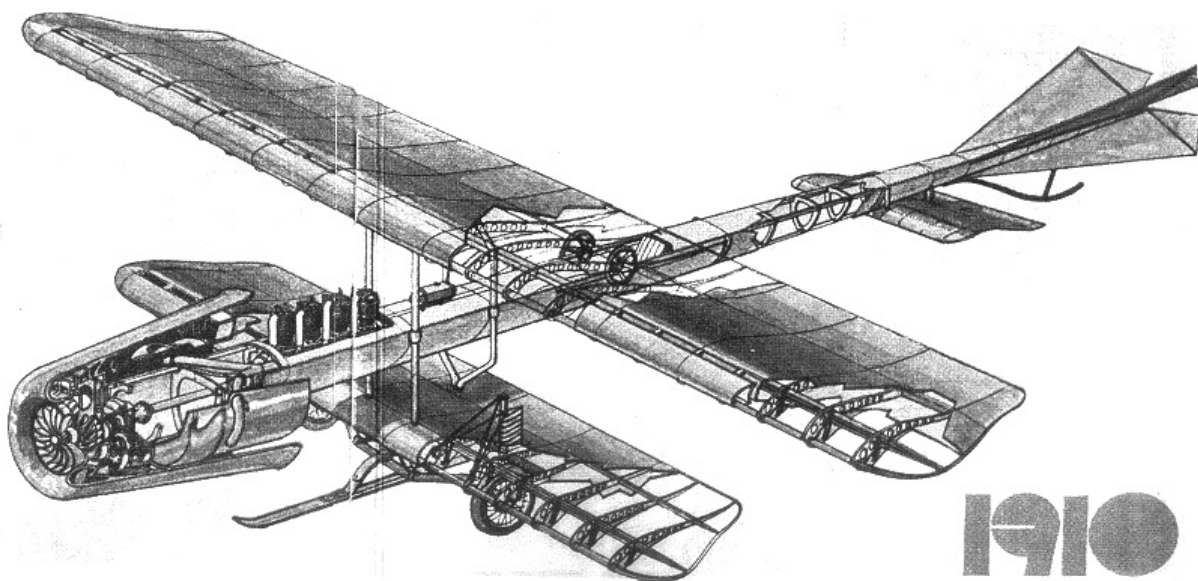


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ROMANIAN AIR DEFENCE 100 YEARS OF HISTORY

This year is marked by the 100th anniversary of the first Romanian anti-aircraft artillery victory, reflected by shooting down an enemy aircraft on 19 September 1916, during the First World War. Together with the progress made in terms of usage by military aviation, Romanian military experts began studying the possibilities of achieving, through their own means, of some defense objectives, troops and population against air strikes.

Implemented into the national consciousness of the Romanian people and in its history as “The War of Unifying the Nation”, the First World War started for Romania on August 15, 1916. With D. I. no. 2784 from 14 August 1916, 21.00 hours, mobilization order was sent to the whole army, together with the setting up mobilization order, which included the Air Defense Corps, as well. The double event was marked by the Order establishing the Air Defense Corps and the first antiaircraft action on the night of 15th to August 16th, 1916, when the Romanian anti-aircraft artillery, hit a Zeppelin, flying over Bucharest.

The Zeppelin damage was confirmed by the crew of the aircraft log: ***“...Right and left the aircraft searchlights appear, which don't spare us at all. As if ordered, anti-aircraft artillery goes into action... There is no doubt, we have been hit...”***

After that, on 19th September, 1916, when the anti-aircraft battery, of the 3rd Army, equipped with Italian Deport cannons, during the execution of the maneuver in Flămânda, shot down a German aircraft. The battery commander, lieutenant Constantin Constantin was decorated with the order „The Crown of Romania” with the knight rank, and the warrant-student Limburg Dumitru received the medal “Manliness and Faith”. This first anti-aircraft victory remained an event with great resonance in the memory of anti-aircraft gunners, being the first success of the recently established branch, being in fact the birth certificate of Antiaircraft Artillery.

We may say that anti-aircraft artillery really received in the military campaign of 1916 the “baptism of fire”, inscribing its name among the active weapons of Romanian army.

The history of weapons development over time, starting from the adaptation of artillery for firing against aircraft and reaching the complex systems ground-to-air missiles are records of bravery and heroism. These facts give them the legitimate right to be engraved in the illustrated gallery of heroes and its army.

Antiaircraft artillery and Missiles is presented today as a subsystem with specific organization and functionality within the General Staff of the Air Force Staff. Their combat actions fit harmoniously in defense operations of Romanian airspace.

Together with aviation and radars, Antiaircraft Artillery and Surface to Air Missile is a key component of the Air Force, with specific missions and complex role in defending objectives, troops and population against enemy surveillance and air threats.

Air defense will continue to be a part of the armed strikes, of national defensive war and of keeping national sovereignty over airspace. It is certain that the role of artillery and surface to air missiles will increase, and the continuous reorganizations will ensure the modernization of this type of weapon, with a rich and long tradition in our army. Thus, the battlefield acquires a new coordinate – the vertical one, in continuous development. According to the principle of action and reaction, part of the creative energies of the day will focus on achieving a weapon to counteract the lethal effects of the enemy aircraft. The chronicle of the weapon evolution, from its foundation to the present, is dotted with numerous acts of heroism, of deeds, that knew how to transform air- defense mission objectives into a sacred and noble duty.

In the 100 years of existence, air defence journeyed full of hard work, from technical improvisation to complexity, from cannon, department and battery to unit and greater unit, from the willpower stimulus to collective force generated by antiaircraft gunners` attitude towards following the supreme soldierly legacy:

„We serve our country!”

THE STATUS OF ARTILLERY AND ANTI-AIRCRAFT MISSILES AT THE CENTENARY CELEBRATION

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Abstract: *Most military actions conducted by modern armies have started with air operations; the employment of land and navy forces was nearly impossible without a proper air support, which increases the idea that the vertical dimension of war extends more and more involving the use of the latest discoveries of science and technology and the design of an effective use. In this article the author's intention is to review some achievements of missiles and artillery air defense weapon system, at a hundred years of existence, as a specialized entity in planning fire fights against aerial enemy, in the area of responsibility of ground forces groups.*

Keywords: *modern war vertical dimension; air defense artillery; air defense missile; air defense weapon system; fighting against aerial enemy.*

1. INTRODUCTION

The analysis of contemporary military phenomenon highlights a continuous growth of the importance and extension of *vertical dimension* in military actions [1], the role of air aggression systems and the fight-back air defense assets in modern clashes. This role results from air forces capacity to strike quickly, suddenly and with great destroying power the vital enemy targets with strong and long-lasting effects upon their capacities and consistencies of the responses. Within the current and future joint military actions their larger integrated nature is more and more visible, revealed as a complex, conceptual and pragmatic phenomenon as theory, structures and actions. It can be appreciated that for the present and future war air and ground forces will conduct operations under the most diverse scenarios, characterized by the emergence of new strategic and doctrinal aspects of means, including interoperability between states allied forces from states categories.

About the battlefield, Napoleon said that “*the permanent stage is chaos and the winner is the one who owns this chaos*”. Under current conditions, it is necessary to take into consideration to develop a command - control system that would allow the Joint Forces commander to have a complete picture of the battle space, through the information received from land, air, sea and cosmic systems. In our view, the implementation of such system will allow the combat entities involved in military actions to be employed effectively, using complex communication systems, based on accurate complete data (land, own troops and the enemy operating in all environments) in accordance with concepts and procedures for planning, deployment, common action and reaction that pursue joint missions with maximum success and minimum losses.

The contemporary technological revolution's impact, a feature of the of the third wave (electronic-informatics), on the size of modern warfare vertical component, has enabled military specialists to rethink the concept of fight back air defense anti-aircraft and to analyze it in relation with the air threat (aggression) directly, as cause and effect. In this respect we try to present some *concepts and connections developed over the 100 years* of air defense missiles and artillery (air medium / anti-aircraft security, airspace research and surveillance system, riposte fire system, anti-aircraft and missile operation, air and antiaircraft fight back, etc.).

2. INTEGRATION IN NATO EXTENDED AIR DEFENSE SYSTEM - A PRIORITY FOR NATIONAL AIR DEFENSE SYSTEM

Under the circumstances of current international security environment, NATO has defined and validated the concept regarding the implementation of the Integrated Extended Air Defense NATO (NATINADS-NATO Integrated Air Defense System), which contains guiding principles and concepts designed to fulfill the mission of collective Alliance air defense, provides real-time capabilities generated for crisis and conflicts management [2]. Enhancing the NATO role and missions in peacekeeping operation, solve the conflicts and the fight against terrorism, determines a process of adaptation to NATINADS in collective defense, to meet the needs of extended air defense and increase its contribution to crisis management.

The essence of integration is the transfer of responsibility, forces and authority need to be used by Supreme Allied Commander Europe (SACEUR) in order to defend European NATO countries against airstrikes, in peacetime, crisis and conflict. In this context, the integration of Romanian airspace into the NATO should be done with guiding principles and concepts of the Alliance for carrying out the collective air defense.

NATINADS integration represents interconnection of national air defense systems of the NATO member states in a single NATO air defense system, within Europe [2]. It has the means, facilities and operational command and control structures, efficient in peacetime, crisis and war.

In order to achieve the integration and to create a viable NATINADS is necessary to fulfill several *requirements* such as: using common procedures which, applied to the entire system, are enabling the deployment of continuous operations; common standards, the base of NATINADS elements, designed to reveal the performance; common language enabling operators to collaborate and change information quickly and clearly; state of combat readiness, according to the main risk / danger; forces availability due to operational needs, while respecting a fair division of tasks; sufficient opportunities to take part in multinational NATO exercises; joint command structure/unified, ensuring a clear division of responsibilities, which facilitates a quick running decision-making process.

At the same time, integration into NATINADS request strict adherence to clear principles: air defense units designed for SACEUR will be under the operational command and control of this body in peacetime, crisis and conflict and will be subject to any restrictions may be imposed related to the use and deployment of forces; air defense forces established will be asked to conduct missions other than air defense only with national approval; centers and command post reported will be employed, particularly with home nation in whose territory is, unless unusual circumstances dictate by other that regulations and only after receiving the national approval; the decision regarding the number, assured force structure and its equipment is a national responsibility; air defense unit will provide for allied NATO countries relevant information, of own interest, to control civil aviation, civil protection and fulfill other national responsibilities; some features, such as internal security and their own commitments outside the framework of NATO, must be covered by national responsibilities [3]. In such circumstances, the required forces can be withdrawn among the designated forces of that country, in accordance with approved procedures; at all levels, commanders are responsible for specific Alliance problems, only to higher allied authorities. In terms of subordination, forces involved in integrated air defense are grouped into several categories: designated forces (under control) NATO; forces subordinate to NATO; forces designed for NATO; forces under national command. This consist in Air Forces, Army and Naval Forces air defense units undergoing continuous training or operational process in order to maintain the required level of efficiency. SACEUR air defense mission in peacetime is to maintain the integrity of NATO airspace and protect European NATO countries and forces against air attacks. Air defense include functions such *air surveillance and police* and is the main factor in maintaining the security of the NATO member states.

In crisis NATINADS extends to support measures undertaken by Allied Command Operations (ACO), to carry out crisis management and to deter aggression, to demonstrate Alliance determination and preparation to withstand attacks from crisis area. In conflicts / war the objectives sought in air defense operations are to defend Allied Command Europe (ACE) area of the responsibility against aerial attacks, causing maximum casualties among enemy air forces through aging and creating a favorable air situation.

The latest theoretical - doctrinal concept, emerged in the last decade of the twentieth century, named *extended air defense* (EAD/AAEx), tries to combine in a revolutionary manner benefits already achieved by *integrated air defense* with benefits that are envisaged to be gained through implementation of organization, equipment and battle training doctrines. This integrated concept of all air defense actions and activities can be extended air defense system - EADS, having opportunities to revolutionize the whole concept on existing operational architecture and mode of action of air defense [4]. At a hundred years of artillery and anti-aircraft missiles existence, the configuration of the extended air defense system as organization, implies the necessity of a distinct form of correlation both between people, technical means and purposes and between people and the existing organizational structures also. At first glance it can be said that the only purpose of extended air defense system is to defend national sovereignty in the own airspace while guaranteeing freedom of operational action in the air space of interest, namely to ensure protection / direct defense and/or some close major objectives in the (task forces, social, political and economic objectives, urban etc.) against attacks taken from aero- cosmic space, by an presumably opponent.

3. LAND FORCES AIR DEFENSE, A VECTOR AIR DEFENSE INTEGRATED SYSTEM

Land forces is the basic component of the army, meant to conduct the full range of operations, terrestrial and airborne, independent, joint, or combined (within multinational forces, NATO or the EU, and UN mandated) on national territory or outside it, in any region and any direction for armed defense of the country or alliance, promoting the values of international peace and stability and the strategic interests of Romania.

According to Handbook for organization of staff and joint operations of the armed forces, citing the source,, ATP35B "Appendix 19 - staff operational language, page 27, states:,, combat forces are those forces using live fire and maneuver to engage enemy forces " and ,, support forces are forces which provides operational support for combat forces". Also, General Tactical Manual of US Land Forces, F.M. 3-90, 04 July 2001 to p.A.-2 lays "combat Arms of Land Forces are units and military in direct contact, destroy enemy forces or ensure compatibility and destructive firepower on the battlefield. Combat weapons of U.S. Army include: artillery and air defense missiles, armored, combat helicopters, genius, field artillery, infantry and special forces".

Land Forces air defense system units are part of the Integrated Air Defense (IADS- national or allied) and include various fire units: antiaircraft missiles / Surface to Air (SAM - Surface to Air Missiles), with very short range, very long-range, portable air defense systems (MANPADS - Man portable Air Defense systems) and gun systems. All air defense forces must have the ability to discover, identify, track and engage a wide range of hostile aerial means.

Air and missile defense, as a battle function of Land Forces missions, contribute to objectives fulfillment by: participating in gaining and maintaining air superiority/ supremacy; air defense forces and vital elements; participation in winning the informational war. The mission is fulfilled through the execution of air defense and missile operations. We face air defense actions at combined forces and groups levels, materialized both through missions and actions of research, control and destroy of enemy air and antiaircraft protection measures. Air defense is achieved through integrated effort of forces and means of artillery and antiaircraft missiles, radar, jamming and countermeasure electronics units, regardless of their organic subordination in a unitary coordination conception.

Land forces air and missile defense system is all specialized and non-specialized means and forces available for carrying out the defend forces and vital infrastructure elements. It must follow the principle of centralized management and decentralized execution.

We consider that, after a hundred years of experience, to achieve the goals, air and missile defense forces and means systems must be part of operational and tactical systems, which meets the following requirements: unitary organization and management; short reaction time; appropriate detection and permanent aerial target acquisition; weapons systems to their maximum possibilities; effort focuses on decisive directions and uninterrupted cooperation; stable performance; interoperability with neighboring air defense systems both national and NATO.

The vertical component of the operation summarizes all the actions and measures to be applied by own forces to counteract air and cosmic enemy [5]. Starting with the system definition, we can say that system of antiaircraft response represents a number of factors (air and missile defense forces and means) dependent each other and forming an increasingly organized structure, among which are established dynamic relations (interactions) based on which it can perform certain functions within a process suitable for the standard purpose (objective).

Air defense and antimissile respond is the *vertical element* of operations conducted by land forces, summing up all the actions and measures to be taken by own forces to counteract air and cosmic enemy. It is placed at least at the same level of importance with the operation *horizontal component*, which sums up all the actions and measures to be executed own forces, obviously in ground space and (or) water. In our view, antiaircraft and missile strikes have a particularly important role, contributing decisively to achieving the armed struggle goal through operational missions executed in all phases of military conflict.

Air defense response is a battle system with a sphere of action defined by area of responsibility airspace, putting together all activities conducted by tactical and operational forces and structures designed to prepare and conduct specific military actions within air defense fire system. Lines of evolution of air defense riposte system must satisfy certain efficiency conditions. In this respect it must: be organized and managed in a unitary conception, in peacetime and must cover the entire area of responsibility, to provide research, finding timely and continuous tracking the opponent air assets, in order to avoid surprise and to have the ability of leading combat operations against aerial enemy in all probable directions of action. Within air defense system riposte, to defend forces and the main objectives in the Land Forces area of responsibility, missiles and air defense artillery units are conducting combat *missions*: surveillance, discovery, recognition, tracking and indication of enemy air assets; fighting against aerial enemy in order to protect the main governance system; fighting against the enemy in order to participate in Land Forces air defense groups, in their area of responsibility during preparation and conducting their operations; fighting against airborne enemy, forbidding its supply and air discharge; protect the main elements of the logistics system (headquarters, combat support units). Air and missile defense takes part in air defense response against the enemy using its main component, fight against aerial enemy. With the other part air defense is involved in carrying out forces measures for insurance and protection, of warning, concealing and dispersal of forces, research and to limit the effects of aerial hits. Therefore, fight against aerial enemy in Land Force area of responsibility is a core aspect of operation [6, pp.126-128]. It covers all actions taken against aerial enemy by forces and means of antiaircraft fire system, according to commander concept, in the acting space, corresponding to area of responsibility. Air defense fire system is part of task force riposte system, developed by the combined ground forces, independently or in cooperation with structures belonging to Air Forces. It consists of: management, informational, runtime (operational), logistics insurance; security subsystem.

Fighting against aerial enemy includes all actions taken against enemy fire subsystem means and force, according to group's commander conception within the action area, in accordance with its area of responsibility [6, pp121-123]. This is characterized by: great firepower and destruction, precisely at high flight speeds, greater opportunities to destroy in short time enemy assets, maneuvers of forces and means to avoid enemy surprise, obtaining intelligence about the air strikes danger in the shortest time.

It can be carried out in any time, season and weather condition, based on information regarding enemy air system provided by own research radars and from the National Air Command Control System as the Local Aerial Picture.

The overall goal of combat actions is thwarting the air enemy assets actions during surveillance and air hits, supplies and air extraction of airborne troops and. In our opinion, the commander will achieve success in the battle against aerial enemy air by the way will require rational application of complex principles of fight, namely: freedom of action, concentrating efforts, unity of action, dispersing forces and resources, the economy of forces and means, uninterrupted cooperation and avoiding surprise, maneuver, real-time information.

4. ROMANIA PARTICIPATION IN ACHIEVING US MISSILE SHIELD

Ballistic missile proliferation, at the beginning of this millennium, represents a continuously growing threat for territory, populations and Alliance forces. The threat counteracting is performed by missile defense and other specific measures. Considering that missile defense is only one section of an extended response to this major threat, it was established that “*Alliance has to develop a missile defense capability to fulfill the fundamental objective of collective defense*” [7]. NATO missile defense capability analysis was carried out, following some principles: solidarity and indivisibility of Allied security, equitable sharing of risks and tasks. Other analysis elements were: the level of threat, affordability, technical feasibility, all in accordance with risk analyzes carried out as recently which were approved by the Alliance.

Romania, after a hundred years of experience in operational environment, has become a constant spearhead of missile defense, adopted at the NATO Summit in Bucharest (2008) by which was laid down the implementation of an integrated defense system against ballistic missiles throughout Alliance members, respecting the principles of Alliance security and collective solidarity. As American partners highlight, the program of SM-3 interceptors development is rated as one of the most successful programs run by the Department of Defense, was labeled as a system with purely defensive features. It is intended to defend against any attack taken with intercontinental missiles, with medium or short acting range, hitting the warhead in their terminal phase. Besides that, the agreement stated that the missile defense system will be used only for self-defense in accordance with UN Charter. In accordance with the Revising report of the US missile defense system, published on 1 February 2010 by the US Department of Defense, there were established four implementation stages for US missile defense system (shield) in Europe, as follows:

- **Phase I** - protection of the European South East area by placing an advanced radar system and SM3-IA interceptors on ships. This stage started in March 2011, by deployment in the Mediterranean Sea of the USS Monterey, equipped with the Aegis system and through radar from Kurecik, Turkey;

- **Phase II** – extending the missile defense to NATO Allies, by rendering operational a new generation of SM3- IB interceptors, disposed at the land base from Deveselu, made operational at the end of 2015;

- **Phase III** – extending, by the end of 2018, of NATO member states coverage in Europe with SM3 missile systems, located at land base Redzikowo in Poland;

- **Phase IV** – extending, by 2020, of the intercontinental missile attacks cover, further development of SM3 missiles and radars, emplacing new class of SM3-IIB interceptors in Poland.

In Romania Phase II was completed at Deveselu Base, Ilt County at the end of 2015, when the interception missiles type SM-3 (Standard Missile 3) Block IB, became operational. The system is composed of terrestrial interceptors and their target guidance system. Radar systems designed to discover ballistic missiles launched by potential opponents will be placed in other states. The planned funds for this system have been allocated by the US Congress (over \$ 265 million in the fiscal year 2013). This reconfirms that Romania and US commitment to achieve one of the most important joint projects was a strong, purposeful who brought extra security for Romanian state.

Placing system components in our country does not affect neighboring countries security nor relations between Romania and those, the defensive nature and the deterrent effect of this system bringing greater security in the region. The small size of the system placed in Romania, the limited action capacity and its endowment structure draw the conclusion that this potential is unable to alter the strategic balance in Europe.

The system configuration will include three batteries, each having eight missiles interceptor SM-3 (a total of 24 missiles). By participating in this program, it is considered that Romania could become a target, but not to a greater degree than before. NATO and collective defense is supposing both privileges and obligations and risks assumption. The benefits conferred by high levels of security are significantly higher than disadvantages; the benefits are clearly greater compared with costs.

CONCLUSIONS

- Romania, at the artillery and anti-aircraft missiles centenary celebration, needs to have air and missile defense / anti-aircraft under NATO command authority from peacetime, to be employed, within the country or outside our territory, against air and aerospace aggression, against air and cosmic platforms unauthorized to use national airspace

- artillery and missiles air defense units, as combat forces, directly engage enemy's surveillance, attack and transport aircrafts, conducting within this process, airspace research, aerial targets discovery, recognition, tracking, control and destruction

- the use of missile and artillery air defense army units, their distribution and maneuver in dynamic progress of land forces operation, is the exclusive competence of the ground forces group's commander and battle fire control is the sole responsibility of missile and artillery air defense army units commanders, according to the operation plan and situations;

- our country participation in US missile defense system is the result of diplomatic approaches made in the previous period, and a major success in bilateral relations between Romania and US, an example of Romania's affirmation within NATO, as a reliable partner;

- the involvement in missile shield project will lead to a significant increase of Romania's national security, and, through the implementation of new missile defense system, in addition to strengthening the national security system, a major contribution will be made at increasing the security of neighboring states, this project having regional dimension importance.

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THE GRAPHITE BOMB: AN OVERVIEW OF ITS BASIC MILITARY APPLICATIONS

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Abstract: *It is well-known that, high-power electromagnetic pulse generation techniques and high-power microwave (HPM) technologies have matured to the point where practical electromagnetic bombs (in fact, E-bombs) are becoming technically feasible, with new applications in non-nuclear confrontations. This paper presents in a short form some theoretical considerations about the technology base and applications of the electromagnetic bombs.*

Keywords: *soft bomb, graphite bomb, carbon filaments, BLU-114/B*

1. INTRODUCTION

Graphite bomb (also, known as the *soft bomb*) is a non-lethal weapon which is used for shutting down the power supply systems of the enemy. The working mechanism of the graphite bomb is relatively simple and is based on making suspensions of air/clouds of carbon filament chemically treated extremely fine over the electrical components, causing short circuits and electrical discharges within the infrastructure of electricity supply (in especially on the power plants, transformer stations, air transportation facilities of electrical power etc.). In addition, the effective use of this unconventional electronic attack system is based on *critical points* identification and disruption philosophy. Carbon filaments used inside of graphite bombs are very small and may give rise to dense clouds, with a long persistence. Also, the name of *soft bomb* it comes from that its basic destructive effects are centered only on the electricity supply facilities, with minimal risk of occurrence of some collateral damage and particularly over the human staff [1-3].

In other news, the effect of the graphite bomb is only over the equipment and facilities of uninsulated power supply. Figure 1 shows the effects of graffiti bombs launched by US Air Force, on 22 March 2003 on a 400 kV Transformer Station in the Electrical Power in Nasiriyya, which caused the power shortage in the city for 30 days [4].



Fig.1 The 400 kV Electrical Power Transformer Station bombed by U.S. Air Force in Nasiriyya on March 22, 2003, with a carbon fiber bomb (Source: R. E. Brigety, Human Rights Watch, 2003, [4])

2. BASIC MILITARY APPLICATIONS OF THE GRAPHITE BOMBS

Graphite bomb was used against Iraq in the first Gulf War (1990-1991), neutralizing about 85% of this country facilities supply electricity. Also, the graphite bomb (composed of submunitions BLU-114/B, produced by USA) was used widely in the NATO military intervention in former Yugoslavia (1999), where its effect consisted in disabling of more than 70% national grid electricity supply.

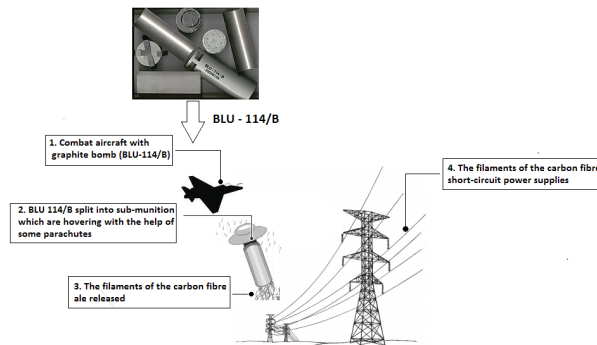


Fig. 2 The mode of action of graphite bomb

Although initially in less than 24 hours, the Serbs have managed to restore their electrical systems operability, however, repeated use of the graphite bomb by alliance thwarted almost any further effort in this direction.

In the final phase of this intervention, NATO air forces used mostly standard carrier vectors (e.g., bombs, missiles etc.) to transport and detonation of the munitions in the area of interest of the graphite bomb.

In addition, for an accurate understanding of the multiple implications (economic, social, etc.) and respectively, the effective conditions of use in a military conflict of a graphite bomb, it is very useful a summary of the main features of a modern system of electrical energy distribution.

It should be remembered first that any modern network of power supply has a high-degree of complexity and, respectively, a wide-range of distribution and therefore the decommissioning of its elements vital involves subsequently a technological effort and substantial financial for a long time. It should also be remembered that, any system of power supply will contain in its architecture the following basic elements: the generator of electricity, the electricity transmission system (incorporating in its structure the high-power transformers, losses into transmission lines which are reasonable if the line voltage is very high, typically up to 400 kV) and the electricity distribution system to the users, industrial and domestic use (i.e., this system consists mainly by the primary distribution subsystem providing voltages between 2.4 and 35 kV and respectively, secondary distribution subsystem providing voltages between 110/220 and 600 V). Theoretically, any of these sub-components may represent a potential target for an attack based on graphite bombs.

In the special literature (e.g., documents prepared by NERC/*North American Electric Reliability Council* etc.), the concept used in the moment when a facility or electricity supply system, as a its whole, suffers damage (or collapse) is called generic *blackout* (shutdown or blindness). In fact, the blackout is a condition which is satisfied when a significant part or the entire electrical network is damaged. Any module containing connections to the high-voltage network and that cannot support a reasonable level disturbances is a significant candidate for the blackout (and of course, for the action of graphite bombs). In addition, in some military documents, the graphite bomb is also called *blackout bomb*. Generally, the blackout condition can be the result of the occurrence of industrial dynamic instabilities (e.g., changing nominal parameters of the operating power generators, the occurrence of the short circuits due to the heat effect or to adverse weather conditions, etc.) or after their artificial induction.

Naturally, in the architecture of any modern power supply system, the critical subsystems for operation are either protected or redundant (forming so-called system of auxiliary power supply) and respectively, exists the possibility to isolate and route the damaged sections. Therefore, a proper attack initiated with the graphite bombs must cover up these subsystems. Consequently, for a maximal effectiveness of the action of such type of bombs, a detailed knowledge of the system architecture of the targeted power supply, concomitantly with a correct identification of its critical points in operation is also necessary.

Like in the conflict from the former Yugoslavia, to prevent the enemy to pass effective actions to restore its power supply system, it must be known or intuit their effective procedures of action in this situation. Consequently, after the removing of the major defects, it is possible to follow two strategies in order to restore the functionality of the energy system: the first strategy, called *all open* follows that all facilities affected and recovered after the attack to be made operational and respectively, the second one, called *operation control* follows to restore the working only of those components which are essential for its revitalization process [5].

3. SOME TECHNICAL CONSIDERATIONS ABOUT GRAPHITE BOMBS

As before mentioned, the combat load of these bombs is based on the massive use of the graphite. As it is already known, the carbon is a nonmetal chemical element in group 4, which is found in nature in two allotropic states: diamond and respectively, graphite.

The graphite contains a special type of atomic network called *atomic layered network* which is represented by a hexagonal atomic network composed by parallel planes of carbon atoms. The hardness of the graphite is by ten times lower than of the diamond one (1 on the Mohs scale), with a density of 2.262 g/cm^2 .

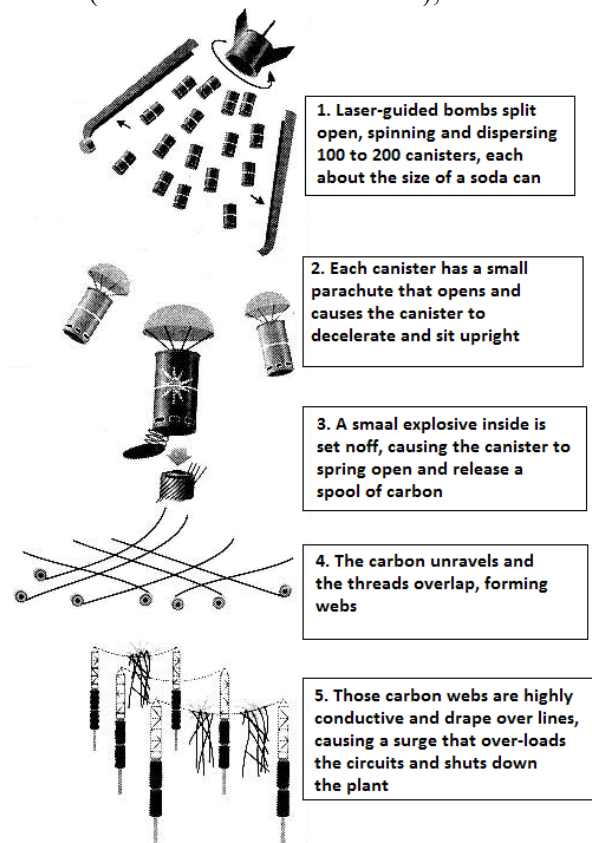


Fig. 3 The mechanism of action of the graphite bomb (schematic)
(Source: W. M. Arkin, *Aviation Week and Space Technology*, [6])

Also, the graphite is an excellent conductor of heat and power (i.e., these properties are generated by the presence into graphite of the chemical π links, and in which the electrons are moving free between the carbon atoms through the overlapping orbits $2p$) and generally, its physical properties (including its electrical conductivity) are determined by the atomic structure resulting from the specific application of some chemical treatments. Also, the graphite may not be molten and for a temperature more than 35000 °C, it directly forms the vapor carbon atoms. In addition, graphite has a low reactivity and practically, does not chemically interact with any other substance.

Next, the intrinsic working mechanism of the graphite bombs action will synthetically described. Taking into account the suggestive scenario illustrated in Figure 2, the basic key-stages of its internal mechanism are the following (see Figure 3).

- 1) The overhead of the target of interest is accomplished breaking the carrier vector (e.g., a laser-guided bombs etc.) and using a spin moving, the dispersion of the submunitions components takes place (e.g., 100 up to 200 submunitions), the size of each submunitions being by *cm* order;
- 2) Each component submunitions have attached a small parachute allowing a decreasing of its fall rate, while ensuring its vertical positioning;
- 3) A small internal explosion in each submunitions assures its breaking and respectively, releasing a coil (reel) of carbon filaments;
- 4) The carbon filaments because of the movement of the printed coil are released and form overlapping spider webs like a network (*webs*);
- 5) These carbon filament nets are highly conductive and overlapping over power lines, having as effect the voltage peaks which are overloading electrical circuits and thus, leads to deactivation of the power supply.

Generally, having as starting point the strict confidentiality of the documents related to the technology used in the design and development of the graphite bombs, the access to the relevant information in this field is more difficult. However, because such systems have been already used with a maximal efficiency in the context of recent armed conflict (former Yugoslavia or Iraq) and the public interest in this area is still risen, in the literature are synthetically indicated an important number of useful references about this weapon system. Consequently, some significant remarks and technological details related to graphite bombs can thus be made.

4. SOME CONSTRUCTIVE EXAMPLES

US Army have in service the weapons system *Blackout Bomb* CBU-94 which is composed by specific submunitions BLU-114/B for attacking electricity supply infrastructure belonging to a potential enemy. Although some few technical details about this classified weapon system are known, its operation mechanism can be summarized by dispersion of its submunitions containing a significant amount of carbon filament chemically treated, and whose action on a power supply system may lead to short circuits into some sensitive equipment components (e.g., transformers or switching power stations). The use of submunitions BLU-114/B is limited to action on power supply facilities with minimal risk of occurrence of collateral damage (hence the name of soft bomb).

By the detonation of these submunitions over the selected targets, a large number of fine carbon filaments are dispersed in the air, each one having a thickness of the order of several hundredths *cm*. Also, these filaments can float into atmosphere and forms dense clouds with a significant persistence. Next, the filaments of carbon fiber dispersed by the BLU-114/B submunitions come into direct contact with the power transformers and other high-voltage equipments. These can provide short circuits and often, an arcing current flowing through the fiber is generated and finally as result, the fiber is subsequently vaporized. Graphite, which is an excellent conductor of electricity, it is probably covered in this case with other materials that enhance this effect. In the area where the electric field is the strongest, this can initiate a download and electrons form rapidly a channel of ionization that will conduct the electricity.

This causes an instantaneous local melting of a certain quantity of material from the surface of the two conductors. If the current has enough intensity, this arc can cause major faults or even, a fire. This fire can be also started in overheated equipments or conductors by a current oversize. In addition, the electrical arcs with very high-energy can cause even a mechanical explosion of the electrical equipments by their action.

Although the most important part of the specific technical details are classified and Pentagon declined intention to provide any information about this submunitions, its cost price is probably somewhere in the hundreds of thousands of dollars.

The relative simplicity of the concept and respectively, the potential use inside of its structure of the components from other munitions leading to relatively low production costs.

In other news, if we consider the overall design of the CBU-94 weapon system, the central element of attraction is represented by submunitions BLU-117/B and less by the submunitions dispensing system [1, 2, 7].

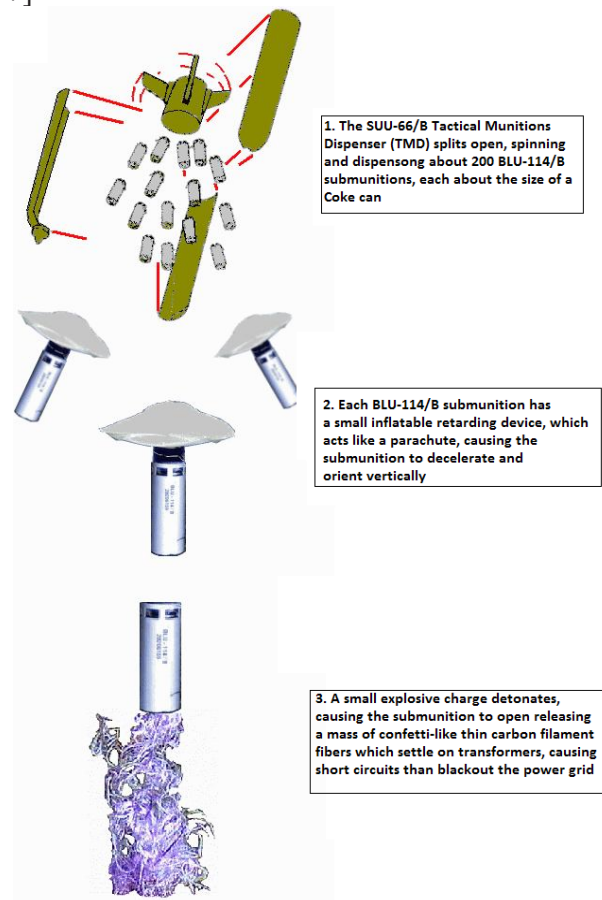


Fig. 4 Mode of presentation of the operation of the BLU-114 / B
(Source: global security, [7])

The first effective use of the submunitions BLU-114/B was for attacking the infrastructure of the power supply belonging to Serbia, where the carrier-vector was based on the airplane F-117 and the dispensing system by the SUU-66/B (i.e., lens ammunition tactical TMD), normally associated with carrier system CBU-97/CBU-105 SFW.



Fig. 5 The carrier system CBU-97
(Source: defense industry daily, [8])

Typically, the circular error assigned to these unguided systems is by order of tens of meters. In the future, by incorporating in the architecture of the next generation of graphite bombs of the advanced guided kits having a high-precision as JDAM (*Joint Direct Attack Monition*) or JSOW (*Joint Standoff Weapon*), the precision and destroying efficacy of these weapon systems will be highly increased [8].



Fig. 6 Examples of CBU-97 weapon system images from the former Yugoslavia conflict (Source: global security, [7])

CONCLUSIONS

The first important remark that can be obtained from the analysis of these military conflicts is that related to the very favorable ratio between the price cost assigned to the current power supply facilities destroyed and respectively, the actual price cost of the graphite bombs. Consequently, the use of such unconventional weapons becomes extremely profitable. Also, can be noted the huge damages, human losses virtually minimal, and a devastating demoralizing effect against the attacked nations etc.

Another important remark is concerning to the fact that, an important number of generations of graphite bombs was developed by the US military. Consequently, starting from the specific ammunitions based on Tomahawk kits and used in the early days of Operation Desert Storm (1991), continuing with the submunitions BLU-114/B massive used in the conflict from the former Yugoslavia (1999) and Iraq (2003) and ending with the next generation of graphite weapons based on the exploiting of the carrier-vector having a high precision like AGM-154 D JSOW, it can conclude that the interest in development of this type of unconventional electronic attack systems remains very high (e.g., given by the relatively low price cost compared to the efficiency of its use and respectively, the membership to the class of software system bombs). Finally, all these important advantages of the graphite bombs will explain the increased human and financial resources which will be allocated in the next period of time.

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BUILDING AN OPERATIONAL ENVIRONMENT MODEL USING MORPHOLOGICAL ANALYSIS

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Abstract: *Achieving success in current and future military operations has become questionable. Whereas the enemy is characterized by a profound character of uncertainty, in terms of shape and location and also regarding methods and procedures of action, the issue highpoints refer firstly to identifying ways and means to counter him and then to setting criteria and measurable standards by which one can appreciate the objectives achievement in military actions. This article focuses on the first part of the problem. The solution is to adapt the forms and methods of preparing the force that, projected in an operational environment that correspond to the coordinates of present and future exacerbated complexity, be able to generate sufficient effects (quantitatively and qualitatively) to achieve a state of security within acceptable limits. Given that the operational environment is the framework in which military action is carried out, this article presents an effective and comprehensive method meant to create a controllable model thereof, in order to provide military specialists a useful tool in preparing the command structures of military instrument.*

Keywords: *operational environment, PMESII, operational variables, morphological analysis, morphological space*

1. INTRODUCTION

An operational environment is a composite system of actors, conditions and circumstances which manifests itself in a well-defined space and which directly influence the use of military capabilities based on the decisions of commanders. It includes, on the one hand, all enemy, allied or neutral forces and systems participating in the full spectrum of conflict and, on the other hand, physical environment and informational framework, governance and policy making factors, level of technology, local resources as well as domestic culture.

The Romanian Doctrine defines the operational environment as “*a system of systems that each of the actors interacts within it, pursuing their own interests. They build / develop strategies and allocate resources to take the necessary actions in order to facilitate their pursuit of power exerting influence over others and achieve their targets.*”¹ For a coherent analysis we should start from the assertion that the actors in the conflict are included in a wide range, starting from regular force configuration, belonging to a state and reaching non-state actors, governmental or non-governmental organizations which act in order to meet their targets. Adding various terrorist and / or organized crime organizations, we get the comprehensive picture that constitutes the environment for conducting military actions. Thus, it can be considered that the operational environment is an arena where operational objectives are achieved not only by force but also by how fast and effective the military force can establish and maintain a stable condition. All actors, allies or enemies, state or non-state, regardless their technological or military capabilities, will likely use every political, economic, informational and / or military tool at their disposal in order to achieve the desired objectives.

Considering all these factors, the most important issue that arouses the interest of military specialists is generated by finding effective solutions to achieve success in such a context.

¹ *** *Romanian Army Doctrine*, Bucharest, 2012, Appendix 1

Analyzing recent conflicts resulted in a reality that was not to the liking of many: technological superiority over the enemy does not create the decisive advantage anymore and, as such, victory cannot be remotely achieved, by simply pressing the buttons.

Actually, this reality is well known for almost two decades. A matter of current fact is, however, the persistence of the same situations where we are still looking for solutions to materialize effective actions against a shapeless enemy, acting without complying with rules, principles or methods written in any manual, against an enemy that gives a new dimension to VUCA² quartet that lists the characteristics of the current operational environment.

Returning to the drawing board, among other issues, a conclusion has been reached that it is the force, through its most valuable component - the human resource, that must be refurbished in order to provide at least a consistent answer as if not a proactive action. Hence the need to develop methods that place in the boots of a fighter a human resource whose training meets the requirements to ensure success. The first activity to be carried out in such an approach is the analysis of operational environment. The last is thoroughly preparing the very force to be launched into action.

Among them there is a whole operational planning process, with all the necessary sequences so that resources can be employed effectively.

All are important, all require effort and all converge towards one point: achieving the goal with minimal effort. Concerning the analysis of the operational environment and force preparation, probably the most effective method is building models which, the closer to reality, the more useful platform is provided to the user, a better framework to enable him carrying both actions with remarkable results.

The analysis of operational environment and strategies of participating actors holds a number of specific issues determined by the nature of their characteristics. Two of these features are considered most important.

The first refers to the inability to quantify the specific features of social systems and related actors, as they concern matters of political, social, economic, cultural or other dimensions. The second refers to the high uncertainty regarding the strategy and plan of each actor and the action dimension in that it expresses.

The two features gives the analyzed system a high degree of non-linear character, situation that makes analytical methods based on the algorithms from exact sciences (e.g. mathematics, statistics, simulation, etc.) have an unacceptable degree of utility.

An important issue is the control over determining the results and identifying the conclusions. One may say that identifying the conclusions on the analysis of a system characterized by non-linearity mentioned above can be done by intuitive methods.

But a simple presentation of the quantity of information to be processed in order to cover all possibilities for future system configurations invalidate any attempt to base the analysis on intuitive. This creates the need to develop a method based on a mechanism able to operate effectively with uncertain and non-quantifiable data and to provide concrete and useable results in the next stages of the study. The solution is offered by morphological analysis method.

2. GENERAL MORPHOLOGICAL ANALYSIS METHOD

„Essentially, GMA (General Morphological Analysis) is a method for identifying and investigating the total set of possible relationships or “configurations” contained in a given problem complex.”³

The morphological analysis method was invented in the 40s by Swiss astrophysicist Fritz Zwicky for the US Army and developed in the 60s at California Institute of Technology (Caltech) as a method of structuring and investigation a full set of relationships that are established in the framework of complex, multidimensional and non-quantifiable issues.

² Volatility, Uncertainty, Complexity and Ambiguity. One should add *fluid* in order to include easily changing nature of operational environment.

³ Tom Ritchey, *Modelling Alternative Futures with General Morphological Analysis*, World Future Review, 2011, available on <http://www.swemorph.com/pdf/wfr-ritchey.pdf>, accessed on 28.03.2016

He used the method in various sub-fields such as classification in astrophysics, development of jet propulsion systems for rockets or aspects related to travel and colonization of outer space (it is said that this method was the basis for Polaris mission design).⁴ Afterwards, the method was developed and used in numerous prospective studies (Godet, 1994; Rhyne, 1995 or Coyle & McGlone, 1995). Once more, GMA was developed in the 90s by Tom Ritchey within the Swedish Defense Research Agency (FOI) to be implemented in studies on long-term defense planning and civil protection.

Morphological analysis method is a participatory and iterative process, involving a series of consultations carried out among a group of experts in the field or area that includes all the issues of the system under analysis. As inferred from the name (morphology⁵ – *morphos* – form, shape) the method is based on decomposing the system analyzed in sub-systems, as independent components, and analyzing all the relations between them on the basis of logical processes of determining the internal compatibility.

*“The method involves a number of iterative steps or phases corresponding to cycles of analysis and synthesis, the basic process for developing all scientific models”*⁶:

3. ANALYSIS PHASE

2.1. Formulating the problem to analyze and identifying the relevant elements. In this first stage one identifies and defines the main areas or operational variables (size, dimensions etc.) that shape the operational environment. *Operational variables* are general features of the operational environment, both military and civilian which may differ from one area to another and affect decisively military operations. They describe not only the military aspects of the operational environment, but also the impact of other factors on it. Typically, military planners analyze operational environment using six interrelated operational variables (PMESII): *political, military, economic, social, information, and infrastructure*. To these, two more can be added: *the physical environment and time*. Each of these operational variables (PMESII-MT) has a set of operational sub-variables.

Besides the fact that they stand for criteria in analyzing operational environment, the operational variables describe for commanders the context in which military operations are conducted. Understanding these variables helps commanders in assessing how the military instrument of national power complements other instruments. The comprehensive analysis of the variables typically occurs at the level of joint operations. In the analysis of the operational environment, commanders continually take into account the dynamics of these variables to have an articulate image of the operational situation.

Political variable describe the distribution of responsibility and political power at all levels of government. It quantifies the political system of main state and alliance type actors. In addition, the variable takes in account the factors that define the identity of a society (culture, history, demography and religion). Population assigns different degrees of legitimacy to political structures and processes at local and international level. The authorities and political powers, constituted formally (political party official or officials) or informally (tribes, ethnic groups or other power centers), or covert political powers strongly influence the situation in the operational environment. Political leaders can use ideas, beliefs, actions and even violence to enhance the power and control over the population, territory and their resources.

There are many sources of motivation in politics. These may include charismatic leadership style or actions of domestic security institutions and even those of religious, ethnic or economic communities. Political parties or groups in the opposition can also influence the situation.

⁴ Tom Ritchey, *General Morphological Analysis - A general method for non-quantified modelling*, available on <http://www.swemorph.com/pdf/gma.pdf>, accessed on 28.03.2016

⁵ The branch of biology that deals with the form of living organisms, and with relationships between their structures, Oxford Dictionaries, available on <http://www.oxforddictionaries.com/definition/english/morphology>, accessed on 29.03.2016

⁶ Tom Ritchey, *General Morphological Analysis – An overview*, Swedish Morphological Society, Stockholm, available on <http://www.swemorph.com/blurbs/gma-blurb-eng.pdf>, accessed on 28.03.2016

Each can cooperate with different actors present in the operational environment or with multinational forces. Understanding political circumstances helps commanders and staff to identify the mechanisms of power and key organizations and to determine their goals and capabilities.

Understanding the political implications requires the analysis of all relevant partnerships, political, economic, military, religious, cultural etc. This analysis holds the presence and importance of external organizations and other groups, including groups united by a common cause. Examples include private security organizations, transnational corporations and NGOs providing humanitarian assistance.

Political sphere also addresses the effect of will as intangible primary factor. This factor motivates the participants to sacrifice for achieving goals. Understanding what motivates key groups (political, military, insurgent etc.) helps commanders understand the objectives and their willingness to sacrifice in order to reach their objectives. Another benefit of understanding the mechanisms that strengthens individuals and groups existing in the operational environment is the possibility of generating credible scenarios to meet the hypothetical threats anticipated by commanders.

Last but not the least, the political variable includes the internal specific environment. Therefore, mission analysis and monitoring of the situation include the awareness of national policy and strategy. Undertaking missions by national military forces can only be done in agreement with the national political decision-maker.

