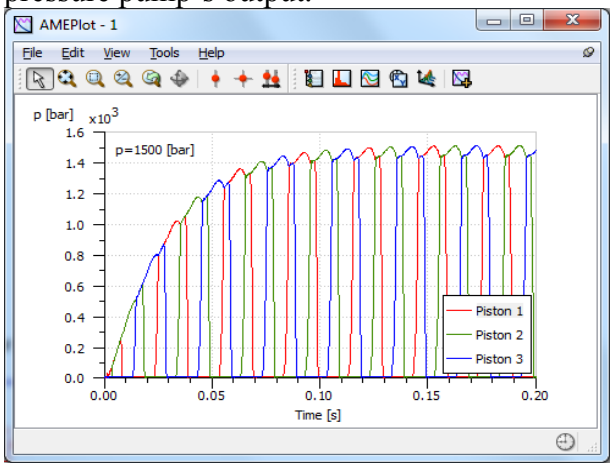


Fig. 5. The evolution of pressure in all the pistons of the high pressure pump

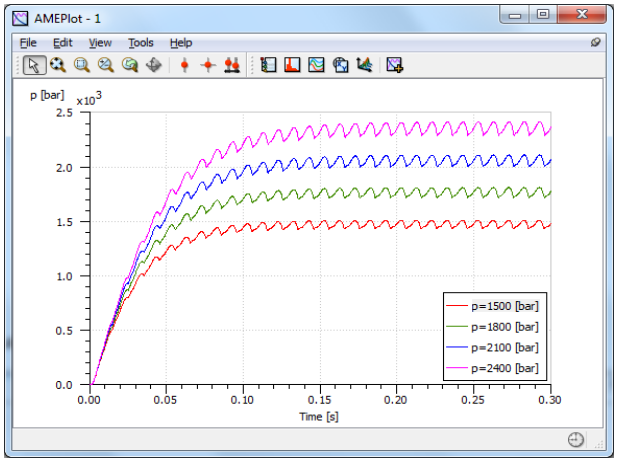


Fig. 6. The pressure evolution at the output of the high pressure pump

To highlight the magnitude by which the high pressure pump's components stress changes in relation to maximum injection pressure change, in Table 2 were represented the percentages by which the stress varied, in three cases of the maximum pressure increase. These cases have assumed sequential increase of the 1500 bar pressure by 20 %.

Stress increase on the pump components in relation to maximum pressure increase

Table 2

Absolute values of the maximum pressure increase range	The percentage of amending the:			
	P	M_{es}	F_c	F_{ov}
	%	%	%	%
Case I: 1500 [bar]→1800 [bar]	20	19	19	20
Case II: 1500 [bar]→2100 [bar]	40	38	37	40
Case III: 1500 [bar]→2400 [bar]	60	57	56	60

As shown in the table above, the increase in pressure determines a proportional increase in stress on the high pressure injection system's components.

6. CONCLUSIONS

Increased injection pressure as a solution to increase the efficiency of the injection process and implicitly the combustion process, modifies the working conditions of the injection system components'.

In the simulations, realized with the AMESim software, which describes the behavior of the radial piston pump operating at different values of the maximum injection pressure, resulted that the stress on the high pressure injection system increase with the same percentage as the fuel pressure increases in the system.

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4. AMESim Assistance help.

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AEROENGINE COMBUSTION INSTABILITY – AN ANALYTICAL EVALUATION

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Abstract: *Combustion processes are sensitive to fluctuations of pressure, density and temperature of the environment. Even slow changes of those quantities affect the energy released according to rules that can be deduced from the behavior for steady combustion. Combustion instabilities normally occur in frequency ranges such that genuine dynamical behavior is significant. That is, the transient changes of energy release do not follow precisely in phase with imposed changes of a flow variable such as pressure. A fluctuation of burning produces local changes in the properties of the flow. Those fluctuations propagate in the medium and join with the global unsteady field in the chamber. The dynamical response of the medium converts the local fluctuations to global behavior. In this paper are presented some results and remarks about combustion instabilities.*

Keywords: *propulsion, combustion, aircraft engine*

1. INTRODUCTION

Chemical propulsion systems depend fundamentally on the conversion of energy stored in molecular bonds to mechanical energy of a vehicle in motion. The first stage of the process, combustion of oxidizer and fuel takes place in a vessel open only to admit reactants and to exhaust the hot products. Higher performance is achieved by increasing the rate of energy release per unit volume. A useful strategy, particularly for applications to flight, is reduction of the average temperature at which combustion takes place. Generation of NO by the thermal or Zeldovich' mechanism is then reduced. Lower combustion temperature may be achieved by operating under lean conditions, when the flame stabilization processes tend to be unstable. Fluctuations of the flame cause fluctuations of energy release, which in turn may produce fluctuations of pressure, exciting acoustical motions in the chamber. The simplest assumption is that combustion processes behave as a first order dynamical system characterized by a single time delay or relaxation time. There are three main reasons that the classical view of acoustics is a good first approximation to wave propagation in combustion chamber:

- the Mach number of the average flow is commonly small, so convective and refractive effects are small;
- the exhaust nozzle is choked, incident waves are efficiently reflected, so for small Mach number the exit plane appears to be nearly a rigid surface;
- in the limit of small amplitude disturbances, it is a fundamental result for compressible flow that any unsteady motion

can be decomposed into three independent modes of propagation, of which one is acoustic. The other two modes of motion are vertical disturbances, the dominant component of turbulence, and entropy waves.

The most obvious evidence that combustion instabilities are related to classical acoustic resonances is the common observation that frequencies measured in tests agree fairly well with those computed with classical formulas.

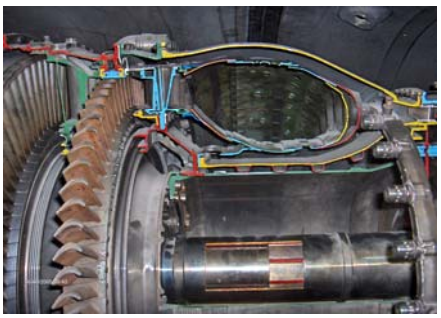

Fig. 1. Combustion chamber

Generally, the frequency *f* of a wave equals its speed of propagation, *a*, divided by the wavelength λ

$$f = \frac{a}{\lambda} \tag{1}$$

The wavelengths of the organ-pipe modes are proportional to the length *L* of the pipe, those of modes of motion in transverse planes of a circular chamber (fig. 1) are proportional to the diameter *D*, and so forth.

There are two basic implications of the conclusion that these formulas seem to predict observed frequencies fairly well: evidently the geometry is a dominant influence on the special structure of the instabilities and we can define some sort of average speed of sound in the chamber (fig. 2), based on an approximation to the temperature distribution.

2. CHARACTERISTICS OF COMBUSTION INSTABILITIES

It is a general result of the theory of linear systems that if a system is unstable, a small disturbance of an initial state will grow exponentially in time: amplitude of disturbance $\approx e^{\alpha_g \cdot t}$ where $\alpha_g > 0$ is called growth constant. If a disturbance is linearly stable, then its amplitude decays exponentially in time, being proportional to $e^{-\alpha_d \cdot t}$ and $\alpha_d > 0$ is the decay constant. Having maximum amplitude $\hat{p}_0$ in one cycle of a linear oscillation the pressure is

$$p'(t) = \hat{p}_0 \cdot e^{\alpha_g (t - t_0)} \tag{2}$$

where $\hat{p}_0$ is the amplitude at time $t - t_0$. If p_1' and p_2' are the peak amplitudes at time t_1 and t_2, we have

$$\frac{\hat{p}_2}{\hat{p}_2} = \frac{p'(t = t_2)}{p'(t = t_1)} = \frac{e^{\alpha_g (t_2 - t_0)}}{e^{\alpha_g (t_1 - t_0)}} = e^{\alpha_g (t_2 - t_1)} \tag{3}$$

$$\log \frac{\hat{p}_2}{\hat{p}_1} = \alpha_g (t_2 - t_1) \tag{4}$$

In practice, $t_2 - t_1$ is usually taken equal to the period τ, the time between successive positive (or negative) peaks.

There is really only one problem to solve: find the growth and decay constants, and the frequencies of the modes. Typically, both the frequency and the mode shape for small-amplitude motions in a combustion chamber are so little different from their values computed classically as to be indistinguishable by measurement in operating combustors.

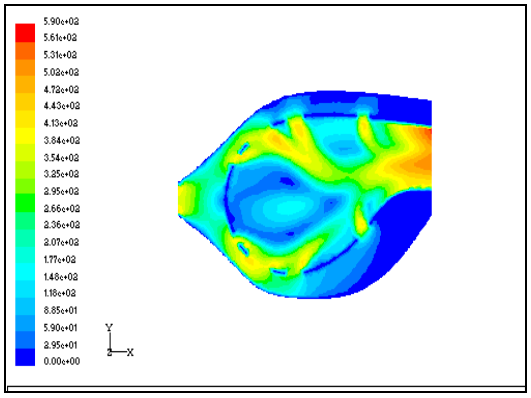

Fig. 2. Velocity field

The linear stability problem is really concerned with calculations of the growth and decay constants for the modes corresponding to the classical acoustic resonances. An arbitrary small amplitude motion can, in principle, be synthesized with the results, but that calculation is rarely required for practical applications.

Results for the net growth or decay constant have been the central issue in both theoretical and practical work. In combustors,

processes causing growth of disturbances and those causing decay act simultaneously. Hence an unstable disturbance is characterized by a net growth constant that can be written $\alpha = \alpha_g - \alpha_d$. Because the problem is linear, the growth constants can quite generally be expressed as a sum of the contributions due to processes accounted for in the formulation, as for example:

$$\alpha = \alpha_g - \alpha_d = (\alpha)_{combustion} + (\alpha)_{nozzle} + \\ + (\alpha)_{mean\ flow} + (\alpha)_{structure} + ... \quad (5)$$

The stability boundary – the locus of parameters making the boundary between unstable $(\alpha > 0)$ and stable $(\alpha < 0)$ oscillations – is defined by $\alpha = 0$. That statement is a formal statement of the physical condition that the energy gained per cycle should equal the energy lost per cycle: $\alpha_g = \alpha_d$

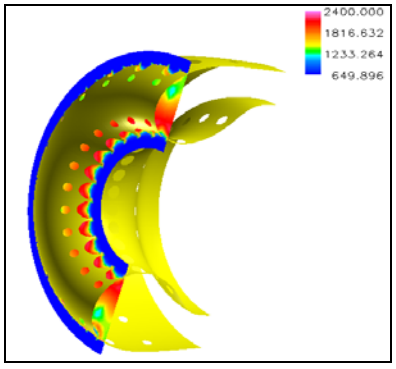

Fig. 3. Temperature field

By the definition of α, both the pressure and velocity oscillations have the time dependence

$$\begin{cases} p' \approx e^{\alpha \cdot t} \cos(\omega \cdot t) \\ u' \approx e^{\alpha \cdot t} \sin(\omega \cdot t) \end{cases} \quad (6)$$

multiplied by their spatial distributions. The acoustic energy density is the sum of the local kinetic energy, proportional to $(u')^2$, and potential energy. If we assume that the period of oscillation, $\tau = 2\pi/\omega$ is much smaller than the decay rate, $1/\alpha$, and the values of these functions averaged over a cycle of the oscillations are proportional to $e^{2\alpha \cdot t}$, the acoustic energy density is itself proportional to $e^{2\alpha \cdot t}$. Integrating over the total volume of the chamber we find that the total averaged energy is $E = E_0 e^{2\alpha \cdot t}$, where E_0 is a constant depending on the average flow properties, the temperature flow field (fig. 3) and the geometry. We find the result

$$2\alpha = \frac{1}{E_0}\frac{dE}{dt} \quad (7)$$

Another elementary property is that $1/\alpha$ is the time required for the amplitude of oscillation to decay to $1/e$ of some chosen initial value. Also, the fractional change of the peak value in one cycle of oscillation $(t_2 - t_1 = \tau = 2\pi/\omega)$ is

$$|p_2'| - |p_1'| = \delta|p'|_m \approx e^{\alpha t_1} - e^{\alpha t_2} = \\ = e^{\alpha t_2}\left(e^{\alpha(t_1 - t_2)} - 1\right) \quad (8)$$

where $|\ |_m$ denotes the magnitude of the peak amplitude. Assuming that the fractional change in one period τ is small, so

$$e^{\alpha(t_1 - t_2)} \approx 1 + \alpha(t_1 - t_2) = 1 + \alpha \cdot \tau \quad (9)$$

The amplitude itself is approximately proportional to $e^{\alpha t_2}$ or $e^{\alpha t_1}$ and we can write the fractional change as

$$\frac{\delta|p'|_m}{|p'|_m} \approx \alpha \cdot \tau = \frac{\alpha}{f} \quad (10)$$

where f is the frequency in cycles per second, $f = \frac{1}{\tau}$. The dimensionless ratio f/α is a convenient measure of the growth or decay of

an oscillation. According to the interpretation noted above, f/α is the number of cycles required for the maximum amplitudes of oscillation to decay to $1/e$ or grow to 'e' times an initial value.

3. NONLINEAR BEHAVIOR

We may anticipate that nonlinear behavior may be regarded in first approximations as an extension of the view of linear behavior because the frequency varies little, remaining close to a value computed classically for a natural resonance of the camber, and the growth of the peak amplitude during the initial transient period is quite well approximated by the rule for a linear stability. Thus the behavior is distinguishable from that of a classical linear oscillator with damping, and having a single degree of freedom. The governing equation for the free motion of a simple mass (m), spring (k) and dashpot (r) is

$$m\frac{d^2x}{dt^2} + r\frac{dx}{dt} + kx = 0 \tag{11}$$

It is surely tempting to model a linear combustion instability by identifying the pressure fluctuation, p', with the displacement x of the mass. Then upon dividing this equation by m and replacing x by p', we have

$$\frac{d^2p'}{dt^2} + 2\alpha\frac{dp'}{dt} + \omega_0^2 p' = 0 \tag{12}$$

where $2\alpha = r/m$ and the undampened natural frequency is $\omega_0 = \sqrt{k/m}$.

According to the theory of classical acoustics for a sound wave, we may identify both kinetic energy per unit mass, proportional to the square of the acoustic velocity u' and potential energy per unit mass, proportional to the square of the acoustic pressure p'. The acoustic energy per unit volume is

$$\frac{1}{2}\left(\bar{\rho}u'^2 + \frac{p'^2}{\bar{\rho}\bar{a}^2}\right) \tag{13}$$

where $\bar{\rho}$ and $\bar{a}$ are the average density and the speed of sound. This expression corresponds to the formula for the energy of a simple oscillator

$$\frac{1}{2}\left(m\dot{x}^2 + kx^2\right) \tag{14}$$

Both the velocity and the pressure fluctuations have spatial distributions such that the boundary condition of no velocity normal to a rigid wall is satisfied. Hence the local pressure p' in the equation (12) must depend on position as well as time. However, the frequency ω_0 depends on the geometry of the entire chamber and according to equation (7) we should be able to interpret 2α as the fractional rate of change of the averaged energy in the entire volume.

Locally in the medium the spring constant is supplied by the compressibility of the gas and the mass participating in the motion is proportional to the density of the undisturbed medium. When the procedure of spatial averaging is applied, both the compressibility and the density are weighted by the appropriate spatial structure of the acoustical motion. As a result, the damping constant and the natural frequency are expressed in terms of global quantities characterizing the fluctuating motion throughout the chamber. So, we can represent

$$p'_n = \bar{p}\,y_n(t)\,\phi_n(\vec{r}) \tag{15}$$

where $\bar{p}$ is the mean pressure and $\phi_n(\vec{r})$ is the spatial structure of the classical acoustic mode identified by the index $(\ )_n$. Hence the typical equation of motion is

$$\frac{d^2y_n}{dt^2} + 2\alpha_n\frac{dy_n}{dt} + \omega_n^2 = 0 \tag{16}$$

The constants α_n and ω_n contain the influences of all linear processes distinguishing the oscillation in a combustion chamber from the corresponding unperturbed classical motion governed by the equation

$$\frac{d^2y_n}{dt^2} + \omega_{n0}^2 y_n = 0 \tag{17}$$

if dissipation of energy is ignored. Because damping in a mechanical system causes a frequency shift, the actual frequency is not equal to the unperturbed value, ω_{n0}.

For combustion chamber it is convenient to regard the linear perturbing process as a force $F_n(y_n, \dot{y}_n)$, so equation (17) is written

$$\frac{d^2 y_n}{dt^2} + \omega_{n0}^2 y_n = F_n^L(y_n, \dot{y}_n) \tag{18}$$

The force F_n^L consists of two terms, one representing the damping of the mode and one the frequency shift:

$$F_n^L = -\Delta\omega_n^2 y_n + 2\alpha_n \dot{y}_n \tag{19}$$

According to classical acoustic theory, a closed chamber of gas at rest has an infinite number of normal or resonant modes. The spatial structures (mode shapes) and resonant frequencies are found as solutions to an eigenvalue problem. A general motion in the chamber, having any spatial structure, can then be represented as a linear superposition of the normal modes. The process of spatial averaging, leading to equation (17), amounts to representing any motion as an infinite collection of simple oscillators, one associated with each of the normal modes. That interpretation holds as well for equation (18) except that now each mode may suffer attenuation $(\alpha_n < 0)$ or excitation $(\alpha_n > 0)$.

Determining the linear stability of a system comes down to computing the value of the constant α. Assume that only one mode is active and the driving force is entirely due to fluctuations of the rate of heat $\dot{Q}'$ provided to the flow, in simplest form the equation for the amplitude is

$$\frac{d^2 y}{dt^2} + \omega_1^2 y = (\gamma - 1)\int \frac{\partial \dot{Q}'}{\partial t}\phi dV \tag{20}$$

where $\phi(r)$ is the spatial distribution of the pressure for the mode defined so the fluctuation is $p' = \bar{p}\, y\phi(r)$. Suppose that the heat release rate is sensitive only to pressure and write its fluctuation as

$$\dot{Q}' = \frac{\dot{Q}'}{p'} p' = Rp' = \bar{p}Ry\phi \tag{21}$$

where R is the response function, having dimensions of inverse time

$$[R] = \frac{[Energy/Volume]\frac{1}{t}}{[Energy/Volume]} = t^{-1}$$

the substitution of (21) in (20) leads to a formula for α:

$$\frac{d^2 y}{dt^2} + \omega_1^2 y = \left[(\gamma - 1)\bar{p}\int R\phi^2 dV\right]\frac{dy}{dt} = 2\alpha\frac{dy}{dt} \tag{22}$$

and α is proportional to the response function

$$\alpha = \frac{\gamma - 1}{2}\bar{p}\int R\phi^2 dV \tag{23}$$

The equation governing the amplitude is

$$\frac{d^2 y}{dt^2} - 2\alpha\frac{dy}{dt} + \omega_1^2 = 0 \tag{24}$$

with the solution

$$y(t) = Ae^{\alpha t}\cos(\omega_2 t + \varphi) \tag{25}$$

where A and φ are constants and $\omega_2^2 = \omega_1^2 - \alpha^2$.

If α is positive, the oscillation is driven by the response of the heat release to the pressure fluctuations.

The essential idea in all applications of the time lag is that a finite interval – the lag – exists between the time when an element of propellant enters the chamber and the time when it burns and releases its chemical energy. Suppose that at time t the pressure in the chamber suddenly decreases, causing an increase in the flow of propellant through the injector, the increased mass burns at some later time $t + \tau$, where τ is the time lag.

4. CONCLUSIONS

Whatever the system, most combustion instabilities involve excitation of the acoustic modes, for which there are an infinite number for any type of chamber. The values of the frequencies are functions primarily of the geometry and of the speed of sound. These modes are unstable and depend on the balance of energy supplied by the exciting mechanisms and extracted by the dissipating processes.

The presence of the combustion processes and a mean flow field are not accounted for explicitly, but it is necessary to include a good approximation to the boundary condition applied at the exhaust nozzle, particularly if the average Mach number is not small.

The most important measure of the perturbations is a Mach number, $\overline{M}_r$ characterizing the mean flow; for many significant processes, α / f equals $\overline{M}_r$ times a constant of order unity, so the measured value of α / f is an initial indication of the validity of the view that a combustion instability can be regarded as a motion existing because of relatively weak perturbations.

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FIBER-REINFORCED POLYMER COMPOSITES AS STRUCTURAL MATERIALS FOR AERONAUTICS

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Abstract: *Composite materials based on fiber-reinforced polymers are becoming preferred materials for aircraft and spacecraft construction. Their use as structural materials in recent years has proved their advantages. This paper offers an overview of several applications in aeronautics, but it focuses on composites application as structural materials, due to the fact that they have recorded a significantly increased use. The nature of composite materials and their behavior under specific stress, special problems in design and preparation, as well as issues connected with their impact damage and damage tolerance, environmental degradation and long-term stability, are presented in this report.*

Keywords: *composites, structural materials, aeronautics*

1. INTRODUCTION

Aeronautics engineering is changing [1,2,3]. Planes have traditionally been made out of metals – usually, aluminum and its alloys, steel, and titanium alloys. Nowadays, engineers are increasingly working with carbon fiber composites. Fiber-reinforced composite materials were originally used in small amounts in military aircrafts during the 1960s, and within civil aviation from the 1970s. By the 1980s, polymer composites were being used by civil aircraft manufacturers for a variety of secondary wing and tail components (such as rudder and wing trailing edge panels).

The latest generation of airliners, such as the Airbus A380, the world's largest passenger aircraft, shows that these composite materials have been employed extensively in the primary load carrying structure: A380 uses composite materials in its wings, which helps enable a 17% lower fuel use per passenger than other comparable aircraft [2], whereas the newest Boeing, the 787 Dreamliner, has the highest content of composites (Figure 1) 50% (http://www.newairplane.com/787).

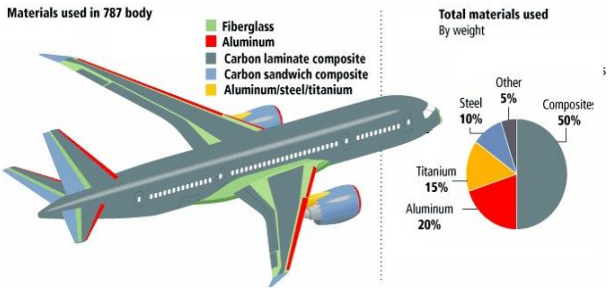


Figure 1. Use of composites in the structure of Boeing 787 Dreamliner (www.boeing.com)

Fiber-reinforced polymer composites can provide a much better strength-to-weight ratio than metals, sometimes by 20%. The lower weight results in lower fuel consumption and emissions, enhanced aerodynamic efficiency, lower manufacturing costs. The aviation industry was the first interested in such benefits and it was the manufacturers of military aircrafts who initially seized the opportunity to use composites characteristics

to improve the speed and maneuverability of their products.

In the last four decades, the aerospace sector underwent a series of changes in terms of composites implementation in aircraft and helicopter production. Fiberglass composites were the first to be used by the aerospace industry, followed by two other composites, *i.e.* carbon fiber and aramid fiber, added in the early 1970s. The main applications of composite materials for helicopter and aircraft interior design include the fabrication of instrument panels, fuselage skin panels, and fuselage fairing panels. Some of the main advantages of using composite materials are the relatively low fabrication and installation costs, as well as lower toxicity and increased resistance to fire.

One great innovation in the field of composite materials for aeronautics is the ability to produce complex parts in one piece, particularly through thermoforming, which will enable reduced costs related to machining and to component assembly. Research provided a reliable database for the development of composites, so that enabled parts to be designed with unique physical and chemical properties for specific use and to meet the specific needs of the industry. Besides offering the opportunity to design durable and resistant parts, fiber-reinforced composites have the advantage of providing excellent resistance to corrosion.

2. COMPOSITES AS STRUCTURAL MATERIALS IN AERONAUTICS

2.1 Aeronautics features. Whether it is a single engine private plane, a giant commercial airliner, or a supersonic fighter plane, aircrafts are the work of engineers. Specific structures in aeronautics have to meet characteristic requirements, such as safety standards (special demands of fire-retardancy [4] and crashworthiness [5-7]), fuel sealing, easy access for equipments maintenance; vacuum, radiation and thermal cycling has to be considered and special materials are required to be developed for durability.

Two major directions of research in this field had a significant influence on the development of new generations of materials and, hence, aircrafts: advances in the computational sciences, generating powerful computational tools, as well as CAD modelling and computer interfaces in manufacturing, and the progress of the composites technology using fibre-reinforced polymeric materials as structural materials for aeronautics. Some requirements of an aircraft structure are presented in Table 1, as well as design demands arising from them [8].

Table 1. Aircraft requirements and subsequent design demands

Requirement	Design demands	Obs.
Low weight	Semi-monocoque construction Thin-walled-box or stiffened structures Use of low density materials: wood, Al-alloys, composites High strength/weight ratio, high stiffness/ weight ratio	Application area: all aerospace programs
High reliability	Strict quality control Extensive testing for reliable data Certification: proof of design	Application area: all aerospace programs
Passenger safety	Use of fire retardant materials and coatings Extensive testing: crashworthiness	Application area: passengers transport
Aerodynamic performance	Highly complex loading Thin flexible wings and control surfaces Deformed shape: aero-elasticity, dynamics Complex contoured shapes: processability, machining, moulding	Application area: all aerospace programs
Stealth	Specific surface and shape of aircraft Stealth coatings	Application in military programs
All-weather operation	Lightning protection, erosion/corrosion resistance Corrosion prevention schemes Issues of damage and safe-life, life extension Extensive testing for required environment Thin materials with high integrity	Application area: all aerospace programs

2.2 Specific requirements for polymer composites used in aeronautics. The use of advanced fiber-reinforced polymer composites in aeronautics has been conditional upon their properties given by both fillers (carbon or aramid fibers) and matrices [9]. Their combined characteristics granted them lightweight, due to high specific strength and

stiffness, fatigue and corrosion resistance, availability towards optimization (*e. g.*, tailoring the directional strength and stiffness), enhanced processability (ability to mould large complex shapes in short time cycles, reducing part count and assembly times), time and place stability, low dielectric loss, achievable low radar profile and stealth availability, etc.

Still, despite all these advantages, these composites have a few flaws: some of the corresponding laminates display weak interfaces adhesion, yielding in poor resistance to out-of-plane tensile loads; susceptibility to impact-damage and strong possibility of some internal damages evolving unnoticed; moisture absorption and consequent degradation; occurrence of possible manufacturing defects.

Nowadays, the use of advanced composite materials has been extended to a large number of aircraft components, both structural and non-structural, based on various factors. Some details from civilian and military aviation [10] are presented in Table 2 and 3.

A realistic approach indicates that estimated benefits, especially when it comes to the new generations of composites [11], are significant and almost all aerospace programs use increasing amounts of composites. Hence, it is necessary to take into consideration the complex behavior of these materials, since they are anisotropic and inhomogeneous, have different fabrication and processing requirements, and need different control methods, new and complex analysis protocols for quality assurance. Moreover, their behavior is not always predictable which makes reliance on several expensive and time consuming tests mandatory.

Table 2. Use of composites in Airbus and Boeing series

Aircraft type	Parts and components	(%)
Airbus A300B2/ B4	Radome, fin leading edge and tip, fin trailing edge panels, cabin and cargo hold furnishings. Fairing -pylon, wing/ fuselage rear.	5
Airbus A310-300	Rudder, elevator, vertical stabilizer, spoilers, cowl (inlet & fan), thrust reverser, main & nose landing gear door of wing leading & trailing edge panels, nacelles. Fairings -Ion, flap track, win fuselage.	7
Airbus A320/A319/A321	Aileron, horizontal and vertical stabilizer, elevator, rudder, spoilers, flaps, engine cowl, radome, landing gear doors (main & nose), floor panels, wing panels (leading & trailing edge), other access panels, nacelles. Fairings-flap track, wing/fuselage (forward & rear), main landing gear leg.	15
Airbus A330	Ailerons, rudder, flaps, spoilers, elevator, horizontal and vertical stabilizer, wing panels (leading & trailing edge), landing gear doors (main & nose), nacelles. Fairings -flap track, wing/fuselage (forward & rear).	12
Airbus A340	Ailerons, rudder, flaps, spoilers, elevator, horizontal and vertical stabilizer, wing panels (leading & trailing edge), landing gear doors (main & nose), nacelles. Fairings -flap track, wing/fuselage (forward & rear).	12
Boeing 737 (200, 300, 400)	Spoilers and horizontal stabilizer (both limited production), trailing edge flaps. Aileron, elevator, rudder, nacelles. Aileron, elevator, rudder, nacelles.	<1 3
Boeing 747-400	CFRP winglets and main deck floor panels. CFRP and AFRP used in cabin fittings engine nacelles.	3
Boeing 757	Aileron, elevator, rudder, spoilers, flaps (in-board & outboard), fairings and nacelles.	3
Boeing 767	Ailerons, elevator, rudder, spoilers, landing gear doors (nose & main), fairings and nacelles.	3
Boeing 777	Ailerons, elevator, rudder, spoilers, flaps (in-board & outboard), floor beams, landing gear doors (nose & main), fairings and nacelles.	10

These challenges can be met by using the advances in computer technology and analysis methods to implement schemes based on computer aided design, computer aided engineering, finite element methods of analysis.

Table 3. Use of composites in military airplanes and helicopters

Aircraft type	Parts and components
F-14	Doors, horizontal tail and fairings
F-15	Rudder, vertical tail, horizontal tail, speed brake
F-16	Vertical tail, horizontal tail
F-18	Doors, vertical and horizontal tail, fairings, wing box, speed brake
B-1	Doors, vertical/horizontal tail, flaps, slats
AV-8B	Doors, rudder, vertical tail, horizontal tail, aileron, flaps, wing box, body and fairings
Typhoon	Wing, fin, rudder, in-board aileron, fuselage
LCA	Wing, fin, rudder, control surfaces, radome
MBB BK 117	Main rotor blades, tail rotor blades, horizontal stabilizer, vertical stabilizer
Bell 206L	Vertical stabilizer
Bell 402	Main rotor blades
Dauphin	Main rotor blades, vertical stabilizer
McDonnell Douglas MD 520N	Main rotor blades, tail boom
McDonnell Douglas MD 900	Main rotor blades, fuselage mid section, tail boom, canopy frame, internal fuselage, horizontal stabilizer, vertical stabilizer
ALH	Main & tail rotor blades, rotor hub, nose cone, crew & passenger doors, cowling, most of the tail unit, lower rear tail boom, cock it section

Thus, the entire process is computer assisted, from design and analysis up to manufacturing, enabling the fast transfer of information and accurate analysis methods for a reasonable prediction of composites complex behavioral patterns [8].

2.3 Reliability and safety issues. Fiber-reinforced polymer composites used in aeronautics have to meet reliability and safety issues, which requires testing at all stages (design and development, proving and certification, in-service inspection and repairs), due to the composites complex behavior and difficulty in creating predicting models. Additional operations are reflected in increased final costs.

Safety issues - risk-based approaches and tools have been developed by the aeronautic communities, especially by the military, to ensure aircrafts availability and to reduce costs while maintaining structural safety [12-15].

Impact damage and damage tolerance – some composites laminates made of fiber-reinforced polymers are characterized by weak interfacial interactions (due mostly to a certain incompatibility between matrix and filler) and this favors phenomena as delamination or debonding under stress [16].

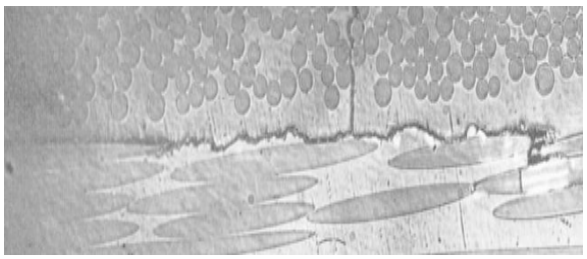


Figure 2. In many types of composite structures (e.g. aircraft, marine, etc.), delaminations are the most common form of defect/damage

Even more, when discontinuous plies (made to create thickness changes) or sharp bends (required in stiffening pieces) are used for structural features, these phenomena are more intense, especially when it comes to damages at impact because they might not be evident in initial stages, but worsen under prolonged stress. This behavior occurs in case of impact with blunt objects at low to medium velocity (accidental dropping, hail, debris, shocks even before the aircraft assembly, or even a bullet impact which, in the case of a fuel tank, will cause a hydraulic ram effect in the fuel, leading to explosion). These flaws may occur not only in 2-D, but they can propagate through the entire thickness, mainly when micro-cracks emerge in back plies or other hidden stress concentrators, detectable by ultrasonic C-scan method. It is possible to limit effects of these damages by combining various approaches: (1) design (structures with alternate load paths) [17], (2) setting lower allowable stress values and (3) defining new inspection intervals and protocols. Damage tolerant structures are designed to sustain cracks before failure occurs, so that the defect is detected in and the damaged part is repaired or replaced (Figure 3). In addition, damage tolerance takes into account initial material or manufacturing flaws by assuming an initial crack, which the fail-safe principle does not do [18].

Humidity is causing weight gain in most fiber-reinforced composites, no matter whether the matrix is a thermoset or thermoplastic polymer. Under the normal operating conditions, the maximum equilibrium moisture gain in an aircraft component can be 1.0-1.4%.

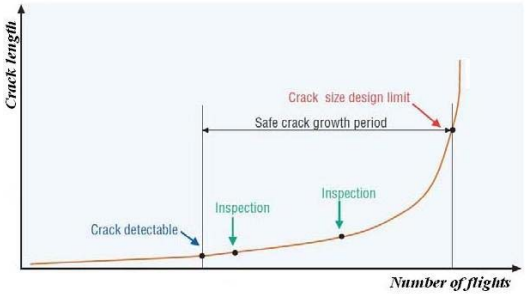


Figure 3. Theoretical damage tolerance inspection regime to detect cracks before they become critical

This may cause swelling and dimensional changes, lowering the glass transition temperature (Tg) of the matrix, as well as a decrease of shear and compression strength.

The diminution of the shear and compressive strength is a major concern in aircraft structures, mainly at high temperatures close to Tg, because polymers Tg is decreasing due to the moisture sorption. Therefore, the design of a structural component proceeds, generally, by reducing allowables for moisture degradation. As a general observation, the dimensional changes and weight gain are not significant in many aircraft structures, but they may be of considerable significance where extreme precision is required, such as in antennae panels and in satellite structures.

Significant issues relate to the UV degradation and radiation effects in long term exploitation, especially for spacecrafts structures. Current studies have provided some solutions.

3. FIBER-REINFORCES POLYMER COMPOSITES USED IN AEROSPACE INDUSTRY

3.1 Background. Advanced research enables scientists and engineers a better understanding of how to use fiber-reinforced polymer composites as structural materials for aerospace industry, but studies also encompass the interactions of the structure with the aircraft system as a whole. Aero-elastic tailoring is one example of such interaction. On another hand, by developing standard tools to test the potential performance of composites, there are possibilities to increase the use of composites in other leading industries.

3.2 Fibers as reinforcement. Carbon fiber reinforced plastics (CFRPs) – used for the first time during the 1960s - owe their high structural performance to the exceptional properties (low density, high thermal conductivity and excellent mechanical properties at elevated temperatures) of the individual strands. By way of comparison, the ultimate strength of aerospace grade aluminum alloys is 450MPa, whilst that of a carbon fiber would be five times higher. Glass, aramid and boron (far superior to carbon fibers, but 6 times more expensive) fibers are also used, but it seems carbon fibers have the best strength/cost ratio for primary load-bearing structure. The carbon fibers technology continues to improve by valorizing the versatility of carbon fibers and new varieties with improved modulus and strength are available. A comparison between fibers used as reinforcement in aeronautics is presented in Table 4 and a synthetic review of aramid fibers commercially available is shown in Table 5.

Two directions of development seem to be concerned:

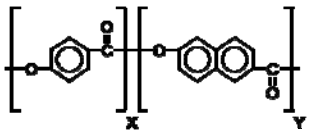
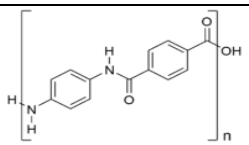
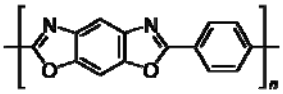
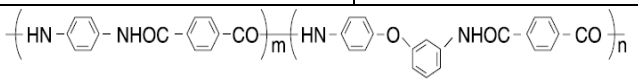
(1) aircraft applications - higher strength (>5 GPa) concurrent with improvements in modulus to moderate levels (>300 GPa) and

(2) space applications - high modulus (>500GPa) along with moderate strength (~3.5 GPa). The development in aramid fibers is also aiming at higher modulus concurrent with increased strength.

Table 4. Reinforcing fibers used in aerospace industry

Fibers		Density (g/cm^3)	Modulus (GPa)	Strength (GPa)	Application
Glass	**E-glass**	2.55	65-75	2.2-2.6	Small passenger aircraft parts, radomes, rocket motor casings
	S-glass	2.47	85-95	4.4-4.8	Highly loaded parts
Aramid (modulus)	**Low**	1.44	80-85	2.7-2.8	Fairings; unloaded bearing parts
	Interme-diate	1.44	120-128	2.7-2.8	Radomes, some structural parts; rocket motor casings
	High	1.48	160-170	2.3-2.4	Highly loaded parts
Carbon (modulus)	**Standard**	1.77-1.80	220-240	3.0-3.5	Widely used for almost all types of parts, satellites, antenna dishes, missiles, etc.
	Interme-diate	1.77-1.81	270-300	5.4-5.7	Primary structural parts in high performance fighters
	High	1.77-1.80	390-450	2.8-3.0 4.0-4.5	Space structures, control surfaces
	Ultra-high	1.80-1.82	290-310	7.0-7.5	Primary structural parts in high performance fighters, spacecrafts
Boron	**3-; 4-; 5.6-mil Boron**	2.38-2.54	380-400	3.6-4.0	Structural reinforcement; thermal and radiative deflectors

Table 5. Aramid fibers used in aerospace industry

Name	Structure	Applications
VECTRAN		Advanced composite materials used by NASA's Extravehicular Mobility Unit and for all of the airbag landings on Mars: Mars Pathfinder in 1997 and on the twin Mars Exploration Rovers *Spirit* and *Opportunity* missions in 2004, as well as for NASA's 2011 Mars Science Laboratory in the bridle cables.
TWARON		Reinforcement in composite parts such as fairings and airfreight containers, containment belts used in turbine engines to protect the passenger compartment in case of engine failure.
ZYLON		Zylon is used by NASA in long-duration, high altitude data collection. Braided Zylon strands maintain the structure of polyethylene superpressure balloons.
TECHNORA		Suspension cords for the strongest and largest supersonic parachute used by NASA for Curiosity Rover.

However, the major improvement for composite reinforcements is the multidirectional weaving. Several processes (weaving, knitting, braiding) have been developed for this purpose and prepregs with multidirectionally woven fibers have been obtained. Significant advances based on the translation of high fibers properties into high performance composites are envisaged, but costs reduction and environmental protection are also aimed.

3.3 Polymer matrices. A remarkable effort in improving composites is focused on improving matrix polymers. The two major concerns mentioned earlier, impact damage tolerance and hydrothermal degradation, provide the main motivation. A major direction of improvement appears to be in the toughness which should result in higher resistance to delamination and impact. High failure strain of matrix polymer would help in translating the higher performance of the improved fiber to the entire composite. Higher shear modulus polymers will achieve better transfer of load from fiber to matrix and again to fiber, therefore improving the compression strength. It is possible for polymeric materials to achieve moduli of approx. 5 GPa, since the current matrices have shear modulus values of about 2 GPa. As far as hygrothermal degradation is considered, newer systems based on cyanate esters look very promising

and some of these have already found application.

Another route being investigated is the use of thermoplastic polymers [26-31] and their blends. Poly-ether-ether-ketone (PEEK) has been considered very promising, but the industry needs to resolve the problems associated with high temperature (> 350°C) processing of the material. Other promising new matrices are temperature-resistant polymers, such as polypropylene (PP) [28,29], polyphenylene sulphide (PPS) [30], polymethacrylimide (PMI) [30], polyvinyl chloride [30] and their derivatives and blends.

A polymer with excellent properties is PrimoSpire® SRP (self reinforced polypheny-lene) by Solvay [32]: tensile properties that are comparable to those of many reinforced plastics (Figure 4), lighter weight and no loss of ductility, high compressive strength – one of the highest among plastics.

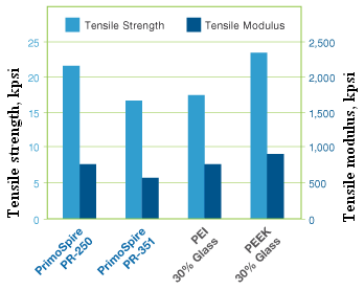


Figure 4. Tensile properties of PrimoSpire® SRP

Due to these characteristics, it is an excellent candidate for weight-sensitive applications that also require superior mechanical performance.

Current approaches appear to be directed towards producing polymeric systems which can be processed in conventional ways. Two promising classes of such materials are under development:

(1) polymerizable liquid crystalline monomers that should result in thermoset resins having high fracture toughness and Tg=170°C, and with high degree of retention (=90%) under hot-wet conditions; compared to thermoplastic PEEK, such matrix will have almost similar fracture toughness along with the advantage of conventional processing. The approach for the development of these new polymers is to synthesize, first, controlled molecular weight backbones consisting of aromatic ethers, esters or rigid aliculic systems [8] with hydroxyl end groups and then to end-cap them with reactive end groups like cyanate ester group or glycidyl ethers.

(2) phthalonitrile resins for high temperature applications which can be cured in conventional manner (at 180-200°C), but can be also post-cured, albeit in inert atmosphere, at high temperatures up to 600°C. Compared with the current resins synthesized by polymerization of monomer reactants for high temperature (250-350°C) applications, the new resins will have better processability, good fracture resistance, better strength and modulus, and very low moisture sorption.

The other area of advances in matrices research is the of low-loss polymers, especially for radomes which use high-performance radars. Different low-loss polyesters and cyanate esters are under study.

4. FUTURE DEVELOPMENT

4.1 Nanoparticles. Fiber-reinforced polymer composites for aeronautics may be further developed by the use nanofillers such as electrospun carbon nanotubes and nanofibers, electrospun silica nanofibres. Adding small amounts of carbon nanotubes (CNTs) (0.15%) to a tetraethyl orthosilicate matrix, obtained *via* a sol-gel process, will yield in composites with CNTs binding

directly the adjacent layers. The electrically charged nanoparticles would bind directly to adjacent plies, each given an electrical charge in advance, to allow binding of the oppositely charged nanoparticles. This would create a "velcro" effect which will reduce reliance on the binding properties of the matrix, producing composites with enhanced strength, more impact resistant and lighter than those known today.

Great opportunities for carbon nanofibre patches are envisaged for advanced repair of composite structures. Such patches would increase the contact surface available for bonding and reduce the need to delaminate additional areas in order to repair a delaminated zone of the structure.

4.2 Ceramic matrix composites and metal matrix compo sites are two other groups of composites able to respond to aerospace industry demands. Ceramic matrix composites (CMCs) made of silicon carbide fibers in a silicon carbide matrix are of great interest for low-pressure turbine blades, pre-combustion mixer of engines and, potentially, the high-pressure core of the engine.

In he case of metal matrix composites (MMCs), the research is still in the beginning, but it is already predicted that these materials, which will use carbon or metal nanotubes to strengthen metal matrices, will have twice the strength of comparable existing metal structures, but only 2/3 of their weight. Such materials would be ideal for engine tie rod struts which transfer the engine thrust into the airframe.

Other directions for the future development of the domain: study of properties of composites with basalt or clay particles, electrospun silica nanotubes, etc.

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NEW THERMOPLASTIC POLYAMIDE-CLAY HYBRID NANOCOMPOSITES FOR HI-TECH APPLICATIONS

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Abstract: *Three series of new polyamide-clay hybrid nanocomposites were prepared using a ternary copolyamide as thermoplastic matrix and various layered silicates. The copolyamide (coPA), having a lower melting point with respect to the initial homopolymers and competitive hot-melt adhesive properties, appears to be a promising matrix for new hybrid nanocomposites. Materials with three different smectite clays as filler (bentonite, montmorillonite K10 and Nanomer I.30P) were prepared by a solventless melt mixing process, in order to evaluate the specific influence of filler on the properties of new hybrid materials. Nanocomposites were preliminarily investigated by the means of FTIR spectroscopy and, subsequently, samples were submitted to thermal analysis by DSC and TG. The results have evidenced the inclusion of nanofillers in the coPA matrix, while the thermal study evidenced the decrease of the glass transition temperature (T_g), along with an enhanced thermal stability of nanocomposites.*

Keywords: *polyamide, clay, hybrid materials, nanocomposites, thermal behaviour*

1. INTRODUCTION

Minerals have been added to thermoplastic polymers since the 1930s for various reasons, mainly to reduce the cost of the end products because many fillers have spectacular low-volume costs compared to thermoplastics. The term "*mineral fillers*" has been also used fairly broadly to include any particulate material, whether inorganic, natural or synthetic in origin (*i.e.*, short glass fibers) used as reinforcement [1]. It has been demonstrated that fillers play substantial roles in modifying the properties of various thermoplastics. The addition of these mineral fillers is an effective way to improve not only mechanical properties (elongation and stress at break, impact strength) of polymeric materials, but others characteristics as well, such as: thermal stability, gas barrier, flammability, ion conductivity, anti-ablative properties, electro-rheological sensitivity [2]. In comparison with these benefits, costs reduction has become less important and the attention of researchers has been focused on the improvement of properties that could be achieved by using these fillers. Several factors that influence the processability and mechanical properties of polymer composites must be taken into account. These include the nature and amount of added filler, the average particle size, interactions between fillers and polymer matrix, as well as interactions between filler particles themselves, yielding in strong agglomerations [3-7].

The field of polymer-silicate hybrid nanocomposites has recently gained an increased attention. Use of clays to obtain polymer nanocomposites allowed new materials with tailored properties and

expanded the range of applications of the original polymers.

Two major findings pioneered the revival of these materials. First, the report on a new nylon 6-montmorillonite material from Toyota research department [8,9], where very moderate inorganic loadings was proven to yield in concurrent and remarkable enhancement of thermal and mechanical properties. Second, Giannelis found that it is possible to melt-mix polymers with clays without using organic solvents [10]. Since then, the high promise for hi-tech industrial applications (transportation and automotive industry, aeronautics, electronics & IT, construction) has motivated research, which revealed dramatic enhancement of many materials properties by the nanodispersion of inorganic layered silicates. Since all these improvements are due to the specific nanocomposite structure and interactions, it seems realistic to anticipate that the principle is generally applicable across a wide range of polymers. Still, further studies on polymer-clay pairs compatibility are of interest.

There is a real potential for this new class of polymeric hybrid materials to replace classic composite materials in the future. Consequently, it is important to understand the role of the clay composition, structure and interactions in enhancing the final material properties. Since the thickness of one clay platelet is on the order of 1 nm, it is decisive to elaborate experiments and models that can provide insight into the deformation process at the molecular level.

Various authors have also investigated the properties of this new class of nanocomposites as a function of processing conditions, degree of exfoliation of nanoclay and type of surfactant [11-15]. Studies on the effects of layered silicate nanoscale dispersion in melt compounded polyamide matrices are reported in literature [16-19]. However, there are still not so many articles concerning the copolyamide-silicate hybrid nanocomposites [20-25]. Actually, scarce literature reports upon the application of bentonite-type clays in thermoplastic nanocomposites, such as (co)polyamides [26-30].

Therefore, the purpose of this study is to investigate new polyamide-clay hybrid nanocomposites obtained using a copolyamide (coPA) as matrix and a specific type of bentonite from Valea Chioarului (Maramures, Romania), prepared by the melt compounding technique. The use of the native bentonite as filler for nanocomposites was investigated as an alternate option to other commercial clays, because this bentonite is less expensive than pure montmorillonite.

For a better understanding of the processing-structure-properties relationship of the new nanocomposites, their structure and the thermal behaviour have been preliminarily investigated. The comparative study of properties of new composites with native and standard commercial silicate clays was performed in order to estimate the competitiveness of native bentonite based nanocomposites.