Military variable is directly influenced by the actions of all elements of the security system of a state or non-state actor. In this respect, the army is the military force primarily responsible for maintaining internal and external security. In a given operational environment variable scans military capabilities of all military forces. In this context, the military forces on both sides can be influenced substantially by paramilitary and guerrilla forces. Also, military action in the area of operation may be affected by soldiers from other countries who are not directly involved in a conflict. Therefore, the analysis in military domain, coupled with the political, should include the relationship between forces present in the area and the actors listed above.

Essentially, military variable analysis focuses on identifying the capabilities of enemy, host - nation and multinational military organizations. The analyzed capabilities covers the following areas: equipment and weapons systems; personnel; doctrine, tactics, techniques and procedures; forces readiness; resource constraints; military leadership and its relationship with political decision-makers; organizational culture; military history and traditions; nature of civil-military relations.

Understanding these factors helps commanders in estimating the real possibilities of action for each armed forces structure. The analysis determines the possibilities of each organizational entity in the area to use its abilities not only domestically but also regionally and even globally.

Economic variable includes individual and group behaviors related to production, distribution and consumption of resources. The specific factors that contribute to defining economic variable take into account the influence of industry, trade, development level (including external support), the management of finance, the monetary policy, the economic institutional capabilities and legal constraints (or lack them) in economics.

An important aspect in this field addresses the fact that, in the international context, the economic development of the state actors sometimes differs substantially. These differences significantly influence policy options, including individual or indigenous groups' decisions to support or undermine the existing order. There are many factors that can stimulate or discourage individuals and groups to change the economic *status quo*, such as: technical knowledge and education; capital flow; investments; price fluctuations; debt; financial instruments; protection of property rights; the existence of the black market and underground economy.

Thus, it can be emphasized that economic variable defines the economic system in the area of operations as a whole, the degree of economic development and the distribution of living standards of population. The indicators for measuring the potential benefits and related costs of influencing political and economic order in the area could intensify how the commanders understand the dynamics of social and behavioral situation of allies, enemy, neutral and local entities.

Social variable describes matters such as structuring society, the judiciary and legislative system, the social and humanitarian policies, religion etc. The society is defined as the population made up of members who are subject to the same political authority, occupy a common territory, and share a common culture and sense of belonging to the same group. The society is not monolithic but includes various social structures involving relationships, often highly complex, established between institutions, organizations and groups of people in a cluster system.

Culture includes common beliefs, values, behaviors, customs and traditions that individuals and groups respect in order to integrate into society. Society usually has a culture which is dominant, but can also have many secondary others. Different societies may have similar cultures, but social attributes change over time. Changes can occur in any of the following areas: demographic; religious; population movements; urbanization; standard of living; education; ethnic, cultural and religious groups' cohesion.

The basic elements that must be analyzed are social networks, social status and social functions and norms supporting and encouraging the society members and their leaders. This analysis should also address societies from outside the operating environment whose actions, opinions or political influence may affect the mission.

People base their actions on perceptions, assumptions, customs and values. Knowing the culture of actors present in the operational environment helps in identifying points of friction, establishing relationships and reducing misunderstandings. It can improve commander's perspective on individual and group intentions and increase the efficiency of military action. Therefore, forces require a careful preparation on the cultural aspects of the participating actors and indigenous people before projecting in a new operational environment and also, a continuous updating during the mission. This allows commanders to understand how their actions affect people and prepares them to relate with local leaders.

Information variable quantifies the information field that is defined as the group of individuals, organizations and systems (information, communication and media) that collect, process, disseminate and/or use information. Information environment provides participating actors the access to information systems and the ability to use data and information to achieve their targets. Commanders use information activities to grasp and shape the operational environment.

Media significantly influences information that shapes the operational environment. Television and the Internet can broadcast real-time images of military actions throughout the world. Media coverage can significantly influence politic decisions by influencing the public opinion (domestic and international). Opponents often use the media to facilitate reaching goals by controlling and manipulating how audiences perceive the content of a situation and/or its context. They often try to create antagonistic partisan views towards a particular cause by providing its own twisted interpretation of events. Television news for propaganda purposes can reach many people. However, mostly in less developed countries, the information is disseminated by less sophisticated means such as messengers or graffiti. Commanders must understand the nature of information flow in their area of operations and apply the best available methods to communicate with the local population.

Infrastructure variable refers to facilities, services and installations needed for society to work. These facilities, services and installations include communication systems, water and electricity distribution facilities, transport infrastructure, irrigation and land reclamation, hospitals, schools, logistic resort facilities etc. Degraded infrastructure affects the entire operational environment. At the highest level, the infrastructure includes sophisticated technological capabilities that make possible the conduct of research and development activities, with further application of the results for civilian and military purposes.

It is important to note that not all segments of society perceive the same way changes to the infrastructure. Improvements seen by some as beneficial can be perceived as a threat by others. For example, the introduction of mobile phone networks and the Internet can help a local economy, but may offend the influential and conservatives local leaders who believe that it allows access to indecent material. Therefore, the actions affecting the infrastructure require a thorough analysis of the possible effects, manifested particularly in the social field.

The physical environment includes the geographical and artificial structures in the operational area.

The following factors affect the physical environment: urban settlements, climate and weather, topography, rivers, natural resources, the biosphere and biological hazards and other environmental characteristics. A potential enemy threat that uses an asymmetric configuration is aware that an open and less complex space may expose his weak points. Therefore, he will try to counter conventional military advantages of own forces by carrying out his actions in urban or complex environments and in hostile weather conditions.

Time is an important element in military operations. This operational variable analysis focuses on how the duration of an operation may help or hinder each side. This has crucial implications in operational planning, regardless the level. Enemy with limited military capabilities is seeking to avoid decisive confrontation and believes that a prolonged conflict creates him certain advantages. He will adopt a strategy of attrition and fights only when the conditions are overwhelmingly in his favor. Generally, this type of enemy focuses on survival, causing victims among civilians and allies. Although the balance of power cannot be changed, this creates opportunities to affect how the local and international public opinion perceives the conflict. As an alternative, the enemy may try to achieve mass effects and achieve decisive objectives in a short period of time.

2.2. Identifying/ defining the range of values. For each field or variable one must identify a sub-set of variables represented by states, relevant alternative conditions, strategies, actions, or a range of values.

From the analysis phase results what is called the morphological space, a mapping table of all possible variants of combining sub-variables or conditions identified above. Both fields / variables that are the elements of analyzed system and the assigned conditions / sub-variables are obtained through consultation sessions with experts selected to participate in the process. Morphological space is actually an n-dimensional matrix (corresponding to n fields / variables) called “Zwicky’s box.” For example, for a three-dimensional morphological space (shown to the right), this can be represented as below (left):

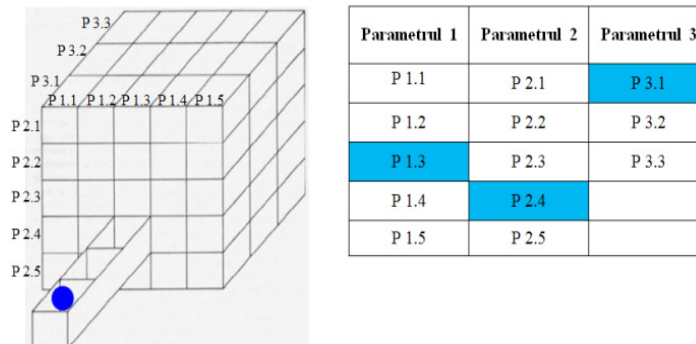


Fig. 1 Morphological Space (5×5×3) – Zwicky’s box

Note that the morphological space can generate a huge number of possible combinations equal to the product of the number of variations for each of the fields / variables considered. In the example above we get $5 \times 5 \times 3 = 75$ combinations. Each new field / variable included in the analysis adds a new term to the product that is equal to the number of conditions / sub-variables assigned to it. For instance, an 8-dimension morphological space each of them having three to five conditions / values (ex. 3,5,4,3,4,3,5,4) contains $3 \times 5 \times 4 \times 3 \times 4 \times 3 \times 5 \times 4 = 43,200$ possible combinations. The method has the advantage that lists all possible combinations (which would have been impossible to consider by intuitive methods) but the effort for processing them is significant. Therefore, it is necessary to reduce the number of combinations, activity that takes place in the next phase.

3. SYNTHESIS PHASE

3.1. Assessment of Consistency Cross (Cross Consistency Assessment - CCA) - by consulting the experts, one performs the crosscheck of each condition / sub-variable state with all other in the model to evaluate the mutual compatibility.

Alongside the establishment of morphological space, this stage involves considerable effort from experts that results in morphological space study in order to identify mutual incompatibilities between states of conditions / sub-variables. The process results in reduction the number of possible combinations by eliminating some “families” of variants that join the incompatible states of conditions / sub-set variables. The relations of mutual compatibility / incompatibility can be set at the level of fields / variables (external) or of conditions / sub-variables (internal).

The extern compatibilities are identified in terms of direct connectivity between fields / variables. We believe that two fields / variables are directly connected if one requires direct constraints on other so that one or more pairs of conditions / sub-variables determine relationships of incompatibility. In other words, if varying the state for conditions / sub-variables of the field / variable A in all the scale one identifies one or more states of conditions / sub-variables that are incompatible with one or more states of conditions / sub-variables of field / variable B, then the two fields / variables A and B are directly connected. On the other hand, if it is found that all the pairs of states of conditions / sub-variables determine a compatibility relationship and do not contain mutual constraints, then the two domains / variables A and B are not connected. It is necessary to highlight the possibility that two fields / variables A and B would be connected indirectly by the fact that each of them is connected to a field / variable C. For these situations do not occur, it is important, in determining connections, to take into consideration only those that are direct. The expert group determines the connections between fields / variables by examining the morphological analysis matrix that lists on the horizontal and vertical all the fields / variables with the assigned conditions / sub-variables. If the matrix is large, the connections identification can be made by subgroups of experts analyzing blocks.

Internal compatibilities between the states of conditions / variables in each field / variable are those that determine the final configuration of the resulting combinations. The compatibility / incompatibility relations are determined by the constraints between them that may be of four types: logical, empirical, normative and required.

Logical constraints are based only on the nature of formal relations between conditions / sub-variables. In other words, the two states set for the conditions / sub-variables of fields / variables A and B may be incompatible when, logically they cannot coexist. It is estimated that this type of incompatibility does not restrict very much the morphological space, so that the empirical, normative and required incompatibilities are those that will make the difference.

Empirical constraints are based on relationships deemed impossible or improbable, considering the knowledge or experience in the area of expertise that the field / variables belong to. Here, expert competence is valued in such extent that, moderated by designated personnel, *the experts* must discern the possibility or impossibility of existing the compatibility relationship between each pair of states of conditions / sub-variables.

Normative constraints are based on prescriptive rules or statements, in terms of what would be normal to be. Consequently, one can distinguish between practical regulations and ethical rules. Practical regulations refer to regulations of “good practice” in terms of strategic, operational or functional and are materialized in effective ways to achieve a goal. Although pointing empirical issues, too, they do not focus on the possibility or impossibility of coexistence of one pair of conditions / sub-variables but on experience and awareness that this link works and is effective. On the other hand, ethical regulations come from judgments based on ethical and ideological values and on “human” issues of the link between the two conditions / sub-variables. Sometimes, the two types of normative evaluation (practical and ethical) come into contradiction. Therefore one must have very clear in mind the real purposes of the operational environment and decide accordingly because this contradiction between practical and ethical, between efficiency and morality occurs especially in the case of “sensitive” problems, aiming social or political issues.

Normative constraints are no less important than logic or empirical ones.

However, it is important to make a clear distinction between these three types not to meet the situation where empirical aspects would cover the normative ethical ones. Typically, normative constraints are determined by institutional policies.

Required constraints relate to pre-defined criteria such as feasibility issues, preferences, operational requirements or prospective conclusions. The configuration of the operational environment built must be strictly modeled by these “*Product Specifications*” which most of the times have the upper hand on all other types of constraints. This priority stems from the fact that, beyond the logical and normative arguments, which are relatively clear as they are expressed through laws or principles, or the empirical ones, which are derived from experience, the required constraints are obtained from the analysis of the real operational environment and are considered “design parameters” that gives accuracy to the model created.

3.2. Synthesis of the mutually compatible configurations. A “mutually compatible configuration” is a set of conditions/sub-variables of each field/variable that can coexist (e.g. cells marked in blue in Fig. 1). The sum of all internal compatible configurations is considered the space of morphological model solutions.

3.3. Identification of the basic model and the alternative. This stage involves interactively using the space of morphological model solutions to investigate and group the configuration that meets all constraints and requirements specified. In this last step one selects the set of values that configures each of the fields / variables (PMESII-PT), taken as layers, so as to meet the desired operational environment. Overlapping these layers results a complete picture of the desired operational environment. Alternative models are obtained by varying the required constraints, in relation with the assumptions used in the sequence of the operational environment analysis. When finding situations that could lead to incompatibilities, part or the entire process can be resumed.

CONCLUSIONS

Such operational environment can be used to set an operational framework for training military structures to execute a mission or for generating scenarios within the prospective analysis. In any case, an artificial model for the operational environment provides the military planners with a “*laboratory instrument*” extremely useful in preparing a force to be able to effectively achieve the success in any present or future confrontation.

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RISKS AND THREATS ABOUT THE STABILITY OF THE STATES FROM EAST EUROPEAN SPRING INSECURITY

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***Abstract:** In comparison to the past years, the security challenges of these days need new, strong and adaptive responses. Threats emanating from Europe's eastern and southern flank range from military to economic to cyber to energy security and give particular urgency to the Alliance's next summit. The NATO Summit scheduled for Warsaw in July has to mark the beginning of a new adaptation process of the Alliance in a world that faces disorder for the foreseeable future.*

***Keywords:** NATO, security threats, east, south, border, summit, Warsaw.*

1. INTRODUCTION

The North Atlantic Treaty Organization also known as NATO has been formed in 1949 in order to deter the threat coming from post-war communist expansion as the former Soviet Union sought to extend its influence around Europe. Nowadays, NATO represents the global most powerful regional defense alliance ever exists. For more than sixty years, NATO has provided the umbrella behind which the democracies of Europe have grown in peace. Although the allies faced a lot of challenges and crises with the former Soviet Union during the Cold War, general commitment for deterrence and strong defense through NATO kept the peace.

Working together, the NATO members prevented another major conflict in Europe, and as a result, their societies could revive from the ash of World War II. Investments made for a strong defense and deterrence created at the same time the proper conditions for all NATO members to improve their economy. In fact, the safety and security provided by NATO was a multiplier reason that made it possible for the all countries to revive from war and reach new levels of prosperity than ever before.

2. RISKS AND THREATS

Unfortunately, today the European community faces a world that is more violent and unstable than at any other period since the end of the Cold War. The continue shifts within the geopolitical environment and political landscape are affecting the outlook for NATO.

The present most fearful threats for NATO's members are as follows: First of all, a more self-assertive Russia started to emerge as a new military power on the eastern border of the Alliance. In fact, Russia's continued aggressive actions threaten the European security order based on the premise to achieve a new rise among the world powers.

Second, deep rifts in North Africa, the Middle East, and Southwest Asia are the main challenges to the security of the southern part of NATO and therefore, the European countries deal with a variety of transnational threats that mostly come from instability in Iraq, Syria, Libya, and the rise of the Islamic State of Iraq and Levant (ISIL). Supplementary, the crumbling order in the Middle East has generated refugee flows not seen since World War II, and has given rise to potent non-state actors with the power to not only make unstable countries in the region, but also capable to perform terrorist attacks around Europe. Confronted with this versatile geopolitical context, NATO must recheck his strategy and take now a 360 degree attitude in order to protect his own security and thwart the entire range of security challenges from any direction, using all the components of his nations' military and politically power.

As a result, the revival of the collective-defense mission has gradually gained support among NATO allies, illustrated by the revised Strategic Concept in 2010 and the decisions made at the 2014 NATO Summit in Wales.

In the light of new challenges appeared, new approaches has been taken into account: needs for increased budgets, improved cooperation with a selection of close allies, and a revitalization of the total defense concept.

Old foe or new ally and the future - Speaking about the security situation on NATO eastern flank, some analysts even worry that NATO is heading toward a new Cold War with Russia.

Since the beginning of 2014, President Putin has sought to undermine the system of European security and attempted to maximize his presence on the world stage. Putin's strategy mounted conditions that will weaken the transatlantic relationship, and damage the political cohesion of Europe. Supplementary, Russia's unconventional tactics could also degrade to conventional warfare if Moscow's frequent flexing of its military muscle slips out of control and leads to an accident or confrontation.

During the past years, Russia continues its military modernization efforts, and its actions in Ukraine and, especially the last one in Syria, show an increasing deployable force projection, combat capability and adequate logistical sustainment capacity. Nowadays, Eastern and Central European states, and especially Poland and the Baltic countries are most concerned about Russia's aggressive intentions in Europe and consider Russia's actions in Ukraine as a confirmation of their concerns. Russia's aggressive foreign policy toward Ukraine exacerbated by Moscow's illegal annexation of Crimea and the open support for both "little green man" and separatist forces in eastern Ukraine amplifies agitation and worries among NATO's eastern flank members.

Even more worrying, Russia has kept a nuclear arsenal that is far bigger than the capabilities of NATO's European members. According to the March 2015 New START figures, Russia manages an impressive nuclear power of 1,582 strategic warheads deployed on 515 intercontinental ballistic missiles/ ICBM, submarine-launched ballistic missiles/SLBM and strategic bombers.

Separately, the Federation of American Scientists check that Russia has several thousand no deployed strategic warheads and about 2,000 tactical nuclear warheads. More than that, another 3,200 warheads are awaiting dismantlement. Russia has also developed both the warheads and delivery systems that are more "usable" on the modern battlefield, so that the threat of using them is much more credible.

Lastly, Russian's use of unresolved conflicts as a foreign policy tool represents another face of the same coin. Labeling the prolonged conflicts in states around the Russian periphery as "frozen" denies the fact that all these are ongoing and controversial processes often controlled by Russia to provide pretext for military intervention.

Related to this, Russia's political use of "compatriots" in other countries, whom Moscow formally defines as almost anyone with any connection way to the former Soviet Union, stand as its new favorite strategy in order to legitimize any interference in its interested areas.

In addition to Ukraine, this deep-laid scheme could be especially important for Kazakhstan, Uzbekistan, the Baltic States, and Republic of Moldova, which mostly have large ethnic Russian communities within. Regarding to this, Russia is waging a constant, unceasing information war against almost every European country. This war takes many forms, but information war involve the weaponization of information in such form as misinformation, propaganda, use of agents of influence, and reflective actions inducing adversaries to react in given circumstances they believe benefit them but in fact, work to the enemy's advantage.

NATO admits that Russia's current behavior is unacceptable, and that Moscow bears real responsibility for the current situation in Ukraine. However, remilitarizing the relationship with Russia would be dangerous, and it would be far from the ideal solution for NATO and the European countries security order.

Refugees, migrants and disguised terrorists -The instability on NATO's southern flank is mostly connected with its efforts to manage the current refugee and migrant crisis. Combined with the expansion of Islamic State (IS), the Syrian civil war has created a massive flow of refugees into Europe exceeding the European capacity to assimilate this migration. According to the United Nations High Commissioner for Refugees, the first three nationalities of the over one million Mediterranean Sea arrivals in 2015 were Syrian (49%), Afghan (21%) and Iraqi (8%).

Supplementary, the IS terrorists' disperse to Europe has made the attacks against some NATO states a reality that did not exist during the cold war.

In terms of security, the challenge that the NATO faces is the pernicious threat of jihad Islam generated by a bad combination of the invasion of Iraq in 2003 and the future sectarian developments, the Arab Spring, the Syrian civil war, the collapse of Libya in 2011, and the new civil war in Yemen in 2015. Above all, the rise of Islamic State and it expanded presence has plunged the Middle East into chaos and bloodshed.

Consequently, the developments have caused a severe humanitarian situation and the result is the largest refugee crisis since 1945.

The European migrant crisis or European refugee crisis began in 2015, when a rising number of refugees and migrants tried to seek asylum in the European Union, traveling across the Mediterranean Sea or through Southeast Europe.

Therefore, in the past months NATO decided to deploy ships to the Aegean Sea being in charge with monitoring and information collecting missions.

In fact, the purpose of NATO's deployment is not to stop or push back migrant boats, but to help NATO's members Greece and Turkey, as well as the European Union, in their efforts to manage human trafficking and the criminal networks that are fueling this crisis.

In fact, the people escaping hardship and war are not a threat to European security. Unfortunately, the refugee crisis serves as a catalyst for the political polarization that can definitely damage European cohesion and the ability to act together.

The range of threats for NATO was magnifying by Russian intervention in support of the Syrian regime. Nevertheless, the fearful feature was generated by the Russian' ability to project his military power so farther and quick.

Currently, the majority of NATO operations are focused on the southern flank. These include the anti-terrorist Article 5 naval mission Active Endeavour in the Mediterranean Sea (starting with year 2001) and the counter-piracy naval operation Ocean Shield in the Gulf of Aden and off the Horn of Africa.

NATO also have tried to enhance its ability to support missions in the region with intelligence, surveillance and reconnaissance (ISR) capabilities based on unmanned aerial vehicles (the Allied Ground Surveillance system) stationed in Sigonella, Italy.

Additionally, NATO has expressed its intention to enhance regional stability through continuing cooperation mechanisms with a lot of partner countries around the region.

3. FROM WALES TO WARSAW

In light of the new security environment, at the Wales heads of state NATO summit in September 2014, the alliance agreed to eagerly desirous of achieving a Readiness Action Plan (RAP) in response to Russia's Ukrainian intervention. The RAP would increase the number, size and complexity of NATO's members' exercises and make sure that forces can be deployed quickly in order to deal with any challenge. Moreover, decisions made in September 2014 have established a new quick – response force that could support jeopardized members, particularly for those which are at the periphery of NATO's territory faster than the existing NATO Response Force (NRF).

Consequently, the Very High Readiness Joint Task Force (VJTF) appears as a multinational combat unit consists of ground forces, with naval, air and Special Forces units in support, staffed by member countries on a rotating basis and ready to deploy on a two days' notice.

Moreover, in order to support the rapid deployment of the VJTF, in Bulgaria, Estonia, Latvia, Lithuania, Poland and Romania were set up little command and control facilities, so-called NATO Force Integration Units (NFIU) occupied on a rotating basis. The NFIU work closely with authorities of the host country together to explore logistical networks, issues of transport and support infrastructure. At the same time, the US created and funded a European Security Initiative to provide resources for a strengthened military posture in Europe.

Supplementary, new NATO's deterrent posture was strengthened by US Secretary of Defense Ashton Carter on February 2016 when he announced that the Pentagon will push \$US3.4 billion into forces and training stationed in Europe. According to Carter's declaration, the US forces will be separate from those announced by NATO, and will offer an important reinforcement to allied forces distributed throughout Europe. Nowadays, there are two U.S. Army infantry brigades stationed in Europe, one in Germany and the other one in Italy. The new \$3.4 billion plan outlined by US Administration would aggregate another brigade to the mix, but it would be made up of soldiers from the United States, on rotating basis. NATO Secretary General Jens Stoltenberg quoted that the US decision to place military assets in Central and Eastern Europe strengthens deterrence in the region and subsequently US has played a big role in the alliance's reinvigorating process. Two years after the Wales NATO Summit, progresses in fulfilling the Readiness Action Plan (RAP) are notable and constitute an encouraging sign toward bolstering the Alliance's credibility. In the same direction, the NATO's February 2016 defense ministerial and the planned increase of the U.S. commitment to embattled Allies are both, signals for a strong change in the Alliance's posture toward Russia and the threats of an unstable southern neighborhood. Now, looking forward for 2016 – Summit in Warsaw, every

NATO member are fully aware that this Summit will be crucial for the future way on which the Alliance must decide how to manage the new security challenges. In this regard, managing the east-south security situation will indeed be critical to keep Alliance unity. Therefore, the biggest challenge for Alliance will be how to find the adequate strategy to keep together divergent interests of its members.

Nowadays, Spain, Italy, and Greece are more interested in Mediterranean security. Portugal looks south, but tends to view the Atlantic space as the center of gravity for Alliance cohesion.

Poland, the Baltic States, Bulgaria, and Romania without a doubt and at the same time understandably put the Russian challenge first. On the other side, France has a huge wager in security in the Mediterranean and south to the Sahel and sub-Saharan Africa, but stay ambivalent about a leading role for NATO there.

Turkey is a leading stakeholder for a credible NATO approach to security on its Middle Eastern borders, but Ankara is equally concerned about countering Russia in the Black Sea, the Mediterranean and in Syria, a concern greatly reinforced by Russian air and naval operations along Turkey's borders in Syria.

Last but not the least, NATO's major powers – the United States, U.K., Germany, and France – will be decisive in managing this balance. Nevertheless, the growth of the Russian factor in the east is an other source of risk but may also prove a unifying element across NATO's geography.

CONCLUSIONS

While NATO faces many challenges, all members must to admit that the Alliance is the only major defense organization with adequate force, credibility and capabilities to deal with Europe's security crises and/or other issues. NATO's leaders in Warsaw will discuss many new challenges faced by the Alliance but the most important issue will be how to strengthen European defense to overcome these multiple threats to NATO. In fact, finding the proper way to strengthen European defense will provide the capabilities to deter the threats from the East and form the South, as well.

NATO nations promised to spend two percent of the GDP on defense but only a little number of members has reached the goal. In real, only five of 28 NATO countries met their 2015 targets of two percent of GDP on defense spending. Therefore, more discussion on this issue could be useful in Warsaw.

Speaking of Russian aggressive stance, many analysts agree that, despite intimidation tactics, Putin will not gamble on provoking a war. The worst scenario would be Putin's use of "hybrid" tactics against the Baltic or the Black Sea states. In this potential case, propaganda, information operation, cyber and "little green men" to infiltrate a target state would be the means. However, if the unpredictable Russian leaderships will stay in charge, NATO must cultivate a corporate defense built on confidence and interrelationship.

If the Alliance is to remain relevant, the growing risks and threats coming from Europe's eastern and southern border will need to be addressed. In Warsaw, NATO must now shift its strategy toward an increased forward presence that would be in place before a conflict starts, and thus serve as a deterring and stabilizing force.

Last but not the least, the increased geopolitical importance of the Asia-Pacific region is prompting the United States to re-direct a larger amount of his military resources to that area of the world, and therefore, Europe will need to make a greater contribution to his internal security.

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TRENDS IN THE FUTURE OPERATIONAL ENVIRONMENT

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Abstract: *When analyzing the future operational environment, we must take into consideration that strengths or weaknesses in one domain may create future opportunities or threats in that area and/or in another which are connected to it. Therefore, a comprehensive awareness of the present operational environment and how it evolves in the future is crucial. The success of military operations carried in the future operational environment requires an exhaustive understanding of its present and, especially, of its probable characteristics. Early identification of trends regarding the factors that define the operational environment will help decision makers to better plan the future military actions. Planning is the art and science of understanding the situation, forecasting the desired end state and establishing effective ways of achieving the expected outcome. The fact that operational environment is the framework of carrying military action makes it a fundamental element to consider in operational planning process.*

Keywords: *future, operational environment, globalization, trends, technology, resources, urbanization, climate.*

1. INTRODUCTION

Romanian land forces, especially air defense structures, will act in a more and more complex operational environment, in which challenges will arise increasingly varied or even unexpected.

On that basis I consider it is necessary to formulate views regarding the operational environment development and forecast trends in air threats that may arise, and will have to be countered by air defense structures.

I believe that these views will enable military planners a better understanding of the context in which forces will act and establish lines of action for future changes in missile and anti-aircraft artillery.

Given the evolving nature of the international security environment, most changes are based on a rather large dose of uncertainty coming from nature, extent or duration, so we can predict its surprising, seismic and discontinuous character.

According to some military analysts' operational environment is "a sum of conditions, circumstances and influences affecting the use of own forces requiring commanders' decision." [1]

2. THE OPERATIONAL ENVIRONMENT

The constituent elements of the operational environment can be grouped according to the following categories [2]: physical environment, threats and uncertainties, the local population, the presence and involvement of other agencies, forces and organizations.

Contemporary operational environment has some constants that define its nature, such as globalization, cross-border crime, ethnic tensions and religious, separatism or national borders contesting and the migration phenomenon, armed forces modernization, international markets diversity, the advanced technologies for different actors (state or non-state) worldwide.

It also has several variables that can be critical like „*international relations and regional nature and stability of the state, the economy, demography and social situation, the intelligence, the physical environment, the technological level, the international organizations, the nation's will, time and military capabilities*” [3].

These variables are interrelated and sometimes overlapping. They may have greater or lesser influence on the operational environment depending on the situation at a certain time.

British doctrine protrudes, quite pragmatically the operational environment of the future: „*Future conflict will not be an exact science: it will remain a unique human activity and impossible to predict accurately. Opponents (state or non-state) and threats (conventional and unconventional) will be in mixed configuration. The palette of threats will be expanded, including the proliferation of weapons of mass destruction, cyber attacks and other new irregular threats*” [4].

Regarding the actors of the future operational environment, as we have shown above, the analysis will be according to their type as state and non- state actors.

Regarding state actors, they are expected to increase control over resources and spheres of influence, a situation in which, combined with the failure of some states it will generate instability and conflict. These animosities between countries can lead to minor conflicts in the first phase, which may degenerate into major conflicts or even wars. Ethnic tensions, religious or separatist may add more volatility to these conflict situations. The rivalry between states, expansionism trends can lead to so-called „wars” that could be carried through intermediaries, a form of unmanageable conflict. Also proliferation of nuclear weapons and technology development remind us the catastrophic type threat as a characteristic of these actors.

Developing air platforms (which can evolve at low altitudes, at speeds ever higher, with a smaller radar footprint) and ballistic missiles constitutes a challenge for anti-aircraft and rocket artillery structures. Non-State actors, as defined by the absence of government involvement and identified as multinational corporations, NGOs, local authorities will be more influential than they are today and will have a greater impact on the world economy.

Cooperation between state actors and non-state actors will be crucial in the evolution of the future security environment. The trends are towards greater commitment and greater importance of local authorities. Extremist non-state actors, in most cases driven by ideology with criminal inclinations, will try to impose their will. They also will be able to exploit information technologies with the potential to significantly influence the economy and will be able to use a certain range of military capabilities on a limited scale, using innovative tactics, which will allow the exploitation of state actors' vulnerabilities [5].

These extremist non-state actors are likely to develop an increasing level of lethality in order to defeat the state actors protection systems and also could have access to weapons of mass destruction. They will try to obtain *spectacular and violent* effects and also link to criminal organizations. As for the future, the threat level will increase and the difference between state actors and non-state actors will decrease noticeably.

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As for the future, the threat level will increase and the difference between state actors and non-state actors will decrease noticeably. The development of radar jamming devices and air reconnaissance stations of various types (active, passive) for air defense structures will have a negative influence on the overall radar image.

The operational environment will continue to evolve, presenting varied challenges to military forces such as threats generated by opponents performing actions whose character range from conventional to unconventional, with capabilities that require cutting-edge weaponry and technology.

These significant challenges arise from: *population growth, migration, decreasing resources, climate change, continued globalization, rapid urbanization and technological advances.*

A combination of these factors can lead to major challenges and an unstable security environment.

Population growth is likely to and will generate overcrowding, especially in urban areas and this will lead to instability. The population is expected to reach 8 billion by 2024, 9 billion by 2040 and 10 billion by 2062[6]. The growth rate will be higher in less developed countries and slower or even zero in the most developed ones. Simultaneously with the population growth we see a decrease in resources which can generate: tensions between state actors, increased migration, extremism and the forging of new alliances. Another component of the demographic dynamics is migration. Migration flow itself influences world's the demographic, social and economic security.

Decreasing resources will lead to increased costs associated with them and together with population growth can lead to high inequalities between nations or within them. As a result, deprived areas it will appear and instability and corruption will be installed very easily. The need for transportation of essential resources using long routes and sometimes bypassing some countries may increase instability and tensions between states. The need to protect these routes, as well as access to resources, may act as a catalyst for conflict between state actors.

Climate change happens nowadays: changing seasons and rainfall, temperature rise, glaciers melting and the average global sea level rise. It is expected that these changes will continue, and extreme weather events that lead to risks like floods and droughts become more frequent and increase their intensity. The impact over nature, economy and our health varies by region and territory and may result in loss of life and material, famine and diseases. Side effects of climate change will be: increased migration, social unrest, instability and conflict.

Less developed countries will feel the impact more acutely because they are unlikely to have the resources necessary like the more developed countries to successfully mitigate it. "*Globalization is a process of interaction and integration of individuals, companies and governments of different nations, a process driven by treaties, investments and access to information technology. This process has effects on the environment, culture, political and economic system, development and prosperity, development and social mental state around the world*" [7].

As a strict term, globalization means a multitude of economic and social changes made by mankind nowadays and monetary financial flows integrated into large scales with an impact on the characteristics of social interactions.

Globalization refers to that transmutation occurred in the structure and organization of human societies that led to extensive dissociation and polarization of nation-states or, at least, what has left nowadays at the beginning of the third millennium. However, the term should not be "read" as likely to foresee the imminent birth of another kind of harmonious society and also should not be understood as a universal process of integration into the new structure of world characterized by increasing convergence of cultures and civilizations, which are today mostly national" [8].

Globalization will have increasingly larger consequences worldwide: affecting national sovereignty, cultural and spiritual identity, domination of multinational companies, free movement of capital, information, persons and goods, affirming the culture of the contract, the birth of a global civil society – and that will require action from the international community.

Urbanization has now become a general phenomenon, specific and irreversible, with a trend towards increased complexity, scale and dynamism. It is expected that the majority of the population will want to live in cities, but because of this, there is possibility that many suburban areas will become ghettos and hence showing major security problems.

Technology has advanced so much that is everywhere in our lives and there is almost no place on the globe where technology has not penetrated yet as part of an important trend of the last two centuries.

The technology provides multiple benefits for humanity, but every advantage can become a disadvantage at the same time because the technology is a double-edged sword.

Technological advance can increase economic imbalance between state actors, generate regional instability and provide opportunities for early control of future threats.

Technological developments will provide opportunities for the armed forces to obtain a military advantage in a future armed conflicts and pressure on defense budgets in order to counter the capabilities of the enemies.

Open markets will facilitate access to all state and non-state actors in modern equipment technology and combined with lower production costs will allow technologies to proliferate, allowing for a diverse range of actors having access to them, including non-state actors' extremists.

Technology development is expected to grow towards new directions and at much higher speeds, which will make the procurement of technical defense to be difficult to sustain according to the new requirements. In my opinion the purchase of superior technique will not be enough and the actors who will be able to integrate new technologies, to modernize and to upgrade existing.

CONCLUSIONS

It is essential to understand these general trends, because they help decision-making elements to apply coordinated national actions in response to these changes. Global trends could lead to tensions, instability and even conflict. Whatever the purpose, the opponents in the future operational environment will be extremely adaptable and “fluid” being able to use a wide range of technological facilities, equipment and procedures, combined with conventional weapons and improvised means.

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THE TYPOLOGY OF UNCONVENTIONAL THREATS IN CROSS-BORDER ZONES

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Abstract: *The phenomenon of illicit cross-border traffic with strategic components represents an outstanding vector of over-borders organized crime, with global implements, of the most diverse: nuclear weapons traffic, radioactive, and bacteriological; arms traffic, ammunitions and warfare equipment; gold traffic, silver and other valuables; intelligence, technology, research, projects etc. In this paper we will discuss only few of the elements that this global and extremely dangerous phenomenon implies for the contemporaneous times.*

Keywords: *contemporaneous security environment, organized crime, illicit cross-border traffic, global illicit phenomenon.*

1. INTRODUCTION

The dynamics of change regarding political, economic and military at international level at the beginning of the third millennium is fast and unpredictable. Each event can have a decisive influence over the way those strategic entities that share economic resources and markets carryout the debate on the construction of a new international order and geopolitical changes. Therefore, any attempt to shape the new international order, built after 11 September 2001, seems increasingly difficult. However, such attempts already exist and are emerging along two main axes. The first is part of the American doctrine, nominated by the US President at the end of January 2001, when the message to the nation stated that the states Iraq, Iran and North Korea were axis of evil. The second, called suggestively axis of reconciliation, includes European members of NATO and countries like China, India, and Brazil. Axis conciliation is, in fact, not so much opposition to the US, as the expression of wish that the component states to be associated with the effort to build this new world order in the new international security.

Among the risk factors specific to illicit trafficking thriving in this article will be detailed strategic international terrorism, the spread of organized crime, migration and xenophobic manifestations, the proliferation of means of mass destruction, manufacture and sale of weapons etc.

2. INTERNATIONAL TERRORISM

After September 11, 2001 we entered into a new period of transition marked by terrorism and counterterrorism globalized. Global terrorism must be eliminated by military and economic means. Romania's participation in combating global terrorism through economic and military means is fully justified and the civil society must support the Romanian government in this endeavor. The game-plan of terrorist threats and elements of specificity corresponding period of their manifestations highlight that in a world dominated by conflicting interests, rights and fundamental freedoms are diverted from their meanings natural and used as motivation for exacerbating nationalism and ethnic separatism and religious, which determines on a daily basis terrorist acts that result in hundreds of thousands of casualties.

Terrorism as a phenomenon and terrorist groups, united as a network or acting as independent entities, is one of the most serious threats of the beginning of this century considering the fact that so many nations of the planet have a fragile international security.[1] Any strategy to combat terrorism must reflect, however, not only the understanding of the reasons and objectives of terrorism, but also an understanding of the advantages that some features of the modern world gives those who engage in terrorist activities.

First of all, the globalization more and more increasingly pronounced of the economic and political life causes irritation in population groups whose values and lifestyles are affected, giving them more and more opportunities to act against democratic nations, institutions of security system global as well as the goals representative of civilized countries (recent actions on targets in France and Belgium).

Secondly, the growing capacity of terrorist groups towards acquiring weapons of destructive power, consequence of technological development and the weakness of public institutions in some countries, give terrorists the opportunity to commit acts that neither would have designed in the past.

Last but not least, the existence of a global expanded media network enables live snapshots of an event anywhere in the world thus giving them terrorists a certainty that their actions, no matter how horrible it may be, will not have a limited impact, but will gain worldwide audience. On the other hand, terrorism itself offers itself as a solution to societies that want, without undergoing a transformation.[2] They may take action to marginalize terrorism and the transformation of public attitudes towards it, so that acts of terrorism will become less probable.

At this moment, Romania's fundamental interests require capitalization unification and valorizing of solitary experience, in order to pass towards a superior organizational stage, that of setup and making operational of the inner mechanism in order to prevent and combat terrorism in a manner that meets specific challenges current security context through national efforts and international cooperation.

3. THE EXPANSION OF ORGANIZED CRIME

Organized crime is one of the most serious transnational threats. Money from drug trafficking and other illegal activities make it easier for organized crime, introducing new techniques and new ways of improving the means of operation from computer fraud to trafficking in arms and human organs. Organized crime is a particularly important element in the logistics of terrorism. Tax evasion, money laundering, illicit trafficking in weapons, drugs, tax system protection, the control of prostitution or gambling networks, extortion, ransom charging, smuggling, fake currency etc. are the usual means by which terrorist organizations clandestinely procure necessary funds.

Thus terrorism is an amplification factor of economic and financial crime, and their symbiosis emerges from a new type of global threat.[3]

Destabilizing criminal process as subversion, drug trafficking, arms trafficking, the works of various mafias are not carried out in isolation, but are intertwined. Today, terrorist groups generally are subsidized directly by drug trafficking (by participating in this activity) or indirectly (offering protection to those dealing with drug trafficking), with links to various mafias, arms trafficking, counterfeiting documents and many other illegal activities.

Organized crime areas known as so-called "gray" areas of the underground economy and are tolerated result in an alternative, at least at certain times, to the legal economy inability to meet market demands or sometimes a dysfunctional economic system. Bad functioning legal economic system is, among other things, the effect induced expansion of organized crime and its control by the leaders of the major levers that influence their decisions and diverts to achieve their goals.

The networks have economic and financial strength that allow them to act as factors, particularly strong, for putting pressure on governments, authorities and institutions, constituting a permanent threat to the legal order. By corruption, in particular, but also by brutal means, uncrowned kings of organized crime can come to dictate governments, political parties or to buy options to manipulate the electorate, inducing lethal danger for democracy.

At international level there is a true power of organized crime whose screening and whose subsequent control are increasingly difficult.

The situation is worsened even more as it appears that the protagonists of illegal activists or anti-system protagonists are prevailing over the legal system. In this case, structured real "cores" of pressure are affecting the national stability, regional and international security.

Transnational criminal activity and related activities, are considered a threat to the political, economic, social and legal, causing: undermining of the society by corrupting political structures and consider violence as a normal fact; distorting market mechanisms to the detriment of economic and trade systems; encouraging individuals to act outside the legal economy and evade taxes; environmental degradation systems, evading restraints and regulations; destabilizing economic progress in transition and developing countries; interfering with foreign policy objectives and with the international system; harming the society by social and economic costs that come from illegal drug trafficking.[6]

4. MIGRATION AND XENOPHOBIA PHENOMENA

In terms of ceasing conflicts with a direct or indirect contact regarding Cold War, it believed that migration movements will be diminished. This phenomena didn't take place due to the fact that on one hand several political, ethnical and religious conflicts appeared and led to people migration and on the other hand the economic and social state specific to the countries of origin got worse.[8] These processes have led to migration as they were looking for better living conditions. Millions of human beings are marched away from their countries due to wars, violence, massacres, hunger, poverty or environmental disasters. Ordinary people become refugees, migrants or forced displaced persons.

In the same time, as an unwanted effect, it was exacerbated xenophobic feeling of the population from countries where the migration increased, with all the negative consequences that this sociological phenomenon implies. Moreover, migration phenomena as yellow danger which could easily modify the equilibrium and demographic composition of regions and led to loss of identity are increasingly common. Furthermore, more than 11 million of Muslims live now in the European Union states. Their presence is nothing else but the effect of migration flows from colonial empires of Asia, Africa and Caribbean.

The migration flows represent a risk for the country they are migrating toward because of consequences as they follow: the impact they could have in social and economic area as the labor force appears and impossible to be entirely absorbed; the implementing of authentic "endocultures" not assimilated by the society; new individuals confronted with the lack of jobs and involved in organized crime activities; increase of health and education expenses in the country they are migrated toward; the migration advantages for terrorist groups.

The conclusion for the consequences mentioned above is xenophobia, the resuscitation of the nationalist extreme right, prohibited legislation regarding free movement of people, and sometimes massive campaigns against immigrants. A rebirth of a strong xenophobia and racism could be explain- as Alexander King and Bertrand Schneider have mentioned in a Council Report of Rome Club-by taking into consideration a millions of people migration. Using Asia, Africa, America and Europe as examples, they are considered as „a threat for country equilibrium and a real danger for its cultural identity, just when this identity is a question mark for its own followers. The insecurity feeling of the individuals against severe affirmation of planetary dimension and regional or inter-regional organizations are to contribute to these xenophobia phenomena”.

5. PROLIFERATION AND ILLICIT TRANSFER OF NUCLEAR COMPONENTS

Proliferation and illicit transfer of nuclear components, and WMD (Weapons of Mass Destruction) are considered to be a real threat and danger for the international security. The Gulf War (1991) provided an opportunity for contradictory and revealing debates in terms of Occident fears. The battle against the proliferation of nuclear weapons continues by acts of war in order to destroy the nuclear installations of the rival state or by legal and diplomatic measures, internationally stated, but hard to follow in terms of application due to their limitations and contradictions.

The first difficulty is focused on the stopping politics of nuclear proliferation in terms of their discriminated principles. So, we can talk about the contradiction between sovereign states equality (with their right to defend themselves) and the idea of a particular type of weapon for a single category of states designed by the states that have to proliferate that type. This discriminated aspect, political, strategic and psychologically sensitive, has the adverse effect and not the right one, making the nuclear weapon a symbol of national independence and dignity. Never the less, what it seemed to be right and cautious for the most powerful and rich states is received as an unbearable humility for disadvantaged states, Arabic states is such a good example for dramatic rebellion.

The second difficulty is the fact that the nuclear weapons are the product of a dual technology, civilian and military, both in the same time. Nuclear power plant producing electricity uses weakly enriched uranium, and using combustion produces radioactive wastes and plutonium. Reprocessing of these led to manufacture of bombs. Dual character of atomic energy complicates the stopping of nuclear weapons proliferation. We face again the discriminatory issue. It is hard to forbid states to give up on atomic beneficial applications (medical research, electricity, etc.) as well as to outline and control the difference between beneficial utility of a nuclear military power plant or a technological flow.

As nothing stop reunited Germany - the most powerful economic state of Europe - to think seriously of a nuclear option in order to gain the same power as military state. Moreover, new generations of fuses, bombs, small sizes nuclear ammunition, easy to transport and launch, and relatively small effects encourage their use. These new types could be used in order to partially destroy enemy positions or its neutralization, and no harm for the radiations to be propagated. This is one of the most dangerous evolutions of the nuclear weapons because of the fact that they could be the reason for triggering wars or limited nuclear attacks.

Another security issue is considered to be analyzed, the beneficial nuclear technology, due to its physical and moral use. We have to take into consideration risks in terms of hijacking the results of scientific research, as an actor with an efficient ICP (Intelligence Collection Plan) could elaborate, achieve or use a surprise technology in his favor. In the future, terrorist and fundamentalist groups and organizations getting nuclear weapons of different sizes is a very dangerous issue. Unfortunately, the most important powerful states in the world (USA, UE, Russia, China, Japan, etc.) didn't seem to agree in terms of strategies and international means of control and coordinated prevention of deviations from the Nonproliferation Treaty of Nuclear Weapons or other weapons of mass destruction.

6. WEAPONS PRODUCTION AND MARKETING

The ability to produce weapons associated with the interest to sell is, consistently, a landmark for identifying major issues of the security agenda of the future. According to the geopolitical context presented it may say that the current security environment has the following features: dissolution of bipolarity and entering a new phase: the US is considered the only political, economic, financial and military superpower, credible and viable; the increasing of EU visibility as a factor of stability and progress, economic and military development of China and Russia's involvement in solving or complicating some major problems faced by some countries (Ukraine, Moldova, Syria, etc.); appearance and consecration of international non-state actors that relate to national values; the implementation of new solutions in the functioning of political, economic and security organizations; the transition from collective defense to the collective security; the initiation and the affirmation of crisis management trends on regional considerations.

CONCLUSIONS

The proliferation of risk factors specific to the intensification of illicit trafficking with strategic materials is the expression of multiple causes, such as: the diversification and the complexity of technology transfer with uses in strategic nuclear environment; the existence of legal programs for the manufacture of dangerous vaccines and production of bacteriological agents; the multiplication capabilities of some states from „ axis of evil “ area concerned by the proliferation of weapons of mass destruction: intensifying recruitment of experienced specialists who may give at modest prices, the advantage of technological surprise; reducing access to high technologies for criminal or terrorist structures who can obtain information and technologies in advanced forms in order to grasp the competitive market, using internal corruption.

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USE OF THE POLISH AIR FORCE OUTSIDE THE COUNTRY- ORGANIZATIONAL ASPECT

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Abstract: *Air Force plays an important role in the security system of each country and alliances. The importance of the Air Force determines the high potential of modern air force and air defense, multiplied by rapid development of technology, particularly the increase of combat capabilities through the use of precision-guided weapons. These features make the Air Force the most predisposed mean of struggle to resolve the contemporary crisis in the international environment. Therefore, this article identifies mission scenarios that can be fulfilled by Polish Air Force (PLAF), declared force level and proposed structure of the air component task forces foreseen to be used outside the country.*

Keywords: *Air Force, Crisis Response Operations, operational capability, module*

1. INTRODUCTION

End of the Cold War contributed to the disappearance of the risks specific to the past bipolar polarization of powers in the world. The armed conflict in the Balkans in the 90s of the last century reminded everyone that from the seemingly safe situation in Europe till the outbreak of the conflict, particularly the regional one, is not that far away. Despite the fact that destructive factors resulting with the threat of stability in the relationship of international powers ceased to exist there are still possible scenarios in which the security of states may be at risk due to the whole spectrum of other factors, mainly related to globalization, which on the one hand stimulates the development of countries and entire regions of the world, but on the other hand involves the risk associated with the spread of severe diseases or of over-exploitation of natural resources, including raw resources for energy production.

Current risks are mainly related to terrorism, proliferation of mass destruction weapons, regional conflicts, decays states and organized crime. Following new threats the concepts of defense of individual states and alliances have changed as well.

The necessity to act before a crisis occurs or in its earliest stage has been distinguished. Therefore, there is a need for defensive tasks beyond country's borders. However, this requires the use of highly manoeuvring forces with large combat abilities, which are the Air Force. Air Force in the near future will belong to one of the most effective tools in dealing with crises, regardless of nature of the conflict (war, other than war or struggle with the effects of natural disasters).

Hence the need for the development of modern air force capable to conduct operations in every region of the globe. Its structure will be created on the basis of specialized, highly mobile units, with considerable combat potential.

The above-mentioned factors led me to define *the aim of this article as to: create new task structures of the air component to be able to fulfil its missions outside of the country.*

2. OVERSEAS AIR FORCE USAGE SCENARIOS

To identify tasks that Polish Air Force can perform outside the country, their range of applications in operations under the flag of NATO and the EU must be determined first. Taking into account the time criteria, the Alliance may be involved into peacetime operations, crisis operations and war.

However, considering the criterion of NATO activities operations can be carried out on the territory of the Alliance and beyond, and can represent collective defense conducted in accordance with Article 5 The North Atlantic Treaty (the direct threat to the security) or crisis response operations.

According to Art.5 of the Washington Treaty, an armed attack against any of the Allies in Europe or North America shall be equal to an attack on all countries in the alliance, and obligates other Member States to provide assistance under attack. The case, known as the *casus foederis*¹, has been applied so far only once after the terrorist attacks on the USA on 11th September 2001. The rules and circumstances of usage of the armed forces of NATO member states in case of external aggression are precisely defined in mentioned art. 5 of the Washington Treaty on collective defence or as part of military deterrence (Collective Defence of NATO Territory). The second type of military operations of NATO as deviating from collective defence in accordance with Article 5 North Atlantic Treaty emergency response operations are non-Article 5 (Non-Article 5 Crisis Response Operations). According to AJP-3.4 (A) - Allied Joint Doctrine for Non Article 5 Crisis Response Operations, NATO stands out in the following breakdown Crisis Response Operations:

Peace Support Operations: Conflict Prevention, Peacemaking, Peace Enforcement, Peace Keeping and Peace Building;

Counter Irregular Activities: Approaches to Countering Irregular Activities, Insurgency and counterinsurgency, Terrorism, Antiterrorism, Counterterrorism, criminality, disorder, Subversion;

Support to Civil Authorities) Military Assistance to Civil Authorities and Support to Humanitarian Assistance Operations;

Search and Rescue (Search and Rescue - SAR), (Combat Search and Rescue - CSAR);

(Non-combatant Evacuation Operations);

(Extraction Operations);

(Sanctions and Embargoes)

(Freedom of Navigation and Overflight Operations)²

With regard to the European Union possible crisis scenarios are as follows:

(Separation of Parties by Force - Šopf).

(Stabilization, Reconstruction and Military Advice to Third Countries - SR).

(Conflict Prevention - CP).

(Evacuation Operations - EO).

(a Humanitarian Assistance Operations - HA)³

Above scenarios complement these assumptions about the possible use of military assets to support civilian authorities and organizations in dealing with crises of a different nature, such as the fights against organized crime and terrorism, in accordance with the provisions of the European Security Strategy.

3. THE LEVEL OF THE AIR FORCE DECLARED TO NATO AND EU OPERATIONS

Currently next to the Polish Army contribution to NATO operations and EU battle groups Poland declared also Air Force component consisting of:

4 F-16 (year of 2010),

2 C-295 aircrafts or C-130 aircraft, as a substitute (2006) ,

Team GROM (4 launchers) - a short-range anti-aircraft unit (2006)

The two helicopters W-3RM version of Search and Rescue (2006)⁴

Most likely two of four declared F-16 version – offensive-defensive will be replaced by aircraft air surveillance version. Additionally, another GROM (4 launchers) team and logistics module for runway restoring will be transferred in the near future.

In terms of the air force tactical combat module it is expected to use the F-16 aircraft. According to the on-going process of achieving full operational capability, the amount of aircrafts that can be further deployed into operations is estimated between 4 to 14.

¹ *Casus foederis* (Latin) - a case which, under the concluded international agreement commits the state allied to the common shares. For example, under the Treaty of Washington (Article 5), the attack on is a special type of military solidarity among NATO members. http://pl.wikipedia.org/wiki/Casus_foederis [Accessed 07.01.2014r.].

² AJP-3.4(A) *Allied Joint Doctrine for Non-Article 5 Crisis Response Operations*, NSA, Brussels 2010, s. 3-1 – 3-17.

³ *European Union Military Rapid Response Concept*, 5654/09 COSDP 57, 23.01.2009, par. 25.

⁴ Based on the statement of Air Force Commander „*Przyszłość sił powietrznych*” as of 12.10.2010.

Minimum level of involvement includes four aircrafts and eight pilots designated to act for a period of 180 days and will be possible to achieve in subsequent years. It should be noted that force rotation is not planned in this variant but will be necessary in case of the possible increase in the quota of air component.

Within the years 2013-2015 there is anticipated possibility to deploy eight aircrafts and 16 pilots - up to 180 days without rotation. For the following two years 2015-2017 partial rotation is the assumptions for the years 2015-2017 on the possibility of partial rotation. In this period four aircrafts will be rotated every three months.

As of 2018 the maximum effort will reach 14 aircrafts and 28 pilots' ready to act for 180 days without rotation, or 4 aircrafts and 8 pilots rotated every 3 months for two years. Maximum exposure level is dictated by the needs to ensure the integrity of their airspace and the need to rotate forces, mainly due to the low total number of F-16 aircrafts in the Air Force.

Quantity of transport aircraft allows the delegation from two up to four aircraft. Therefore, air transport composition for abroad operations can be as follows: two CASA C-295M aircraft, 4 CASA C-295M aircraft or two CASA C-295M aircraft and two C-130E Hercules aircraft.

Current operational capabilities in the area of anti-aircraft module dedicated to the protection of the air base allow only for a symbolic involvement into overseas operations.

Presently it is an anti-aircraft team consisting of four two person groups equipped with rocket GROM each. It is anticipated that in the future it will be two teams (8 launchers).

4. THE REQUIRED OPERATIONAL CAPABILITIES OF THE AIR FORCE MISSION STRUCTURES

The recent changes in the area of international security - globalization and asymmetric threats, creates the need to achieve by the armed forces desired operational capabilities, enabling them to respond effectively even directly in the origin of threat.

Previous experience and future operational scenarios confirm the need for system solutions for the forces preparation to conduct the full spectrum of activities - against any threat, in any area and in specific geographical environment, etc. These challenges generally fall within two complementary areas - structural and technical (armament and military equipment).

Task force structures of a new type, capable to respond against changes in the international security environment should be characterized by the following operational capabilities:

readiness at a given time, ensuring the use in the operation of all necessary means within a given period, after reaching their readiness to use according to their purpose;

flexibility of command and control;

the efficiency of an intelligence, allowing gaining information about potential enemy and threats and to deliver this information to all recipients in real time;

mobility, enabling operational development of the forces in a specific region of the mission including usage of air transport and the creation of task groups within given time and place.⁵

business continuity ensuring creation of proper circumstances needed by delegated forces to achieve aims of operation in any area both in favourable and hostile environment (without adequate infrastructure, host nation support and in adversary weather conditions);

resistance and force protection, which allow to maintain own combat potential during operation and minimize losses;

Interoperability, enabling cooperation in operations conducted under the auspices of the European Union.⁶

5 According to assumptions for EU battle groups future operations area will be quite far from Polish borders: Balkans, north Africa, close east.

6 Based on: *Polska wizja przyszłego pola walki udział polskiego przemysłu obronnego w zabezpieczeniu potrzeb Sił Zbrojnych RP*, Cz. II, Warszawa 2006, s. 6-7.

5. THE DESIRED CAPABILITIES OF THE AIR FORCE TO CARRY OUT TASKS OUTSIDE THE COUNTRY

Hypothetical range of future operations indicates that in order to create flexible Task Force package (Unit of Action) there has to be a proper baseline and mechanism of action prepared in advance. It will consist of combat modules highly “saturated” with operational capabilities resulting from the integration of various specialties.

For the Air Force this module should be prepared to act all over the world, regardless of the weather, condition of the technical infrastructure and the level of support from the host nation (HNS). Depending on the type of mission module should be able to operate independently, as the part of the international forces, as the whole or a part of the forces. Task Forces with modular structure must perform also strictly air tasks as the struggle for domination in the air, strikes - including tasks for the army, the air interdiction of the fighting area and defensive tasks in the air defence system.

To meet these challenges Air Force module has to be based upon following six modules: destruction, manoeuvre, search and rescue, security, logistics and command.

6. DESTRUCTION MODULE

The module should be based on combat platform (multi-purpose aircraft) fourth or fifth generation providing high manoeuvrability, low detectability by air defence systems (Stealth), supersonic cruising speed and short take-off and landing (STOL). Furthermore, the ability to engage targets from long distance, out of a range of enemy’s air defence; display tactical situation picture and the low radar detection vulnerability. It is required that the airplane is equipped with integrated avionics, communication, navigation and identification. The platform should also be compatible with a wide range of weapon systems including guided munitions, rapid-fire cannon—designed against air or ground targets, missiles of various types: air to air, air to ground/water and aerial bombs. In addition, the plane should also be prepared to move fake thermal and radar aims launcher (chaff and flare).

These requirements (a wide range) are met by the F - 16⁷ purchased by Poland. Taking into account F-16⁷ combat capabilities it is assumed that this jet will play a major role in the battle to dominate the sky. The aim of this fight is to control airspace by providing the freedom of its use by own aircraft, while the same time preventing its usage by enemy aircraft.

Most likely this will be achieved by carrying out simultaneous offensive and defensive actions. Considering the range of armament of Polish F-16 to control objects from a group of active measures against the enemy air force will be applied laser- guided bomb GBU-12 Paveway II and guided missiles, AGM-65G Maverick.

The impact on the fortified airport infrastructure and command control facilities will be carried out by using bombs guided by inertial navigation system with satellite navigation correction type GBU-31 JDAM/GBU-38 JDAM⁸ The defensive tasks will be performed by shifts in the zones of action, patrolling designated areas or zones through ensuring obedience of No-fly zone through usage AIM-9X Sidewinder and AIM-120C AMRAAM missiles. An equally important task carried out by the F-16s will be strategic strikes, carried out in order to minimize political, military, economic, and moral potential of a opponents’ country.

The most effective weapon of F-16 designed to destroy critical objects is: laser guided bombs GBU-24 Paveway III, bombs guided by inertial navigation system with satellite navigation correction type GBU-31 JDAM and gliding tray JSOW AGM-154c. There is no doubt that the F-16 in combat operations will also fight against army and navy. In this case task of F-16 will focus on the close air support and air interdiction.⁹ Taking into account the availability of weapons of Polish F-16 (guided missiles AGM-65G Maverick, unguided bombs Mk-82/Mk-84 and rotary cannon M61A Vulcan), the main targets in case of close air support could be tanks, armoured vehicles, artillery and helicopters.

7 27 Dec 2002 Polish government decided to buy 48 Lockheed Martin F-16 C/D Block 50+ aircraft.

8 *USAF Intelligence Targeting Guide*, February 1998, Chapter 6 Weaponering, s. 96, <http://www.fas.org/irp/doddir/usaf/afpam14-210/part06.html> [21.01.2014].

9 R. Szpyra i in., *Zmiany taktyki współczesnego lotnictwa uderzeniowego*, Warszawa, AON, 2006, s. 67.

On the other hand in case of air interdiction impact will be focused on the fight against armoured and mechanized forces while movement, in the assembly area and rest areas, roads and railways, transshipment points, bridges as well as logistical depots and warehouses. Combating land forces and battlefield infrastructure should be carried out by using unguided bombs Mk-82/Mk-84, guided bombs GBU-31 JDAM/GBU-38 JDAM, and guided missiles AGM-65G Maverick.¹⁰ Another possible role to play for F-16 both in combat and crisis environment will be air reconnaissance. It should be emphasized that this requirement is met by reconnaissance Pod DB-110. It is likely that the future tasks of Polish F-16 will be extended by electronic warfare.

Having all above in mind it is quite obvious that air force involvement into operations outside the country will enforce the use of a wide variety of munitions of various impact, purpose and method of guidance. Therefore it will be very important to organize efficient logistic system in order to provide requested supplies in sufficient quantity, assortment, in the right time and place. In addition, such a wide range of requirements needs prepared and skilled personnel. The desired aspect of preparation at least two pilots for each plane should not also be neglected. While deploying 14 F-16 aircraft there have to be 28 pilots deployed as well. Furthermore it should also be noted that right now Polish Air Force has no specialized equipment to electronic warfare. Therefore, this task should be considered as forward-looking.

7. MANOEUVRE MODULE

Manoeuvrability is a basic feature of most Air Force elements and components. It is expressed by ability of quick movement of whole or part of forces; complete the task within the prescribed time and readiness recovery. Therefore, module should have ability to perform wide spectrum of missions, starting from humanitarian operations, throughout transportation operations, ending with the special actions, such as air refuelling and participation in landing operations.

Analysing PLAF previous experience we can assume that cargo aircrafts would be the most commonly used resources during non-military operations. Air transport is divided into two basic groups: strategic and tactical.¹¹ So usage of declared Polish cargo aircrafts C-295/C-130 should be seen as mentioned previously, despite the fact that it cannot be included in the strategic range aircraft. The main objective of the air transportation in strategic scope, in reference to PLAF declared resources, is supply of necessary equipment and facilities for Polish Deployable Forces participating in given operation.

Main objectives, in the tactical scope, include carrying passengers and cargo between airfields and airstrips in the theatre of operations. So cargo aircraft C-295 and C-130 should be treated as mentioned previously.

It should be noted, that in the field of air transportation PLAF's capabilities are very limited, especially when there is a need to move outside loads to distant places. Current quantity of cargo aircrafts may be too small to sustain needs of particular PLAF modules (e.g. protection) and other type force components in an international scale. Usage of aircraft for different tasks simultaneously (e.g. carrying people, medical evacuation etc.) and the consequent need to quickly change the configuration of the loading compartment could appear as the next problem.

It is necessary to equip aircrafts with devices able to engage self-defence measures automatically, including passive detection of approaching guided ground-to-air missiles and ground radar signal passive detection, analysis and identification.

8. SEARCH AND RESCUE (SAR) MODULE

The main objective of search and rescue (SAR) module is aimed to minimize health and life threat of crew and passengers of faulty aircrafts or aircrafts which for any other reasons are in danger.¹²

10 *USAF Intelligence Targeting Guide, USAF Intelligence Targeting Guide*, February 1998, Chapter 6 Weapon engineering.

11 *AJP-3.4 Non-Article 5 Crisis Response Operations*, NSA, Brussels 2010, s. 2-12.

12 *European Union Personnel Recovery Doctrine and Tactics, Techniques and Procedures*, Study Draft 1, 2009, s. 9.

The main task for PLAF SAR components will be aimed at aircrew searching and assistance after emergency landing or for those which were down during operations. The next possible task is connected to air drop of rescue teams and survival kits for survivors, not necessarily resulting from enemy impact and participation in air transportation as well. We cannot exclude usage of SAR helicopters, involved in the shares of humanitarian aid (air drop and food delivery and rescue equipment), removal of effects of natural disasters and industrial disasters. We cannot also ignore its participation in people and equipment airlift. However, it seems, SAR objectives are only subsidiary.

The optimal means to achieve the above tasks, connected to personnel recovery, are helicopters type W-3RM, but only in the territory of northern Europe. This version of helicopter provides execution SAR tasks in various conditions such as: tasks over the water and land, in harsh weather conditions during the day and at night and in icing.

In Poland peace time SAR system is well developed, especially in AF, which have designated facilities. The main problem is preparation of soldiers to conduct isolated personnel recovery during military actions. Lack of doctrinal documents and necessary procedures in planning process, consistent tactics and training rules for personnel exposed to isolation pose next problem in this area.

9. SURVIVAL MODULE (PROTECTION AND DEFENCE)

High mobility and readiness for immediate use of close range anti-aircraft module, declared from PLAF to operate abroad, is its main advantage. These capabilities allow for a flexible response in case of danger associated with the appearance of enemy air raid, which may affect protected objects. We should be aware, that combat capabilities of given module, during operations abroad, are limited to two essential tasks: point-defence and cover of fighting forces. Point-defence seems to be essential task assigned to close range air self-defence. Man-portable air-defence system GROM, in the area of operation, may optionally be designed to cover: airports (airfields, airstrips, take-off and landing zones, embarkation and disembarkation places), essential for military and non-military forces logistic facilities. Cover of fighting forces (combat groups), in its essence, would be task similar to previous one. Due to manoeuvrability and range of the fire module, it could be perfect applicable measure to cover moving convoys or military forces in the event of a threat of air attacks.

It must be emphasized, that incomplete team capabilities in the field of airbase cover are limiting factor and its usage is acceptable in composite combat team only and in cooperation with other teams. Moreover, taking into account support and protection procedures of anti-air module, tasks can be executed only for the airbase with combat or airlift aircrafts national modules. Hence, close range air self-defence module can complement complementary formation designed to cover key objects against air attacks or other threats, including asymmetric ones. Achieving full ability to independently cover base requires, that covering forces should be equipped with new short-range air defence systems.

10. THE PROTECTION AND SUPPORT MODULE

The protection and support battle modules PLAF in the operation outside the country represent total earlier pre-plan action of powers and measures of the logistic system, medical and in the protection of military personnel, armies being aimed at keeping the air force vitality and sustaining their continuity of operations.

With no less important functional aspects carried out will be guarantee to ensuring appropriate conditions of the conduct battle actions.

The logistic protection combat module PLAF in the operation outside the country he is a process, which the main focus is establish the proper logistic conditions for protected battle modules, directed and performing tasks by them.

For main tasks of activity of logistic services protecting action of allocated battle modules PLAF in the operation outside the country will be assembling, keeping battle and material reserves of funds, keeping the essential material potential, technical, cargo, infrastructure and medical for current supplying and the service.

Moreover of service delivery social-living, as well as providing for the continuity protecting them. In the matter of fact, that logistic protection forces prepared for operation outside the country will be keeping all PLAF contingent, so battle modules and elements of supporting and safeguarding these forces.

Medical protection of the battle modules PLAF in the operation outside the country an entirety will constitute planned activities of powers and means of the medical system previously, to aim the keeping combat abilities of forces, by guarantee granting the help and the medical care. The undertakings force protection allocated battle modules they have enabling to preserve the freedom for the task and effectiveness their activity in international circle, under huge probability of the influence on the enemy forces. The goal of protection forces is minimization sensitivity of the military personnel, objects, equipment on all threats and appeasement their effects in the destination of keeping military abilities for manoeuvrability and efficiencies of action of powers.¹³ It consists of: protection, masking, the common air defence, engineering support, defence against weapon of mass destruction.

The completion of above undertakings takes place in active defence, passive defence, protective security and recovering operational capabilities.¹⁴ Essential it is matter that logistic protection forces performing tasks outside country borders are in the national responsibility.

However concerning details of the international cooperation and the logistic support of forces participating in operations outside country borders they will be resolved by international arrangements. So according to applicable rules the logistic support of combat modules PLAF participating in operations outside country borders it should be carried out only by powers and means allocated from logistic PLAF.

However in situations in which financing of the supply is difficult or economically unprofitable we should use local logistics resources, which after entering relevant agreements and contracts should be recruited in the appropriate amount. In the destination of providing for the continuity the logistic forces sended outside country borders PLAF should have powers and means to organize and delegating NATIONAL SUPPORT ELEMENT (NSE) and specialists prepared for entering into agreements and contracts with using provided benefits by other countries alliance in frames HOST NATION SUPPORT (HNS).¹⁵

With particularly a neuralgic element in the process of protecting battle modules outside the country is technical support, because apart from standard functions we should take circumstances associated with the aviation maintainance support. At present wait to the spare parts for combat aircraft is growing longer (up to couple months), and problems with operations of aircraft appeared.¹⁶ Next the problem associated with the medical support appeared during Afghanistan mission.

A lack of personnel medical in PLAF forces was highlighted and problems with recruiting civilian personnel -even at very good earnings.

According to support system we should state that practically it doesn't exist in PLAF. In the air bases specialist protection branches are missing and it causes that duties of protection of personnel, aviation and infrastructure are transfered to civilian employees.

Such a solution cannot be practised in missions outside the country. One should also prepare and equip with the appropriate air defence systems for base protection.

11. THE COMMAND MODULE

It is estimated that the command and control modules, which are part of the components, will be implemented at the Combined Joint Task Force (CJTF) level, as part of the allied or multinational operations. For this purpose, the perspective battlefield management system should create a unified image of the battlefield based on operational images from other modules and collect information from other systems.

Moreover, it should allow creating an awareness of the tactical situation, and knowledge of the weapon systems and weapon availability, what gives a possibility to make an immediate assignment of a target to engage or to renew the attack, depending on the situation. Furthermore, it should also ensure both rendering and exchange of an up-to-date display of the real air situation via automated system (Automated Data Processor) within the Integrated Environment of the Tactical Management Space.

13 Regulamin Działań Sił Powietrznych, DD3.3, Warszawa 2004., pkt 8001

14 AJP-3.14, Allied Joint Doctrine for Force Protection, Brussels 2007. p. 1-1.

15 *Doktryna logistyczna Sił Zbrojnych Rzeczypospolitej Polskiej*, Szt. Gen. 1566/2004, pkt. 2020.

16 M. Zieja i in., *System Informatycznego Wsparcia Eksploatacji Wojskowych Statków Powietrznych*, Logistyka nr 4/2012, Poznań, s. 47-56.

For several years the Air Force has strived to fulfil requirements necessary to obtain a real and current image of the airspace by implementation of NATO automated command systems. From the perspective of ensuring the function of command outside the national borders, the biggest issue may be mobility of the command system. The solution is to organize the Mobile CRC (MJDCOP) and to equip it with appropriate command means. It should be noted, however, that it is an executive element that provides control of active means of fight. During the Air Force activities abroad there may be a perceptible lack of a mobile planning authority. Therefore, a proposed solution may be to create a mobile air operations planning center, like Allied Joint Force Air Component Commander (JFACC) or Deployable Combined Air Operation Centre (DCAOC).

CONCLUSIONS

There are no doubts that the use of the PAF resources abroad is essential. It comes from the general assumption of deploying Polish Armed Forces in the international field in the aspect of allied commitments. We have to remember that participation of the PAF and the rest of AF modules will depend on their combat capabilities and political decisions made with respect for national interests. It must also be noted that the scope of deployment of the declared forces will be dictated by solutions then developed in allied operations or solutions from allied standards and doctrines. Generally, cargo aircraft are going to be most used component in the PAF abroad due to character of contemporary threats, among which natural and humanitarian disasters are of the top priority.

In connection with the provision of humanitarian aid, casual evacuation and supplying essential supplies are going to be basic tasks accomplished by C-295 and C-130 aircraft.

It is estimated that potential Polish F-16s participation will focus on conducting Recce Missions and also maintaining appropriate level of the airspace control in the area of conflict reacting to emerging threats. We cannot absolutely eliminate situations in which our F-16s will participate in typical Air to Ground missions. During military operations and in the unfriendly environment we must not forget about the meaning of the SHORAD module. We have to take into consideration all qualities of the SHORAD, which may be the sole mean available to protect against A-G threats. It is also worth to underline the role of the protection and support module especially in the environment where there will be a lack of the support from HN side (Host Nation). As the part of this module there are additional ones like logistic, medical and security modules. Additionally, crucial during abroad operations is the Search and Rescue module used to recover isolated personnel. The command module is the last of reviewing structures.

Without this structure it will be impossible to meet mission needs abroad. The basic task of this module is to organize the communication and information system, task force and measures, monitoring of the tasks' implementation, and command of active measures of fight.

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<http://www.fas.org/irp/doddir/usaf/afpam14-210/part06.html>.
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SPECIAL FORCES TRANSFORMATION IN FACE OF THE CONTEMPORARY CONFLICTS CHALLENGES

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Abstract: *Historically called “unconventional” operations are not new phenomenon. Guerilla warfare has a long history of operations (actions) at the tactical level, when the “irregular” forces fought against “regular” one¹. However, in this context, strength of “irregular” forces was mostly associated with non-state and quasi-state groups, whereas the “regular” one with the armed forces which are legitimate policy instrument of governments and states. What is the most striking in terms of special operations in late of twentieth century; it is a remarkable increase in irregular activities conducted by regular forces in unconventional style in order to protect the operational and strategic effects². In the first part of the paper attempted to define Special Forces as kind of forces and operations (actions) especially in terms of their utility at operational level. Later on an attempt to identify main changes and emerging trends in the tasks and capabilities of Special Forces, which in last decade has become an obvious tool in responding to crises of last decade. An attempt was also made to analyze innovative modes of action that have emerged in recent operations in Afghanistan and Iraq.*

Keywords: *special Forces, operations contemporary conflicts, transformation*

After the Soviet Union collapse in August 1991, nature of armed conflicts and way of military forces use appeared to go beyond the existing, traditional and fixed boundaries³. One of more interesting current phenomena in area of military operations is growing importance of special operations and role of Special Forces.

At the edge of the twentieth century, most armed forces have begun to build up an elite combat unit, which in most cases were included in army structure. States with higher amount of forces also possess Navy and Air Force special units.

Generally their main task was to support the achievement of operational and strategic objectives and complementing of the conventional forces operations⁴. However, over the last decade there was a distinct turn in development of Special Forces that have become an important, well-functioning and separate component of modern armed forces, with its own structures and doctrines.

Increasingly, Special Forces acquire “joint” character, proving their immense usefulness across whole spectrum of contemporary conflicts, and thus have direct impact on operational art, strategy development and the conduct of military operations.

It could be argued that Special Forces are currently precursor of changes in way the modern operations are perceived and conducted. In addition, they offer a more effective and legitimate options in traditional approach to use of force by state.

Most conclusions are the result of lessons learned and analysis regarding the way special forces are used by United States and Australia.

1 W. Laqueur, *Guerrilla Warfare: A Historical and Critical Study*, Transaction Publishers, New Brunswick, NJ, 1998, pp. 45.

2 C. Gray, *Modern Strategy*, Oxford University Press, New York, 1999, pp. 286-289.

3 M. Evans, *From Kadesh to Kandahar: Military Theory and the Future of War*, Naval War College Review, vol. 56, no 3, summer 2003, pp. 132–50.

4 A. Beaumont, *Special Operations and Elite Units: 1939–1988*, Greenwood, Westport, CT, 1988, pp. 7.

In most of experts and analysts opinion just these two countries made the greatest contribution to the concept of Special Forces use.

Therefore they are the best example on how the Special Forces underwent a transformation, and in which direction changes will go⁵.

To commence broader analysis of Special Forces we must begin with its theoretical basics, although in this case practice and empirical experiments are certainly richer than poorly written theory⁶.

Special forces, although often operate behind closed doors security policies of governments in mystery aura, without doubt, are the most glorified category of national forces by the media.

They are characterized by specific abilities and opportunities arising from the needs of a given state, for this reason, from the multinational operations perspective, have little in common beyond the status of being elite.

Given this, and no other circumstances, any attempt to define them, usually ends up on comparison of their capabilities with the capabilities of conventional forces - Special Forces as opposite to the main force which constitute defense forces.

Such tautological approach, however, is in its essence not very precise, because it should entail a broader set of military organizations with their various tasks and abilities.

For instance, certain Special Forces units can play role either internal policing or role of intelligence and reconnaissance, while others may perform airborne tasks.

An alternative and perhaps more appropriate approach seems to be to define what constitutes such activities (operations) can be called special and indicate of what kind of forces are chosen to conduct such kind of operations.

In western military thought operations/special activities are usually defined in the context of conventional high-intensity wars, shaped as result of twentieth century interstate conflict experiences.

For example, Edward Luttwak describes special operations as “independent military operations carried out by the self-sustained forces operate in hostile territory”⁷.

Similarly, Foot special operations sees as “unconventional attacks [...] unexpected sudden strikes, usually conducted and carried out outside the area of ongoing operations that have a surprising effect on opponent - preferably at the highest level of command”⁸.

However, Maurice Tougwell and David Chartres correctly note that these definitions are inadequate, due to lack of issues, that would indicate that modern special operations in many cases are executed outside the context of a conventional war.

What is associated with the fact that there is no properly defined “adversary” often not on “hostile territory” (although very likely still dangerous), and in fact does not always involve the use of violence”⁹.

Tougwell and Chartres in their considerations go further and suggest the most likely coherent and complete definition of a special operation, which although formulated in 1984 is still valid:

5 Other states with the highly developed special forces are: the United Kingdom, South Africa and Israel. Unfortunately, in contrast to the United States and Australia, there is a very limited access to information about them. For these reasons, it is difficult to analyze transformation of forces in these countries.

6 English literature often refers to the publications of: W.H. McRaven, *Spec Ops, Case Studies of Special Operations Warfare: Theory and Practice*, Presidio, Novato, CA, 1995. Less known but more useful seems to be publication of C.S. Gray, *Explorations in Strategy*, Greenwood Press, Westport, CT, 1996.

7 E. Luttwak, *A Systematic Review of “Commando” (Special) Operations 1939–1980*, C&L Associates, Potomac, MD, 1982, pp. I-1.

8 M. Foot, *Special Operations, I*, [red] E. Elliott-Bateman (ed.), *The Fourth Dimension Resistance*, Manchester University Press, Manchester, 1970, pp. 19.

9 M. Tougwell, D. Chartres, *Special Operations and the Threats to United States Interests in the 1980s* [red] F. Barnett, B. Hugh Tovar, R. H. Shultz [red], *Special Operations in US Strategy*, National Defense University Press, Washington, DC, 1984, pp. 34.

“small-scale clandestine, secret, covert or overt operations of an unorthodox and frequently high-risk undertaken to achieve significant political or military objectives in support of policy¹⁰.

Special operations are also characterized as a simple or complex operation, conducted with limited use of violence, involving the use of military and nonmilitary measures, including intelligence and supervised by the highest level of the state administration¹¹.

If we look at the definition recognized by the U.S. Department of Defense it is seen, that its contents are similar to those previously quoted academic definition “special operations are the activities carried out in a hostile, unfriendly or politically sensitive environments to achieve military, diplomatic, informational and economic objectives by the use of military capabilities for which there is no need to apply a wide range of conventional forces¹². If we look at the current Australian military doctrine we can find, that it defines special operations as a highly focused operations implemented at the tactical level, using unconventional military means for achieving broader operational and strategic effects. Equally important is that the Australian government acknowledges that the nature of operations is shaped by special circumstances like political and military factors, for this reason these have to be dealt with at the national level¹³.

From the art of war theory perspective the most significant aspect of the Special Forces is the recognition of their operational utility. The concept of the operational usefulness endeavors to assess the effectiveness of certain types of military operations, taking into account the course and outcome of the conflict. Experts suggest that Special Forces may influence the outcome of the conflict at the tactical level in a direct manner while at the operational level, both indirect and direct. Colin Gray argues that the increasingly frequent decisions of the states to conduct special operations as well as associated with this phenomena noticeable recent development of Special Forces is largely due to their operational utility - it is their usefulness in providing “economy forces” and “extension of operational capacity”¹⁴. For Gray there are two “fundamental issues” that form the core of the operational usefulness of the Special Forces, so that one can get significant results with limited resources.

They act as “Force multiplier” to other conventional components operating in the area of operations and directly affect the conduct of activities¹⁵. Secondly, Special Forces expand the range of available options in the implementation of political and military objectives. Gray indicates that, in theory, governments always possess different possibilities in the use of force, for example, diplomatic solutions, sanctions etc. It notes, however, that in practice, “there are some situations that cannot be solved successfully without resorting to physical coercion.

Availability of Special Forces and their ability means that the state can use military force”in a flexible, limited and precise way”¹⁶. Gray in his study also presents seven operational utility aspects of special forces, which include: innovative action, influencing improve morale, being a showcase of military competence, providing moral support and mental humiliation of the enemy, enabling control of escalation and shaping the future¹⁷.

10 Ibid, pp.35. We should emphasize the difference between the meaning of “secret” and “hidden” adopted in the context of the definition. K.O ‘Brien gives a concise definition, which indicates that the “secret operations refer to activities carried out by soldiers wearing uniforms [...] so their actions cannot be neither confirmed nor denied, but they are not released to the public information. In contrast the hidden operations refer to activities carried out by no uniformed soldiers or non-combatants, in such a way that their involvement may be denied. See. A. O’Brien, ‘Special Forces for Counter-Revolutionary Warfare: The South African Case’ Small Wars and Insurgencies, Vol 12, No. 2, Summer 2001, pp. 79-109.

11 Ibid, pp. 121

12 US Department of Defense, Special Operations Force Posture Statement 2003/2004, [access 14.06.2013], www.defenselink.mil/policy/solic/2003_2004_SOF_posture_statement.pdf.

13 See, Australian Defense Doctrine Publication 3.12—Special Operations, 2004.

14 C. Gray, Handfuls of Heroes on Desperate Ventures: When do Special Operations Succeed?, Parameters, spring 1999, no 2, pp. 163.

15 Ibid., pp. 168-74. Gray indicatesseventeen reasons why special operations forces provide economy.

16 Ibid, pp.174.

17 Ibid, pp. 175-85

Given the increasing complexity of modern security environment Mark Mitchell notes other issues, which in his belief are very important in the context of the operational usefulness of the Special Forces - “the ability to adapt to missions”¹⁸. Examples of Afghanistan and Iraq confirm that modern Special Forces are characterized by adaptability to diverse, constantly changing situations and conditions and possess skills, experience and operational maturity having allowed using them in the broad spectrum of tasks.

One can ask question whether modern Special Forces vary significantly from its historical predecessors or recent precursors. Over the millennia, in fight against an opponent, society used methods of conducting operations using irregular or raid units. One can even refer to Roman and Persian empires era, which led operation in unconventional character already 1500 years ago.

In nineteenth and early twentieth century British fought desperately on the India north-western boundary with the adversary, who led the military operations of an irregular and unconventional character¹⁹.

Colin Gray points out that although modern Special Forces actually have historical predecessors (particularly in tradition of non-western organization and training of small elite groups of soldiers), it is only recently changes and innovations in military affairs left a significant impact on their character²⁰. Special Forces experienced the greatest growth and achieved a significant position during World War II, when almost all parties involved developed and exploited certain types of unconventional and irregular operations.

What has changed in relation to that period and what draws more and more attention is the fact that modern Special Forces required to maintain an extremely wide range of tasks in a highly complex global security environment. To achieve these tasks must have a completely new and innovative ability. These new tasks include: conducting operations in a global framework within preemptive action including so called Global War on Terrorism, role in shaping national security, national fight against terrorism, several key tasks outside the scope of combat operations, including fight against narcotic traffic and tasks in area of crisis response.

Special Forces are increasingly being used to conduct operations on a global scale in different regions of the world in the context of preemptive action –expeditionary operations. Undoubtedly on undertaking this kind of operations have had impact attacks in 11 September 2001 and October 2002.

Both stressed the requirement for taking preemptive action or at least maintain the ability for preemptive military actions against two key factors of terrorism: international terrorism and proliferation of weapons of mass destruction.

Special Forces have become “forces of choice” for both international counter-terrorism operations and activities aimed at stopping the proliferation of weapons of mass destruction. One of the recent RAND reports indicates that such an offensive orientation in the fight against terrorism is clearly different from previous efforts in this area²¹. Offensive tasks in the fight against terrorism are not conducted by United States armed forces, but also their coalition partners and partner states.

The exact nature as well as amount of undertaken operations remains a topsecret due to operational security reasons, however there are indications that suggest a high rate of these activities.

Thomas O’Connell Assistant Secretary of Defense for the Special Forces and conflicts of low intensity indicated that United States Special Forces are currently operating “strategic intelligence combat missions and training missions around the world”²².

18 M. Mitchell, *Strategic Leverage: Information Operations and Special Operations Forces*, Naval Postgraduate School, Monterey CA, 1999, pp. 84.

19 T. Moreman, *The British and Indian Armies and North-West Frontier Warfare: 1849–1914*, *Journal of Imperial and Commonwealth History*, vol. 20, no 1, 1992, pp. 35–64.

20 Gray, *op. cit.*, pp. 146

21 B. Nardulli, *The Global War on Terrorism: An Early Look at Implications for the Army*, RAND Corporation, Arlington, VA, 2003, pp. viii.

22 G. Gilmore, *Special Operations: Force Multiplier in Anti-terror War*, *American Forces Information Service*, October 2003, www.defenselink.mil/news/Nov2003.

In addition to these visible actions in Iraq and Afghanistan, U.S. special forces were engaged in an offensive combat terrorism operations in the Philippines, Djibouti, Yemen, Somalia, Pakistan, Georgia, Uzbekistan and Colombia²³. It is estimated that from 11 September 2001, United States Special Forces have likely performed more than 4,000 different kinds of operations in more than 100 countries. Unofficially it is said that as a result abovementioned actions have been taken, killed or captured over two hundred terrorist groups' leaders planning actions in twenty different countries²⁴. Defense Secretary Donald Rumsfeld responsible for conducting offensive operations against terrorism appointed the U.S. Special Operations Command as a Unified Combatant Command²⁵.

Moreover in short time notice a Special Forces Command as a "global synchronizer" in the war on terrorism for all U.S. military combatant commands and made them responsible for development of a new campaign plan in the global fight against terrorism and conduct intelligence and reconnaissance preparatory tasks against terrorist organizations around the world²⁶. This new approach documented in a secret National Military Strategic Plan for the War on Terrorism, for the first time in the history of United States unified armed forces under the umbrella of special operations²⁷.

This was a significant step because since then have exist special forces command, which have primary control over all ongoing offensive operations against terrorism around the world. Usability special forces in a global nature, is not only because their ability to conduct war operations, but more importantly so called soft capabilities ie. linguistic skills, specializations in cultural, political area and use of information technics. This kind of "soft capabilities" Special Forces have developed in recent times, and as operational cases show brought success that Anthony Cordesman has labeled them as "snake eaters with master's degrees"²⁸.

Since the mid-90s of last century Special Forces have been used more often to carry out various "nontraditional" military tasks. It went beyond current range of military operations and was related with support of the broader national security policy objectives and international efforts to maintain peace²⁹. Undoubtedly, the reason for increased use of Special Forces was their high readiness and wide range of activities as opposed to a conventional unit. In the world Special Forces have begun to develop unique capabilities within national forces and maintain a high level of training required for conduct of activities with minimal risk. Significant achievements in carrying out nontraditional nature tasks caused that Special Forces now become a common tool in the hands of politicians and governments in the case of international crises. Australia and United States are instances which in the 90's last century repeatedly used their special forces to conduct nontraditional tasks³⁰ such as counter-narcotic operations, tracking and capturing terrorists and war criminals. Starting in the mid-90s of last century, the U.S. government began to use Special Forces to conduct covert and overt action against the drug industry in South and Central America.

23 G. Corera, Special Operations Forces Take Care of War on Terror, *Jane's Intelligence Review*, January 2003, pp. 73.

24 M. Billingslea, Principal Deputy Assistant Secretary of Defense SO/LIC, *Waging the War on Terrorism*, [access 14.03.2012] www.heritage.org/research/nationalsecurity

25 M. Fitzsimmons, *The Importance of Being Special: Planning for the Future of US Special Operations Forces*, *Defense and Security Analysis*, vol. 19, no 3, 2003, pp. 203–18.

26 L. Robinson, *Plan of Attack*, *US News and World Report*, pp.23 [access 02.02. 2012] <http://www.usnews.com/usnews/news/articles/050801/1terror.htm>

27 *Ibid*, pp.25.

28 A. Cordesman, *The Iraq War: Strategy, Tactics, and Military Lessons*, CSIS Press, Washington, DC, 2003, pp. 364.

29 L. Fuller, *Role of United States Special Operations Forces in Peace Operations*, Strategy Research Project, US Army War College, Carlisle, PA, 1996, pp. 124

30 Special Forces of many other countries also carry out such type of tasks. Most NATO states have used it in a lesser or greater extent in the Balkans and now uses in Afghanistan. France has repeatedly used its special forces in humanitarian aid tasks in Africa.

In most cases operations supported structures of host country in order to detect, coerce or interfere any actions linked with illegal drug activity³¹.

Indeed in 1997 alone U.S. Special Forces conducted over 194 counter-drug operations presumably mostly in Central America³².

These forces are still present in the region and continuously train host-nation forces directed to fight against drug industry particularly in Ecuador and Colombia, where Colombian forces captured key leader and drug lord Ricardo Palmera - allegedly with the assistance U.S special forces³³.

Some U.S. politicians have called for greater involvement of special forces in Colombia, where Colombian Revolutionary Armed Forces have a strong rebel army in an amount of about 15 000 soldiers. This army has developed from a classic guerrilla army in the organization of the terrorist - criminal nature, dealing in the trade of narcotics and which is now a major threat in the region.

Possible model for fighting drug cartels of so importance has been suggested by two American analysts A. Valenzuela and V. Rosello, who predicted involvement of troops in form of mobile training teams of Special Forces. These teams have been used successfully in El Salvador in the eighties and early nineties of the last century³⁴.

Also Australian Special Forces have also begun to play a key role in the counter drug operations. A case of such kind of operation would be a situation when Australian Special Forces entered suspected drug traffickers ship Pong Su belonging to North Korea and sailing on Australian territorial water. 50 kilograms of heroin have been found and operation was a major success for Special Forces and cooperating agencies³⁵.

It is significant that only Special Forces were able to carry out such kind of attack in extremely short period of time without much preparation. This fact indicates that very likely such abilities will be increasingly used by states to fight against drug trafficking.

One of the major tasks of Special Forces was to detect and capture key persons so called key targets.

As an example of this might be German Otto Skorzeny kidnapping during the Second World War or Chinese leadership Ah How in the Malay jungle in 1958³⁶. Currently Special Forces are tasked with similar nature mission in case of two very different types of targets: international war criminals and leaders of international terrorist groups. Today's tasks have however several specific characteristics underlying their uniqueness.

Firstly, task of locating and capture these targets more often is conducted in no well-defined area of operations or even in a specific geographical area. Secondly intelligence requirements that are required for success of the mission have inter-agency and multinational character as so require high levels coordination and cooperation. Thirdly Special Forces are forced to act in contrary to accepted norms and conventions of war and even against opposing public and political rhetoric³⁷.

Especially notable were operations of various countries special forces in Bosnia and Herzegovina.

The International Criminal Court for the former Yugoslavia after approval of Dayton Peace Agreement in 1995 has indicted a number of war criminals. Both the NATO stabilization force and current resident - European forces are aware of the problems arising from the remaining war criminals on loose. The task of finding and arrest criminals was mostly designated to United States and Great Britain.

31 Special Operations Force Posture Statement 2003/04, op. cit., pp. 40.

32 P. Schoemaker, US Special Operations Forces: the way ahead, *Special Warfare*, winter 1998, pp. 5.

33 J. Forero, Columbian rebel's capture was result of hunt aided by US, *New York Times*, 4 January 2004.

34 A. Valenzuela, V. Rosello, *The War on Drugs and Terrorism: El Salvador and Colombia*, *Military Review*, March-April 2004, pp. 28-35.

35 P. Conford, B. Malkin, *Seized: Ship They Hunted for Days*, *Sydney Morning Herald*, 21 April 2003, pp. 65.

36 K. Conner, *Ghost Force—The Secret History of the SAS*, Orion Books, London, 2000, pp. 50.

37 W. Ferrell, *No Shirt, No Shoes, No Status: Uniforms, Distinction, and Special Operations in International Armed Conflict*, *Military Law Review*, vol. 178, winter 2003, pp. 94-141.

In a typical fashion these forces operated in Bosnia beyond NATO mandate conducting direct actions at the national level or special rescue tasks. American special units such as SEAL Team 6 and Delta Force have already occasionally operated in Bosnia accomplished with effort approximately 300 soldiers³⁸. These forces also demonstrated significant intelligence - strategic reconnaissance and rescue capabilities during operation in Somalia in 1992-1995. An example may be a Task Force Ranger which captured key members from Aided Mohamed network although suffered significant losses³⁹.

British Special Air Force Regiment has also been operating in Bosnia for some time and search for war criminals has been a core task for them. In contrast to United States Special Forces which units have well-defined, short-term tasks, the British forces in Bosnia operated with small units. This solution gave undoubtedly greater opportunities to gather intelligence and reconnaissance data useful in planning and training for specific tasks as well as rapid response to any emerging local information. British forces captured General Stanislav Galic the Serb Commander whose army sieged Sarajevo in December 1999. In 2000 year British Special Forces conducted eleven of such kind operations in the British Sector of Bosnia. Operations led to arresting fifteen suspected persons and killing another two. However the most wanted two persons identified as war criminals such as Karadzic and Ratko Radovan Mladic remained long in release⁴⁰.

During the war against Iraq in 2003 Special Forces were used in more coordinated and synchronized way to search Baathist leaders. The new Task Force 121 has been created with the task searching Iraqi leaders and key terrorists operating in the region. Most of these forces remain covered. Undoubtedly Task Force 121 was prepared to carry out specific tasks elimination highly valuable targets. Soldiers of this unit found out and captured Hussein⁴¹.

In recent years U.S. Special Forces conduct large-scale operations in the south-eastern mountains of Afghanistan along the border with Pakistan⁴². This was due to recovery of efforts to find Osama bin Laden and his coworkers and preventing resurgence of Taliban and al-Qaida forces in border provinces. These Special Forces units were allegedly part of Task Force 121. As an evidence of their high activity can be helicopter crash belonging to the U.S. Special Forces in Kunar province resulted in sixteen Special Forces killed. Probably they had been involved in rescue smaller group of four soldiers from the unit SEAL involved in seizure one of key Taliban commanders⁴³.

This kind of operations conducted against leaders will continue as long as coalition led by United States and ISAF forces will fight militant groups in Afghanistan region. Also Australian government's decision to send back to Afghanistan Special Forces Task Group with Special Air Service Regiment is another sign of weight and role Special Forces play in this operational area.

More frequently undertaken and challenged tasks are unconventional one. These include: a broad spectrum of military and paramilitary operations led by local forces organized, trained, equipped, supported and directed by so called external source⁴⁴.

Ironically unconventional operations are one of the primary tasks that led to creation of permanent Special Forces units in the modern armed forces of Western states. There are certain capabilities developed as a result of extensive allied troops experience gained during World War II in training and equipping guerrilla forces from France and Yugoslavia in Europe and Burma and East Timor in Asia⁴⁵.

38 R. Newman, Hunting War Criminals, World Report, [access 6 February 2012], www.specialoperations.com/Army/Delta_Force/bosnia.

39 J. Celeski, A History of SF Operations in Somalia: 1992–1995', Special Warfare, January 2002, pp. 16–27

40 SAS Sweep on Serb Butcher, Daily Mail (UK), [access 21 December 2010], www.specialoperations.com/Focus/butcher

41 T. Shanker, E. Schmitt, Pentagon Says a Covert Force Hunts Hussein, New York Times, 7 November 2003

42 B. Gellman, D. Linzer, Afghanistan, Iraq: Two Wars Collide', Washington Post, 22 October 2004, pp. A01

43 A. North, US Navy SEALs Afghan Disaster, [access 25 July 2011], http://news.bbc.co.uk/go/pr/fr/-/2/hi/south_asia/4712885.stm.

44 US Department of Defense Joint Publication 1-02, [red] K. Dickson, The New Asymmetry: Unconventional Warfare and Army Special Forces, Special Warfare, fall 2001, pp. 16–17

45 G. Jones, Unconventional Warfare: Core Purpose of Special Forces, Special Warfare, summer 1999, pp. 5–6.

At the beginning of Vietnam War most Western special forces rarely led unconventional operations focusing on other operational priorities. However at the beginning of twenty-first century these activities have become once again the focal point in developing Special Forces capability. Probably reason for returning to such kind operations were spectacular successes of United States special forces in Afghanistan at the end of 2001 and early 2002 in Operation Enduring Freedom.