2. EXPERIMENTAL

2.1 Materials

The matrix – the copolyamide (coPA) was prepared in the "Petru Poni" Institute of Macromolecular Chemistry from Iasi (Romania) and was synthesized by direct melt polycondensation through a "one-pot" technique previously described [31]. Main characteristics of coPA are: M=2800-3000 g/mol; melting temperature interval=125-135°C; Vicat softening point=118°C; melt flow index (MFI, 2.16 daN/190°C) = 18-20°C; density (at 23°C)=1.11 g/m^3.

Fillers - Na-bentonite (BTN) was collected from Valea Chioarului (Maramures, Romania) and was supplied by S.C. Mateo S.R.L. BTN is a mixture of silicates, mainly montmorillonite (over 70%), with different size particles, and minor components such as quartz, mica, chlorite and feldspat [32-34]. Typical properties for the raw bentonite: powder presentation, light cream colored, specific surface area=25-30 m^2/g; specific gravity=260-300 g/L.

Data concerning the bulk chemical composition of BTN, presented in Table 1, indicate a very high content of silica and Na, and a low content of iron oxide, as compared with other Romanian bentonites [35].

Table 1. Chemical composition of the native bentonite from Valea Chioarului (Maramures, Romania)

Component	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	$Na_2O + K_2O$	H_2O
%	75.04	14.32	1.64	1.16	2.41	1.86	3.57

Other samples from related geological sites in Valea Chioarului were extracted and analysed prior to use. Results showed their composition vary within narrow limits, which is a solid indication on the composition homogeneity of the native bentonite deposit [32,36].

Montmorillonit K10 (MMT) was purchased from Sigma-Aldrich Company (USA). MMT was a high-purity grade and used as received (Table 2). Main characteristics: white powder; surface area 220–270 m^2/g; bulk density=300-370g/L.

Table 2. Chemical composition of the Montmorillonite K 10 nanoclay [37]

Component	SiO_2	Al_2O_3	CaO	Na_2O	H_2O*
%	43.77	18.57	1.02	1.03	35.61

* amount of water lost through calcination at 150-1000°C

Table 3. Elemental composition of Nanomer I.30P by XRF [38]

Elements	Si	Al	Mg	Na	Ca	Fe	O
%	39.03	13.46	2.59	0.18	0.23	2.19	41.83

Nanomer I.30P was purchased from Nanocor Inc., USA (Table 3). It represents a natural montmorillonite which was organically modified by octadecylamine (ODA) (70-75% montmorillonite and 25-30% ODA). Characteristics: white powder; density=1.7 g/cm^3; mean dry particle diameter=10-25 μm, interlayer distance=2.10 nm.

2.2 Preparation of the coPA-clay hybrid nanocomposites

Drying

Prior to processing, all materials were dried at 80°C in an oven for 24 hours, up to remanent moisture below 0.2 wt%, in order to prevent bubble formation and polymer hydrolytic degradation during processing.

Melt compounding

After drying, the pre-calculated amounts of clay (5wt%) and polymer were premixed in a tumble mixer. A Haake Rheocord 9000 mixer was used for the preparation of the coPA-clay hybrid materials. The processing conditions were fixed to assure a good dispersion of clay on the matrix: temperature=160°C, rotating speed=100 rpm; mixing time = 7 min. For comparison, neat coPA was also melted in the mixer under the same processing conditions.

2.3 Characterization

The FTIR spectra (KBr pellets) were recorded in the range of 4000-400 cm^{-1}, using a Bruker Vertex 70 spectrometer.

The DSC measurements were performed under nitrogen atmosphere by using a TA instrument from Perkin-Elmer (USA), Pyris Diamond model.

Thermal gravimetric (TG) analysis was performed on a Mettler Toledo TGA-SDTA 851 device, in air stream, with a heating speed of 10 K/min, in the temperature range of 25-700°C, using samples of 4-6 mg.

3. RESULTS AND DISCUSSION

3.1 FTIR spectroscopy analysis. Fourier transform infrared (FTIR) spectroscopy is most useful for identifying chemical bonds and their absorption spectra are almost like molecular fingerprints. In order to determine various functional bonds formed during the melt blending, FTIR was performed on the matrix, clays and hybrid composite samples.

Figure 1 presents the FTIR spectra of clays selected for our study, whilst Figure 2 shows FTIR spectra of coPA and its nanocomposites (all spectra have the same absorbance scale, but are vertically displaced for clarity).

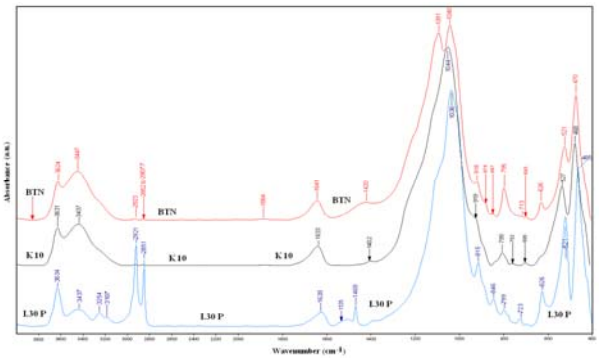


Figure 1. FTIR spectra of selected clays: BTN, K10 and I.30P

Silicates specific peaks due to Si-O bonds (bending and stretching vibration) can be easily indentified for BTN, K10 and I.30P in the interval 400-600 cm^{-1}. Other characteristic peaks were also observed: at 521-527 cm^{-1} (Si–O bending) and at 915-919 cm^{-1} (Si–O stretching, in-plane), at 527 cm^{-1} due to Si-O-Al (octahedral) and 463 cm^{-1} due to Si-O-Si bending vibration; signals at 1628-1641 cm^{-1} were attributed to –OH bending due hydration; peaks at 1036-1091 cm^{-1} are due to Si–O–Si stretching vibrations and those at 3624-3634 cm^{-1} correspond to Al–Al–OH stretching. The strong signals at 795-799 cm^{-1} are assigned to the presence of a quartz admixture in the sample (Si-O-Si vibrations) [39-41]. In the case of I.30P clay organically modified by ODA, specific bands were identified at 2851, 1469 and 1535 cm^{-1} (attributed to symmetric stretching vibration of alkyl groups $-CH_3$), at 2921 cm^{-1} (assigned to the asymmetric stretching vibration of $-CH_2-$ groups) [42,43].

The FTIR spectrum of neat coPA was discussed in previous papers [44,45]. Three basic polyamide bonds, *i.e.* amide N-H at 3280-3300 cm^{-1}, hydroxyl O-H at 2850-2950 cm^{-1}, and carbonyl C=O at 1630-1660 cm^{-1}, are of primary interests. Peaks at 1018 and 1046 cm^{-1} can be solely attributed to the Si-O vibrations in clays, since the only contribution from coPA in this region is the small peak at about 1030 cm^{-1} which has a much lower intensity compared to clays peaks.

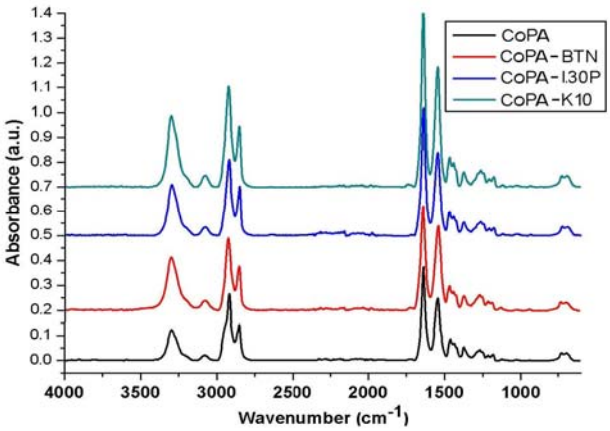


Figure 2. FTIR spectra of coPA (black), coPA-BTN (red), coPA-I.30P (blue) and coPA-K10 (green).

The common feature for these spectra is represented by peaks at 1000, 1100, 1112 and 1115 cm^{-1}, respectively, that are absorption bands attributed to Si-O-, C-O-, Si-O-Si, C-O-C, Si-O-C stretching vibrations specific to coPA, clays and hybrid materials, as well, which is a clear indication of the inclusion of layered silicates in the coPA matrix. Unexpectedly, the differences between coPA and corresponding nanocomposites spectra are not remarkable. The FTIR analysis results indicated that silicate layers neither disturbed the coPA chains stacking, nor enhanced the order of this stacking [46].

3.2 The differential scanning calorimetry (DSC). The DSC allows the evaluation of the glass transition temperature (T_g), melting temperature (T_m), heat of fusion (ΔH_m), crystallization temperature (T_c) and heat of crystallization (ΔH_c) of coPA and its hybrid nanocomposites. Main data concerning thermal properties of coPA and its nanocomposites are presented in Table 4 and Figures 3 and 4, respectively.

As shown in Table 4, the addition of 5% nanoadditives generally lowered values of all parameters, except the heat of crystallization. The samples containing I.30P clay displayed a different behavior: all parameters values are higher as compared to the other hybrids, although still lower than those for the raw coPA. This might be explained considering the structure and properties of the modifier used

Table 4. DSC data for coPA and its nanocomposites

Parameter / Sample	T_g (°C)	ΔC_p (J/g · °C)	T_m (°C)	ΔH_m (J/g)	T_c (°C)	ΔH_c (J/g)
coPA	18.10	0.629	122.21	21.61	85.67	22.19
coPA-BTN	15.09	0.543	117.56	20.61	78.65	28.77
coPA-K10	13.28	0.592	116.05	19.58	65.75	26.47
coPA-I.30P	16.55	0.604	116.38	19.49	66.97	26.15

T_g – the glass transition temperature; ΔC_p – heat capacity; T_m – the melting temperature; ΔH_m – heat of fusion; T_c – crystallization temperature; ΔH_c – heat of crystallization

for this silicate, namely ODA, whose conformation contributes to a higher order of the macromolecular chains.

Glass transition temperature offers a good indication on the effect of additives on the matrix polymer and enables the choice of processing conditions. The T_g of neat coPA is 18°C, lower than other aliphatic copolyamides [47-50], due to the copolymerisation that leads to flexible chains and lower T_g, respectively. At the same time, an increased aliphatic content in coPA enhances macromolecular flexibility. Addition of 5wt% clays determined a decrease of T_g for all hybrids, by disturbing the macromolecular backbones regularity. This can be attributed to the existence of a thin interface layer that tends to enhance the polymer segments dynamics during the melt processing, resulting in a plasticizing effect [51,52]. T_g of coPA-I.30P nanocomposites is slightly higher as compared to the other hybrids due to the presence of ODA which weakens the polar interactions between adjacent clay layers, which is a prerequisite for polymer macromolecules to migrate and intercalate into the clay galleries.

Concerning the ***heat capacity*** values associated to the glass transition, it was proven that dynamics of coPA chains in the glass transition region is slightly reduced by the immobilization induced by clay particles.

Crystallization and melting temperatures of the hybrid materials are lower than those of neat coPA, except nanocomposite coPA-I.30P. Thermograms (Figure 3) of the coPA-BTN and coPA-I.30P samples displayed peaks at lower temperatures, but of higher intensities probably as a result of increased degrees of crystallinity.

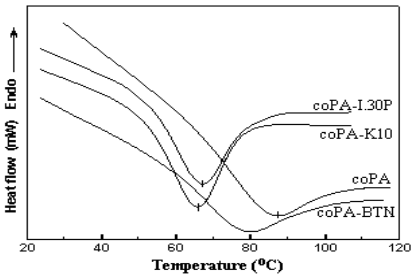


Figure 3. DSC scans on cooling of neat coPA and corresponding nanocomposites

The lower crystallisation temperatures might be explained by a feeble nucleating effect and a lower diffusion rate of the polymer chains. Thus, the polymer–clay interactions appear to hinder the mobility and diffusion of coPA chains and formation of crystalline segments in the space between silicate layers, which is in agreement with previous studies [53-57].

Another important feature concerns the ***enthalpy of crystallization (ΔH_c)*** of coPA-K10 and coPA-I.30P samples, which is the same (T_c is approx. 66-67°C), lower than ΔH_c of coPA-BTN nanocomposites, but still

significantly higher than coPA`s. It might be considered that K10 and I.30P nanoparticles delay crystallization process of these composites, due to the weak interactions at the coPA-clay interface.

The melting temperature (T_m) of coPA, a statistic copolyamide 6/6.6/6.10, is far lower than that of any corresponding homopolymer due to conformation changes of PA6 (approx. 70wt%). Incorporation of co-monomers and, subsequently, clays modifies the inter-molecular phase angle along with progressive attenuation of the intermolecular interactions (hydrogen bonding) between nylon molecules, yielding in lower T_g and T_m. [48]. DSC signals (Figure 4) reveals the presence of other morphological segments developed in nanocomposites, which melt around of 97-98^{o}C.

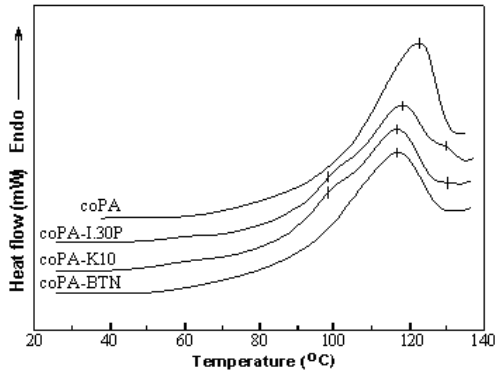


Figure 4. DSC scans on heating of neat coPA and corresponding nanocomposites

Even more, a weak melting process was recorded at 130^{o}C, close to the main melting peaks. These weak melting processes are due to a small crystalline fraction that is more thermodynamically stable and melts at higher temperatures. The crystals of this fraction are bigger and better developed. Additionally, the decrease of the T_m for all nanocomposites compared with neat coPA is correlated with decrease of coPA crystallites dimension, when different clay types were added. This behaviour explains the development of a new morphology in nanocomposites due to the presence of clays, so, the thermal response is a consequence of the coPA polymorphism and the reduction in crystalline order [58]. Nevertheless, since the melting enthalpy values of all samples are very close, changes in terms of crystallinity are not as dramatic as expected.

3.3 Thermal Gravimetric (TG) Analysis

Clays characterization. For a better understanding of fillers effect on the properties of hybrid materials, the TG analysis was performed, first, on clay samples and themograms are presented in Figure 5.

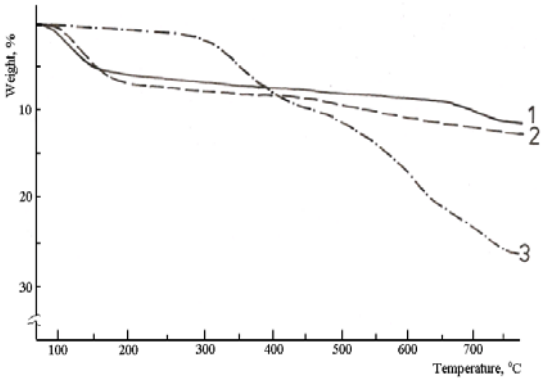


Figure 5. Thermograms of BTN (1), K10 (2) and I.30P (3)

The thermal curves of the BTN and K10 are very similar, but all decomposition processes occurred in three steps. The first degradation phase was in the temperature range of 20-200°C, where BTN and K10 displayed the maximum weight loss. It is know that clays contain three types of water molecules: free water molecules, hydrogen-bonded water molecules and water molecules strongly coordinated to the interlayer cations [43]. In the process of dehydration, an initial rapid weight loss, which occurs at temperatures up to 150°C due to the removal of the free water molecules from the interlayer space, is followed by slower losses until constant weight in the end of dehydration. The weight loss recorded in the temperature interval 150÷200°C may be due to the hydrogen-bonded and coordinated water molecules, finally yielding in the "collapsed" structure [43]. Interlayer water loss dominates the thermal behaviour below 350°C. However, the possibility to remove some of the hydrogen-bonded and coordinated water molecules in the lower temperature range cannot be ruled out.

The weight losses registered into the second phase (200-500°C) were obviously resulted from the decomposition reactions of the organic matter present in clays.

In the temperature range 500-750°C, the hydroxyl groups covalently bonded in the crystal lattice are dehydrated. In the interval

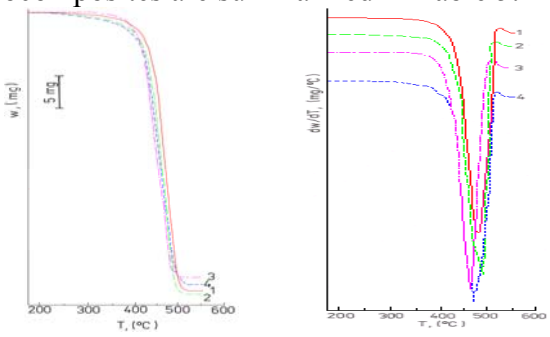
600-750°C, the weight losses for BTN and K10 might be associated with the dehydroxylation reaction of Na-MMT [59].

In the case of the I.30P, the presence of organic cations increases the thermal stability in the range temperature 20-300°C and the weight loss that occurs between 300-500°C can be explained mainly by the decomposition of ODA and partly by the adsorbed water molecules [31,60]. The weight losses above 600°C are attributed to the removal of the interlayer and structural water present into the clays galleries. Total weight losses (%) for the considered clays, at 750°C, are: 12.70 - BTN, 11.69 - K10 and 26.20 - I.30P. The extent of loss for I.30P is due to the supplemental degradation of alkyl chains of ODA.

TGA study of hybrid materials. The thermal stability of the neat coPA and its corresponding nanocomposites was evaluated by TGA and Figure 6 displays TGA and DTG curves obtained for coPA and its hybrids.

The thermal stability of nanocomposites is definitely influenced by the dispersion of nanoclay platelets within the coPA matrix, which may act as thermal insulating layers, thus reducing the diffusion of volatiles, as degradation products, out of the matrix. It has been found that the layered clays are excellent thermal and mass transport barriers, which slow down the rate of volatiles emission as the matrix decomposes [61].

TGA data for coPA and its corresponding nanocomposites are summarized in Table 5.



a b

Figure 6. TG (a) and DTG (b) curves for neat coPA and its nanocomposites: coPA (red), coPA-BTN (green), coPA-K10 (violet) and coPA-I.30P (blue)

Table 5. TGA data of coPA and its hybrid composite materials

Sample	T_i, °C	T_{max}, °C	T_f, °C	$T_{5\%}$, °C	$T_{50\%}$, °C	ΔW, %
coPA	205	480	524	385	430	86.28
coPA-BTN	225	483	520	225	426	86.40
coPA-K10	310	462	507	388	430	82.26
coPA-I.30P	215	470	517	320	430	84.28

where: T_i – onset temperature of main decomposition stage; T_{max} – temperature of maximum decomposition; T_f – temperature at the end decomposition stage; $T_{5\%}$, $T_{50\%}$ – temperature of decomposition for 5%, respectively 50% weight loss; ΔW – weight loss in the interval T_f -T_i

One possible explanation resides in the crystalline structure of coPA that disappears during melting (125-135°C) and is replaced by an irregular atomic arrangement. Literature data [62] indicate that covalent bonds (such as C=O, N–H and O–H) present in coPA and its nanocomposites contribute to the thermal stability of the hybrid materials, because the strength of these bonds is enhanced by clay particles through interactions at the interface.

This increased thermal stability of nanocomposites may be also explained on the

basis of the stabilization due to transition metals (Fe, Mn, Ti, Cu) present in clays as impurities. It is well known [63] that metal ions have significant influence on the thermal stability of polyamides and are commonly used as antioxidants in products targeted for hi-tech applications. Even in low amounts (<50 ppm), the presence of transition metals (such as Fe) and their derivatives is partly responsible for the improved stability of the hybrid composites and are effective for the long-term stabilization of (co)polyamides, acting as radical scavengers.

Weight losses of coPA and its nanocomposites, measured up to 250°C, were found to be very small and may correspond to the loss of water and some volatiles.

The temperatures corresponding to 5% weight loss ($T_{5\%}$) of coPA, coPA-BTN, coPA-K10 and coPA-I.30P were 385, 225, 388, and 320°C, respectively. The improved thermal stability of coPA-K10 nanocomposites might be explained by a better dispersion of clay particles that can prevent fast transmission of heat and limit the continuous decomposition [64]. For coPA-I.30P composites, limited improvement in thermal stability may be attributed to the decomposition of ODA used in the modified clay. The temperature values at the final stage of decomposition (T_f) of nanocomposites are in a narrow range: 507-520°C.

3. CONCLUSIONS

Three series of new polyamide-clay hybrid nanocomposites were prepared by a solventless melt mixing process, using a ternary copolyamide as thermoplastic matrix and various layered silicates. Nanocomposites structure was investigated by the means of FTIR spectroscopy which have evidenced the inclusion of nanofillers in the coPA matrix.

Samples were also submitted to the thermal analysis and the study proved that the addition of 5% nanoadditives generally lowered values of all analyzed parameters, except the heat of crystallization. The main characteristic temperatures (T_g, T_c, T_m) of the new hybrid materials are lower than those of the neat coPA. Clay particles act not only as nucleating agents, but they affect the movement of macromolecular chains, yielding in a decreased crystallinity and T_g. Under these circumstances, the operational parameters for melt mixing processing need to be optimized for a better diffusion of polymer chains within the clay galleries.

Results obtained by TGA indicated that the presence of 5 wt% clay increased the thermal stability of coPA, proven by the temperature of the initial decomposition which increased by 10-95°C (thermal stability of samples: coPA-K10 > coPA-BTN > coPA-I.30P > coPA).This behaviour is explained on the basis of the stabilization due to transition metals present in the clays as impurities. The increased thermal stability of nanocomposites is a result of the thermal insulating properties of the layered silicates which act as barrier to the volatile products generated during decomposition.

Data presented in this article are only preliminary. Further study will correlate them with results from other measurements, in order to optimize the processing conditions, to better understand the effect of nanoclays on coPA and to establish the structure-properties-application relationship for the new hybrid materials.

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5. AIR FORCE

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COMMAND AND CONTROL SYSTEM BASED ON ARDUPILOT MEGA 1.0 AUTOPILOT

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Abstract: *This paper focuses on the design and implementation of command and control system for unmanned aerial vehicle. The controller is based on an Ardupilot Mega 1.0 board which is a custom PCB with an embedded processor ATMega168. The ground station software's purpose is to provide an easy-to-use graphical interface to the autopilot. Software is written in Borland Delphi language.*

Keywords: *Ardupilot, UAV, Mavlink*

1. INTRODUCTION

Unmanned aerial vehicles (UAVs) have become a hot research topic in the last decade worldwide. Their great potential has been explored in numerous military and civil implementations.

The command and control systems for UAV include the autopilot which is responsible for the autonomous operation of the aircraft and ground station. The autopilot is managed via a ground station laptop, with dedicate software, which allows the operator to control the aircraft, upload flight plans, and view aircraft data navigation and telemetry.

2. ARDUPILOT 1.0 AUTOPILOT

The autopilot board is the most important and complex piece of hardware in the command and control systems for UAV. The function of the autopilot is to stabilize the aircraft and to execute the user programmed mission and the pre-programmed fail-safe functions.

The ArduPilot Controller board, shown in figure 1, was used as the main platform for the flight control system due to the functionality and availability of open source support.

Fig. 1 ArduPilot Controller Board and IMU.

The ArduPilot is a full-featured autopilot using an Inertial Measurement Unit (IMU) for stabilization and GPS for navigation. The ArduPilot features are: built-in hardware failsafe, multiple 3D waypoints, altitude controlled with the elevator and throttle, a GPS connector and six spare digital input/outputs for additional sensors. The autopilot system use the GS407 U-Blox5 GPS, operating at 2Hz.

The UAV navigates from one waypoint to another make by comparing its present location to the next location. Depending on this comparison and the PID values set for the Roll, Yaw and the Pitch servos, the Ardupilot calculates the movement required for the

corresponding control surfaces to reach the destination.

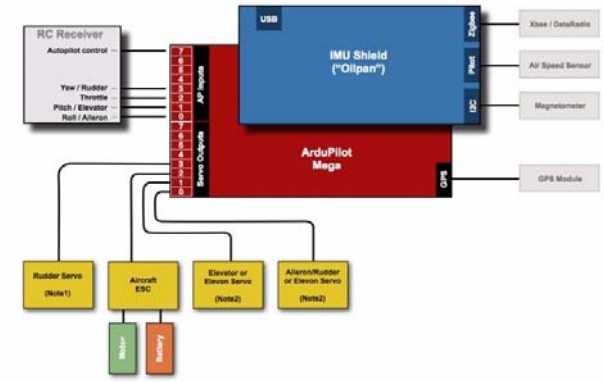

Fig. 2 Ardupilot block diagram.

Figure 2 shows the Ardupilot block diagram and how to connect the servo and sensors.

3. GROUND STATION

The second component of the command and control systems for UAV is ground station. The ground station for the autopilot system has a laptop connected with a "XBEE PRO 900 XSC" modem through a USB cable working at a baud rate of 57600 and at a frequency of 900MHz.

The software running on the ground station laptop is developed in Borland Delphi. This software implements communication protocol Mavlink (Micro Air Vehicle Comunication Protocol). MAVLink was developed specifically for unmanned aircraft on board and is an open source protocol.

The ground station software is responsible for attitude estimation, processing sensor data, parsing GPS data, controlling the aircraft, and handling communications with the ground station. The ground station software's purpose is to provide an easy-to-use graphical interface to the autopilot. The ground station software runs on a Windows based laptop computer.

The ground station software is written with optimization, functionality, development, and compactness in mind. The software is divided into two sections. The code for first section is responsible for initialization of the autopilot hardware, declaration of global variables, and initialization of global variables and structures.

The second section of the autopilot code is the main loop. The main loop runs continuously and is responsible for gathering and processing sensor data and computing the low-level control algorithms.

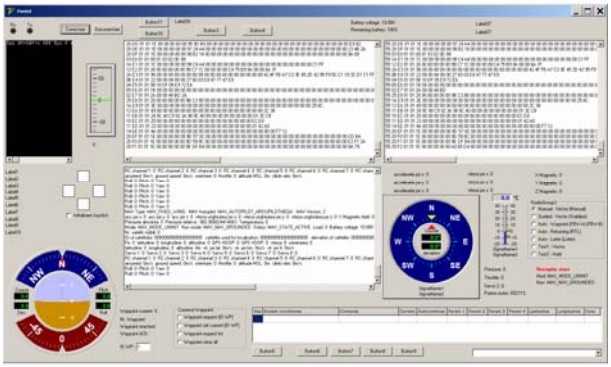

Fig. 3 The graphical user interface.

The graphical user interface (figure 3) displays aircraft attitude, altitude, location, and other information like battery voltage, throttle percentage and airspeed. This allows complete situational awareness and helps the operator to communicate with the autopilot to ensure the safety of the system.

4. CONCLUSIONS

The ArduPilot autopilot has all the functionality necessary to operate the aircraft without human interaction. The ArduPilot has complete control over the engine and all onboard servo motors as long as the mode of operation was autonomous. The human pilot from the ground station has control of the aircraft, trough developed software, selecting manual or automatic mode.

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THE HIERARCHICAL INFORMATION MODEL WITHIN INFORMATIONAL SOCIETY

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Abstract: *The specific opportunities offered by information and communications technology for the military field aim at ensuring the necessary conditions for substantial improvement of planning and engagement manner of modern war. It is about available informational systems that integrate sensors, cameras and other equipment for obtaining information and which are continuously perfected. These equipments show step by step the rising level of connectivity with the informational networks for ensuring an appropriate visibility of the battlefield, including placement of each fighter or means of fighting. In this article the analysis effort will be focused on detailing the information hierarchical model within the informational society with an emphasis on the main effects of the impact of informational era on the social environment.*

Keywords: *informational revolution, informational society, informational model, integrated system*

1. INFORMATIONAL SOCIETY – THE SOCIETY BASED ON INFORMATION AND KNOWLEDGE

Since ancient times, people felt the need to be informed, to know the surrounding world and to know what is happening around them in order to act accordingly, especially to keep themself away from danger. Information, especially military information and its usage at the appropriate time was, is and will be a basic weapon of any state. Ignoring own allies or the inability to know them well and on time, and especially the inability to know your opponents might have serious consequences. More than 2500 years ago, the famous Chinese theorist Sun Tzu considered that „He who knows his opponent in good conditions, as he knows himself has the victory asured. But one who does not know his opponent will surely lose and can not ever be considered a winner." [15].

The effects of the ongoing informational revolution in the *social and military fields* are in permanent attention of military thinkers, and those who share common points of view and approve the informational revolution involvement consider that the current revolution in computers, telecommunications and informational technology will profoundly change society, democracy and our daily lives [9]. From a military perspective, informational revolution technologies will provide the means to increase the military efficiency by reducing losses and diminishing budgets. The union of military and social perspectives regarding military structure is essential, as well as the option and direction in which it develops.

Informational society is the organizational structure in which production and use of information is the most essential resource, information being recognized as core technologie, informational and communication technologies beeing the base, while informational environment associated with the social and ecological environment shapes human existence. In this context, the

dimensions of the contemporary society based on information and knowledge are the following:

- *social* - with applicability in health, human protection and democracy fields;
- *educational* - for the development of conceptual and ongoing competence of activity in a computerized system, proper/intelligent management of processes and activities (distance education and learning, digital libraries, e-Teaching programs and e-learning);
- *environmental* - with an impact on resource use and environmental protection;
- *cultural* - with an impact on heritage preservation and development, cultural industry evolution (museums, galleries and art exhibitions on the Internet, digitization of information: books, national, regional and international heritage records);
- *economical* - for development of new economical paradigms in the digital and knowledge plans (we take into account programs such as: e-Commerce, e-Banking, e-Learning, e-money, e-Trading, Internet operations and businesses, etc.).

The main effects of informational era impact on the social environment and especially on the military field are considered to be the following: time and distance become less important in the spectrum of constraints; events can be influenced by a number of transnational and international factors; boundaries of any kind between international actors will become increasingly insignificant step by step; regionalization and globalization tendencies will have an ascending course; inequality between rich and poor will only deepen; threats can result from multiple diffuse sources, while asymmetric warfare is a real danger, although not a new concept aimed at national security and national interests; significant mutations in the strategy and tactics will happen in an attempt of constantly adapting to the requirements of the battlefield; real revolution in military spectrum is achieved by combining information and communication technologies in the present case with other technologies with applicability in the military environment.

The need for data and information obtained, processed and transmitted in "real time" concerning the enemy and the battlefield has increased the role of information and the importance of informative products. Informational superiority can be defined as *"the ability to collect, process and disseminate information continuously, while exploiting or reducing (destroying) informational support capacity of opponent forces"*[11]. The processes of data gathering, processing and disseminating must ensure the relevance, timeliness and accuracy of information important for deployed forces, according to specific echelon requirements of which they are part of, the ultimate goal being to make available to the combatants a continuous operational picture of the battlefield. Also military intelligence must have the ability to make predictions and projections on the evolution of the security situation in a specific geographic area of interest, in order to provide the most favorable foreign policy decisions, at a given time.

Governments collect, process and use information. A writer concerned with the issue of war called the art of government as being *" the central importance of knowledge, both in general and in particular"*.[8] In the formulation given by Deutsch, the systems that realize the knowledge represent the *"nervous system of the government"*.[3] He presents a series of associations with international relations, national defense, national security, classified character and specialized institutions labeled as *"intelligence"*[7]. However, within the governmental activity the term "intelligence" has a meaning more concentrated than the one of information and information services. The American professor, Sherman Kentmember, a member of intelligence services in the period of the World War II and a CIA specialist addressed the term "intelligence" since 1949, defining it as "a kind of knowledge achieved by a particular type of informative organization". Although this definition is often used, the main element of intelligence is represented by the organizational one. In the framework of government, the term "intelligence" is based on a particular set of structures bearing the name of "intelligence services" (information services) or "intelligence communities".

Other organizations have their own informational systems and the term "intelligence" is sometimes used to describe all these governmental or nongovernmental systems and the information which they produce. Terms like "business intelligence" or "competitive intelligence" are already consecrated as specific elements of the private sector, other commercial information services have similar names. In large organizations, the term "intelligence" is used to designate "information - questions, intuitions and deductions, assumptions, evidence - with impact on the organization's policy"[17]. According to some analysts, "social intelligence" is the system / process by which a company, organization or individual accumulates, processes, assesses, stores, disseminates and uses information in the practical action.

Informative activity consists of what these organizations do as cognitive elements which are produced as a result of their work. The Romanian translation of the term intelligence, according to the most common dictionaries, has several meanings: cleverness, wisdom, information, espionage. Any of this terms do not fully express the term of inteligence when it is used to express the activity and the services of informational services, reason why, in general, the term was asimilated as such in the Romanian literature. Organised informational activities have constituted an industry in the twentieth century, and are currently in full development, most governments having it permanently institutionalized. It constitutes an important part of the modern state and also a factor contributing to the success or failure of a government activity. It consumes significant resources, if not enormous. U.S. spending in this sector at the end of the Cold War, amounted to about one tenth of spendings on national defence and the British effort in this area currently costs more than the effort in diplomacy. Although the tragic events of September 11, 2001 represent a failure of U.S. intelligence, the U.S. and UK efficient use of resources allocated to this sector as a whole is unquestionable. Also, informative activity had direct economic effects such as the influence manifested in the early computer industry and in the development of satellites and miniaturized electronics. In addition, this type of activity gave concreteness to a certain kind of power at state level: power given by information activities, due to the ownership of information.

2. THE ROLE OF INFORMATION IN THE EVOLUTION OF MILITARY CONFLICTS - INFORMATION HIERARCHICAL MODEL

Modern military conflicts use informational technology as a means of achieving economy of time, forces and means, in which information is a vital element in obtaining success. Analyzing latest armed conflicts, it can be concluded that the main factors influencing the fight are: armament and equipment; human, strategy and doctrine; information and communications.

The role of military intelligence has grown considerably once the Romanian Army started to attend international missions under various mandates. Thus, early warning, identification and evaluation of risk factors, intelligence protection of military actions and forces are basic missions for military intelligence structures deployed in theaters of operations. Moreover, past military conflicts have highlighted the importance of information in preventing surprise, fair assessment of situations, decision making, planning and conducting successful joint actions against terrorism.

If we represent, in another way, the *role of information* in the management of military structures, we must emphasize at least the following aspects of *information*: it causes the *decision-action reaction* at management level;

is related to the human, technical and material resources, objects, time, space and relationships; represents a novelty or a piece of news about forces, events, actions, ideas, opinions, experiences and so on, all related to past, present and future; reflects *the interests and will of the manager*; *establish direct contact* between the manager and the people / structures which act directly to achieve objectives.

The activity of information faces two major problems[14], both comprehensive and never ending. The first problem concerns *the activity of prediction*. The objective is, of course, to predict what will happen next. This activity has steadily improved with the increase of intelligence activity instruments. If Wellington said: *"All the problems of war consists of guessing what is behind the hill"*, research technology that is currently available can see much farther than "over the hill". Another problem that intelligence activity is facing is the so called *Cassandra Complex*: what should be done so that political and military decision makers accept information that they do not agree. This aspect is not new and has been identified in the course of history. Alfred von Schlieffen, the Chief of the General Staff of the German Army before World War I, said that *"in general, commanders at the highest levels, make their own opinions about friends and enemies, taking into account their own desires. If the reports received match this image, they accept it with satisfaction. If the reports are in contradiction with the image previously formed they consider it to be false "*. Marshal Montgomery, the initiator and organizer of World War II "Market Garden" Operation, refused to take into account the evidence of German armored units presence at Arnhem and analysts who presented him the reports were changed from their positions. The result was failure in conquering that bridge and huge human losses.

According to Russell Ackoff, a specialist in theory systems, the ensemble of the human mind includes: data, information, knowledge, understanding and wisdom.[2] Data is *"a description of letters and / or numbers of a phenomenon, process, object, fact, event or actions within or outside military organization"*[10]. It is composed of a group of structured symbols according to a predetermined syntax recorded on a support material which can be manually, mechanically or electronically processed. Data represents any conventional notion represented by a number, size, link etc.. It is produced through research activities, aims to solve a situation and is subjected to subsequent manufacturing processes at different time intervals. Data is *"a fact, notion or statement represented in a suitable conventional form of communication, interpretation or processing by human or automatic means"*[4].

Information is data processed for use and contains answers to the questions "who", "what", "where" and "when" that have acquired meaning through relational connections. Their meaning might be useful or not. The notion of information is defined as *"a communication, news, story that puts someone up to date with a situation; all materials used for informing and documentation sources (written text, spoken message, plastic images, indication of an instrument)"*[5].

The information is *"the basic object in communicating knowledge. Any information can be seen from two perspectives: that of the meaning (semantic content) and that of the structure"*[6]. *Knowledge* is the application of data and information and answers the question "how". It is an useful adequate collection of information.

Understanding is the process in which previous knowledge is summarized, concentrated and transformed into new knowledge and requires an answer to the question "why". The difference between knowledge and understanding is as that between learning and memory. Those who understand can perform useful actions because they can synthesize new knowledge and information from that already known. *Wisdom* is evaluated understanding and is thought to be an applied knowledge.

Ackroff states that the first four categories are related to the past and have in consideration happened or known facts. Only the fifth category, wisdom, refers to the future and contains vision and projecting.

John Arquilla and David Ronfeldt have created a classification of information based on the pure meaning of this categories. According

to this model, information is any informing way involving the use of human mind to create other information. Therefore it can be concluded the following hierarchical order of these categories: data, followed by information and knowledge. It can be observed that the main achievement of this classification rule is determined strictly by the inverse correlation between the amount and quality of information as part of the its processing. The amount of information decreases with the increasement of its quality, thereby leading to outline a pyramidal model ***(Figure no. 1).***

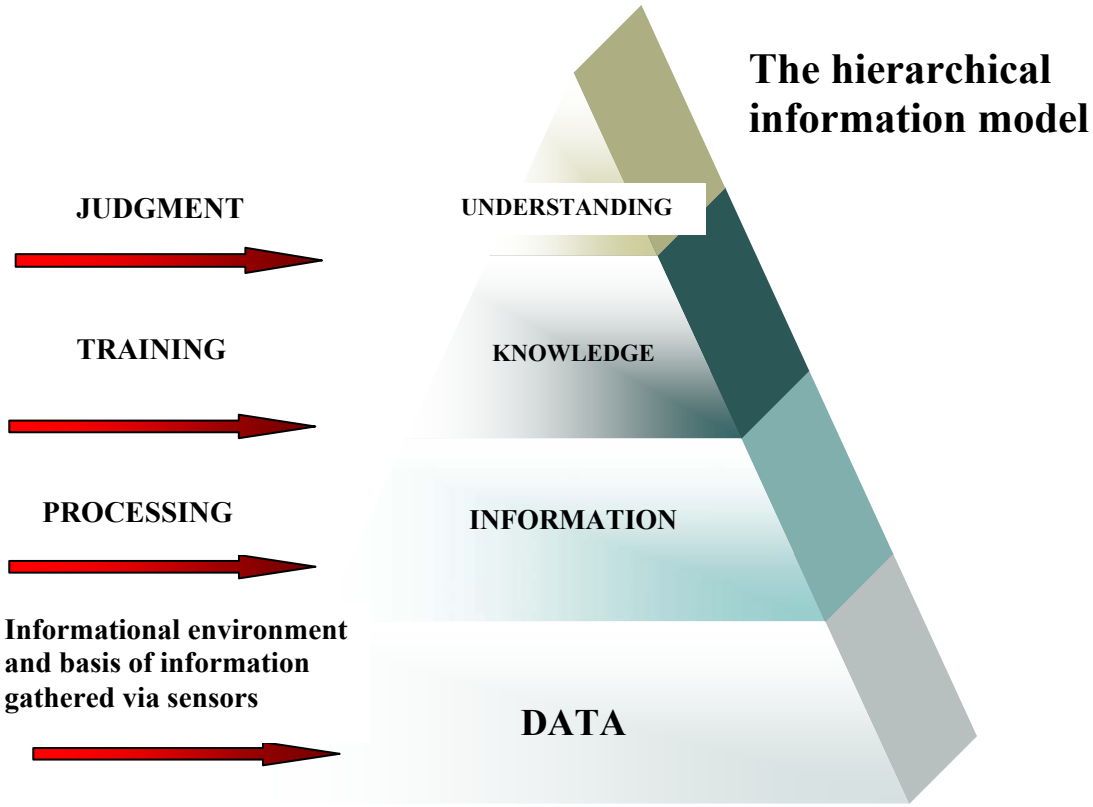

Figure no. 1 The hierarchical information model
Source: Arquilla John, Ronfeld David, *Preparing for Conflict in the Informational Age*

Information theory is the mathematical theory of general characteristics of information sources, transmission channel, storage and processing installations of information concerning their statistical properties. Some definitions of the term "information" highlight a number of its *features,* as follows: a real objective property that performs orientation of actions[1]; possible succession defined by physical events aiming to influence activity of human sense organs and showing situations which are not easily notified; measurement of matter and energy unevenness repartition in space and time; abstract measurable quantity whose value should not depend in any way on the nature of the information; contributes to the organization of numerous regulation and self-regulation processes of the perceptible and

acceptable truths; is part of basic human needs; will be the key of the fourth wave [16].

3. CONCLUSIONS

Information, as a notion, is an integral element of all sciences, with the specification that some of it have performed quantitative determination and qualitative expression of these sciences. In a broad sense, information is an active and dynamic expression of substance and energy used for the disposal of uncertainty[13]. *Information*, as opposed to data, from the view of leadership, brings more knowledge and helps reaching a decision or to transpose its application. Information is a fundamental element of the informational systems, the raw material in the development of decision making.

The impact of technological evolution does not occur only in the battlefield, it affects *defense policy* too, these events occur in several *directions,* the most important being: information is essential to increase the wealth, power and influence, it is more important than traditional sources of wealth, considering that the new defense policy reconsider security objectives and activities of information defense and protection; permanent change of material and moral character norms of value must be based on a growing openness to information, the technological support facilitates people access to information, including the ordinary citizen; informational technology must continue to produce changes in the organization, structure and technological support of all parts of society including the military component, and information flows must facilitate the command and control in real time and in places in which distance, platforms and hierarchical levels are no longer taken into consideration.

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THOUGHTS ON UAV OPERATOR'S SIMULATOR TRAINING

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Abstract: *It is not unreasonable to say that we are living in the age of the simulator. As a result of the rapid spread of computers and IT systems, simulators have become part of everyday work and life. The world of aviation is no exception. The most developing scope of the modern warfare is relating to the design and deployment of those systems, which - with a minimized casualty number – is capable of fulfilling tactical requirements, reconnaissance tasks, destruction of enemy forces, combat support of own forces and after action evaluations. These requirements are fully covered by the remotely operated vehicles (particularly by the unmanned aerial vehicles). The criterion for the successful deployment is a well-trained system operator. Obviously flight simulators are the essential tools in the operator's training. The objective of writing this article is to introduce flight simulators and outline the perspectives and advantages of their application in the context of UAV operator training.*

Keywords: *UAV -Unmanned Aerial Vehicle., simulator, training, operator.*

PREFACE

The last decade has brought a quite tremendous evolution considering Unmanned Aerial systems (furthermore: UAS) and Unmanned Aerial Vehicles (furthermore: UAV). This evolution can be thanked to the fact, that military leadership has recognized the wide spectrum of possible deployment areas of UAVs upon the asymmetric warfare[1]. As soon as the newly designed UAVs (with their quite new capabilities) got into the military service, the need arose to train operators who can deploy them effectively. Accounting the training devices, which are capable to fulfill the present day's training requirements, we must turn to the simulators. Considering the uniquely short UAS military deployment experience, it is understandable why we have to look at the UAV simulator's market as an improving one.

The immense past deployment experience of UASs revealed that their combat- and combat support capabilities are inevitably important during the modern day's warfare, but their operational effectiveness highly related to the accessibility of a well-trained human resource.

Present days we are experiencing the era of a rapid technological evolution, which is practically affects every aspect of our lives. The affects of technological evolution can be traced both in the every day's life, and in the completion of the most complicated industrial processes. The modern technological devices are playing important roles in our activities on ground, in the water and up in the air. All around the world emphasized attention is paid

[1] It is typical during the asymmetric warfare that the participating counterparts warfare's philosophies-, the combat method's in their characteristics are considerably differing from each other.

toward those vehicles which are using the airspace (UAVs included), toward their designs, safe and effective deployment.

Basically, we can divide the UAV connected activities into two main groups. One group deals with the activities related to development, the other one is with the already developed UAV deployment. One of the most effective training mean of preparation to a real UAV application is a simulator[1].

The UAV simulator is basically a training device which is on one hand capable for modeling the elements of the real flying activities under all kind of meteorological situation, on the other hand for modeling the usage of sensors and weaponry. When we are dealing with the real flying elements we must understand all the practical activities from powerplant starting till its shutting down under it. Considering the sensor operator's training, the simulator must be capable for modeling the opposite force itself with its vehicles and ordnance, the enemy's activities/maneuvers with its ground based resources (like radars, air defense systems) under different daytime and concealment circumstances.

UAV OPERATOR'S TRAINING:

It is understandable, that UAV operators must meet high training standards. They must be capable of operating their vehicle, in close cooperation with the related air traffic control units and other air means participating GAT[2] and OAT[3], of effectively using the UAV onboard sensors, of the recognition and quick evaluation of the tactical situation, of proper usage of the ordnance. If we are considering the „capability package" of an UAV, we can form a picture about the UAV simulator requirements/capabilities.

When we are examining the UAV operator's simulators, providing practical training and the capabilities required from them, we must make distinction upon the differences on their deployment fields.

The wide spectrum of deployment possibilities is followed by the range of tasks with their special conditions.

The tactical level battle targets are usually reached by small combatant units (like an infantry platoon), an operational level targets by a combatant force which is not less than a company (rather battalion), and strategic targets by the minimum force of battalion but rather brigades[4]. We can generally declare that the deployment of various UAV categories is determined by the level of the combat targets.

It is understandable that one cannot use the UAV of same category to collect reconnaissance information for an infantry platoon and to explore and destroy enemy's ground-based air defense means.

In order to meet the various operational requirements different categories of UAVs were developed (Table 1.)[2].

[2] General Air Traffic.

[3] Operational Air Traffic.

[4] Regarding the minimal size of the combatant force related to a given strategic level target, we must make an exception with the Special Forces. Special Forces are completing their strategic level tasks basically in an 8-10 soldier group (Special Operational Task Group - SOTG).

Category	**Range** (km)	**Maximum operating altitude** (m)	**Maximum time of flying** (hour)	**Average take off weight** (kg)
Nano	≤1	100	≤1	≤0,025
Micro	10	250	1	≤5
Mini	10	150-300	≤2	≤30
Close range	10-30	3000	2-4	150
Short range	30-70	3000	2-4	150
Medium range	70-200	5000	6-10	1250
Medium range endurance	≥500	8000	10-18	1250

Table 1.: The categories of UAVs.

Evaluating the above demonstrated UAV categories with their given limitations, we can easily declare, that there must be a great difference between the training of an operator using Micro category UAV – who controls his or her device in the vicinity of a clear visual range – and a training of an operator who controls his or her UAV through satellites (since the device has intercontinental level range capabilities). There is no reason to set the same standards toward their training.

SIMULATORS PROVIDING TRAINING CAPABILITIES TO UAVs:

SIMULATORS PROVIDING T RAINING CAPABILITIES TO THE CATEGORIES OF NANO-, MICRO- AND MINI UAVs:

Right before the detailed look into the simulators capable for providing adequate training for the operators of these UAVs, I demonstrate these devices themselves. (Figure 1.)

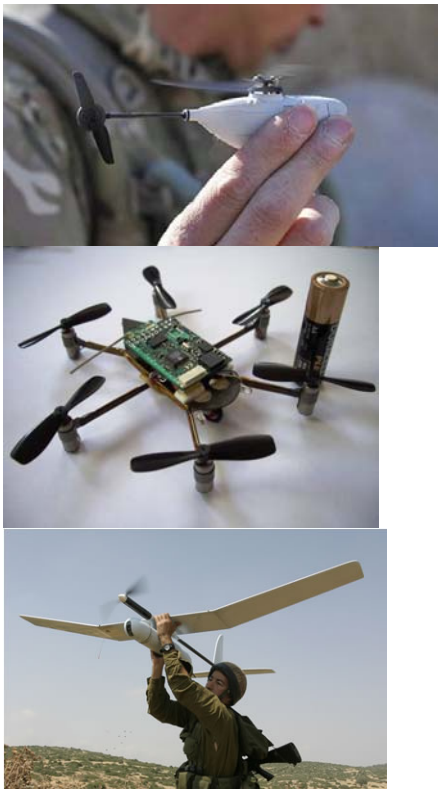

Figure 1.: Nano, Micro and Mini UAVs.