During OEF special forces were used to conduct unconventional operations in two ways. Firstly in the words of former Secretary of Defense Donald Rumsfeld “you do not wipe out terrorists using conventional means you can do this by unconventional measures and using specialized combat skills which can provide only special forces personnel”⁴⁶.

Secondly, American political and military leaders wanted to avoid reiteration of the past experiences, when United Kingdom and Soviet Union engaged, a huge amount of conventional land forces in Afghanistan. During OEF the most famous example of Special Forces success in unconventional activities was undoubtedly liberation of Mazar-e-Sharif city on 10 November 2001. During operation 5th Special Forces Group assisted Northern Alliance to beat much superior Taliban forces⁴⁷. Special Forces performing functions of military advisers assisted Northern Alliance in almost all battles for major cities of Afghanistan such as Kabul, Jalalabad, Kandahar and Konduz⁴⁸. 5th Special Forces Group has been conducted similar unconventional tasks in another country in Central Asia for six weeks before attacks of September 11, 2001. The group moved to Afghanistan in the middle of October and merged with Harmed Karzai and his Northern Alliance forces⁴⁹. Soldiers of this unit had an enormous huge operational experience dated back from Central Asia many of them spoke local languages. This example shows the importance of long-term approach and commitment to the development of specific skills in unconventional Special Forces personnel activities.

One may note that in recent years of United States defense policy unconventional activities have become particularly important. In this context, special forces are now seen as a “global scout” which serves “to ensure allies and United States friends to carry out solutions of U.S. government”⁵⁰ that in future will be used to defeat a strong opponent “by means and methods so called anti-access and anti-denial”⁵¹. It should be mentioned that even before announcement Global War on Terrorism United States widely used Special Forces for training and support tasks around the world. Just in 1997 Special Forces have been used in 144 countries⁵². Recent unconventional operations in Afghanistan have achieved so much success that operation focused on Special Forces (SOF- centric campaign) has been described as a possible future model of operations in general.

Several commentators assumed that this type of unconventional war may be applied throughout whole spectrum of future conflicts⁵³. An example of such an approach was involvement of Special Forces in Operation Iraqi Freedom in early 2003. One of the key aspects of overall operational plan was coordination of Kurdish forces operations in northern Iraq by Combined Forces Special Operations Component Command. This task was a classic example of unconventional operations.

Presented examples are American lessons learned; however Special Forces of many other countries have similar or close capability that can be employed to unconventional operations. Australian Special Air Service Regiment probably in the early 70 ‘s have already developed “wing of non-conventional operations”.

46 H. Kennedy, Will Special Ops Success Change the Face of War?, National Defense Magazine, [access 12 February 2012], www.nationaldefensemagazine.org/article.cfm?Id=721.

47 S. Biddle, Afghanistan and Future of Warfare: Implications for Army and Defense Policy, US Army War College Strategic Studies Institute, Carlisle, PA, 2012, pp. 8–10.

48 Kennedy, op. cit., similar unconventional task were conducted in Iraqi Freedom Operations 2003.

49 A. Finaln, Warfare by Other Means: Special Forces, Terrorism and Grand Strategy, Small Wars and Insurgencies, vol. 14, no. 1, 2003, pp. 92–108.

50 Special Operations force Posture Statement, op. cit., pp. 28.

51 Erckenbrack, op. cit., pp. 8.

52 Schoomaker, op. cit., pp. 3 in 1997 average number of forces deployed was 4760 weekly.

53 See T. Shanker, Conduct of War is Redefined by Success of Special Forces’, New York Times, 21 January 2001 or R. Scarborough, Pentagon Uses Afghan War as Model for Iraq, Washington Times, [access 4 December 2011],

It was based on American team “A” special forces concept and initially used U.S. doctrine⁵⁴. David Horner has documented involvement of these forces in a quasi- nonconventional operation in the 70’s and 80’s of last century. Examples of such tasks identified by Horner included training of land and security forces in Thailand and Indonesiaby Special Air Service Regiment personnel⁵⁵. Australian experience in training of local forces back to war in Vietnam when army training teams trained local forces. Although unconventional operations are now shadowed by Global War on Terror and offensive actions to combat terrorism, but in the future it may prove to be extremely effective method in combating threat of weak states and non-state actors. Dean Newman believes that in war on terror Special Forces unconventional operations striking the non-state actors are extremely attractive alternative to traditional concepts of use military force. Newman among reasons of growing importance of unconventional operations in achieving objectives emphasizes reduced funds requirements, benefits of economic and historical examples of success⁵⁶.

Another important element contributing to Special Forces transformation is their organizational structure and way of training as well as new approaches to operations. Nature of special operations since end of World War II required combination of land and air assets operating simultaneously in a multidimensional way. Preliminary analysis of conventional armed forces selected alliance member states shows that in most cases they still cling to their own military service doctrines. Concurrently analysis of Special Forces shows that in many countries they transformed into a true organization of joint forces. Emphasis put on joint forces means that in terms of command and control (and even tactical cooperation) Special Forces use task forces and task groups not one service forces. Also great emphasis has been placed on developing interoperability with international Special Forces and increasingly non-governmental organizations which was already evident in peacekeeping operationsin 90’s of the last century. As a result of these changes today’s Special Forces are at forefront of many coalition and joint operations conducted within the framework of the global war on terrorand international peacekeeping. In turn, analysis of ways of conducting operations by special forces show a steady growth, high specialization andwide diversity of tactical procedures for operations in high-risk environments. Noteworthy are two new concepts in which Special Forces operate at tactical level. One of them relates to the combination of efforts land force special elements with Air Force. Second concerns use of network-centric in special operations.

Both concepts point out growing role of information and increasing use of advanced technology at an individual level.

The theory and practice of joint operations refers to “synergistic application of exceptional abilities and capabilities each of service forces in such a way, that the final result is a capability that is greater than the sum of its parts”⁵⁷. Striving towards joint operations caused by two factors: natural advantages of services forces and changes in global strategic context. Substantial impacts have also civil and political requirements which necessitate a more precise application of combat power⁵⁸. Joint operations involve series of interoperability problem that relate to four key areas: culture (modus operandi), technology, division of functions and organizational structures⁵⁹.

According to experts, conventional forces always struggled with these problems while Special Forces now reaping benefits of this, that are already inherently joint forces on several levels.

Firstly, special operations are usually multifaceted nature and for this reason require engagement, collaboration and synchronization the Army, Navy and Air elements.

54 D. M. Horner, SAS: Phantoms of War, op. cit., pp. 398–404.

55 Ibid,pp.421.

56 D. Newman, Operation White Star: A UW Operation Against an Insurgency’, Special Warfare, vol. 17, no 4, April 2005, pp. 28–36.

57 M. Noonan, M. R. Lewis, Conquering the Elements: Thoughts on Joint Force Organization, Parameters, fall 2003, pp. 31.

58 Ibid, pp. 33.

59 C. Call, US Army Special Forces Operational Interoperability with the US Army’s Objective Force—the Future of Special Forces Liaison and Coordination Elements, Monograph, School of Advanced Military Studies, US Army Command and General Staff College, Ft Leavenworth, KS, 2003, pp. 8.

Because of that are becoming more interoperable with conventional forces i.e. “mutually provide services in a way allowing effective joint operations”⁶⁰. Interoperability has been achieved through proper education and training system focused on jointness. Special Forces now have extensive experience in planning and executing joint operations in a wide spectrum of conflict. Moreover interact closely with other government agencies (border guards, customs, police and intelligence services), international organizations (UN or NATO), non-governmental organizations and private companies paramilitaries. For more than a decade U.S. special forces have been leading main role in adapting doctrine, education and training system for joint operations requirements.

It happened after 1986 when Congress of United States expressed concern for the position and status of Special Forces within overall United States defense planning. This was result revealed shortcomings and deficiencies of these forces after failed attempt to rescue hostages in Iran in 1979 during Operation Eagle Claw and problems during operation Urgent Fury in Granada in 1983. These concerns led to establishment of U.S. Special Operations Command authorized by an amendment to the Cohen-Numme Authorization Act amendment Department of Defense in 1987⁶¹. This law enabled creation of joint command supervising all special forces, responding directly to Secretary of Defense on budget, equipment, training and doctrinal issues⁶². U.S. Special Operations Command is one of nine “joint combat commands”. As such, it is also responsible for planning, command and control of special operations and ensuring Special Forces support from Geographic Combatant Commander in area of security cooperation⁶³. Currently approximately 49 000 personnel serves under the Special Operations Command. It is divided into three component commands, which constitute majority of Special Forces units such as Army Special Operations Command, Naval Special Warfare Command and Air Force Special Operations Command. There is also one Joint Special Operations Command, which provides an analysis of special operations requirements and compatibility between services forces. Oversees standardization of equipment, develops doctrines and tactics of joint operations, and ensures coordination with conventional forces⁶⁴. Another case is changes in 2003 done by Australian Defense Forces. A new command for special operations was created and approved by Minister of Defense Robert Hill on 5 May 2003⁶⁵. It was response to bombings carried out in Bali in October 2002. In this way intentions of government in improving the ability of Australian Special Forces were confirmed and meet increasing joint capability needs to fight against terrorism. Australian Special Operations Command is truly joint command equal to land, sea, air and combined logistics commands. Commander of Special Operations is in charge directly to Chief of Defense Forces for operations against terrorism and Head of Joint Operations for support of Special Forces for all other operations. Command consists mostly of land special forces units with supporting elements such as organic logistics and air forces. What is more command operates in coordination with other elements of government and liaise with other organizations. Perhaps the best example displaying joint character of Special Forces and their role in wider activities can be operation Iraqi Freedom in 2003. Most experts agree that Special Forces played a major role there. Anthony Cordesman presented analyzes stating that general Franks deployed in Iraq from 9 to 10,000 Special Forces that constituted approximately 8% of total number fighting forces⁶⁶. In Iraq there were present all three service special forces units including previously mentioned special tasks forces, as well as a significant Australia and United Kingdom forces.

The multinational forces were grouped in Combined Forces Special Operations Component Command), which subordinate directly to U.S. Central Command as a Geographic Combatant Command.

60 Ibid, pp. 7.

61 Schoemaker, op. cit., pp. 3.

62 Special Operations Force Posture Statement 2003/04, op. cit., pp. 8–10.

63 A. Feickert, *US Special Operations Forces (SOF): Background and Issues for Congress*, Library of Congress Congressional Research Service (CRS), CRS Report For Congress, 15 August 2003, pp. 3.

64 US Department of Defense Joint Publication 3-05, *Doctrine for Joint Special Operations*, [access 17 December 2013], www.dtic.mil/doctrine/jel/new_pubs/jp3_05.pdf.

65 Minister for Defense Media Release 47/2003, *New Special Operations Command*, 5 May 2003

66 Cordesman, op. cit., pp. 362.

Special Forces units operating in Iraq used doctrine and principles of joint operations on several levels. First it was organization of a combined and joint character, in which partners from different countries have been fully integrated into a single command structure however with their national command elements. Secondly units conducted an independent, autonomous of small-scale operations, such as capturing airfields, coastal protection terminals supplying oil and previously mentioned search for Iraqi leaders. In one of recent work Michael Noonan introduced these “autonomous” operations as a characteristic feature of contemporary action and pointed out that the Special Forces, although small in number, reaching a disproportionately large result in achieving goal. There are three reasons for this: high standard of tasks accomplishment, experience and freedom in conducting such tasks⁶⁷. Thirdly, Special Forces increasingly play role of a key component in operation area collaborating with land and air elements as well with nonmilitary one.

Examples this kinds of cooperation can be: tasksto find a rocket launcher (Scud Hunting) conducted by Australia and UK special forces western Iraq⁶⁸, creation of combat teams, consisting of special forces with small armored elements including tanks, interaction with army units as U.S. 173 Brigade Airborne and 45 British Royal Marine Commando⁶⁹.

Combat operations in Iraq have shown already maturity of joint forces, “for the first time [...] integration enabled conventional forces (air, land, sea) use of Special Forces full capabilities and counter asymmetric threats, while allowing precise targeting in the same space. A similar situation occurred with respect to Special Forces, which used conventional forces to increase scope and enable fulfillment of special tasks. In fact Component Command Joint Forces Special Operations in Iraq at the same timeconducted operations on three fronts, performing tasks with different objectives and specific requirements.

In northern Iraq Special Forces units played supporter role. Main task was to prevent Iraqi units deployed in this region to strengthen defense of Baghdad. In western Iraq special forces supported Air Force component removing SCUD launchers. Whereas in southern Iraq supported coalition land forces allowing them quick approach to Baghdad. So Special Forces acted both as a supporter and supported component, which required a completely new approach in integration of joint forces. In experts and analysts opinion this approach has been successful. It should be expected that as such will probably be considered as a model for future operations⁷⁰.

Special Forces abilities to conduct joint operations led also to specific innovations in their tactics. Probably the most important, yet most successful achievement was integration of Air Force with troops operating on the ground. It consisted in use of number techniques and tactical procedures developed in order to improve Special Forces operations called “Human sensors” for realization of strategic air force tasks. This kind of relationship “sensor with firing” also related use of Air Forces to provide a joint fire support for Special Forces acting as maneuvering forces⁷¹. Americandoctrines concerning joint special operations indicate two tasks (missions) which define scope of Special Forces support to Air Forces i.e. direct actions and special recognize.

Within direct actions tasks Special Forces direct and point defined in targeting process targets at strategic and operational level and then these targets are destroyed by precision guided air missiles. In recognize tasks special forces define nature and specificity of targets, assessment and recognition of area after bombing⁷². Johnny Huster proposes other possible innovative ways of using Special Forces. He says namely that joint forces commander can deploy Special Forces components that would act as a combat weapons system. Huster suggests in the process of targeting to take into account, special forces combat capabilities and consider them as so “Alternative option” intargets neutralization by air or missile Tomahawk means⁷³.

67 Noonan, op. cit., pp. 37.

68 T. Ripley, Iraq’s Western Desert Special Forces Playground, Jane’s Defence Weekly, 9 April 2003.

69 Noonan, op. cit., pp. 31.

70 P. Braganca, Joint Forces Evolution, Military Review, January-February 2004, pp. 50–3.

71 M. Findlay, R. Green, E. Braganca, SOF on the Contemporary Battlefield, Military Review, May–June, 2003, pp. 10.

72 US Department of Defense Joint Publication 3-05.5, Joint Special Operations Targeting and Mission Planning Procedures, 10 August 1993, pp. II-1.

73 J. Hester, Integration of Special Operations Forces into the Joint Targeting Process, US Army Command

However in the opinion of many experts application of this concept is limited by actual capabilities both forces components.

While strike on stationary targets with high precision in case of Air Forces is feasible, however locating and attacks against mobile targets, operating at critical time is still a very difficult task. Of course, use of Special Forces to find and eliminate operational and strategic level targets as part of air operation is nothing new. Many on this subject can be found in William Rosen publications who wrote on use of U.S. Special Forces “behind enemy line”. Both during Vietnam War, as well as in Persian Gulf. Their activities concentrated on searching especially important targets and calling for air strikes⁷⁴. Rosenan emphasizes that in both cases, these turned out to be much less successful than officially considered. The main reason of failure resulted from application by opposing side effective preventive measures. An additional problem was shortage in appropriate technical assets equipment and lack of situational awareness. It should be noted that role of such problems increases considering vast area and difficult terrain⁷⁵. The need for a greater number of so-called human sensors on the ground appeared again during Operation Allied Force - (air operation), directed against Serbia at the end of the 90’s last century. Static targets such as bridges or factories were destroyed by Tomahawk missiles and attacks by air means to destroy or interfere mobile or hiding Serbian forces in Kosovo posed serious problem. Covered support for Kosovar Liberation Army has been provided by United States and Great Britain Special Forces. Some sources indicate relatively small success of the U.S. Air Forces for which land activities targeting were a significant part of hidden support⁷⁶.

It should be emphasized that since Kosovo tactics and technics related to Special Forces and air forces joint operations have developed significantly. This was reflected in operations Enduring Freedom and Iraqi Freedom.

David Sullivan has evaluated method of operations in Afghanistan and commented that “the combination of special and air forces in warfare is a transformation in operational art use of force”⁷⁷. In case of United States beginning of a new synergy may be found in concept of Joint Vision 2010 and precise impact based on effect based precision engagement⁷⁸. Air operations in particular those conducted in Afghanistan shows that U.S. Special Forces and their coalition partners have made significant progress and development in joint operations integration area. Sullivan points out that change in the nature of air operations in Afghanistan and Iraq is a direct result of “technical progress and evolution in joint operations doctrines”⁷⁹. A new approach to operations is mainly based on use precision weapons, provided by air means operating at safe altitudes supported by special force teams which observe and pointed out targets on the ground. These units are equipped with modern optical laser systems, indicating the location, portable computers and various means of communication. In this way Special Forces teams are able to identify targets invisible or undetected by unmanned reconnaissance assets. This fact alone contributes significantly to improving decisive impact of bombing and air strikes in Afghanistan.

Also innovative was tactical coordination, command and control special and air forces. Both targeting and fire support in joint operations are highly complex process. In practitioners and experts opinion are even more challenging due to non-contiguous nature of modern battlefield in particular that in Afghanistan. During Operation Enduring Freedom Special Forces units and headquarters elements were not able to accurately predict deployment and location of enemy groups and mobile targets. This situation meant that operations could not be planned in advance and there was no clearly defined area of operation.

and General Staff College, Ft. Leavenworth KA, 2003, pp. 3.

74 W. Rosenau, Special Operations Forces and Elusive Enemy Ground Targets: Lessons from Vietnam and the Persian Gulf War, RAND Publication MR-1408-AF, RAND Corporation, Arlington, VA, 2001

75 Ibid, pp. 2.

76 A. Cordesman, The Lessons and Non-lessons of the Air and Missile Campaign in Kosovo, Center for Strategic and International Studies, Washington, DC, 1999, pp. 250–6.

77 D. Sullivan, Transforming America’s Military: Integrating Unconventional Ground Forces into Combat Air Operations, US Naval War College, Joint Maritime Operations Department, Newport, RI, 4 February 2002, pp. iv.

78 US Department of Defense, Joint Vision 2010, pp. 21.

79 Ibid, pp. 9.

In order to overcome these problems, already during the operation coalition forces have developed and implemented a number of interesting methods worth mentioning.

First, developed operational design always contained two fundamental elements i.e. task and designated area of operations. Different from the previous one was combat space geometry since operating units were off each other and there was no line of separation. The fire support coordination elements included areas without fire, restricted areas of fire and kill- boxes⁸⁰.

Second in most cases, instead of pre-planning fire support increased use of direct fire control and indicating targets by Special Forces. If distinct teams came into unexpected contact with the enemy could expect immediate direct air support.

Alternatively, they could receive support of directed fire that could observe and adjust accordingly. In fact combat aircraft flying into area of operations, received target's position data only when teams operating on ground reported enemy positions in real time⁸¹. Such method was continued in Operation Iraqi Freedom, where one of Special Forces strategic importance key tasks was search for SCUD missiles and related installations in western Iraq.

They were often mobile and well hidden targets, so destroy them based on specified previously coordinates was possible only if location of targets has been confirmed by Special Forces reconnaissance elements operating in the area⁸². The ability to call for immediate air support meant that Special Forces units could operate in remote areas without support of heavy artillery and other land-based support elements⁸³.

Special Forces capabilities in identifying and destroying enemy command and control C2 SCUD missiles elements were extended by use of joint reconnaissance assets such as aerialunmanned vehicles. These means being at Combined Forces Air Component Commander disposal, routinely operated with Special Forces.

They were used to locate, identify, track and destroy such kind of targets. Video recordings were then transferred to other aircraft platforms such as the AC -130 "Spectra" - providingtargeting information already inengagementphase⁸⁴. Moreover Special Forces teams used widelyBlue-Force system which strongly improved situational awareness and reduced friendly fire. Blue- Force is an automated tracking system that sends coded information every five or ten minutes, identifying units and giving their location in GPS coordinates. Tracking makes full use of Special Forces in the own plans framework. These measures also provide Special Forces teams' continuous communication with other land forces units and most importantly being recognizable by its own air assets⁸⁵.

Unmanned flying assets and Blue-force are excellent examples of growing interdependence special forces from advanced technology. A small team or even one soldier now have access to unprecedented levels of battlefield communications, data exchange intelligence and reconnaissance allowing build up so-called situational awareness.

Network Centric warfare by use advanced technology and proper tactics provides full advantage of information and enables quick and flexible deployment and use of all available means of combat. As for Special Forces they have adopted network-centric warfare with a great enthusiasm, which contributed to the fact that outcome of many special operations is now achieved even at individual soldier level.

There is a misconception that network-centricwarfare is merely a combination of different computer systems. In fact it relies on use both material factors (technical) as well as human resources.

80 S. Jackson, *Tactical Integration of Special Operations and Conventional Forces Command and Control Functions*, monograph, School of Advanced Military Studies, US Army Command and General Staff College, Ft Leavenworth, KS, 2003.

81 Ibid.pp. 11.

82 I. Bostock, *Australian Forces go SCUD Hunting in Western Iraq*, *Jane's Intelligence Review*, 1 July 2003, pp. 87.

83 T. Ripley, *Iraq's Western Desert a Special Forces Playground*, *Jane's Defence Weekly*, 9April 2003, pp. 35.

84 C. Bradley, *Intelligence, Surveillance and Reconnaissance in Support of Operation Iraqi Freedom: Challenges for Rapid Maneuvers and Joint C4ISR Integration and Interoperability*, Joint Military Operation Department, Naval War College, Newport, RI, 9 February 2004.

85 Cordesman, *Lessons of Iraq*, op. cit., pp. 363.

Accurate explanation of network-centric warfare concept is statementsaying that it is “strong relationship concept of warfare and linked military capabilities which includes three joint warfare domains(physical, information and cognitive) in order to generate increased combat power by achieving greater speed in command and increase lethal capability assets,survival opportunities and response to the situation⁸⁶. Another definition propose Alberts, Garstka and Stein who describe network-centric warfare as “[...] a phenomenon that is characterized by ability of geographically dispersed forces to create a high level of sharing combat space awareness which can be used by synchronization and other network-centric operations in order to achieve commanders intents”⁸⁷.

Special Forces embody this vision, as network-centric warfare effectiveness results from the increased sensitivity special forces team to accumulate abilitiesand achievements of the entire “network” therefore enhance overall combat strength and accelerate decision process⁸⁸. In a recent work Greg Gagnon presented results on network-centric warfare research in special forces operations, which proves that it can increase likelihood of victory on three ways: by simplicity and innovation in planning, security, repetition and speed, surprise and adaptability in execution⁸⁹. He observed that both favorable opportunityas well as resources and capabilities can now occur simultaneously, allowing tactical element to achieve strategic aim - situation that was unlikely in industrial period warfare. Most concepts describing network-centric warfare phenomenon and Special Forces capabilities have found practical application in recent operations. It was expressed by common situational awareness, very good connectivity and better utilization of sensor-shooter relationship. United States and coalition special forces operating in Operation Enduring Freedom and Iraqi Freedom, have achieved a high level of success. This success is largely attributed to network-centric warfare abilities. This new concept has become so important that U.S. Special Operations Command believes that it dramatically changes way of carrying out tasks by Special Forces⁹⁰. Network Centric Warfare is expressed in three operational areas: situational awareness, precision fires and increasing operational “transparency” combat space⁹¹.

86 US Department of Defense, Network Centric Warfare: Department of Defense Report to Congress, Department of Defense, Washington, DC,27 July 2001, pp. 3–10.

87 D. Alberts, J. Garstka, F. Stein, Network Centric Warfare: Developing and Leveraging Information Superiority, Command andControl Research Program, Washington, DC, 2000, pp. 88.

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BETWEEN GLOBALIZATION AND REGIONALIZATION – TWO IRREVERSIBLE PROCESSES WITHIN THE FRAMEWORK OF THE PRESENT-DAY INTERNATIONAL SECURITY ENVIRONMENT

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Abstract: *The present paper aims at presenting two irreversible processes within the framework of the present-day international security environment: globalization and regionalization. Globalization must be accepted, it must not be avoided or criticized. The causes and the effects of this phenomenon should be understood. The good aspects should be used without highlighting the destructive ones. The phenomenon of globalization also affects Romania because the sovereignty is limited to the powers of the state. On the one hand, globalization is considered to be a process that is in full progress having a worldwide impact. On the other hand, its content can also suggest an ideology that could signify the “westernization” of the world. This study also lays emphasis upon a case study, Romania, presenting the vulnerabilities, risks and threats to the national security. When talking about national security, the vulnerability to threats represents the minimization or the complete annulment of the ability to deal with a real or potential danger brought to the national security. The present study analyzes the non-military as well as the military risks and threats to the national security trying to offer a perspective on the prevention and fight against the vulnerabilities, risks and threats to the national security. The present paper also renders the opinions on the concept of national security and the case study of Romania, this part being based on a questionnaire applied to a number of 33 subjects. Thus, this work is based on both quantitative and qualitative research methods. At present, Romania has to open itself to what the future holds, but it must not deny its past. Romania must reorganize and repattern its political system for it to be aligned to the new forms of society while the government shapes itself in order to adapt to the newly created society.*

Keywords: *globalization, regionalization, irreversible process, international/ national security*

1. INTRODUCTION

While a world fades away, and another one rises, Romania confronts itself with a series of transformations. During the past century, on one hand, many good things have happened. Romania redefined its national unity, shifted from an agrarian economy to an industrialized one, but on the other hand, other worse things happened, such as: the loss of territories, the communist experience and the participation in the bloody anti-communist revolution. Consequently, it is interesting to underline not only the positive aspects, but also the negative ones, which have contributed to a number of changes in Romania.

2. BETWEEN GLOBALIZATION AND REGIONALIZATION

It can be stated that regionalization defines a consequence, a way of protection against globalization. Regionalization transforms itself into an instrument which can be used in order to overcome the difficulties caused by the small dimensions of the national states.

There are two types of regionalization. The first one is a *hard essence* regionalization, which has the objective of transforming the micro-regions into national state spaces that should co-operate. The second type stands for the *soft* form of regionalization, open to modernization and “westernization” through *soft-power*.

Today Europe can be considered the only region in the world where the process of regionalization is visible as she is described in the revue entitled

Psihosociologia standing for Psychosociology, year V, number 2 (1999:19).

The issue of the frontier permeability is the common element of the two types of regionalization. The main role of the frontier is no longer represented by the traditional one, to protect the territory. The state becomes part of the globalized world, which represents the whole.

On the one hand, the money flows, the information and the culture are transformed into power vectors for those states that know how to produce them and on the other hand, into factors of destabilization if they are viewed as a fatality.

Romania was a country with oil and wheat and now its gross domestic product has a low value. In 2001, the level of its industrial production represented only 60% of the production registered in 1989 and Romanian politicians search for solutions to fix and stabilize the economy. It can be stated that the phenomenon of globalization has taken Romania by surprise without being prepared for it. At present, Romania is a state that struggles to make the transition from the economy on demand to that of free market (Chirovici, 2001:115-119).

In the case of Romania, the globalization process can have two kinds of consequences: the positive and the negative effects. The former type of consequences, namely the positive ones, refers to the fact that Romania needs a foreign fund of investment in order to grow. Romania cannot produce this capital only from internal resources. But we all have to agree on the fact that Romania is a state of economic opportunities: from tourism to the oil industry. There are also some economic forces and companies that could play an important regional or international role. The latter type of consequences, namely the negative ones, refers to the risks of the globalization process: the open economy will absorb the external shock with higher difficulty; the security will diminish especially in the capital city, consequently the organized crime could arise. Romania has changed its position from the status of a country perceived as a bridge for smuggling drugs to that of a consuming country and finally to a producing one.

Thus, it is harder and harder for the security structures to deal with the modern challenges and defiances: the financial “infiltrations”, money laundering, the cruel redistribution of income, the massive corruption, which is hard to imagine among the white-collar workers. In Romania, one can speak rather about a Hispanic-American type of income dispersion than a European type (Chirovici, 2001:121). Although Romania cannot be considered one of the powerful states, it has the potential to become an influent one. Our national identity is not permanent and this issue must be accepted.

If Romania adapts to the world, which is continuously changing, then its future will definitely be secured on a long term basis. We must recognize and accept the fact that the 21st century nation-state will no longer have the features we all have been used to (Lupu, 2001). When a certain form of sovereignty disappears, a new kind of social settlement arises. Actually, this new structure incorporates at the same time the international and national sides.

3. VULNERABILITIES, RISKS AND THREATS TO ROMANIA’S NATIONAL SECURITY

In the late 20th century and the early 21st century, the world is marked by contradictions and ambiguities. Thus, a more complex and heterogeneous world comes into being.

The present-day security environment lies under the sign of severe transformations, while concepts, such as: dysfunction, vulnerability, risk, threat and danger, are frequently used.

The national doctrine for security information introduces the concept of aggression. All these notions are also presented and analyzed by Ion Bidu (2004).

Regarding security, dysfunction can mean a slight transformation in the balance of a certain subsystem resulted from a lack of correctness in legislature by an unappropriate application of a normative act.

The national doctrine of security information approaches the vulnerability as a phenomenon belonging to the internal life of a national community, which minimizes society’s capacity of reaction to the external threats with consequences in the field of homeland security.

The threat is defined as a hint that predicts a future danger, the action of being a danger to someone or something or as a paradigm foreseeing something bad.

The threat represents the manifestation of any intention which could shape a possible danger. Nevertheless, this danger can jeopardize the economy of the state, the constitutional order, the fundamental rights and liberties of people.

The concept of danger refers to any situation that could jeopardize either the existence or the integrity of a person. In other words, the danger is the result of a threat that has already taken place, or is to happen in the future.

In the context of national security, the aggression is defined as a violent or non-violent action, which can occur through armed, psychological or informational means. It is based on the strategy of a certain entity – states or centers of power – against the interests of national security.

A risk represents the possibility of reaching a point when something jeopardizing could take place. The risks to which the national security can be exposed to are those circumstances in which threats are encouraged, becoming a reality. As a consequence, this issue affects the balance in a democratic society.

According to Ulrich Beck, the father of the risk society theory, the risk is a systematic way of managing events that are exposed to imminent danger and of the insecurity which is the result of the modernization (1992:10).

The risk factors to national security must be searched for not only in the interior and exterior of a country, but also at the social, economic, political, military, informational and ecological levels.

4. NON-MILITARY RISKS AND THREATS TO THE NATIONAL SECURITY OF ROMANIA

The non-military risks to the national security of Romania can be of economic, political, social, cultural, ecological, technological, ethnic or religious nature.

The economic risks are felt by all people because they have a great impact on the individual's security. By becoming part of the European Union, on the one hand, the Romanian companies have started to explore new possibilities, which can also involve some risks, especially for those companies that were not familiar with high rates of market competition.

The economic risks that can influence the national security can be on the one hand, internal risks and vulnerabilities and, on the other hand, external risks. Among the main internal economic risks and vulnerabilities, we can mention: the depreciation of the national currency, the property uncertainty, the sudden increase of the underground economy, the lack of reliability in the banking system. The external risks include the economic globalization against a national background incapable of repatterning controversial regionalization.

The lack of a national economic strategy and the impossibility for the financial system to align to the new market requirements could represent some of the main factors of economic risks having a great impact on the economic security of the state.

As for the political risks, it should be mentioned that these can also be internal and external. Among the internal political risks, it is worth to mention the political instability, the failure to correctly apply the democratic laws, the authority crisis in the power institutions. At least a few external political risks should be highlighted: the repatterning of the spheres of influence, external pressures on the minorities' issue, territorial claims made by powers from our own area of strategic interest, geopolitical reorganizations different from those imposed by the European integration.

The fight for power and the lack of morality in politics could be considered the main political risks. But it should be mentioned that this situation is a characteristic feature of the entire world, not only of Romania.

All the previously mentioned issues have made it possible for Romania to make a transition from an authoritarian regime to a democratic one.

The internal social risks are the following ones: the degradation of citizens' health and socio-professional status, the social unreliability, unemployment, poverty, the *brain drain*. The external social risks are those related to the globalization of poverty, the lack of demographic consolidation in the Balkan region as well as the Romanians' immigration in the West.

Another category of risks is that of the internal cultural ones among which we should mention the decadence of the national educational system, the devaluation of the national values, the aggressive multiculturalism. The external cultural risks refer to cultural pressures, the replacement of values with non-values, the cultural globalization, the increase of subculture, non-culture and anti-culture.

The ecological risks can be divided into internal ones, such as: the environmental degradation, natural hazards, ecological accidents and into external risks, such as: the toxic waste deposited on the Romanian territory, the natural calamities registered in countries situated in the vicinity of Romania.

The internal technological risks include the degradation of the technological heritage or the incapacity of producing modern technology, whereas the external risks refer to the limitation of the access to modern technology and the increase in the price of modern technological equipment.

Among the internal ethnic risks, we can underline the pressure exerted by some ethnic groups and the issue of the autonomous regions established according to ethnic criteria.

Among the external ethnic risks, we can highlight the pressure of certain groups exerted on behalf of some organizations or communities in order to federalize the country or to give autonomy to ethnic territories.

Concerning the religious risks, we can state that in Romania the majority of population is Orthodox, and the Romanians' belief in God is very powerful. Also, we can add that the internal religious risks are not significant, but there are some actions against some of the Church figures. Definitely, there are some tensions between the Greek-Catholic Church and the Orthodox one in terms of heritage. There is a fierce fight against the religious sects as well as against religious extremism.

The national security of a state can be consolidated either by diminishing the vulnerabilities or by preventing and reducing its threats (Chețe & Ciobanu, 2004:30). Thus, the national security strategy should orient itself to the reduction of the state's internal vulnerabilities or to a minimization of the external threats.

5. MILITARY RISKS AND THREATS TO THE NATIONAL SECURITY OF ROMANIA

At present, the European Union is no longer threatened by classical conflicts or symmetric ones, but it is confronted with asymmetric ones. Likewise, Romania as a component part of the European Union, could face, at a certain moment, a situation in which it could feel threatened by asymmetric conflicts.

The most important military threats are international terrorism, the proliferation of the weapons of mass-destruction, the regional conflicts as well as the organized transnational crime.

The 9/11 terrorist attacks, registered in the United States of America as well as other similar actions that took place in Europe and other regions all over the world, can stand as proof for the fact that terrorism is one of the most severe threats to the people's freedom, to democracy and to other fundamental rights and values, which constitute the fundamentals on which a democratic community can be based.

The international terrorist networks can cause massive casualties. Due to the access to all kinds of weapons of mass destruction, the effects could become devastating.

The vulnerability of all the states in front of such a real danger is highlighted by the open character of democratic states as well as by the complex and contradictory way in which the process of globalization manifests itself.

There are two very important measures that must be taken: namely, the annihilation of international terrorism as well as the co-operation of the democratic forces.

As Lucian Stăncilă considered, terrorism itself cannot change the political will of a nation, but, it rather creates a state of insecurity, a sort of "psychosis" which, subsequently, tends to be eliminated by the public opinion (2004:63).

The proliferation of the nuclear, chemical, biological and radioactive weapons stands for a very serious threat and the access to such weapons can be easily obtained.

Even if some states possess all these kinds of weapons and develop new combat types, they might face the risk of collapse. Thus, the black market for such weapons flourishes rapidly.

Although the European continent seems to be a safe place, the strategic area in which Romania is located is threatened by local conflicts, which diminish the regional and European stability and security.

Generally speaking, the inter-ethnic or religious conflicts represent an important threat to the regional security. Many of such conflicts in the vicinity of Romania magnify the violence, causing poverty and insecurity.

Organized crime can be perceived as an expression of the sudden increase of negative phenomena. It has intensified due to the process of globalization and the inefficient management of political, economic and social transformations that have taken place after the collapse of the communist regimes in Eastern, South-Eastern and Central Europe.

In this context, the strategic interest space in which Romania is situated has become both an area of transit and destination for a wide range of illegal activities, such as: the illegal trafficking of weapons, drugs and human beings as well as money laundering.

The local conflicts are those favoring such activities, which, in their turn, might favor terrorism and the proliferation of the weapons of mass destruction.

6. ROMANIA'S VULNERABILITIES

Still having a not so powerful economy as well as a not very easy transition towards democracy, Romania widens its uncertainty area to the terrorist attacks. According to Mircea Mureșan and Gheorghe Văduva (2004:475), these vulnerabilities cover the entire Romanian territory, some of the most important ones being the political, diplomatic, economic and military vulnerabilities.

Among the political vulnerabilities we can mention the massive corruption in the political branch, the fight for power, the political behavior of opportunity, the lack of ethics as well as the lack of experience.

Also, there should be mentioned diplomatic vulnerabilities, such as: the breakthrough of elements lacking diplomatic abilities as well as the creation of new situations of uncertainty.

The economic vulnerabilities are numerous and this category consists of the proliferation of underground economy, the support of certain international terrorist groups as well as the vulnerability of the banking system in Romania.

Last but not least, there must be underlined the military vulnerabilities, which refer to the Romanian military structures that are on a mission outside the Romanian territory, the insufficiently securized strength on the shooting grounds.

Likewise, the civil-military relations that describe the relationship between the civil society as a whole and the military organizations established to protect it as well as the computer-aided systems are easily penetrable due to the fact that they are harder to securize.

Romania could be exposed to global terrorism, to the crime-based terrorism, which is adjacent to mafia networks, to the mobsters' nets as well as to drug smugglers and human traffickers, to the psychopatic and fortuitous terrorism.

States should build up some protection structures in order to fight against terrorism. As for Romania, the solution could come from the Special Forces or other structures specific to the Romanian armed forces.

Some actions of the Special Forces are small-scale and short-lasting strikes, decisive and fast operations, which aim at destroying certain objectives and marking certain targets that eventually will be hit by aviation or other types of weapons (Bădălan & Frunzeti, 2004:227-228).

Romania takes part in the *war on terror*. Thus, the potential terrorist attacks on Romania might integrate themselves within the framework of a larger concept motivated only by belligerence.

7. THE PREVENTION AND FIGHT AGAINST THE VULNERABILITIES, RISKS AND THREATS TO ROMANIA'S NATIONAL SECURITY

One of Romania's priorities is represented by the way in which the national security is assured. In this respect, two major dimensions should be taken into consideration.

The first major dimension refers to the intensification of the internal co-operation among the institutions which have assignments in the field and the development of specific ways and means of action.

The second major dimension refers to the permanent co-operation with the international structures and institutions specialized in the fight against the large scale risks and threats.

The co-ordination of the national actions in the field of security is based on a set of laws, rules, regulations and fundamental documents, which stipulate the main ways and means of action: the *Romanian Constitution*, the *Strategy of National Security*, the *Military Strategy*, *The White Paper on Security and Defense* etc. The Romanian Law is adjusted so that it should defend the national interests and strengthen the homeland security.

The new risks and threats to the national security of Romania have determined changes in the structure and functioning of the main institutions, which have been repatterned in order to be able to respond to the new challenges and to the asymmetric vulnerabilities, risks and threats.

Romania has set a series of measures to fight against the risks and threats in fields, such as: foreign policy, finance, economy, national security and national defense.

In the field of foreign policy, Romania has taken measures, such as: the participation in international missions under the auspices of NATO in order to fight against terrorism, the development of new relations with the EU member states, the development of a Strategic Partnership with the United States of America, the involvement in achieving a European Identity of Security and Defense, the support of the European dimension - referring to all the European countries - specific to the Organization for Security and Co-operation in Europe as a forum for dialogue in the field of security, the participation in peace operations initiated by the United Nations, the promotion of a certain politics and policy at the international level in order to assure the security in South-Eastern Europe, South Caucasus as well as the Danube and Black Sea region.

Among the measures initiated by Romania in the economic and financial areas, there should be highlighted the economic and financial system based on a market economy, the correlation of the national economic policy with the European Economic and Monetary Union, the harmonization of the economic and financial regulations as well as tax policy with the European laws and rules and the EU requirements.

Romania has also taken a series of important measures in the national security and public order areas. These specific actions regard the prevention and fight against the organized crime, the citizens' protection as well as the protection of both the private and public property.

In order to achieve such objectives, there are required several ways and means of action, such as: an efficient system to protect the classified information at the same time respecting the citizens' right to be informed as well as the intensification of the fight against massive corruption and organized crime.

In the national defense area, Romania has taken a series of significant measures, such as: the process of repatterning the Romanian armed forces by creating an army capable to carry out a wider range of missions.

The main measures deal with the modern operational instruments turning Romania into an actively involved state in the NATO's missions and in military operations designed to build and maintain peace, to strengthen the stability and security in Central and South-Eastern Europe, to offer humanitarian assistance.

Romania's *National Security Strategy* consists of the assessment of the international security environment, the identification of both national and international risk factors, the national objectives and interests in the field of national security.

On a long-term basis, Romania's *National Security Strategy* contains the evaluation of the resources allotted to defense in order to achieve the objectives of the main institutions involved in the national security and defense.

Romania's *National Security Strategy* is the fundamental document on which the defense planning at national level is based.

Romania's *Security and Defense White Paper* establishes the objectives and responsibilities of the main institutions involved in national security, the actions and measures that can be taken as well as the natural, human and financial resources, which can be allotted annually in order to create and prepare the forces participating in the national defense. This document is important for the Romanian military strategy.

By its content and developed issues, the present Romanian Military Strategy reveals, from a realistic perspective, the multifarious manifestations from the field specific to the promotion and protection of the fundamental national interests (Bădălan, Berdilă & Bogdan, 2009:185).

The Romanian Military Strategy establishes and depicts the security environment, the risks, national military objectives, strategic principles and concepts, strategic missions, the structure of the armed forces, logistics, resources and many other aspects.

Romania plays a new role, that of a state situated at the east border of the Alliance, a location which makes possible the opening of new important strategic orientations and directions.

Romania and the Romanian armed forces share the common interests of the Alliance. Romania turns into a sort of vector projecting the democratic values eastwards.

8. OPINIONS ON THE CASE STUDY OF ROMANIA AND THE CONCEPT OF NATIONAL SECURITY

8.1 The Questionnaire. In order to find out the opinions of the young people living in the present-day Romania on the concept of national security and the case study of Romania, I suggest the following questionnaire consisting of a set of 10 questions.

Q1. In your opinion, how should we understand the phenomenon of globalization in the case of Romania, which is considered to be a small country, in order to make the clear-cut distinction between the winners and the defeated?

- a. it should be accepted; it should neither be avoided, nor contested;
- b. its causes should be understood;
- c. its effects should be understood;
- d. one should act in the sense of *aikido*: we should take advantage from its power and we should not let it crush and defeat us.

Q2. In the case of Romania, what is, in your opinion, the greatest modern defiance to national security?

- a. massive corruption;
- b. money laundering;
- c. the cruel redistribution of income;
- d. financial "infiltrations".

Q3. Where should we search for the factors of risk to the national security of Romania?

- a. within the framework of the country;
- b. outside the country's limits;
- c. at the social, economic, political, military and informational levels;
- d. both inside the country and outside it as well as at the social, economic, political and military levels.

Q4. What do you think is the greatest internal political risk in the case of Romania?

- a. political instability;
- b. failure to correctly apply the democratic laws;
- c. the crisis of authority related to the institutions of power;
- d. the unclear definition of the national interest.

Q5. What is, in your opinion, the most serious internal social risk in the case of Romania?

- a. the degradation of the health status;
- b. the degradation of the citizens' social and professional condition;
- c. social incertitude;
- d. the phenomenon of *brain drain*.

Q6. To what type of terrorism do you think that is exposed today's Romania?

- a. to global terrorism;
- b. to the crime-based terrorism which is adjacent to mafia networks as well as to drug and human traffickers;
- c. to psychopathic terrorism;
- d. to fortuitous terrorism.

Q7. What is, in your opinion, the most important measure initiated by Romania in the field of foreign policy?

- a. its participation in international missions under the auspices of NATO in order to fight against terrorism;
- b. its participation in the process of achieving the European Identity of Security and Defense;
- c. its support of the European dimension, referring to all the European countries, specific to the Organization for Security and Co-operation in Europe as a forum for dialogue in the field of security;
- d. the promotion of a certain politics and policy at the international level in order to assure the security in South-Eastern Europe, South Caucasus as well as the Danube and Black Sea region.

Q8. According to you, what should today's Romania do?

- a. to open to the future;
- b. not to deny its past;
- c. to repattern its political system;
- d. to adjust its governing to the new type of society.

Q9. In the context of globalization and regionalization, which are considered to be irreversible processes marking the present-day international security environment, how should we behave? What should we do?

- a. to hate each other and treat each other as enemies;
- b. to ignore each other;
- c. to find out if we want to search for our faults in order to strengthen our own stereotypes;
- d. to know each other better, to tolerate each other and to live together peacefully.

Q10. In your opinion, what is a globalized world like?

- a. an integrated and harmonious world;
- b. an integrated world, but not necessarily an integrated one;
- c. a world that can be reduced to a unique parameter – the globalization of insecurity;
- d. a unique place, but at the same time a diverse one.

8.2 The Subjects of the Questionnaire. The previously presented questionnaire has been distributed to a number of 33 subjects aged in between 19 and 23. It is worth to mention the sex of the subjects: out of the 33 subjects, 12 are male subjects representing 36.36% and 21 are female subjects standing for 63.63%. Regarding the subjects' nationality, we confront ourselves with unity in diversity. Out of the 33 students, one student has Venezuelan nationality – 3.03%, another subject has German nationality (Hungarian and Czech) according to that particular subject's statement – 3.03%, 2 subjects have Hungarian nationality – 6.06% and 29 are of Romanian nationality – 87.87%. All in all, except for the fact that all the subjects are students within the framework of the Cultural Studies program at *TRANSILVANIA* University of Brasov – Romania and all of them live in an urban area, we can say that we deal with the phenomenon of *diversity in unity* due to the various religious backgrounds and nationalities registered in this study based on 33 subjects or *unity in diversity* as although they belong to different categories, they are united within the framework of an academic environment, which offers them the same chances irrespective of sex, nationality or religion.

9. INTERPRETATION OF THE DATA ON THE CASE STUDY OF ROMANIA AND THE CONCEPT OF NATIONAL SECURITY

The present set of ten questions is centered on the case study of Romania and on the concept of national security.

The 1st question is centered on the way in which the phenomenon of globalization is understood and interpreted in the case of Romania, which is considered to be a small country, in order to make a clear-cut distinction between the winners and the defeated.

Out of the 33 respondents, 3 subjects (9.09%) have chosen variant a) considering that the phenomenon of globalization in the case of Romania should be accepted, it should neither be avoided, nor contested.

Out of the 33 subjects, 5 subjects (15.15%) have selected variant b) thinking that the causes of globalization should be understood and 2 subjects (6.06%) have chosen variant c) considering that the effects of globalization should be understood.

Most of the subjects, that is 23 (69.69%) out of 33, have selected variant d) considering that one should act in the sense of *aikido*: that is, we should take advantage from the power of the phenomenon of globalization and we should not let it crush and defeat us.

Concerning the 2nd question, "In the case of Romania, what is, in your opinion, the greatest modern defiance to national security?", there have been registered interesting answers.

Out of the 33 respondents, 32 subjects (96.96%) have chosen variant a) according to which the massive corruption represents the greatest modern defiance to the national security of Romania.

No subject (0%) has selected variant b), that is, money laundering, only one subject (3.03%) has chosen variant c), namely, the cruel redistribution of income as the greatest defiance to national security and again no subject (0%) has chosen variant d) standing for the financial "infiltrations".

The 3rd question, "Where should we search for the factors of risk to the national security of Romania?", has been differently interpreted by the various respondents.

Among the respondents, 6 subjects (18.18%) have chosen variant a) considering that the factors of risk to the national security of Romania should be sought within the framework of the country.

In the opinion of one respondent (3.03%), these factors of risk should be sought outside the country's limits, thus, outside Romania.

According to 7 subjects (21.21%), the factors of risk to the national security of Romania should be searched for at the social, economic, political, military and informational levels.