The range of these devices can be considered as a short one, their operational/flying altitude is, usually, low-level. Generally they are deployed in the operators' field of view since radio waves are used to control them. The capabilities provided by them, are basically (solely) limited to reconnaissance data collection. As for their use, they request a crew of two.

One of them is responsible for flying control of the device; another person is a sensor operator who carries out the actual data collection. The two-way communication between them is essential, since the flying route and attitude of the given UAV is closely affected by, and must be continuously adjusted by the online observed location of actual ground based targets.

After these, it can be declared that the deployment of these UAV categories request two main knowledge/skills. One of them refers to the knowledge of flight controlling techniques; another is to the appropriate usage of the on-board sensors.

The device, which provides training for flight control techniques, consists of two structural parts. These are the PC (as a hardware tool) with its installed software that provides UAV visualization in the simulation; and the control devices attached to the PC. The control device's structure is likely the same which is used to control civilian RCs[5]. The sensor operator's training device is connected to a PC providing the main simulation, since there is no reason for operating sensors without the actual simulation itself. (Figure 2.)

Figure 2.: Training device providing simulation for Nano, Micro and Mini category UAVs.

[5] Radio controlled flying devices (models).

Obviously, the operation of the sensors can be only carried out during the actual flights. Could that be a real-, or a simulated flight. As for this, the training for an UAV device operation relating to these categories must be completed in two steps. The flight controller's training must be completed at first, and then the sensor operator's training follows.

It is important to stick to these training steps, since the mission commander can only obtain valuable reconnaissance information if the flight controller is capable to react immediately to the command of the sensor operator. He or she can direct his or her UAV to the best data collection position.

SIMULATORS PROVIDING T RAINING CAPABILITIES TO THE CATEGORIES OF CLOS E-, SHORT- AND MEDIUM UAVs:

Like I did above, I start with the introduction of these kinds of UAV categories. (Figure 3.)

Figure 3.: Close , Short, Medium and Medium Range Endurance UAVs

Since these kinds of UAVs are flown beyond the visual range, both the controlling and navigation are carried out via satellites. The flight route is planned on PC[6] during the pre-flight preparation, and then it is uploaded to the onboard navigational computer. The flight is completed by the operator upon the pre-programmed flight route, keeping his or her device on the given track. Modern medium and higher categories UAVs are installed with such a navigational equipments which facilitates autonomous completion of standard arrival and departure procedures, landings. They are important aids to ease the workload of operators during the long operations, and to lower the flight safety risk.

The tasks of a sensor operator on these UAV categories are not really differing from those, which must be carried out on the lower category ones. The minimum difference is given upon that, the observed information is not transmitted directly to the sensor operator's display via radiowaves, but transmitted via satellites. However, major difference must be observed on the field of onboard ordnance, since medium and higher category UAVs have them on their hard points. These UAVs are capable to demolish both ground located and aerial targets. Because of this, the crew of these given UAVs is complemented with one more person, called weapon operator. The efficient deployment requires complex cooperation among the crewmembers.

After these, it can be declared that the deployment of these UAV categories request three main knowledge/skills. One of them refers to the knowledge of flight controlling and navigational techniques; another is to the appropriate usage of the on-board sensors, the third one is to the use of air-to-ground and air-to-air weapons.

The category related UAV simulator must facilitate the simultaneous training of a minimum two crew member. They are the flight controller and the sensor operator. (Figure 4.)

Figure 4.: Simulator which provides training to a medium category UAV.

The simulator's cabin layout looks exactly the same like the real UAV cabin. The sameness

[6] Personal Computer

can be found in the operator's controls units, in the navigational instrument's displays.

The most important factors of the efficient simulator training are onboard communication and in-flight crew coordination. Only the existence of these, will grant the professional training and operational execution. Once the UAV is flown to the actual target zone the sensor operator takes the mission commander's responsibility. It is him or her, who directs the flight paths of the device by the flight operator, he or she explores the opponent forces, and then he or she makes the target acquisition for the weapon operator. After target acquisition the weapon operator takes mission command. It is him or her, who directs into the best position of weapon deployment, then he or she carries out firing. Following the firing a crucial task must be completed, that is belongs to the sensor operator again. He or she must collect information on the degree of demolition. The evaluation of collected information/data will determine the possible need for repeated actions upon the given targets.

Over viewing the previously explained deployment method, it is clear that the success of a mission depends closely on the efficient communication among the crew members. As for this, both the simulation and the "real UAV" cabin layout facilitate the work of crewmembers in a common space. They are not separated from each other or confined to a separate work in separate rooms. But there is one more advantage of a common cabin work, it makes possible for them to look over to each other's displays. It is useful, if we consider that the well-trained crewmembers can prepare for the next tasks which are implied by the images. For instance the flight controller can direct the UAV to the best observation position prior the sensor operator's command.

THE REQUESTED CAPABILITIES UPON UAV SIMULATORS, PROVIDING PRACTICAL TRAINING:

There are clearly set requirements toward the simulators, which are providing practical training aid for the various operators. However these requirements have been set upon a quite short operational experience. Firstly, we have to declare that useful practical training can only be completed on a simulator which "flying" characteristics are the same like the real devices'. If the simulation cannot meet the aerodynamic requirements, the flight controller/operator – after his or her training – won't be able to carry out safe flights. Should an unexpected weather phenomenon emerge during the given flight, the operator will loose his or her control over the UAV, which lead to the damage of a device.

Controls, used by flight controller, sensor and weapon operators must be totally the same like those, which are installed into the real UAV device. It is crucial and required, since during a real time missions it is common to carry out sudden control movements[7]. In these cases, the efficient and safe deployment depends on automatic reactions/control movements of the operator, which were created in the simulator.

The simulator must possess an interface, which facilitates the adjustment of weather criteria/setting preflight and during the actual flight. The possibility of weather setting adjustment is important for practicing various flight maneuvers under different circumstances (underlining take off and landing procedures). The option of changing meteorological situation in the simulation is useful (especially at short and higher-categories UAVs), when the flying time between taking off and landing is so long that a change in the meteorological conditions is presumed It could happen, that at the time of taking off the weather conditions can be considered as simple, but at the time of landing it deteriorates because of a possible sandstorm. This means that - as an essential requirement - the simulator device's software must support setting changes regarding to wind direction and speed on different altitudes, changes to precipitation (conditions like: fog, rain, snow, ice), settings on various types of clouds on their coverage rates on different altitudes.

[7] Immediate action is necessary from the controller if the flight equilibrium is affected by the weather elements, or to avoid obstacles during low-level flights. Immediate intervention is required from the sensor operator, if enemy forces and equipment popping up suddenly at the periphery of his or her surveillance zone.

The simulator must support both daytime and night time flight circumstances. For the full flight daytime training, the simulation must be able to realistically display natural/terrain (hills, mountains, trees)-, and artificial (buildings, towers) obstacles. Furthermore, in the context of contemporary operations, it is stated that the need arose to display combat forces applied at night. Since the development of sensors increasingly shifting UAV deployment toward the direction of the night, it is important to underline the night flight simulation.

The simulated spatial visualization must support the fulfillment of basic flight elements such as straight and level flight, climb and descent, constant angular-speed standard turning, turning to specified direction, climb and descend turns with different steeps, configuration changes, airport visual approach procedures.

Especially in the first phases of flight training, there is almost constant danger that the UAV gets into an "in-flight adverse attitude"[8]. In order to be exercised in the management of these complex situations, spatial visualization must be capable to support the completion of large-pitches, steep turns, and flying at stall speed.

At short and higher categories of UAVs, the simulation must provide the possibility to install navigation information to the on-board PC, considering the VFR[9] and IFR[10] flights. It is important that these navigational procedures can be even completed in the simulation. For the training of IFR navigation procedures, the simulation must include the ground-based (simulated operating) navigation equipments (VOR[11], ILS[12], DME[13], NDB[14]). Since the satellite navigation system (GPS[15]) is an indispensable tool for these category UAVs, the simulation must be able to support GPS navigation.

The UAVs are an integral part of a general aviation. They are flying in such a dense airspaces, which are regulated by restrictions; the usage is precisely coordinated/managed by air traffic controllers. Therefore, UAV operators must know and understand GAT in general; how the structure of the airspace is formed, what are the basic rules on airspaces usage; how to coordinate with the airspace management units; how to forward different airspace request orders. Therefore, the simulation must ensure the setting of air traffic flow, and the generation of air traffic control.

Beyond the exercises of practical flight elements it is important to master the application of the sensors, as well. Modern UAVs primarily have electro-optical and infrared reconnaissance tools. Electro-optical sensors are used for the daytime observations, while night vision capable sensors (working in infrared range) for information gathering during night time. In order to ensure that received signals can be utilized by the sensor operator, the software of the simulation must support the realistic imaging. Accordingly, the simulation must ensure both day- and night time target visualization on the enemy forces and on their weapons.

The simulation of enemy activity is closely related to sensor operator's training. . In a view of UAV's tasks, the simulation visualization must primarily focus on the enemy forces,

8 The in-flight adverse attitude means that the device is (accidentally) forced to the flying attitude which differs basically from the safe/normal, and poses fight safety risk toward GAT, OAT. The risk of crash is imminent.
[9] VFR = Visual Flight Rules.
[10] IFR = Instrument Flight Rules.
[11] VOR = VHF Omni-directional Radio-range.
[12] ILS = Instrument Landing System.
[13] DME = Distance Measuring Equipment.
[14] NDB = Non Directional Beacon.
[15] GPS = Global Positioning System.

on their maneuvers, on the enemy's ground-based weapon systems (e.g. radars, air defense complexes). The simulation must be capable to model the activities of low-level- and speed flying aircrafts, as well as airspace violator fighters. The sensor operator – during his or her training – must detect enemy's activity; identify all of the natural and artificial obstacles which could affect the freedom of movement of our own forces. He or she must be capable of an accurate data evaluation, and of a speedy processing. This implies that simply the sensor management training is not enough for a well-trained operator. It is important to learn the tactical knowledge as well.

At present time, it is normal to have (especially on close- and higher category UAVs) weapons hard points. Considering the weapons, the air-to-air and air-to-ground missiles are used. There are numerous simulation criteria for an efficient weapon operator's training. One of them is a proper day and night visualization of enemy forces (explained above), another one is a real visualization of the given weapon's destructive impacts. The simulator's hardware system must include that weapon control panel, with its design and usability, which must be equal to the "live" device's control panel. The weapon operator's training can only be considered as effective, if the weapon operation reach the proper level of destruction. The assessment of the extent of the destruction is such an important question, which must be answered in the simulation.

In the case of training for multiple crew UAV operations (flight controller, sensor and weapon operator), the first step always must be the crew position specialized, customized training. After this individual training - in order to form proper crew co-operation - the crew level training takes place. The training for the crew's proper onboard co-operation, in NATO terminology, is called to be "Crew Resource Management" training (CRM training). In order to facilitate CRM training, simulation must support the crew level pre-flight preparation, a common platform task execution (with the simulation of on-board communication, rapid information exchange) and post-flight evaluation.

In relation to the requirements set toward UAV simulators I have only been writing about the training means of operators, but it is important to mention the so-called "Instructor facility".

The Instructor facility must facilitate the adjustment of pre-flight and in-flight meteorological situation; the tactical situation even during the execution; the maneuvers of the enemy forces; the air traffic situation. It must be capable to imitate aircraft failures during the entire flight (from engine start up till its shutting off). During the execution of the given task, in order to have operators' experience in detecting and managing certain instruments, and system failures gained, the Instructor facility must simulate any kind of failures, at any stage of the flight.

Accordingly, the Instructor facility must be able to: set meteorological conditions, imitate failures, adjust visual background during VFR and IFR flights, load navigation data, and simulate communication between air traffic control units and other aircrafts.

SUMMARY:

The object of writing this article was to explore the possibilities of flight simulators used to aid UAV operator's training, to introduce current simulators with their capabilities, limitations, and their possible application areas. I tried to summarize all the expectations toward the UAV simulators which have been my collected upon my pilot training experiences.

Upon my expectations I corroborated that one of the most important and most cost-effective element of the UAV practical training lies in the simulation, their usage is essential to the application of an aircraft with complex systems. Training on them, regarding the flight safety aspects, is inescapable in the period of combat training phase.

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THE BEGINNING OF RADARS IN HUNGARY

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Abstract: *The article reviews of the beginning of radars in Hungary. It gives a general picture of the time between the two World Wars in Hungary, what happened in the country related to this topic. After that the authors analysed the development process of building of radar capabilities in Hungary for WWII including the domestic development and imported systems.*

Keywords: *community, intercultural context, communication*

Introduction

A well- functioning, integrated radar system is too important and specific to be considered simply one of the subordinate elements of the C41SR system. Undoubtedly, it belongs to the major components of the air defence systems, both in our days and in the times of its early-day appearance. Radars became the most important devices of air reconnaissance during WW2. At those times, however, they constituted a part of different observation and reporting services.

Their importance became obvious from their very first use. They managed to alleviate the drawbacks of the traditional reconnaissance means (eyes, ears, binoculars, listening devices) significantly. They possessed much better qualities, although not without problems, for target detection that did not depend on the season, time of the day and the flight altitude, for the timely access of information for the fighter control, as well as for the air defence missile firing.

The development of radars, their production, and their use in battles wasn't limited only to superpowers, and definitely not only to the British system, highly advertised both in literature and films. Besides German, American and Russian locator technology, „smaller" states were also able to show results. The Hungarian Royal Army was a good example during WW2.

The Hungarian Army entered WW2 with serious deficiencies. There were two basic reasons for that. On the one hand, the decisions of the Trianon Peace Agreement, signed after the lost Great War, caused about 10-15 years of impediment in the development of the armament, on the other hand, the economic position of the country could not allow the appearance of a modern army. It is an exaggeration to say that the country had to fight its battles on the technical level of the previous wars. But it was obvious that it struggled with serious lack of equipment. These factors soon came into light during military maneuvers. In our article we are going to describe problems arising in the reconnaissance of enemy aircraft and in their military solutions.

The time b etween the tw o World Wars in Hungary

The Trianon agreement did not prohibit the formation of the observation and report system for Hungary, only the active military forces

connected with it, as well as the use of air defence artillery and air force. In 1920, the Hungarian commanding staff had already started dealing with the question of air defence, as well as with that of reconnaissance and warning.

The country was divided into seven *„Royal military districts"* and district commands (1. Budapest, 2. Székesfehérvér, 3. Szombathely, 4. Kaposvár and after the end of the Serbian occupation, Pécs, 5. Szeged, 6. Debrecen, 7. Miskolc) The Air Defence district was established in the same areas in 1922 and later, in 1924, the seven Air defence areas appeared (I-VII)

The main rules of the observation and reporting services were established as follows:

- Gap-free, many-lined battle formation
- „Coverage" of the country's entire territory
- Combination and deployment of the mobile and immobile sentinels according to their tasks
- Necessary grouping of the forces and equipment to strengthen the effectiveness of air force and air defence
- Conditions and readiness proper for the military, not depending on the time of the year or day
- Timeliness, both in reconnaissance and information, precision (place of service, number of items, flight direction, altitude, activities)
- Organisation of unified, centralised leadership, based on integrated organisation and possibilities
- Based on the district and the setting, from the proper level, information and alarm of the population and the military organisations
- Cooperation between the military units with similar functions, as well as with the civilian defence forces.

The Hungarian radar system in WW2

After Hungary joined the war in 1941 it soon became evident that the observation and reporting services didn't meet the requirements. On March 31, 1942 a reduced air defence readiness was ordered in the country, because it was observed that the front line moved from the borders and Soviet air attacks were not expected. It didn't prove to be the right decision, since there was an air attack against the country on the 4th and later on the 9th of September. In the case of the first one, due to the reduced readiness, the air defence system proved unreliable. It was clear that the expected activities and the defence against them needed a new device: the RADAR.

The Hungarian observation and report system was fully established by the middle of 1943. All air defence centres of the 15th Air Defence Area were operational. In 1944 the exchange of information between all centres and their subunits was automatic. Their staff was comprised of 550 observation and reporting sentries (some of them existed only on „paper" or with deficiency of special and signal equipment.) There was a mobile signal division on readiness with 32 signal sentries, basically for supplement of immobile sentries.

By the beginning of 1940's the completion of air defence tasks became more and more difficult. Due to this fact the effectiveness of the observation and report system, established earlier, became reduced. There was a need to get the information as precisely and early as possible.

To make the reconnaissance system more effective and to keep its operability was practically impossible without a newer, more modern device. The modern air defence practically „demanded„ the radio wireless location system. To perform the tasks well it was necessary to introduce them to the domestic air defence and its units. The classic problem areas of air defence came into light again, such as the question of early reconnaissance provision, the warning system, the continuous, minimally late information, the activation of forces and equipment, their timely deployment, the optimal division of resources for a successful battle.

By this time radiolocation and radars had a significant past, since Heinrich Hertz proved in 1886 that electromagnetic waves reflect from electrically conducted materials.

The research and experiments conducted by the Germans intensified from 1935. The problems of radiolocation and hence the establishment of the „radar" was in the highlight of interest among researchers. In 1937 the „Gema" factory manufactured the FREYA device with its range of 35-40 kilometres. From 1938 the „Telefunken" company started experiments with WÜRZBURG radar family and later they started their production.

In Hungary experiments went on from the 30's. In the labs of the Tungsram dr. Bay Zoltán (1900-1992) (3. Dr. Bay Zoltán was one of the prominent members of the Hungarian science. Before the age of 30, he became a teacher of theoretical physics in Germany. In the University of Szeged he worked as a professor of theoretical physics until 1936 when he was invited to be the leader of the Tungsram laboratory. After the World War he became even more famous in the international scientific life with his experiments, such as the measurement of distance between the earth and the moon by microwave technology, etc.)

There was no production of independent locator yet, so Hungary needed German import and support.

For effective air defence Germany manufactured locators for four different types of tasks, for the air attack warnings, for the fire of the air defence artillery, for fighters fire and as equipment for aircraft (night fighters). We were interested in the whole spectrum of the system, because a unified system of domestic air defence could not function with the lack of any elements. It was probable that the expected activities- the worsening threat of air attacks against Hungary- would increase the importance of the night time fighter activities and the necessity of the effectiveness of the air defence artillery. It was also connected with this problem that the population would be alarmed and informed at the right time.

The Hungarian Royal Military Institute wanted to introduce domestic production and design. In the summer of 1942 the institute proposed to start the experiments. Naturally, the institute didn't refrain from foreign procurements, but they were considered supplementary until self-supply was established. In September the director of the institute reported to the Chief of Staff and the Minister of Defence. He recommended domestic production, independently from Germany. The Minister of Defence, following his personal discussion with Dr. Bay, asked him to work out the theory of radar technology for the Hungarian army and to perform the basic experiments. So the military leadership accepted the proposals and they provided 150000 pengő (Hungarian currency of that time) for the project. This money was distributed among the members of the team which consisted of eight engineers, a physics teacher and about ten technicians, led by Dr. Bay. So there were enough finances for the Hungarian far- distance reconnaissance locator program. (It was based on FREYA type, its design, production and its name was first VIKTOR, then SAS.) The manufacturing of the radar soon started. The production of four pieces was planned and the Ministry of Defence provided 400 000 pengős. Genius professor Bay and his team did an excellent job. Though they had to work with triode transmitting valves- they were familiar with the magnetron and klystron theory- but there was not enough time and money for the domestic production. Even with these obstacles they managed to produce excellent devices. The practical work was performed by dr. Istvánffy Edvin, the director of STANDARD and his team.

In December 1942, with the leadership of Major General Hellebronth Vilmos, a group of

Hungarian specialists travelled to Germany to study locators. The Chief of the Air Force reported the following after his discussions with General Milch:

There were two basic types mentioned which were necessary to deploy:

Search locator „FREYA" (reconnaissance range 120-300 kms)

Air defence fire delivery locator „ little WÜRZBURG„ or „WÜRZBURG- DORA„ (working range about 30 kms)

Fighter detection locator „the big WÜRZBURG„ or „WÜRRBURG- RIESE„ (reconnaissance range 40-75kms)

Fighter instrument „LICHTENSTEIN„ (recce range about 3 kms)

General Hellebronth, besides immediate Hungarian needs (1 piece of FREYA, 2 pieces WÜRZBURG – RIESE and 4 pieces of WÜRZBURG- DORA) announced our further requests, which were 4 pieces of FREYA, 8 pieces of WÜRZBURG-RIESE and 30 pieces WÜRZBURG-DORA, together with the possibility to participate in the production of locators and their parts. Mainly, the Hungarian industry would be capable to produce transmission valves and electric parts.

With the leadership of Colonel Dr. Jáky József, there was a a two-day visit at the „ Luftwaffen – befelfa- haber – Mitte „ firm. His report was not too optimistic. His task was to study the German radio measuring system, its production, and also to choose the necessary types for us, and he gave a more detailed description of the examined locators. The Colonel mentioned in his report that the answers he got to his questions were often evasive or exaggerated or too general. As it turned out later, the parameters of the devices were quite different from those that the Germans gave. More or less, they gave the data found in table number 1.

These numbers were corrected later. The other task of Jáky and his group, besides requesting equipment from General Hellenbronth, was to ask for equipment for domestic training. They were established earlier as 2 pieces of search, 2 pieces of air defence fire delivery and 8-10 pieces fighter detection locators.

It was obvious that the Hungarian requests seemed exaggerated for the Germans who needed all their locators due to the intensifying allied bombings, but if we wanted to obtain an effective recce system, we really needed to get serious quantity of those.

By the beginning of 1943 the Reichslufwehr Ministry accepted an order for 1 search, 2 fighter detection and 4 fire delivery locators. Naturally it did not satisfy the needs of the Hungarian Command and the needs of other specialists. So a decision was made that an independent design and production should be introduced. The work of the Bay team was considered very successful, especially with the search and distance recce locators. The development of the other three types was also necessary. So they decided to strengthen this area as well.

On the 5th of May, 1943 the Minister of Defence tasked Dr. Jáky to lead the establishment and the production of the Hungarian locator. He was subordinated directly to the Deputy Minister of Defence. He was also tasked with involvement of the country's radio industry and electric engineering in the task. The Bay group's deadline of experiments and development was the end of 1943 and the mass production was to start in the following year. He got a definite task to involve, if necessary, other industries, such as the heavy industry and the precision mechanics industry in his work, following agreements with the MoD. He was also responsible for the development, establishment of the signal network of the locator system, as well as supervision and coordination of electronics that remained from the German import. He was also responsible for the supervision of the project's finances. His tasks and authority was widespread, but the complexity and the importance of the task required it. This choice of the person for that task proved to be perfect. Choosing Jáky provided an excellent organiser, a leader who had independent concepts, great knowledge for the development of the Hungarian locator system.

The Bay group prepared the plans for the Hungarian FREYA and its production started in the same year. Experiments with locators for air defence artillery and fighters continued. It was necessary since as it turned out, we couldn't expect any supplies from abroad.

On the 12th of February the German air defence attaché in Budapest informed the 5th division of the MoD that by April 3 the Germans will deliver 3 air defence artillery locators, and by May one search and 2 fighter detection locators for the Hungarian army. There was also an agreement about the training of the necessary staff. In the 1st phase the acquired or manufactured locators were to be used as follows:

Budapest would get 4 FREYAs, Balaton 3, Miskolc 3 Győr 3 , Lispe 1, Szolnok 3 pieces.

For night time fighter missions 5 fighter cells which need 5 FREYAs and 10 WÜRZBURG-FRIESEs

For air defence batteries are 45 WÜRZBURG-DORAs.

In the course of the following developments the entire territory of the country was to be covered with 27-30 FREYAs and they would also provide recce across the borders as well as deployment of further 16 fighter cells (with 1 FREYA and 2 WÜRZBURG-Rs per cell). For the expected air defence batteries further 20 WÜTZBURG-Ds were planned.

In May the Germans gave the Hungarians 3 WÜRZBURG-Ds for the air defence artillery and further 2 in November. The system of locator qualification was prepared, and it was proposed to start the team trial of the three devices that arrived in the spring at the air defence district in Budapest.

The STANDARD Company had already mentioned to the MoD that with their existing capacity they would not be able to to manufacture the necessary devices by 1944/1945. The order of the MoD provided 6 million pengos for 1944 and 10 million for 1945. There was a need for a new factory block and they asked for a loan of about 4 million pengos from the defence cabinet. The factory was planned to be built in the surroundings of Budapest or some other big industrial city. As a necessity for the production, about a thousand workers were hired. The 17/B department of the MoD, following the discussions with Colonel Dr. Jaky in November decided to provide the hall of the bus garage in Kelenfold, together with 2 million pengos as a loan. The deadline of the establishment was the middle of 1944. The MoD accepted the proposal to pay the loan in parts until the end of 1945. They introduced the present state of the production and the expected outcome.

In May and in the beginning of June Colonel Jaky reported to the Commanding Staff about the work he had done in his field of responsibility. The group led by Dr. Bay showed serious results both in preparation in manufacturing and in experimenting. On the one hand, with the construction their production was based on well- known ideas, on the other hand, their production introduced their own independent procedures that were based on their experiments, which caught the attention of the Germans, too. So, for example the reconnaissance range of the SAS was longer than that of the FREYA. On the roof of the building of the Egyesult Izzo they created a new research laboratory and they managed to achieve significant results in the development of cathode ray valves. The productions of both the transmission and reception valves were at a stage of starting their mass production. The productions of the Hungarian designed locators were quick. The „general arraignment" drawing of the BORBALA artillery locator was ready. Colonel Jaky tasked the GANZ and the GAMMA with the mechanical construction.

He thought it possible that the Hungarian industry would be able to produce one piece for the beginning of the next year. The work on the fighter guidance locator BAGOLY was also going well. The BAGOLY and the BORBALA were different only in their mechanical build-up, their electric set-up was almost the same. The biggest difference was in the size of the parabola mirror. Jaky also tasked other Hungarian firms with mechanical work of the fighter guidance locator. This task was given to the WAGON and GEPGYAR in Gyor and the MAVAG. In his opinion the experimental production could have started in August- September. Out of the 4 search, distance recce locators that were ordered at the end of 1942 1 piece was produced by the 1st of July. It was considered an experimental one and they wanted to modify the 3 devices during the undergoing production based on their findings. The SAS was capable for 60 kms of recce distance, but Jaky thought that the distance could be extended to 100 kms and even further. As it turned out later, his prognosis was correct. He expected the next device to be ready by September and the 4th one by the end of the year.

The Gneral Staff insisted to start the design work on the Hungarian radar TURUL to be fitted into fighters. It was done in the PHILIPS factory, but mainly only in theory. In the report it was also mentioned that if they get the necessary support, mainly for factory capacities, then the mass production could be started in the second half of the year. It is true that Colonel Jaky also emphasized that the Hungarian factories, not only the STANDARD but also the industrial units producing mechanical and electric elements, needed to be developed. He considered that very important because in his opinion the Germans established the prices of locators as unrealistically high.

Eventually he informed the General Staff about the possibilities of the Hungarian production (in case his suggestions were accepted) about the expected and necessary German delivery, as well as the expenses in connection with the locators in the following 2 and half years.

The expected expenses were very high, though. For 1943 it meant about 13 and half million pengos with all equipment, supplies, with the locator premises, and by 1944 72 million, by 1945 57 million pengos. Unfortunately, in spite of the existence of the designs and the intentions for the production there were no finances and production capacity. And as it soon turned out there was no sufficient time, either.

By August Col. Jaky prepared the network for instalment of the search and artillery locators for the entire territory of the country, which he coordinated with the Commander of the Air Defence and he presented the plan to the General Staff. In his opinion it was necessary to establish a recce and an artillery system in the country. As a first step he proposed to establish 8 SAS and FREYAs. He recommended installing the search locators in pairs, since a device of this type was able to search in 225 degree radius. So they would be capable to do circular recce from all positions, in the directions of danger even overfolding could be provided. The establishment of a position was quite expensive, it cost about 1 and a half million pengos. In perspective he planned to establish a system that would provide extension of the radio location field over 100 kms, out of the borders of the country. Besides the search devices he recommended to deploy 2-2 pieces of BAGOLY and WURZBURG-Rs because from technical point they did not cost extra (10 000 pengos). He also planned the first phase of the deployment of the artillery fire delivery locators. He recommended deploying 4 locator bases for the Budapest air defence fire system, 2 for Gyor, 2 to Veszprem, 2 to Szolnok, 2 to Miskolc and 2 to Lipse. He also worked out the organisation of the night time fighter guidance system. He needed further 18 plants. For the effective reconnaissance, fire delivery and fighter location he needed 40 air defence radio measuring (LRB) devices.

In September 1943 the second modified version of the SAS locator was ready at STANDARD. On the 2nd of November Jaky reported to the General Staff that there were 2 Hungarian- produced search locators

available. One of them was deployed at Janos Mountain. The locator was experimental, further devices would be modified on its basis. It was also used for training purposes at home. The place of deployment was not a proper one, so Jaky recommended Sari to be the next place. From there SAS was capable to lead the 3 WURZBURG-Ds of the fire systems in Budapest. The Sari plant was ready by December and started its work on the 20th. The second domestically produced locator was designed for night time fighter detection. There was an argument about where to deploy the device. They recommended Csorvanyos, then Felsoerdo, but the General Staff did not support these locations. Then Terecske and Jaszkiser came up as a solution, so taking into consideration the aspect of time the decision was made for the second location. That locator and the plant started to work in the beginning of 1944. The SAS worked perfectly and in good conditions it was able to detect targets in the range of even 500 kms. By the end of the year the „air defence radio measurement artillery/ fighter" plant was in working order (its device was the FREYA from German import) in Dunapentele. Colonel Jaky proposed a „fly in „ of the locator and its deployment from the 1st of December.

The signal network of the plant was also arranged. According to the decision of the General Staff the locator in Dunapentele was also used for long-distance recce, its „switching on „ was allowed only in exceptional situations. For fighter guidance the 2 available WURZBURG-Rs were deployed in the same district. In December the Germans gave the next 2 FREYAs to Hungary.

But by the end of 1943 the plants only in Sari and Dunapentele had worked. In October Colonel Jaky ordered an establishment of a furtherLRB/V plant near Jaszkiser. He wanted to deploy there the SAS, the second Hungarian search and long-distance recce locator for fighter guidance. The production of the Hungarian BORBALA was also in process at STANDARD but the production of the 3 locators stopped with the German occupation. But according to the experiments the locators performed their tasks perfectly, with great mobility, since their equipment was mounted on the 36M air defence cannon. The radars built into fighters and aircraft were only in the phase of design or in the beginning of production. In 1943 the entire domestic air defence observation and warning system got under the authority of „Air Defence Forces Command". By the end of the year the air defence had - though not all devices were deployed - 4 search (two of which were domestically produced SAS), 5 WURZBURG-DORA air defence artillery fire delivery (all German products) and 2 WURZBURG- RIESE fighter guidance (also German) locators. One piece of the search locators was planned to be used for long-distance recce, 2 for fighter guidance, 1 for air defence artillery fire delivery. So the army had a system of devices that could have provided the basis for the establishment of the modern air defence. But the chance was lost due to the events of the war and partially, of the German occupation.

On the 23rd of November both General Zoltan Harmos and Colonel Jaky asked for the extension of the work of the Bay team until the 31st of December 1944. In their opinion, at least one more year was neccessary to continue and end the research, trials and planning. As a result, General Harmos said the following: „ of the 3 locator types we would have our own by 1944". So the industrial capacity is capable to satisfy the need for the production of 300 locators. In his opinion it was impossible to rely on the German import, since they delivered only 6 radars so far. Besides, he also emphasized that the devices

planned and produced by the Bay team, such as the transmitting valve, the reinforcing valve, diode, the low performance vibration valve, cathode ray valve were excellent.

The reason for the extension request was that there were still a lot of unsolved matters. These were the problems in disturbance protection, the friendly aircraft detection system and the wave ranged devices. He emphasized the unique credits of Dr. Bay and since the professor did not accept any payment, not even money for his expenses, he proposed to give him an award.

From the 2nd half of 1943 the Germans started to plan the deployment of many recce and fighter detection locators to Hungary, but for their own purposes. The Hungarian recommendation for common use of these devices was probably not accepted.

After the German occupation on the 19th of March, the Bay team was involved, after working on the development of the Hungarian locator, in the preparation for the mass production of a universal German military microwave valve. Colonel Jaky Jozsef, the genius organiser, lost his life during the air attacks against Hungary.

The Hungarian civilian and military leaders tried to supply the Hungarian military with proper equipment according to the given circumstances and opportunities. This proved to be successful. It was only in the middle of the next decade that Hungary and its army had the chance to obtain excellent equipment like this.

Conclusion

It would also be useful in our days if the „small states „ paid more attention to this system of organisation and equipment so effective for security. Even though there is little chance for a traditional war in Europe, but the events of 9/11 demonstrated that there are new dimensions of air threats.

Hungary and the Hungarian defence forces must have the following systems for the proper security and defence:

1. A basic radar system that continuously provides the minimally needed coverage. This can be achieved by the deployment and usage of 3 high performance NATO radars.
2. A mobile radar system. With its help it would be possible to extend the radio location area in a given direction, with given requirements.
3. The most critical part of the system is the lack of air reconnaissance. The Hungarian Defence Forces do not possess their own satellite system; there are no AWACS, not even „balloon" radar. The fulfilment of these necessities is not expected in the near future.
4. The database of the civilian air traffic control has been used but the recce of the air combat equipment cannot be based on a secondary system whose identification capability, disturbance defence is highly limited from the military point of view, not to mention the fixed location (Korishegy, Puspokladany, Ferihegy)
5. The HDF has the command point and the system necessary for the data collection, processing and forwarding of the above-mentioned elements. Continuous modernisation is necessary in this area as well.

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THE ROLE OF THE HUMAN FACTOR IN MAINTAINING THE DESIRED LEVEL OF AIR MISSION EXECUTION SAFETY

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Key words: *human factor, aviation safety, situational avareness*

INTRODUCTION

Flight safety is neither the objective nor is it the task of aviation. Flight safety is a condition in which all planned objectives are realized, while at the same time potential hazards that could affect the course of their realization are kept under control. The role of the "human factor" in the aviation safety system has been known for a long time. It was also the subject of studies in many research centers, but only in the late twentieth century, was that research given the appropriate importance. Today we recognize that the "human factor" has been "institutionalized".

THE CONCEPT OF SAFETY IN AVIATION

Aviation is a special type of human activity, which is the fulfillment of man's age-old dream of the conquest of the skies. With time, dreams of the pleasure of soaring in the skies turned into a desire to use the aircraft as a tool to do more practical, commercial tasks. Quite soon it became clear that that activity is accompanied by a number of risks[1] that contribute to undesirable flight-related events. That phenomenon is exacerbated when safety standards in aviation are violated, regardless of who, with how vast experience, and flying what type of aircraft, is executing an air mission. Risks in aviation varied depending on the stage of aviation development. By the early 1950s, causes of undesirable flight-related events[2] were associated first of all with technical factors[3]. On one hand, aviation was seen as a very effective tool in the battle field, but on the other hand the importance of the aircraft as an extremely important element of the transportation industry was constantly growing. Low level of aviation technology, compared with the present day, low strength of materials used in aviation and too frequently repeated design flaws were key factors influencing the level of flight safety. That situation caused the research in the areas of aviation safety to focus on the improvement of technical factors. In reference publications, that period is referred to as the "technological age". However, one should not be confused by this name, because, according to the author, even at that time an important role was already

[1] At the time of World War I losses caused by air accidents reached 72%–83%, and during World War II and the Korean War reached the level of 52–55% – H. Michałowski, *Wysoki poziom bezpieczeństwa lotów podstawowym warunkiem gotowości bojowej lotnictwa*, Wyd. CW, Warszawa 1973, WPL N° 3/73, p. 3.

[2] For the purpose of this publication it is assumed that the term "undesirable flight-related event" refers to air accidents and incidents described in Article 134, *Polish Aviation Law Act* of 03 July, 2002 (Journal of Laws from 2006, No. 100, item 696, as amended) and § 20 of the *Flight Safety Instruction of the Polish Armed Forces*, WLOP, Warszawa 2004,WLOP 346/2004

[3] Developed on the basis of – ICAO, *Safety Management Manual*, Doc. 9859-AN/474, ULC, Warszawa 2009, Second Edition, pp. 2-2 – 2-5.

given to the significance of man in the system of aviation safety and to appropriate preparation of man to executing air missions. The evidence of that is the importance that was attached to the development of aviation subjects – navigation, aerodynamics, flight mechanics, etc., and techniques used in the training and professional development of flight crews as well as to the tools used in that process – flight training devices. Technical factor did not always come first in preventive actions taken in response to undesirable flight-related events.[4] The 1970s brought about significant advances in technology and materials used in aircraft construction. With the progress in aviation old threats were replaced by others, as a consequence of the introduction of new, often revolutionary, design solutions. Examples of such risks, can be found – among other things – in the causes of undesirable flight-related events connected with aircraft automation[5], or in the increased maneuverability of combat aircraft resulting in a high incidence of high G-loads which affect the operator – the pilot of the aircraft[6]. Steady progress in the development of aviation technology meant that increasingly sophisticated designs were put at man's disposal, which meant that ever greater demands were to be met by operators and support personnel. On the other hand, those designs were characterized by larger and larger spatial-temporal, technical and functional capabilities. This meant the beginning of the era referred to as the "human factor". The focus in the areas of aviation safety was moved to the human factor and the associated human activities, including, i.a., crew resource management, line-oriented flight training, operating highly automated aircraft, which was oriented on man and the role of other aviation personnel in the preparation and implementation of flight tasks. Unfortunately, despite large-scale efforts to reduce human errors, human factor was still the "weakest link" of the aviation system. The reasons for this state of affairs was sought in the fact that too much attention was given to individual actions of the pilot and other aviation personnel, leaving in the background broadly understood mission environment and its impact on aviation safety. In the early 1990s, these findings led to the initiation the era of "organizational factor", which put special emphasis on issues related to the manner in which mission environment – organizational, environmental, and task-related factors, [7] etc., can affect the safety and

[4]After the introduction of jet aircraft, the Headquarters of the Royal Air Force (RAF) was forced to take action to counteract the causes of a series of accidents resulting in the deaths of dozens of pilots. Those actions were aimed primarily at improving the elements related to the human factor, and consisted in: reduction of aircraft type number flown by a single pilot; supervision of the training process in the air force units by experienced pilots (required flying time of unit commanders – min. 400 hours on jet aircraft); putting a large emphasis on flying personnel's knowledge of aircraft design, operating principles and piloting techniques; emphasizing the need to abide by the principles of operation – procedures – related to aircraft equipment; obliging pilots to do 5 simulated flameout trainings a year; putting particular emphasis on the use of flight training devices in training – Developed on the basis of: K.S. Sulikowski, W. G. Kowalski, M. Żebrowski, *Wypadki w lotnictwie wojskowym i cywilnym*, (in) K. Klukowski (Ed.), *Medycyna wypadków lotniczych*, PZWL, Warszawa 2005, pp. 177-185.

[5] DC-10 Air New Zealand collided with Mount Erebus, 1981 – the crew entered incorrect data to the navigation system of the aircraft; B-747 Chine Airlines, Pacific, 1985 – gradual loss of power in number four engine, autopilot trying to maintain a prescribed heading and altitude led to the stalling of the aircraft. Airbus A320 Lufthansa, 1993 – computer interference in the decisions of the pilots.

[6] In 1986 – 1996, the cause of 14 air accidents in the U.S. Air Force was attributed to exceeding the allowable G-load– J. Auten, *GLOC...is the clue bag half full or half empty?*, Flying Safety, June 1996, p. 6.

[7] When speaking of the mission environment, the author has in mind two of its main areas:

1. Internal environment – the aircraft – degree of automation, aerodynamic properties, maneuverability, degree of standardization, ergonomics, warning systems (e.g.. TCAS, stall warning in the event of exceeding the critical angle of attack), the availability of maintenance, reliability, ease of piloting, etc.; pilot (crew) – selection, health condition, personality and professional qualities, resistance to stress, level of training, level of communication, teamwork, experience, continuous specialized training, motivation, etc.

2. External environment – environmental conditions (weather, altitude, terrain features, etc.) as well as services and means of securing the implementation of

the effective implementation of air operations. It should be noted that regardless of the stage of aviation development, all of the above-mentioned safety factors (human, technical, organizational) were taken into consideration, to a greater or lesser extent, in the investigation of the causes of undesirable flight-related events and in the development of preventive measures. Despite making extensive efforts to reduce the impact of the above-mentioned factors on the occurrence of undesirable flight-related events, those factors are still the main cause of them. Therefore, contemporary theories of aviation safety deal with issues related to aviation safety (broadly understood) through the prism of the above-mentioned factors (Fig. 1).

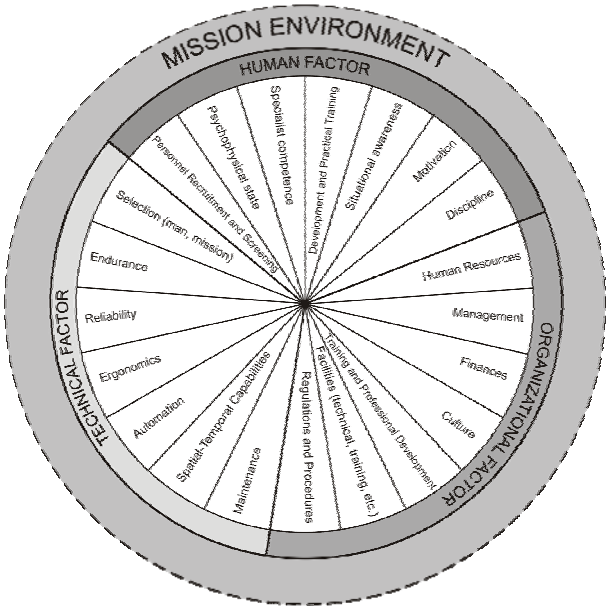

Fig. 1. The approach to the theory of aviation safety from the point of view of safety factors. Author's own work, developed on the basis of: Op. cit. ICAO, *Safety Management Manual* ... , p. 2-4; *Model systemowego ujęcia problemów bezpieczeństwa wg Łomonowa i Płatonowa,* (in:) E. Klich, J. Szczygieł, *Bezpieczeństwo lotów w transporcie lotniczym*, PIB, Radom 2010, p. 50 and the results of the author's own studies.

When discussing the essential safety factors in the context of determining the level of air mission safety, we must always subject them to analysis from the point of view of internal interactions taking place between the components of each factor as well as the external interactions that occur between particular safety factors. The higher the level of compliance of the interactions concerning the safety factors and their individual components with the nature of the tasks performed, the less "problems" will be encountered in their mutual relations – interactions, and thus the higher the level of air mission safety will be. Confirmation of this view is also found in generally accepted theories of safety, including, i.a. in C.O. Miller's 5M model,[8] Edwards and Hawkins's SHELL model, or J. Reason's model[9].

The concept of safety in aviation can have different connotations, i.e. it may refer to absence of air accidents, reduction of threats to air operations or elimination of errors committed during their execution. Regardless of the connotation taken into account, the

air operations – maintenance services, air traffic control services, radio navigation assets, airports, etc.

[8] Initially, that model was named 4M and contained four elements: Man – Machine – Medium – Management. It was then extended to the 5M Model by isolating the fifth element, Mission (task), from the already existing elements.

[9] More details can be found in: J. Kozuba, *Impact of human factor on likehood of aircraft accident*, TRANSPORT SYSTEMS TELEMATICS – TST-11, Katowice 2011, pp. 29-36; J. Kozuba, *Czynnik ludzki – rola symulatora lotniczego w szkoleniu lotniczym*, Poznań 2011, Logistyka Nr 6/2011, pp. 1817-1829.

aircraft operator [10] as well as technical and navigation personnel have to meet one condition necessary from the perspective of aviation safety, i.e. they have to gain control over all elements of the mission which are within their competence, in order to achieve the desired level of safety during the preparation and execution of air missions. Past experience has shown that the ideal situation should be such, when the tools at the disposal of aviation organization managers allow them to identify all the variables that can lead to undesirable flight-related events. Gaining total control over the factors bringing about undesirable flight-related events would be highly likely owing to eliminating such events or minimizing their impact by taking actions commensurate to the expected or perceived threat (risk group). However, because of the fact that the environment of air mission preparation and execution is open and dynamically changing, this goal is impossible to achieve in practice. Therefore, today's safety in aviation can be seen through the degree of adapting these undesirable variables, which accompany the execution of air missions, to the mission environment.

The experience in various areas of aviation safety seems to confirm the view that "no human activity or man-made system is guaranteed to be completely free from internal threats, operational errors and violations"[11]. In light of the above, it is essential to use even the most unpleasant experience from undesirable flight-related events in daily implementation of preventive activities concerning aviation safety. It should be emphasized that each undesirable flight-related event, despite a number of similarities to past events, should be treated on a par with undesirable flight-related events previously unheard of, and the lessons to be learned from it should be widely publicized. In summary, undesirable flight-related events have occurred, are occurring, and will occur in the future, regardless of the scale of the efforts made by aviation organizations to prevent them. Therefore, the main objective of activities carried out in the areas of aviation safety should be to minimize the probability of undesirable flight-related events, and when they occur, the supreme objective should be to minimize the negative effects associated with them.

Taking into account the conclusions of the foregoing considerations, safety in aviation should be treated as a concept that fits more to the theory of probability rather than to the theory of certainty, according to which an increasing threat to safety is a consequence of risks that are necessary to be accepted in the environment of preparation and execution of air missions. Therefore, the quality, and thus the safety of air mission execution largely depends on the style of management and the effectiveness of the two main systems implemented in the operation of aviation organizations, i.e the Safety Management System (SMS) [12] and the Quality Management

[10] In this publication, the author uses alternately the terms pilot, pilot-operator, operator of the aircraft, and (air)crew to refer to one- or multi-person crew responsible for managing the aircraft.

[11] Operational errors are defined as acts or omissions having a direct negative impact on an air mission being executed. They are usually regarded in retrospect as dangerous activities. Operational errors are usually associated with the first line of aviation personnel – pilots, air traffic controllers, engineers, aircraft technicians, etc., and they may lead to undesirable flight-related events. The first line of the air personnel has the potential to break through the so-called first line of defense created by aviation organizations, in order to maintain the desired level of safety during air operations. Errors committed by aviation personnel can be the result of "inadvertent" activities leading to the risks in the areas connected with air missions execution – normal errors, or the result of conscious actions involving violations of the rules and procedures of aviation law – violations. Most result from operational procedures which are defective or incompatible to the reality and which allow air personnel to make attempts to override them, usually in order to accomplish the air mission objective. They are divided into routine, which in time become a "normal" way to execute air missions, and situational, which occur in specific situations favorable for violating the existing rules and procedures (time constraints, a large number of steps to complete, external conditions, etc.). Developed on the basis of: Op. cit. ICAO, *Safety Management Manual …*, pp. 2-5; A.S. Kolman, *Human Performance & Limitations*, KLM Flight Academy 2010, pp. 9-1 – 9-6.

[12] SMS – Safety Management System of an aviation organization assumes that safety is a priority in the activities carried out by aviation organizations. SMS

System (QMS) [13]. As long as undesirable flight-related events within a given aviation organization occur at an acceptable level, i.e., they are not arousing a sense of danger to users of air equipment, aviation will be regarded as safe, regardless of the type and the application of aircraft involved. Thus, technical failures and operational errors occurring at an acceptable rate will be tolerated by the safety systems of aviation organizations.

Due to the complexity and high degree of openness, there are different approaches to defining aviation safety. J. Lewitowicz [14] defined safety in aviation by analyzing the relationship of air system components, M-AC-ME[15], and described it as "a set of characteristics of the system, which includes aircraft, ground control and navigation assets, air traffic control, flight crew and ground personnel who support and provide airworthiness of an aircraft, in order to prevent any situation of emergency, to protect the persons involved in the flight from potential damage and to ensure their rescue in the event of equipment failures, errors of the flight crew or ground services, as well as in cases of adverse external influences". Roland and Moriarty on the other hand, taking into account the system theory claim that"safety of the system can be defined as the property that allows the system to function with predefined specific risk factors which are characterized by an acceptable level of probability of occurrence." J. F. Federer expressed the opinion that the safety of a system is the "creation of an assessment of the organization from the temporal perspective, based on risk identification and management".[16] In conclusion, aviation safety can be defined as a condition in which the probability of an undesirable flight-related event is reduced and maintained at or above the acceptable level of risk through implementation of a continuous process of identifying hazards and managing their level in the areas related to the preparation and execution of air missions.[17]

Undesirable flight-related events constitute a factor that has negatively affected the development of aviation since the first time when such an event occurred. On the other hand, they are an element that should be considered as a motivation to introduce new solutions. These activities should be carried out in all areas related to the theory and practice of flight safety regarding basic elements of the aviation system, man – aircraft – environment, in order to avoid similar incidents in the future.

regarded as a process is based on eight key elements: organization management commitment to the problem of safety management; effective safety reporting system; continuous monitoring; careful study of undesirable flight-related events; promoting safety awareness and experience in the field of aviation safety; integration of security training in for operational personnel; effective implementation of standard operating procedures SOPs); continuous development of the organization and its members in the areas of safety. Op. cit., ICAO, *Safety Management Manual ...,* pp. 3-9 – 3-15.

[13] QMS – Quality Management System of an aviation organization is based on the integral structures of organized quality control in each organization and on specific regulations– FTO – PART –FCL1 (FCL2), MTO – Part-147, MO – Part – 66 etc. Op. cit. ICAO, *SMS – Safety Management Manual ...*, pp. 7-8 – 7-10

[14] J. Lewitowicz, *Podstawy eksploatacji statków powietrznych, vol. 3 – Systemy eksploatacji statków powietrznych,* ITWL, Warszawa 2006, p. 264.

[15] M – man, AC – aircraft, ME – air mission environment

[16]The SMS project team of the Air Line Pilots Association, International, *Background and Fundamentals of the Safety Management System (SMS) for Aviation Operations,* Second Edition, February 2006, p.10.

[17]Op. cit., ICAO, *Safety Management Manual ...,* p.2-2

Currently, safety in aviation is increasingly seen as an outcome of managing the major processes implemented by an aviation organization, whose aim is to achieve and maintain the desired level of safety resulting from threats in the operational context. Previous experience in aviation and analyses of air accident reports clearly show that man is still the most unreliable element of the aviation system. That is why so much attention is paid to the human factor in all areas of aviation safety.

HUMAN FACTOR – THE CONCEPT AND THE IMPORTANCE TO FLIGHT SAFETY

According to the Polish Ergonomics Society, ergonomics is the applied science whose object is the optimum adaptation of tools, machinery, equipment, technology, organization, physical work environment and consumer items to the requirements and needs of physiological, psychological, and social needs of man.[18] In other words, projects created with taking into account the principles of ergonomics help to maintain prescribed standards of health and safety of workers. Ergonomics is the term preferred in European countries, Australia and New Zealand. The Americans, however, preferred to use the term "human factor" for the same concept. Currently, these concepts are used by the Americans alternately. In Europe, the concept of "human factor" is used more liberally, and is applicable to all human-related factors affecting the preparation and execution of all kinds of tasks by man. This term includes also issues related to areas such as ergonomics, psychology, environment, etc. Therefore, in relation to aviation, ergonomics is often treated as a sub-discipline of areas related to the human factor, with the exception of those related to the design.

In the basic model of ergonomics, Man - Machine - Environment, man plays a key role in all phases of the "life" of the machine (e.g. aircraft) through exerting an influence on it, i.e. the human factor. It is assumed that that role can be positive, but it can also be negative as it may, e.g. bring about undesirable flight-related events, as a result of negative action or of the lack of such an action which is considered to be positive (including remedial action) in a given situation connected with mission execution. Man may also find himself in a situation where he will not be able to counteract emerging threats, by opposing their predicted consequences. The reason for this may be, among other things: time deficit, lack of skills, lack of knowledge or insufficient availability of resources to cope with the evolving situation threatening the mission execution safety (technical failure, error in handling, error in design, etc.). Thus, the concept of the human factor should be seen in the relationship between the human operator (pilot, air traffic controller, aircraft technician, etc.), and other areas relevant to the operation of machines (aircraft).

A similar approach to the concept of "human factor" is presented by the International Civil Aviation Organization (ICAO). ICAO documents claim that the concept of "human factor" is so broad that it is difficult to be clearly defined. It is treated from a multidisciplinary perspective and its main focus is on the interactions that occur between members of air organizations – the people and the environment they live and work in, and delivering solutions for good fit of man to the environment. In the multidisciplinary approach "human factor" is recognized as a source of knowledge from a wide range of scientific disciplines, such as psychology, physiology, anthropometry, biomechanics, biology, chronobiology, design, statistics, etc. Ergonomics is a term which is often used instead of the term "human factor", but only with regard to the relationship between human beings and technology.[19]

A widely recognized model, which facilitates a deeper understanding of the "human factor", used for illustrating the interactions between man and the elements of

[18] Developed on the basis of: http://ergonomia.ioz.pwr.wroc.pl/klasyczna-ergonomia-definicje.php, 25th April, 2011

[19] Developed on the basis of: http://aviationknowledge.wikidot.com/aviation:icao-human-factors, 17th March, 2011

the aviation system in the organizational and operational context, is known as the SHELL model (Fig. 2). The SHEL model was originally developed and described by Edwards in 1972, and it was later supplemented by the second element of L by Hawkins in 1975, since when it has been referred to as SHELL. Man-operator (L_1) is not as predictable and reliable as certified devices present in aviation work environment due to the fact that as a human being he has certain capabilities and limitations. Therefore, this model refers to the interaction between the central element of L_1, and the rest of its components, i.e. S,H,E and L_2[20]. It does not refer, however, to interactions outside the areas directly related to the human factor, i.e. S-H, S-E and H-E. Man, being in the center of the model (L_1), is an element susceptible to adaptation to the surrounding environment, which includes legal-procedural and training (S) environment, technical (H) environment, work environment (widely understood) (E), and the personnel of an aviation organization (L_2). Therefore, the considerations concern, on one hand, the possibility of adapting the above-mentioned elements of the model to the human being (design stage), and, on the other hand, the possibility of adapting the human being to the elements of the model (design, implementation and operation stage). A gap between man and the other four elements of the model – in the interactions taking place – usually leads to human error during the preparation or execution of air operations.

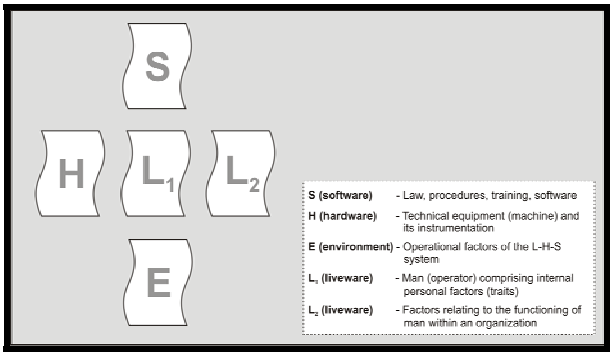

Fig. 2. SHEL(L) model. Author's own work, developed on the basis of: Op. cit. *Safety Management Manual* …, p.2-13.

Taking into consideration the above, the relationships between the individual elements of the SHELL model are as follows:

1. Man – Machine (L_1-H). This relationship is one of the most widely examined issues related to the working environment of an air personnel member. For example, when designing a pilot's seat the designers must take into account the characteristics resulting from the construction of the human body, and when designing an instrument panel monitor or a dial of a cockpit instrument they have to match the characteristics of sensors with perception and information processing capabilities of a human being by using coding system, type, size and color of the markings, etc that are the most appropriate in terms of ergonomics. In the case of instruments (monitors), no less important than the visualization of information is the location of data sources on the dashboard, taking into account optimization factors from the perspective of the deployment of other instruments and equipment in the aircraft cockpit. The operating parameters and the arrangement of all instruments and indicators
in the cockpit should be based on the characteristics of adaptation resulting from the

[20]For the purpose of this work, in order to better distinguish between the elements of the model, for the elements marked with the letter L, the following notation was used: L_1 – man (operator), L_2 – factor relating to the function of man within an organization.

nature of man (construction, capability of perception and information processing in a complex work environment, etc.), and thus minimize the risk of erroneous instrument reading or an incorrect interpretation thereof by the pilot. A pilot-operator who meets the criteria set out in the relevant aviation legislation (health, knowledge, skills, flight experience, etc.), and who takes into account the experience of the past operation of technical equipment such as aircraft, should not worry about the effects of the interactions taking place between L_1-H. Adaptive capacity based on his experience, knowledge, skills, and general human nature should allow such a pilot to optimize the system L_1-H, and, consequently, to neutralize any deficiencies which were impossible to anticipate in the earlier stages of the development of technical equipment (e.g. aircraft).

2. Man – Law, Procedures, Computer Control and Management Software, etc. (L_1-S). This interaction includes the relationships between man and the supporting systems in the workplace, such as regulations, operating instructions, documentation defining or implementing maintenance activities, particular in-flight events, standard operating procedures (SOPs), trainings and supporting computer programs, etc. These relationships concern the ease of use and the uniqueness of the above-mentioned elements. This is possible when they are characterized by: universality, accuracy, clarity of visualization / transmission, specialist vocabulary, clarity, and standard symbols. This means that specialized terminology which should be used in information transmission should not be ambiguous, confusing or too complicated. Specialized software used in aviation should be structured in such a way as not to become a challenge to the operator who has average skills in programming and software use. At the same time, the information they send should be clear, legible and should meet the requirements of the certification standards for machines, equipment, instruments, etc., used in aviation. The term "procedures", in this case, refers to the personnel's theoretical and practical knowledge concerning the operating procedures and the accuracy of their implementation, including knowledge of emergency situations and how to counteract them, adherence to air traffic regulations and airport procedures, as well as procedures relating to pre- and post-flight activities. The term "training" refers to the compliance with clearly defined procedures and training programs, as well as to the use and operation of modern training tools (flight training devices, e-learning) and the current regulations, specialized instruction manuals and guides. Experienced instructional personnel having wide range of expertise still remains an important element of the training. Moreover, the training facilities being at the disposal of the aviation organization should allow the prevention of operational errors by facilitating continuing self-education of air personnel.

3. Man – Environment (L_1-E). This relationship refers to the interactions between man and the internal and external environment of his activities. Internal work environment of air personnel includes such elements as: temperature, ambient light, noise, and vibration. External work environment of air personnel includes such elements as: visibility, weather conditions (rain, turbulence, icing, wind shear) and the height of land above sea level. It should be noted that all elements characterizing the external and internal work environment of air personnel have a high level of volatility and unpredictability, also in relation to the normal biological rhythm (time of day, time of year). Furthermore, aviation personnel carries out operational tasks in a given organizational environment, vulnerable to economic change, which in turn can have a great impact on the environmental elements of the organization such as technical equipment, support infrastructure (training, technical, social, etc.), the financial position of the company and its employees and thus significantly affect maintenance of the desired safety level of missions executed by the members of the organization.

4. Man – Organization (L_1-L_2). $L_1 – L_2$ interface is seen through the interactions between the members of the organization in the work environment, with particular regard to the interaction operator – management

personnel. These relations are seen through the prism of the organization of work, the prevailing relations between people at different levels and areas of management and their understanding of safety issues. Training of air and support personnel, especially in the early stages of their gaining professional ratings, is carried out in relation to the individual, not the crew (team). Many years of experience have shown that the lack of understanding and inadequate teamwork skills in the crew were the cause of a number of undesirable flight-related events, despite the highest level of specialized knowledge and skills presented by individual crew members. The authors of the SHELL model suggested specific strategies aimed at preventing and eliminating operational errors committed by the team (crew). In the early 1990s, those strategies were defined as CRM (Crew Resource Management) for air personnel, TRM (Team Resource Management) for operational staff of air traffic services (ATS), and MRM (Maintenance Resource Management) for maintenance personnel[21]. Implementing effective training programs for flight crew training, operational teams of air traffic services and technical services in order to prepare them to better cooperation and communication should result in a significant reduction in the probability of committing errors concerning the $L_1 – L_2$ relationship.

Conclusions from the analysis of the interaction between the human operator, and the other elements of the $SHEL_1L_2$ model , show that the maintenance of an acceptable level of safety in the preparation and execution of air operations will be subject to fulfillment of i.a. the following conditions:

- When designing the aircraft, the designer should take into consideration a number of ergonomic factors.The pilot-operator should meet high standards concerning health, knowledge and skills (L_1-H).
- Every aviation organization should have flight training facilities which would allow adequate preparation of its personnel to carry out the their tasks. It should also have such equipment that may be defined as "friendly" to the operator (L_1-S).
- The personnel of the organization shall be prepared to respond to the challenges arising from the specific work environment in such a way as to take into consideration: existing standards and procedures, optimum disposition of available funds, and elements having a significant impact on safety ($L_1 – E$).
- Members of flight crews, air traffic control services and maintenance services should be adequately prepared to work in a crew/team (L_1-L_2).

In summary, the human factor refers to the human being in the environment of his work and life, to the interactions between him, machines, and air mission environment as well as to the relationships between particular members of an aviation organization in their work environment. In aviation, the term human factor is also used in relation to

[21] CRM as MRM emphasizes the team approach to reducing human error through application of certain rules to improve communication, situational awareness, problem solving, decision making and teamwork. In contrast to the traditional orders and top-down hierarchical safety programs, it supports decentralized approach to safety. In MRM teams are encouraged to communicate in order to avoid operational risk regardless of rank and position of particular team members, thus enabling rapid response to crises. However, the objectives of TRM come down to the optimum use of all available resources – people, equipment and information – in order to optimize the safety and the effectiveness of air traffic services activities.

seeking ways to adapt the human being characterized by his abilities and limitations – personal, medical, biological, etc. – to carry out specific tasks using specific aircraft dedicated to these tasks. Taking into account the above considerations, it can be argued that air mission execution safety depends on the adaptation of the pilot to operate under certain technical (aircraft) or environmental (aviation organization and mission environment) conditions . Thus, the degree of adaptation of the pilot for the air tasks in which he is engaged under certain conditions can be considered as a measure of the probability of undesirable flight-related events, and, what it involves, the measure of aviation safety.

HUMAN FACTOR AND UNDESIRABLE FLIGHT-RELATED EVENTS

Z. Baranowski, when considering the relationship of the human factor and the undesirable flight-related event[22], highlights the inadequacy of the actions taken by operators – pilots and other aviation personnel who remained in close connection with flights, their organization and safety, to the situation that occurred in a certain phase of flight. Such action usually leads to an undesirable flight-related event. That situation occurs if threats caused by factors independent from human control were not, despite the real possibilities, removed, or reduced to an acceptable level. Every action is the result of a particular decision and the related decision-making process. The factor that conditions the occurrence of an undesirable flight-related event is usually the occurrence of several consecutive errors in the system of directing (management) an aviation organization, errors in handling the aircraft or in air traffic control and / or operational errors committed by the air crew. The causes of erroneous decisions made by the pilot-operator are sought for at various stages of investigation whose aim is to discover them, taking into account the particularly complex characteristics of the aviation system and its environment. Therefore, when discussing the causes of undesirable flight-related events, errors committed by the crew of the aircraft at various stages of the decision making and implementation process are generally regarded as the key factor bringing about more or less serious consequences.

The history of air accidents is as old as the aircraft. The first air accidentoccurred during the flight of Orville Wright with Lieutenant Thomas Selfridge, U.S. Artillery, on 7th September, 1908 in Fort Myer, California. According to the statistics of the Geneva-based Aircraft Crashes Record Office, in the years 1905 – 2010 129,920 people were killed in 19,908 air accidents around the world.[23] The main causes of these events were classified into three main groups, namely: human error – 68%, technical failure – 22%, and other (sabotage, bird strike, unexplained, etc.) – 10% (Fig.3).

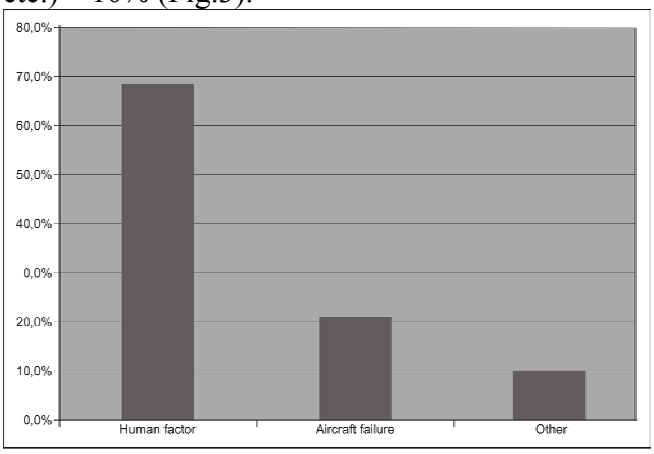

Fig. 3. Causes of air accidents between 1905 – 2010. Source: Author's own work, developed on the basis of: Aviation Crash Statistic – http://www.baaa-acro.com/statistics.html, 20th November, 2011r.

The Boeing Aircraft Company while adopting a more detailed breakdown of the main causes of air accidents also points to the flight crew error (55%) as a major cause of 183 accidents which occurred in 1996-2005. It should also be noted that operating errors (4%), air traffic services errors (6%) or aeronautical communications errors / incomprehension (8%) can also be included in

[22] R. Błoszczyński, *Psychologia lotnicza – wybrane problemy*, BWW Warszawa 1976, p. 472.

[23] Aviation Cash Statistic – http://www.baaa-acro.com/statistics.html, 20th November, 2011r.This statistic does not include general aviation aircraft accidents. In the military aircraft category only transport aircraft have been taken into account.

the flight crew error category (55%), which indicates that the major cause of about 73% of the analyzed aviation accidents involving transport aircraft was the human factor. The cause of the remaining 27% of the undesirable flight-related events was weather conditions and aircraft failures (Fig.4).

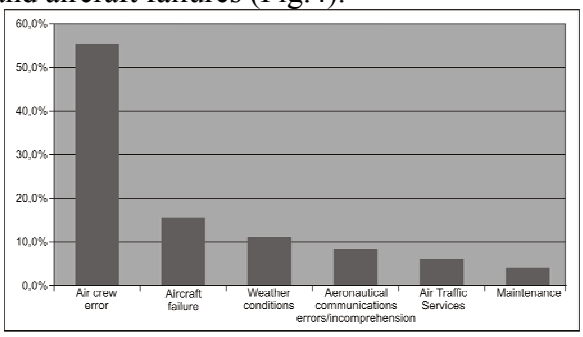

Fig.4. Causes of air accidents of Boeing transport aircraft between 1996–2005. Author's own work, developed on the basis of: N. Ehsan, K. Rafique, „Probable cause factors in UAV accidents based on human factor analysis and classification system" p. 1., Proceedings of 27th International Congress of the Aeronautical Sciences – ICAS 2010.

The results of the analysis of air accidents that occurred in the Polish Armed Forces, in the years 1946–2003 show that 71% of them were caused by human errors (crew, maintenance personnel, flight management services), 16% by the aircraft failure, and the remaining 13% by other factors, such as weather conditions (Fig. 5).

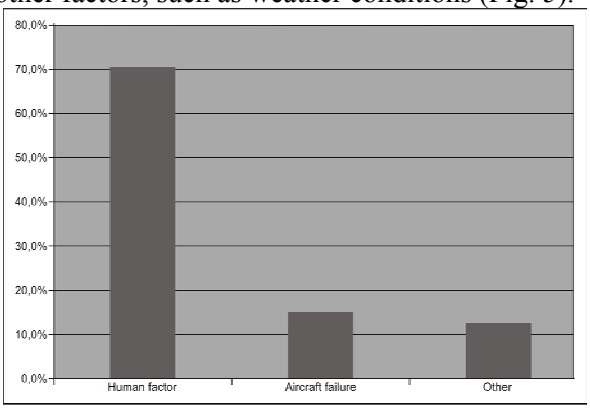

Fig. 5. Causes of air accidents[24] in the Polish Armed Forces between 1946–2003. Author's own work, developed on the basis of: J. Zieliński (Ed.), „Pamięci lotników wojskowych 1945-2003", Dom Wydawniczy Bellona, Warszawa 2003, pp. 177-462.

In the case of the U.S. general aviation in the years 2000–2009 values describing the main causes of air accidents differ only slightly from those shown in the charts above. Of the total number of 2,799 accidents, the cause of 75% was the human error, 10% the aircraft failure, and the remaining 15% other causes (Fig. 6).[25]

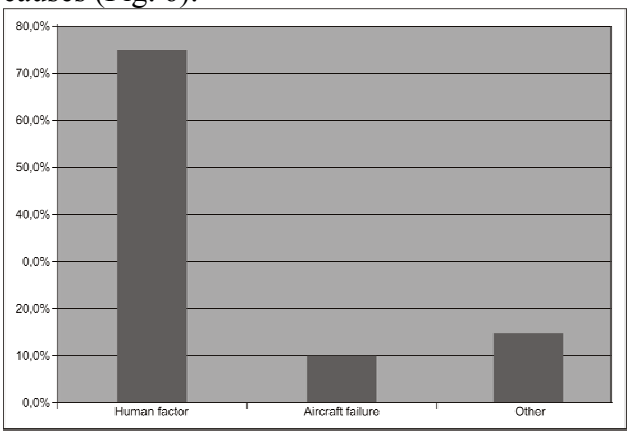

Fig.6. Causes of air accidents in U.S. general aviation between 2000–2009. Author's own work, developed on the basis of: "NALL Reports– AOPA Aviation Safety Foundation, 2001 – 2010".

[24] air accident – according to § 20 *Flight Safety Instruction of the Polish Armed Forces,* MON, Warszawa 2004,WLOP 346/2004**,** An accident means an occurrence associated with the operation of an aircraft, which takes place from the time any person boards the aircraft with the intention of flight until such time as all persons on board have disembarked, and in which any person suffers at least serious injury or the aircraft sustains damage and/or structural failure, or the aircraft is missing, and the official search has been called off, or the aircraft is completely inaccessible. Air accidents are categorized as accidents (W_C) and serious incidents $W_{(L)}$.

[25] "NALL Reports – AOPA Aviation Safety Foundation, 2001 – 2010".

The results of above analyzes of air accidents clearly show that – regardless of the type of aviation, aircraft type, nationality of the aircraft, and the time period taken into account in the analysis – it is man, described from the perspective of the human factor, who is the cause of approximately 70% of events of this type in aviation. In the context of those analyses it is particularly important to apply the appropriate accident investigation methodology, draw appropriate conclusions and take consistent preventive actions aimed at preventing the occurrence of similar undesirable flight-related events.

What lies at the root of this situation? The complexity of the tasks performed during the preparation and execution of air missions makes it clear that it is not possible to give a definite answer to such a question.

A broader analysis of accident reports[26]lead to the conclusion that the pilot not always has the right "tools" (specialized knowledge, skills, flying currency, experience, etc.) to properly perform the role assigned to him in the cockpit. In general, pilots are trained to perform specific tasks in specific environments. An exception is the preparation of the pilot to deal with common emergency situations, which result from previous experience gathered from operating a given aircraft type – engine failure, the failure of the landing gear extension subsystem, etc. This results in, among other things, the fact that pilots are not able to effectively identify a number safety hazard symptoms during air mission execution and the point at which they begin to perceive them comes too late to take effective preventive measures against undesirable flight-related events.

Another reason for this may be the fact that it is more and more difficult for pilots to achieve the desired level of adaptation to rapidly evolving aviation technology, including the ever increasing degree of automation. The factor that intensifies that state is the level of the pilot work load in different stages of air mission execution, which is particularly important in maintaining the desired level of situational awareness. The term mental workload refers to the relationship between the total mind's capacity of the pilot, determined by his ability to process information which he is able to assimilate within a specific period of time, and the requirements of the task that he has to perform.[27]

On the other hand, R.M. Yerkes and J.D. Dodson understand the term "workload" as the outcome relating to varying relationships between the performance of ongoing operations by the operator under standard conditions of the mission environment and the performance of the same actions under the conditions of very low or very high workload level.[28] Situational awareness is particularly important for the pilot in understanding the mission environment. It plays a crucial role in pilot decision-making.[29] The high level of situational awareness possessed by the pilot is necessary for his acting within the complex system at each stage of mission execution. Many flight-related events take place in mission environments which demand high level of situational awareness from the pilot. The results of analyses related to the degree of pilot workload in each stage of air mission execution show that this factor has a direct impact on the probability of an undesirable flight-related event (Fig. 7).

[26]The conclusions provided by the author are based on the air accident reports available in the archives of the Polish Armed Forces as well as those relating to general aviation in the Republic of Poland, available on the website: www.ulc.gov.pl, 01th January 2011.

[27] S. G. Hart, L.E. Staweland, Development of NASA TLX (Task Load Index): *Results of empirical and theoretical research*, (in:) P.A. Hancock, N. Meshkahi (Ed.), Human Mental Workload, North Holland, Amsterdam 1988, pp. 139–183.

[28] R.M. Yerkes, J.D. Dodson, The relation of strength of stimulus to rapidity of habit-formation, Journal of Comparative Neurology and Psychology Nº 18/2008, pp. 459–482.

[29]The issues related to situational awareness and its importance to safety in air mission execution are presented in more detail in Chapter III of this work.

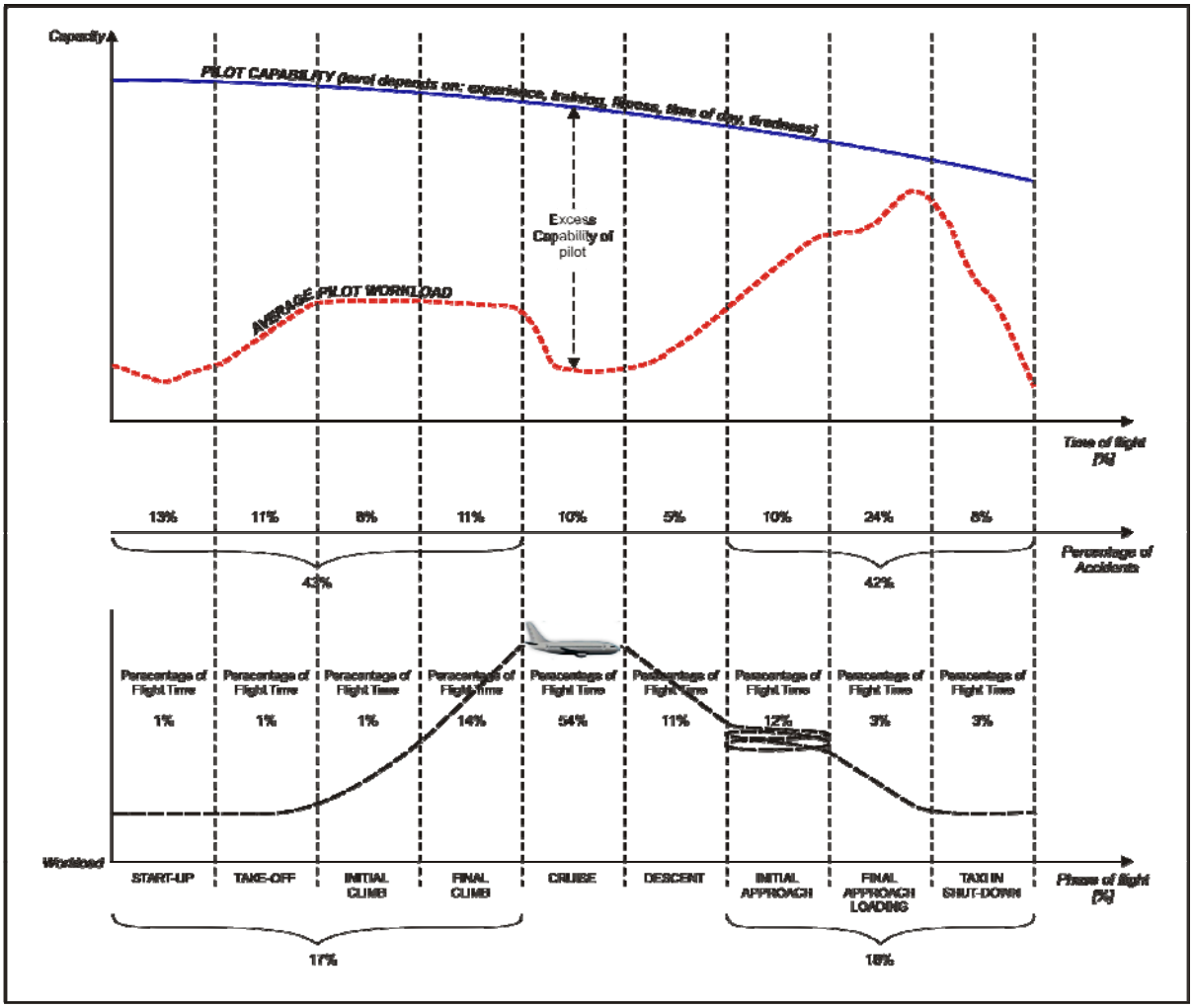

Fig.7. Pilot workload in particular stages of air mission execution and statistics concerning undesirable flight-related events. Developed on the basis of: Op. cit. E. Klich, J. Szczygieł, *Bezpieczeństwo lotów w transporcie ...,* p. 138, T. Thom, *The Air Pilot Manual*, Vol. 6, *Human factors and Pilot Performance*, Airlife, Shrewsbury 1995, p.110.

As it is clear from the above comparison of the data depicted in the figure, the most dangerous phases of flight, which are also characterized by a high degree of workload, include the takeoff and the initial as well as the final climb segments – 43% of air accidents, and also the initial, final approach and the landing, taxi in and shut down segments – 42% of accidents. The remaining flight phases, which represent 35% of the time of flight have an accident rate of 85%. This disproportion becomes understandable when we consider that the flight phases which are characterized by the highest accident rate are those in which the flight crew workload is the highest. The above disproportion also results from the fact that those phases are executed at medium and low altitudes, in high traffic congestion, as well as from the fact that the pilot while implementing various procedures related to those flight phases has to operate a

number of aircraft systems and equipment to maintain the prescribed conditions.

All of the above seems to support E. Klich's opinion that "The existing methods and means of developing the awareness of the risks, which are limited mainly to one-off actions organized after an accident, seem to be insufficient. Used temporarily, to a limited extent, and irregularly, such measures become forgotten in a short time. Recurring accidents caused by identical slight errors confirm the low effectiveness of actions taken so far" in the area of safety.[30] The statistics presented show that this statement focuses on man, a member of aviation personnel. Preventive measures identified by air accident investigation boards in relation to a member of the flight crew, an aircraft maintainer or an air traffic controller were too frequently confined only to the perpetrator of the undesirable flight-related event, and they were actions of limited scale, carried out immediately after the event. Scientific and research resources currently available to organizations which investigate undesirable flight-related events facilitate wide-range analyses of the causes of errors committed by flight crews. The results of these studies should help to define the areas of risk and develop a methodology of taking appropriate actions in order to neutralize those risks. Such activities should be system-wide and should include aviation personnel group(-s) selected from the perspective of characteristic traits of the perpetrator (or perpetrators) of undesirable flight-related events. Knowledge of the threats should result in finding a way to avoid or neutralize them, even if not all threats are possible to eliminate.

Previous experience of the author, the conclusions from air accident investigation reports[31] and analyses of reference publications indicate that each perpetrator of an undesirable flight-related event can be characterized by specific factors that affected the error committed by him. With regard to the pilot, these factors can include, among others:

- age – to determine the age range in which the pilots of a specific task group committed the most errors;
- total flight time, including the specific type of aircraft on which the undesirable flight-related event occurred – to determine the influence of the level of aviation experience possessed by the pilot on the probability of his committing errors under certain conditions;
- the level of pilot training from the perspective of his professional ratings – to determine the influence of the level of air training received by the pilot on the probability of his committing errors under certain conditions;
- last leave/vacation with a particular focus on the time between flights (pilot currency), including the pilot currency issues associated with health problems – to determine the influence of currency on the piloting skills;
- the most recent undesirable flight-related event (if any) – to determine the the impact of that event on the pilot's psychophysical condition and piloting skills;
- weather conditions, with particular emphasis on hazardous meteorological phenomena (fog, wind shear, icing, etc.) – to determine the impact of the weather conditions on the probability of pilot error;
- terrain, where the event occurred (mountains, sea, etc.) – the effect of topography on the probability of a given type of event;
- type of aircraft on which the flight was conducted – to determine the influence of ergonomic factors and handling characteristics of the aircraft on the probability of errors being committed by a pilot having a certain aviation experience;
- type of air mission – to determine the influence of task complexity on the probability of errors being committed by a pilot having a certain aviation experience;
- aviation phraseology and radio communications congestion – to determine the

[30] E. Klich, *Bezpieczeństwo lotów – wybrane zagadnienia.* AON, Warszawa 1999, p. 50.

[31] (a.o.) Cdr B.K. Umesh Kumar, Gp Capt. H. Malik, *Analysis of fatal human error aircraft accidents in IAF,* Aerospace Med Nº 47(1)/2003, pp. 1-7.

influence of the manner of conducting radiotelephony communication on the probability of pilot error under certain conditions of mission execution.

Systematically collected databases categorizing undesirable flight-related events into specific groups e.g. loss of spatial orientation during flight in the clouds, in-flight icing, etc., taking into account the above-mentioned factors concerning the perpetrators of such events, may be used by aviation organizations to determine high-risk groups among their personnel and to take appropriate preventive measures e.g. refresher training, simulator training, health care, etc.

Examples of this type of activities can be found in the history of aviation. After the introduction of the new generation of jet aircraft in the 1960s, the number of air accidents in the RAF grew significantly. Taking into account the fact that the causes of most of the accidents were related to the human factor, a number of recommendations were made and implemented to enhance the safety level of air operations, including, among others:

- Limited range of cockpit equipment standardization and the lack of uniformity of distribution of flight instruments in the cockpit, necessitated the introduction of a limit of aircraft types to be flown by an individual pilot.
- Only experienced pilots with a minimum of 400 hours total flying time on jet aircraft were appointed instructors and air unit commanders.
- Only the most experienced instructors were assigned to supervise the training process in air units.
- Specific requirements were raised relating to the flight crews' level of knowledge concerning aircraft construction, operating rules and piloting techniques for particular aircraft types.
- Procedures were introduced in order to enhance the supervision over the observance of the operating rules concerning onboard equipment (oxygen system, ejection seat);
- Simulated flameout trainings became mandatory – each pilot was obliged to take five such trainings per year.
- The simulator training program was supplemented with new exercises; existing exercises were revised.

The above-mentioned actions were based on, among others, the conclusions from the past undesirable flight-related events. It was determined, among others, that undesirable flight-related events occurred mainly during the approach to landing and the landing phase and were caused by the fact that the approach-to-landing speed was increased twice compared to that of piston engine aircraft. It was pointed out that most accidents were caused by pilots aged 19 to 21 years, and at the fewest by pilots aged 26-35 years. With the emergence of jet aircraft, the change of speed parameters brought about hitherto unknown phenomena, such as high-altitude hypoxia, faster G-load increase, canopy glass condensation or frosting, and changing the characteristics of the aircraft especially at transonic speeds.[32]

The results of these analyses indicate that a person working as an aircraft operator, aircraft technician or air traffic controller continues to be the weakest element of M-AC-ME system. They also indicate the need for constant preventive measures aimed at improving the level of flight safety,

[32] Developed on the basis of: K. Klukowski (Ed.), *Medycyna wypadków w transporcie*, Wydawnictwo Lekarskie PZWL, Warszawa 2005, pp. 178-179.

particularly in relation to the areas of the so-called human factor. Taking such measures is justified not only by the deaths of flight crews and passengers, but also by huge losses to property and equipment.

CONCLUSION

The use of safer and safer, but also more and more complex aircraft systems in mission environment characterized by high levels of volatility causes that flight crews and teams supporting air operations have to meet higher and higher requirements. In the twenty-first century, it is man, not the technological development, that is a limitation affecting the aircraft specifications. So we should take advantage of all the possibilities, even the most expensive, in order to improve the level of flight safety. Therefore, undesirable flight-related events should be treated as those which set out further stages of flight safety development. Lessons to be learned from undesirable flight-related events and preventive recommendations set by air accident investigation boards should be treated as a source of knowledge to build new and enhance existing strategies to prevent errors committed by aviation personnel. These activities should be carried out at all levels of aviation organizations, with particular emphasis on personnel directly involved in the preparation and execution of air missions. Man, who created that system and who always takes care of its development, too often forgets that he is the key element of it and it is he who determines the level of air mission safety. Despite efforts being taken, the human factor is still essential, and yet the most unreliable part of the aviation system.

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THE RELATIONSHIP BETWEEN THE EUROPEAN STATES AIR FORCE AND THEIR GEOPOLITICAL POSITIONS

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Abstract: *In today's establishing European air forces; gross national income, populations, connected groups like NATO or former Warszaw pact and their geopolitical position are main factors. In this study, the geopolitical positions and the air forces of Europian Countries are discussed. Additionaly, army aviation forces police aviation forces are added to discussion.*

Keywords: *World Air Forces, Geopolitic, Globalizations*

1. INTRODUCTION

European Countries Armed Forces have restricted your expenditures recently because of increasing the effect of the European Union and in comparison with the recent years, it has been pronounced by lowest numbers indeed. This situation has also affected the structure of the armed forces. For example; according to the research made in 1996, While Romanian Air Forces have total 894 air vehicles including 646 aircrafts, 28 transport aircrafts and 220 helicopters, this number has dropped to 742 3 years later in 1999. As a result of this trend that has been continuing each year, nowadays, the inventory of Romanian Air Forces has totally 167 vehicles including 82 aircrafts, 16 transport aircrafts, 63 helicopters and 7 UAV (see Fig. 1). [1, 2, 3]

In most European countries, particularly in EU countries, it has been observed that number of vehicles has been decreasing and on the other hand, in some countries, the inventory numbers have been increasing.

Figure 1: A MiG-21 of Romanian Ait Force [3]

In this study, this formation has been handled by its reasons.

2. APPROACH TO AIR FORCES OF EUROPEAN COUNTRIES

In Table 1, as of 2013, the inventories of air forces of each European country have been seen. When reviewing this table, we could see that these 5 countries are composed of Russia, Turkey, England, France and Germany.

Table 1. European Countries Air Forces Inventory

	Aircraft*	Transport Aircraft**	Helicopter	UAV	TOTAL
Russia	2243	612	1606	30	**4491**
Turkey	769	122	633	274	**1798**
United Kingdom	660	118	504	30	**1312**
France	490	196	484	4	**1174**
Germany	385	94	404	6	**889**
Italy	344	123	393	6	**866**
Spain	304	119	297	0	**720**

Greece	398	76	217	20	**711**
Poland	203	59	270	30	**562**
Ukrain	216	56	253	0	**525**
Sweden	283	21	52	10	**366**
Portugal	155	39	152	0	**346**
Kazakhstan	237	22	76	0	**335**
Azerbaijan	95	5	184	10	**294**
Switzerland	135	6	46	84	**271**
Finland	171	10	52	1	**234**
Serbia	97	12	70	10	**189**
Netherlands	81	30	77	0	**188**
Belgium	119	19	31	18	**187**
Romania	82	15	63	7	**167**
Austria	59	15	85	0	**159**
Belarus	72	6	76	0	**154**
Czech Republic	55	17	78	2	**152**
Bulgaria	61	10	59	0	**130**
Norway	73	15	36	0	**124**
Denmark	57	7	51	2	**117**
Crotia	55	3	37	8	**103**
Bosnia Herzegovina	10	0	86	0	**96**
Armenia	33	3	44	0	**80**
Hungary	25	8	33	9	**75**
Albania	13	0	57	0	**70**
Georgia	10	0	29	7	**46**
Slovenia	19	5	16	0	**40**
Slovakia	16	5	12	5	**38**
Moldova	26	6	5	0	**37**
Ireland	5	18	10	3	**36**
Lithuania	15	11	6	0	**32**
Cyprus	1	1	25	2	**29**
Macedonia	11	1	16	0	**28**
Montenegro	11	0	16	0	**27**
Latvia	4	4	9	0	**17**
Malta	4	4	5	0	**13**
Estonia	0	2	4	1	**7**
Iceland	0	1	2	0	**3**
Luxembourg	3	0	0	0	**3**
TOTAL	**8105**	**1896**	**6661**	**579**	**17241**

***All fighter, training etc. aircrafts**
****All transport, tanker, VIP, Electronic war etc. aircrafts**

According to the data of 1999; the first 5 countries are Russia, France, Turkey, Germany and Italy and there is not any different perspective and when comparing with the Table 1, except Turkey, the inventory numbers of other countries have been decreasing. In this manner, Russia is the first country by decreasing the number at the rate of 70% and the other countries respectively have decreased the number of their aircrafts and helicopters in their inventory such as ; France is at 50%, Italy is at 25% and Germany is at 22%. However, in contrary to these four countries, Turkey has increased the number of inventory at the rate of 23%. On the other hand, England has located in first 5 countries in 2013 and has increased its inventory at the rate of 5%. However, according to this study that was performed in 1999, during the period of 1999-2013, the inventory amount of European Countries Air Forces have decreased in the great amount at the rate of 51% and the number has dropped from 33809 to 17241 indeed.

Table 2. European Countries Air Forces Inventory (First 5 countries in 1999)

	Aircraft	Transport Aircraft	Helicopter	TOTAL
Russia	6086	1139	8105	**15330**
France	1314	138	905	**2357**
Turkey	859	102	503	**1464**
Germany	592	84	769	**1445**
Italy	715	52	641	**1408**

The reasons of this decline are as follows:

- The period where the balance of powers of Russia and countries of former Warsaw Pact that used the products that had produced by the Former Soviet technology had been provided by the number of aircraft, tank, helicopter had provided was closed. On the other hand, disintegration of Soviet Union and Former Warsaw Pact was realized and these countries had preferred to combine with other Western European Countries so that the market share of the western products had increased. These products are the superior products in terms of technology and they do not need any numerical superiority.

- Due to the fact that it is very expensive to use the defense industry products and particularly to use the aircrafts, even great number of squadron affects the country economies. Because, the maintenance, repair and operation expenditures for an aircraft is more than the cost of that aircraft.
- On the other hand, one of the other reason is to decrease the war danger between the European countries considerably and to remove the borders . Previously, East-West cold war and afterwards, integration with the EU so that the hot war danger was also eliminated are the reason of decreasing the number of inventory not

only in the air forces but also all armed forces accordingly.

- In spite of the fact that the technology has been rapidly developing and the drones and cheapest systems have been used in the war technologies, the importance of the aircraft and helicopter numbers have decreased ultimately. Particularly, it is more than difficult to explain the extraordinary rising in the number of UAV. In 2012, in accordance with the research in a notification that was handled in this congress, when total UAV number of European Countries was 181 (table 3), one year later, this number became 579 indeed (Table 1).
- In the structuring of Air Forces, the most important and effective reason is the geopolitical location that was also taken in this notification

3. STRUCTURING AIR FORCES AND GEOPOLITICAL LOCATION

45 countries defined in Table 1 are the European Countries having an arm and armed forces and in the period of 1999-2013, only 5 countries have increased the number of their inventories belonged to the air forces. These countries are Azerbaijan, Kazakhstan, Switzerland, Turkey and England.

Azerbaijan needs to have continuous power because of the historical conflict against its neighbor, Armenia. Particularly thanks to its rich natural resources, it is on the first countries whose national income has been increasing fast. This case has provided an advantage for Azerbaijan in terms of arming.

On the other hand, Kazakhstan is a country that was disintegrated from Soviet Union and has biggest land and the country has to pay ultimate attention in terms of border security indeed. This also requires a strong arm forces.

Switzerland that is one of the oldest independent country gives ultimate attention to the border security nowadays. Because, everything and all balances in the world has been changing day by day but Switzerland is still called as " Safe Box of the World". It is more than explanatory to increase the number of UAV fleet from 24 to 84.

On the other hand, Turkey has different a geopolitical location in comparison with other European countries. Its land and surroundings have caused great wars during the history and these wars have been still continuing. Besides, Turkey has been attacked by the terrorist groups for years from Iran, Iraq and Syria through the PKK terrorist organization and in the meantime, it must have disincentive power against its neighboring countries.

By the way, United Kingdom has preferred to be a leading and responsive country in the international response powers together with the USA. Especially in last years, the emergency response requirements such as Middle East problem, Arab Spring responses, Falkland Islands have caused to increase the military power.

4. CONCLUSIONS & ACKNOWLEDGMENT

- Due to their geopolitical locations, Switzerland, Turkey, Azerbaijan and Kazakhstan Air Forces have increased their powers.
- All other European Countries have decreased their powers. The reason of this is that they do not have geopolitical locations; Former Soviet Products have been removed; war danger between the European Countries namely border removals as

well as the economic power of all Europe have decreased accordingly.

- Because of its geopolitical location, Russia is located in the first rank in Table 1 by a great difference. Because, its borders are the longest border all around the world and it expends two continents. It is neighbor both with USA and China and it wants to keep its super power in this sense.

- The most attractive development is about UAV numbers. According to this, in the beginning of the period 1999-2013, when any UAV has not been officially used, nowadays, 579 UAV has been using indeed. This number was 181 as of 2012.

- The first country that has been using UAV very much is Turkey and Switzerland follows Turkey as in the second place. The only reason of this structuring is the geopolitical position of both countries.

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COST REDUCTION AN AIRCRAFT ENGINE PART OF TURBINE DISC MANUFACTURING

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ABSTRACT: *Widely used in Aircraft gas-turbine engines with features and a very special super alloys materials, latest technology and the process of developing manufacturing methods that work to reduce cost of a special operation is to be done. Superalloys are produced based on their iron, nickel and cobalt content and they are very resistant to high temperature applications. But with today's gas-turbine engines are usually due to superior qualities who are nickel-based is used. In this Project RENE 88 DT – based a nickel super- alloy with a disc of lathe operation conditions have been checked and made of a work to reduce cost.*

KEY WORDS:*Super alloys , Lathe , Insert*

1.INTRODUCTION

Matching the most suited cutting tool material (grade) and insert geometry with the workpiece material to be machined is important for a trouble-free and productive machining process.Other parameters, such as cutting data,
tool path, etc. are also vital for a successful result:

Cutting tool materials, such as cemented carbide, ceramics, CBN, PCD, etc.

Workpiece materials and classifications from a machinability point of view.

2.PRODUCTIVITY AND COST

There is a general imbalance between the cost development and what the market is willing to pay. In order to bridge that gap, there is a need to continuously increase efficiency and productivity. To help us improve our efficiency and us to lower the cost per piece of methods used by the project;

- Selection of machining method and tool path
- Choice of tool, insert geometry and carbide grade
- Cutting data (speed, feed and depth of cut)
- Fewer tool changes - more machining time

2.1 Increased Cutting Data Reduce Costs

Increased cutting data and process improvements can dramatically reduce the cost per component and thereby increase a company's profitability. In most cases, it is by far more profitable to increase cutting data than to increase tool life. Likewise, it is much more profitable to use cutting tools that can withstand high cutting data than to use low quality tools.Tool life and tool costs have minor effects on the component cost compared to cutting data. The exact effect on component costs depends on the machining process parameters and the company's cost structure.

In order to improve profitablity, it is important to study the process in detail. There

are many methods for improving processes and each situation is different.

3. MACHINABILITY

Machinability of disc-materials increases in difficulty according to the following sequence: iron based materials, nickel based materials and cobalt based materials.

All the materials have high strength at high temperatures and produce segmented chips during cutting which create high and dynamic cutting, forces. Poor heat conductivity and high hardness generate high temperatures during machining. The high strength, work hardening and adhesion hardening properties create notch wear at maximum depth of cut and an extremely abrasive environment for the cutting edge.

3.1 Carbide And Ceramic

Carbide grades should have good edge toughness and good adhesion of the coating to the substrate to provide good resistance to plastic deformation. In general, use inserts with a large entering angle (round inserts) and select a positive insert geometry.