Most respondents, that is, 19 subjects (57.57%) consider that these factors of risk to Romania's security should be looked for both inside the country and outside it as well as at the social, economic, political and military levels in accordance with answer d).

The 4th question is centered on the greatest internal political risk in the case of Romania.

This internal political risk has been associated with the political instability by 13 subjects (39.39%) who have chosen variant a), with the failure to correctly apply the democratic laws by 12 subjects (36.36%) who have selected variant b), with the crisis of authority related to the institutions of power by 5 subjects (15.15%) who have chosen variant c) and with the unclear definition of the national interest by 3 subjects (9.09%) who have selected variant d).

The 5th question deals with the most serious internal social risk in the case of Romania, the 33 respondents perceiving differently this issue.

Out of the 33 respondents, 5 subjects (15.15%) associate this main internal social risk in Romania with the degradation of the health status represented by variant a), 16 subjects (48.48%) with variant b), that is, the degradation of the citizens' social and professional condition, 10 subjects (30.30%) with variant c), namely, with social uncertainty and 2 subjects (6.06%) with variant d), with the phenomenon of *brain drain*.

The 6th question refers to the type of terrorism to which Romania is exposed at present being registered a multitude of perspectives in this particular case.

According to 3 subjects (9.09%), today's Romania is exposed to global terrorism identified with answer a) and according to 25 subjects (75.75%), it is exposed to the crime-based terrorism, which is adjacent to mafia networks as well as to drug and human traffickers, represented by answer b).

One subject (3.03%) considers that our country is exposed to the psychopathic terrorism according to answer c) and the opinion of 4 subjects (12.12%) is that Romania is exposed to fortuitous terrorism according to variant d).

The 7th question, "What is, in your opinion, the most important measure initiated by Romania in the field of foreign policy?", has registered interesting answers.

According to 13 subjects (39.39%), variant a) is the most appropriate one, namely, Romania's participation in international missions under the auspices of NATO in order to fight against terrorism is perceived as the most important measure initiated in the field of foreign policy.

There are 7 subjects (21.21%) considering that variant b), that is, Romania's participation in the process of achieving the European Identity of Security and Defense, can be viewed as the best foreign policy measure that has been initiated by our country.

According to 2 subjects (6.06%), variant c) is the best answer, namely, Romania's tendency to support the European dimension, referring to all the European countries, specific to the Organization for Security and Co-operation in Europe as a forum for dialogue in the field of security. This can be perceived as the most important foreign policy measure.

There are 11 subjects (33.33%) considering that this foreign policy measure consists in promoting a certain politics and policy at the international level in order to assure the security in the South-Eastern Europe, South Caucasus as well as in the Danube and Black Sea region, thus choosing variant d) as the best possible answer.

Concerning the 8th question, "According to you, what should today's Romania do?", there have been registered multifarious answers.

In the opinion of 4 subjects (12.12%), Romania should open to the future as it is suggested in answer a), 2 subjects (6.06%) considered that our country should not deny its past according to variant b), 23 subjects (69.69%) have chosen variant c) according to which Romania should repattern its political system and 4 subjects (12.12%) have selected variant d) thinking that Romania should adjust its governing to the new type of society.

The 9th question has been the following one: "In the context of globalization and regionalization, which are considered to be irreversible processes, marking the present-day international security environment, how should we behave? What should we do?"

No subject (0%) has considered that we should hate each other and treat each other as enemies as it has been suggested in variant a).

One respondent (3.03%) thought that the solution could be that of ignoring each other as it has been suggested by answer b).

According to 5 subjects (15.15%) who have chosen variant c), we should find out if we want to search for our faults and strengthen our stereotypes.

There have been 27 subjects (81.81%) who have considered that we should know each other better, we should tolerate each other and live together peacefully.

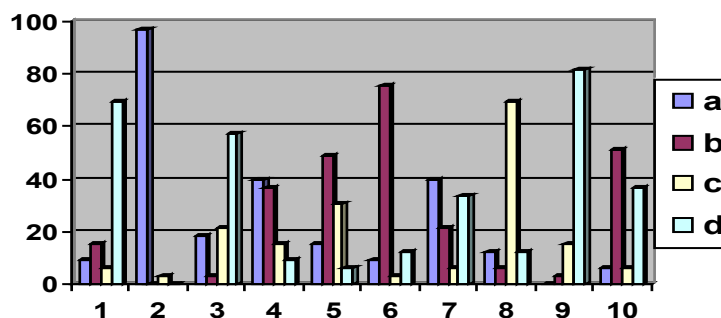
The last question, the 10th one, "In your opinion, what is a globalized world like?" has the role of drawing a conclusion.

According to 2 subjects (6.06%), a globalized world is an integrated and harmonious world as it has been suggested by variant a).

There are 17 subjects (51.51%) who think that such a world is an integrated world, but not necessarily a harmonious one.

Answer c) has been chosen by 2 respondents (6.06%) who view a globalized world as a world that can be reduced to a unique parameter – the globalization of insecurity.

Other 12 respondents (36.36%) have selected answer d) according to which a globalized world stands for a unique place, but at the same time a diverse one being characterized by multifarious aspects, which are interwoven, thus giving its uniqueness and diversity.



As it can be seen in the Figure above, there have existed only three cases representing three answers that have not been chosen by the respondents.

The first case as well as the second one refer to the same question, the 2nd one. No one has chosen either answer b) or answer d). Thus, it results that in Romania's case, the greatest modern defiance to national security is neither money laundering, nor financial "infiltrations".

The third case refers to the 9th question. Nobody has chosen answer a). Hence, in the context of globalization and regionalization, which are considered to be irreversible processes marking the present-day international security environment, we should not hate each other and treat each other as enemies, but on the contrary, we should tolerate each other and live together peacefully.

CONCLUSIONS

At present, we live in a multicultural and multiethnic world and this thing must be understood, recognized and accepted.

Globalization and regionalization are irreversible processes and within the framework of the international security environment, all that remains for us to do is to know each other better, to tolerate each other and to live together peacefully.

As Mihai Hotea considers, ignorance represents the main cause for 99% of the conflicts registered all over the world (2005:84).

We live within the framework of different cultures, different civilizations and religions and that is why we should find out if we want to search for our faults in order to strengthen our stereotypes or we are willing to look for and find common points.

The world is deprived of stability although it has important values and landmarks. The evil spreads all over the world. And it is not the state of security that dominates the world, it is not peace that overwhelms the world, but, unfortunately, it is the state of insecurity and fear that is dominant.

Even if, after two world wars and a cold war, the world has suffered a lot being redimensioned, no one could ever deny the fact that the continuous effort to build a new viable national and international security environment is beneficial for all of us.

The highly technological progress creates certain threats to security. The enemy can be annihilated only by founding new institutions and structures that are able to act asymmetrically. Thus, we assist at a repatterning of a new world order.

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THE OPERATIONAL COMPONENTS OF THE DEFENSE, NATIONAL SECURITY, AND PUBLIC ORDER INTEGRATED SYSTEM

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Abstract: *The operational components of the defense, national security and public order integrated system are evaluated by the indicators of their performance. The performance of such a system determines its level of operational or its operating level. The system's high degree of efficiency is given mainly by the professionalism of the human resources and the availability of equipment and performance materials which can provide integration of the system's components. In this article we present some details on the operational components of the defense, national security and public order integrated system that ensure its proper functioning in complex situations caused by the manifestation of crimes, crisis or conflicts, with serious implications for national security.*

Keywords: *organized crime; national security; C4I2SR integrated system; standard operating procedures; preventive action; cross-border threats.*

INTRODUCTION

This short study looks at the operational components of the defense, national security, and public order integrated system attempting to analyze their reaction capacity in different situations generated by cross-border criminal activities. Our research intends to identify and lay out the operational requirements that facilitate the proper functioning of the system's components such as: the command and control, execution, and support.

1. THE COMMAND AND CONTROL COMPONENT

The command and control component is defined in the military literature as the institutional structure which provides the integration of specific actions through planning, organization, coordination, control, and evaluation conducted at all levels. [1]

The command and control component consists of the personnel, communication equipment and networks, standard operating procedures, command posts, and key infrastructure used to coordinate the fight against cross-border criminal activities.

The personnel who works in the command and control components must adhere to the following operational standards: a high level of personal training, especially for those who are employed in the decision, intelligence, operations, communications, and human resources centers; a deep understanding and correct employment of the EU and NATO standard operating procedures for crisis management; promote cooperation in order to perform mission analysis, situation estimate, decision making, and concept of the operation production; high adaptability and ability to cope with unforeseen situations in order to update the orders required in crisis management; a thorough understanding of the orders/plans production process, based on the leadership assignment held; deep knowledge of the command and control posts operating procedures; self-learning ability through participation in academic training sessions and complex practical exercises;

the degree of interoperability between the national leadership and the ones of the EU and NATO members states, at all levels.

It is very important to note that meeting these operational requirements by the leadership will ensure decision superiority in combating cross-border criminal activities. The communication equipment provides the required networks and links among all the components of the national security integrated system.

The operational requirements of the communications systems are: provide continuous communications between all the components, at the strategic, operational, and tactical levels; acquiring and fielding all the components with high performance C4I2SR systems; timely synchronization and integration of the C4I2SR systems in the decision making process; improving the information management process in order to facilitate decision making; employ early warning systems in order to signal any unconventional incident; developing cross-border cooperation networks within EU and NATO.

By meeting these operational requirements the communication systems will facilitate both decision making process and the conduct of operations in the field. [2]

Standard Operating Procedures must meet the following operational requirements: to fill in the national database with information required to plan, organize, coordinate, control, evaluate, and execute the actions required to combat the cross-border organized crime; to be produced for every level of leadership; to include specifications for orders, information reports, and other documents required for that component; to include collaboration procedures among command, execution, and support components, at all levels; to follow the EU and NATO operational planning process steps; to ensure interoperability both at decision and execution levels.

Given the above, we consider that the standard operating procedures provide the theoretical and methodological support required by to ensure the proper functioning of the command, execution, and support components. The command and control posts have to meet the following operational requirements: provide planning and rest facilities for the personnel; provide a classified materiel handling point; employ communication systems and computers operators; ensure security, protection, and support teams for the command post; write and rehears the command post defense plan; provide command post duty personnel; establish the parking lot and the proper operating procedures; enforce access control and procedures in and out of the command posts.

We want to emphasize the importance of the command posts. These are the infrastructure elements which provide facilities for the leadership required to ensure decision making and orders production. These facilities have to ensure the application of standard operation procedures for handling sensitive information, work compatimentalization, and securing the communication networks in order to push orders to subordinate units and coordinate ongoing operations. These facilities consist of: buildings, communication systems, vehicles, equipments, and materials required by the leadership. Also, they must be included in the development plans in order to ensure the proper functioning of the command components. Constant improvements of the command posts infrastructure will facilitate decision making and execution of operations to combat cross-border criminal activities.

2. THE EXECUTION COMPONENT

The execution component consists of the intervention organizations which transform decisions into actions. The operational requirements of the intervention organizations require the existence of the capabilities to perform the full spectrum of operations in the border areas, cross-border, and on national territory in order to counter the organized crime threat. [3]

In this respect, the most important operational requirements for the execution component are: the capacity to collect and disseminate relevant information from the hostile areas to the command components, using both human and technical sources; the capability to conduct synchronized operations in the border areas in order to control and survey the border-crossing;

the ability to increase cooperation in the rear areas between the intervention organizations in order to identify and prosecute criminal activities to provide security for local communities and citizens; providing adequate equipment and resources needed to conduct successful operations against criminal groups; existence of specialized organizations to counter the psychological operations conducted by the criminal groups and also, to provide correct and timely information for the citizens; develop and rehearse cooperation procedures between the Ministry of Interior, Public Ministry, and Ministry of Defense units to facilitate proper interventions across the full operational continuum; develop common training plans to ensure participation of all the execution components of the national security integrated system.

All of the above requirements ensure proper, timely, and effective intervention of the execution components when demanded by the decision makers.

3. THE SUPPORT COMPONENT

The support component uses specific methods, procedures, and tactics to support command and execution components during all stages of the operations to counter cross-border criminal activities. Therefore, we consider that the support component has to adhere to the following operational requirements: to be included in all the organizations in order to ensure operational independence; to ensure the required facilities to provide transportation, evacuation, and maintenance of the equipment and materials; to ensure proper medical facilities in order to provide medical support for the personnel; to provide the necessary facilities required for work, relaxation, and rest.

The identified operational requirements ensure proper functioning of all the components of the national security integrated system to counter cross-border criminal activities.

Preventive actions consist of information, evaluation, prognosis, and identification activities.

Information activities consist of: surveillance, observation, search, and identification of criminal individuals, groups, and networks; identification of criminal groups key infrastructure and resources; identification of key terrain points used by criminal groups; identification of types of crimes committed by criminal groups and also, their dynamics and evolution over time.

The national intelligence agencies will conduct these operations in cooperation with border police, national agencies of the other states from the area of interest of Romania, and EU agencies. The importance of these agencies is very high because they provide the information about this complex phenomena which is rising in intensity and influence on national security. It is also very important to connect the intelligence agencies with the communication systems in order to provide timely intelligence for command and execution components.

Evaluation and prognosis activities consist of: estimation of numbers, size, potential, and dynamics of the cross-border criminal groups; estimation of the affected areas and countries, and also the possible evolution of this phenomena in space and time; prognosis and identification of the causes which can transform criminal activities into actual crisis or conflicts; estimation of the resources available for criminal networks, their employment within the border areas; identification of local hot spots which contribute to the increase of the cross-border criminal activities.

Evaluation and prognosis of the cross-border criminal activities are key actions in the process of prevention of this phenomena. As a result, we estimate that without a viable prognosis there cannot be any preventive action.

Also, without a proper evaluation of the criminal factors there cannot be any effective planning and execution. Furthermore, we consider that evaluation and prognosis go beyond prevention. They generate the conditions required to effectively counter cross-border criminal activities.

Analysis and identification activities consist of: analysis and identification of types of criminal activities within the operational environment; identification and knowledge of networks, key points, and other organizational structures of the cross-border criminal groups; identification of the center of gravity, key points, and high intensity areas for the criminal activities;

identification and analysis of the operating modus of criminal networks in order to predict the evolution of their activities; identification of connections between different types of criminal activities, especially with terrorism and corruption; identification of the resources available for the criminal networks.

The activities of analysis and identification are key factors which support decision at all levels. Besides the existing databases, constant analysis and identification of the criminal activities factors represent a top priority for the specialized components of the system in order to provide situational awareness and decide on a course of action.

Cross-border criminal activities counter operations consist of activities and actions which have a big impact on causes which generate such phenomena, on actions of criminal networks, and on outcomes.

Activities which impact on causes consist of: political and diplomatic preventive actions; creation and application of economic and social measures designed to reduce inequality among people; identification and analysis of possible causes of the cross-border criminal activities; activities of assessing, preventing, monitoring, and reducing the impact of causes generated by the organized crime groups; activities of informing, investigating, assessing, preventing, and eliminating the causes and impact of criminal activities on citizens and local communities.

Actions which impact on networks and infrastructure of the cross-border criminal groups consist of: identification, localization, and disruption of resources along with annihilation of causes of criminal activities; identification, localization, and annihilation of criminal groups along with reporting the data to the neighbouring countries and EU agencies;

identification, localization, and annihilation of computer and communication networks used by criminal groups along with reporting the data to the neighbouring countries and EU agencies; execution of complex actions by the units of External Intelligence Service, Romanian Intelligence Service, Ministry of Interior, Public Ministry, Finance Ministry, and Ministry of Defense in cooperation with other agencies against cross-border criminal groups.

Activities which impact on effects refer to the full spectrum of missions executed in the operational environment, in border regions, cross-border, and rear areas in order to neutralize criminal networks and disrupt their actions. [4] These activities require the existence of plans, cooperation procedures, and firm execution of operations.

We consider that this study identified the components of the national security integrated system, highlighted the operational framework required for preparation and execution of operations, and also, identified the types of preventive, sanctioning, and countering of cross-border criminal activities operations. But, we have to consider that the national security integrated system has limitations in its functioning.

Preparation and execution of operations to counter cross-border criminal activities fall into the responsibility of the political and military leadership who establishes the levels, objectives, and limits of the operations depending on international constraints. Countering the cross-border criminal activities is no different from the military operations. Therefore, in all the situations objectives are set, resources are allocated and operational structures are configured.

While in the field of national defense military operations are conducted, when referring to counter cross-border criminal activities operations we could consider that they can be executed independently, in cooperation with other agencies, and in conjunction with a military operation. Another important note here is that at these types of operations all the components of the national security integrated system are involved, to include the Ministry of Defense forces.

These factors determine that any type of military, civilian, or civil-military operation must adhere to the following operational requirements: ensure legitimacy and legality, based on national and international rules in the field; provide force protection, according to the law provisions; ensure flexibility and adaptability; protect participating states suzerainty when multinational operations are conducted; ensure predictability and proportionality with the crisis; prevent collateral damage and side effects; protect population, infrastructure, and institutions. [5]

Operational planning for counter cross-border criminal activities operations becomes very complicated when limitations and restrictions are imposed. Therefore, the planners must ensure that the legal limitations are obeyed. This becomes even more complicated during undercover operations, intelligence collection operations, and operations against criminal groups conducted by militarized units. As a result, we consider that the proper functioning of the national security integrated system must be constantly evaluated in order to identify and fix any malfunctions in combating the cross-border criminal groups activities.

CONCLUSIONS

We presented the main operational requirements of the national security integrated system and consider that the following conclusions could be drawn: the process of designing and implementing the national security integrated system is part of the national security system which ensures operational success against cross-border criminal groups; national security comprises of actions executed in different public fields (political, diplomatic, economic, cultural, morale, environment protection, judicial, humanitarian, democratic, and military) by the public and state authorities across the entire operational spectrum; implementing the NATO procedures in order to ensure operational success of the national security integrated system facilitates effective management of the system in order to contain and counter the cross-border criminal activities.

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HALBACH ARRAY LAUNCH SYSTEM

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Abstract: *This paper presents a new design of an electromagnetic launch system which solves the weakness of previous designs. The presented system is based on Halbach array arrangements of permanent magnets. In the first part of paper are presented the railgun and coilgun designs and the weakness are identified. Based on this observation a new design is presented. In order to analyze the interaction between all elements of this design was used an interactive software package based on finite element method (FEM) to analyze, solve 3D electromagnetic field problems, and simulate the movement of Halbach array armature. The interaction between all elements of the design was checked for six values of current in conductors $I = \{100, 300, 500, 700, 900, 1100\}$ A. All simulation data confirm this new design has a great potential of development.*

Keywords: *railgun, coilgun, Halbach array, Lorentz force*

1. INTRODUCTION

In order to accelerate an object of mass m a different kind of energy can be used. If we want to obtain also great performance the chemical energy can be used. In time the launch systems based on chemical energy achieved their limits. In order to expand the limits of launch systems electromagnetic energy can be used. During time different electromagnetic launch systems were developed. The most promising systems were based on using Lorentz Force. According to theory the Lorentz force is:

$$\vec{F} = q\vec{v} \times \vec{B} \quad (1)$$

Because in electromagnetic launch systems we don't use a singular charge but many it is much easy to use the equation of Lorentz force based on current intensity.

$$F = I \cdot l \times B \quad (2)$$

This form of Lorentz force is sometimes presented as Laplace force. Because:

$$F = I \cdot l \cdot B \cdot \sin \alpha \quad (3)$$

where α is the angle between vector l and B ;

The force has a maximum when $\alpha=90^\circ$ and a minimum when $\alpha=0^\circ=180^\circ$. This is a very important observation because when we create an electromagnetic launch system the magnetic field B must be perpendicular on a current-carrying wire. During time different designs of electromagnetic launch systems was studied. One of the best designs is called railgun.

A railgun consists of two parallel conductors called rails and a sliding conductor between rails called armature. The projectile is mechanically connected with armature.[1]

A very high current I flow through rails. The combination between this simple design and very high currents create the condition to obtain a great Lorentz force on armature according with fig. 1.

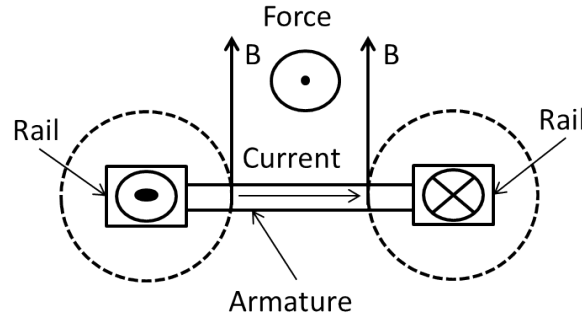


Fig. 1 Railgun

Studying fig 1 we can observe some advantages of this design:

- the magnetic field B is perpendicular on armature;
- the current I create the magnetic field around rails and the current on armature. By increasing the current I the Lorentz force is also increased;
- the length of rails can be calculated according with the performance of the launcher.

The expression of force acting on armature can be approximate according with equation 4.

$$F = \frac{1}{2} I^2 L' \quad (4)$$

where L' is magnetic gradient inductance.

Because this design uses only straight conductors the value of magnetic gradient inductance is very low. The only way to obtain a high value of force is to increase the current I which flow through conductors. Other important advantage of this design is the position between magnetic field and armature. Even the magnetic field created by rails is not so strong compared with a magnetic field created by a coil the armature is touching the rails and use very efficient the magnetic field created [2]. This big advantage comes also with a big disadvantage of this design, sliding contacts between armature and rails. In order to create a great electromagnetic launch design we should preserve the advantages of railgun design and to avoid his great weakens sliding contacts.

The second direction of development of electromagnetic launch systems is induction coilgun. In order to reduce the value of current I the rails can be replaced by coils. By using coils we can obtain the same value of magnetic field density B created by the rails with less amount of current. The current inside armature can be obtained by using induction instead of sliding contacts.

$$u_i = -\frac{d\phi_B}{dt} \quad (5)$$

$$u_i = -\frac{d}{dt}(B A \cos\theta) = -\left(\frac{dB}{dt}\right) A \cos\theta - B \left(\frac{dA}{dt}\right) \cos\theta + B A \sin\theta \left(\frac{d\theta}{dt}\right) \quad (6)$$

where θ is the angle between \vec{B} and \vec{n} (normal unit of surface area A). We assume the magnetic field is uniform distributed in space.

The coilgun design was developed based on Faraday's law of induction, named induction coilguns where only the magnetic field is variable, the surface A and angle θ are constant.

The Faraday's law can be written:

$$u_i = - \left(\frac{dB}{dt} \right) A \cos \theta \tag{7}$$

One design consists of coils which create a barrel and allow a projectile made by aluminum to move inside them.

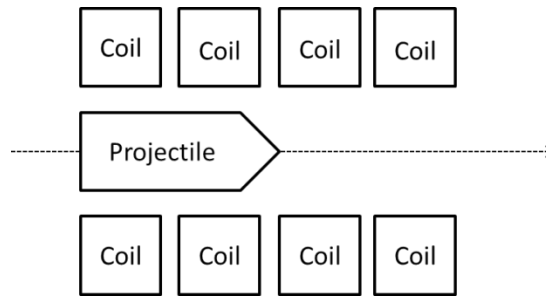


Fig. 2 Induction coilgun

The axial component of magnetic density \vec{B}_a inside coil creates the induced current inside projectile, which interact with radial component of magnetic field density \vec{B}_r [3, 4]. The induced current depends by rate of change of the axial magnetic density \vec{B}_a and the radial magnetic flux density \vec{B}_r depends by amount of magnetic flux. The magnetic flux is created by the coil and is only one magnetic flux, which induces current in projectile and provide in the same time the radial magnetic field on induced current.

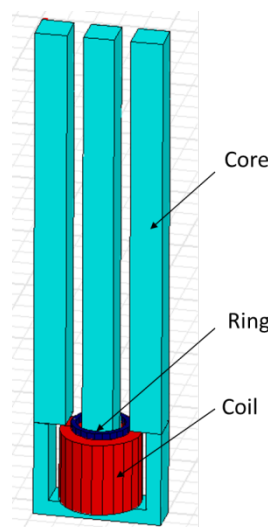


Fig. 3 E shaped coilgun

It is difficult to control in the same time with one coil the rate of change of the axial magnetic density \vec{B}_a and the radial magnetic flux density \vec{B}_r . Also it is difficult to control the phase of induced current in projectile and the phase of the radial magnetic flux density \vec{B}_r . Compared with railgun the coilgun create a strong magnetic field using only a fraction of current and avoid the sliding contacts. The coilgun design is also much complex than railgun because the position of projectile must be synchronized with powered coil.

Also the coilgun use AC currents instead DC currents and the phase must be tighten controlled.

In order to increase the radial magnetic flux density \vec{B}_r and to decrease the current inside the coil a design with magnetic circuit made by ferromagnetic materials was proposed. The magnetic circuit creates also a zone where the magnetic field is radial on conductor, in our case a ring. (fig. 3). The E shaped design use the soft magnetic materials and use the Lorentz force to accelerate projectiles but that design does not allow to control the difference of phase between induced current in projectile and the phase of the radial magnetic flux density \vec{B}_r . [5]

At this point we can identify the main aspects which should be taken into consideration when a design of an electromagnetic launch system is created:

- the Lorentz force should be used to accelerate the projectile;
- the magnetic field should be perpendicular on current-carrying conductor;
- for great efficiency the current-carrying conductor should be intersected by the high magnetic field created;
- the contact between the projectile and the accelerator should be avoided.

If is possible the electromagnetic launch system should be simple as a railgun and efficient as a coilgun. A design which obeys all this conditions is presented in the following chapter.

2. THE NEW HALBACH ARRAY GUN

Before the presentation of a new electromagnetic launch system let analyze again the equation of Lorentz force:

$$F = I \cdot l \cdot B \cdot \sin \alpha \tag{3}$$

In order to obtain maximum force the angle must be $\alpha=90^\circ$. The magnetic flux density B with 1 tesla can be easy obtained with permanent magnets. A value of 10 tesla is relatively hard to obtain and the increase in value of force is not justified. In the near future it is possible to obtain permanent magnets with more than 1 tesla magnetic field. The next element is l . Apparently the value of l cannot be increased but if we use more wires like in a coil we can increase easily the value of force by N times. The value of current I can be easily increased.

For this design we use a circular Halbach array with uniform field inside made by 12 permanent magnets like in fig. 4

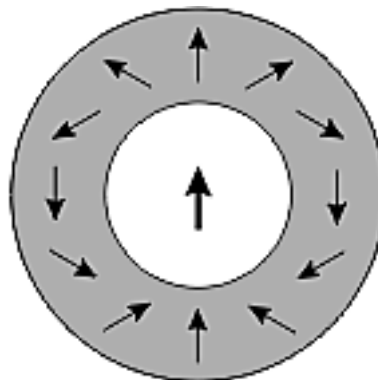


Fig. 4 Cylindrical Halbach array with uniform field inside

The direction of magnetization within the ferromagnetic material, in plane perpendicular to the axis of the cylinder, is given by:

$$H = M_r \mathbf{h} \left(\frac{R_o}{R_i} \right) \hat{x} \tag{8}$$

where M_r is the ferromagnetic remanence (A/m). If the ratio of outer R_o to inner radius R_i is greater than e the flux inside the bore actually exceeds the remanence of the magnetic material used to create the cylinder.

The Maxwell interactive software package that uses the finite element method (FEM) was used to analyze, solve 3D electromagnetic field problems, and simulate the magnetic field created by the circular Halbach array. The result is showed in fig. 5.

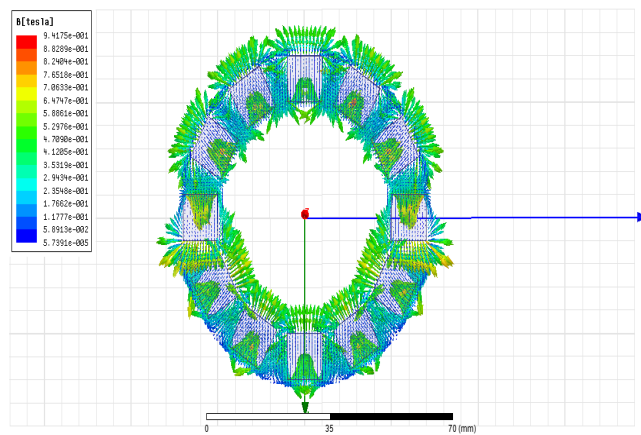


Fig. 5 Magnetic field created by a circular Halbach array

In this design the circular Halbach array is the moving armature and the projectile can be mechanically attached by this armature in order to be accelerated.

The non-moving part of electromagnetic launch system is represented by conductors arranged as displayed in fig. 6.

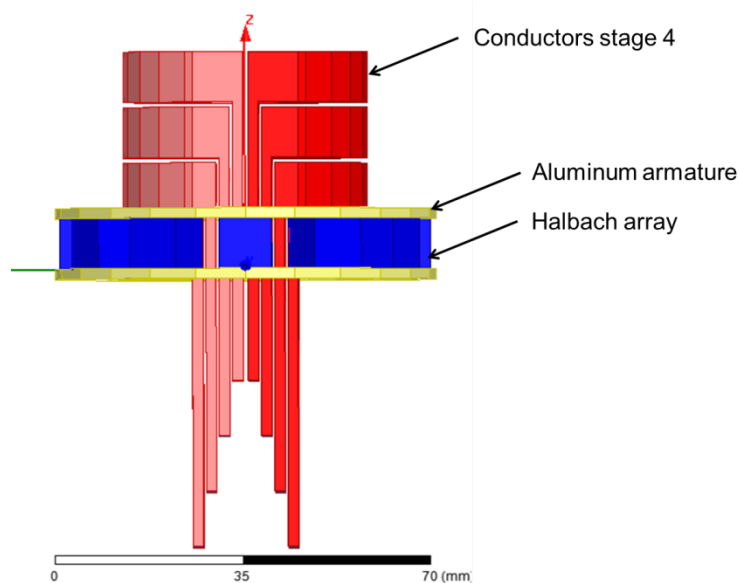


Fig. 6 Halbach Array launch system (side view)

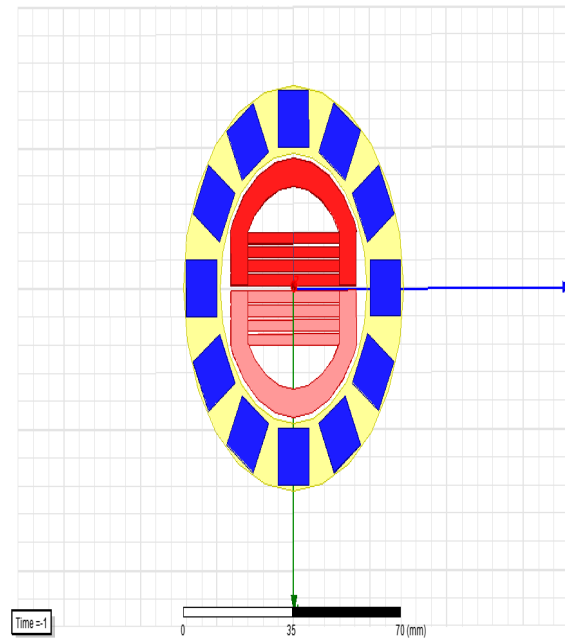


Fig. 7 Halbach Array launch system (top view)

The conductors are placed where the magnetic field has the highest value on x axis of the cylinder and are placed in such a way to obtain many conductors with the same direction of the current inside. The conductors are divided in 4 stages of the length equal with the length of permanent magnets. For each stage we have two sets of conductors in order to obtain the Lorentz force in same direction on both sides of Halbach array cylinder. The magnetic field B is perpendicular on conductors and with this configuration we have N conductors of length l placed inside magnetic field. The conductors are arranged in such a way to carry the same intensity of current in each conductor. Now we can increase the value of current in order to obtain the desired value of force.

In order to rigidize the Halbach array two aluminum plates are placed in top and bottom of the permanent magnets. The bottom part of the design represents the connection of conductors to sources of direct current. In the following chapter is presented the simulation results of this new design.

3. THE SIMULATION RESULTS

The permanent magnets are cube shape with length of 10 mm arranged into cylindrical Halbach array with magnetic field inside in one direction along x axis. The conductors are placed inside cylinder and are divided into four stages. The number of stages depends by the acceleration length necessary to obtain desired muzzle velocity of projectile. Each stage has two sets of conductors in order to control the direction of current inside. In this way the direction of Lorentz force is the same for both sets of conductors of each stage. The conductors are powered with a DC current source. Each set of conductors can accommodate 100 separate conductors. The inner radius of Halbach array is $R_i=25\text{mm}$ and the outer radius is $R_o=35\text{mm}$. The total mass of permanent magnets and aluminum rings is $m=0,1$ kg.

In order to analyze the interaction between all elements of this design was used an interactive software package based on finite element method (FEM) to analyze, solve 3D electromagnetic field problems, and simulate the movement of Halbach array armature. The interaction between all elements of the design was checked for six values of current in conductors $I=\{100, 300, 500, 700, 900, 1100\}$ A. The variation of maximum Lorentz force acting on z direction on armature is presented in fig.8

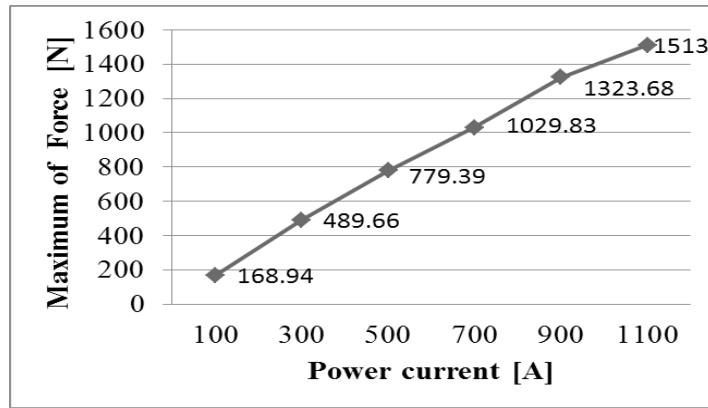


Fig. 8 Maximum Lorentz force acting on armature

Because the magnetic field B and the number of conductors N have constant values the value of force depend only by value of current I . According with graph the maximum force has a linear growth.

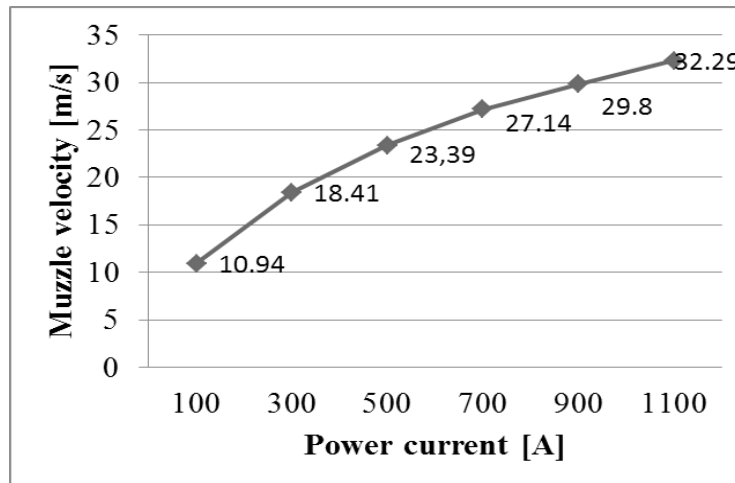


Fig. 9 Muzzle velocity of armature

Based on force acting on armature the muzzle velocity is calculated. The velocity of the armature does not increase in the same way like force because the time of acceleration decreases nonlinear. In the fig 10 is displayed the acceleration time of the armature.

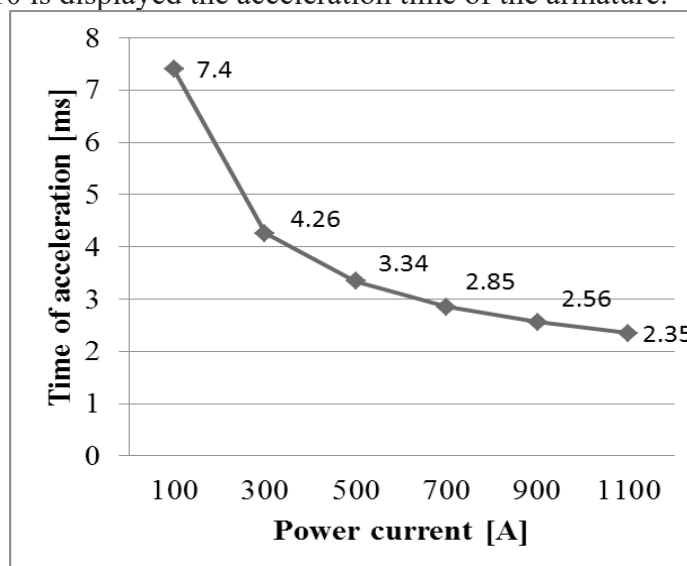


Fig. 10 Time of acceleration

CONCLUSIONS

This design has great advantages over current electromagnetic launch systems. The static part of accelerator can be easily powered with high currents according with destination of accelerator. The magnetic field is perpendicular on conductors from the design. The number of conductors and the length of acceleration path can be calculated according with destination. For a long length of acceleration different number of stages synchronous powered with the position of armature can be created. Between stator and armature are not any contact, the armature is moving freely during acceleration. The intention of this paper was not to obtain maximum muzzle velocity of armature. The muzzle velocity can be increased if the magnetic field is increased. With a proper design of Halbach array the magnetic field can be increased. If the materials of permanent magnets are improved a higher value of magnetic field can be obtained. Because the time of acceleration is very short for special application the Halbach array can be created using electromagnets powered only during acceleration time. Taking into consideration all this aspects we can conclude this Halbach array gun has a great potential of development.

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OUTDOOR HYBRID LOCATION TRACKING SYSTEM WITH REMOTE MONITORING

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Abstract: *A hybrid location and tracking system designed for near real-time location monitoring of persons or objects in an outdoor environment is presented in this paper. The proposed system follows a client-server architecture, which confers flexibility and modularity characteristics. The client is represented by a System-on-chip (SOC) device, namely Raspberry Pi, equipped with a Global Positioning System (GPS) module and an USB 3G modem, configuration which ensures both localization and 3G (the 3rd Generation of Mobile Communications) capabilities. This approach provides three mechanisms for retrieving the current location: based on the GPS module, based on 3G triangulation and based on the serving cell location, hence the hybrid characteristic of the system. The remote monitoring feature is ensured by a server which can be accessed over the internet. Its purpose is to host the database in which the tracking information is stored and to provide a reliable web framework which ensures that end-users can access this information remotely, via a dedicated web-page or a smartphone application.*

Keywords: *Localization, 3G, GPS, RSSI based Triangulation, Raspberry PI.*

1. INTRODUCTION

In the past few years the market of localization systems grew considerable mainly due to its applicability in a large array of domains covering both enterprise and home environments. Advanced tracking technologies and systems have been successfully used in fields such as automotive, medicine, geography or biology in the pursue of retrieving detailed insights in terms of time and space location of objects, people or animals. The most popular tracking technology is by far the GPS, but there are many other technologies which can be used, such as RFID (Radio Frequency Identification), GSM/UMTS (Global System for Mobile Communications/Universal Mobile Telecommunications System), wireless Ethernet [1], [2], [3], or ultrasonic systems (for a very precise localization), each having a distinct set of advantages dependent on the environment in which they are used.

In this paper a fully automated location tracking system is presented, capable of near real-time location retrieval and remote monitoring. Its main advantage compared to other existing implementations [4], [5] consists in the mechanisms used for determining the location which make use of both GPS and 3G technologies.

The default mechanism, and the most accurate, is based on the GPS module, which provides data related to the current location in NMEA (National Marine Electronics Association) format. If GPS signal is not available, a fallback mechanism is used, based on triangulation.

The USB 3G modem provides cell information such as: Mobile Network Code (MNC), Location Area Code (LAC), cell id (CID) and Received Signal Strength Indicator (RSSI), making it possible to retrieve the coordinates of the cell. If the coordinates of the serving cell and neighboring cells are available, a RSSI triangulation algorithm can be applied to determine the current location. If information related to the neighboring cells is not available, then the location of the serving cell is reported as current location.

This hybrid approach increases the location tracking device reliability, ensuring that, even if the GPS module is malfunctioning, the location can still be retrieved with the cost of a diminished accuracy. After the location retrieval step, the data is formatted and sent to the server which inserts it into a MySQL database. The server is also responsible with providing the necessary web framework for remote monitoring and end-user access management. Each end-user has an individual account and each account is mapped to one or more location tracking devices, thus ensuring that each end-user can access only the data related to his own device(s).

The system provides two possibilities for remote monitoring: via a web page and via an Android based application, both offering the same array of services, amongst them being location history preview, last reported location preview and navigation to last reported location.

2. SYSTEM ARCHITECTURE AND DESCRIPTION

The system architecture is client-server oriented and has a modular design, the overall functionality being divided and assigned to individual components, thus, increasing the system reliability and flexibility. The system architecture is presented in the Fig. 1 below.

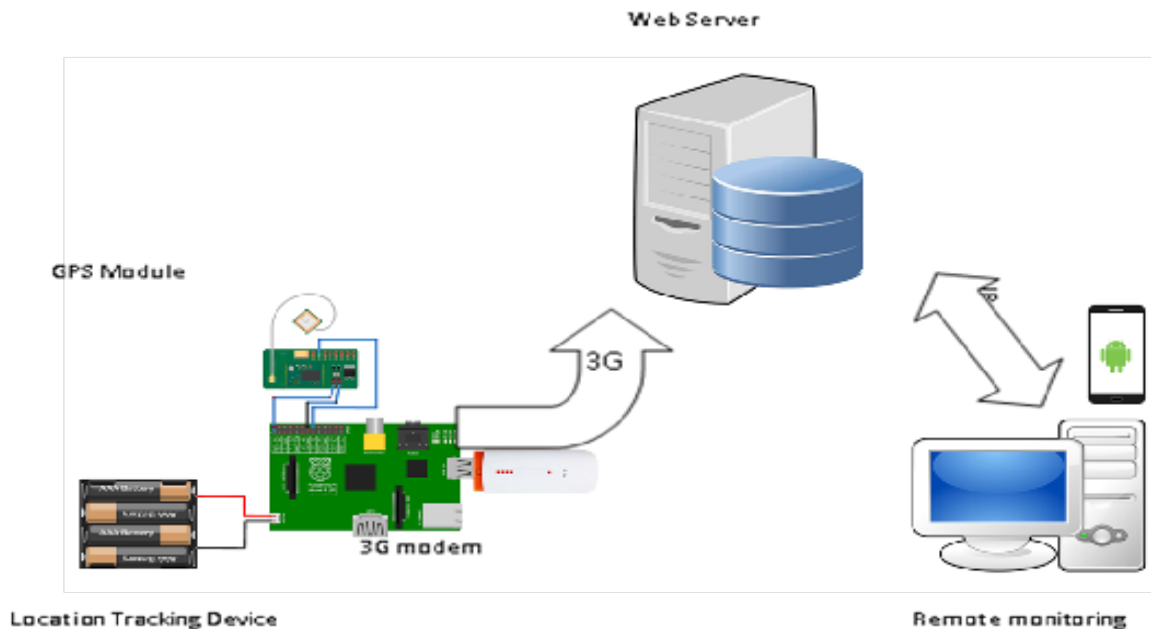


FIG. 1. Outdoor Hybrid Location Tracking System With Remote Monitoring architecture

The location tracking device comprises the Raspberry Pi board, the GPS module and the USB 3G modem. The Raspberry Pi device is the core component of the system. It manages the GPIO (General Purpose Input/Output) interface, to which the GPS module is connected, and the USB ports, to which the 3G modem is connected. It contains the Script Execution Engine which retrieves the coordinates from the GPS module and 3G network related parameters such as: CID, LAC, MNC and RSSI. Based on availability, it chooses one of the localization mechanisms: based on the GPS module, based on triangulation or based on currently registered cell coordinates and provides the location coordinates. After this step, the location coordinates are sent to the server. In the event of a network unavailability, the coordinates are stored locally and will be sent to the server as soon as the network becomes available.

The server represents the bridge between the location tracking device and the end-user. It manages the data received from the Raspberry Pi device and handles end-user requests via its web framework. The server also provides security and privacy features.

By analyzing each request, it is able to determine whether the request came from a trusted device or end-user, in which case the request is processed, or it came from an unknown source, when the request is rejected. The privacy feature is ensured by providing the end-user only data related to his associated device(s).

The remote monitoring service provides, for the end-user, the means for accessing information related to his associated location tracking device(s). This can be achieved either by using the dedicated web interface or by using an Android based application. Both approaches offer the same functionality and it is up to the end-user to decide which one to use. Amongst the information which can be retrieved via the remote monitoring service are the last reported location of the location tracking device and a history of previously reported locations.

3. THE LOCATION TRACKING DEVICE

The location tracking device has a modular software architecture in which independent, interconnected components, coordinated by a manager unit, execute specific tasks in order to achieve the desired functionality. Figure 2 presents the software architecture of the location tracking device.

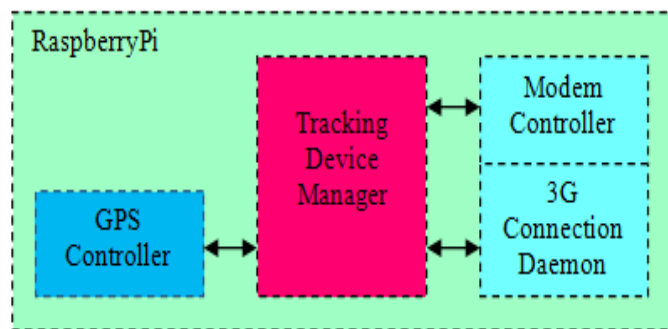


FIG. 2. Location Tracking Device Software Architecture

The GPS Controller is the component responsible with GPS module data retrieval and parsing. The GPS module provides sentence codes in NMEA protocol format. The GPS controller tracks the Global Positioning System Fix Data (GPGGA) sentence codes, extracts and parse the latitude and longitude parameters from them and forwards this data to the Tracking Device Manager. For ensuring the network connectivity a 3G Connection Daemon is used. It runs in separate background process and it is started only when certain data needs to be sent to the server. This approach was preferred because keeping the 3G connection always alive leads to more power consumption, this being an important aspect of battery powered devices. Activating the 3G connection only when is needed means that the 3G modem will spend more time in a stand by state, thus reducing the power consumption. In order to retrieve 3G network cell information the Modem Controller is used. Whenever a request for new data comes from the Tracking Device Manager, the Modem Controller initializes a serial interface which establishes the communication with the 3G USB modem, which it then controlled via AT commands. The following commands are used to retrieve the MNC, LAC, CID, RSSI for registered and neighboring cells:

- AT+CSQ: returns the RSSI;
- AT+CREG?: returns the MNC, LAC and CID;
- AT^SMONP: returns neighboring cells info.

The Tracking Device Manager is the core component which implements the system logic. It manages and coordinates all the software components and ensures that the system is working in optimal conditions. It also handles a local SQLite database which contains data regarding 3G network cells localization.

A. 3G cell (Node B) coordinates database A key point in supporting the above mentioned localization fallback mechanisms is the local SQLite database which contains the cell coordinates. When the cell info is retrieved from the 3G modem, a SQL query is sent to this database in order to retrieve the cell coordinates. Such databases already exists and can be easily deployed into the Raspberry device, but it is possible that, for certain geographical areas, no cell information exists. The proposed system was tested in such an area and, to overcome the lack of cell information, a mobile Rohde & Schwarz (R&S) network scanning solution was used capable of mobile network cell detection and localization [6]. The solution consist in an autonomous mobile network scanner R&S®TSMA and the R&S®Romes4 software platform. Figure 3 shows the graphical interface of the R&S®Romes4 when running the 3G cell localization functionality. After scanning the geographical area of interest, all the cell information is exported from R&S®Romes4 and deployed into the Raspberry Pi local SQL database. The database can be useful for localization inside the 4G network, too, considering that e-Node B and Node B are placed usually in the same site.

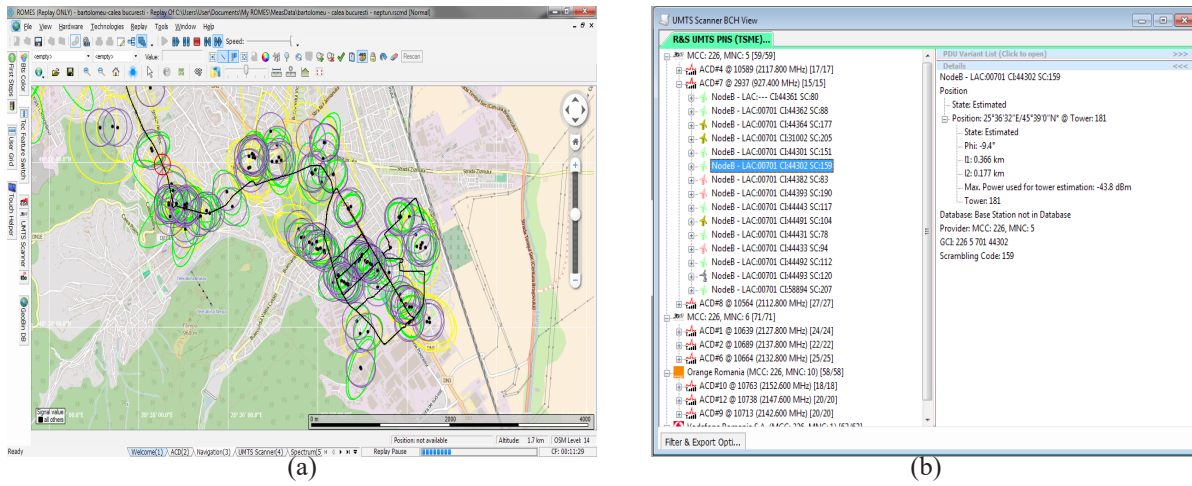


FIG. 3 R&S®Romes4 running 3G cell (Node B) localization

B. 3G Triangulation mechanism To perform basic triangulation, the location tracking device sends a request to the Modem Controller which responds with information regarding the serving cell and two of the neighboring cells which have the highest RSSI value. The principle of determining the location is presented in the Fig. 4, where the green cell represents the serving cell and the blue cells the neighbors, and each circle radius is relative to its corresponding RSSI value.

The algorithm used to determine the device location is:

$$w_{RSSI}(n) = \frac{RSSI(n)}{\sum_{k=1}^3 RSSI(k)} \quad (1)$$

$$D_{longitude} = \sum_{n=1}^3 (w_{RSSI}(n) \cdot Cell_{longitude}(n)) \quad (2)$$

$$D_{latitude} = \sum_{n=1}^3 (w_{RSSI}(n) \cdot Cell_{latitude}(n)) \quad (3)$$

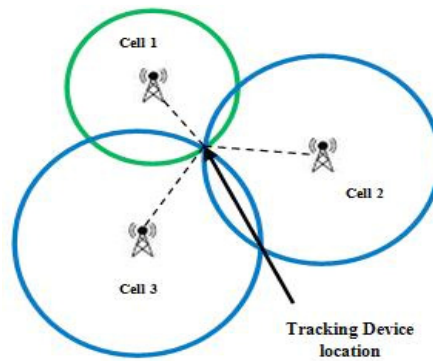


FIG. 4. 3G triangulation mechanism

4.5 EXPERIMENTAL RESULTS The proposed system was tested in Braşov city, Romania, area which was previously scanned with the R&S mobile network scanning solution. A GP-20U7 module was used as GPS receiver and a ZTE MF-195 was used as 3G USB modem.

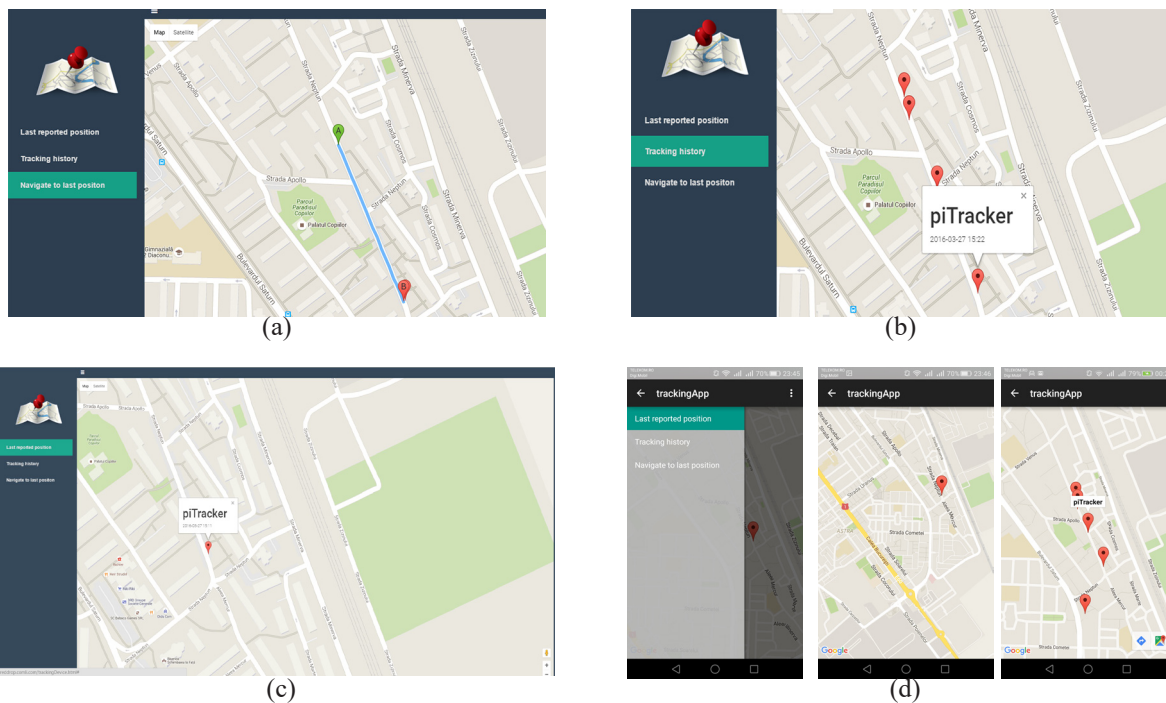


FIG. 5. Remote monitoring

In a first step the system was tested in normal conditions, with all the modules enabled. Figure 5 illustrates the remote monitoring web page in which the following services were selected: (a) navigation information from the end-user location to the last reported location (b) location history, (c) last reported position. The remote monitoring Android application is presented in the Fig. 5(d) in which the same services were accessed; in this case, the navigation to the last reported location feature was linked to the Google Navigator application.

In a second step, the GPS module was disabled, in order to test the fallback location retrieval mechanisms. The ZTE MF-195 modem does not provide an AT command to retrieve information related to the neighboring cells, so only location retrieval based on the serving cell location was tested. Figure 6 presents the location reported via the fallback mechanism in contrast with the location provided via the GPS module.

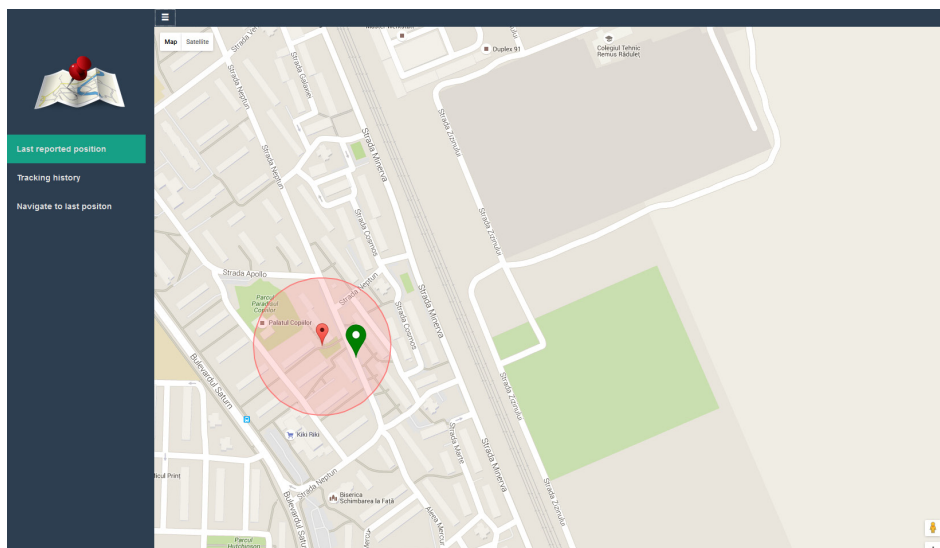


FIG. 6. Location reported via serving cell location (red marker) in contrast with real location (green marker)

CONCLUSIONS

In this paper a fully automated hybrid location tracking system was presented. Due to its capabilities and features, the proposed system can be used in any field which requires outdoor localization and remote monitoring services. Its hybrid characteristic and modular design confers high accessibility, performance and an increased reliability, ensuring fallback mechanisms when determining the location. A very important component of the system is the software, which is not the subject of this paper.

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RECOVERY SYSTEM OF THE MULTI-HELICOPTER UAV

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Abstract: *The developments of UAS over the last decades have imposed approaches regarding the recover and rescue segment for aerial vectors. Operational and research requirements for UAV impose the use of recover systems due to the nature of the missions. The main purpose of the paper is to offer a global image regarding the recover and salvation systems used of the UAVs.*

Keywords: *Unmanned aerial vehicles/sistems (UAV/UAS), recover system, multi-helicopter, paragliding*

1. INTRODUCTION

The sudden development in the last decade regarding unpiloted aerial system has imposed an increase in the reliability through a series of necessities: design, fabrication, flight insurance for the exploration and operation of the aircraft, economical, rules for flight acceptance, [1, 2, 6, 23, 24, and 25]. Operational and exploration requirements for UAVs impose in particular cases the use of rescue and recover systems. These systems could possess a large range of constructive solutions, such as: recover parachutes, recover bags, recover thread, and pneumatic cushions boats. The rescue and recover systems must allow a safe landing in case of emergencies and could become a solution to a standardization regarding landing in extreme weather and geographical conditions, [4, 5]. According to “goggle patents” around 1000 invention applications have been submitted till today, only for the UAV multi-helicopter salvation system. This type of UAV is mostly used due to the recoverable parachute.

1.1. HISTORY AND EVOLUTION

The first concept of recuperation from the air according to specialty references were applied during the Renaissance period in 1470 and the concept of the modern parachute were used in 1783 and 1787, see figures 1.1b and 1.1c. According to specialty references [16, 17, and 18] a series of rescue and recover systems were approved starting with 1950.



Fig. 1.1. First concept of recoverable systems: parachute [2]

1.2. SOLUTIONS REGARDING THE UAV RECOVERY

In the UAS domain, sustained increase of investments regarding, 3500 mil. \$ 2016 [6] led to new implementation for the concept and design for reliability of the UAS. Recover systems are used in a wide range of constructive solutions, which may be classified as: manual and automatic command, standard or emergency procedure; destructive or nondestructive recover; shock or without shock (mechanical, pyrotechnical/pneumatic); maneuverable or non-maneuverable, mounted on aerial vector or system on ground systems (parachute, airbag, recover bag/thread, see figure 1.2a, 1.2b, [12, 13 and 14].



a. Recoverable parachute and airbag [4]



b. Recovery mesh [5]

Fig. 1.2 Types of the recover systems

According to [7] the functionality of (ballistic) recover systems with parachutes are composed of four distinctive steps represented in figure 1.3.

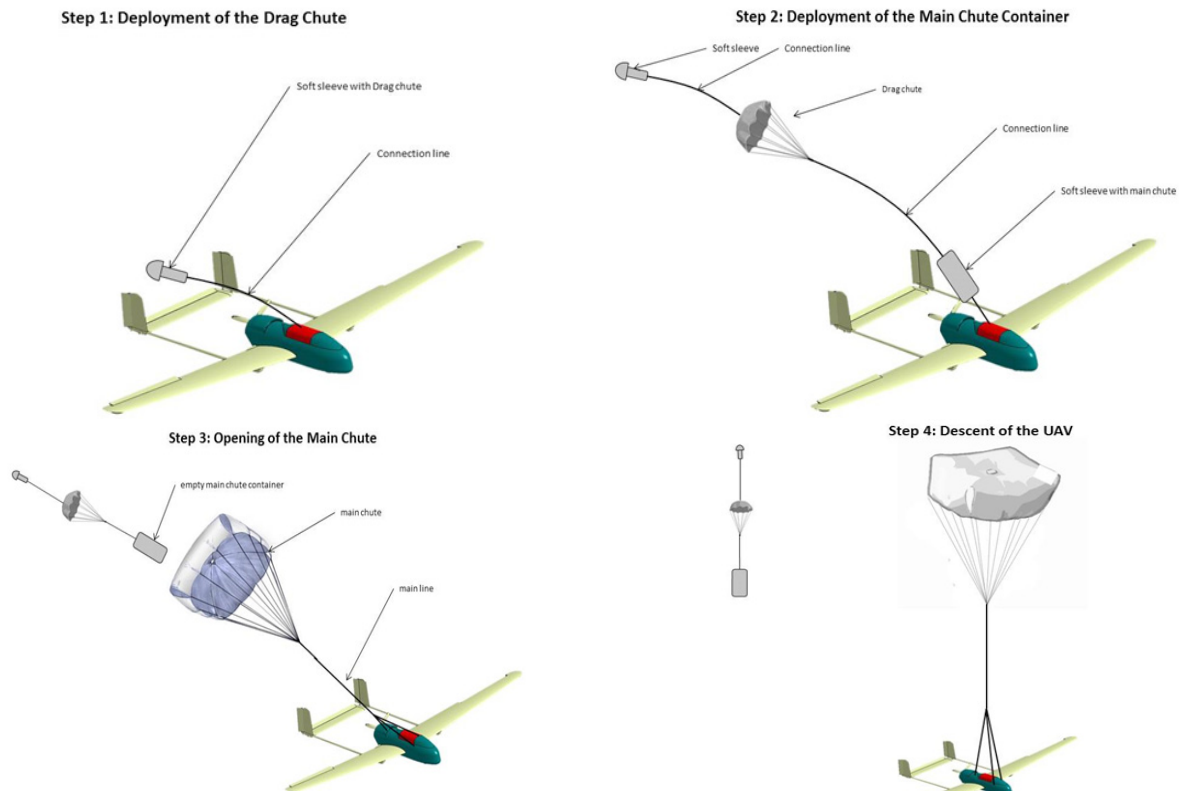


Fig. 1.3 Operating stages of a recovery and rescue system [7]

2. UAV RECOVERY SYSTEMS

In this chapter we represent the state regarding the recover system. According to specialty sources there are a series of companies which developed a salvation and recover system with a high success on the UAV market, [8, 9, 10, 11, 14, 20 and 22].

In 2013 MARS Company developed a series of units to enhance the safety of air operations and accident prevention for recover systems. This was only for UAV that had a weight between 1.8 and 11 Kg, see figure 2.1, [8, 9].

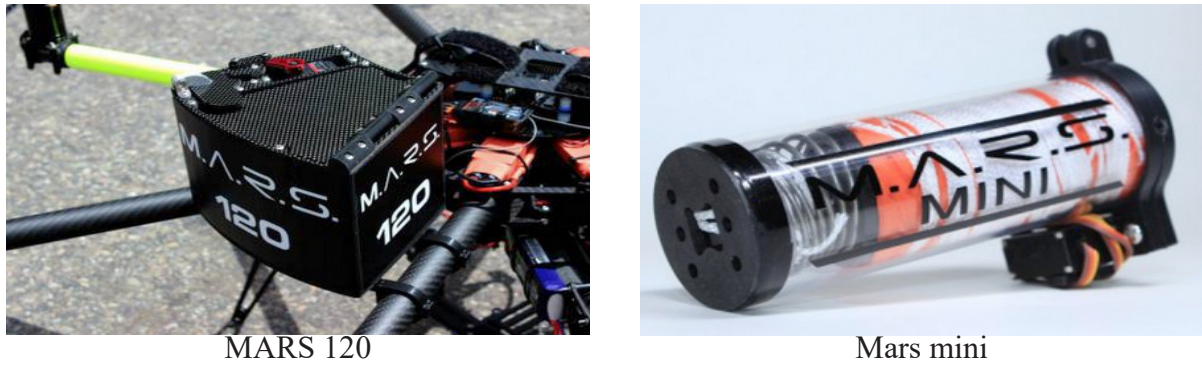


Fig. 2.1 MARS recoverable systems [9]

Opale-Paramodels offers recover containers with servomechanism action, see figure 2.2, and the opening of the parachute reduces instantaneously the altitude opening, [11].



Fig. 2.2 Multi-rotor recover kit and recovery parachute [10]

Sky-graphics offers recovery solutions of the UAV for segment from 45 to 100 kg see figure 2.3, [11].



Fig. 2.3 Protect-UAV recover kit [11]

Recovery System of the Multi-Helicopter UAV

Lithuanian company “My Research UAB” produces and sales recover modules since 2007 [20] see figure 2.4. The module has two pyrotechnic injectable portents, which offer high stability on the recover trajectory and the mass of this module has 0.5 kg which can be used by any multi-helicopter that has a weight between 5 at 9 kg.

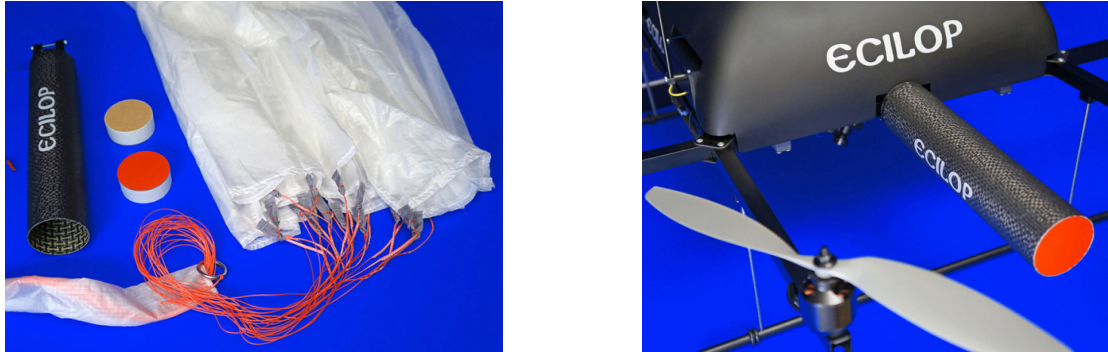


Fig. 2.4 ECICLOP recovery module [20]

Ballistic Recovery Systems produces four types of rescue modules for UAV and piloted aircrafts, container (figure 2.5a), kit rescue module (figure 2.5b), rescue bag (figure 2.5c) and recover and rescue system (figure 2.5d).

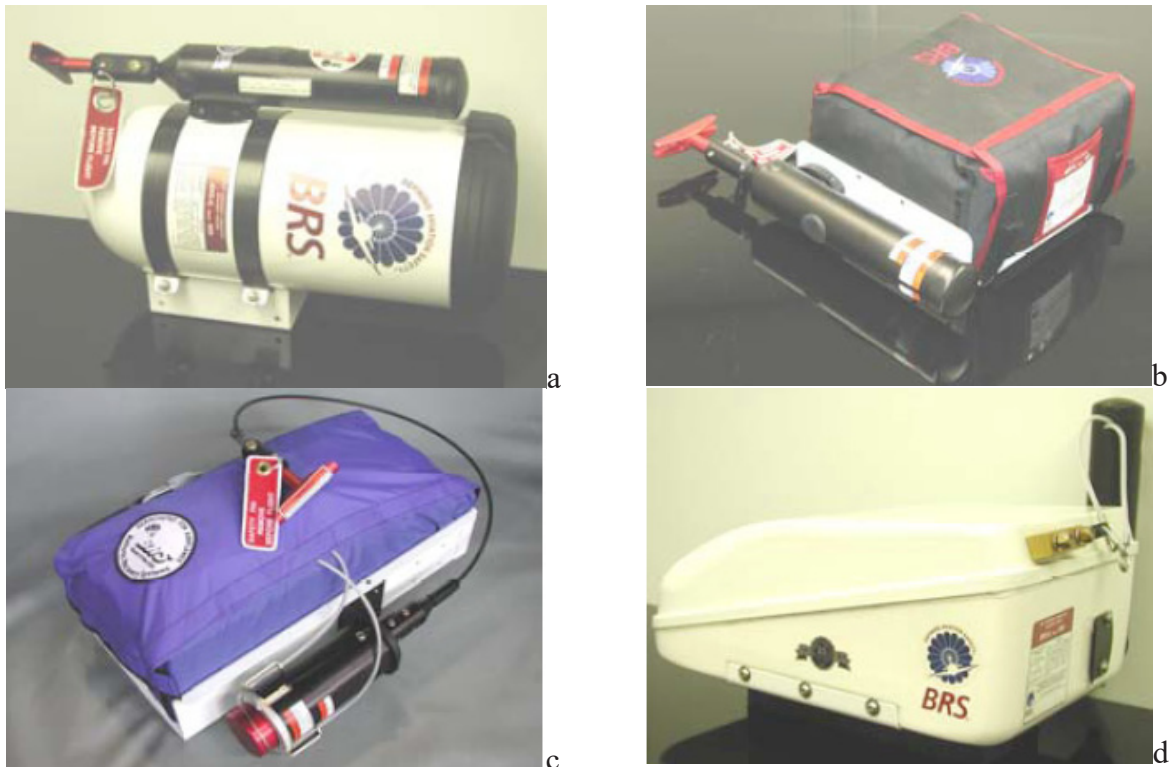


Fig. 2.5 BRS rescue and recover systems [14]

According to [22] even the French company *Arctic Parachute* developed a series of salvation modules with portent surfaces from 2.5 m² for 16 m² for UAVs with weight between 4 at 25 kg. Specialists from the French company recommend the use of a descend speed of 4 m/s while the system is in descend configuration.

3. A PROPOSAL REGARDING THE USE OF RESCUE AND RECOVER SYSTEM FOR UAS WITH ROTATE WING

Rescue systems with recoverable parachutes have a series of aspects regarding the weight of the aerial vector and the recovery system that was used.

The concept and design of these systems must contain a series of requirements, such as: simplicity in design, simplicity in exploration, safety and reliability during its functionality, volume and weight reduce, reduced force for action mechanism, automation capabilities, precision for landing (for missions), reduced cost for acquirement and exploration, [15].

According to specialty references, the portend surface of the salvation and recover parachute is direct proportional to the mass of the aerial vector, see table 3.1, [3, 15].

Table 3.1. Characteristics of the rescue and recovery system (m/s)

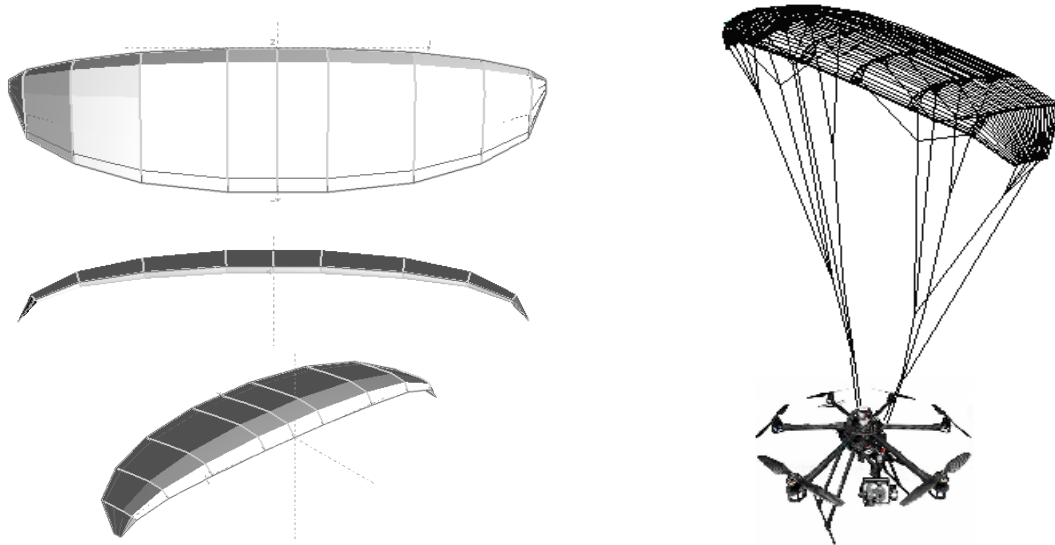
Mass / surface	2	2,5	3	3,5	4	5	6	7	8	9	10	12	14	16	18	20 kg
1,8	4,6	5,0	5,7													
2,5			4,0	3,6	5,1											
4,0				3,4	4,0	4,5										
6,0						3,6	4,0	4,2	4,4							
12,0									3,2	3,4	3,6	4,0	4,2			
15,0 m ²												3,5	3,8	4,0	4,1	4,2

The rescue and recovery module type paragliding is composed of: lifting surface with suspension lines, the arc mechanism to pull out the veil is conceived with a servomotor.

The form and characteristics of the rescue and recovery module are highlighted in figure 3.2 and table 3.2, the module is dimensioned for a multi-helicopter with a weight of 3 kg having a descent speed of 5.7 m/s, according to table 3.1.

Table 3.2 Technical characteristics of the lifting surface [21]

Span	2,99 m	X_{cp}	31%
Aspect ratio	5	Cell numbers	8
C_0 / C_e	0,66 / 0,21 m	Surface	1,79 m ²
Angle of attack	5°	Projected surface	1,58 m ²



canopy wing.
Fig. 3.2 Lifting surface of the rescue and recovery module [19, 21]

A series of simulations with software XFLR5 have pointed out a satisfactory behavior of the flying with the form as in figure 3.2. The simulation conditions are noted in table 3.3., considering a trajectory planation at an angle of 45° , [19].

Table 3.3 Simulation conditions

Speed	5,7 m/s	Simulation method	VLM
Gliding angle	$-1 \dots 10^\circ$	Reynolds (central axis) Re	$2,85 \times 10^5$

In figure 3.3 two cases of gliding are selected and we reveal the flight characteristics for a UAV system type multi-helicopter with a mass of 3 kg. According to the simulation cases at $AoA 0^\circ$ we have $C_z = 0,1295$ and at $AoA 5^\circ$ we have $C_z = 0,4766$. This rescue and recover module, optionally can be equipped with two commands for maneuverable flight on recovery section in case we use a multi-helicopter in difficult zones.

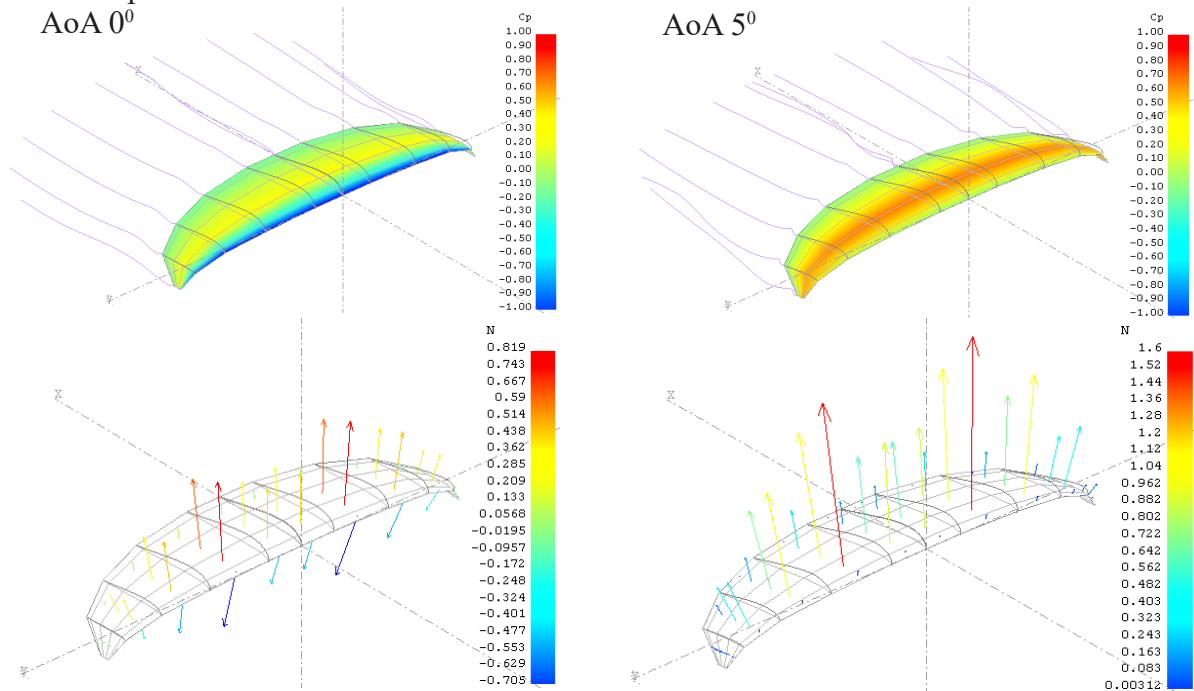


Fig. 3.3 Pressure coefficient C_p (up), force distribution on canopy (down)

The costs for this module are highlighted in table 3.4, acquiring approximately 5% of the price of the multi-helicopter.

Table 3.4 Cost of the rescue and recovery module

Container module	10 lei	Servo standard (2 buc)	100 lei
Paragliding wing	90 lei	Accesories	10 lei

CONCLUSIONS

Specific missions require high reliability from the UAS. The recover solutions are a way to complete the global reliability; these solutions can be conceived, analyzed and realized in accordance with the global performance indicators. The fabrication costs are important only when selecting the strategy for the salvation and recover of the UAS.

The principals of designing recover systems for UAS are adaptable so it can open a new approach generated by the cost of the systems onboard and the flight parameters at the beginning of the recovery stage.

ACKNOWLEDGEMENT

The National Authority for Scientific Research, Romania supported this work – CNCS-UEFISCDI: PN-II-PT-PCCA-2013-4-1349, MASIM project “*Multi Agent Aerial System with Mobile Ground Control Station for Information Management*”.

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BRUSHLESS MOTOR CONTROLLER FOR NANOTEC DB22L01

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Abstract: This project is aimed at achieving a laboratory layout in order to highlight a method to control the Brushless DC electric motor NANOTEC DB22L01. This project was modularly built, each block having a distinct destination. I.E. the first block is the control unit which includes the microcontroller, the on/off button and the programming interface for the microcontroller (ICSP a serial converter). The second block includes the power block (the driver for MOSFET transistors and an inverted H montage). The driver for TC4469 transistors is necessary to adjust the current level between the field effect transistors and the microcontroller outputs, while the inverted H bridge generates the signal that controls the motor (ΦA , ΦB and ΦC) from the six complementary signals generated by the microcontroller (AL, AH, BL, BH, CL, CH). The whole assembly was fixed on a Plexiglass plate in order to give a pleasant appearance to the project. A LCD display is located on top of it showing the engine rotation speed and the current consumption. We can change the rotation speed of the motor using the on-mounted potentiometer.

Keywords: electric motor, transistor driver, inverted H Bridge, microcontroller, potentiometer

1. INTRODUCTION – ELECTRIC MOTORS

An electric motor is an electromechanical device that converts electrical energy into mechanical energy. Regardless the type of motor, it is built into two parts: the stator and the rotor. Generally the stator is fixed externally to the motor and includes the housing, the power terminals, the stator ferromagnetic armature and the stator winding. As the moving part of the motor, the rotor is placed usually inside. It consists of a shaft and an armature that supports the rotor winding. An air gap exists between the stator and the rotor allowing the movement of the rotor toward the stator. The thickness of the air gap is an important indicator for the motor performance. Most of electric motors run based on the exploitation of the electromagnetic field that acts on a conductor carrying electrical current. Built within a various range of electrical powers, electric motors are used in different domains such as electronic components (HDD, CD-ROM, printers), and large electrical power drive systems (pumps, locomotives, cranes) as well.

According to the type of current that goes through, electric motors can be classified into AC motors and DC motors.

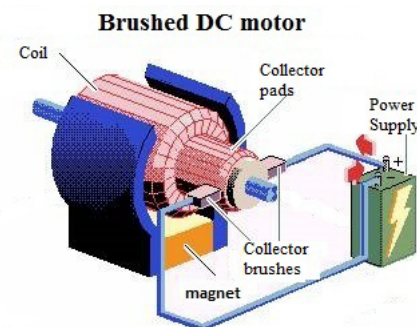


Fig. 1 – Brushed DC motor¹

As well, depending on the number of electrical current phases, the electric motors can be classified as single phase motors or multiphase motors.

¹

The DC motors runs based on a current that does not change direction, i.e. the continuous current. The magnetic poles and the concentrated magnetic coils generating the magnetic field excitation are placed on the motor stator. On the motor shaft a manifold is located which changes the direction of flow through the rotor winding so that the magnetic field excitation continuously exerts a force to the rotor.

Types of motors:

- DC motors with or without brushes;
- Stepper motors;
- AC inductive motors;
- Switched reluctance motors.

The first two types are used more often in microcontroller applications. A motor can be controlled by a microcontroller both directly and through specialized programmable interfaces.

2. BRUSHLESS ELECTRIC MOTOR

Brushless DC motors (BLDC) are preferred for the higher efficiency of low power motors, quiet operation, compact size, and reliability as well as the cheaper and easier maintenance. This type of motors can perform the most complex revolution in the domestic appliances field including washing machines, air conditioners, refrigerators, vacuum cleaners. By this time, domestic appliances were run mainly on motors made by traditional technologies, such as single phase AC and universal motors.

These classic engines typically operate at a constant speed directly from AC power source not taking into account efficiency increase. Consumers today want to acquire low power consumption, high performance, and low noise products. Traditional technologies cannot provide these solutions.

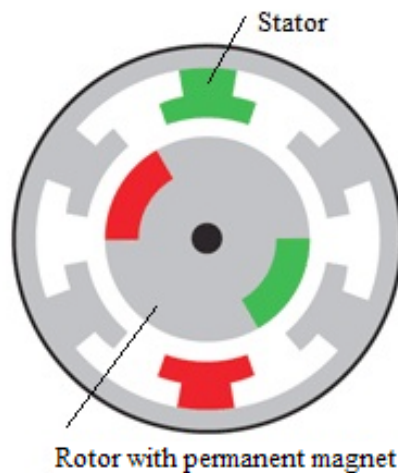


Fig. 2 – BLDC Structure²

2.1 BLDC structure A Brushless DC motor is mainly designed as a permanent magnet rotating into a winding through which electrical current flows. To this respect it equals an inverted DC motor, wherein the magnet rotates while the conductors remain still. In both cases, the current flowing through the conductors must reverse polarity every time a magnetic pole passes by the conductors to ensure the single-direction action of the couple. With the classic collector-equipped DC motors, the polarity reversal is performed by the collector-brush assembly. As the collector is mounted on the rotor, the commutation moments automatically synchronize with the alternant polarity of the magnetic field which is crossed by the conductors. Reversal of current polarity in the brushless DC motor is performed by power transistors which are to be switched in synchronism with the rotor position.

² <http://www.freescale.com/webapp/sps/site/overview.js>

2.2 BLDC VS. Conventional DC motor With a conventional DC motor, the collector brushes mechanically touch a set of electrical contacts on the rotor (called the switch-collector), establishing an electrical circuit between the DC power supply and reinforcement wound armatures. While the plates rotate, the stationary brushes come into contact with different sections of the collector. The system consisting of the collector and brushes includes a set of electrical switches, each of them operating in frequency so that the electric power is always distributed through armatures near the stator – permanent magnet.

In a BLDC motor the electromagnets remain still while the permanent magnets rotate and the armature is not moving. This solves the issue related to power transfer to a moving armature. In order to do it, the switch assembly is replaced by an electronic controller. The controller performs the same power distribution as in a conventional DC motor, just using a “solid state” fixed circuit instead of a collector. The multiple benefits of BLDC motors compared to the conventional DC motors are as follows:

- Fast dynamic response;
- Increased efficiency;
- Longer lifetime;
- Noiseless operation;
- Higher rotational speeds.

Nevertheless, cost is the main disadvantage of BLDC motors, as they require complex speed controllers to operate.

3. THE MOTOR USED FOR THE PROJECT

The motor used for this project is DB22L01 made by Nanotec. This is a brushless DC motor equipped with inside-mounted rotor fixed to the shaft.

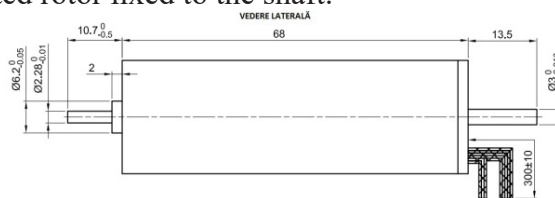


Fig. 3 –Nanotec DB22L01 Side-View

Table 1 – Nanotec DB22L01 Connectors

CONNECTOR TABLE					
	PIN	COLOR	FUNCTION	DESCRIPTION	FUSE
8 pole motor	6	Red	U		UL 1007 AWG 28
	7	Brown	V		
	8	Black	W		
Hall sensor pinout	1	Blue	Vcc	Hall sensors power supply	UL 1007 AWG 26
	2	Red	HALL A		
	3	Yellow	HAL B		
	4	Brown	HAL C		
	5	Green	GND	Hall sensors ground	
Encoder (optional)	6	Yellow	A		
	7	Brown	A\		
	8	Gray	B		
	9	Gray/Pink	B\		
	10	Violet	I		
	11	Red/Blue	I\		

This motor contains 8 poles and 3 phases that are necessary to perform control.

The specifications include 24Vdc power supply; it can reach maximum currents of 1.5A; and the maximum power is 20W. This type of motor has a maximum number of 3500 rev/min. three Hall sensors are used in open collector montage in order to establish any time-rotor position against the stator windings, and reduce energy consumption. Therefore they are 5Vdc supplied for operation through a pull-up resistor.

4. CIRCUIT OPERATION

In order to outline the assembly, we designed the whole circuit electrical diagram.

It displays the two essential components of the model: the microcontroller part – the brain of the circuit, and the second one - the power driver (MOSFET transistor driver and inverter H Bridge).

Nanotec DB22L01 is the Brushless DC electric motor required to embody this project; it is a three-phase motor which includes Hall sensors to establish rotor position against the stator.

The closed-loop diagram stands for the control scheme of the motor. This means that additionally to the control circuit starting from the microcontroller to the motor, there is a feedback circuit which conveys information from the Hall sensors to the microcontroller, to enable the decision making process and establish the control phase.

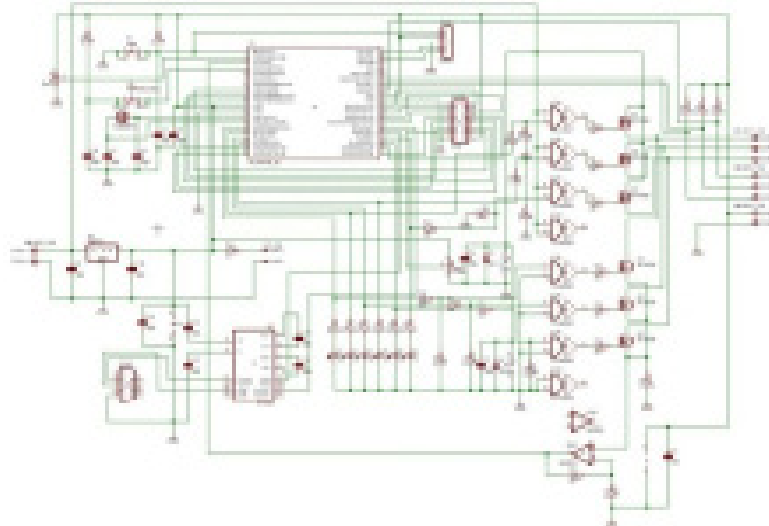


Fig. 4 – The Complete Wire Diagram

As the motor is three-phased, its control sequence is divided into six (Fig. 5), and the signal from Hall sensors is divided into two for each sensor – for instance A sensor state is High (logical 1) for a rotation of 180°, while the other 180° is set to Low (logical 0).

The following figure illustrates the temporal correlation between the signal generated by sensors and the control signal for each phase and stage in part.

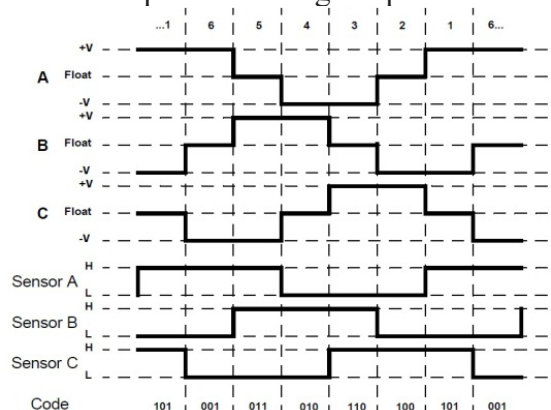


Fig. 5 – Conduction Time of the Transistors

This figure displays two adjacent sensors conducting through a 60° length at the same time.

The same chart illustrates the leading windings at a moment in time, and even the direction of the current flow through the coil. For example related to the 6th phase, the leading winding the electric current passes through from A to C is the A-C winding and A is the leading the sensor. Two ways to connect to the microcontroller can be seen on the same circuitry, based on a programmer (ICSP connection) or via serial connection (ST232 converter). Serial connection was implemented in order to achieve real-time monitoring of microcontroller's states and responses and execute direct control from the keyboard of a computer.

The wiring diagram includes an LCD display aimed at displaying the motor speed and the current it consumes. In order to display the control signal, the easy way of using optical LEDs was chosen, even if at high speed their latency and the integrator character of the human eye makes them look like they are all on. At low speed or even when manually turning the rotor (assuming that the motor is not powered up but the low power – microcontroller and Hall sensors are connected to the power supply) the control signal on each phase can be seen, as generated when perceiving the signal from the Hall sensors. The LEDs are physically located at AH-BH-CH-AL-BL-CL from left to the right.

After all blocks are fed (the low power part at 9Vcc – as the circuit has a 5Vcc stabilizer, and the high power part at 12Vcc, maximum 24Vcc.) press the START button to ignite the motor. At this moment it is possible for the rotor to be perfectly aligned with the stator's windings and the magnetic field not to be able to initialize the revving of the motor. This can be avoided based on software methods, including into the code a sequence of initialization of the motor. In this sequence the motor starts in an open loop, regardless the Hall sensors response, then it goes back to closed loop control. A potentiometer was used to control the motor revving, which is done by measuring the voltage between a terminal pin and the cursor.

The current is measured based on the voltage level fallen on the resistor mounted in the source of the transistors on the H bridge. Both current and speed are then displayed on the LCD display mounted on the layout.

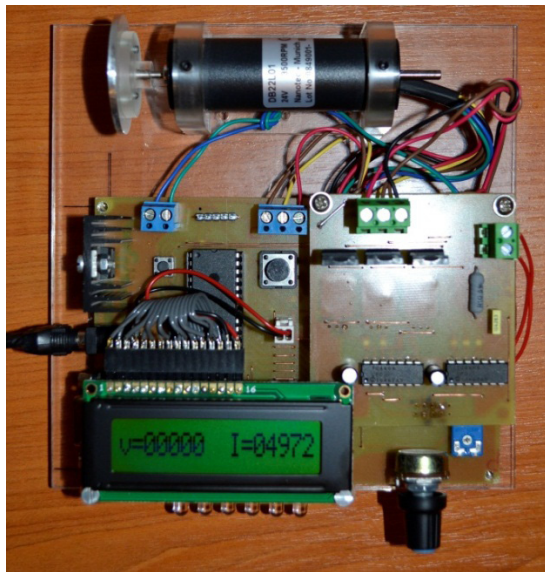


Fig. 6 – The Layout

CONCLUSIONS

In order to establish how the Nanotec DB22L01 motor works a preliminary documentation was necessary first because in the catalogue datasheet the procedure related to the internal connection of the Hall sensors was not shown. It was necessary for me to have in view other applications based on this type of motor.

Therefore I concluded that the sensors are open collector-mounted and in order to be connected to a microcontroller they need to be connected to a 5Vcc power supply through a pull-up resistor. Until the acquisition of the LCD and in order to make things easier, I decided to use a boot loader enabling control execution directly from the computer via serial connection, while the controller response could be real time watched on the computer's monitor.

PIC18F458 was my microcontroller option as it disposes of a memory-program space which is bigger than the one in the PIC16FXXX microcontroller family as well as of an increased stability to high frequencies due to the LAT registry.

If my 5Vcc stabilizer was not supplied from a commercial switch source, my microcontroller would be reset as a result of voltage variations. I replaced two potentiometers used for the establishment of Uref (revving variation) as they had genuine shortfalls, not having a linear variation of the resistor and being disrupted (lack of contact).

In order to simplify the circuitry I connected the motor and the power block to 12Vcc source as well. I installed a metal disk on the motor shaft to see whether is revving or not. The disk enables subsequent upgrades, such as installation of a slit disk and optical sensors on the chassis frame in order to establish the rotation speed. To motivate the voltage coming from the final transistors source, the signal level needed to be amplified in order to get convincing values. As the current was measured from a source with variations, I used a software filter presented like a vector which includes instantaneous values; therefore the displayed current is an average value of the 20 instantaneous values included into this vector.

For a pleasant appearance of the layout I used a backlight LCD display fitted with a program on/off switch.

To verify the control signals I used a 4-channel capture plate from Agilent – PCI 1711.

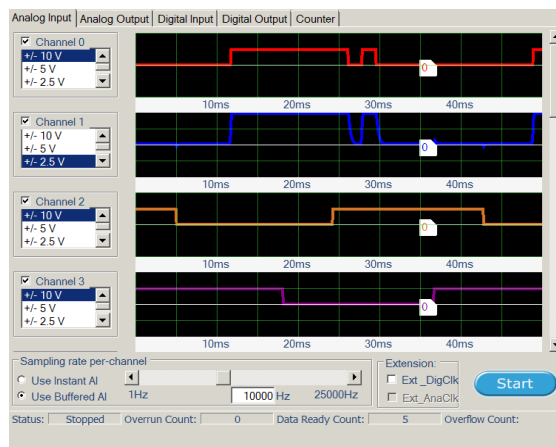


Fig. 7 – Control Signals

At this moment, the motor starts in closed loop control, therefore when pressing the START button there is a chance for it not to start spinning. This is the result of the rotor being aligned with the stator windings. This issue could be solved by introducing a sequence of initialization that entails the motor to start in open loop control, and then by generating a control signal within the closed loop control.

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MONITOR THE SIMULATION OF MECHANICAL STRESSES BY COMPUTER

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Abstract: The aim of the paper is to develop interactive software for monitoring the technological process. Thus, the conceptual, theoretical and methodological framework in IT for generating new instruments, technologies for specific application in the area of technological process is created. Taking into account the state of the art of knowledge in this area, the following specific objectives are proposed in the paper: developing techniques and methods for data acquisition; designing programmers for a database containing the results obtained during the theoretical and experimental research; developing interactive programmers for monitoring the results obtained. The method can also be applied for monitoring of the mechanical stress nodal of aircrafts, rockets, ballistic missiles and gun barrels.

Keywords: sensor, transducer, software simulation, mechanical testing, mechanical stress.

1. INTRODUCTION. STATICAL ANALYSIS A TRACTION TEST

The Generative Structural analysis programming module of CATIA environment allows the simulation of the test pieces mechanical behavior. [1, 2, 3]

The sketch of the probe is shown in figure 1.

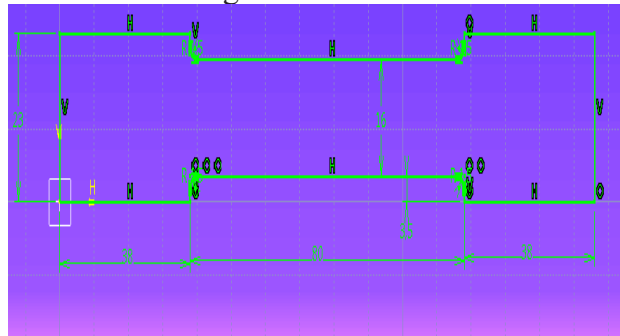


Fig.1 The sketch of the probe

The drawing of the test pieces model is shown in figure 2.