In turning and milling, ceramic grades ca a) be used, depending on the applicatior Ceramic grades can be applied in a broad range of applications and materials; most often in high speed turning operations but also in grooving and milling operations. The specific properties of each ceramic
grade enable high productivity, when applied correctly. Knowledge of when and how to use ceramic grades is important for success. All ceramic cutting tools have excellent heat and wear resistance at high cutting speeds. Below you can find the most common types of ceramics used in hard and /or difficult to machine materials.

3.1.1 Cutting Parameters For Ceramics

The speed should be balanced to create enough heat in the cutting zone to plasticise the chip but not too high to unbalance the ceramic.

The feed should be selected to give a chip thickness which is high enough to not work-harden the material but not be too high to cause edge frittering.

Higher feeds and depths of cut require a reduction of the cutting speed. These boundaries will change depending upon the component material hardness and grain size.

4. OPTIMIZATION AND TOOL WEARS

The disc part used different inserts and tools in every region for lathe operation.Used in the inserts were collected for all regions. This inserts the following information is determined depending on wear.

1-) Flank wear

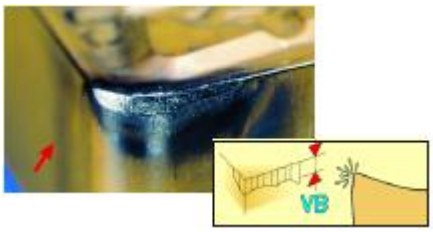

Figure 1

Rapid flank wear causing poor surface finish or out of tolerance. (Fig.1)

Cause

Cutting speed too high or insufficient wear resistance.

Solution

a. Reduce the cutting speed
b. Select a more wear resistant grade.
c. Select an Al_2O_3 coated grade.
d. For work-hardening materials, select a smaller entering angle or a more wear resistant grade.

2-)Notch wear

Notch wear causing poor surface finish and risk of edge breakage. (Fig.2)

Figure 2

Cause

a) Oxidation
b) Attrition

Solution

a)Select a cermet grade
b) Reduce the cutting speed.

(Whenmachining heat resistant material with ceramics, increase cutting spee

3-)Crater wear

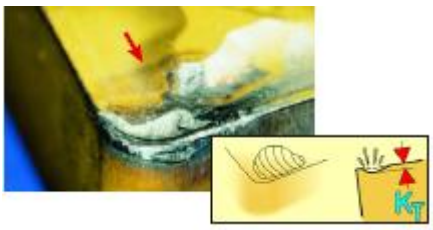

Figure 3

Excessive crater wear causing a weakened edge. Cutting edge reakthrough on the trailing edge causes poor surface finish.
Risk of insert breakdown. (Fig.3)

Cause
Diffusion wear due to cutting temperatures that are too high on the rake face.

Solution
a) Select an Al_2O_3 coated grade.
b) Select a positive insert geometry.
c) First, reduce the speed to obtain a lower temperature, then reduce the feed.

4-) Plastic deformation

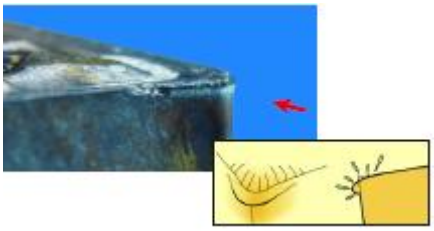

Figure 4

- Plastic deformation.
- Edge depression or flank impression.
- Leads to poor chip control and poor surface finish.
- Risk of excessive flank wear leading to insert breakage. (Fig.4)

Cause
a) Cutting temperature is too high, combined with a high pressure.

Solution
a) Select a harder grade with better resistance to plastic deformation.
b) Edge depression – reduce feed.
c) Flank impression – reduce speed.

5-) Built-up edge (B.U.E.)

Figure 5

Built-up edge causing poor surface finish and cutting edge frittering when the built-up edge is torn away. (Fig.5)

Cause
Workpiece material is welded to the insert due to:
a) Cutting that is too low.
b) Negative cutting geometry.
c) Adhesive workpiece material.

Solution
a) Increase the cutting speed or cool heavily.
b) Select a positive geometry. Reduce feed at the beginning of the cut.
c) Select a thin coated PVD grade and a positive geometry.

6-)Chip hammering

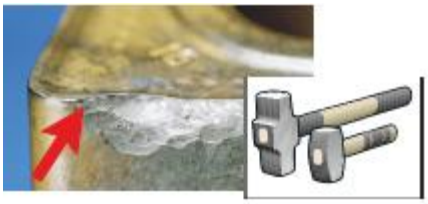

Figure 6

The part of the cutting edge not in cut is damaged through chip hammering. Both the top side and the support for the insert can be damaged. (Fig.6)

Cause

a) The chips are deflected against the cutting edge.

Solution

a) Change the feed.

b) Select an alternate insert geometry or change to a tougher grade.

7-)Frittering

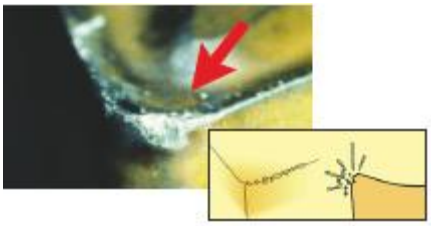

Figure 7

Small cutting edge fractures (frittering) causing poor surface finish and excessive flank wear. (Fig.7)

Cause

a) Grade is too brittle
b) Insert geometry is too weak
c) Built-up edge

Solution

a) Select tougher grade.
b) Select an insert with a stronger geometry (bigger chamfer for ceramic inserts).
c) Increase the cutting speed or select a positive geometry.
Decrease the cutting speed and coolant.
Reduce feed at the beginning of the cut.

8-)Thermal cracks

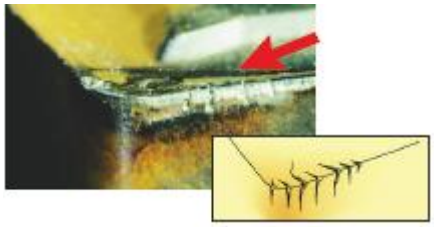

Figure 8

Small cracks perpendicular to the cutting edge causing frittering and poor surface finish. (Fig. 8)

Cause

Thermal cracks due to temperature variations caused by:

a) Intermittent machining
b) Varying coolant supply

Solution

a) Select a tougher grade with better resistance to crack propagation
b) Coolant should be applied copiously, or not at all

9-)Insert breakage

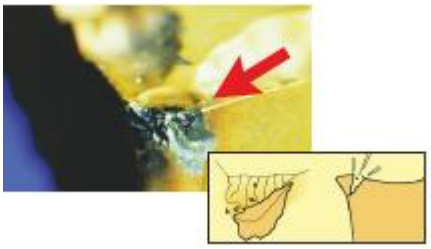

Figure 9

Insert breakage that damages not only the insert but also the shim and workpiece. (Fig.9)

Cause

a) Grade is too brittle
b) Excessive load on the insert
c) Insert geometry is too weak
d) Insert size is too small

Solution

a) Select a tougher grade.
b) Reduce the feed and/or the depth of cut.
c) Select a stronger geometry, preferably a single-sided insert.
d) Select a thicker/larger insert.

10-)Slice fracture – ceramics

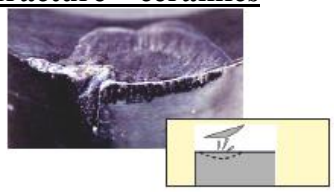

Figure 10

Cause

a) Excessive tool pressure

Solution

a) Reduce the feed

b) Select a tougher grade

c) Select an insert with a smaller chamfer, or use another geometry to change cutting force direction

5. PREPARATION FOR CUTTING AT LATHE MACHINE

5.1 Fixture Setup

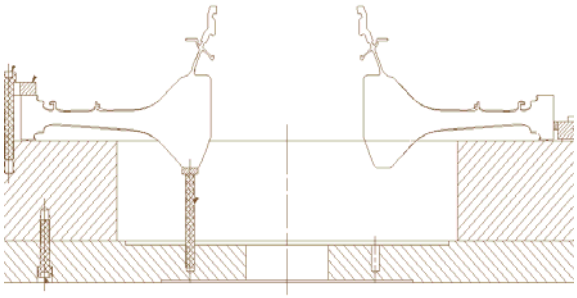

Figure 11

It is connected to Fixture. Tool and fastener elements are check is as clean.Inner diameter rotary control run-out and face run-out control. (Fig.11)

5.2 Part Setup

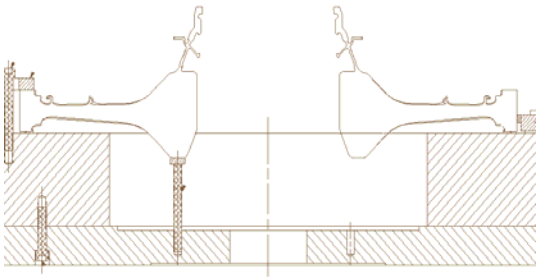

Figure 12

Part run out are control on lathe machine than check are reference dimensions. (Fig.12)

6. CHANGE INSERTS THE CUTTING AREAS

Using special form insert has been removed in these area. In stead of carbide ınsert used in these area. (Fig.13)

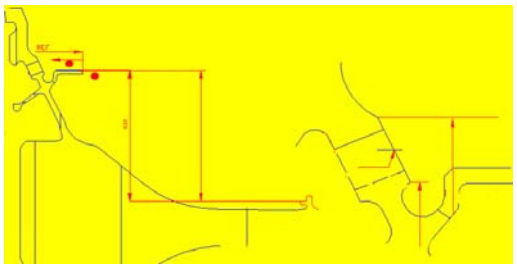

Figure 13

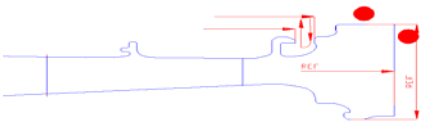

Figure 14-a

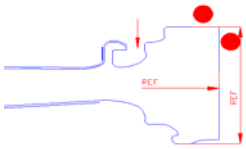

Figure 14-b

Special form carbide insert used in these areas has been removed.Ceramic insert using in these area. (Fig. 14 a and b)

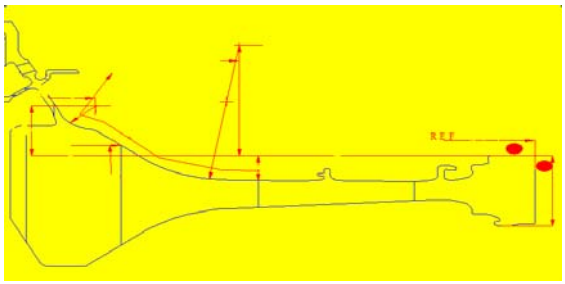

Figure 15

4V carbide insert used in these area.4V carbide insert has been removed.4V using inserts have been at grinding operation than obtained by grinding non-standart 3.5V insert using in these area. (Fig.15)

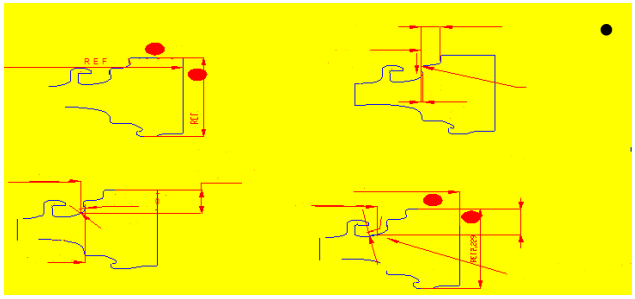

Figure 16

The combined are cutting the same area.This area was reduced to a single tool. (Fig 16)

7. CONCLUSIONS & ACKNOWLEDGMENT

In the first stage using part only lathe machine restirected the planning sheme.Required sales time to train and created difficulties in terms of quality production for lathe operation at part using adaptaston more machine. All of these adverse conditions, taking into account the results of the project operation:

- In some regions, instead of a special ceramic insert to carbide insert was obtained by using the cost-effective large profit. Ceramic inserts with changes made to the program by using the advantage of progress and time savings are obtained by increasing feed and rotation.
- HNK machines magizenes using maximum number of 12 tools, so tools number reduced 15 to 12. so that two parts can be processed at the same time. As a result relieved planning requirements and the period for tools maginez setup eliminated.
- The special form of the piece is expensive 4V insert instead of 3.5V insert using at the factory obtained by large profit.
- Places to cut as much as possible so that the same regions combined; shimset and tool data taking periods is eliminated.
- The special inserts are used for parts only, increases the cost per piece. The adoption of standard inserts are used to track a lot of stocks in the factory cost of the insert was obtained huge profits.
- Used Tool reducing at the part manufacturing is obtained by cost profit.
- Lathe operation, the workpiece 32 hours operation time was reduced to 26 hours.

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RUNNING UNMANNED AERIAL VEHICLES IN HUNGARY

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Abstract
Flight tests proved that it is cost effective to use commercial modelling components for building UAVs used by the military. First it may look like we are building an aerial vehicle using toy parts, but nowadays' manufacturing is well-developed, and by applying adequate quality control system, air safety will be ensured. This study was realized through the assistance of the European Union, with the co-financing of the European Social Fund. It enjoys the support of "Critical Infrastructure Protection Research TÁMOP-4.2.1.B-11/2/KMR-2011-0001".

Subordinated plan: „Data integration

Highlighted project: „Operations of Unmanned Aerial Vehicle and its aspects for Air Safety"

Key words: *Fool-proof, Cost-effective, Air safety*

1. INTRODUCTION

The Hungarian Defence Forces (HDF) use radio-controlled (RC) aircraft models during the training of their infantry and air-defence units. The aircraft models imitate enemy aircraft on tracking exercises and live-fire manoeuvres.

The models 'GÓLIÁT', 'METEOR-1', 'METEOR-2' and 'METEOR-3' were conventional radio-controlled types. The requirements of the 'MISTRAL' short range air-defence missile system acquired in 1999 for HDF showed the path along which the necessary modifications (infrared-emitter, Lüneberg-lens) of the 'METEOR-3' model had to be made. It was soon proved that conventional radio-controlled models can not provide the operational radius for the exercises.

Fig.1.

Originally, to increase the operational radius of the model, 2 operators flew it. The first controlled the take-off and flew the model to the area of operation, where the second took over and controlled the flight along the track. This method required a high level of cooperation between the operators, and also it endangered the safety of the second operator who had to stay in the area of operation. In order to eliminate the disadvantages of this procedure, a GPS-based control system was fitted on the model, which was named 'METEOR-3M' – Fig.1. – and made a successful debut in 2005 at a live-fire exercise.

The target model was under continuous development to meet the requirements placed by the air-defence units. Based on the previously successful control system, an autonomous and re-usable target aerial vehicle was built. It was the 'METEOR-3MA' TUAV (target unmanned aerial vehicle). – Fig.2.

Fig.2.

2. FIRST STEPS

The METEOR family stepped into a new age after the development of the new type of air-targets. The auto pilot system made possible to reach 40-50 km range without visual contact. [1]

However the real success was not the application of the autonomous system, but the TUAV's adaptation to national and international legislation.

According to risk analysis, because of the autonomous flight mode and the increased speed (250 km/h), the TUAV became a danger source of such a degree, that a reliable and safe operational method had to be developed – or an already existing method had to be taken over.

Based on the National Aviation Authority's (NAA) statement, the TUAV can not be fitted into the model category because of its flight capabilities and size. It stands closer to airplanes, so we have to apply aviation rules when flying the TUAV. This high-level quality assurance system helps to keep the aviation incidents at low-level.

When experts talk about the development of UAS they usually think about the UAV with ground equipment. In our opinion however, the running of UAS contains the legislation background too, as well as the airworthiness-, radio equipment- and radio frequency certificates, the approved flight plans, the training of the operator teams, all of which are approved by the NAA.

3. QUALITY CONTROL OF MATERIALS AND COMPONENTS

Air safety is maintained by application of legislative measures. For the sake of safe operation of passenger airliners we have to keep up a high-level – and expensive – quality control system. However, UAS manufactures could only sell their products if they keep the costs down.

High-level quality control and low costs are expectations of a contradictory kind, so there is a need for urgent compromise.

According to comparative analysis, Hungary can operate Class-1 (below 150 kg) and Class-2 (150-600 kg) types of UAS. [1]

A competitive procurement price for the UAS can only be provided if the manufacture purchases some components of the aircraft and/or the system from civil market. Servos, motors and batteries used by modellers are an obvious solution. [2] However, running UAS requires aviation safety at the same level as running any other aircraft. So after the basic requirements of UAV air targets were determined for achieving success at tracking exercises, the commercial components that are acceptable for military purposes were chosen. But if we want successful and safe operation we have to develop a control system what can provide fool-proof running.

During production the control methods have to cover all subsystems (hardware), and control needs to be carried out repeatedly despite the compulsory periodical check-ups of the UAV. This way the condition of the UAV can be followed and we can find hidden quality problems. During the periodical check-ups the endurance tests of the wings, the fuselage and the surface controls are carried out over and over again.

We did not discover any faults of the autopilot system that could cause air incidents during the test period. If we use commercial modelling components (servo, electrical motor) we have to check their lifespan rate and also check the survival characteristic of the fuselage. We have scanned metal gear servos for 100+ hours, whether they will be able to work in extreme weather conditions or not.

The main requirements of the air frame would be low cost of the material, short production time, simple production technology and good survival characteristics. The optimal testing environment is not always available when we are operating Class-1 type of UAV, so the airframe could easily be subject to damage during landing. If we choose an airframe type that is resistant to mechanical impacts we can greatly reduce the chances of irreversible damage. Experiments with delta-winged aircraft and blended-wing-bodies proved that these types of airframes have the characteristics which cover the above stated requirements of UAVs'.

4. AIR INCIDENTS – TRAINING OF STAFF

Operation experiences proved that air incidents usually happen because of the human component of the system (operator personnel). The most common problems are:

- lack of operator training
- missing pre-flight checks
- overconfidence in abilities
- lack of identification of possible dangerous circumstances (e.g. weather).

The operators' continuous training ensures that air incidents will be kept at low level, and even an UAV with poorer characteristics can be operated by professionals. [3]

Class-1 type aircraft's payload is extremely limited. If we need to mount parachutes or airbags for ensuring safer landing, the payload will become even smaller. Highly-trained operators are the guarantee of efficient running and safe landings and there will be no need for extra landing systems. We should consider however the circumstances of using UAVs in operational theatres, where controlled landings could be compromised because of enemy fire.

The NAA has approved a training syllabus for the operating staff. During both the academic and practical training the emergency procedures has to be emphasized. These procedures includes avoiding dangerous approach, or flying a UAV with limited

control capabilities (e.g. because of system failure). Learning these emergency procedures is extremely important for operators working close to, or behind enemy lines.

5. CLOSED AIRSPACE – IS IT SAFE?

According to current Hungarian legislation, UAVs allowed to fly only in closed airspace. When we carried out test flights with the METEOR-3MA TUAV, we had the opportunity of flying in closed and in restricted airspace too. Based on our experiences, the closed airspace distributed in NOTAMs does not provide real safety for the UAV. There was precedent of an aircraft violating the restricted airspace, and this type of dangerous approach can easily be missed be the pilot of the other aircraft.

It is essential that future UAVs should be equipped with an appliance that warns the pilot on board the aircraft that violates restricted airspace. A cheap (although payload-limiting) solution could be mounting flashlights on the airframe of the UAVs, and placing observers all along the borders of the training airspace. But it is just a temporary solution. In order to achieve efficient and flexible operation, further development is necessary to avoid dangerous approaches and violation of restricted airspace.

6. OPERATORS

In the early years (METEOR-1, METEOR-2) the UAVs were controlled by 2 operators. Depending on the nature of the task (complexity), one of them flew the UAV, and the other carried out the special task (e.g. timing the dropping of infrared emitters with parachutes).

At the moment 2 operators are the minimum requirement of safe operation. The operators decide the necessary measures to be taken during the flight, based on information provided by computerized data. If observers are also present, they follow the UAV's flight with binoculars and make sure that no aircraft violates the airspace.

The so popular FPV (First Person View) system allows the operator to fly the UAV as if he was on board, like a pilot of any aircraft.

In order to keep the costs low and the operation fool-proof, a similar video system was mounted on the TUAV. This equipment informs the operators about the actual position of the UAV, so in the case of autopilot failure or loss of telemetric connection, this secondary system is able to provide enough flight information for the operator to recover the UAV.

7. RADIO FREQUENCIES

The necessary data transmission to control the UAV is ensured by radio waves. If we examine the propagation of radio waves, we will find that the frequencies in the chart below (Fig.3.) ensure the best connection between the UAV and the control centre.[4]

Name	Frequency
VHF (Very High Frequency)	30 MHz-300 MHz
UHF (Ultra High Frequency)	300 MHz-3 GHz
C-band	4-8 GHz
X-band	8-12 GHz
Ku-band	12-18 GHz

Fig.3.

This wide interval however can not be used as it is, according to current legislation.[5] We have to separate ground-based static, ground-based mobile and aeronautical mobile radio service. According to legislation only those frequencies can be used which are still free, and not issued to anybody. Most of the frequencies are reserved for air traffic and telecom systems, thus our powers are greatly limited.

Military frequencies used by NATO countries provide communication for military UAS. But civilian UAS are not authorized to use these frequencies; they soon will need their own frequencies in order to operate safely. An alternative could be the frequency band used by radio amateurs.

8. CONCLUSIONS

We can state that good quality commercial parts are suitable for building UAVs. But in order to keep up air safety it is inevitable to develop quality control methods to reduce the probability of air incidents.

Recommended conditions of fool-proof operation of UAS:

- Determination of the maximum load-bearing capacity of the chosen parts; based on this figure the working load can be also determined.
- Examination of the lifespan of the chosen parts. When their lifespan expires or they brake down, they should be replaced because repairing them is not cost effective.
- Pre-flight system checks are to be carried out before each take off.
- Periodic inspection of the airframe and electronic systems is also recommended.
- Proper basic training and consecutive training courses for the operators.
- Maximum respect of all of the regulations.

Basic rules of flight planning:

- Do not fly above populated areas in order to minimize secondary incidents.
- Bear in mind the topography of the area where UAV tracks are planned, to avoid crashing, and to ensure continuous communication between the operator and the UAV.
- Fuel capacity determines flight range, but it depends on weather conditions too.

Motto:
High level of competence both theoretical and professional, a way of life according to regulations, and respect for military code and technological discipline are the principles of air safety.

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DIGITAL SYSTEM FOR TRACKING AND DISPLAYING TRAJECTORY AND PARAMETERS OF AN OBJECT TRACKED BY AIR DEFENSE SYSTEM 1RL-35M RADAR

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*** Transilvania University of Brasov

Abstract: *The presented paper is the result of a research project. The goal of the project is to develop a digital system for coordinates acquisition of a moving object pursued by the radar (1RL-35M) and data processing in order to display the object trajectory and parameters needed to air defense system. The experimental model presented below, is a functional laboratory prototype which satisfies the requirements imposed by research topic.*

Keywords: *radar, target coordinates, acquisition*

1. THE DESIGN OF ACQUISITION SYSTEM MODEL OF INFORMATIONS CONCERNING TARGET COORDINATES WHICH IS TRACKED WITH CRT 1RL-35

The experimental model involves the existence of a data acquisition board (NI USB 6210 type) provided by National Instruments with specialized software (LabView) and application made for data acquisition. The voltages obtained from computing device CRT are simulated by three voltage sources. Figure 1 shows the block diagram of the experimental data acquisition system.

Data to be acquired are the current rectangular coordinates (X, Y, H) of the object that results from transformation of spherical coordinates (azimuth, elevation angle and slope distance). These are obtained from 1RL-35 radar as DC voltage.

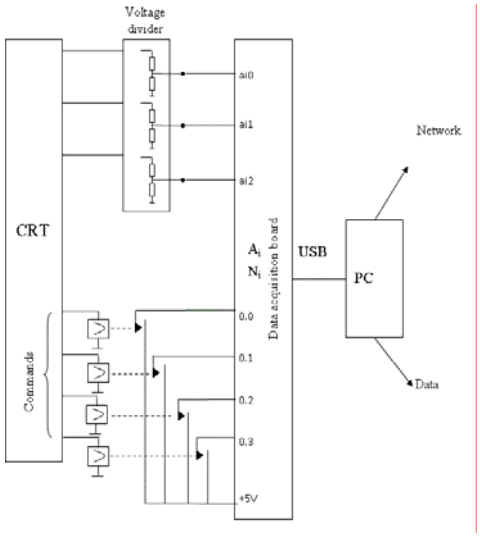

Fig. 1. Block diagram of the data acquisition system

Taking into account the variation of the DC voltage corresponding to object coordinates obtained from the CRT, it is necessary to adjust the voltage level to values of voltage on the 3 input channels of data acquisition board. This is made using 3 voltage dividers.

The graphical interface simulates the on - off switch of the control indicators. This is necessary to signal the relevant events for the object targeting regime as the start and the end automatic tracking. Software control of these signals is performed by relays operated by appropriate command from CRT.

1.1 Continuous takeover of target coordinates data / tracking system operation. This function is provided by the NI USB 6210 that has the ability to acquire 8 digital data and 8 analog values. The analog inputs ai0, ai1, ai2 takes the analog data that indicate the target position on 3 coordinates collected from CRT. To the digital inputs (ports 0.0-0.3) are applied high logic levels corresponding to signaled events - for example, the start and end of automatic tracking through relays contacts.

Acquisition and tracking program of target coordinates is shown in Figure 2.

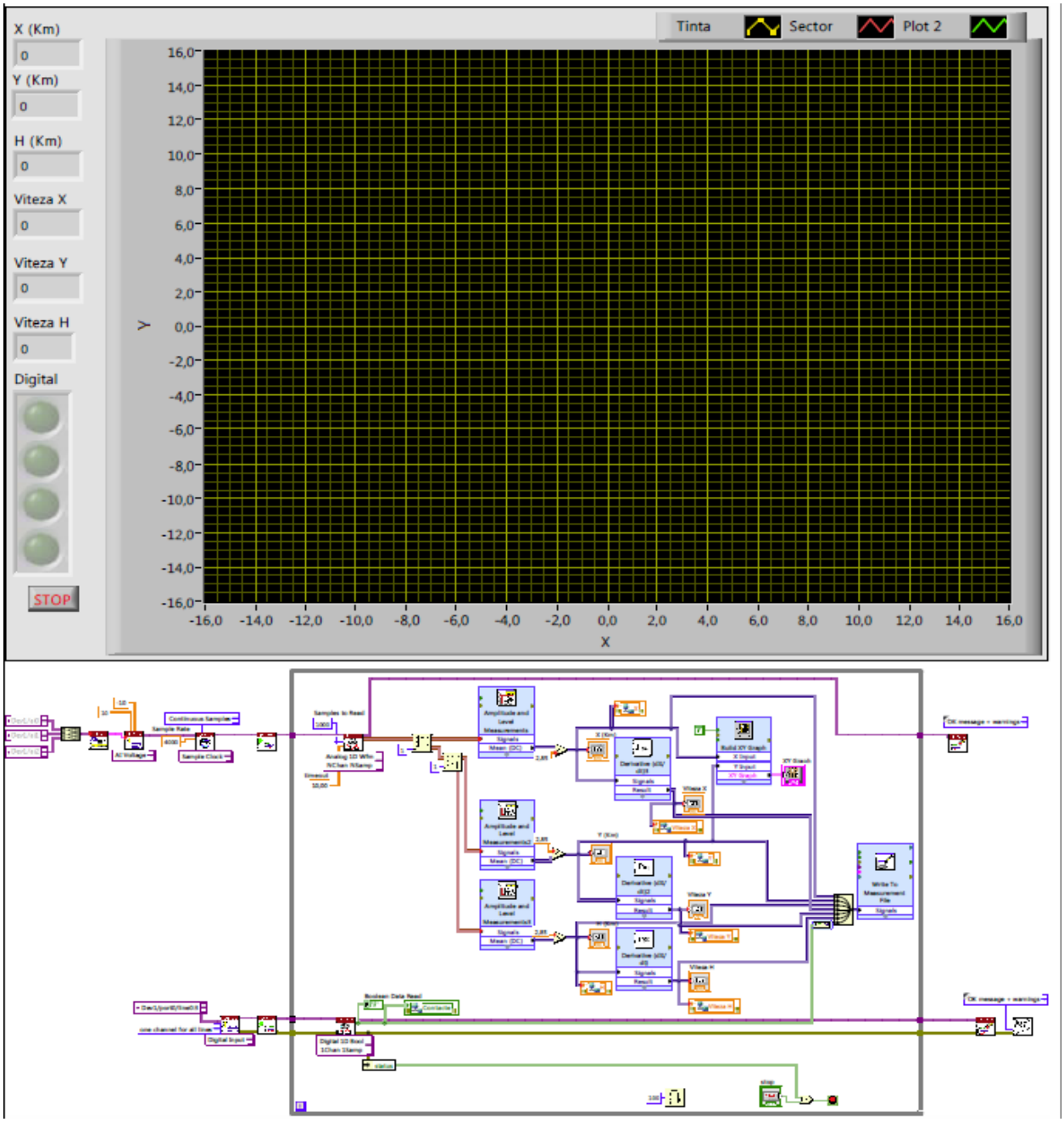

Fig.2. Acquisition and tracking program

The blocks that are represented in Figure 3 perform simultaneously the conversion of the data (analog to digital) and continuous acquisition of the digital data corresponding to

the object coordinates. The sampling rate is required by the acquisition board and it must be enough to record the smaller variations of the object coordinates.

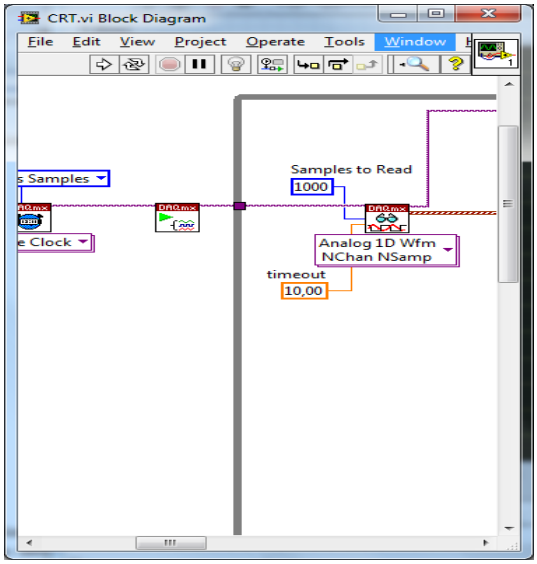

Fig.3. Analog to digital data conversion

1.2. The second function is to display the acquired data (from 1RL-35M) using a graphical interfa ce. Following steps are required:

sampling-holding-quantization

transmission of the digital data in a form of a linear array with three elements

splitting of vector with "Split 1D Array" and filtering of signal to remove noise and unexpected distortions of voltage waveforms corresponding to the target coordinates

transfer to display blocks

The manually setting of radar position coordinates values "X CRT, Y CRT, H CRT", on the front of graphical interface is done by correspondence with the „X CRT, Y CRT, H CRT" blocks from diagram. Values are displayed in km. Also, with an adder in the loop of the program, the absolute values of the object position are automatically obtained on the front panel (the sum between CRT position and object position from CRT – X abs T, Y abs T, H abs T).

To display the combat sector limits (previously entered in the database), the solution -at this moment- is to set the front panel display scale values to the maximum values of the 1RL-35M radar (fig.4).

Displaying the current object position and its trajectory is performed using the XY Graph block.

Examples of trajectories displayed are shown in Figure 5.

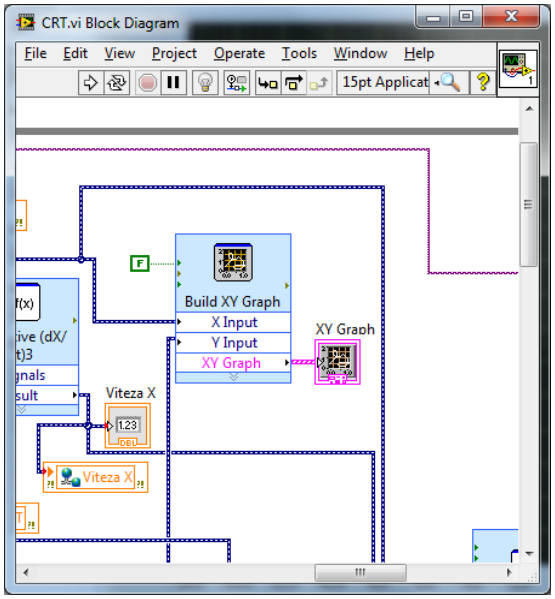

Fig.4. Display creating of object position

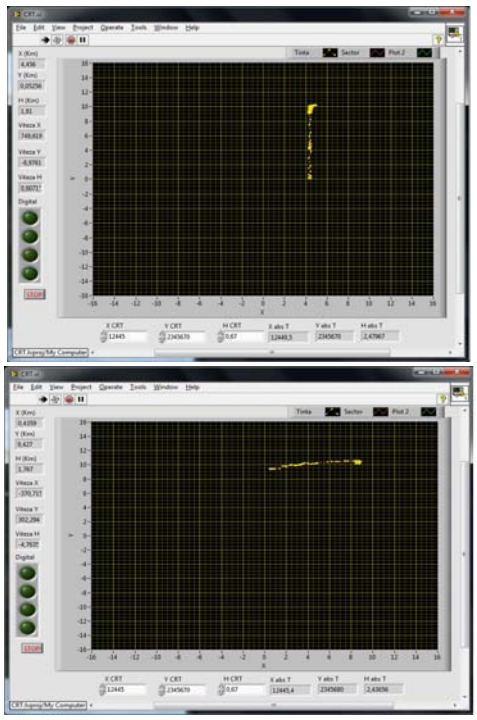

Fig.5. Mode of variation of target positions

1.3. Saving object trajectory data in a database (desired to be accessed in real time remotely through a network protocol).

All the data is collected and entered into the program by means of a multiplexer, obtaining a database during the running of the program,. The database can be found in the form of a file called "Date". A sequence from file in table 1 is presented

In the "Date" file are saved the retrieved and processed data by the program while it is running. Reading the file it can be obtained object trajectory data, given that the data saving to the file is made with appropriate speed sampling rate. Remote real-time transmission implies the existence of a computer network, or a network protocol. In this conditions on control (follow-up) computer should be installed the same software.

Table 1

Dev1/ai0 (DC Voltage)	Dev1/ai1 (DC Voltage)	Dev1/ai2 (DC Voltage)	Dev1/ai0 (Derivative (dX/dt))	Dev1/ai1 (Derivative (dX/dt))	Dev1/ai2 (Derivative (dX/dt))	Untitled	Untitled 1	Untitled 2	Untitled 3
10,084739	-0,000407	-0,000516	0,144654	-0,023013	-0,052601	0,000000	0,000000	1,000000	0,000000
10,084941	-0,000354	-0,000513	0,808748	0,210406	0,013150	0,000000	0,000000	0,000000	0,000000

On this computer will run a second program, illustrated in Figure 6 - which will access the program input data from computer situated in radar through network protocol and specified IP address. As result of running the "Remote" program on the front panel will be displayed the same image as on the display of the computer situated in radar. Figure 7 shows an example with an image of the object trajectory displayed on both panels of computers (radar and control).

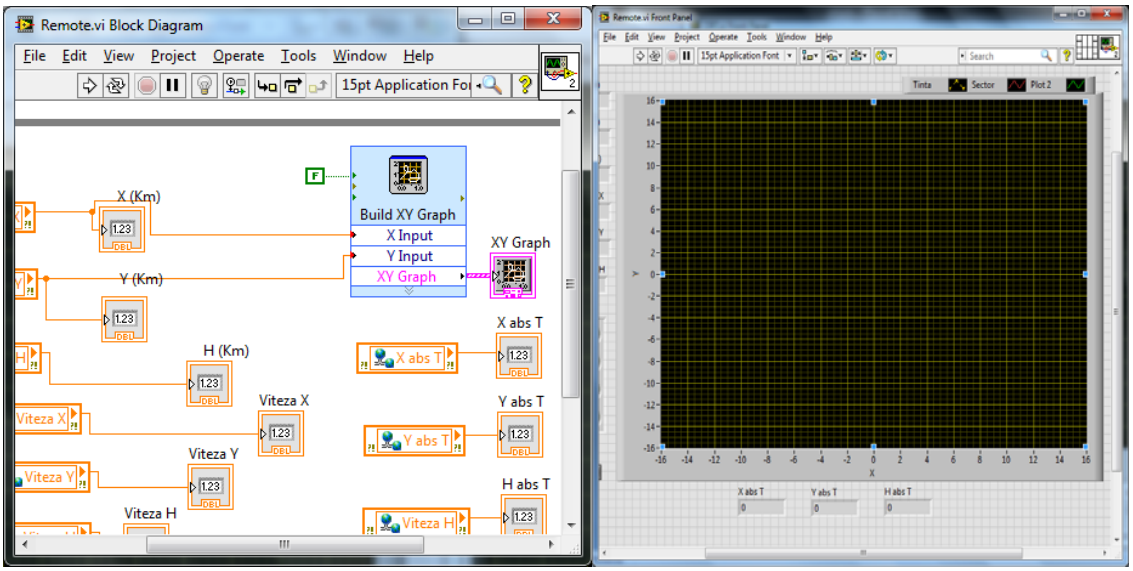

Fig.6. "Remote" program

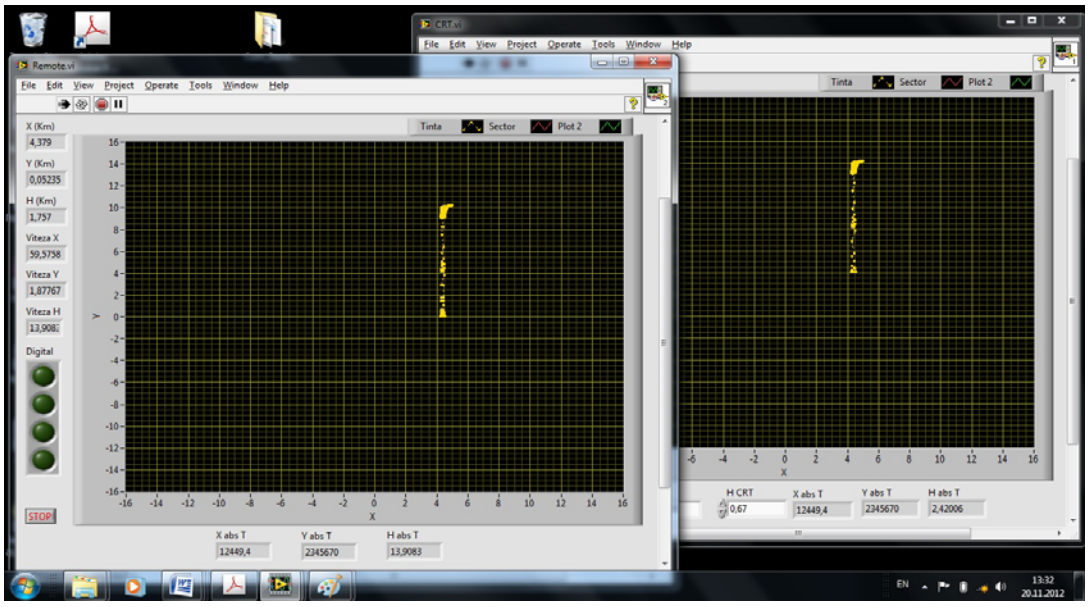

Fig.7. The frontal panels of the computers

2. CONCLUSIONS & ACKNOWLEDGMENT

This paper presents experimental model of a "Digital System for Tracking and Displaying Trajectory and Parameters of an Object Tracked by Air Defense System 1RL-35M Radar ".

The experimental model is fully functional in terms of polygon, in which case the three voltage values corresponding object

coordinates X, Y, H, are acquired from radar computing device. For the experimental model we used three independent voltage sources whose voltage was varied to simulate the variation of the object coordinates.

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MATHEMATICAL MODELS USED TO STUDY THE AIRCRAFT WAKE VORTICES

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Abstract: *Developing air traffic and introducing large aircrafts in use in the group of transport aircrafts has led to the necessity to optimize separation distances between aircrafts, especially near airports. These distances are imposed by airport safety and security conditions, related to the action of the wake turbulence generated by an aircraft on another. At the edge of the aircraft wings, longitudinal vortices are created by pressure differences inside the boundary layers and rotated in opposite senses. It can constitute a danger to another aircraft that flies in this wake, especially during take-off and landing. This paper presents the mathematical models used to simulate the aircraft wake vortex behavior.*

Keywords: *aircraft, wake vortex, turbulence*

1. INTRODUCTION

Research conducted on the wake turbulence of aircrafts is determined especially by a series of economic, ecological and flight safety and security demands. These vortices are responsible for resistance to advancement induced by the lift force, which represents approximately a third of the total resistance to advancement of the aircraft. Considering the actual importance of air transport, an induced decrease with only a small percentage in resistance to advancement allows an annual significant cutback in fuel consumption (a few billions of liters of fuel).

Induced resistance is an important characteristic that is taken into consideration when projecting a new wing. Therefore, the weaker the intensity of the wake turbulence, the weaker the resistance induced by the lift force, thus decreasing fuel consumption [1]. This raises the problem of decreasing the intensity and coherence of the wake turbulence of aircrafts, in order to decrease the resistance induced by the lift force [2]. In this case it is recommended to reduce the distribution of the lift force near the end of the wing, by using longer wings and decreasing the incidence or the surface towards the end of the wing.

Wake turbulence of aircrafts also has a negative ecological consequence, because of its role in the dispersion of polluting particles in the atmosphere and through the contribution of the artificial cloud created by condensation, to the energetic balance of the planet. The persistence of the artificial cloud created in the air is directly connected to the duration of vortices inside wakes.

The most important consequence of wake turbulence consists of the risk of air incidents due to the encounter between an aircraft and the wake generated by a preceding aircraft [3].

This situation is more frequent in the take-off and landing phases, when aircrafts are encountered, during movement, one behind the other, at a small enough distance and when

interaction phenomena between the wake and the ground can lead to an increase of the intensity of wake vortices and, thus, to a probability of air accident production with devastating consequences.

2. RISK ASSESSMENTS OF ACCIDENTS PRODUCED AS A RESULT OF THE AIRCRAFT WAKE VORTEX

The main effect of wake turbulence on an aircraft is the induced rolling motion that can even lead to an overturn. These phenomena can become extremely dangerous during the take-off or landing phases when the aircraft moves at a low altitude and can't recover. Aircrafts that have small wing spans are the most affected [4]. The effect of the wake depends on various factors, of which we remind the weight and the span of the aircraft that enters in the action range of the wake and the relative position between the aircraft and the wake turbulence. Due to the action of the wake turbulence, numerous air accidents happened along time:

- 30 May 1972 - The McDonnell Douglas DC-9-14 Aircraft crashed on the Southwest International Airport in Fort Worth, Texas, being affected by the wake turbulence generated by a McDonnell Douglas DC-10 aircraft. Following this incident, a series of regulations regarding the minimal separation distances between aircrafts have been introduced;
- 20 September 1999 - a JAS39 Gripen aircraft passed through the wake turbulence of another aircraft of larger proportions during a military maneuver, crashing in a lake;
- 12 November 2001 - an Airbus A300 aircraft crashed on New York airport, under the action of the wake turbulence generated by a Boeing 747 aircraft which had taken off two minutes before;
- 4 November 2008 - LearJet 45 XC-VMC aircraft crashed near the international airport in Mexic. Subsequently, it was proven that this incident was due to the action of the wake turbulence of a Boeing 767 aircraft;
- 25 February 2009 - the Boeing 737-800 aircraft of the Turkish Airlines company crashed near the Schiphol airport in Amsterdam, being affected by the wake turbulence of a Boeing 757 aircraft, that had landed on the same landing run two minutes before;
- 2 March 2009 - according to press information, the Control Tower of the Henri Coanda airport in Otopeni discovered in due time that the landing trajectory of the ATR aircraft of the TAROM company intersected that of a Boeing 727 aircraft of the same company. At the last moment, the employees of the control tower have cancelled the landing procedure, and the plane was forced to postpone landing, in order to avoid passing through the action range of the wake turbulence of the first aircraft.

In order to avoid air incidents caused by the action of wake turbulence a series of regulations have been established to define the minimal time intervals between two landings/take-offs of two aircrafts, depending on their proportions, so that the wake of the first aircraft doesn't affect the second aircraft significantly (fig.1). For example, no other aircraft should take-off or land behind a Boeing 747, no sooner than two minutes, which corresponds to a distance of approximately 7,2 km between the aircrafts. This distance becomes greater if the following aircraft is from a smaller category [5].

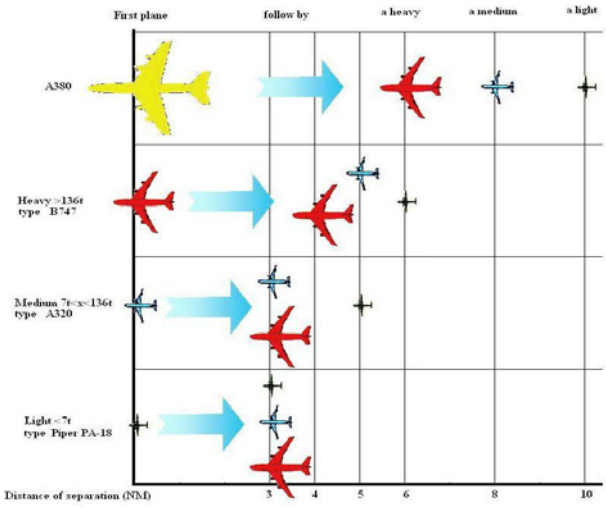


Fig. 1. Distance of separation between two aircrafts

The minimal time intervals established by the air authorities led to a limitation in air traffic. Therefore, modern airports are dealing with a highly important problem that is optimizing air traffic so that it allows the

circulation of a larger number of aircrafts on the take-off/landing run, but without endangering them [5].

Research on wake dynamics have been the object of important programs financed both by the European Union and by other international organizations.

3. MODELS FOR WAKE VORTEX

3.1 Rankine vortex. A first approach to longitudinal vortex is the two-dimensional isolated vortices type Rankine. This vortex is a classic model characterized by a rotation in the vortex core. It corresponds to a constant vortices (ω) distribution in a cylindrical tube infinite and with a radius r_0. The vortices are equal to zero outside of the tube (fig. 2).

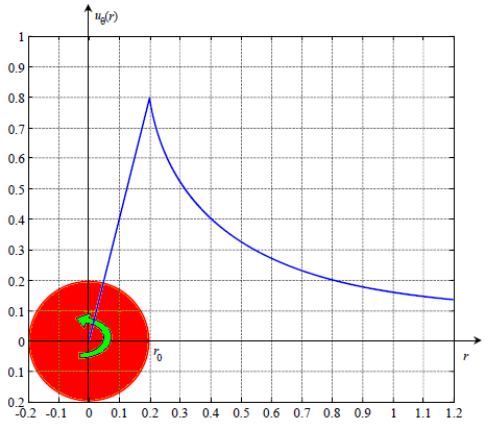


Fig. 2. Distribution of the tangential velocity for a Rankine vortex

The vorticity for the Rankine vortex will have the distribution:

$$\omega(r) = \begin{cases} \omega_0 = \dfrac{\Gamma_0}{\pi r_0^2}, 0 < r \leq r_0 \\ 0, r_0 < r \end{cases} \quad (1)$$

The tangential speed for the Rankine vortex will have the relation:

$$u_\theta(r) = \begin{cases} \dfrac{1}{r}\displaystyle\int_0^r \omega_0 r' dr', 0 < r \leq r_0, \\ \dfrac{1}{r}\displaystyle\int_0^{r_0} \omega_0 r' dr', r_0 < r. \end{cases} \quad (2)$$

$$u_\theta(r) = \begin{cases} \dfrac{\omega_0 r}{2} = \dfrac{\Gamma_0 r}{2\pi r_0^2}, 0 < r \leq r_0, \\ \dfrac{\omega_0 r_0^2}{2r} = \dfrac{\Gamma_0}{2\pi r}, r_0 < r. \end{cases} \quad (3)$$

The Rankine vortex model which is presented here consists of a solid rotation of the heart of the vortex and a potential flow. In this model the viscosity isn't taken into account and also this model is not an exact solution of Navier-Stokes equations [6].