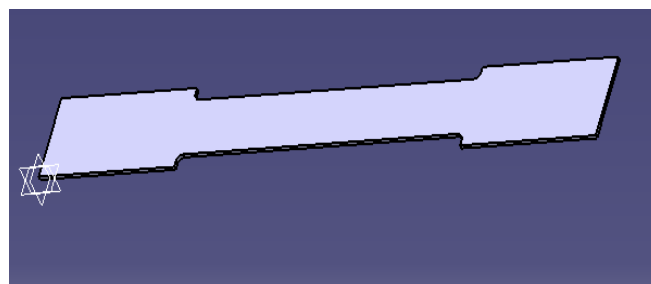


Fig. 2 Test pieces model

The displacement constraint and the distributed force of 7000 N is shown in figure 3 and 4.

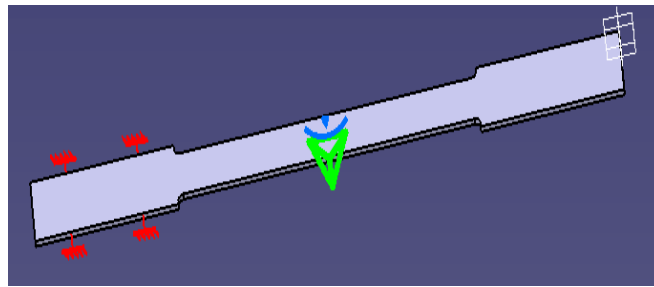


Fig.3 The displacement constraint

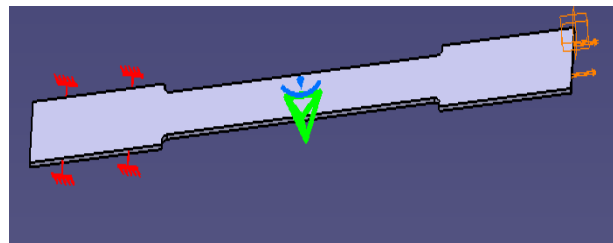


Fig.4 The distributed force

Solving the model and processing the results The calculation model is launched. Figure 5 shows the deformation of piece.

The stress von misses is shown in figure 6.

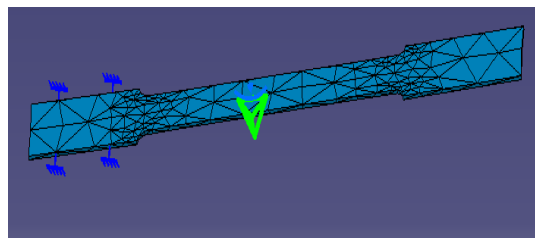


Fig. 5 The deformation of piece

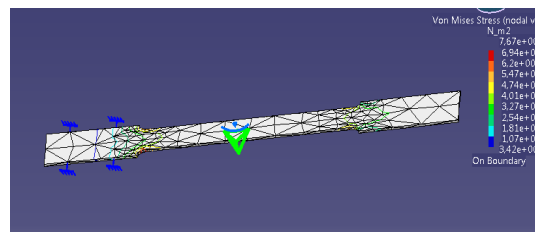


Fig. 6 Von Misses Stress

2.THE EQUIPMENT USED FOR THE EXPERIMENTAL RESEARCH STUDY

For testing the traction and determining the relative elongation, a traction device and a Wheanstone bridge are used and are shown in figure 7.[4,5,6,7,12]



Fig. 7 Device for the traction test

Some nodal values of mechanical stresses is shows in table 1.

Table 1 Von misses stress

X[mm]	Y[mm]	Z[mm]	Von misses stress[N/m ²]
43,1937	8.267	1	4.094e+008
52.87	6.71	1	4.34 e+008
58.98	11.59	1	4.36 e+008
52.52	11.44	1	4.33 e+008
68.88	10.94	1	4.37 e+008
78	11.5	1	4.36 e+008
87.29	11.48	1	4.37 e+008
95.78	11.54	1	4.35 e+008
108.51	11.32	1	4.14 e+008
111.96	11.48	1	3.80 e+008

3. MONITORING INTERACTIVE SOFTWARE OF MECHANICAL TESTING

Designing a software that stimulate the state of strength in the material under conditions of strength offers the possibility of creating a virtual laboratory able to make applications to different areas: medicine, constructions, aeronautics.

Estimated original elements

- new techniques of mechanical testings of advanced materials;
- modelling and simulating the behaviour of materials subjected to mechanical stress in traction and compression;
- designing interactive programmes using MySQL , PHP and HTML languages for a database; [8,9,10,11]
- designing interactive programmes for monitoring the obtained results.

3.1 Programme for creation of database

```
<html>
<head><title>Aplication base of data
</title></head><body>
<center>
<h1>creare tabel date</h1>
```

```
<?php>
$conn=mysql_connect(„localhost”,„joeuser”,„”);
mysql_select_db(„test”,$conn);
$sql=„create table ExportDataFile(id int not null primary key auto_increment, x varchar (75),
y varchar (75), z varchar (75), t varchar (75))”;
if (mysql_query($sql,$conn)){
echo „ data table created”;
} else {echo „something went wrong”;}
?> </center></body></html>
```

3.2 Creation of HTML form, introduction of data

```
<html>
<head><title>Inserare form
</title></head>
<body><center>
<h1>using buton</h1>
<FORM METHOD=POST ACTION=„insert.php”>
<p> adauga x:<br>
<INPUT TYPE=„text” Name=„textfield1” size=30><p> adauga y:<br>
<INPUT TYPE=„text” Name=„textfield2” size=30><p> adauga z:<br>
<INPUT TYPE=„text” Name=„textfield3” size=30><p> adauga tensiune:<br>
<INPUT TYPE=„text” Name=„textfield4” size=30><br><p><input type=submit
name=„submit” value=„insereaza date”></p>
</FORM></center></body></html>
```

3.3 PHP programme creation, taking data, inserting data in a MySQL database

```
<html>
<head><title>Aplicatie baze date
</title></head><body>
<center><h1>creare tabel date</h1>
<?php>
$conn=mysql_connect(„localhost”,„root”,„”);
mysql_select_db(„test”,$conn);
$sql=„insert into ExportDataFile (id,x,y,z,t) values(„’,’$_REQUEST[textfield1]’,
‘$_REQUEST[textfield2]’,’$_REQUEST[textfield3]’,’$_REQUEST[textfield4]’)”;
if (mysql_query($sql,$conn)){
echo “data inserted”;
} else
{echo “something went wrong”;}
?> </center></body></html>
```

3.4 Insert user’s nodal value programme

```
<html>
<head><title>Insert form
</title></head>
<body><center>
<h1>using buton</h1>
<FORM METHOD=POST ACTION=„vizualizare.php”>
```

```

<p> insert x:<br>
<INPUT TYPE="text" Name="textfield1" size=30><p> insert y:<br>
<INPUT TYPE="text" Name="textfield2" size=30><p> insert z:<br>
<INPUT TYPE="text" Name="textfield3" size=30><br><p><input type=submit
name="submit" value="data"></p>
</FORM></center></body></html>

```

3.5 PHP programme for visualising the values of stress

```

<html>
<head><title>Insertion form
</title></head><body><center>
<h1>using buton</h1>
<?php
$conn=mysql_connect(„localhost”,„root”,„");
mysql_select_db(„test”,$conn);
$sql="select * from ExportDataFile where (x=$_REQUEST[textfield1]) and
(y=$_REQUEST[textfield2]) and (z=$_REQUEST[textfield3])";
$result=mysql_query($sql,$conn) or die (mysql_error());
while ($newArray=mysql_fetch_array($result)){
$id=$newArray[„id”];
$x=$newArray[„x”];
$y=$newArray[„y”];
$z=$newArray[„z”];
$t=$newArray[„t”];
echo „pentru coordonatele x=$x;y=$y si z=$z rezulta efortul t=$t<br>”;
}??>
</center></body></html>

```

3.6 PHP programme for visualising the maximum values of stress

```

<html><head><title>maximum determination
</title></head><body><center>
<h1>using buton</h1>
<?php
$conn=mysql_connect(„localhost”,„root”,„");
mysql_select_db(„test”,$conn);
$sql=select MAX(t) as maxim from ExportDataFile;
$result=mysqlquery($sql,$conn) or die (mysql_error());
// maximum viewing
while($row=mysql_fetch_array($result)){
echo „maximum value is”,$row[„maxim”];
}??</center></body></html>

```

CONCLUSIONS

This method permits the geometrical modeling of a test probe, the application of various materials stored in the library of the programmer, the modifications of these materials, making constraints and force application. The test results are graphically visualized. In this way, the user can simulate the behavior of different materials subjected to tensile test. Then, the specific deformation of the test pieces is calculated, the pulling force and the corresponding unitary stress.

Designing a software that stimulate the state of strength in the material under conditions of strength offers the possibility of creating a virtual laboratory able to make applications to different areas: medicine, constructions, aeronautics.

Creating interactive programmers for monitoring the results obtained after the analysis with finite elements on any platform working with the Internet Explorer browser ensure the requirements of compatibility in order to integrate Romania in the European economic environment.

These programmers will develop the conceptual, theoretical and methodological framework of computerized technologies. They will generate new instruments, technologies and networks for specific applications. These programmed will be part of computerized systems that can be used in the educational field and they represent instruction-assisted technologies.

The paper designing interactive programmes using MySQL, PHP and HTML languages for a database; [8,9,10,11]

The paper present interactive programmes for monitoring the obtained results.

The method can also be applied for determining and monitoring of the mechanical stress nodal of aircrafts, rockets, ballistic missiles and gun barrels.

The method is a modern one and allows the simulation and monitoring of the tensile test of the materials used in the future for research focused on the study of the resistance structure (fuselage, wing, helicopter blade) component of airplanes, helicopters and missiles.

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METHODS OF INTEGRATING mVoIP IN ADDITION TO A VoIP ENVIRONMENT

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***Abstract:** Along with the power of consumer applications and devices, expectations regarding the communication capabilities in the VoIP (Voice over Internet Protocol) environment are increasing too. The integration of the mobile VoIP (mVoIP) technology in addition to VoIP environment is illustrated in this paper and some proposed and tested by the authors integration methodologies, basic call flow and authentication method for mVoIP, common topologies and solutions to achieve mobility in VOIP networks are presented.*

***Keywords:** mVoIP, mobility, SIP, VoIP, remote subscribers, SBC*

1. INTRODUCTION

The mobile VoIP technology is the new extension of a VoIP network, capable of transmitting voice packets using a software installed on the mobile phone or on other mobile communication devices. Mobile VoIP is considered extremely important in the overall scheme because VoIP will not grow if it remains wired, as the trend is connectivity within the context of mobility.

Wireless Internet is the biggest limitation for mobile VoIP. There are two choices: Wi-Fi hotspots, which are generally free, and 3G, 4G or the future 5G cellular networks, which are not. [1]

Wi-Fi hotspots are free but small, because they don't have a large coverage area. However, using the wireless network at the office alongside with the mobile VoIP applications, can offer the advantage of free VoIP calls. 3G and 4G networks calls are not free, but these networks have a large area of coverage and their users can have high mobility and speeds. Furthermore, 3G networks do not always offer a consistent connection speed. 4G networks, which are faster and becoming more prevalent on large geographical areas of the world, make connection speed more consistent for mVoIP.

Likewise, there are two methodologies of integrating a mobile device into a VoIP network. The most used one turns the mobile device into a standard SIP (Session Initiation Protocol) client and then uses a data network to send or receive SIP signaling messages and RTP (Real-time Transport Protocol) voice packets.

Another implementation of mobile deployment uses a soft-switch like a gateway to bridge SIP and RTP into the mobile network's SS7 (Signaling System no. 7) infrastructure. In this implementation, the mobile handset continues to operate as it always has (as a GSM or CDMA based device), but now it can be controlled by a SIP application server which can now provide advanced SIP-based services.[1]

There are multiple advantages of using mVoIP [8]: a mobile user can be reached via one published number regardless of his/her location or device, it reduces communication costs, it can work with the user's existing IT (Information Technology) and telephony infrastructure and it allows the user to make video calls.

Also, mVoIP offers the possibility to create or join conferences, option to easily move calls between desk phones and mobile phones, device selection, call decisions, security.

In the unified communications world, more and more voice and video communications will be launched from (and connected to) mobile wireless devices. Integrating the mobile users' voice and real-time communications services with core enterprise communications lets them do their jobs regardless of location. [9]

2. PROPOSED INTEGRATION METHODOLOGIES AND TOPOLOGIES

As we stated before there are two main methodologies of integrating a mobile device within a VoIP network, both of them being implemented and tested by the authors

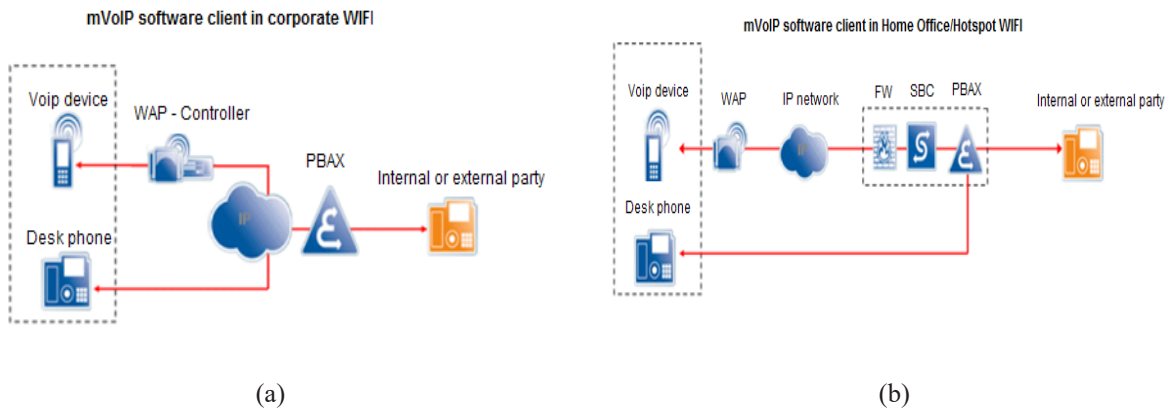


FIG. 1. mVoIP integration methodologies in VoIP networks

This figures illustrates the two typical deployment in an enterprise environment. Fig.1. (a) describes the way a mobile device is directly connected to the PBAX (Private Branch Automatic Exchange). This integration is possible only when the mobile device is connected to the corporate network, if it's in the same network as the PBAX.

Additionally Fig.1. (b), remote users can connect to PBAX via Wi-Fi/3G/4G through a Session Border Controller (SBC). The SBC is mandatory when users are connected to a different network than PBAX. SBC is used for initiating, maintaining and closing the SIP sessions, and also for security and media anchoring.

The user can use two devices, a desk phone and a mobile device with an VoIP application loaded on it. He can be reached via one number, for example 40268334711 which is a number assigned to the desk phone. For the mVoIP application a new subscriber is needed to be assigned, for example 40268334711 (we will assign on this subscriber the 40268334711 One Number Service) which connects or registers to the PBAX via Wi-Fi.

In case of an incoming or outgoing call, PBAX knows which one of this two devices is the preferred one. One Number Service lets calls follow the user to whatever device he selects – whether office, home, mobile or desk phone – completely transparent to the caller.

Fig. 2. (a) below describes an example of a network architecture proposed by the authors to be used in a company. The communication platform (PBAX) is connected to the UC (Unified Communications) server and communicates with it via CSTA (Computer-supported Telecommunication Applications) messages.

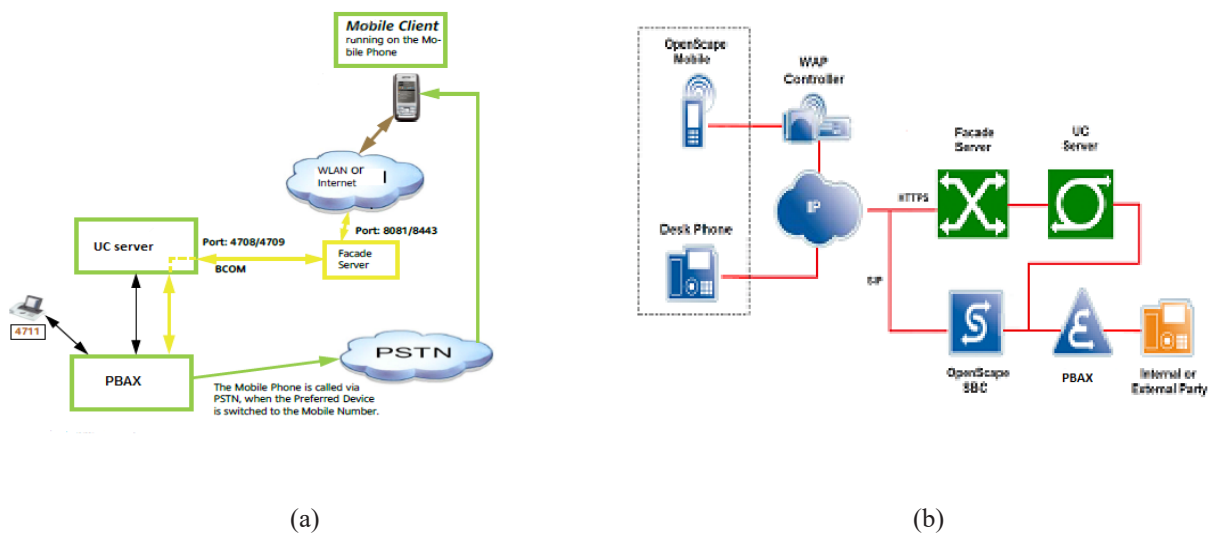


FIG. 2. The proposed mVoIP topology

Unified communications server (UC Server) [9] is a comprehensive solution that ties different services, applications in a single component. UC is not a single product but rather a solution made up of a variety of communication tools and components. UC components include all control and multimodal communications, presence, instant messaging, unified messaging, speech access and personal assistant, conferencing - audio, Web and video, collaboration tools, mobility, Business Process Integration (BPI), software to enable business process integration, One Number Service and the management of the PBAX.

On the UC Server side a DMZ (demilitarized zone)[11] with internet connectivity is required. In computer security, a DMZ is a physical or logical subnetwork that contains and exposes an organization's external-facing services to a larger and untrusted network, usually the Internet. Within the DMZ, a so-called Façade Server is installed which is the endpoint of the incoming internet connection from the client. This connection required only one port to be open in the outer firewall (in Fig.2. (a) the opened port is 8081). The Façade server communicates with UC server via the https protocol. Any request coming from Façade server to UC will be processed by UC and if needed the PBAX will be contacted via CSTA messages [4].

The usage of an SBC (Session Border Controller) [7] enables enterprises to extend SIP-based applications beyond the Enterprise network boundaries, when users are not all within the same IP network.

SBC provides secure remote user access to the IP telephony infrastructure of an PBX system for SIP phones regardless of location. It supports the necessary near-end and far-end Network Address Translation (NAT) traversal functions for connection using a public IP addresses through the Internet. SBC can also support remote users that are installed behind a far-end NAT/firewall as shown in Fig.2 (b). It is mandatory to have such equipment in the context of mobile VoIP.

When the remote user is a hard phone there is generally no support for a VPN (Virtual Private Network) connection at the phone and use of an SBC, to allow connection to the communication platform, is necessary.

3. THE DIAGRAM FOR A POSSIBLE CALL FLOW AND SCENARIO

The diagram for a possible call flow, in case a mobile SIP client is used, is described in the Fig. 3. below:

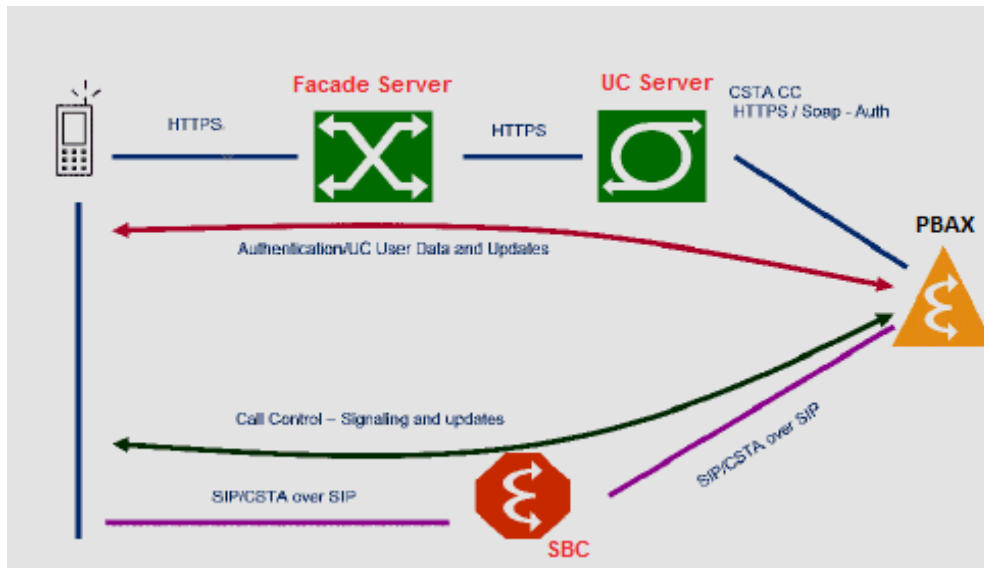


FIG. 3. mVoIP call flow

The mobile SIP software contacts the Façade Server via https protocol and sends a request for authentication. The Façade Server forwards this request to UC server, which checks the UC user id and asks the PBAX (via CSTA protocol) if this user has a mobile subscriber configured.

If PBAX has assigned a specific subscriber for mobility usage then the authentication will be successful and UC Server will answer to the initial request with SIP Login Info. This SIP Info needs to contain the SIP IP public address of the centralized SBC. When this SIP Login info is received the mobile phone knows where to send the SIP signaling messages.

For example the INVITE message will be sent from mobile phone to the public SBC address through the Internet, the SBC will forward the message from its access side to the core side (private IP address) and the core side will continue to forward the message to PBAX. When the connection with the called party is made (from the signaling point of view) the RTP messages will be sent to SBC, which behaves as an anchor for them and forwards the packets to a SIP trunk, gateway or another subscriber if the called party is a SIP subscriber located in the same network. [2]

A real call flow example with two participants is represented below. The first participant is 74995799173 which uses an application called OSMO installed on a Sony SGP771 28.0.A.8.251 Android 5.0.2. The second participant is 749957991721 with ONS 74995799172 which uses an application installed on a computer. Both participants are connected to a Wi-Fi 802.11n network with 300 MB speed. In our test the participant one calls the second participant. The IP addresses of all involved equipments are as follows: SBC WAN IP address 95.163.87.42, PBAX 10.10.222.12 in trace, UC server - 10.10.222.22, Facade - 95.163.87.43/10.10.222.56, SBC LAN - 95.163.87.44.

First the authentication [6] for 74995799173 takes place and the Façade server check with the UC server the account for this specific subscriber:

[OSMCService] Login for 74995799173@system using OpenScape Mobile 72550 on Sony SGP771 28.0.A.8.251 Android 5.0.2 with mobile

[74995799173@system/3] Calling user: 74995799173@system [74995799173@system/3] Transport protocol (http): org.apache.axis.transport.http.HTTPTransport@8c74fa01

INFO [OSMCService] User is OSMO capable, get OSV/PBAX Data

After the authentication the device of the first participant send a SIP invite message to the SBC WAN IP address 95.163.87.42 which will be next forwarded to SBC LAN - 95.163.87.44 and then to PBAX 10.10.222.12.

Based on this INVITE message PBAX communicates with the UC server and checks the options for 74995799172 where 749957991721 is set as the preferred number. As stated above, each application used has a different subscriber number configured behind the 74995799172 ONS number.

```
LogId Event="update" User="74995799172@system" /> Registered Device:+749957991721
set for user: 74995799172@system
```

```
FINE [com.siemens.symphonia.bcom.addressmanager.impl.SystemDataImpl] <LogId
Event="update" User="74995799172@system" /> Preferred Number: +749957991721 set for
user: 74995799172@system
```

When UC server finds out that the preferred device for this 74995799172 participant is 749957991721 configured on a computer, it forwards the SIP invite to this device. From this point all the signaling messages follow this path: participant 1 device $\leftarrow \rightarrow$ SBC $\leftarrow \rightarrow$ PBAX $\leftarrow \rightarrow$ SBC $\leftarrow \rightarrow$ participant 2 device.

CONCLUSIONS

The paper shows how can be added the mobility feature in addition to VoIP environment by using different topologies and methodologies. Basically the implementation of this service requires the development of a SIP application which will act as a standard SIP client by using a data network to send or receive SIP signaling messages and RTP voice packets.

In addition to the SIP application a Session Border Controller is needed to manage the remote sessions and a Façade server to verify the user data and authentication data. The usage of mobile VoIP technology offers a complex set of new and interesting features, independent of the operating system, such as the possibility to be reached on one number regardless of you location or device, possibility to create or join conferences, video calls, option to easily move calls between desk phones and mobile phones, etc.

From the infrastructure cost point of view this solution seems to be a good choice since the purpose of the mVoIP is to reduce costs and achieve flexibility.

The mVoIP technology is a pretty stable one and offers a lot of features and capabilities but it can be improved in many ways: the security can be enhanced, the voice quality can be increased, the achievement of new features such as voicemail to email transcription, music on hold, find me/ follow me call routing, call detail reports, call screening, single sign on, etc.

This paper is a small guide for anyone looking towards voice mobility as a solution to real-world business problems: IT engineers looking to understand the potential for converting offices to all-wireless; network designers and architects planning on rolling out a fully-mobile voice network; and administrators operating or troubleshooting voice mobility networks.

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A STUDY OF THE TECHNOLOGY TRANSITION FROM IPv4 TO IPv6 FOR AN ISP

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Abstract: *The internet protocol IPv4 has met the demand for years, but the number of addresses, while vast, is finite. The solution to mitigate this problem was the development of the new IPv6 protocol, which extends the address space from 32-bits to 128-bits. IPv4 and IPv6 networks will interoperate during the transition period, although the two protocols structure is not compatible. This paper will shed the light on IPv4 and IPv6, look into the requirements of an ISP network and present three mechanisms that will make the transition from IPv4 to IPv6 smoother: Translation, Tunnel and Dual-Stack. Also, the implementation of Dual-Stack for an ISP and the obtained results are presented in this paper.*

Keywords: *IPv4, IPv6, ISP, Transition, Translation, Tunnel, Dual-Stack*

1. INTRODUCTION

The internet world has to go through a transition, but in this process both protocols, IPv4 and IPv6 (Internet Protocol version 6), have to connect to each other. IPv4 network has grown far more than anyone had ever imagined when the protocol was designed. As technology is developing new services and Internet-enabled devices use more mobile connectivity (2G, 3G and 4G), IPv4 is challenged with a series of problems, the most demanding one being address exhaustion. There are not enough IPs available from ISPs (Internet Service Provider) to meet the demand.

The new IPv6 protocol is needed to satisfy the needs and it features improved scalability and routing, simplified header that makes forwarding packets more efficient, end-to-end connectivity because there is no need for NAT (Network Address Translation), ease-of-configuration because it supports stateful and stateless auto-configuration, and information being stored in the start of the header is useful for a router thus resulting in higher performance routing.

The major flaw of IPv6 is that it is not compatible with IPv4, and to use the new protocol changes are required in software and every networked device. The majority of network services and applications still use IPv4, therefore it will not be replaced for a long time. So, the two network protocols will have to coexist. [1]

2. PROTOCOL SPECIFICATIONS AND THE TRANSITION MECHANISM

Addressing is a key function of network layer protocols that enables data communication between hosts, regardless of whether the hosts are on the same network or on different networks. Both IPv4 and IPv6 provide hierarchical addressing for packets that carry data. [2]

IPv6 provides for 340 undecillion addresses (the number 340, followed by 36 zeroes). However, IPv6 is much more than just larger addresses, it fixes the limitations of IPv4 and include additional enhancements. One example is Internet Control Message Protocol version 6 (ICMPv6), which includes address resolution and address auto-configuration not found in ICMP for IPv4 (ICMPv4). [3]

Mobility is another key feature of IPv6. This feature enables hosts (such as mobile phones) to roam around in different geographical area and remain connected with the same IP address. [4]

2.1 IPv4. Using the TCP/IP (Transmission Control Protocol/IP) model allowed IPv4 to become the core of the internet addressing as we know it today. In IPv4, addresses are 32-bit binary numbers and can cover 4.3 billion addresses. Some technologies have been employed to postpone the exhaustion of network numbers. The system in use today is referred to as classless addressing. The formal name is Classless Inter-Domain Routing (CIDR). However, this did not provide a long term solution and other technologies, such as NAT and DHCP (Dynamic Host Configuration Protocol) were introduced. IETF (Internet Engineering Task Force), in 1994, began its work for a successor to IPv4 which eventually became IPv6. [2]

1.2 IPv6 extends the address space from 32-bits of IPv4 to 128-bits and it supports CIDR as described above and many other features that make it an improvement over IPv4. Unfortunately, IPv6 is not backwards compatible which makes the transition more complicated. In the new IPv6 IPsec (Internet Protocol Security) was integrated, which was optional in IPv4. It is a set of Internet standards that uses cryptographic security services to provide confidentiality, authentication and data integrity. More features can be added to IPv6 due to its option field. Because of its large consumption of resources broadcast traffic is no longer available. Also, there are three modes of addressing for IPv6 packets: Unicast, Multicast and Anycast.[4]

1.3 Header differences. The innovation of IPv6 lies in its header. It is two times larger than IPv4 header and it is formed of a Fixed Header and zero or more Extensions (optional headers). All the essential information for a router is kept in the fixed header. The Extension contains optional information that helps routers to understand how to handle a packet. The IPv6 header has lost some fields that were used in the IPv4 header as you can see in Fig. 1, thus saving time processing the packets. IPv6 fixed header is 40 bytes long while IPv4 is 20 bytes. The version field represents the version of internet protocol (i.e. 0110 is version 4).

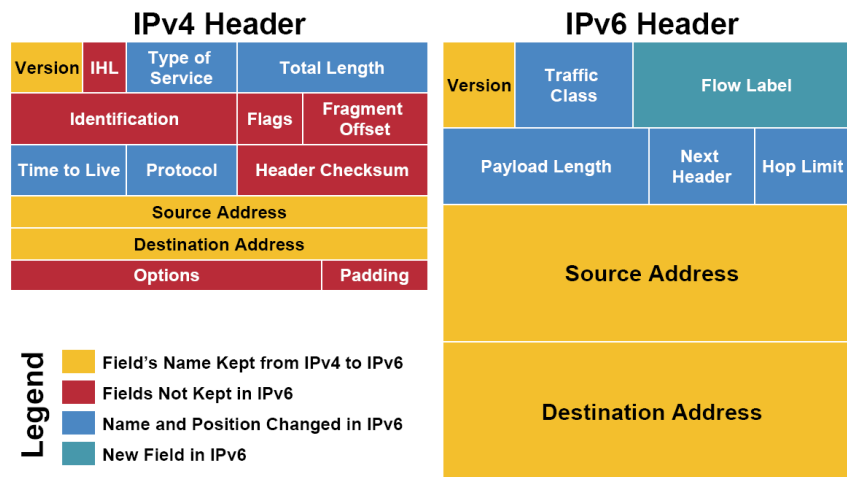


FIG. 1. IPv4 header and IPv6 header [5]

Traffic class is divided into two parts, the most significant 6 bits are used for Type of service and the least significant two bits are used for Explicit Congestion Notification (ECN). QoS (Quality of Service) management is provided by Flow Label field which is 20 bits. The source labels the sequence to help the router identify that a particular packet belongs to a specific flow of information. It is designed for streaming/real-time media. Payload Length is 16 bits long and is used to tell the router how much information a particular packet contains in its payload. Payload is composed of Extension Headers and Upper Layer data.

The type of extension header used is detected by the Next Header field. TTL field in IPv4 header is now renamed to its exact meaning Hop Limit.

Source Address and Destination Address are both 128 bits and have the same use as in IPv4 header. [4]

2.4 Transition mechanisms. The transition from IPv4 to IPv6 is expected to take years, and in the meantime, both protocols will have to coexist and interoperate. For this to happen IETF has developed various tools that come to help the network administrator's transition to IPv6. There are three categories of migration techniques:

- a) **Dual Stack:** Both IPv4 and IPv6 will run simultaneously on devices in the network, allowing them to coexist in the ISP network
- b) **Tunneling:** An IPv6 packet is encapsulated in IPv4 packet and send over an IPv4 network.
- c) **Translation:** A similar technique to NAT for IPv4 is used. Using NAT64 (Network Address Translation64), the IPv6 packet is translated to IPv4 packet.

End to end Dual Stack represents a major project for an ISP and it takes from 2 to 5 years to implement. The starting point of change is the core of the network, which is easy for most network operators, meaning a few months of work. The real problems start in the edge and access distribution layers, mostly because of the legacy equipment that does not support IPv6. Changing CPEs (Customer-premises Equipment) will most likely take years and IPv6 is needed in the meantime. As represented in Fig. 2 a server in dual configuration (IPv4 and IPv6 address) can communicate with other hosts through a dual stack router.

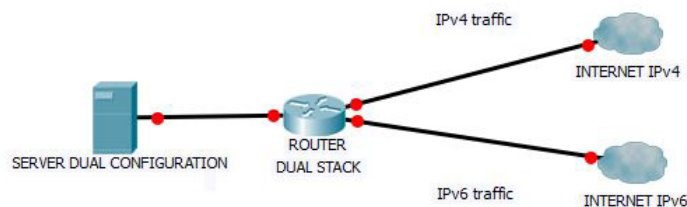


FIG. 2. Dual stack

The advantage of dual-stack is that it makes available to use devices that support only one IP protocol or both, allowing older network services to still be used. On the other hand, the costs for implementation are very high and very few organizations can change from IPv4 to IPv6.

Tunneling allows the use of IPv4 networks to carry IPv6 traffic and its basic principle of is shown in Fig. 3. This can be done either in a manual or in an automatic way. The manual configuration requires definite specification of the IPv4/IPv6 source and the tunnel IPv4/IPv6 destination. When the number of tunnels grows, administrating this technique becomes a major drawback.

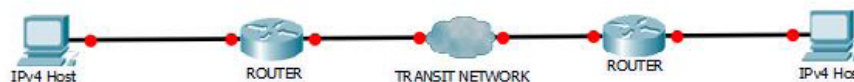


FIG. 3. Tunneling

For the automatic configuration, the final destination address of the IPv4/Iv6 packets is determined using an IPv4-compatible address of the IPv6 packet, which is usually the IPv4 address prefixed with 96 bits of 0s [6]. The main advantage of using the tunneling technique is that it uses the existing infrastructure of the ISPs and it meets their standards in terms of administration and costs.

Translation is used to achieve direct communication between IPv4 and IPv6. The new protocol supports translation from IPv4 header to IPv6 format. As illustrated in Fig. 4, when an IPv4 host tries to communicate with an IPv6 server, a NAT-PT (NAT – Protocol Translation) enabled device removes the IPv4 header of the packet, adds an IPv6 header and then sends it through to the server.

When the reply comes it does the other way around.

The algorithm for all translation methods is known as Stateless IP/ICMP Translator (SIIT). For an ISP, translation is not seen as a viable solution because of NAT use with IPv4.

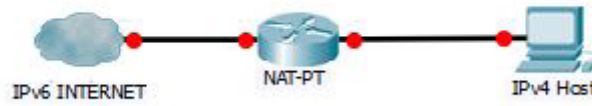


FIG. 4. NAT-PT Translation

3. IMPLEMENTATION AND ANALYSIS

For our dual-stack implementation we used the network diagram in Fig. 5. It represents real equipment from an ISP’s GPON (Gigabit Passive Optical Network) based infrastructure. The end user is connected to the network through the F668 ONT (Optical Network Terminal), which supports the dual stack configuration. For IPv6 we practiced on the subnet 2a02:2f0f:5c::/48, which we divided in four /50 subnets. The subnet on our VLAN (Virtual Local Area Network) was 2a02:2f0f:5c::/50, while our IPv4 subnet was 89.33.4.0/25. Also, for the IPv6 implementation, DNS6 was provided by the higher tier ISP connection. More on the configuration of our network card can be seen in Fig. 6.

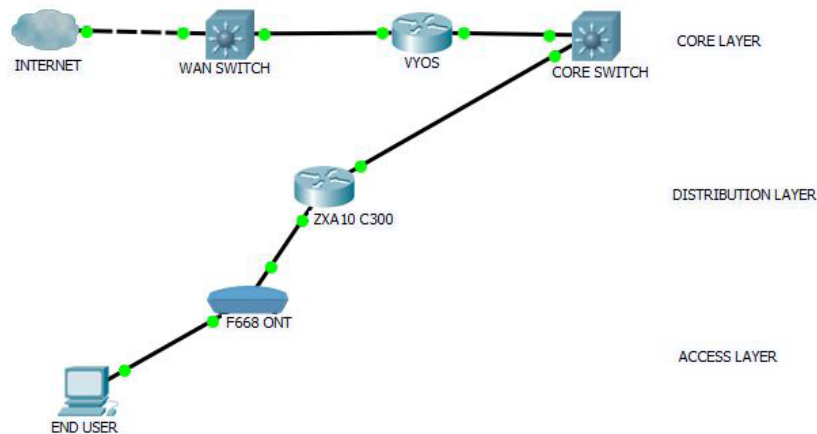


FIG. 5. Dual-Stack Network Topology

The VYOS internal router provides software-based network routing and was configured with BGP (Border Gateway Protocol) routing protocol.

Customers are aggregated by ZXA10 C300, which is an OLT (Optical Line Terminal). In our configuration we used the carrier’s OLT and ONT just for transport purposes. The default gateway was directly the VYOS router, which had dual-stack configuration, and as it can be seen in the Fig. 6, we had both IPv4 and IPv6 gateways on the end device.


```

C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.10586]
(c) 2015 Microsoft Corporation. All rights reserved.

C:\Users\enach_000>ipconfig

Windows IP Configuration

Wireless LAN adapter Local Area Connection* 3:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . :
    IPv6 Address . . . . . : 2a02:2f0f:5c::2
    Link-local IPv6 Address . . . . : fe80::1508:7f1a:f20d:17a%21
    IPv4 Address. . . . . : 89.33.4.133
    Subnet Mask . . . . . : 255.255.255.128
    Default Gateway . . . . . : 2a02:2f0f:5c::1
                                89.33.4.129
    
```

Fig 6. End User network card

Firstly, IPv6 connectivity was tested and for that purpose, we used Wireshark for network packets capture while we initiated ping to Google IPv6 public DNS server, as shown in Fig. 7.

No.	Time	Source	Destination	Protocol	Length	Info
96	14.689028	2a02:2f0f:5c::2	2001:4860:4860::8888	ICMPv6	94	Echo (ping) request id=0x0001, seq=1457, hop limit=128 (reply in 98)
98	14.732811	2001:4860:4860::8888	2a02:2f0f:5c::2	ICMPv6	94	Echo (ping) reply id=0x0001, seq=1457, hop limit=55 (request in 96)
102	15.693439	2a02:2f0f:5c::2	2001:4860:4860::8888	ICMPv6	94	Echo (ping) request id=0x0001, seq=1458, hop limit=128 (reply in 104)
104	15.735839	2001:4860:4860::8888	2a02:2f0f:5c::2	ICMPv6	94	Echo (ping) reply id=0x0001, seq=1458, hop limit=55 (request in 102)
107	16.700184	2a02:2f0f:5c::2	2001:4860:4860::8888	ICMPv6	94	Echo (ping) request id=0x0001, seq=1459, hop limit=128 (reply in 109)
109	16.742798	2001:4860:4860::8888	2a02:2f0f:5c::2	ICMPv6	94	Echo (ping) reply id=0x0001, seq=1459, hop limit=55 (request in 107)
112	17.704563	2a02:2f0f:5c::2	2001:4860:4860::8888	ICMPv6	94	Echo (ping) request id=0x0001, seq=1460, hop limit=128 (reply in 112)
113	17.746814	2001:4860:4860::8888	2a02:2f0f:5c::2	ICMPv6	94	Echo (ping) reply id=0x0001, seq=1460, hop limit=55 (request in 112)
130	19.733744	fe80::20c:29ff:fe7f_	2a02:2f0f:5c::2	ICMPv6	86	Neighbor Solicitation for 2a02:2f0f:5c::2 from 00:0c:29:7f:ec:c0
131	19.733796	2a02:2f0f:5c::2	fe80::20c:29ff:fe7f_	ICMPv6	86	Neighbor Advertisement 2a02:2f0f:5c::2 (sol, ovr) is at 08:62:66:cf:65:c3
146	24.645983	fe80::1508:7f1a:f20_	fe80::20c:29ff:fe7f_	ICMPv6	86	Neighbor Solicitation for fe80::20c:29ff:fe7f:ecc0 from 08:62:66:cf:65:c3
147	24.646623	fe80::20c:29ff:fe7f_	fe80::1508:7f1a:f20_	ICMPv6	78	Neighbor Advertisement fe80::20c:29ff:fe7f:ecc0 (rtr, sol)
178	29.653617	fe80::20c:29ff:fe7f_	fe80::1508:7f1a:f20_	ICMPv6	86	Neighbor Solicitation for fe80::1508:7f1a:f20d:17a from 00:0c:29:7f:ec:c0
179	29.653787	fe80::1508:7f1a:f20_	fe80::20c:29ff:fe7f_	ICMPv6	86	Neighbor Advertisement fe80::1508:7f1a:f20d:17a (sol, ovr) is at 08:62:66:cf:65:c3
201	34.839996	fe80::ffff:ffff:ffe	ff02::2	ICMPv6	103	Router Solicitation
203	34.893323	fe80::8000:f227:a10_	fe80::ffff:ffff:ffe	ICMPv6	151	Router Advertisement

FIG. 7. Wireshark IPv6 ping capture

Afterwards consecutive pings to Google and another site which does not have IPv6 connectivity were sent to test out our dual-stack configuration. The result is illustrated in Fig. 8, where highlighted in blue are the DNS enquires and responses from the servers and on pink background the actual ping requests and reply from IPv4 site and Google for IPv6. In the info tab for DNS lookup we can see the queries of type A for IPv4 and type AAAA for IPv6, which return the IP address of the site.

A Study of the Technology Transition from IPv4 to IPv6 for an ISP

No.	Time	Source	Destination	Protocol	Length	Info
61	6.084983	2a02:2f0f:5c::2	2a02:2f0c:8000:3...	DNS	90	Standard query 0xc550b A google.com
62	6.091077	2a02:2f0c:8000:3::1	2a02:2f0f:5c::2	DNS	106	Standard query response 0xc550b A google.com A 216.58.214.238
121	14.169788	2a02:2f0f:5c::2	2a02:2f0c:8000:3...	DNS	91	Standard query 0xc26c A arenait.net
122	14.169917	2a02:2f0f:5c::2	2a02:2f0c:8000:3...	DNS	91	Standard query 0xc4581 AAAA arenait.net
123	14.175101	2a02:2f0c:8000:3::1	2a02:2f0f:5c::2	DNS	107	Standard query response 0xc26c A arenait.net A 188.241.113.239
124	14.175101	2a02:2f0c:8000:3::1	2a02:2f0f:5c::2	DNS	149	Standard query response 0xc4581 AAAA arenait.net SOA ns1.intovps.com
125	14.180591	89.33.4.133	188.241.113.239	ICMP	74	Echo (ping) request id=0x0001, seq=10155/43815, ttl=128 (reply in 126)
126	14.186179	188.241.113.239	89.33.4.133	ICMP	74	Echo (ping) reply id=0x0001, seq=10155/43815, ttl=57 (request in 125)
129	15.184207	89.33.4.133	188.241.113.239	ICMP	74	Echo (ping) request id=0x0001, seq=10156/44071, ttl=128 (no response found!)
130	15.189722	188.241.113.239	89.33.4.133	ICMP	74	Echo (ping) reply id=0x0001, seq=10156/44071, ttl=57 (request in 129)
138	16.189213	89.33.4.133	188.241.113.239	ICMP	74	Echo (ping) request id=0x0001, seq=10157/44327, ttl=128 (reply in 139)
139	16.194868	188.241.113.239	89.33.4.133	ICMP	74	Echo (ping) reply id=0x0001, seq=10157/44327, ttl=57 (request in 138)
142	17.199770	89.33.4.133	188.241.113.239	ICMP	74	Echo (ping) request id=0x0001, seq=10158/44583, ttl=128 (reply in 143)
143	17.204915	188.241.113.239	89.33.4.133	ICMP	74	Echo (ping) reply id=0x0001, seq=10158/44583, ttl=57 (request in 142)
63	6.097024	2a02:2f0f:5c::2	2a00:1450:400d:8...	ICMPv6	94	Echo (ping) request id=0x0001, seq=1525, hop limit=128 (reply in 64)
64	6.111984	2a00:1450:400d:807::200e	2a02:2f0f:5c::2	ICMPv6	94	Echo (ping) reply id=0x0001, seq=1525, hop limit=57 (request in 63)
65	6.564285	fe80::ffff:ffff:ffff	ff02::2	ICMPv6	103	Router Solicitation

FIG. 8. Wireshark IPv4 and IPv6 ping capture

Source and destination address in Wireshark show end-to-end connectivity for both IPv4 and IPv6. As shown in the above figure we established both IPv4 and IPv6 connection using dual stack configuration on our end device and on real, ISP grade, equipment.

CONCLUSIONS

With IPv4 resources depleted, ISPs must enter the IPv6 era. Countries such as China and India are already moving forward, changing their infrastructure to support the new IP protocol. This fact determined ISPs from around the world to make the first steps towards the feature-rich IPv6, but there is still a long way to go. Given the transition mechanisms we overlooked in this study, dual stack is the viable solution for an ISP to migrate gradually to IPv6. It offers the possibility for hosts to reach content in both networks because of its ability to run the two protocols at the same time. Tunneling is not the way to go for an ISP because the protocol overhead increases the latency in the network.

Another drawback would be the administration of so many tunnels in an, already congested, service provider network. In this paper we created a sample of an ISP's network for the purpose of experimenting with IPv6 features and better understanding the steps of the migration, along with its transition mechanisms. We were able to test and debug on live equipment which gave us a better view of a real implementation when the time comes.

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NEW CONCEPTS ON MODERN AEROSPACE VEHICLES

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Abstract: *In the context of very rapid development of technology (also the Revolution in Military Affairs) and the growing importance of the vertical component in the modern warfare, a special attention should be given to possible ways of action and improvements in this field. A number of important physical phenomena open interesting possibilities of applications in the aerospace engineering, based on new principles of operation, able to completely revolutionize the constructive conceptions and the modalities of achieving the aerospace vehicles in the near future. To these physical phenomena and their possible applications in aerospace engineering, is dedicated the present work.*

Keywords: *Coanda, lenticular aerodyne, MHD propulsion, lifter, high-lift.*

1. INTRODUCTION

This paper seeks to highlight the modalities of application of some physical phenomena in the modern aerospace transport. In such a manner is put into attention a part of the bibliography of inventions used by the author in order to identify new constructive solutions and to draw the fundamental elements of new conceptions in aerospace engineering. Indeed, the present conceptions are largely wrong, and anyway, they not allow anymore notable improvements. Therefore, to get more and more new improvements will be necessary to completely modify our conception about the modalities to design/built and about the operating mode of the aerospace vehicles.

For example, we have to admit that *the lenticular form* is *optimal* for a modern aircraft, and such examples may continue. Another aspect investigated by this paper is the attempt of the author to present several models of aerospace vehicles based on hybrid technology.

In the author's conception, the use of hybrid technologies (adapted to the specific environment in which flies the vehicle) represents the solution that should be considered in the coming decades. Thus, we enter in a very few explored field and about that we still have much to learn...