3.2 Lamb-Oseen vortex. In analyzing the influence of the viscosity on the vortex dynamics we used another longitudinal vortex, Lamb-Oseen vortex model. This situation allows us to obtain an analytic solution. The flow of a single vortex isolated as Lamb-Oseen admits a revolution symmetry. We chose also cylindrical coordinates. We used Navier - Stokes equations to solve this problem [7].

The vorticity for a vortex will have this expression:

$$\omega_z(r,T) = \frac{\Gamma}{\pi r_0^2 (1+T)} e^{\frac{r^2}{r_0^2}\frac{1}{1+T}}. \quad (4)$$

where we use the reduced time T, and we note the viscous time with t_v:

$$T = \frac{t}{t_v}, t_v = \frac{r_0^2}{4\nu}. \quad (5)$$

Also, the tangential velocity (fig. 3) of a vortex will have this expression:

$$u_\theta(r,T)=\frac{\Gamma}{2\pi r}\left[1-e^{-\frac{r^2}{r_c^2}\frac{1}{1+T}}\right], \quad (6)$$

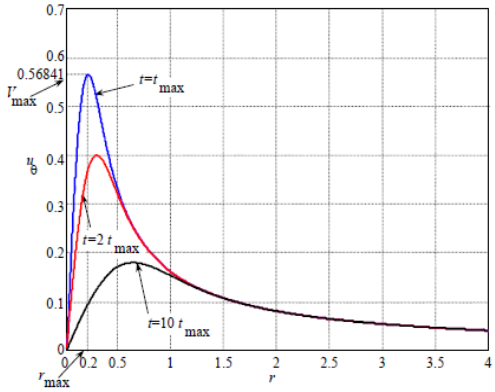


Fig. 3. The tangential velocity for a Lamb-Oseen vortex

The Lamb-Oseen vortex is a simple model of longitudinal vortex frequently used to model the wake of the aircraft. It provides a good numerical representation of longitudinal vortices.

3.3 Lamb-Chaplygin model for wake-vortex pair. Preceding models are used for solitary vortices. The non-linearity of the Navier-Stokes equations imposes some problems in the case of the superposition of elementary isolated vortices. The model of Lamb-Chaplygin takes into account the both the high wake vortices. Besides, in this model, it is not held counts of the viscosity, what removes considerably results of the reality.

Lamb-Chaplygin model consists of a counter-rotating wake-vortex pair with the vorticity concentrated in the circle with the radius R (fig. 4):

$$\omega(r,\theta)=\begin{cases}-\dfrac{\mu_1^2}{R^2}\psi(r,\theta), & r\le R\\ 0, & r>R\end{cases}, \quad (7)$$

where:

U – velocity of vortex-pair propagation;

J_0, J_1 – Bessel functions;

$\mu_1=3.8317$, the first solution of J_1;

$$\psi(r,\theta)=\begin{cases}-\dfrac{2U\cdot R}{\mu_1 J_0(\mu_1)}J_1\left(\mu_1\dfrac{r}{R}\right)\sin\theta, & r\le R\\ -U\cdot r\left(1-\dfrac{R^2}{r^2}\right)\sin\theta, & r>R\end{cases} \quad (8)$$

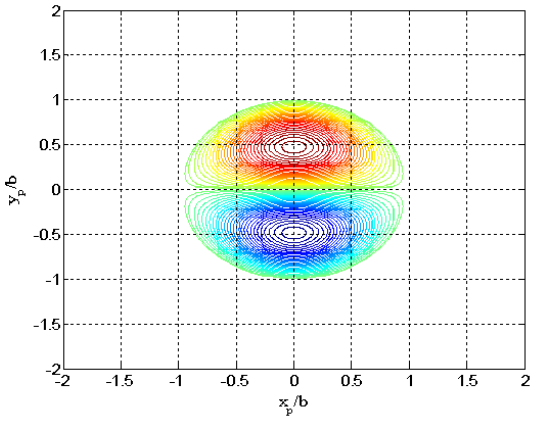


Fig. 4. Distribution of the vorticity for a Lamb-Chaplygin vortex pair

3.4 Counter-rotating vortices using Lamb-Oseen model. To obtain a configuration of a wake of aircraft we can choose the Lamb-Chaplygin model or use the superposition of two simple vortices (Rankine or Lamb-Oseen) model (fig. 5).

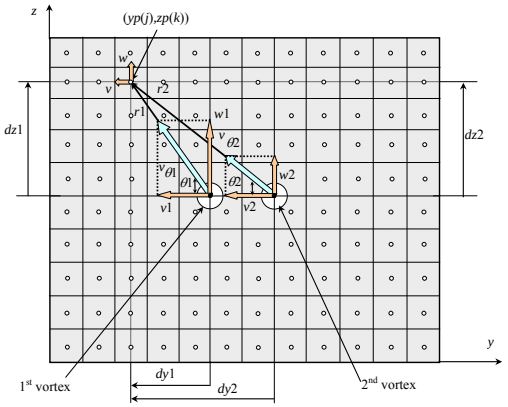
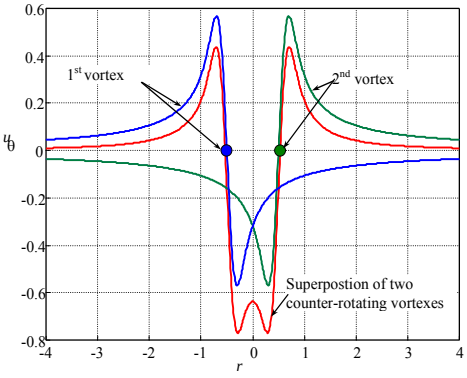


Fig. 5. Velocity field in the case of counter-rotating vortex



pair

Fig. 6. Velocity distribution in the case of counter-rotating vortex pair

The solution obtained by using of superposition of two simple vortices is not a solution of the equations of Navier - Stokes due to the non-linearity of these equations.

After superposition of two vortices we should use a calculation of adaptation to remove this defect [10]. Fig. 6 and 7 present the velocity and pressure distribution obtained using the superposition methods of two counter-rotating Lamb-Oseen vortices.

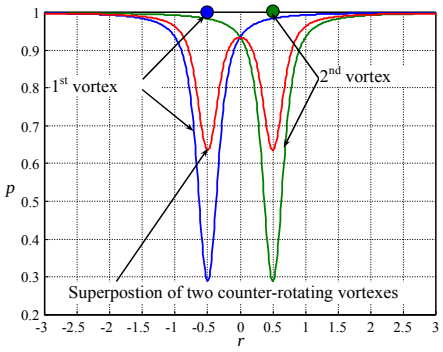


Fig. 7. Pressure distribution in the case of counter-rotating vortex pair

Solutions are defined within calculation, also to have solutions that correspond to the reality, this implements a mathematical model that will interact with the solution proposed for the closer to reality. After a sufficient number of iterations of the simulation of adaptation, speeds and pressures field obtained can be considered as the Navier Stokes equations solution [11].

3.5 Counter-rotating vortices using rows of vortices model. The method of modeling a pair of counter-rotating vortices by the superposition method describes the flow in the infinite medium. The numerical simulations are often done in a finite computation field. In this case the rows of vortices are the most appropriated method [9].

To create the rows of vortices are used Lamb-Oseen vortices (fig. 8). For a single vortex with the coordinates of its heart in the plane Oyz, (y_c, z_c), the velocity field has the following distribution:

$$\begin{cases} v(y,z) = -\dfrac{\Gamma_0}{2\pi}\dfrac{z-z_c}{r^2}\left[1-e^{-(r/r_c)^2}\right] \\ w(y,z) = \dfrac{\Gamma_0}{2\pi}\dfrac{y-y_c}{r^2}\left[1-e^{-(r/r_c)^2}\right] \end{cases}, \quad (9)$$

where $r = \sqrt{(y-y_c)^2+(z-z_c)^2}$.

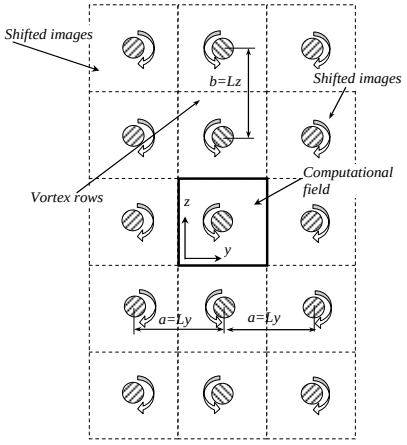


Fig. 8. Rows of vortices

We consider a vertical row of vortices at a distance. To determine the velocity distribution for this row using the stream function as follows:

$$f(\xi) = -\frac{\Gamma_0}{2\pi}\ln(\xi-\xi_c), \quad (10)$$

where $\xi = y + zi$ et $\xi_c = y_c + z_c i$.

After computing for $n \to \infty$ vortices we get the rows of vortices:

$$\begin{cases} v(y,z) = -\dfrac{\Gamma_0}{2b}\dfrac{\sin[2\pi(z-z_c)/b]}{\cosh[2\pi(y-y_c)/b]-\cos[2\pi(z-z_c)/b]} \\ w(y,z) = \dfrac{\Gamma_0}{2b}\dfrac{\sinh[2\pi(y-y_c)/b]}{\cosh[2\pi(y-y_c)/b]-\cos[2\pi(z-z_c)/b]} \end{cases}, \quad (11)$$

In the middle row we must remove the solution corresponding computational domain:

$$\begin{cases} v(y,z) = -\dfrac{\Gamma_0}{2\pi}\dfrac{z-z_c}{r^2} \\ w(y,z) = \dfrac{\Gamma_0}{2\pi}\dfrac{y-y_c}{r^2} \end{cases}. \quad (12)$$

It has been added m shifted images in the horizontal direction. The final solution is:

$$S(y_c,z_c)=S_o(y_c,z_c)+S_r(y_c,z_c)- \\ -S_p(y_c,z_c)-\sum_m S_r(y_c\pm a\cdot m,z_c)\ . \quad (13)$$

where:

S – final solution;

S_0– solution for the central vortex pair (9);

S_r – solution corresponding to the row of vortex (11);

S_p – solution corresponding to computational field (12).

5. CONCLUSIONS & ACKNOWLEDGMENT

The presented models can be used as initial condition for the numerical simulations of the behavior of the isolated wake vortex or of the wake vortex counter-rotating pair [8]. The numerical simulation can be realized using the Direct Numerical Simulation or Large Eddy Simulation methods [12].

These methods are based on finding a solution through the method of finite volume of fundamental equations of turbulent fluid flow, the Navier-Stokes equations. The Direct Numerical Simulation (DNS) method of modeling turbulent flow has the advantage of being very precise, but it's necessary to realize simulations on a very large number of calculus points, which obviously involves using a high calculus power.

The Large Eddy Simulation (LES) method of modeling turbulent flow consists of directly simulating large turbulent structures, the small ones being modeled by specific methods. The reasoning of this method is based on the fact that large turbulent structures are directly influenced by the geometrical characteristics of the studied situation, while small structures have an universal character, and the errors introduced by modelling them are insignificant. The advantage of this method is that it offers results as precise as those obtained through the direct numerical simulation method, but using a smaller amount of calculus numbers, therefore a smaller calculus power.

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MILITARY INFORMATION AND ITS IMPORTANCE FOR UNDERSTANDING THE INTERNATIONAL POLITICAL-MILITARY PHENOMENON

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Abstract: *From the perspective of policy makers, the military information is a notification system with the purpose of triggering reactions, which in turn determine the actions. Responding promptly to external signals represented by primary information and informing in an appropriate way, the military and military-political decision makers, can prevent aggression, this being the reason why between military intelligence and policy makers needs to exist a continuous two-way communication path that is able to allow notification and react approach to any threat, communication being the key factor of transmitting the military information. This article focuses on the analysis of military intelligence seen as an important element of international military-political structures, also focusing on the place and role of military information systems providing information for effective strategic decisions.*

Keywords: *military decision makers, military information, military information systems, information environment, military terminology, data, information, knowledge, information products*

1. INTRODUCTION

In our days, it is more and more necessary to find ways to estimate the amount of information needed and being sufficient to perform the necessary tasks, due to the fact that information began to overwhelm both the volume, diversity and dynamics of the phenomena described, and the growing need of its distribution among individuals and departments that process and distribute it in a periodical manner. Thus, it is necessary to limit the amount of information only to be used to enable the military and military-political international order to preserve national interests and prevent aggression, facts that are only possible by knowing the elements of military information assessment, its characteristics and its parameters.

The military information is „*a message concerning the facts and the military and military-political events witch have to be understood, used by governing structures and sent to executive structures to help achieve goals*."[9] Data and information in military terminology is defined in terms of finality and must ensure a level of understanding of the environment so that it can be used by the consumer. The data is defined as: representations of events, concepts or instructions presented in a note that can be used in formal communication, interpretation, analysis, human processing or by automatic means, any representations; such characters written or in any other form that can be attached analogue to that meaning[8], representation of information in a formalized manner that can be transmitted, interpreted or

processed[2]; raw signals transmitted between any two centers or obtained from the environment by a collector of any kind (human, mechanical or electronic).[5]

Also, in terms of military terminology, information is defined as: events, data or instructions in any enclosure and for any configuration, meaning that man, as an individual, attaches data by means of conventions used in their representation[8], data processed in order to be understood[5] (people give data more generally in cognitive hierarchy).

2. MILITARY INFORMATION CONCEPTS, FEATURES, REQUIREMENTS, CLASSIFICATIONS

Military information is important for understanding both the military and international political-military phenomena and to eliminate uncertainty about the occurrence of various anomalies in its progress, for which consideration it should be given more importance to the military information characteristics, as follows:

- *The age of information* - it is the time elapsed between when the information was collected and when it will be used by the analysis and synthesis organs;
- *Accuracy* - means that information elements have to form a complete and real informative picture of the described event. Accuracy of information can be appreciated by the number of responses to requests for information and the total number of application ratio, or the degree of information required to assure objective reflection of reality;
- *Opportunity* - reflects the need for providing information to the analyst officer when he needs it, in real time, in order to prevent events that could affect national interests (preventing surprise, aggression);
- *Form* - directly influences the speed of information and speed product decision development ;
- *Ability to integrate* - to achieve maximum information from a minimum processed primary information; the contribution of each information to create the informative image;
- *The complex character* - encompassing elements that allow the formation of a comprehensive picture of the process, event or situation. Efficiency is influenced by the degree of completeness of the following information barriers: *historical* (accessibility to information is directly proportional to its age), *geographic* (accessibility to confidential information is inversely proportional to the distance to the source), *economic* (availability depends on the ability to withstand "cost" purchase information) *terminology* (data are much more available to the intelligence officer than when referring to the military than in any other field) *language* (availability depends on the knowledge of the source of information or editing the source document) *regime* (accessibility to information is greater for democratic regimes which promote free access to information) *resonance* (availability depends on the extent to which information-gathering body is able to understand the meaning and value);
- *Utility* – getting appropriate information to the receiver;
- *Consistency* - logical ordering of signals in such manner up to acknowledge the information and afterwards, to accept and assimilate it;
- *Perishability* - refers to the time value of information (may be valid for a time, a time or have permanent value);
- *Rigor* - define the degree of accuracy, detail and brevity of information in relation to the essence of the message;
- *Vulnerability* - refers to the probability that the information can be canceled as a consequence of truth value (other information which may be true or false);
- *Argumentation* - characterizes the level of scientific substantiation of statements or information by logical demonstrations, all together confirming the truthfulness of its content and let us not forget the usefulness;
- *Reliability* - important information parameter that combines all the other features in order to give a value of true or false to the information;
- *Portability* - characterizes the ability of information to be processed and stored in an

informational system without being semantically altered;
- *Clarity of semantics* - semantics are defined by the uniqueness of the message: 1 for clear and 0 for unambiguous;
- *Concision* - is a parameter derived from the restrictions imposed by the methods of cryptographic protection of information;
- *Form of the message* - messages are defined as classes of communication (signals, messages, graphics, radio transmission, wireless, email, etc..) or by coverage (digital, coded, secret);
- *Operational risk* - the risk assumed by the transmission of information from receptors to the analysis and synthesis structures;
- *Message confidentiality* - the message quality to resist attempts of unauthorized access during transmission, processing and storage in databases;
- Information status - can be: static (semantically) expressing the ratio of the information provided and the event to which it relates or it can be dynamic (programmatic) expressing the effect of information on beneficiaries.

Due to the high cost of obtaining and processing information, the need for identification and authenticating sources, safety related channels, and authorizing limited access to information and receiving and understanding the transmitted information, military information must be precisely defined, clear, concise and obtained as a result of a explicitly stated request.

This information must have certain properties in order to be integrated into a global system and, therefore, be used. The information must meet certain requirements to be used. These requirements have to be as following: *to be necessary* - the leading factors have to depend on it at a specific moment of interest, *to be authentic* – it must not distort the reality and present events according to the reality, *to be exact* – to not be ambiguous, can be used without the need for further details, *to be complete* - does not need to be supplemented, to be focused and relevant to the subject to which it relates, *to be appropriate* - be disseminated in the right time in order to be used in decision-making process, *to be recent* – the interval of time between the occurrence of a conflict that requires the intervention of the leader, until the time when the information at hand reaches the leader to be minimum, *to be rhythmic generated* - to reach a leading department with a established frequency in order to allow proper organization of the subordinate departments, *to be reliable* – the information must not be affected during collection, transmission and processing, *to have a dual nature* - the information should be objective (characteristic given by the intrinsic informational content), but also subjective (character given by the value attached to it).

Emphasizing the military dimension of the term, we can define the information (this concerns the processed information - *intelligence*) as "*a product resulting from the processing of information relating foreign nations, hostile or potentially hostile forces, elements or areas of operations or potential operations*."[4] This term may be used to name the activities that lead to the emergence of information and, as a generic designation for those involved in the process of obtaining information.

Classifying information is done by highlighting the quantitative criteria, the qualitative side, the issues related to the action, the destination, the system features and procedures of sending it.

Depending on the destination of the information, there are two categories of information: *cyber information* - for the government as a process of determining the existence and operation of any system type, *non-*

cyber information - referring to the inorganic world and needs to be managed.

In relation to the characteristic of certain types of information systems, there are two categories of info: *technical information* - allowing the operation of technical systems, having a probabilistic expression, *social information* - intended for managing processes in different domains (social , economic, etc..) and governs the evolution of human society and the individual. Within this category, there are communicative types of information (which have a story), control information (which engages an action), organizational information (which generates a specific ordering) and recurring information (which ensures efficiency and auto regulation against hazard)[11].

Depending on the relationship between source, broadcast channel and receiver we can identify the following types of information:

- *Distributed computing* – there are no precisely established consignees and does not require communication channels (for example radio and television);
- *Oriented information* - has both known and unknown recipients, but receivers have common characteristics and can assimilate information; requires communication channels (radio, thematic discussions on the Internet, books, magazines, scientific communications, etc.).
- *Group information* - the number of receptors is known to the source, the channels of communication are established by the source; the information can be assimilated;
- *Direct information* - which has a single recipient (both source and recipient are unknown, and the transmission channel has the required parameters); the information can be assimilated.

2. THE MILITARY INFORMATION SYSTEM (MIS), THE STRATEGIC DECISION SUPPORT STRUCTURE

The command and control of military operations, in addition to strategic information of national, political, social and economic interest, has to have a significant amount of specifically military information at all levels (strategic , operational and tactical). The strategic level information is integrated within the politico - military one, building the object of study that concerns the decision analysis and high-level control structures: the President, Parliament, CSAT, MAp.N, CNMC. The military intelligence structure plays a special role, its primary mission being to prevent strategic surprises/aggression (figure no. 1).

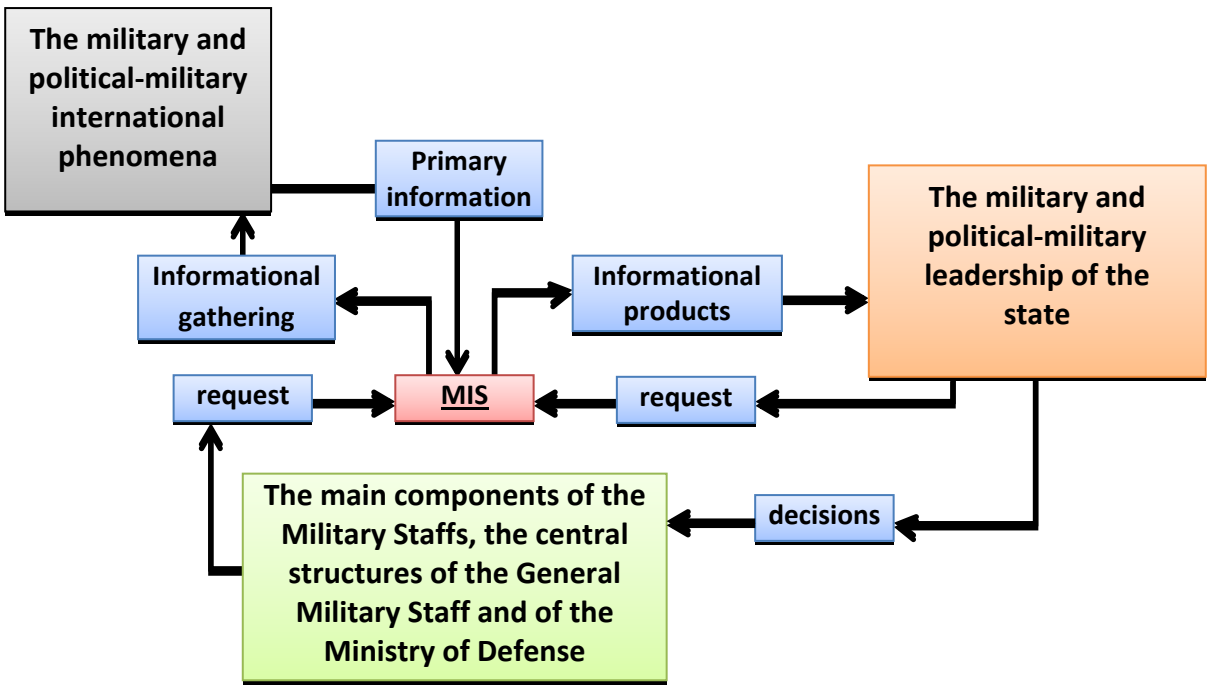

Figure no. 1 ***Location and MIS role in providing information for strategic decisions***

Source: Gheorghe Savu, *The role and mission of military intelligence, activities necessary for the execution of strategic research*, GMR nr.6/2006, p.11

Operational level of information is the result of an informational cycle conducted by the Operation Command Center using information received from strategic levels.

Tactical information derives from operational headquarters, large neighboring units subordinated and supporting their research.

The information may be divided up to three types according to its level:

- *Basic information* – it represents information about a particular subject that is stored in databases and updated both in peacetime and during operations. The main use of the basic information is to establish a general framework in order to start missions and meeting the information requirements relating immutable data such as terrain features in the area of operations and climate conditions that can occur during operations;

- *Current information* – it refers to the information that it is produced in response to the additional information concerning the current operation defined as "information that reflects the current situation at both strategic and tactical levels";[1]

- *Information about the target /objective* - it is defined as "information that describes and locates the components of a target or groups of targets and indicates the vulnerabilities and their relative importance."[1] Information regarding the target provides data for the identification of objectives. This process ensures that the support systems are used at maximum efficiency.

The technological progress has made its mark on every human activity, implicitly on the military ones. Any military action plan is based on information that is available, even if the information is incomplete, it cannot miss when planning and executing an action. Commanders have a modern information system capable of continuously collect data from areas of interest, adversary, own troops, weather, etc.. It is not enough just linking all the data, it must be analyzed and disseminated in order to predict the opponent's intentions and capabilities. Each commander, at all levels, will try to discover the opponent's intentions, its possibilities in order to be able to make a correct decision and lead the mission, within certain ordered restrictions.

The informational architecture is performed on three levels (strategic, operational, tactical) and may include: structure management, the execution forces, information flow and information products. The informational structure is designed according to the mission, in order to satisfy the commander's needs of information at different echelons. The tactical combatant commanders are in need of tactical information and therefore subordinate intelligence forces will be organized in order to respond to these requests.

In the planning and analyzing of different intelligence activities, the aim that must concern us most is that of obtaining an informational advantage, a decision-making advantage and an advantage regarding the actions taken against the opponent. These informational advantages are generally accepted at three levels: information superiority, supremacy of information, information dominance. Defining the levels used to quantify the informational advantages of the situation we must take into consideration the following *factors*: the ability to obtain the largest possible amount of information from diverse sources, reducing the likelihood of using false information by adopting techniques, tactics and effective procedures for the collection, processing, transmission in various formats (fix format and dynamic format) and automatic processing of them; the capability of the communication systems for transmitting the entire flow of information ,safely and on-time; the levels of protection and security of data and

information structures; the commander ability to use the information in order to take decisions, remaining one step ahead of the enemy etc.

For the success of the operation and the efficiency of the activities that have developed for the safety of the military information and the politically and military activities of the state, in time of peace and war, the modern military information defines the entire process of gathering the information, evaluation, coalition, interpretation and distribution, activities that are executed in a succession of well-defined algorithms.

The informational environment defines the source of information which operates with the informational system along with every technique support and human resources they have. The concept of informational environment is given by the characteristics of the informational systems, by composing fragments which are based on the information we have, referring to the whole amount of information, generators referring to the written and audio press, all sorts of publications, inventions, social, cultural, scientific manifestations, internet and publicity.

The informational systems that belong to some departments like economic or security, consider those elements of informational environment as well as their technique support as being open sources of information, focusing on the informational product in the security field.

The military informational environment can dispose decisions regarding the informational product coming from: one informational system, national systems and the departments of internal responsibility, national systems and departments of external responsibility, open sources. Specific to the defense department the informational environment is based on the action of the informational environment of the national security regarding the internal and external areas of defense and protection.

3. CONCLUSIONS

We appreciate that the defense structure is classified, limited to the public access. It can define its informational environment as being a coalition of resources and national security which includes people, technical support and the doctrines that are capable to assure the informational military action. At this we can add the informational exploitation and all the informational systems, open sources for the military informational environment and the commercial environment. A lot of states are adopting these informational sources at the highest rank.

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TYPE CERTIFICATION AND AIRWORTHINESS CERTIFICATION PROCEDURE OF UNMANNED AIRCRAFT

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Abstract: *The paper describes the Hungarian certification procedure of Unmanned Aircraft Systems as state air vehicle. The UAS consist of the aircraft and ground control station as well as communication system. The article shows the Hungarian type certification and airworthiness certification requirements of UAS.*

Keywords: *unmanned aircraft system, type certification, airworthiness*

1. INTRODUCTION

Today, as in the various countries of the world in Hungary growing number and many different configuration unmanned aircraft systems (UAS) are used both civil and state aviation.
Application of these special air vehicle beside the high quality technical design essential the adequate aviation legal background too.
Before deployment or integrate the UAS into the conventional aviation traffic different certification and validation procedures must be performed on the UAS.
The positive outcomes of this certification contribute for the safe operation of UAS as well as increase the flight safety.

2. UNMANNED AIRCRAFT SYSTEM

The UAS is composed of aircraft (fix wing, rotor wing etc.) and ground control station as well as communication link.
You should not forget the operators of aircraft and ground control unit and maintenance experts who are important part of the whole system. The safe operation of an unmanned aircraft system requires the air, ground and communication subsystems reliable working both separately and together.
Beside the above it is important that the quality of system components and parts are appropriate and their operations shall be trusty. However, in this case the reliable cooperation of the subsystems should be more relevant.

3. UAS OPERATION ENVIRONMENT

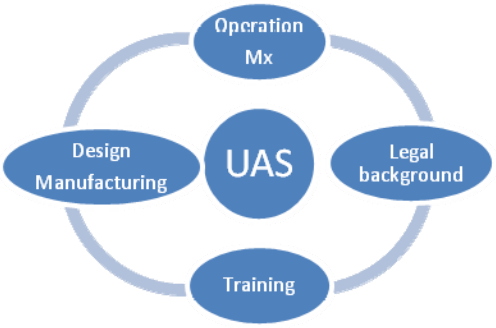

Fig.1 Unmanned Aircraft System full operational environment

The legal background of the certification and licensing procedures are developed in several national and international working groups by aviation experts.
A major challenge is for the policy-makers that unmanned aircraft have numerous configurations, geometries and weights. Beside that they are operated in much different environment with special flight task.
Development of unified regulatory environment is a complex task.

In Hungary the National Transport Authority / Aviation Authority responsible for the different validations, certifications and registration of state air vehicle.
For the operation of Unmanned Aircraft Systems as state aircraft required the following certifications:

- authorization of UAS design and manufacturer company;
- licensing to the operator crews;
- authorization of UAS holder, operator and training organizations;
- type certificate for the UAS (contains the aircraft, ground station and communication link);
- frequency spectrum licence;
- airworthiness certificate;
- registration certificate;

4. TYPE CERTIFICATION

The purpose of the type certification to certify that unmanned aircraft system suitable for the safe flying.
In Hungary presently more unmanned aircraft systems are applied in the state aviation.

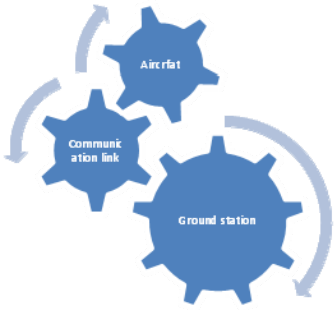

Fig.2 Unmanned Aircraft System

The depth of the type certification depends on the category of UAS and its required operating environment.
During the certification process beside the air vehicle the ground station and the communication system are examined too.
The authority experts together with the designer and manufacturer engineers develop the detailed certification procedure which contains the necessary documents, static and dynamic load tests, test flight programs.
Since the beginning of the UAS designing the Authority engineers have monitored the development of the UAS manufactured in Hungary.
After checking the aircraft plans the static load tests of fuselage, wing, horizontal and vertical stabilizers as well as the ailerons, elevators, rudders are accomplished.
The engine (electric, gas, jet) of the aircraft is checked by the experts.
The production environment of the engine and quality of the main components and the fuel system are examined.

Essential part of the type certification work is the examination of the flying control system of the aircraft.

During the certification process for the specific tests external expert organizations are involved by the Aviation Authority.
It should be noted that the flying control system is the most important part of the unmanned aircraft system related to the aviation safety. This subsystem together with the communication link has fulfilled preprogrammed commands by the actuator. Furthermore this subsystem is responsible for targeting of the aircraft on the pre programmed waypoints.
UAV flying in Hungarian airspace can be implemented only in segregated/closed airspace available for dedicated, adequately insured for the operation under conditions prescribed by law!

In the under 20 kg maximum take off weight unmanned aircraft's many components and parts (for example: different electronic items, cameras, servos, receivers, electric motors, electronic speed controls, jet engine etc.) can be purchased from commercial market.
High priority of the quality management system of the UAS manufacturer organizations is to certify the „civil" components and parts suitable for the installation into an air vehicle.
During the type certification these parts are investigated within different special tests.

Beside the aircraft the operation and reliability of the ground unit has to be checked in different operating modes.

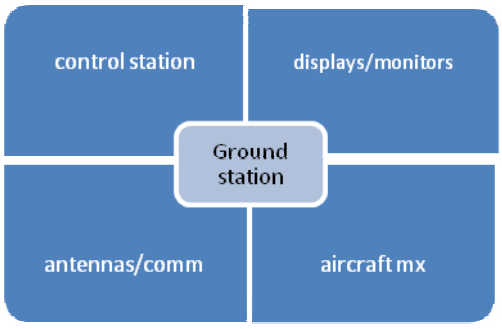

Fig.3 Main parts of Ground Station

The ground station consists of the following parts:

- control station for the aircraft direction and navigation;
- different displays to project the aircraft video signs;
- several antennas for the transmission the radio, video signs;
- maintenance part where the different checks (preflight, rout waypoint loading) related to the aircraft are accomplished;

The operation flight tests processes start after the design examination and ground tests.
During different special flight test programs the structure and maneuverability, stability and load test of aircraft are examined in several speed.

We can get many different real time telemetry (flying speed, altitude, direction, g-load) details and video signs through multiple communication system.
The test flight period is followed by the evaluation and summarize of the flying parameters.
The continuous communication without interference is essential for the reliable operation of unmanned aircraft systems. Number of real time data exchange required

between aircraft and ground station. During the operation radio signals of different frequencies are used for GPS and to communicate with other aircraft as well as ground station.
During the type certification the frequency and performance of applied radio signals have to be checked to meet the relevant legislation.

After the successful type examination the Aviation Authority issues the type certificate with data sheet.
The data sheet contains the parameters of the unmanned aircraft system including the aircraft, ground station and communication system. Operation restrictions are contained in the data sheet too.

5. AIRWORTHINESS CERTIFICATION

Beside the type certificate the airworthiness certificate is an essential document of the unmanned aircraft system.
The airworthiness certificate is an individual document of the aircraft so each air vehicle has one.
The airworthiness document certifies that the unmanned aircraft suitable for the air traffic.

Fig. 4 Main fields of airworthiness certification

Before issuing of airworthiness certificate on each unmanned aircraft system an airworthiness examination have to be performed.
During the airworthiness examination it is necessary to check the technical condition of the system which means the ground and air operability as well as the documentation of the system.
Functional check flight program is used for examining the air operability of the unmanned aircraft.

6. CONCLUSIONS & ACKNOWLEDGMENT

Parallel to the conventional air vehicle the usage of unmanned aircraft systems in many countries is also spread.
But as long as the conventional aircraft must not be operated without any type certificate and airworthiness certificate in some countries there is no any certification requirements for the small category unmanned air vehicle.
Based on the last years of practical experiences can be stated that in unmanned aviation it is important and significant to develop the appropriate operating environment and legal background.
Similarly usage of conventional air vehicles to operate an unmanned aircraft system should be the number one priority the flight safety.

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INTEGRATION OF THE VSHORAD MISSILE WITH THE SMALL CALIBER ANTI-AIRCRAFT GUNS - A WAY FOR AN INCREASING EFFICACITY

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Abstract: *Battlefield is a dangerous zone for the ground troops, even outside of the fight actions. The aerial threat imposes to every unit to take air-defense measures. That refers to much type of targets, against which the weapons hit / kill probability are so different. Most actually solutions are based on small caliber anti-aircraft guns or on VSHORAD missile systems. All these systems have engagement peculiarities and some efficacy limitations result. By integration of guns and missiles in mixed air-defense systems, the characteristics of both equipment can be optimal used, allowing to the troops much coverage and efficacy. The paperwork presents some basic considerations of the mixed-AD systems theory and two Romanian developments also.*

Keywords: *missile, gun, probability, efficacy, integration, target*

1. INTRODUCTION

The East-European zone was longtime connected to doctrines, tactics and battle technologies considering the possibility of an open major conflict between the military blocks. In these conditions the air-defense in all aspects were constantly preoccupied the Romanian military thinking, confronted mainly with the relatively Western air superiority.

In our country the production of the AD (air-defense) equipment has a tradition begining before the WW2, when licensed a.a. (anti-aircraft) guns were produced (Vickers cal.75mm and Rheinmetal cal.37mm), as well as the indigenous designed centralized fire-control equipment and the ammunitions also.

Concerning the ADMS (air-defense missile systems), in period of the '60 –'70 years few repair and maintenance facilities were founded, following the R&D, design and production capacities, especially for short-range air-defense missiles.

Representative for this category were the CA-94 and CA-95 systems, destined to the close defense of ground troops, using IR-homing missiles, together their school, training and checking devices.

Fig. 1 The CA-94 system

The CA-94 system is a MANPAD using an IR-homing AD missile with the following characteristics:

	U/M	A-94
Caliber	mm	72
Ceiling	m	2,300
Range		4,200
Target velocity	M	0.75
Average speed		1.5
Warhead	kg	0.8 HE
Weight		10
SSKP		0.22

The self-propelled CA-95 system uses an IR-homing fire-and-forget short-range AD missile, and allows a.a. coverage for the mechanized ground forces.

Fig. 2 The CA-95 self-propelled system

The A-95 missile has the following characteristics:

	U/M	A-95
Caliber	mm	120
Ceiling	m	2,800
Range		4,200
Target velocity	M	0.9
Average speed		1.5
Warhead	kg	2.8 HEF
Weight		30
SSKP		0,33

The systems are in use with Romanian Ground Forces.

2. NEW OPERATIUONAL TRENDS AND SYSTEM REQUIREMENTS

The international engagements impose a new mission profile for a different operational theatre. For the AD that means the direct a.a. protection allowed to small size units, tactical disposals and civilian objectives against aggressor low altitude aircraft.

Concerning the short-range air defense (SHORAD), the modern battlefield has as main characteristics:

- high density of the attacks
- increasing level of coordination
- intensive use of ECCM to blind or to fox the enemy systems
- communications network disturbances
- use of ELINT systems to locate the AD means and C^3I centers

These features impose AD configuration concordant with the menace evolution.

Aerodynamic vector requirements – Surface-To-Air Missile:

- the storage, transport, and release to be made to /from sealed container;
- preparing of missile launching from launch facility takes no more than 10 sec.;
- the protection of proximity fuse against the active and passive jamming;
- facility to work with solid fuel engines ;
- the initiation of warhead owns at least 3 levels of safety, of which no more than one stage to stand before startup missile;
- standard operation life of the missile to be at least equal to standard operation life of the system as a whole (without replacement of more than 5 % of components in terms of value);
- the level of probability of false alarm proximity fuse to < 0.01% in both presence of active and passive jamming;
- do not require special storage conditions and outdoor storage shorten not more than 30% specific service life cycle where maintenance would be done in enclosed storage.

Gun component requirements:

- have small caliber (20-40 mm);
- have several barrels (2-4);

- hit probability ≥ 0.9 to 10 projectiles;
- have high rate of fire (≥ 500 lov . / min / barrel);
- be able to use all types of anti-aircraft projectiles, proximity fuses;
- be able to use projectiles with submunitions, prefragmentate elements etc.

Generally, the a.a. automatic guns allow the fire volume, rapid reaction and self-defense capability, while the missiles allow a higher engagement envelope, direct SEAD tactics inhibition and edge range efficacy.

Mixed systems can reject the saturation attacks, when the enemy concentrates a large number of aerial assets (including UAV) against of a high value target. The density of defensive riposte continuously graduates when the target approaches by the objective.

The proposed basic tactical unit is mixed AD battalion, which assures some facilities, like:

- increased level of defensive automation
- enhanced C^3I/C4I facilities
- ECM resistance growth
- short reaction time
- multiple-targets engagement capacity.

3. THEORETICAL CONSIDERATIONS

For the gun-based AD systems may be observed that the hit probability severe decreases by range.

A good approximation for the hit probability in case of the barreled artillery Systems [1] is obtained by Raleigh formula:

$$HP_1 = 1 - \exp(-kxT_a/(\Delta xX)^2) \quad (1)$$

where Ta represents target area perpendicular projected on shooting plan, Δ is a total error in mRad, X is the range in km and k a correction coefficient.

For a burst fired with a single tracking and aiming data set [11], can be writing:

$$HP_S = 1 - \exp(Sx\ln(1 - HP_1)) \quad (2)$$

where S represents number of shoot in burst.

$$KP = HPxZ_1 \quad (3)$$

where Z_1 represents single shell kill probability, and the reliability coefficient for AD artillery ammunition is practically 1.

Contrary, a missile system has an impractical close zone, but keeps a relative efficiency just to the maximum range.

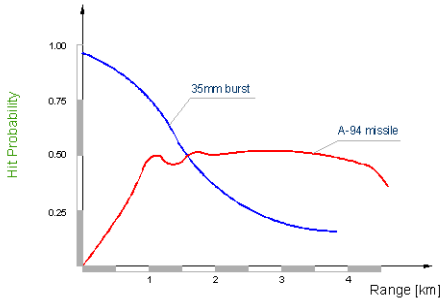

Fig. 3 The aspect of HP curves for a gun and a missile

Considering a standard data set about target and fire units type GDF003 and CA95M (T_a = 9, elliptic dispersion centered on target with 1,8/3,6 mRad deviation, aiming error 2 mRad, Z_{1M} - 0,45, Z_{1G} - 0,15) the hit and kill probability was calculate if a 35 mm HEI burst and a A95M missile will fired [2].

In the case of multi-missile use, the hit probability [5] is determined like follow:

$$HP_N = 1 - (1 - HP_1)^N \quad (4)$$

where N represents number of the missiles. Kill probability cumulates the hit

probability, the reliability and the shot efficacy on target [6].

$$KP_N = 1 - (1 - Z_1 HP_1)^N \qquad (5)$$

In rapport to the gun type, the results obtained by running a specialized program show the superiority of the missile starting with ranges over 1500 to 2500 m.

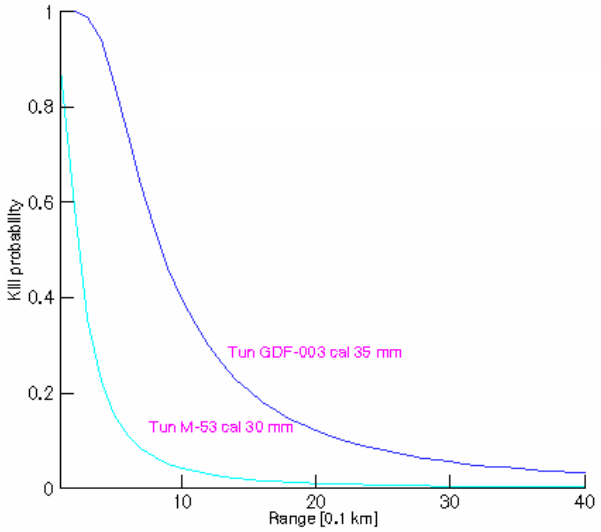

Fig. 4 The kill probability for M-53 and GDF003 guns

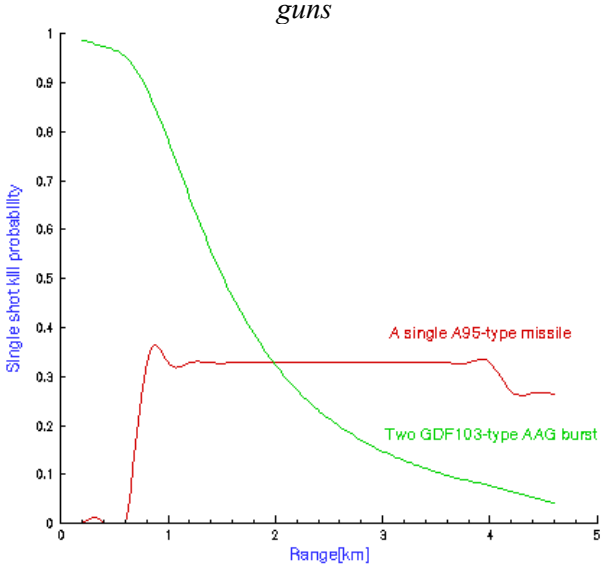

Fig. 5 The kill probability for a GDF003 battery and a CA-95 system

4. THE MIXED GUN-MISSILE SYSTEM GEPARD-R

In the years 2004-2005, the companies SC Electromecanica Ploieşti SA and Krauss Maffei Wegmann have developing a common project based on the Romanian Gepard SPAAG and the CA-94 IR-homing VSHORAD MANPADS missile system.

The Romanian partner was responsible for missile, launcher, FCS with missiles, crew training and field-range test organization, while the German partner was responsible for FCS integration, supply, special maintenance facility and logistics.

Fig. 6 The IL A94-G for Gepard-R side weapon station

Fig. 7 The GEPARD-R mixed SPAAG/Missile

The mixed integrated system was designed, realized and was performed a testing program. The results out passed the initial requirements.

Fig. 8 Gepard-R field-range test

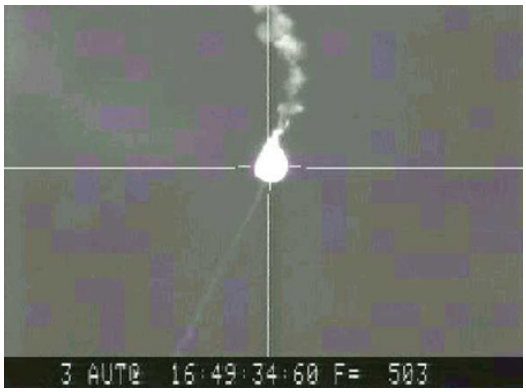

Fig. 9 A missile shot registration result

Practically, in field-range test the missile ripple fire can be executed against two different targets, before the guns opening fire.

Both missile shots were accurate, despite little angular difference between targets and their remnant IR trace.

The mixed system combines the advanced searching and tracking capacity of the basic SPAAG with the A-94 missile performance, a high mobility and increased fire-power system resulting.

5. THE INTEGRATED GUN-MISSILE SYSTEM 35mm AAG / CA-95

The small caliber automatic 35mm GDF003 gun system [3] with their associated searching/FCS equipment (SHORAR low altitude radar station and GSN optical tracker) can be integrated with the CA-95 self-propelled missile system, resulting a high effective mixed AD battery. This experiment was performed by SC Electromecanica Ploieşti SA together ACTTM Bucureşti at the prototype level and tested in Capu Midia field-range.

The system architecture is based on SHORAR battalion's command point (BCP).

Fig. 10 SHORAR command post

The emission can be stopped in 3 sectors with variable limits to protect the shelter against anti-radiation missiles. The radar search and made IFF interrogation in the same time with target tracking (track while scan capability).

Searching zone is covered by 2 electromagnetic fascicles (for low / medium altitude), which computer automatic and adaptive commute.

Searching zone Range Altitude Elevation	 D=25 km H= 3 km ε= 45°
Scan rate	57/38 rpm
Emitter pick power	1,8 kW
Work frequency	X band
No. of pursued targets	20
No. of tracked targets	10
Power input	8.5 kW

Fig. 11 The Oerlikon GDF003 2 x 35 mm gun

Max. effective range	4 km
Rate of fire	1100 rds/min
Vertical firing field	–5° ÷ + 92°
Ready to fire ammo	2 × 56
Muzzle velocity	1175 m/s
Traverse rate	120°/s
Elevation rate	60°/s

The battalion commander assures operation control by means of tactical console, located in BCP. This console shows:

- tactical scenario display
- aerial situation display
- menace evaluation
- targets distribution towards batteries.

The BCP connected in radar data-link network generates in real time the aerial situation image and is informed about the targets which will enter in their own search and fire zone.

The information about targets concerns location, identity (friend/foe), classification (plane/helicopter), direction, speed, engagement envelope.

Because of multiple sources, which don't be simultaneously jammed/destroyed, the network is more stables than any individual search asset and the weapon systems don't be detected when execute active search.

In order to use external sources for FCS (ASOC included), the CA-95 platform was extensively modified, a lot of data-processing and command equipment being accommodated.

Fig. 12 Inside of the CA-95 firing post

In basic mode the targets indication comes from GSN. The launcher is automatic driven in azimuth. The operator uses the optical sight and the joystick to acquire the target, which initiates the automatic track. Advance angles has predetermined values and are automatic introduces. The shot is fired at the operator initiative.

In reserve mode the target indication is received from BCP by digital data-link and autonomously detected.

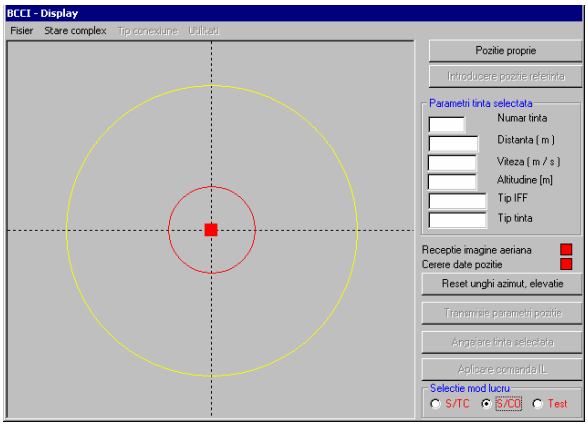

Fig. 13 The on-board data-control panel

Such equipment permits to build a mixed battery structure, with two guns and two missile stations, around a GSN FCS. Even a tracked derivative version of the CA-95 missile launcher can be easily obtained [4].

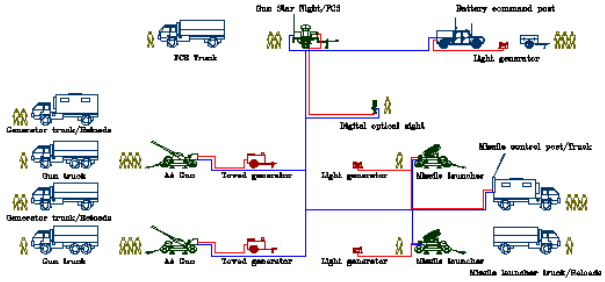

Fig. 14 The integrated AD Battery structure

Connecting three batteries with a SHORAR BCP an integrated mixed AD battalion can be obtained, allowing direct protection of small sized military and civilian objectives and tactical disposal elements against low altitude targets like fighter-bombers, hovering ground assault aircraft and helicopters, cruise missiles and drones.

At the unit level the AD performances exceed the possibilities of individual weapons, with few relevant characteristics [9]:

- Search range 25 km
- No. of pursued targets 20
- No. of tracked targets 10
- Kill probability 0.68 ÷ 0.96
- Effective AD coverage 17 km
- Simultaneously engaged targets 9

6. CONCLUSIONS & ACKNOWLEDGMENT

The system integration supposes the existence of an industrial infrastructure, capable to assure:

- platform upgrade
- board devices
- weapon systems and ammunition
- C^3I/C^4I hardware and software

In the same time the free access on market for some specialized devices (like solid-state computers, positioning equipment, data link, communication stations, GPS, INS, night vision equipment) is necessary [7].

A schedule for an industrial development of a mixed gun/missile system shows that an economy that was designed, was tested and was produced separately missiles, guns and platforms is more than capable to integrate this parts into a mixed AD systems [8], [10].

Another idea refers to the possibility to obtain a good result concerning the efficacy through a mixed system using even ageing weapons, but supported at the system level by the state-of-art equipment and software.

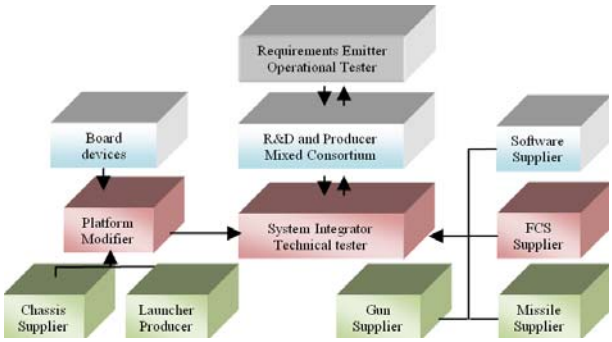

Fig. 15 Industrial development schedule

These can be a way of action for the armies disposing of the stocks of weapons from previous generation.

Not at least, the mixed AD systems allow grater engagement flexibility against the aerial targets and much stability for the general area defense.

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OVERVIEW OF THE RESEARCH AND TECHNOLOGY PROJECT ON UNMANNED AERIAL SYSTEMS (PITVANT PROJECT)

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Abstract: *This paper presents an overview of the Research and Technology Project on Unmanned Aerial Vehicles (PITVANT project), funded by the Portuguese Ministry of Defense (MoD). A joint team of Portuguese Air Force Research Center and Engineering School of Porto University is carrying on the execution of the project. About 800 autonomous flights in different platforms, adding up to about 400 hours of flight have been performed so far. The project is focused in maritime operations, in the context of both Surveillance and Search and Rescue missions. Portuguese MOD is studying forms to allow the transfer of the developed technology to the industry.*

Keywords: *Unmanned Aerial Vehicles, Unmanned Aerial Systems, PITVANT.*

1. INTRODUCTION

This paper describes a global overview of the Research & Technology (R&T) project PITVANT[1], funded by the Portuguese Ministry of Defense and carried out by the Portuguese Air Force (PoAF) and Porto University (UP). PITVANT started in November 2008 and will be completed by November 2015. Funding for the entire duration of the project is approximately 2M€. This does not include the matching contributions from the PoAF and from UP.

Regarding the PoAF, PITVANT is carried out by its higher education school: the Air Force Academy (AFA). AFA's Faculty and students have a long history of pioneer projects in unmanned aerial vehicles (UAV) in Portugal, including several innovative aeronautical technology in-flight demonstration and validation tests, in the smart materials and adaptative structures research area. The College of Engineering (FEUP) is the lead partner from UP. FEUP has been designing, building and operating unmanned underwater, surface and air vehicle systems for innovative applications with strong societal impact since 1992. The other partner from UP include the Faculty of Sciences, contributing with their expertise in gravimetry, inertial navigation and image processing.

The AFA/UP team is backed up by valuable international partners such as *Honeywell*, *Embraer-Brasil*, *Swedish Defense Agency* (FOI), *University of California at Berkeley* and the *Armed Forces University, Munich*.

There are four main objectives in PITVANT: *i*) development/testing technologies for Unmanned Aerial Systems (UAS); *ii*)

[1]PITVANT- portuguese acronim for *Projecto de Investigação e Tecnologia em Veículos Aéreos Não Tripulados* (Research and Technology Project on Unmanned Aerial Vehicles).

development of new concepts of operation (CONOPS) for small/medium UAS, up to 150 kg of maximum take-off weight (MTOW); *iii*) testing of systems and technologies in a wide range of civil and military mission scenarios; *iv*) advanced training of UAS operation teams.

To accomplish these objectives, PITVANT follows a *Systems Engineering* methodology. Technologies, CONOPS and payload are developed/integrated, tested, validated and matured on smaller and simpler UAV, and then moved on to larger and more complex platforms.

This paper is organized as follows: section 2 presents the UAS, including the overall architecture as well as the airborne and ground components; section 3 briefly describes the command and control framework; section 4 is focused on CONOPS and procedures; section 5 presents future trends and developments. The paper ends with a short conclusion.

2. UAS

2.1 Overall UAS architecture. The *System Breakdown Structure* (SBS) for the PITVANT UAS is depicted in Fig. 1. The UAS is decomposed onto 3 main sub-systems: *UAV*, *Ground Station* (GS) and *Command and Control System* [1]. The team has created processes for *Development*, *Test and Integration*, *Operations*, development of *CONOPS* and *Training*.

All of these systems and sub-systems (with the exception of the *Auto-Pilot* (AP)), and also most of the components, have been developed by the project. In the current configuration the UAV are equipped with *Piccolo* AP from *CloudCap Technology* that are controlled from the GS. On-board computer systems are being installed in the actual generation of PITVANT UAV in order to increase the data processing capacity. These range from PC-104 stacks with card expansions for image processing and communications, to small size computers for the smaller platforms.

The interactions among these components are depicted in Fig. 2.

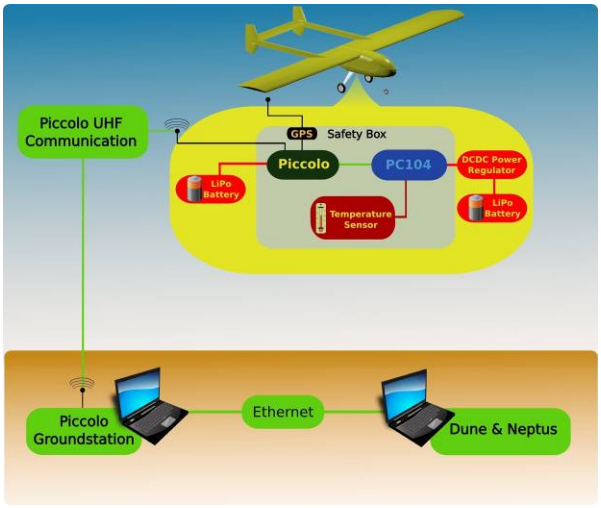

Figure 2 Interactions among UAS components.

2.2 Airborne components. The platforms in use for this project were developed and manufactured at AFA. This section presents photos for each platform, and a summary of their geometric and performance characteristics.

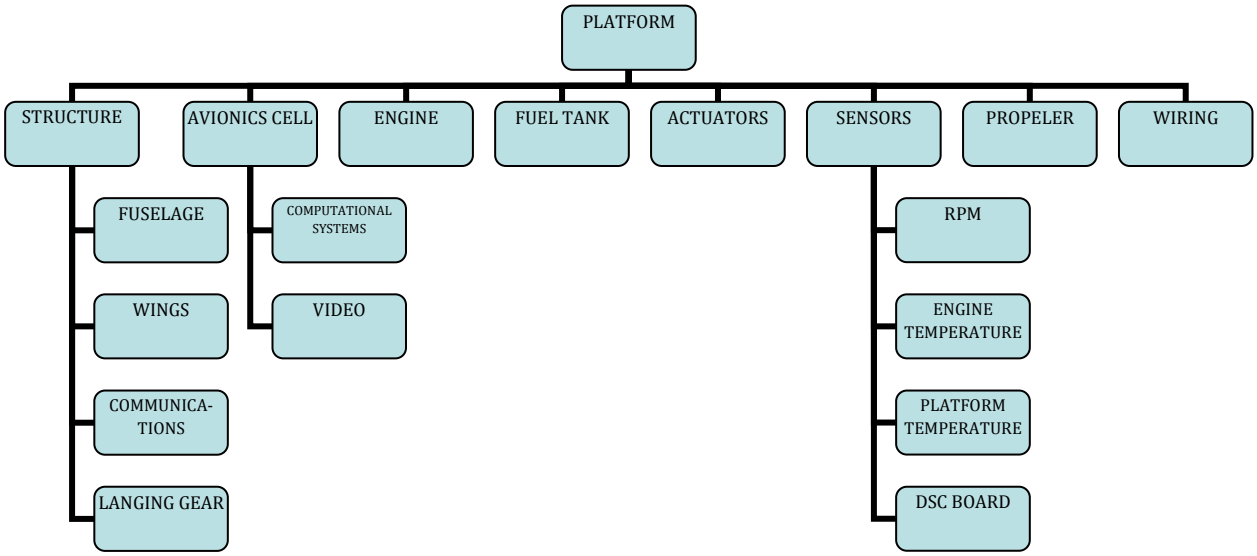

Figure 1 PITVANT UAS SBS.

The design and optimization methods in use for platforms development are also briefly described.

Figs. 3 to 7 show respectively: the *Flying-Wing*, the *Mini-UAV*, the *ALFA*, the *ALFA-Extended*, and the *ANTEX*.

Figure 3 Flying-Wing.

Figure 4 Mini-UAV.

Figure 5 ALFA.

Figure 6 ALFA-Extended.

Figure 7 ANTEX.

Table 1 presents the main characteristics for each UAV.

Table 1 UAV Main Characteristics

	Flying Wing	Mini UAV	ALFA	ALFA Extended	ANTEX
Wing span [m]	2	2	2.4	3.5	6
MTOW [kg]	3.5	4	10	20	100
Payload [kg]	1	2	4	10	30
Engine	Electric	Electric	Electric / combustion	Electric / combustion	Combustion
Endurance [h:m]	01:00	01:00	02/05:00	03:00	06/08:00
Max Speed [km/h]	90	90	120	130	150
Number of Aircraft	2	1	9	1	2
Obs	Hand launched	Hand launched	--	--	--

When PITVANT began, the AFA already had considerable experience on UAV platform design and construction. Those platforms were built for the purpose of in-flight testing of new technologies, such as smart structures, and eventually they became the starting point of the autonomous flight research at AFA.

Although they served the first stages of the project quite well, further research not only demanded extended requirements for payload weight and volume, endurance and performance, but also new aircraft concepts. This represented an opportunity to develop and improve skills in aircraft design.

Owing to the evolution of optimization algorithms and computational analysis tools in the last decade, research studies have been focused on the following areas:

Parametric studies on UAV flying qualities – a Matlab tool has been developed to understand how changes in the geometry of the aircraft might influence and improve its performance. It can either be used in early stages of design or to modify existing aircraft.

Prototyping of new designs: *i*) the wing of the ALFA-Extended was improved for endurance using an aerodynamic optimization tool; *ii*) design, construction and testing of a new concept of UAV: Mini-UAV shown in Fig. 4.

Multidisciplinary optimization – aerodynamic and structural optimization is being integrated in a software tool in order to support the preliminary aircraft design. The current version has already been successfully used to optimize a wing shape and correspondent structural layout, for different purposes such as: *endurance*, *range* and *weight*.

The PITVANT UAS can use several payloads, depending on the mission:

Onboard Computer (PC-104): providing the UAV with the capability to perform onboard data processing to carry out missions autonomously, onboard video recording and the ability to communicate using different communication protocols (such as STANAG 4586). The DUNE software is the Operative System of this computer;

Video cameras: there are several video (some of them gimbaled) cameras that may be used for *intelligence, surveillance and reconnaissance* (ISR) missions in real time. It may also record video onboard allowing post-data processing with high quality resolution video, after the mission;

Video transmitters (*Analog and Digital*): for real time video feed;

IRIDIUM Modems: for *Beyond Line Of Sight* (BLOS) missions with satellite communications;

GSM Modems: for low cost BLOS flights;

WiFi: for low cost communications and video streaming.

2.3 Ground component. The GS used in PITVANT, comprises the ground equipment and infrastructures that allow the operation of UAV. This segment of the UAS displays the information about the vehicle to the operation team, through a PC, connected to a GS box, and receives commands from the operator. Additional information like video captured on-board or information about algorithms being tested can also be presented on an additional monitor or computer. Another important

element to assure the safety of the vehicle is the possibility of the pilot to control the UAV using a command connected directly to the GS. The GS is able to receive GPS signal and communicates with the vehicle using 2.4 GHz link. It also allows the usage of an *Iridium* satellite link to extend the area of operation BLOS. The ground segment also contains an area to enable maintenance actions.

The PITVANT project uses the *Neptus*/ *Inter Module Communications* (IMC)/*Dune* software toolset, developed at FEUP, for the UAS command and control applications. This tool set is easily configured for deployment in heterogeneous UAS to carry out mixed-initiative missions due to its modular design and the use of a publish/subscribe framework.

Neptus is a *Command, Control, Communications, Computer and Intelligence* (C4I) framework. The interactions with human operators are classified according to the phases of a mission life cycle: world representation, planning, simulation, execution and post-mission analysis. *Neptus* supports different communications protocols by having a specific communications layer that gives support to message based protocols, being agnostic to the chosen transport protocol (UDP, TCP, NDDS, HTTP). *Neptus* supports distributed networked vehicles operating in wide areas. This is done with the help of the IMC message protocol that defines a common control message set understood by all types of our systems (*vehicles*, *consoles*, or *sensors*) in networked environments. IMC provides for standard coupling of heterogeneous components in terms of data interchange. IMC also provides support for interacting with other autonomous vehicles, such as submarines or surface vessels.

DUNE is the system for vehicle on-board software. It is used to write generic embedded software at the heart of the vehicle, e.g. code for control, navigation, or to access sensors and actuators. DUNE has provisions to transparently route data between heterogeneous network links, balancing bandwidth and range. Routing and store-and-forward is implemented with the aid of the *Delay Tolerant Networking* (DTN) reference implementation.

3. Command and control framework

3.1. Reference control architecture.

The PITVANT networked vehicle system consists of a collection of entities - vehicles, sensors, human operators, communication devices and software applications - that interact with each other to execute tasks while evolving in a common time and space.

The team follows a three-fold approach to the development of the framework: *i*) low cost modular vehicles for experimentation and evaluation; *ii*) a planning, command and control framework within which the interactions among heterogeneous vehicles, sensors, operators and software applications are standardized and mediated; and *iii*) a software tool set which implements the framework over inter-operated (possibly intermittent) communication networks.

A layered approach to planning and control which builds on a few concepts that lend themselves to the modular verification of the framework has been developed. In these developments mixed initiative interactions are considered, where operators intervene in the planning and control loops. In part this is because essential experience and military insight of these operators cannot be reflected in mathematical models, so the operators must approve or modify the plan and the execution. Also, it is impossible to design (say) vehicle and team controllers that can respond satisfactorily to every possible contingency. In unforeseen situations, these controllers ask the human operators for directions.

The control architecture consists of two main layers: vehicle and multi-vehicle control. Each layer, in turn, is further decomposed into other sub-layers. The vehicle control architecture is standard for all vehicles. The multi-vehicle control structure is mission dependent. The control architecture is formally described as a class of interacting hybrid automata.

Vehicles are abstracted as providers of maneuvers and services, which are made available through standardized interfaces. Maneuvers are templates for motions and actions. Services include, for example, communications and computations.

Mission plans are encoded as a graph where the nodes consist of maneuver and service specifications and the arcs encode the transition logic. From the perspective of mixed initiative interactions, maneuvers define, if that is the case, patterns of interaction with the operators which are easily understood by a human operator.

The vehicle control architecture consists of four layers presented in Fig. 8.

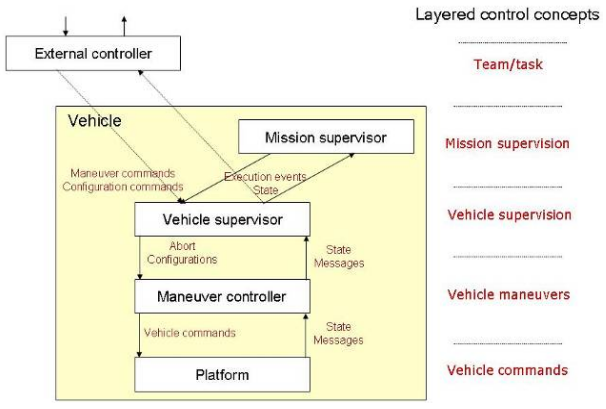

Figure 8 Vehicle control layered architecture.

3.2. Current implementa tion of Command & Control Structure. The creation of a *Command & Control Structure* is essential to the development of UAS. In the context of the PITVANT project the need for such support is mandatory, given the diversity of computational entities and their different dynamics. In this structure one can identify: *i*) the on-board software, *ii*) the hardware interface to the AP and GS, and with the network communication between control consoles or UAV; *iii*) the interface with external software or UAV.

Piccolo Command Center: this is the basic tool developed by *Cloudcap Technologies* for the interface between the Piccolo AP and GS.

Neptus: this C4I system is compatible with STANAG 4586.

STANAG 4586 Modules: PITVANT UAV may potentially inter-operate with the system under the STANAG 4586 protocol for interoperability of UAV.

Matlab: in certain situations to test and develop control algorithms, instances of Matlab can be part of the system.

DUNE: this software runs onboard the aircraft (or on land) and allows the interface between the AP and the GS. It also allows the definition of real-time tasks with varied functions like the interface between AP and GS, interoperability capability, and communication mechanisms.

Fig. 9 illustrates how these entities are inter-connected in the system current configuration.

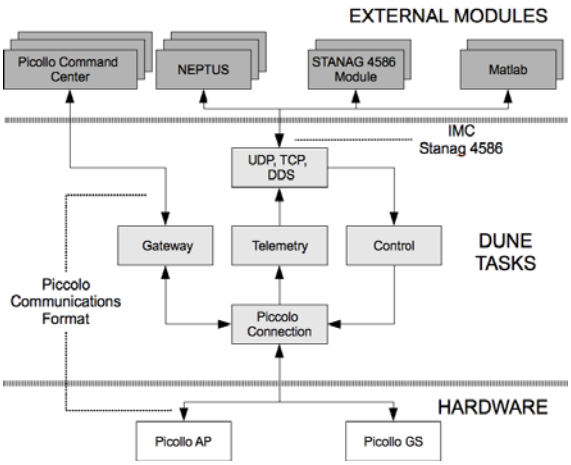

Figure 9 Command and Control Configuration.

3.3. Algorithms Development and Flight Testing. For flight testing purposes, the developed algorithms should run through the following phases: 1st) *numerical simulation and validation*; 2nd) *hardware-in-the-loop simulation*; 3rd) *flight testing with ground computation*; 4rd) *flight testing with onboard control*.

So far, within the PITVANT project the following main fields of investigation have

been pursued: *i*) *path following* and *trajectory tracking* for target tracking and river following applications; *ii*) *obstacle avoidance* for collision avoidance systems; *iii*) *GNSS and INS integration* for enhanced navigation; *iv*) *image processing* for target detection, river following and obstacle avoidance; *v*) *thermals navigation* for enhanced autonomy of UAV; *vi*) *formation flight* for thermals seeking; *vii*) *cooperative control* for complex and distributed mixed control missions.

The first three fields of research presented above are already on phase 3 and the remaining ones are still on phase 2.

4. Concepts of operation and procedures. So far, the PITVANT team has tested the following CONOPS: *i*) single UAV operation; *ii*) night operation; *iii*) GS handover; *iv*) multi-UAV operation; *v*) BLOS operation in the context of maritime surveillance; *vi*) autonomous take-off and landing.

All UAS operation follows checklists and written procedures to be carried out by the team members. This includes UAV pre-flight inspection, run up, take-off, manual to AP flight control transition (and vice-versa). It also includes GS operation in different roles such as payload operation and mission control. These procedures and check lists have been developed by the team and validated in training sessions [2].

The hardware in the loop simulation allows verification of all new equipment and algorithms in ground tests. Therefore every new equipment or control algorithm is subjected to a specific sequence of ground testing prior to be authorized to proceed to the flight test phase, as described in sub-section 3.3.

For each team member, there is a training routine according to his/her back-ground experience on the team before he/she is considered able to perform his duties without supervision. This includes studying the procedures, passing written quizzes to guarantee that the procedures are well understood, and completing a number of missions under supervision of another team member.

The operators instruction and training consists of five different areas: *i*) principles of flight - aerodynamics, stability, control and maneuvering, grouping the basic level of knowledge that an operator must have on the behavior of an aircraft in flight and the associated phenomena; *ii*) air operating platform - platform performance, features, payload, possible configurations and limitations; *iii*) AP information and UAV operations, which concerns all the information about the characteristics of the AP, limitations, operation, flight models, software interfaces with the platform, simulator and all the procedures for operating UAV in different missions; *iv*) tests and evaluations to be performed by the student operator with a minimal score of 75%; *v*) skills and extra training is mandatory to achieve different levels of responsibilities in the context of UAV operation, such as Flight Manager and UAV configurator.

5. Future trends and developments.

PITVANT is now on its fifth year. The team has completed about 800 autonomous flights in different platforms, adding up to about 400 hours of flight. In the next two years of remaining life of the project, the team will continue working along the lines presented in this document, to accomplish the transition of all technologies to ALFA-Extended and ANTEX. In the short term, the most intensive developments will be the validation of the use of these platforms on *Maritime Surveillance* as

well as *Search and Rescue* missions. The first flights over the sea took place in April 2012 between Santa-Cruz airfield (located at the Portuguese western coast) and the Berlengas Islands, in a total distance of 80 km. In 2013 the PITVANT's team intends to operate the ALFA-Extended to perform a maritime mission between Madeira and Selvagens (Portuguese Atlantic Islands) in a total distance of 630 km.

Portugal has one of the largest Exclusive Economic Zones of the European Union and has jurisdiction over marine protected areas located beyond the 200 NM limit, and possible extensions of the Continental Shelf will reach 400 NM in some regions [3]. Portugal is also responsible for one of the largest flight information region (FIR), the Santa-Maria FIR. The Portuguese government is taking steps toward the definition of an integrated maritime policy in order to explore the vast maritime resources of Portugal [4].

In this context, maritime surveillance is an obvious and strategic application for UAS. The largest platforms, ANTEX, are being prepared for autonomous flight, in order to demonstrate to the Portuguese authorities the feasibility of including UAS in the national maritime surveillance effort. In terms of crew training, there are some challenges related to this operation. Procedures and checklists must be developed for the ANTEX. As new test sites are likely to be used, namely, in Azores and Madeira archipelagos, local procedures must also be developed and trained by the team.

At this stage, the systems have achieved a maturity level that enables cooperation with future users in order to establish the UAS capabilities and CONOPS that will fulfill their mission requirements. Steps towards industrialization are being undertaken in order to allow the transfer of technology and operational know-how developed so far.

UAS represent one of the fastest growing fields of research, development and innovation. A difficulty that most academic teams, as well as industry face is the lack of appropriate test sites, large enough to allow flight testing of platforms, algorithms and systems with the appropriate safety conditions. The lack of regulation throughout European countries concerning UAV flight is also a drawback when it comes to flight test an experimental vehicle.

The need of appropriate test sites for UAV is felt not only in Europe. In fact, in the United States of America (USA) the Federal Aviation Administration (FAA) is in the process of creating several test sites. The competition between States is fierce, as such infrastructures generate employment. From a strategic point of view, Europe should not fall back in this trend of development, as the European industry and academia are capable of delivering innovative and cost efficient products, to supply the growing demand in both the civilian and military market for UAS applications. For this reason the creation of a European UAS Testing Structure (EUTS) is needed to keep Europe in the lead when it comes to UAS development and avoid its competitors to gain a technical advantage that once gained will be difficult to overcome. Moreover, these test sites can also be used to demonstrate, in real conditions, the weaknesses of resources and equipment based on satellite navigation systems in environments where GNSS are degraded, mitigated or denied by natural or intentional causes. GNSS denied environment poses a threat to the UAV autonomy which depends significantly on GNSS sensors.

Amongst the European countries, Portugal gathers simultaneously several conditions that would enable the creation of a network of test sites, which can be arranged in order to develop a EUTS. In fact, Portugal possesses: *i*) a wide maritime area; *ii*) outstanding meteorological conditions all year-round; *iii*) not very crowded airspace as it is not located in the center of Europe; *iv*) a network of military airfields distributed throughout the country in a way that enables the definition of air corridors between them; *v*) national experience in the development, flight testing and operation of UAS. Of the existing UAV test sites known in Europe, such as the *Artic Test UAV Flight Center* in Finland, the *North European Aerospace Test Range* in Sweden and the *Parc Aberporth UAV Center* in the UK, none gathers all of the above mentioned

conditions simultaneously, that can satisfy European needs at a global level.

6. Conclusions

The PITVANT project is the main UAS research and development project in Portugal. It has an important operational focus, and also a very strong line of work in the state of the art in UAS research, both in conceptual design and optimization of the vehicles and in command and control technology of individual vehicles and teams of vehicles.

In the context of the project about 800 autonomous flights in different platforms, adding up to about 400 hours of flight have been performed.

The last two years of the project will be devoted to maritime operations, both *Surveillance* and *Search and Rescue* as well as technological transfer to the industry.

The intense UAS operation in PITVANT project is pushing forward the settling of a European UAS Testing Structure in Portugal sponsored by Portuguese Ministry of Defense.

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DESIGN & PRODUCTION CRITERIA AND AUTHORITY REQUIREMENTS FOR THE HUNGARIAN DEFENSE FORCES OPERATED UAS

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Abstract: *In my article I aimed to present the Hungarian designed & manufactured and Hungarian Defense Forces (HDF) operated Unmanned Aerial Vehicle and -Systems (UAV/UAS)'s design and production criteria. Furthermore I would like to introduce the certification environment, auditing procedures and applicable standards which were used by the Hungarian military aviation authority during the certification and authorization procedures of the UAS.*

Keywords: *TUAV, RS UAV, Organization Exposition, AQAP, MAWA, EMARs, Site Survey, Airworthiness*

1. INTRODUCTION

The Hungarian Defense Forces (HDF) has been operating different type of Unmanned Aerial Vehicle (UAV) and Unmanned Aerial Systems (UAS) since 1960s.

Early aerial vehicle in terms of their level of technology were considered rather flight model as UAV's. Their flight control during their missions was generally performed with radio-controllers in direct way; they fly as a remote controlled aircraft model. The aircraft were used by the HDF, on the one hand as Target - UAV (TUAV) with training tasks to the air defense units of HDF; on the other hand, there was improved different type of aircraft for reconnaissance and surveillance missions equipped with special payload (cameras, microphones, etc.).

1.1 Target - UAV (TUAV): The traditional asset demand of air defense missile systems for long remained satisfied with this primitive model aircraft, because of the more powerful anti-aircraft systems, training of operators of conventional aircraft were still used.

The philosophy change in the Hungarian UAS application was happened on the basis of the cost effective solution seeking. After all, the cost of a small robotic aircraft operating hour substantially below a conventional military aircraft flight hours cost (e.g. the operation cost of a Mi-24 combat helicopter: ~ 10,000-15,000 EUR / flight hours), while the cost of the flight hour of TUAV is less than 10-fold.

To replace the traditional military aircraft, in connection with the training of air defense units, with modern TUAV systems the flight range of the aircraft and the effective radar surface of the plane had to be increased significantly.

In order to increase the flight range initially used two pilots, one pilot made the first take-off and led to the aircraft to the flight level, the other pilots in the target area in a bunker carried out the flight. This method required a high degree of co-pilots and pilots endangered the physical safety as well.

These disadvantages and hazards in GPS-based flight control system were developed for the TUAVs, which have acquired an autonomous task execution, i.e. pre-stored flight plan is to fly along capability.

Fig. 1. METEOR-3MA TUAV [1]

1.2 Reconnaissance and Surveillance UAV (RS UAV): In connection with the RS UAVs the need for autonomous flight capability has been present since the beginning of the execution of the tasks because of the detection distances and large flight areas.

The appearance of the autonomous flight capability, the increase of the aircraft size and its performance data (e.g. Wingspan $\geq$ 5m, $v_{flight} \geq 200$ km/h) and the jet engine usage on the aircraft board finally take the unmanned flight a new foundation. With special regards the above mantioned fact it was desirable, such as the HDF and manufacturing companies too, in the controlled aircraft design, manufacturing and operating environment into.

Fig. 2. SZOJKA-III. RS UAV [2]

2. DESIGN & PRODUCTION CRITERIAS

To determine the corner stones of the new way in the field of the UAV development and production only the rethinking of the aircraft manufacturing could help us. Rethinking on the basis of the international quality management standards (ISO 9001:2008, AQAP 2000, AS 9100) and rebuild the whole manufacturing system based on the special points of the standards in connection with the aerospace- and military systems. Furthermore, the Hungarian UAV manufacturers started to work together with the HDF, the supervisory bodies, like the Military Aviation Authority, and the scientific UAV mater experts to create a reliable and acceptable quality and high flight safety UAS. During the inspection of production circumstances a significant problem occurred. The previously assembled aircraft were built up largely retail elements (engine, body, two-way radio, camera, etc), which elements essentially have been developed hobby purposes. Thus, the precise equipment life and reliability was not known to the manufacturer.

To solve this problem, according to the applicable standards and comply with their basic principles, the manufacturer developed a kind of custom test body and an internal testing process for the small trade items. As a result of the testing procedure, the appropriate qualified items may have been used as components of UAVs and could then be integrated into the board of the aircraft.

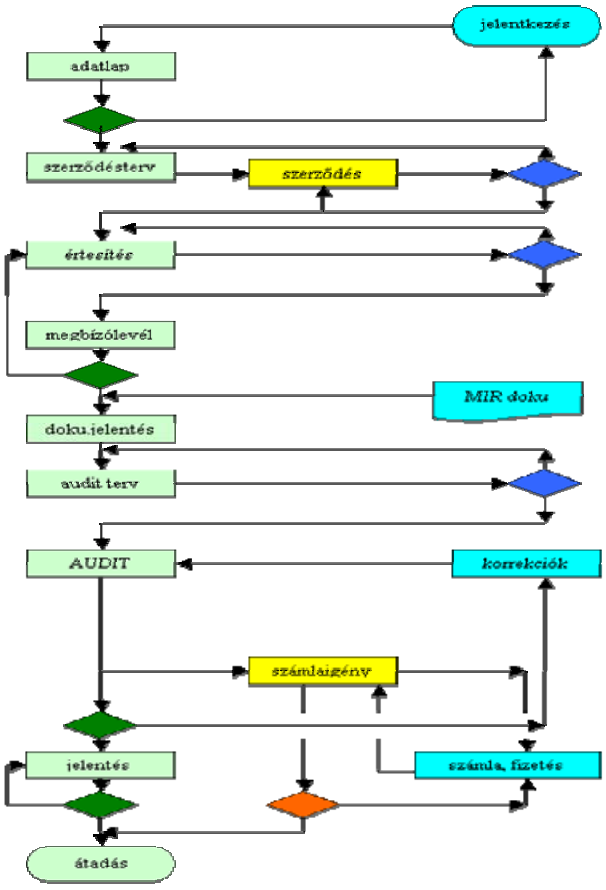

Fig. 3. NATO AQAP tanúsítási eljárás [3]

3. AUTHORITY REQUIREMENTS

In Hungary, the National Transport Authority Aviation Authority (NTA/AA), as the law designated, first instance military aviation authority responsible for the state aviation which covers the military-, police, disaster management aviation.

The Authority, according to the Hungarian air navigation law and the legal background, carries out the certification of the aircraft manufacturer (design & production organization), the type design investigation and validation of the aircraft, the airworthiness inspection on the each individual aircraft within the type design, and finally take the certified aircraft into the Hungarian State Aircraft Register.

As the unmanned aircraft, considered a special kind of aircraft and therefore difficult to interpret the traditional concepts used airplanes and legal norms. For example, an ultra light category (MTOW: 15 kg.) RS UAV, which is shipped to the theatre in a bag in disassembled form, *non - airworthy* status, will be assembled and prepare for its mission by the operator. After the carrying out its mission the UAV will be disassembled again and lose the airworthiness again.

Accordingly, the legislation is necessary to apply a systemic approach, which requires the assistance of experienced professionals, state of the art control and regulation systems for tracing and application consideration. Considering the above mentioned things, to find the best practice within the certification procedure, during an UAV manufacturer certification process, the domestic regulatory background as well as the international regulatory system had been applied together, for example the civil aviation regulatory requirements for Design & Production organization like EASA Part 21.

Furthermore, the future common European military aviation regulations (EMAR: European Military Aviation Regulation) were used by the NTA/AA as a baseline during the audits.

3.1 Common Military Aviation

Regulations: In 2008, under the auspices European Defense Agency EDA, a number of EU national MoD representative formed the Military Airworthiness Authorities (MAWA) group with the objective of the single European military aviation regulatory system (EMARS) formulation and to establish the EASA model European Joined Airworthiness Authorities Organization (EMJAAO) [4].

The MAWA and its working groups, during its operation, have created a number of common European military regulations regarding the aircraft type certification, design and production certification (EMAR 21), which regulations were used by the NTA/AA during the type or type design certification procedures in connection with the domestic or foreign UAV manufacturers.

According to the Hungarian and the European aviation rules, in connection with a design & production organization approval procedure the Hungarian authority, during an audit firstly study the *Organization Exposition (OE)* of the inspected organization. This is the *On-Desk* phase of the audit. After this first phase, based on the described information about the company, the authority will create a *Site Inspection Plan* and start the second, *On-Site* phase of the audit. During this phase the authority shall verify in practice as described in the descriptive document like the OE.

For example: within the organization the facilities - which designated for aircraft manufacturing - conform to national standards the extent necessary and sufficient for the national requirements. The main phase of the aircraft manufacturing processes separated enough and properly documented in all stages. The production technology and documentation is available for the staff of the organization. The organization has well trained and educated manpower for the intended work.

During the audit the authority checks the organization's quality management system, and its valid certificates issued by relevant organizations.

At the end of the On-Site inspection authority representatives create a record about their experiences during the survey and send a proposal to the management staff of the authority. The head of the authority will decide, on the basis of this proposal, to issue the *Authorization* for UAV design & production organization or not. This Authorization remains in force until its revocation.

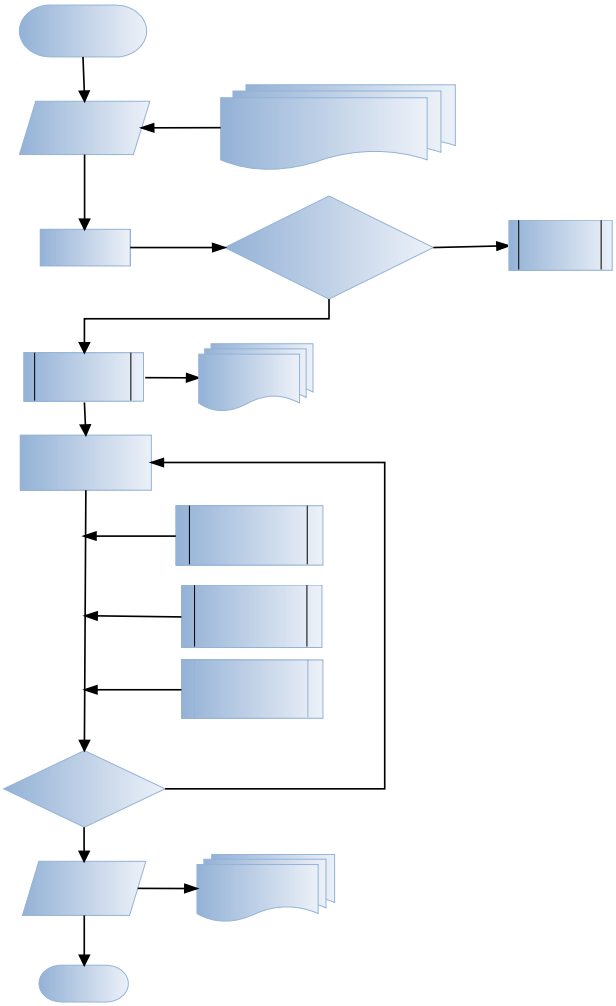

Fig. 4. NTA/AA Authorization procedure for Design & Production Organization [5]

4. CONCLUSION & ACKNOWLEDGEMENT

As I detailed in this article the design & production criteria and the special authority requirements in connection with the UAV or UAS are very incomplete at present.

To use military standards and aeronautical industry standards in the field of e.g. a small UAV manufacturing to be too strict requirement for shoring and mean a very costly quality management system. It should be further examined the appropriate UAV production and certification self-regulatory system and the possibility of developing the existing legislation should be supplemented by the production of UAVs with specific provisions.

The quality management system should seek to establish an appropriate system for seeking the most cost-efficient production structures to create the maximum flight safety in place.

To support this plan, firstly it is very necessary to categorize the UAVs and the UAS by appropriate air navigation rules and legal background so as to ensure realistic and real technical content requirements for shoring right up to the manufacturer or to the operator's body.

5. CLOSING REMARK

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Subordinated plan: „Data integration"

Highlighted project: „Operations of Unmanned Aerial Vehicle and its aspects for Air Safety"

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PERSPECTIVE OF AIR DEFENCE

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Abstract : *The contribution speaks about new role of Air Defence in conditions of asymmetric threats and new safety environment. The article refers according these observations about new requirements on Air Defense means, command and control system, warning systems, detection means, radars and missiles systems. In conclusion it shows on new perspective Air Defence for future.*

Keywords: *air defence, evaluation, perspective, fire unit, mission, operation, environment, protection.*

Fulfill participation observe responsibility which results from participation to generic integrated system of safety air area NATO (NATINADS) require different understanding operational preparation, training of personal and building other specific competence of Air Forces. Considering fulfilling task in national control of sovereignty air area with the same resources which are available for NATINADS, it is very important their complex coordination following by disposition of air situation with homogenous command and control system ACCS/ASACS to selected powers and means[1].

In these days competences of Air Forces in general present capabilities:

- support to built safety scene in system of corporate defense with common and combination operations,
- provide integrity of air area – to monitor and control of air area, safety of sovereignty of air area NATINADS countries,
- to fulfill operational requirements of battle support and battle safety of Ground Forces,
- ensure air search salvage service and transfer injured person (CSAR),
- to make air transfer in favor of Armed Forces,
- use information of strategic intelligence early and correctly identify threats,
- keep up and develop competence stationary and mobile communication and information system,
- ensure in meteorological services and photogrammetric map,
- defend chosen object of critic infrastructure,
- accept forces of NATO and EU in fly over area of arrangement and in course of activity.

We can see the majority of task it is role of Aviation and position of Air Defence is on the periphery of interest. Air Defence can play more important role in present time too.

Variability of Air Defence tool in battle use have to guaranty without safety strategic objects and sectors Air Defence in interest tendency, also flexible maneuver means to another sector for example in this assistance in monitor state boundary, like to safe

understanding of civil emergency planning and public administration in boost attack through recco subsystem(Fig.1).

Fig. 1 Air Defence SA – 6 launcher

Recco subsystem have to be able to fulfill full-value radiolocation information in real time for national command and at the same time for Air Defence systems in command and control system C2I(C4I2) NATINADS[2].

Air area is considered to be continual. It comes to this that entity, which isn't latticed on military and civil. Some part is mainly from cause of safety restricted for particular user – these users are Armed Forces, aero clubs, air repairs.

Strategic intent is unification of air area, which leads to one, integral air area in whole Europe. This study is based on continual air area axiom, which presents maximal freedom for users in required level of security in services. It will be done with holdback safety and security each state.

Presently is also very often discussed about relevancy and building of radars or positions for rocket systems in the area of Czech republic and Poland. Reasons of these suggestions are very interesting. Supposed improvement of security of countries of NATO by empowering of defence against potential terroristic air attacks, especially against attack with ballistic rockets by creating of anti-missile umbrella. In closer analysis we could find out that this threat is not so realistic because of more reasons. In the first place, the probability that terrorists capture ballistic rockets with launchers is very low. In addition, countries which have weapons of mass destruction which could be abused for terroristic attack don't have own carriers which could enable transportation of these weapons to point of destination for targets in countries of NATO. Because these reasons we are not threatened in this way from the air. There is another danger from the air space in last years which is more serious than air terrorism. It is not controllable movement of various means in the air (aero planes, helicopters, ultra light aircraft etc.). In last five years there were more than 200 cases of violation of principles in air traffic in air space of Slovak republic, from simple case, e.g. violation of flight level or deviation from flight corridor, to the disturbance of air space and not controlled movement in this space. How it is possible that these situations occur? In past years the count of forces and means of Armed forces and count of means of Air forces recognition were significantly reduced. Therefore also possibilities of locating and reliable monitoring of targets, especially on low altitudes, that is why sport aero plane from Austria in flight corridor can threaten airliners, another ultra light plane from Hungary half of hour threatens training of army pilots in space close to airport.

Concluding this question we can claim that the development in this airea is in harmony with requests of Armed Forces of SR and coalition partners in NATINADS. However, we need to build subsystem of recognition using also another means. Conception of competencies of Air Forces especially in part "Operations of national security" have to be more concrete and to refer to possibilities and problems of recognition subsystem.

When we see more closely on possibilities of warning system and on capabilities to react on threats by actual Air Defence means we can observe that these ability Air Defence has but its using is disesteem. It is result from different views under review possibilities of Air Defence. NATO countries were always oriented for using aviation ,fighters or multifunctional aircrafts and the same is it in present time. New armies from NATO countries, in nowadays do not dispose of the highest technology and financial resources for purchase of modern Air defence means. For all that exist means and sensors which make possible these means of air attack to uncover and armies and objects early to alert and protect.

There are from warning system the first of all radars means – active and passive too. Because ballistic missiles have extreme small effective reflection surface, we can use from active radars only radars with millimeter and meter extension. While the first type is more accurately and has smaller range, the second has bigger range but smaller precision for locking and tracking of targets.

Besides them is possible to use passive radars too, the third generation of radars has in equipment some NATO countries and has ability to detect air targets using technology STEALTH.

Considering also ability of obtaining information about air targets from space reconnaissance, with accent in areas with high probability of threat by balistic missiles we have wide spectrum information in disposition for fire units.

Because balistic missiles(in asymmetric conflicts) very often ,there are not classic means of tactic assessment (e.g. with range to 100km) and often there are not neither rockets with typical ballistic air trajectory, but there are launched from range a few kilometers, max. some tenth kilometers, in consideration will not come middle and long range Air Defence missiles systems. The application vice – versa will be here short and very short range Air Defence systems especially combined missile – artillery systems with reactive time some seconds. These systems are characterized high killing probability of targets, useful killing zone, ability parallel firing of targets missiles and artillery firing and possibility repeat firing on targets in short time period.

Big advantage of modern reconnaissance and fire means is fact that do not need special command and control systems. Actual technologies and computers makes possible to transmission information and commands practically in real time. It means that fire units can open fire on targets depending up reactive time directly after target detection.

Opposite these requirements and possibilities, present Air Defence have to satisfy new appeals and perspectives in next spheres[3]:

Operational Intelligence:

- Ability to afford strict and relevant operational and intelligence information for NATO, partners and coalition organizations for early planning and operations leading and for increasing of understanding on operational levels.
- Ability of common gathering, coordination and control requirements on intelligence informations and information management with NATO interoperability tools, processes and practices which permit effective and coordinated collection of information from different sources.

Air Surveillance Capability – Deployable Electronic Surveillance Measures

- Ability uncontinual passive air reconnaissance in daily and nighty time in all weather to support statement creation about air situation,
- Ability active air reconnaissance to enable search on long distance of wide radar field,

Fire Capability

- Ability to destroy wide spectrum of air targets(planes, helicopters, space means, rockets, missiles, balloons and others

C2 System

- Ability to monitor and evaluate move operations
- Ability to change information with others command and control systems automaticly,
- Ability to create RAP (Recognised Air Picture),
- Ability to afford RAP to COP (Common Operational Picture)

Air Command and Control Capability (Static or Deployable)

- Ability to apply meassures for vulnerableness minimalization against cybernetic attacks
- Ability of effective communication with command posts of force protection.

In conclusion we can emphasize fact, that not only typical tasks is the future of Air Defence . New roles will come with development information technologies, with new abilities in the subsystems fire, reconnaissance and command. The Air Defence importance will increase with enlargement of possibilities to supply more sophistic information for wide spectrum of users. We have to get back to history and think up that forces and Air Defence means belong as inseparability component every operation on random level.

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ANALYSIS OF THE ROBUSTNESS OF THE AUTOMATIC CONTROL SYSTEMS

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Abstract: *Modern control systems act in real environment, and must be able to handle problems of reference signal tracking and disturbance attenuation simultaneously. This paper highlights theory of the analysis of the robustness of the automatic control systems used in automatic flight control systems.*

Keywords: *modeling uncertainties, loop shaping, robust stability, robust performance.*

1. INTRODUCTION

This paper is lean upon early work of the author dealing with analysis of the robustness of the automatic control systems in general [1], and on paper representing application of this theory to analyze stability augmentation system of the aircraft [2].

Control system is designed to work in real environment. The controller is often designed for the system with simplified mathematical model. Nonlinearities are often omitted or linearized and the controller is synthesized for the linearized system. However, controller works with the real nonlinear system. Sensor dynamics, actuator and motor dynamics are also simplified or neglected. Dynamics of the plant contains high frequency elastic oscillation modes, which can be neglected.

The control system, which is able to work in real environment, is called for *robust* one. It means that controller is able to meet design requirements not only for the simplified plant model used during synthesis but for its family representing all possible plant models including both nonlinearities and high frequency dynamics. In this case control system has robust stability and robust performance.

For instance, automatic flight control systems are designed to work also in extreme flight conditions, e. g. extremely high or low air temperature and pressure, load factors, maneuvers, turbulent air etc. Flight control system is able to meet all design requirements in any flight conditions.

Mathematical description of the deterministic systems is given in [5, 6, 7]. The stochastic dynamical systems and signals are analyzed in [3, 4, 5, 7, 8, 9, 10]. In [4, 8, 9, 10] there are many applications of robust control and modeling robust control systems. In [10] an example of robust controller synthesis for fighter aircraft is presented when high frequency dynamics of the aircraft fuselage is added to that of the rigid one. In [13] mathematical models including static and dynamical ones are given. Part II. of [13] deals with modeling of stochastical systems, and with design of the robust dynamic controller.

Chapter 3 gives more general interpretation of the mathematical models given for the SISO[1] control systems and derives matrix equations for MIMO[2] control systems.

Chapter 4 shows loop shaping problem, which is about bounding sensitivity transfer function, and closed loop system transfer function, and gives some remarks on this problem.

[1] Single Input – Single Output
[2] Multi Input – Multi Putput

Chapter 5 is for defining mathematical models of the uncertainties playing active role during synthesis of the robust controller.

Chapter 6 is dealing with robust stability of the control systems, i. e. giving mathematical models both for the additive and multiplicative uncertainties. This section also deals with derivation stability margins, which are very important quantitative measures during control systems' analysis and design.

2. DYNAMIC PERFORMANCES OF THE SISO SYSTEMS

Block diagram of the SISO control system can be seen in Fig 1 [1].

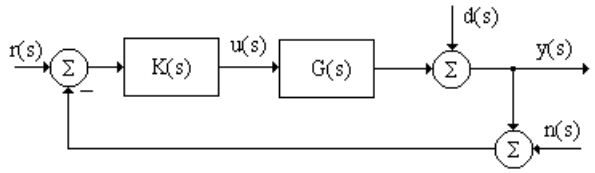

Fig 1. Block Diagram of the SISO control system.

In Fig 1: *r(s)* - reference signal, *d(s)* – external disturbance, *n(s)* – sensor noise, *G(s)* – transfer function of the plant, *K(s)* – transfer function of the controller, *u(s)* – input vector, *y(s)* – output signal. Using Fig 1 the output signal can be derived as:

$$y(s)=\frac{K(s)G(s)}{1+K(s)G(s)}r(s)+ \\ +\frac{1}{1+K(s)G(s)}d(s)-\frac{K(s)G(s)}{1+K(s)G(s)}n(s) \qquad (2.1)$$

Let us introduce the following substitutions: $L(s)=K(s)G(s)$ – open loop transfer function, $S(s)=\frac{1}{1+K(s)G(s)}$ – sensitivity transfer function, $T(s)=\frac{K(s)G(s)}{1+K(s)G(s)}$ – closed loop complementary transfer function (closed loop transfer function). From equations given above it is evident that

$$S(s)+T(s)=1 \qquad (2.2)$$

For achieving prescribed reference signal tracking ability sensitivity transfer function *S(s)* should has small value in given frequency domain, i. e. open loop transfer function is large. For achieving necessary noise suppressing ability sensitivity transfer function *S(s)* must have small value in the frequency domain, in which external disturbance *d(s)* acts [4, 8, 9].

Sensor noises are said to be well damped if the closed loop transfer function *T(s)* has small values in the given frequency domain, i. e. open loop transfer function is also has small value.

Bode diagrams of the sensitivity transfer function *S(s)* and the closed loop complementary transfer function *T(s)* can be seen in Fig 2.

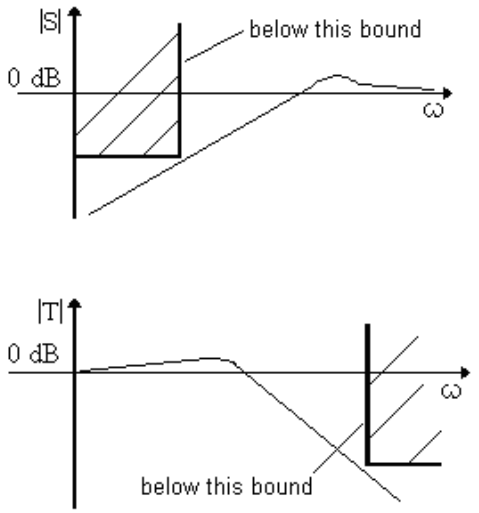

Fig 2. Bounds for $|S(j\omega)|$ and $|T(j\omega)|$

In low frequency domain $|S(j\omega)|$ must be kept small, in high frequency domain its absolute value goes to unity. In low frequency domain $|T(j\omega)|$ must be kept unit value, in high frequency domain is bounded for 'good' noise suppressing ability.

For the SISO control system these simultaneous requirements given above determine the shape of the open loop Bode diagram illustrated in Fig 3. In low frequency domain, in which reference signal and the disturbance act, open loop gain must be kept large. In high frequency domain open loop gain must be small for 'good' noise suppressing ability. For the control of the gain and phase margins at the crossover frequency slope of the Bode plot is – 20 dB/decade.

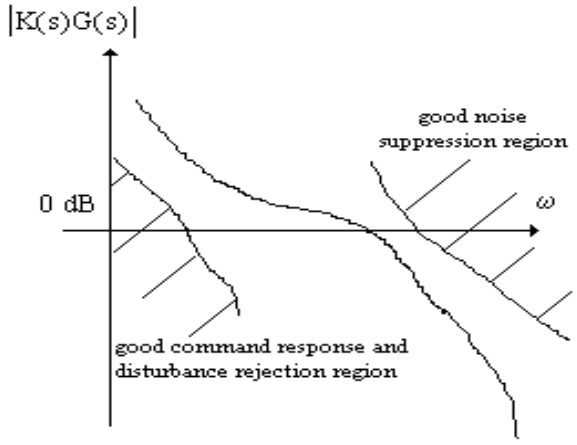

Fig 3. Desirable shape of the open loop system Bode diagram.

Summing up what has been said before: in the SISO control system nominal performances set limits on the size of the open loop gain $L(s) = K(s)G(s)$ [1, 4, 8, 9].

3. DYNAMIC PERFORMANCES OF THE MIMO SYSTEMS

Most of the control systems are MIMO ones and the state space method should be applied for its analysis and design. In this case all input signals are vectors. In the MIMO control system we deal with so-called transfer function matrices. For the evaluation of the size of matrices there is widely applied the *matrix singular value* method. For the MIMO control system eq. (2.1) may be rewritten in following manner [1, 4, 6, 8]:

$$\mathbf{y}(s) = \frac{\mathbf{G}(s)\mathbf{K}(s)}{\left[\mathbf{I} + \mathbf{G}(s)\mathbf{K}(s)\right]}\mathbf{r}(s) - \frac{\mathbf{G}(s)\mathbf{K}(s)}{\left[\mathbf{I} + \mathbf{G}(s)\mathbf{K}(s)\right]}\mathbf{n}(s) + \frac{1}{\left[\mathbf{I} + \mathbf{G}(s)\mathbf{K}(s)\right]}\mathbf{d}(s) \tag{3.1}$$

The sensitivity and the closed loop sensitivity transfer function matrices can be determined as follows:

$$\mathbf{T}(s) = \frac{\mathbf{G}(s)\mathbf{K}(s)}{\left[\mathbf{I} + \mathbf{G}(s)\mathbf{K}(s)\right]} \qquad \mathbf{S}(s) = \frac{1}{\left[\mathbf{I} + \mathbf{G}(s)\mathbf{K}(s)\right]} \tag{3.2}$$

Nominal performance criterions for the SISO and the MIMO control systems are summarized in Table 1. Subscript 'm' denotes the largest singular values of the matrices [1].

Dynamic Performances of the SISO and MIMO systems Table 1.

	Low Frequency Domain		High Frequency Domain	
	SISO	**MIMO**	**SISO**	**MIMO**
Reference Signal Tracking	$\lvert K(s)G(s)\rvert \gg 1$ or $\lvert S(s)\rvert \ll 1$	$\sigma(\mathbf{K}(s)\mathbf{G}(s)) \gg 1$ or $\sigma_m(\mathbf{S}(s)) \ll 1$		
Disturbance Rejection	$\lvert K(s)G(s)\rvert \gg 1$ or $\lvert S(s)\rvert \ll 1$	$\sigma(\mathbf{K}(s)\mathbf{G}(s)) \gg 1$ or $\sigma_m(\mathbf{S}(s)) \ll 1$		
Noise Suppression			$\lvert K(s)G(s)\rvert \ll 1$ or $\lvert T(s)\rvert \ll 1$	$\sigma_m(\mathbf{K}(s)\mathbf{G}(s)) \ll 1$ or $\sigma_m(\mathbf{T}(s)) \ll 1$

The transfer function matrices are functions of the complex frequency *s*, their singular values are frequency dependent ones: singular values determined for $s = j\omega$ can be plotted versus frequency. Singular value frequency plots are generalizations of Bode magnitude plots for the MIMO systems.

4. LOOP SHAPING OF THE CONTROL SYSTEMS

It is known from control theory that dynamic performances of the feedback control systems can be translated into specifications on the sensitivity transfer function *S(s)* and the closed loop transfer function *T(s)*. The control system design methodology based upon determination of the appropriate bounds on *S* and *T* called *Loop Shaping*. This procedure can be applied for multivariable systems when we shape singular values of matrices ***S(s)*** and ***T(s)***. Let us consider the feedback system block diagram represented in Fig 4 for the formulation of problem of the loop shaping [1, 4, 7, 8, 9].

Firstly, let us consider *d(s)* and *n(s)* for the inputs. Using Fig 4 – for the SISO control system – following equations will take place:

$$\begin{aligned} &\mathbf{Z}_1(s) = \mathbf{W}_S\left[1 + \mathbf{K}(s)\mathbf{G}(s)\right]^{-1} d(s) \\ &\text{or } \mathbf{Z}_1(s) = \mathbf{W}_S\mathbf{S}(s)d(s) \\ &\mathbf{Z}_2(s) = \mathbf{W}_T\left[1 + \mathbf{K}(s)\mathbf{G}(s)\right]^{-1}\mathbf{K}(s)\mathbf{G}(s)n(s) \\ &\text{or } \mathbf{Z}_2(s) = \mathbf{W}_T\mathbf{T}(s)n(s) \end{aligned} \qquad (4.1)$$

Secondly, let us consider for the input reference signal of *u(s)*. It yields to the following formula:

$$\mathbf{Z}_2(s) = \mathbf{W}_T\mathbf{T}(s)\,u(s) \qquad (4.2)$$

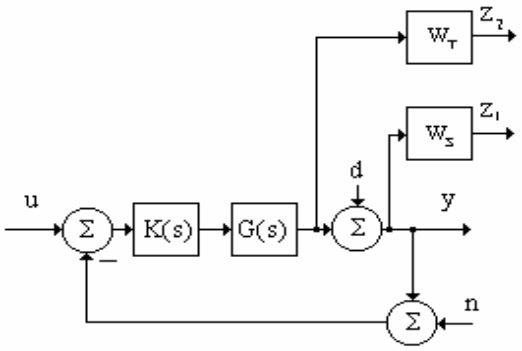

Fig 4. Loop shaping of the feedback control system.

In eqs. (4.1) and (4.2) $\mathbf{W}_S$ and $\mathbf{W}_T$ are weighting matrices that are used to bound **S** and **T**. Typical shapes for the ***S(s)***, ***T(s)***, $\mathbf{W}_S(s)$ and $\mathbf{W}_T(s)$ are given in Fig 5 [1].

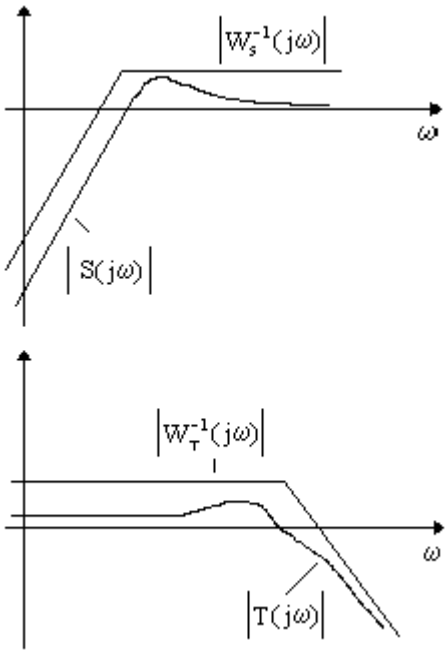

Fig 5. Shapes for **S** and **T** and their weights.

From Fig 5 following equations can be derived

$$\left|\mathbf{S}(s)\right| \le \left|\mathbf{W}_S^{-1}\right|, \text{ or } \left|\mathbf{W}_S\,\mathbf{S}(s)\right| \le 1 \qquad (4.3)$$

In control theory this inequality is known as the *weighted sensitivity problem.*

Secondly, for the closed loop transfer function **T**(s) takes place the following inequality:

$$\left|\mathbf{T}(s)\right| \le \left|\mathbf{W}_T^{-1}\right|, \text{ or } \left|\mathbf{W}_T\,\mathbf{T}(s)\right| \le 1 \qquad (4.4)$$

This problem is known in modern control theory as the *weighted complementary sensitivity problem.*

The simultaneous application and satisfaction of both constraints is called *mixed sensitivity problem* [1, 2, 5, 6, 7, 8, 9].

5. MODELLING OF UNCERTAINTIES IN CONTOL THEORY

Model uncertainty can be divided into two categories: structured and unstructured uncertainties. Structured uncertainty is the modeled one and has ranges and bounds on it. Unstructured uncertainty is the less-known one. We can assume that its frequency response lies between two bounds [1, 2, 5, 6, 7, 8, 9, 10, 11].

Unstructured uncertainty can be modeled in two different ways. One can discuss additive or multiplicative uncertainties. Let the nominal system model is denoted by $G(s)$. The actual true system is defined by $\tilde{G}(s)$. The actual system can be modeled as sum of nominal system plus additive uncertainty model:

$$\tilde{G}(s) = G(s) + \Delta_a(s) \qquad (5.1)$$

From eq. (5.1) the model of the additive uncertainty can be derived as:

$$\Delta_a(s) = \tilde{G}(s) - G(s) \qquad (5.2)$$

Additive uncertainty can be represented using eq. (5.1) and it can be seen in Fig 6.

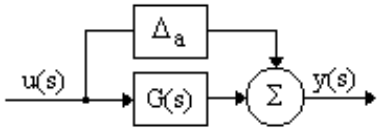

Fig 6. Block diagram of the additive uncertainty model.

Additive uncertainty model is often used in automatic flight control system to model aeroelastic high frequency dynamics of the aircraft fuselage [2, 5, 12, 13]. Additive uncertainty represents absolute error in the model e.g. omitted high frequency elastic motion dynamics.

In multiplicative uncertainty case one can find the true model of the system as:

$$\tilde{G}(s) = \big(1 + \Delta_m(s)\big)G(s) \qquad (5.3)$$

Multiplicative uncertainty can be built using eq. (5.3). It can be represented at the plant input or at the plant output. Block diagram of multiplicative uncertainty can be seen in Fig 7.

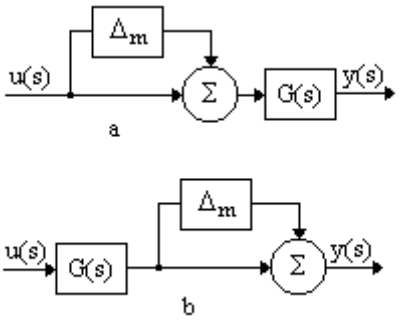

Fig 7. Block diagram of the multiplicative uncertainty model.
'a' – uncertainty at the plant input, 'b' – uncertainty at the plant output

Multiplicative uncertainty represents relative error in the model and it is used more often than additive one.

6. ROBUST STABILITY OF CONTROL SYSTEMS

Let us consider a feedback control system containing a plant and the compensator designed for the nominal plant $G(s)$. The compensator is *robustly* stabilizes the system if the closed loop control system remains stable for the true plant $\tilde{G}(s)$.

Robust stability conditions can be derived from variation of the Nyquist stability criterion or from the so-called *small gain theorem*. This theory states that, for the closed loop stability the open loop gain $|G(s)K(s)|$ is small.

The small-gain theorem guarantees internal stability. It means that all possible closed loop transfer functions are stable and all internal signals are bounded for bounded inputs.

From Chapter 2 it is known that for good command performance and for good disturbance rejection in the low frequency

domain the open loop gain must be larger than one (see Figure 3). Hence, the control system satisfying this theorem will have poor dynamic performances. Inspite of this it is possible to apply the small-gain theorem for control systems with additive and multiplicative uncertainties.

The small-gain theorem is mainly used for answering the following two questions. The first is, if the given uncertainty is stable and bounded will the closed loop system be stable for this uncertainty? The second one is, for the given control system what is the smallest uncertainty destabilizing the closed loop control system?

Consider a system with nominal plant $G(s)$ and the compensator (see Fig 8). The plant and the compensator are supposed to be stable ones.

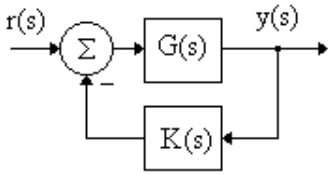

Fig 8. Block diagram of the feedback control system.

Using Nyquist stability criterion the closed loop control system is stable if and only if takes place the following inequality:

$$\left|G(s)K(s)\right| < 1 \qquad (6.1)$$

Left side of the inequality can be rewritten as:

$$\left|G(s)K(s)\right| \le \left|G(s)\right|\left|K(s)\right| \qquad (6.2)$$

The closed loop stability condition can be derived from eqs. (6.1) and (6.2). We have for this criterion:

$$\left|G(s)\right|\left|K(s)\right| < 1 \qquad (6.3)$$

Let us use the small-gain theorem for derivation of conditions of robust stability of control system under multiplicative uncertainty at the plant output. Consider the feedback system shown in Fig 9a. To derive the block diagram of the feedback system in Fig 8 it is necessary to determine the transfer function seen by the uncertainty. For these refer to Fig 9b and the transfer function *M(s)* (see Fig 9c) between 'input' and 'output' is given by [1, 5]:

$$M(s) = \frac{-G(s)K(s)}{1+G(s)K(s)} \qquad (6.4)$$

The small-gain theorem states that if the above transfer function and the uncertainty transfer function are stable the closed loop control system will be robustly stable if and only if [1, 4, 5]:

$$\left|\Delta_m(s)\right| < \frac{1}{\left|G(s)K(s)\left[1+G(s)K(s)\right]^{-1}\right|}, \qquad (6.5)$$

or in other representation

$$\left|\Delta_m(s)\right| < \frac{1}{\left|T(s)\right|}. \qquad (6.6)$$

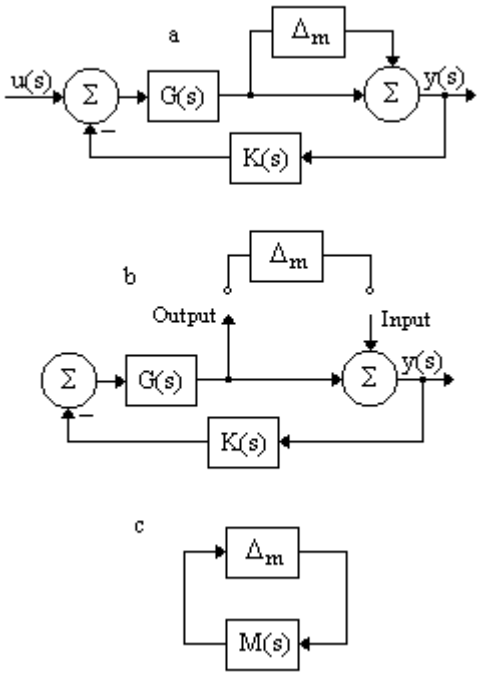

Fig 9. Feedback control system with multiplicative uncertainty.

Eqs. (6.5) and (6.6) can be used to answer the first of two questions posed earlier. If the uncertainty is bounded by the given scalar γ, one can have the following inequality:

$$\left|T(s)\right| < \frac{1}{\gamma}, \text{ or } \left|\gamma\, T(s)\right| < 1 \qquad (6.7)$$

The second question of two posed before is about finding the smallest stable multiplicative uncertainty, which will destabilize the closed loop system. It is known that uncertainty must be smaller than $\frac{1}{\left|T(s)\right|}$, i. e. it must be smaller

than minimum of $\frac{1}{|T(s)|}$. For the minimum of the right side of eq. (6.6) we must maximize $T(s)$. The maximum of $T(s)$ over all possible frequencies is its peak value. The smallest uncertainty destabilizing the feedback system is given by [6] to be:

$$MSM = \frac{1}{M_r},$$

$$\text{where } M_r = \sup_{\omega} |T(j\omega)|. \qquad (6.8)$$

In eq. (6.8) *MSM* denotes the *Multiplicative Stability Margin*.

The *supremum* of $|T(j\omega)|$ is equal to the maximum of the function being investigated on the given frequency range.

For the MIMO feedback system the size of the smallest destabilizing multiplicative uncertainty can be derived as follows:

$$\bar{\sigma}[\Delta_m(j\omega)] = \frac{1}{\bar{\sigma}[T(j\omega)]}. \qquad (6.9)$$

Using the same approach conditions of robust stability under additive uncertainty can be determined. In this particular case transfer function seen by the uncertainty is given as follows

$$M(s) = \frac{-K(s)}{1+G(s)K(s)} \qquad (6.10)$$

The feedback system will be robustly stable if takes place the following inequality:

$$|\Delta_a(s)| < \frac{1}{\left|K(s)[1+G(s)K(s)]^{-1}\right|}, \qquad (6.11)$$

or, in other manner

$$|\Delta_a(s)| < \frac{1}{|K(s)S(s)|}. \qquad (6.12)$$

If the additive uncertainty is stable and bounded by

$$|\Delta_a(s)| < \frac{1}{\gamma}. \qquad (6.13)$$

The closed loop robust stability can be guaranteed if

$$|K(s)S(s)| < \frac{1}{\gamma}, \text{ or } |\gamma K(s)S(s)| < 1 \qquad (6.14)$$

The *Additive Stability Margin (ASM)* can be defined by [6] as follows:

$$ASM = \frac{1}{\sup_{\omega}|K(j\omega)S(j\omega)|}. \qquad (6.15)$$

For the MIMO feedback system the size of the smallest additive uncertainty destabilizing the feedback system can be derived as follows:

$$\bar{\sigma}[\Delta_a(j\omega)] = \frac{1}{\bar{\sigma}[K(j\omega)S(j\omega)]}. \qquad (6.16)$$

It is easily can be seen that for protection against destabilizing multiplicative uncertainties MSM must be large, the complementary sensitivity must be small. It leads to good noise suppression but conflict with reference signal tracking and disturbance rejection. The transfer function of ASM is that of determining control energy.

7. SUMMARY

The paper dealt with dynamic performances of the SISO and MIMO feedback systems and with its main equations. The sensitivity and closed loop sensitivity transfer functions have been involved to determine the desirable shape of the open loop control system Bode diagram. Shapes of these functions were determined so as to meet dynamic performances of the feedback system.

Two kinds of uncertainties were derived for determination if controller is able robustly stabilize the true plant with given uncertainty. For derivation of smallest uncertainty destabilizing the closed loop control system the multiplicative and additive stability margins also were determined.

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ANALYSIS OF ROBUSTNESS OF THE UAV STABILITY AUGMENTATION SYSTEMS

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Abstract: *This paper deals with analysis of the robust analysis of the UAV longitudinal motion stability augmentation system (SAS). In classical interpretation of the automatic flight control system's theory the aircraft or the UAV is considered as the rigid-body one. The controller stabilizing automatically UAV spatial motion is designed for the nominal plant. In real flight conditions UAV behaves elastically. The most common mathematical representation of the aircraft fuselage bending motion is the transfer function method. Mathematical model of the elastic UAV motion can be considered as additive uncertainty. The purpose of the authors is to analyze if the given static controller able to stabilize the UAV spatial motion when its real dynamics is taken into account during controller gain selection.*

Keywords: *elastic motion dynamics, additive uncertainty, robustness, SAS, additive stability margin.*

1. INTRODUCTION

This paper is lean upon early work of the author dealing with analysis of the robustness of the automatic control systems in general [1], and on paper representing application of this theory to analyze stability augmentation system of the UAV [2].

The true control systems are highly nonlinear with complicated dynamics. The controller of the closed loop systems is often designed using simplified mathematical model of the plant. Simplification means linearization of the nonlinear systems, pole zero cancellation etc. Elements of the control systems are often considered to be linear with simple mathematical models.

Neglecting nonlinearities, simplification of the dynamics of actuators, motors, sensors and amplifiers leads to the so-called nominal systems. However, controller must work with the true system in real environment.

Knowledge of the UAV elastic motion is important for designers from the point of view of derivation of the sensor location on the UAV. If elastic motion results in the error of rate sensing it is necessary to filter electric signals of the sensors.

Many UAV, or aircraft flight control system is equipped with butterworth filters designed for filtering unwanted signals from the first and second overtones [4, 6, 7, 8]. The question is how to model the elastic motion of the UAV, or aircraft? One of the possible methods is the classical representation based upon the transfer function method.

This paper deals with representation of the high frequency elastic motion dynamics of the UAV using transfer function method.

Theoretical backgrounds, main methods of dealing with and equations of the aeroelasticity are given in [1, 4, 5, 6, 7, 11]. There are two methods available for modeling UAV, or aircraft elastic motion, i.e. classical and modern methods.

This paper applies classical method based on transfer functions. In [5, 6, 7, 12, 13, 14, 15, 16] there are given block diagrams of the automatic flight control systems, which are based upon stability augmentation systems.

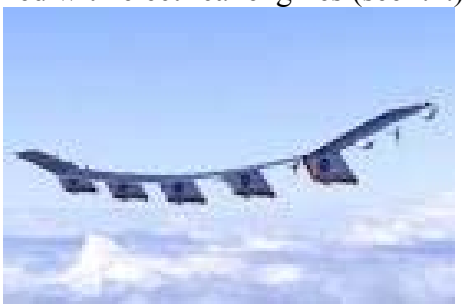
Flying qualities of the automatic flight control systems are defined in [7, 8, 10, 13].

Analysis of the control system robustness is presented in [9, 17].

References [12, 14, 17] give some examples of the robust dynamic controller and filter design for the aeroelastic fighter automatic flight control system using both LQG and LQG/LTR design methods.

In [19] Palik deals with UAV flight management and flight safety aspects of the UAV flights. Palik and Vas dealt with UAV applications in aerodromes, and with its legal and airspace management aspects [20].

There are many UAVs owning non-conventional fuselage and wing design. The Helios UAV is a solar-powered HALE[1] UAV, propelled with electrical engines (see I.1.)



I.1. Helios Solar HALE UAV (www.google.com)

The Helios UAV does not have wing or fuselage in the classical meaning.

The strategic reconnaissance UAV 'AeroVironment' is the non-conventional UAV with large wingspan. The UAV fuselage is not a conventional one, i.e. it is very close to that of the long, thin rod (see I.2.a., I.2.b.)

I.2.a. AeroVironment HALE UAV (www.google.com).

I.2.b. AeroVironment HALE UAV (www.google.com).

The scientific research of the UAV in India resulted in DRDO HALE UAV (see I.3.)

I.3. Indian DRDO HALE UAV (www.google.com).

Next example of the non-conventional design of the HALE UAV is the Zephyr HALE UAV.

I.4. Zephyr HALE Solar UAV (www.google.com).

It is easy to see that new aerodynamic design and new materials applied in manufacturing of the modern UAVs results in a highly aeroelastic aircraft.

2. MATHEMATICAL MODEL OF THE ELASTIC UAV, AND ELASTIC AIRCRAFT

During mathematical modeling of the elastic UAV the fuselage and the wings elastic motion can be analyzed. The UAV fuselage is

[1] High Altitude Long Endurance

considered as a simple rod and its bending distorsion can be analized using Fig 1.

The slender beam differential equation of the vertical displacement *w* of any fuselage segment when pure bending deflection of this element is considered is given by [2, 3, 4, 5]:

$$\frac{\partial^2}{\partial x^2}\left[EI\frac{\partial^2 W(x,t)}{\partial x^2}\right]+ + m(x)\frac{d^2[W(x,t)]}{dt^2}=F_y(x,t) \quad (2.1)$$

In eq (2.1) *EI* is bending stiffness, *m(x)* is running mass, the mass per unit of the fuselage distance, *W(x,t)* is the vertical displacement of the elements of the fuselage and finally, $F_y(x,t)$ is the running external load.

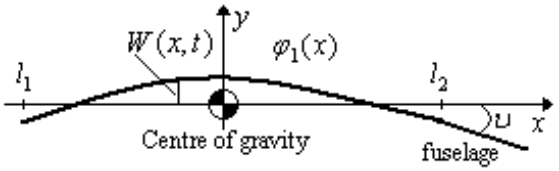


Fig 1. UAV fuselage bending motion
ν – angular deflection related to the fuselage unstrained position

Displacement *W(x,t)* of any fuselage segment from its unstrained initial position can be derived as

$$W(x,t)=\sum_{i=1}^{\infty}\varphi_i(x)\,q_i(t), \quad (2.2)$$

where: $\varphi_i(x)$ –*i*th normal mode shape function, $q_i(t)$ –*i*th mode generalized coordinate. Substituting eq(2.2) into eq(2.1) and applying the property of the normal modes, which states that

$$\sum_{i=1}^{\infty}\omega_i^2=\frac{\frac{\partial^2}{\partial x^2}\left[EI\frac{\partial^2\varphi_i(x)}{\partial x^2}\right]}{m(x)\sum_{i=1}^{\infty}\varphi_i(x)}, \quad (2.3)$$

leads to the following equation:

$$m(x)\sum_{i=1}^{\infty}\varphi_i(x)\frac{d^2q_i(t)}{dt^2}+ + m(x)\sum_{i=1}^{\infty}\left(\varphi_i(x)\,\omega_i^2 q_i(t)\right)=F_y(x,t) \quad (2.4)$$

or, in the other manner:

$$\sum_{i=1}^{\infty}\left[\varphi_i(x)\frac{d^2q_i(t)}{dt^2}+\varphi_i(x)\,\omega_i^2 q_i(t)\right]m(x)= =F_y(x,t) \quad (2.5)$$

The distributed external load $F_y(x,t)$ at station x_E can be expressed as follows:

$$F_y(x,t)=F_y(t)\delta(x-x_E) \quad (2.6)$$

In the case when the external load $F_y(x,t)$ is developed by the angular deflection of the elevator – mounted at station with coordinate of x_E – the distributed load can be determined as:

$$F_y(x,t)=K_E\delta_E(t)\delta(x-x_E), \quad (2.7)$$

where: $\delta_E(t)$ – angular deflection of elevator, and, K_E – elevator gain. Applying Lagrange technique for the determination of the fuselage bending motion we have [2, 3, 4, 5, 6, 12, 17]:

$$M_i(\ddot{q}_i+2\xi_i\omega_i\dot{q}_i+q_i\,\omega_i^2)=F_i(t), \quad (2.8)$$

where $M_i=\int_{-l_1}^{l_2}m(x)\varphi_i^2(x)dx$ – generalized mass of the *i*th elastic mode, $F_i(t)=\int_{-l_1}^{l_2}\varphi_i(x)F_y(x,t)dt$ – generalized force of the *i*th elastic degree of freedom.

Substituting eq. (2.7) into equation of $F_i(t)$ defined above leads to:

$$F_i(t)=K_E\,\varphi_i(x)\big|_{x=x_E}\delta_E(t) \quad (2.9)$$

The fuselage bending motion equation (2.8) respecting eq. (2.9) can be rewritten in the following manner:

$$\frac{d^2 q_i(t)}{dt^2} + 2\xi_i \omega_i \frac{dq_i}{dt} + \omega_i^2 q_i(t) = , \quad (2.10)$$
$$= K_1 \delta_E(t)$$

where: $K_1 = \frac{K_E}{M_i} \varphi_i(x)\Big|_{x=x_E}$ – constant gain. When the aeroelastic bending modes of the fuselage are taken into account to determine the output signal of the pitch rate sensor, in the complex frequency domain we have:

$$\omega_{Z_E}(s) = s\upsilon(s) = \sum_{i=1}^{\infty} s q_i(s) \left(\frac{d\varphi_i(x)}{dx} \right)\Bigg|_{x=x_S} \quad (2.11)$$

where: $\omega_{Z_E}(s)$ –pitch rate of the elastic UAV.

Secondly, taking the Laplace transform of eq. (2.10) with zero initial conditions we have:

$$\left(s^2 + 2\xi_i \omega_i s + \omega_i^2\right) q_i(s) = K_1 \delta_E(s). \quad (2.12)$$

It is easily can be seen that output signal of the pitch rate sensor can be determined as follows:

$$\omega_{Z_E}(s) = \sum_{i=1}^{\infty} \frac{sK_i}{s^2 + 2\xi_i \omega_i s + \omega_i^2} \delta_E(s), \quad (2.13)$$

where $K_i = \frac{K_E}{M_i} \varphi_i(x) \left(\frac{d\varphi_i(x)}{dx} \right)\Bigg|_{x=x_E}$ is the gain of the *i*th elastic degree of freedom.

In [5, 6, 12, 17] parameters of the 1st and the 2nd overtones of the high maneuverability UAV/aircraft fuselage elastic bending motion are given as follows:

$$K_1 = 10\, s^{-2},\ \omega_1 = 10\, s^{-1},\ \xi_1 = 0{,}05$$
$$K_2 = 5\, s^{-2},\ \omega_2 = 20\, s^{-1},\ \xi_2 = 0{,}02 \quad (2.14)$$

It is supposed that the longitudinal motion control system is affecting only the short period motion. The simplified mathematical model of the longitudinal motion of the rigid aircraft for the flight conditions H=1000 m and M=0.4 is given in [5, 6, 7, 12, 14, 15, 17] as follows:

$$\omega_{Z_R}(s) = -\frac{A(1+sT)\omega_\alpha^2}{s^2 + 2s\xi_\alpha \omega_\alpha + \omega_\alpha^2} \delta_E(s). \quad (2.15)$$

In eq(2.15) let us consider the following parameters of the aircraft [5, 6, 12, 17]:

$$A = 1{,}5\, s^{-1};\ T_\theta = 2\, s;\ \omega_\alpha = 5\, s^{-1};\ \xi_\alpha = 0{,}5. \quad (2.16)$$

The resulting output signal of the pitch rate gyro can be determined as sum of the rigid and elastic aircraft output signals defined by eqs (2.13) and (2.15):

$$\omega_Z(s) = \omega_{Z_E}(s) + \omega_{Z_R}(s) \quad (2.17)$$

The aeroelastic aircraft model built by eqs (2.13), (2.15) and (2.17) is represented in Fig 2.

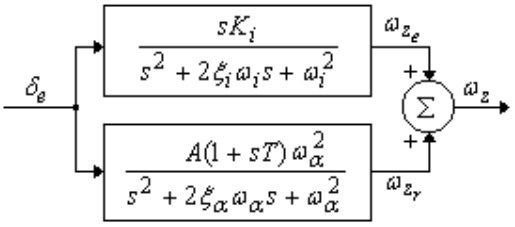


Fig 2. The rigid UAV longitudinal motion model perturbed by elastic high frequency model dynamics.

Sign '–' in rigid aircraft transfer function is for direction measuring between elevator deflection and the pitch rate. Elevator deflection is supposed to be positive if leads to negative pitch rate. If to neglect this sign in pitch rate damper the feedback must be positive.

3. TIME DOMAIN ANALYSIS OF THE LONGITUDINAL STABILITY AUGMENTATION SYSTEM

Let us consider the aircraft model defined by eqs(2.15)–(2.16). Eigenvalues and dynamic performances of the uncontrolled rigid aircraft are as follows [16, 18]:

$$\lambda_{1,2} = -2{,}5 \pm 4{,}33i, \xi = 0{,}5, \omega = 5 rad/s \quad (3.1)$$

Dynamic performances of the uncontrolled aircraft are different from the desired ones e.g in general case damping ratio must lie between 0,6 and 0,8 [7, 8, 10, 13].

Assuming high natural frequency of the rate gyro it can be modeled as a simple proportional term with static gain of $K_s = 1{,}5$. The compensator is supposed to be proportional term of $K_c = 2$.

During analysis of the pitch rate it is supposed that hydraulic actuator of the damper has fast response to input signals without any

time delay. Simplified block diagram of the longitudinal stability augmentation system of the aircraft when its elastic motion is taken into account can be seen in Fig 3.

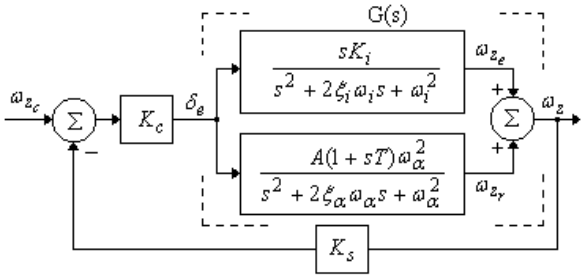


Fig 3. Longitudinal Motion Stability Augmentation System.

The uncontrolled and the controlled aircraft was analized in the time domain. Results of the computer simulation can be seen in Fig 4. From Fig 4. it is easily can be seen that the uncontrolled aircraft transient response has large overshoot and large response time.

The controlled rigid aircraft has faster response without overshoot. Dynamic performances of the closed loop system are as follows [2, 16, 18]:

$$\lambda_1 = -0{,}599, \lambda_2 = -229$$
$$\xi_1 = \xi_2 = 1 \qquad . \qquad (3.2)$$
$$\omega_1 = 0{,}599 rad/s, \omega_2 = 229 rad/s$$

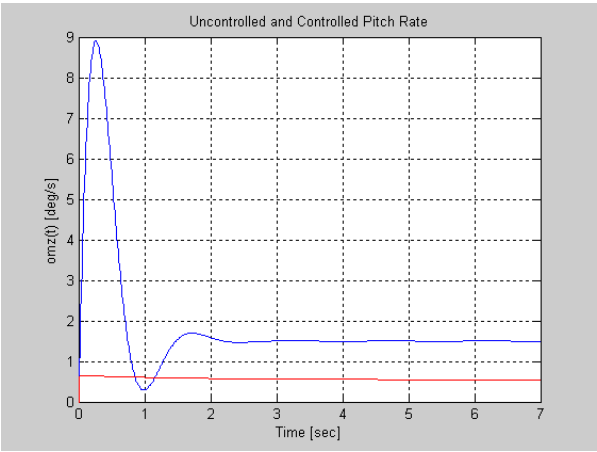


Fig 4. Aircraft pitch rate step responses.
uncontrolled rigid aircraft controlled rigid aircraft

The closed loop perturbed control system was analized in the time domain. Results of the computer simulation can be seen in Fig 5.

From Fig 5. it is easily can be seen that first and the second elastic motion overtones lead to slight oscillation caused by dynamics of the first overtone.

Dynamic performances of the closed loop control flight control system were found using [2, 16, 18] to be:

$$\lambda_{1,2} = -0{,}519 \pm 1{,}95i; \xi_{1,2} = 0{,}0266; \omega_{1,2} = 1{,}95 rad/s$$
$$\lambda_3 = -0{,}58; \xi_3 = 1; \omega_3 = 0{,}58 rad/s$$
$$\lambda_{4,5} = -0{,}729 \pm 9{,}52i; \xi_{4,5} = 0{,}0764; \omega_{4,5} = 9{,}54 rad/s$$
$$\lambda_6 = -274; \xi_6 = 1; \omega_6 = 274 rad/s \qquad (3.3)$$

From eq. (3.3) follows that complex conjugate roots of $\lambda_{1,2}$, and, $\lambda_{4,5}$ are developed by the elastic motion high frequency dynamics.

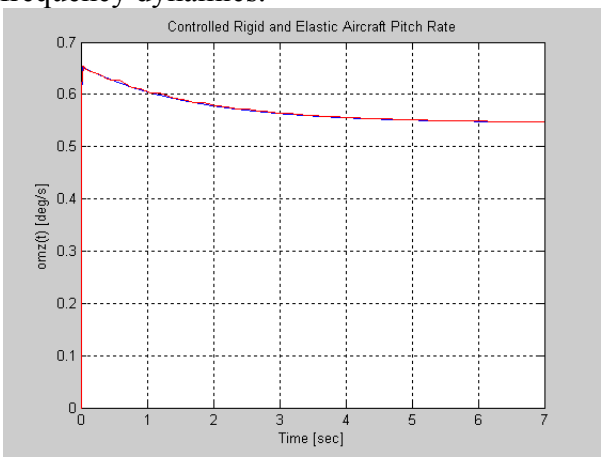


Fig 5. Aircraft pitch rate responses.
controlled rigid aircraft controlled elastic aircraft

4. FREQUENCY DOMAIN ANALYSIS OF THE LONGITUDINAL STABILITY AUGMENTATION SYSTEM OF THE AIRCRAFT

Robust stability analysis gives answer to question 'if the static controller is able to stabilize the true plant?' Firstly, let us analyze

the frequency domain behavior of the additive uncertainty. Bode diagram of the uncertainty can be seen in Fig 6.

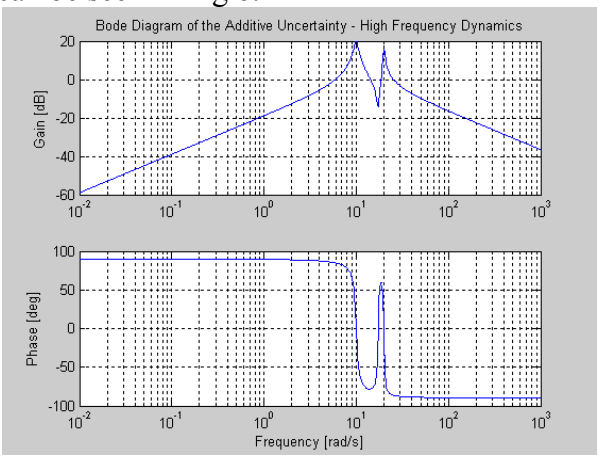


Fig 6. Bode diagram of the additive uncertainty.

Uncertainty gain has resonance peak at 5 rad/s. This is because of the D-term in the numerator of eq. (2.13). Both in low and in high frequency domain the gain is small. The additive uncertainty affects the open loop system frequency domain behavior. Results of the computer simulation can be seen in Fig 7.

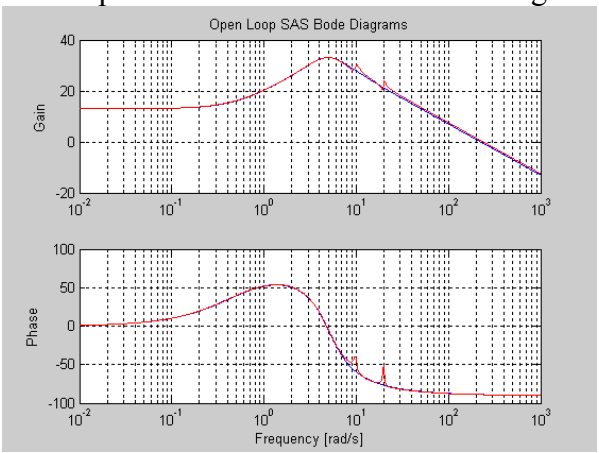


Fig 7. Bode Diagram of the Open Loop Nominal and Perturbed Systems.
nominal SAS perturbed SAS

From Fig 7. it can be seen the effect from elastic motion dynamics, which can be considered for additive uncertainty. At resonance frequencies of 5 rad/s and at 10 rad/s the gain and the phase angle have peak in their values. The open loop gain and the phase angle are increased only at the resonance frequency and in its bordering domain.

5. ROBUSTNESS ANALYSIS OF THE LONGITUDINAL STABILITY AUGMENTATION SYSTEM OF THE AIRCRAFT

From Fig 3. following transfer functions can be obtained [1, 2, 7]:

$$S(s) = \frac{1}{1 + K_c(s)K_s(s)G(s)}, \qquad (5.1)$$

which is sensitivity transfer function, and,

$$T(s) = \frac{K_c(s)G(s)}{1 + K_s(s)K_c(s)G(s)}, \qquad (5.2)$$

which is closed loop complementary transfer function.

Using simplified block diagram of SAS (see Fig 3.), and using eq (2.16), and parameters defined for sensor transfer function, and the feedforward static controller, sensitivity and complementary transfer functions were found to be [16, 18]:

$$T(s) = \frac{150s + 75}{s^2 + 230s + 137{,}5}, \qquad (5.3)$$

$$S(s) = \frac{s^2 + 5s + 25}{s^2 + 230s + 137{,}5}. \qquad (5.4)$$

Results of the computer simulation in the frequency domain can be seen in Fig 8.

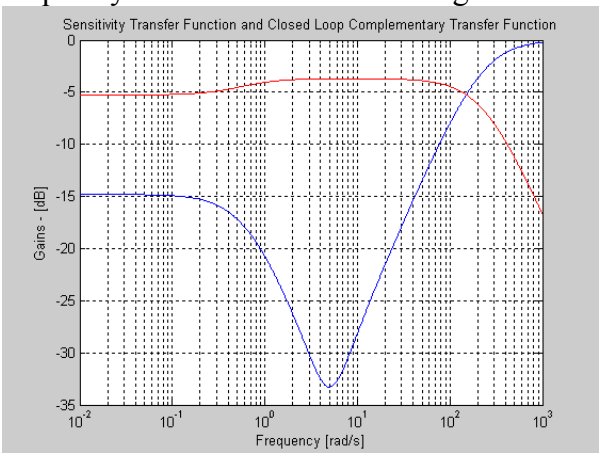


Fig 8. Sensitivity and the Closed Loop Complementary Transfer Functions.
Closed loop complementary transfer function of T(s)
Sensitivity transfer function of S(s)

Conditions of robust stability under additive uncertainty can be determined using the small-gain theorem.

Transfer function seen by the additive uncertainty is given by

$$M_a(s) = \frac{-K_s K_c}{1 + K_s K_c G(s)}. \qquad (5.5)$$

The feedback system will be robustly stable if takes place the following inequality:

$$|\Delta_a(s)| < \frac{1}{\left|K_s K_c \left[1 + K_s K_c G(s)\right]^{-1}\right|}, \qquad (5.6)$$

or in other manner

$$|\Delta_a(s)| < \frac{1}{|K_s K_c S(s)|}. \qquad (5.7)$$

From eq (5.6) it is evident that the closed loop system equipped with static controller can be said robustly stable if and only if additive uncertainty gain $|\Delta_a(s)|$ less than magnitude of the inverse of transfer function of $M_a(s)$.

If the additive uncertainty is stable and bounded one can write that

$$|\Delta_a(s)| < \frac{1}{\gamma}. \qquad (5.8)$$

The closed loop robust stability can be guaranteed if

$$|K_s K_c S(s)| < \frac{1}{\gamma}, \text{ or } |\gamma K_s K_c S(s)| < 1. \qquad (5.9)$$

The *Additive Stability Margin (ASM)* can be defined by

$$ASM = \frac{1}{\sup_{\omega} |K_s K_c S(j\omega)|}. \qquad (5.10)$$

For the MIMO feedback system the size of the smallest additive uncertainty destabilizing the feedback system can be derived as follows:

$$\bar{\sigma}[\Delta_a(j\omega)] = \frac{1}{\bar{\sigma}[K_s K_c S(j\omega)]}. \qquad (5.11)$$

Condition of robust stability defined by eq (5.7) was analyzed and the closed loop system given in Fig 3. was tested for this inequality. Results of the computer simulation can be seen in Fig 9.

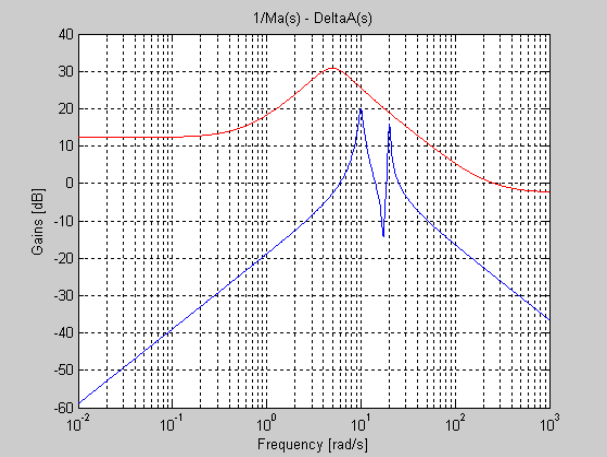


Fig 9. The Inverse Sensitivity Transfer Function and the Additive Uncertainty Gain
1/Ma(s) DeltaA(s)

From Fig 9. it is evident that magnitude of the transfer function seen by the additive uncertainty of $M_a(s)$ larger than the additive uncertainty gain of $|\Delta_a(s)|$: i.e. closed loop control system of the longitudinal stability augmentation system working with simple static controller of K_c can be said robustly stable. For uncertainty given by eqs (2.13)-(2.14) additive stability margin is, $ASM = 4{,}4874$.

6. SUMMARY AND CONCLUSIONS

The paper dealt with basic equations of the aircraft elastic motion. The transfer function of the elastic aircraft was derived. The high frequency dynamics generated by elevator deflection has been involved as additive uncertainty. The closed loop control system of the aircraft longitudinal stability augmentation system was analized for the 1st and for the 2nd overtones of the fuselage elastic motion. The transient behavior, Bode diagrams and the dynamic performances were derived and analized. The robust stability was derived using small gain theorem for additive uncertainty. It was stated that for the given

uncertainty the closed loop system is robustly stable even when it is equipped with static controller.

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