2. NEW CONCEPTIONS

We will begin by presenting some technologies little or no further applied in the design and construction of the current aerospace vehicles, and how can be achieved the hybrid concepts using in this regard a discoidal aerodynamic cell. In fig. 1 is shown an proposed conceptual model for an experimental piloted aerospace vehicle, designed as *unconventional technologies demonstrator* for the following technologies:

-*cyclonoidal sustentation* (lift) and *propulsion* (the vacuum-propulsion type Liciar) using yhe elements (1) which are rotoric devices type cyclonoid (according the patent RO 21,370 granted in 1933 to Rudolf Liciar), also RO 24,293 granted to R. Liciar for the so-called "Turbomobil" or patent US 2,918,230 granted to Alexander Lippisch in 1956 etc.;

-*the hyper-sustentation (high lift) type Coanda*, with toroidal tank of compressed air and annular gap;

as shown in the drawing at (3) and according to Coanda's patents US 2,988,303 (in 1961, June) for an "Jet-Sustained Aircraft", US 2,939,654 granted in 1960, US 2,108,652 granted in 1938, US 2,920,448 for an "Aparatus for imparting a rapid speed to a mass of fluid" granted in 1960, US 2,946,540 for an "Jet propelled aircraft" granted to Coanda in 1960 etc.;

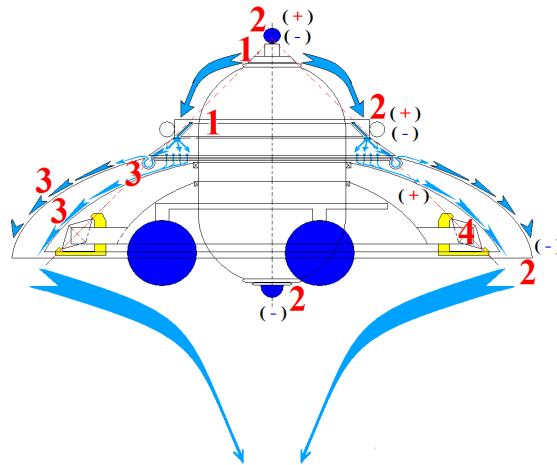


Fig. 1 A model of hybrid aerospace vehicle type electrokinetic/electrodynamic gyroscope with vacuum-sustentation.

-the electrokinetic sustentation and propulsion with high voltage electric field using beams of air which is preliminary (photo)ionized by the action of UV sources having an appropriate frequency and intensity, some of this electrokinetic installation are shown in the drawing by number (2); according the patents

US 7,182,295 (S. Redmond) in 2007,

US 3,227,901 (Bahnson) from 1966,

US 2,958,790 (Bahnson) from 1960,

US 3,263,102 (Bahnson) from 1966,

US 2,949,550 (T. T. Brown) from 1960, US 3,120,363 (G. Hagen) in 1964,

US 3,699,387 (Harrison) in 1972,

US 3,130,945 (De Seversky) in 1964,

US 3,464,207 (E. Okress) in 1969,

US 3,662,554 (De Broqueville) in 1972, US 6,145,298 (K. Burton) in 2000,

US 6,404,089 (M. Tomion) in 2002,

US 3,223,038 in 1965, GB 1,073,778 for "A system of flying ballistic or space bodies" granted to Werner von Enjel in 1963, US 2,279,586 for an "Electric discharge system" granted to W. H. Bennett in 1939, US 2,552,050 for an "Method of and means for generating electrical energy" granted to E. G. Linder in 1959, US 3,095,163 for an "Ionized boundary layer fluid pumping system" granted to G. A. Hill in 1963, US 3,360,220 for a "Magnetohydrodynamic method and apparatus" granted to R. X. Meyer in 1967, US 6,570,333 for a "Method for generating surface plasma" granted to P. A. Miller and B. P. Aragon in 2003, WO 2008/016928 for "Wingless hovering of micro air vehicle" granted to Roy Subrata in 2008 etc.

-the enhance of electrokinetic thrust effects by rotating the armatures between it is applied the electric field; according US 2,958,790 (Bahnson) from 1960;

-to use the engines with magnetic energy for driving the alternators (but there are other technological solutions: classic thermal engines with the Coanda's low-pressure turbine, the Tesla turbine etc.); according the patents RO 109,405 granted to N. Moraru in 1995, RO 122,470 granted to Gabriel Diaconu in 2009, RO 126,006 also granted to G. Diaconu in 2011 (all for engines which use the magnetic energy),

US 3,892,653 for an hydrogen generator, granted to Fr. Pacheco, GB 1908/22740 granted to Nicolaus Mischin in 1909 for an high voltage engine, or (in the field of thermal engines) RO 126,687 "Hydrogen generator with combustible emulsions" (G. Bordeianu), RO 123,124 for "Internal combustion engine" (G. Bordeianu), RO 122,868 for "Cylinder Head with rotating valves for the internal combustion engine" (G. Bordeianu), RO 122,351 "Vehicle powerplant" (G. Bordeianu), RO 119,561 "Complex Cylinder Head" (G. Bordeianu), RO 119,560 "Internal combustion engine" (G. Bordeianu), US 3,301,233 (Gianni Dotto) for an rotary engine, FR 661,254 granted to Tr. Vuia and E. Yvonneau in 1929 for a steam generator, FR 740,226 also granted to Tr. Vuia and E. Yvonneau in 1933 for a steam generator, the patents RO 41,446 (in 1960) and RO 42,186 (in 1959) granted to Henri Coanda and N. Teodorescu-Tintea for a turbine applying the Coanda effect, the patent US 4,935,639 for an improved turbine using the Coanda effect etc.

-to use *the improved secondary electrochemical sources*, powerful and compact battery type Pb-acid with *granulated electrodes and gelatinous electrolyte*, according the inventions of Nicolae Moraru;

-the sustentation *using very high vacuum which is electrodynamically generated* (the Marcel Pages's inventions);

-sustentation using *the gyroscopic vectorial force*;

-*the peripheral driving of air fascicles* using rotational (disc) surfaces provided with helicoidal slideways;

-to use the high voltage transformer type Tesla in order to achieve the high voltage and high frequency electric field for applying it between the armatures of the electrokinetic system, according the patent US 1,119,732 (Tesla) in 1914;

-to use the electromagnetic thrust vectoring, by the controlled varying of fields configuration and electromagnetic interactions.

Our proposed model is a hybrid aerospace vehicle, VTOL type, functioning completely silent, two-seater, five engines, equipped with five categories of virtually independent systems of lift/propulsion, operating on totally different principles which are indicated in the drawing by the numbers 1 - 4:

1- the vacuum-propulsion system (consisting of two motors with *cyclonoidal rotors*, one located at the leading edge and the other, inside the structure, used for driving the air fascicles through the internal ducts) forming an important low-pressure region at the leading edge of the flying vehicle and provides the boundary layer blowing on the all upper surface of the vehicle, so that the aerodynamic drag decreases considerably and the lift force is improved; on the surface of the rotative armatures described at 2, there are a series of helicoidal guides that make the air blown by cyclonoidal rotors to be engaged in a vortex motion and therefore, it participates in increasing the total thrust;

2- the electrokinetic installation consists of a dome (semi discoidal) which is fixed rigidly to the cabin and it is powered by the secondary of the Tesla transformer, being charged with positive or negative electric charges; other two devices which have the shape of a dome (semi discoidal) but smaller than the previously mentioned, being contra rotating (one rotates in one direction, the other in reverse) and being driven even by the applied electric field; one of these rotating domes is the electric armature of the opposite sign (+ or -) and the other is simply a reactive element which rotates contrary to the direction rotary electric armature;

3- the hypersustentation/propulsion installation type Coanda, supplied with the air under pressure which come out of the cyclonoid blades and it is used for boundary layer blowing on the upper surface of the static semi-discoidal dome, which could be (optionally) used as electrical armature into the electrokinetic installation, as described at 2;

4- the gyroscopic system (rigidly secured to one of the semi-discoidal rotating domes) that provides the vector summation of forces which have the application sense in upward, thus participating in the lifting and propulsion, independent from the electrokinetic system functioning and from the vacuum-propulsion system, the latter needing the presence of the relatively dense atmosphere in order to operate; the gyroscopic system need no atmosphere, but only an gravitational field;

5- the toroidal lifting system provided with an vacuum chamber, the vacuum being electrodynamically generated, in this regard, inside the annular chambers electron beams are accelerated to relativistic speed (*not shown in drawing*).

3. SEVERAL HYBRID MODELS

The description of an discoidal aircraft (shown in fig. 2) entirely based on unconventional technologies: 1- the upper armature of the electric discharge system; 2- lifting cyclonoid; 3- the secondary of the

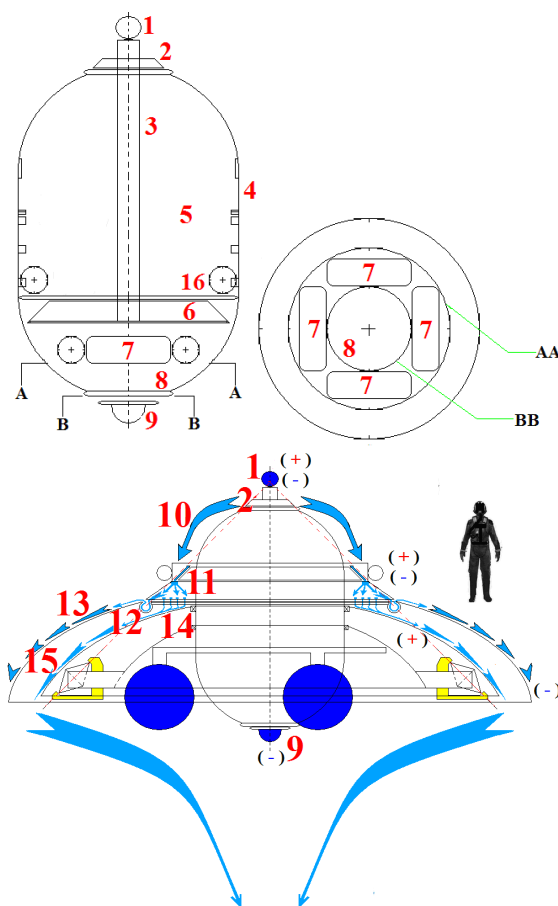


Fig. 2 An model of discoidal aerospace vehicle based on new technologies.

Tesla transformer; 4- the hermetical outer cabin having the outer envelope made from dielectric material; 5- the cockpit; 6- the primary of Tesla transformer (designed to operate at 1 MW power); 7- pair motor-generator group composed of magnetic engine type Moraru and a compact three-phase alternator developing a rated output of 125 kVA; there are provided 4 such pairs of motor-generator with a total power (output) of 500 kVA and a weight of approx. 200 kg, the Moraru magnet motor operates at a ratio of 7 HP (5.15 kW) / kg of magnetic core, and develops 125 kW using to this end 25 kg of magnetic material, and the 125 kW alternator has about 25 kg; 8- acces hatch for crew; 9- lower armature; 10- the air jets ejected from the lifting cyclonoid, by applying the Coanda effect adhere to the cabin wall going into the annular air-intakes of the propulsion cyclonoid; 11- the propulsion cyclonoid sends the high-speed air jets in the aircraft's internal pipes; 12- annular device (invented by Coanda) provided with exhaust slot for the air jets which make the boundary layer blowing on the outer wall surface, applying an upward force; 13- by applying the Coanda effect on the semi-lenticular surface, the air adheres to the outer surface, creating depression;

14- the air jets which could not enter into the Coanda device, above mentioned, go on the semi-lenticular interior wall, where they make a depression on the upper surface and thus another force oriented upwards, due to excess pressure from the low surface; 15- the air flows on the semi-lenticular rotating surface provided at the upper side with a network of helical grooves, which makes the air to get a swirling motion and that causes the exhaust to produce an additional thrust; 16- the motor-generator backup system, developing also 500 kVA. Alternator Lucas AE 2134: Rated output power- 120 kVA, Maximum power- 180 kVA, Short time power- 240 kVA (for 5 seconds), Power factor- 0,75 – 0,95, Rated voltage- 200/115 V, Rotation speed- 12,000 rot/min, Cooling system- with pulverized oil weight- 26,3 kg.

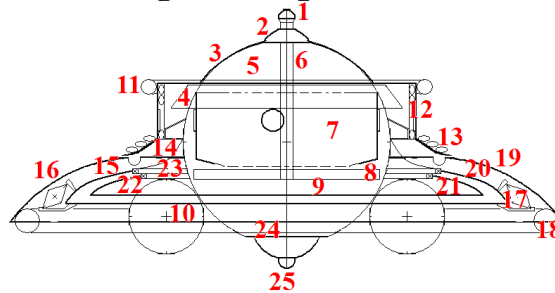


Fig. 3 Another model of unconventional aerospace vehicle

In fig. 3 is shown a possible model of an electrokinetic/gyroscopic vehicle with vacuum-propulsion: 1- the upper electrode of the high voltage (and high frequency) installation powered by the secondary of a Tesla transformer (patent US 1,119,732 1914); 2- the annular rotor of the lifting cyclonoid (patent RO 21,370 in 1933, March 11th) whose purpose is to produce a vacuum region (p-) at the leading edge of the vehicle; 3- the surface where is flowing the air ejected from the cyclonoid (2) and thus is surrounded (by applying the Coanda effect, according to the patent FR 792,754, also published as US 2,052,869) by a low pressure (p-) boundary layer in order to reduce the air friction (the aerodynamic drag) and therefore, to increase the total lifting force; 4- the annular rotor of propulsion cyclonoid, which sends the compressed air into the vehicle's internal ducts; 5- the pressurized cabin, made from (electro)insulated material; 6- the metal pillar (insulated on the outside) that provides (according the Patent US 1,119,732 granted in 1914) the high-voltage power supply of the components (1) and (19); 7- the cockpit provided for a team of two persons, at least; it is a hermetic cabin fitted with side portholes and access hatches at it's upper and lower side; in the top of the cabin is a service module that has inside several components of the electrical installation and tanks with materials for the air conditioning installation, magnet motors (according the Patent RO 109,405 granted in 1995) used to drive the rotors of cyclonoids etc.; in the lower side of the cabin is the compartment of the electrokinetic engine aggregates, which contains among other things, electrogene groups, the Tesla transformer etc.; 8- the primary of the Tesla transformer (an large diameter Tesla coil); 9- the compartment for the engine aggregates; 10- the spherical capacitors of the maneuvering system (according the Patent US 2,958,790 granted in 1960, US 3,263,102 granted in 1966 and US 3,322,374, granted in 1964) which are rigidly fixed to a annular platform (not shown in illustration) made from dielectric material and rigidly fixed to the cabin structure (5) ; 11- the toroidal winding participating at the air ionization (according the Patent US 3,322,374 granted in 1964) and the formation of a magnetic field which drives the ionized particles; 12- UV-C bulbs used for the photo-ionization of the air in the boundary layer region (according the Patent US 7,182,295 in 2007); 13- intermediate annular electrodes (according the Patent US 3,322,374 granted in 1964); 14- shaped surface for guiding the air jets; 15- the toroidal chamber fitted with a Coanda annular gap (according the Patent US 2,990,103 granted in 1961, or the Patent RO 24,690 granted in 1936) in order to blow the boundary layer on the upper surface of dome (semi-discoidal) surface (19);

16- the low-pressure region (p-) made by blowing the boundary layer according the model of the Coanda lenticular aerodyne (the patent FR 1,156,516 granted in 1958); 17- gyroscopic devices of reaction, that develops precession forces which are oriented obliquely upwards; they are mounted in bearings and fixed to the rotating disc (20); 18- toroidal chamber in which electron beams are accelerated at relativistic speed creating the total vacuum and therefore (according the Patent FR 1,253,902 granted in 1961) applying the principle of Archimedes; 19- the outer electrode which is rigidly fixed to the cabin (5) and it has as power supply, like the upper electrode (1), the secondary (6) of the Tesla transformer; 20- the internal rotating electrode (according the Patent US 3,223,038 granted in 1965) which is coupled to the opposite terminal of the voltage source, it is charged with electric charges of opposite sign than the armature (19); in its peripheral region, this rotational (gyro) electrode has several counter-rotating components (of reaction) which use the force of precession; 21- the (semi)discoidal dome which rotates contrary to the rotating discoidal armature (20) therefore canceling its gyroscopic torque; 22- bearings devices on that are attached the two semi-discoidal rotating domes (20) and (21); 23- annular platforms rigidly fixed to the cabin (5), which have to their end the bearings (22); 24- the lower access hatch; 25- the lower side electrode which has the same high voltage power supply as the components (1), (19) and (20).

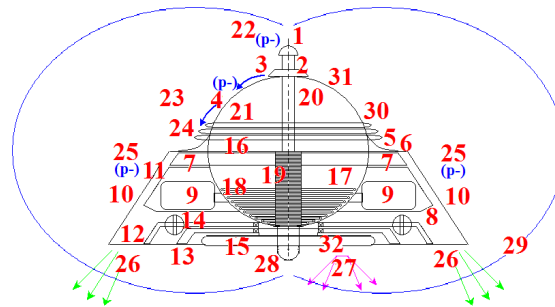


Fig.4 A simplified model of unconventional aerospace flying vehicle.

As part of the designing were taken into account the technological solutions proposed by the inventors: *Scott Redmond* (according the Patent US 7,182,295 granted for „Flying Individual Apparatus”), *Mark Tomion* (according the patent US 6,404,089 granted for „Electrodynamic Field Generator”), *R. J. King* (US 3,322,374 for „Magnetohydrodynamic propulsion apparatus”), *A. H. Bahnson* (US 3,263,102 for „Electrical Thrust production device”, US 3,227,901 for „Electrical Thrust production device”, US 3,223,038 for „Electrical Thrust production device”, US 2,958,790 for „Electrical Thrust production device”), *Otis Carr* (US 2,912,244 for „Amusement device”), *Harvey Fiala* (US 2011/0219893 for „inertial propulsion device”), *Harold Aspden* (GB 2,209,832 for „Gyroscope propulsion and levitation”), *Marcel Pages* (FR 1,253,902 for „Engin pour vols cosmiques”), *Ya-Ta You* and others (US 6,794,783 for „Flat rotary electric generator”), *Subrata Roy* (US 2010/0102174 for „Micro Air-vehicle of Wingless hovering”).

The description of model shown in fig.4: 1- the upper side armature of the electrokinetic installation, powered by the secondary of the Tesla transformer; 2- central pillar (used for power supply) made of a (electro)conducting material; 3- lifting cyclonoid (used for sustentation); 4- region of low-pressure created by blowing the boundary layer; 5- aerodynamic flap; 6- annular air inlet for the propulsion cyclonoid; 7- propulsion cyclonoid; 8- the fairing of the service module which is located within the structure of the aerospace vehicle and it has inside the electrogen groups; 9- the electrogen groups; 10- armature fixed rigidly to the cabin; 11- toroidal conduit using for the air outlet; 12- internal mobile armature; 13- counter-rotating disk with anti-torque role and for maximizing the field effect (it is not powered by any electric source, but located within the electric field of 12 and reacting to this field); 14- reactive gyro-elements located on the periphery of the rotor (13); 15- capacitors organized in three segments offset at 120° each;

16- the platform of cockpit that separates the cabin from the engine module; 17- the engine module; 18- the primary of Tesla transformer; 19- the secondary of Tesla transformer; 20- the region where work the UV-C radiation sources; 21- the cockpit; 22- the low-pressure zone at the leading edge; 23- ionized air; 24- intermediate toroidal coils powered at high-frequency (microwaves) in order to ionise the air and to drive the ionized air molecules after the field lines; 25- low-pressure zone at the trailing edge; 26- ejected air at the trailing edge; 27- the action of the electric field made by the capacitors; 28- the lower side armature of the electrokinetic installation, powered by the Tesla transformer together with the elements (1), (10), (12) and (24); 29- the field lines formed around the vehicle; 30- the portholes; 31- external video cameras; 32- the landing gear compartment located in the spaces between the segments of the capacitors used for maneuvering.

4. NEW SOLUTIONS

Currently, based on the previously submitted models, it can be designed such an experimental VTOL [1] (or STOL [2]) aerospace vehicle as a demonstrator for the following *technical solutions*:

- the steam generator type Vuia – Moraru [3] operated anaerobic and applied as orientation-stabilization engine, using for flight commands the TVC [4] method;
- the oxygen plant [5] type electrolyte-regenerative [6], using an homopolar [7] generator and an hydrolytic [8] device, with a system that provides the partial regeneration [9] of the expired gas and of the water into the microatmosphere [10] of the cabin;
- the magnetic engine[11] type Moraru [12] used to drive the rotors of the eletrogene groups and the cyclonoidal devices;
- the electrostatic generator, capacitive [13] type, made by J. G. Trump [14], device operating in a high vacuum;
- the improved brushless homopolar generator [15];
- the internal wing [16] type Coanda, endowed with an high-lift system which absorbs the boundary layer on the upper side of the wing, using porous shell [17];
- the thrust vector control [18] using aerodynamic control surfaces working at the trailing edge [19];
- lifting and propulsion within the Earth's atmosphere using the cyclonoid [20] system;
- the wing with negative dihedral [21] and variable wing span, also used as landing tripod [22];
- the MHD [23] rocket engine with pulsed plasma source type Z-pinch [24] and a magnetic accelerator type Bitter [25];
- MHD propulsion system integrated [26] into the surface of the wings and containing the high voltage electric discharge device and the magnetic winding;
- the secondary electrochemical sources with granular electrodes and gelatinous [27] electrolyte.

An experimental aircraft designed to test all these technologies, might be in the form of a multi-engine rocket-plane, two-seater cote-à-cote, monoplane, mid-wing, with variable dihedral angle and span, when the wing has its maximum negative dihedral position, it can be used as a part of a landing tripod.

This flying apparatus type VTOL (vertical take-off/landing) is provided with lifting system type cyclonoid, equipped with a special semi-lenticular [28] surface for high/low-lifting [29]. When the cyclonoid [30] rotor is positioned above the surface of semi-lenticular surface, it operates in the high-lifting mode, and when the rotor is positioned on the underside of the semi-lenticular surface, it works in operating as low-lift device (the controled decreasing of lift force in order to make the downward movement of the aircraft in the vertical plane). With the lifting-cyclonoid and the high/low-lift surface, the vehicle can take-off and land slow and vertically, using almost any land surface, even the undeveloped land [31].

The control of spatial position and movement in flight is ensured through a system of vector commands composed of aerodynamic flaps at trailing edge, fitted in behind the ejector (nozzle) of the main *atmospheric engine* [32] engine, and formed from two pairs of horizontal and vertical tail assemblies located at the trailing edge and provided with mobile command surfaces. Besides this system, the experimental flying vehicle also might have an improved steam generator type Vuia-Moraru [33], with anaerobic work. This has four mini-nozzles arranged symmetric and antagonist (up-down, left-right) plus a nozzle disposed in the longitudinal axis ejecting the gases against the direction of flight, this latter facilitates the braking when the flying apparatus is moving with low speed near the ground, to land slowly and vertical. The steam generator type Vuia-Moraru (operating anaerobic) provides mini-jets for the correction of the position and orientation in space, especially in the upper atmosphere, where the classic aerodynamic surfaces become ineffective or even useless above a certain height [34].

The actuation of the *cyclonoid* devices (for lifting and propulsion) can be performed using the engine type Moraru [35], powered by the electrochemical secondary source with granular electrodes and gelatinous electrolyte.

The wing can be trapezoidal, rectangular, with variable negative dihedral and variable span, adjusted according to speed; another solution is to use the fixed tail assemblies type 4-fins placement or other models, having the same structure and role as the variant with variable geometry wing. In the latter case, the end (wing tip) of the wing is provided with an aerodynamically shaped body, type winglet [36], and a front rod which serves to ensure the good stability of the ground stationing (part of the landing tripod). The wing is also provided with an internal leakage surface (the so-called “internal wing type Coanda”), a porous upper-surface of wing, which absorbs the boundary layer. Both the upper side and the lower surface of the wing might be equipped on all its area, with discharge electrodes supplied with high voltage, and with magnetic winding [37]. Using MHD-type systems it can achieve improved performances [38], [39], [40] for the systems which apply the Coanda [41] effect, but also in the systems designed to reduce [42] the aerodynamic resistance (the drag). The air is ionized by the electric discharges and then accelerated in a magnetic field, thus optimized the air leakage in the region of boundary layer and optimized the propulsion by a significant drop in air resistance (drag force) and the warming caused by the air friction. With the increased speed of flight, the crew can adjust the negative dihedral angle and the wing span [43]. The work of the wing can be both improved by high-lift device which absorbs the boundary layer optimizing its aerodynamic performances, and by the magnetohydrodynamic control of the air flow. At the same time, the wing might be used (during the landing and ground parking) as a landing tripod (instead of the classic landing gear) and in this regard it can be equipped at its end with a rubber roller package [44]. To serve as a landing tripod, the wing have to be adjusted to the position of the maximum negative dihedral angle.

The power supply of the MHD system inserted in the wing structure, but also of the plasma source of the main engine, might be achieved using the Trump electrostatic capacitive generator [45] (or improved models [46] of it) operating under vacuum. It can supply megawatt [47] power and high voltage if operating in pulsed mode. The magnetic coil that enfolds the wings is powered by an improved model of the brushless homopolar generator [48], that provides a current high enough to obtain the required magnetic induction. The electrostatic capacitive generators can also supply special engines [49] which work at high voltages and are much more simple and efficient than the classic electric engines.

The motorization is made via three main types of propulsion systems:

- *the atmospheric propulsion system*, which has to ensure the functioning exclusively within the Earth’s low atmosphere and stratosphere;
- *the space propulsion system*, which has to operate in the upper atmosphere and outer space;
- *the orientation-stabilization engine* that works both in the dense atmosphere and outer space.

The atmospheric propulsion system consists of two rotary devices type *cyclonoid*, one used for lifting and the another for propulsion [50]. Also, the MHD system inserted in the wing structure and the internal air-leakage system or for the absorption of boundary layer on the upper side of the wing, still belong in this category.

The space propulsion system (the engine for cosmic flight) consists of a chamber with coaxial electrodes Z-pinch [51] type, with pulse operation, supplied by a DC high voltage generator (pulse operation too), like the one invented by J. G. Trump. The same propulsion system contains a *Bitter* [52] magnetic accelerator with continuous operation. It is supplied from the homopolar generator, and the Z-pinch co-axial discharge chamber is fueled with the hydrogen produced in the hydrolytic basin of the oxygen plant [53]. There, the water is decomposed into hydrogen and oxygen, of which the oxygen is sent in the micro-atmosphere of the cockpit, and hydrogen is sent to a storage tank endowed with metal hydrides [54] or is sent directly inside the Z-pinch discharge chamber of the cosmic engine.

The hydrogen is ionized, magnetic compressed and accelerated using the phenomenon of Z-pinch, being sent inside the magnetic accelerator where the plasma is again confined and accelerated to relativistic values for the effective exhaust velocity.

During the movement in the upper atmosphere and outer space, as any time when a quick correction of the orientation and spatial position of the vehicle is necessary, it might be used the orientation-stabilization engine with micro-jets of steam. It uses an anaerobic combustion mixture which fueled a steam generator, according to the invention of Traian Vuia [55], later improved by Nicolae Moraru [56]. This high pressure steam generator, supplies five mini-nozzles located right at the leading edge of the aerospace vehicle, and it can act on the direct command of the pilot or automatically, on the autopilot command. Its consumption is small, its interventions being brief and with very low flow rates. Given the very high initial pressure of the steam, the thrust is sufficient to achieve the desired positioning/orientation of the vehicle. Regarding the main engine operation, it is optimal in the rarefied strata of the atmosphere and in outer space, however, it is not impossible (but not recommended) in the dense layers [57] of the atmosphere. The hydrogen plasma is initially accelerated (about 1000 km/sec) by the magnetic compression (Z-pinch) and then (within the magnetic accelerator type *Bitter*) with a magnetic field of more than 20 Tesla. The action of the magnetic field on the plasma represents the reaction force underlying the thrust developed by this engine.

CONCLUSIONS

First, we need to notice that the current technologies applied in the aerospace field are based on a number of fundamental errors:

- the optimal aerodynamic configurations are not used or even no model close to them;
- there are not canceled but only reduced in small measure the shock waves and the marginal vortices formed during the movement in the atmosphere;
- there are not used the electrical and magnetic phenomena that could force the air to follow much better controlled trajectories;
- the external surface of the aircrafts is not used to obtain the full lift and propulsion capacity (using the MHD methods);
- there are not taken into account the methods of creating regions of vacuum or low pressure at the leading edge or in the boundary-layer zones;
- there are not considered the hybrid methods and technologies etc.

All these aspects and others not mentioned here, will therefore be considered in order to obtain completely new models for the design of aerospace vehicles in the near future.

The revolutionizing of the aerospace technologies represent a field which still reserve us a lot of surprises and therefore, more and more opinions are expected in this respect, particularly from specialists.

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ASPECTS REGARDING THE QUALITATIVE ANALYSIS OF RISKS DUE TO THE OCCURRENCE OF LOW PROBABILITY AND VERY HIGH IMPACT EVENTS

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***Abstract:** Extreme events, such as earthquakes, floods, tsunamis, nuclear accidents, terrorism etc., have a very high impact, they are claiming large material losses and casualties in many cases. For the assessment of such low probability events it is necessary to use qualitative analysis techniques. Risk matrices used in qualitative analysis places these risks in the medium risk category, meaning an acceptable level. The paper proposes a means of changing matrices used in qualitative analysis, so that extreme risks from increasingly present to be classified as having a high level. Such theoretical repositioning will lead to changes in treatment applied.*

***Keywords:** extreme event, qualitative analysis, risk, probability impact, matrix*

1. INTRODUCTION

As a result of economic globalization become multi-national with divisions and productive units dispersed across territories political, legislative, social, cultural, economic, competitive and natural factors are different from one territory to another. This situation generates a multitude of risks highly complex, with different manifestation from one territory to another. Diversity and dynamic factors give rise to a whole series of global risks, decisively influencing management decisions.

Together with the economic globalization, the competition gains another dimension, also through its globalization, and the factors of the competitive external environment linked to: industrial rivalry, suppliers, consumers and substituting products. As a result, generates a whole series of risks: exploitation risks, financial and bankruptcy risks which require adaptability and flexibility in the decisional and managerial systems of the economical organizations.

In the case of a trans-national company, the internal environment gains a new territorial dimension, which comes with new series of risk factors, such as: work attitude, work costs, cultural and religious elements, workforce qualification etc. Certain factors that may represent a particular territory strengths other territories become weaknesses, is on the one hand generating risks, and on the other hand increasing the number of variables in decision-making processes. Economic globalization creates an environment where factors such as: natural catastrophes, threats from new technologies (nuclear risks), demographic and climatic changes lead to a large number of risks which have to be taken into account by enterprise management in the decision making process [1]. The "Global risks 2015" report, presents as the most important risks for trans-national companies, the following [2]:

- geopolitical risks: international conflict, failure of national governance, state collapse or crisis, proliferation of the weapons of mass destruction etc.;
- social risks: diminished water resources, quick spread of infectious disease;
- environmental risks: extreme meteorological events, failure to adapt to climatic change etc.;
- economic risks: high unemployment or underemployment rates, failures of or attacks on energy, water and transport systems etc.

A large part of the risks faced by economic entities is generated by events with a low probability to appear but with a very high impact (EPAMIR). Events such as high earthquakes, extreme weather events (hurricanes, tsunamis), terrorism, massive population migrations, economic crisis etc. belong to this category.

2. THE QUALITATIVE ANALYSIS OF RISKS CAUSED BY EPAMIR

In order to be placed in the EPAMIR category, an event must meet the following conditions:

- is extreme, well beyond normal expectations, as nothing from the past can indicate convincingly the possibility of its appearance;
- has an extreme impact;
- although the event is extreme, human nature makes us produce the explanations required to explain it only after its appearance, making the event look predictable and explainable.

Because very small probabilities are difficult to determine, analyze qualitative gains, in case of EPAMIR phenomena, a major issue in the process of risk management and involves the following steps [4]:

- choosing the scales of probability and risk impact;
- establishing a risk matrix reference;
- determining the risk score and risk matrix composition;
- risk hierarchy.

2.1 Choosing the risk probability and impact scales. The appearance probability of an extreme phenomenon is very low and hard to determine. On the other hand, the probability does not indicate the timing of the event. This is the reason why a scale with risk probability levels can be used to place each risk factor within certain probability levels. This can usually a number of levels ranging between 3 and 5. Such an example of risk probability scale is shown in Table 1. It can be built with the help of two values categories [4]:

- ordinal values, in which case each risk level gets a grade, respectively: very low (almost impossible), low (improbable), medium (possible), high (probable), very high (almost certain);

Table 1. Risk probability scale

Qualitative evaluation of probability	Quantitative evaluation of probability	Probability score
Very high	Once in 5 years	5
High	Between 5 and 10 years	4
Medium	Between 10 and 20 years	3
Low	Between 20 and 50 years	2
Very low	Above 50 years	1

- cardinal values, in which case each level is attributed a probability score, respectively: 1, 2, 3, 4 și 5, where 1 is the score for a risk with a very low probability of appearance and 5 is the score for a risk with a very high probability of appearance.

Also, for the risk impact a scale with impact levels is chosen which reflects the damage severity in the event that risk and it can have:

- ordinal values, respectively impact grades: very low, low, moderate, high, very high;
- cardinal values, with values of the risk impact of 1, 2, 5, 10 and 20, where 1 is the value for a very low impact risk, and 20 for a very high impact. An example scale for the risk impact is presented in Table 2 [5].

Table 2. Risk impact scale

Qualitative impact evaluation	Quantitative evaluation of impact	Impact score
Very high	Material damage is higher than 20% of the objectives' value, serious injuries for more than 10 people and/or loss of human lives	20
High	Material damage between 5 and 20% of the objectives' value, severe injuries for 1-10 people.	10
Moderate	Material damage between 3 and 5% of the objectives' value, light injuries for 3-10 people.	5
Low	Material damage between 1 and 2% of the objectives' value, light injuries for 1-3 people.	2
Very low	Material damage below 1%, no injuries.	1

2.2 Establishing the risk reference matrix. The risk reference matrix is built by combining the risks' probability and impact scales shown in Tables 1 and 2. The risk matrix can be represented both in a ordinal form (the risk level matrix) and a cardinal form (the risk score matrix). The risk matrix can be built using 3, 4 or 5 levels of probability or impact. Some authors use a matrix of risk level consists of 4 levels of probability and impact [6], while others recommend five such levels [7]. The authors propose for this study, the level of risk matrix with 5 levels of probability and impact presented in Table 3. The aim, through this approach, is to improve decision support regarding the choice treatment to apply to extreme risk.

The risk level matrix shown in table 3 is obtained by combining the ordinal probability and impact scales from tables 1 and 2. This matrix contains five risk levels, which are: very low, low, moderate, high and very high. Each risk level is given a color, that is: dark green for very low, light green for low, yellow for moderate, orange for high and red for very high.

Table 3. Risk level matrix

Very high	5	Low	Moderate	High	Very high	Very high
High	4	Very low	Low	Moderate	High	Very high
Medium	3	Very low	Low	Moderate	High	Very high
Low	2	Very low	Very low	Moderate	Moderate	High
Very low	1	Very low	Very low	Low	Moderate	Moderate
	Score	1	2	5	10	20
PROBABILITY		Very low	Low	Moderate	High	Very high
		IMPACT				

The risk score (SR), is a criterion which can be used to rank risks and it is calculated as the the product between the probability score for the risk (sp) and its impact score (SI), according to Relation 1:

$$SR = SP \times SI \tag{1}$$

The risk score matrix, which confers a quantitative aspect to the qualitative analysis, is shown in table 4 and is obtained in two stages:

- replace the ordinal probability and impact scales in table 3 with the cardinal scales chosen in tables 1 and 2;

- **establish in each cell of table 4 the values of the risk scores, calculated with the relation 1.**

Risk classification, respectively associating the colors corresponding to both the risk level matrix and the risk score matrix is shown in table 5.

Table 5. Risk classification

SR Value	Risk Level	Associated color
$50 \leq SR \leq 100$	5 – very high risk	Red
$25 \leq SR \leq 40$	4 – high risk	Orange
$10 \leq SR \leq 20$	3 – medium risk (moderate)	Yellow
$5 \leq SR \leq 8$	2 – low risk	Light green
$1 \leq SR \leq 4$	1 – very low risk	Green

2.3 Risk evaluation. A frequently approach used in risk evaluation, known under the ALARP acronym (As Low As Reasonably Practicable) it is treated extensively in the literature [8][9][10][11]. ALARP method divides the risks in three zones:

- the unacceptable zone, which includes the high and very high risks, with the red and orange colors in Table 5. The risk is considered unacceptable and in this case risk reducing measures are obligatory, regardless of the costs involved;

- the tolerable zone, which includes the medium risks, with the yellow color. The risk is considered tolerable, if reducing it is impossible or the costs to reduce it surpass the obtainable results;

- the acceptable zone, which includes the low and very low risks, with the dark and light green colors. No measures are required for these risks, as long as they stay at these levels.

2.4 Determining the risks' scores and building the risk matrix. For each of the identified risks of risk factors (R_i), the probability score (SP_i) and the impact score (SI_i) area established according to the chosen probability and impact scales and the SR_i score is calculated, where $i = 1, 2, \dots, n$, using the relation 1. The global risk score is determined by using the Relation 2:

$$SRM = \sum_{i=1}^n SR_i / n, \tag{2}$$

where n is the number of risk factors.

With the help of these data, the risk matrix, presented in Table 6, is built.

Table 6. Risk matrix

Risk	Probability					Impact					IPR
Score	1	2	3	4	5	1	2	5	10	20	
R_1		SP_1						SI_1			$SR_1 = SP_1 \cdot SI_1$
R_2				SP_2			SI_2				$SR_2 = SP_2 \cdot SI_2$
...											...
R_i			SP_i						SI_i		$SR_i = SP_i \cdot SI_i$
...											...
R_n			SP_n					SI_n			$SR_n = SP_n \cdot SI_n$
SRM											$\sum SR_i/n$

In order to evaluate the risk factors, the risk score matrix is ordered after the descending values of the calculated risk score, thus obtaining the ordered risk matrix. Such an example is shown in Table 7.

Table 7. Risk matrix

Risk	Probability					Impact					IPR
Score	1	2	3	4	5	1	2	5	10	20	
R_1		SP_1						SI_1			$SR_1 = SP_1 \cdot SI_1$
R_2				SP_2			SI_2				$SR_2 = SP_2 \cdot SI_2$
...											...
R_i			SP_i						SI_i		$SR_i = SP_i \cdot SI_i$
...											...
R_{n-1}		SP_{n-1}							SI_{n-1}		$SR_{n-1} = SP_{n-1} \cdot SI_{n-1}$
R_n			SP_n					SI_n			$SR_n = SP_n \cdot SI_n$
SRM											$\sum SR_i/n$

Inside this matrix, each risk is associated, depending on its score, the corresponding color, in accordance with the classification in Table 5 and, depending on this level, measures are taken to reduce the risk by following the ALARP risk evaluation model.

2.5 The limits of the risk’s qualitative analysis model in the case of extreme phenomenon.

In the case of EPAMIR, according to the risk matrix shown in Table 3, the risk associated with the very low probability and very high impact is classified as moderate being colored yellow. [4][5] [12]. According to ALARP, moderate risks are considered tolerable and they don’t require special measures. Calculating the risk score according to relation (1), we obtain $SR = 1 \times 20 = 20$.

This score places the risk, according to the risk score matrix shown in Table 4, in the moderate category, which is acceptable. In authors opinion , they are rare events having a devastating impact and are unacceptable.

These risks must benefit from one of the two categories of measures to reduce them:

- elimination – for example, in the case of airplane terrorism, the risk can be eliminated through thorough passenger, crew and airport personnel checks;
- impact reduction – for example, the risk of strong earthquake, higher than 7, can't be avoided, but its effects can be considerably reduced by consolidating vulnerable buildings or by designing buildings with the proper supporting structure.

3. REFERENCE MATRICES USABLE IN THE QUALITATIVE ANALYSIS OF EXTREME EVENTS

For the qualitative analysis of EPAMIR events, a risk level matrix is proposed where the pair very low probability and very high impact. Is associated brown color and its risk level is considered high. The new risk level matrix is shown in Table 8.

Table 8. Risk level matrix

Very high	5	Low	Moderate	High	Very high	Very high
High	4	Very low	Low	Moderate	High	Very high
Medium	3	Very low	Low	Moderate	High	Very high
Low	2	Very low	Very low	Moderate	Moderate	High
Very low	1	Very low	Very low	Low	Moderate	High
	Score	1	2	5	10	20
PROBABILITY		Very low	Low	Moderate	High	Very high
		IMPACT				

According to this matrix, EPAMIR are no longer part of the medium risks, acceptable according to ALARP, they are now part of the *high risk category*, which must be dealt with, either by eliminating them or by reducing their impact. In the case of the risk score matrix, the very high impact level gets a score of $SI = 25$. The risk scores corresponding to the (*very low probability – very high impact*) pair becomes $SR = 1 \times 25 = 25$.

This score brings this category of risks to level 4 – *high risks*, which must be either eliminated or their potential impact reduced.

The risk score matrix thus obtained is presented in Table 9.

Table 9. Risk score matrix

Very high	5	5	10	25	50	125
High	4	4	8	20	40	100
Medium	3	3	6	15	30	75
Low	2	2	4	10	20	50
Very low	1	1	2	5	10	25
	Score	1	2	5	10	25
PROBABILITY		Very low	Low	Moderate	High	Very high
		IMPACT				

The new risk matrix, above, can be used in the qualitative analysis of risk events EPAMIR framing them in the high risk category, which can not be accepted. If the latter category, analyze risk factors, even after the events and the establishment of appropriate treatment will be impossible to produce such events.

CONCLUSIONS

The EPAMIR type events must be included in the high risk category, which means that measures must be taken to either eliminate them or reduce their impact.

The qualitative analysis gains special importance in the risk management process for EPAMIR, as it allows the risks to be evaluated and the decision to be made on the appropriate response measures. Evaluating the risk factors, events occurred and establishing the appropriate corrective measures will lead to the prevention of similar future events.

The risk matrices currently used place EPAMIR in the medium risk category, which are considered acceptable and do not require corrective measures. The matrices proposed in this paper place EPAMIR in the high risk category, where corrective measures, such as impact reduction or elimination, are obligatory.

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COMMUNICATION BETWEEN DOCTOR AND THE IMPRISONED PATIENT

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Abstract: *Based on the idea that, sending a message, encode but also decode a conduct, an attitude and a behavior; the communication is the answer to those mentioned above.*

So, the particularity of communication between the two (doctor - patient) depends on the patient's identity which, in our case, is deprived of liberty, which determines knowledge and application of special strategies that can solve the health problems and not only that.

In this case, communication between the two players choose the efficiency method so our patient must remain patient and not an object and the Hippocratic Oath must be applied in all related cases.

Keywords: *communication, doctor, prisoner, specificity, efficiency*

1. INTRODUCTION

To start towards a definition of communication is a long road of knowledge and identity, as items implicated in the process, generates a series of metamorphoses that change the meaning and perception of the act itself. Thus, we choose to start our enosological incursion from the following:

a) DEX - (1975) = defines communication as a process to make known, to let you know, to inform, to instruct, to say or talk;

b) Lohisse (2002) - communication conveys relationship with each other;

c) Prutianu (2000) - communication is what creates communion and community, ie a web of relationships rather than a quantity;

d) Lemeni and Miclea (after Pașca - 2012) - communication is defined as the process by which information are transmitted from a transmitter to a receiver, by application system of signs and symbols.

We will definitely get to a paradox at a first logical investigation, that communication is a game of mutual influences between people or between freedom and affection, according to Commarmond and Exiga (2005), remaining in expectation when choosing, Pruteanu St. (2000). Communication escapes attempts to define it, communication semantics of the term does not fit into a definition, but each definition captures something of what communication is.

Basically, communication is in fact a transaction between inhabitants: the transmitter and receiver are simultaneous, the transmitter being at the same time, receptor and transmitter, and then the receiver (mutual is also available). Therefore, communication is a social act, deliberately or unintentionally, consciously or not. It is in any case one of the acts underlying social bond, and you cannot live without communication, all these if we start from the idea of Watzla Wick (1972) - "If we admit that, in interaction, all conduct has the value of a message; in other words is communication that you cannot communicate, whether you like it or not".

Continuing the journey of identity, in terms of a psychosocial analysis, communication is a set of processes, which exchange information and meanings between individuals in a given social situation. By definition we can detach the item - exchange of information, meaning that falls within the communications processes are essentially social phenomena relying on the interaction determined by the actors.

In particular, the message communication between doctor and patient, the first must ensure (regarding the patient) if the second got the message; as it receives; what to expect, as is the whole approach, which is the feedback, so the next step to trigger active listening.

Active listening refers to understanding and receiving the message, which means encouraging the discussion partner through a series of gestures and behaviors aimed at clarification of uncertainties; demonstrating understanding of the conveyed message, interest in discussion so that the receiver (in our case, the patient) can express an opinion regarding the perception of the facts and the opportunity to change something at/in the situation during communication with the transmitter (doctor).

An important role between the two and how and for the choice of communication channel, is related to:

- strong connotations given to the social dimension of the situation;
- the way of sending the message (voice, writing, gesture) and physical conditions (their position in space, meeting place);
- two types of spatial arrangement that fosters communication, namely: face to face and side by side.

Basic pieces of communication are also included: doctor and patient vs. patient and doctor having two players in the role of communication Feertchak (1996) saying that any individual who communicates directly involved in the communication situation by engaging in it its personality and its own system of needs that determine motivations. The interlocutors, communication actors are best placed to:

- choose the language;
- think about the used words;
- knit words in the desired order;
- transmit words / information through a canal.

According to Blakar (1979), the transmitter is a creator through its message providing a whole set of data - signs on himself, his vision on the object communication or social situation that he wants or levy - which will be perceived and evaluated by the caller, determining reactions as commitment, responsiveness or blockage.

Basically, it is evident that communication between actors is necessary to have a purpose which has to:

- achieve certain objectives;
 - avoid dangerous situations,
- designed to develop a certain behavior to determine the normality of the act itself.

In this context, patient-physician communication, according to Tudose (2003), is a direct communication, face-to-face, unmediated and unofficial. Between the two subjects of information transfer, there is a continuous exchange of information, which leads each of the two partners to the specific aims of the meeting, namely:

- information about the health of the patient;
- proposed remedies and treatment;
- practical ways of action.

In another perspective, communication, according to Enătescu (2007), passed through an objective analysis, highlights, three stages defined by dominance, namely:

1) - the first stage with a very low dominance index which tends to zero, defines the first stage of communication, which exposes the patient, quasi-continuously streamed own history and symptoms that caused him to turn to the doctor; this stage generally occurs with very little dialogue from the doctor, his questions having only an overall aspect;

2) - second step is characterized by a balance of dialogue, with dominance index values around 0.5 which corresponds to managing dialogue by the physician through asking questions;

3) - the third stage is characterized by the dominance of the physician in the communication corresponding application i.e.: application diagnosis and therapeutic indications by the physician, or possibly applying specialized techniques “psychotherapy” (like suggestive therapies). The same authors mention that the ratio of the three stages depends on several factors as:

- the specialized area in which the test is performed;
- the psychological structure of the patient in his special situation of disease;
- medical psychology and affinity for communication.

Yet there are a number of factors that disrupt the communication process, which creates dysfunctions while running the medical act between doctor and patient. In this context, Tudose (2003) notes three factors, namely physical, internal and somatic.

These factors appear when the doctor does not appeal to patience or empathy (which represents the state in which you can feel as the other); as empathy with the patient is extremely important because it can create a state of incompatibility both for the doctor and for the patient, through barriers created to each other. According to Egner (1992), the most important barriers between doctor and patient are:

1) obstacles created by the physician:

- loose too much time;
- increased nervous consumption, especially when a tired doctor, after call or after a number of consultations, is overwhelmed by their own troubles;
- loss of control of biomedical problems of anamnesis;
- “not my job” - is a formula for dismissing the psychosocial issues that accompany any pathological or imagined suffering;
- the doctor cannot, objectively, put himself in the place of the patient;

2) obstacles created by the patient:

- attempt to hide his emotions in front of the doctor;
- fear of being put in an embarrassing situation;
- willingness to comply with the doctor’s expectations, not to deviate from the presentation of the “technical” symptoms;
- fear of being sick;
- fear (possibly excessive respect) to the doctor.

but these empathetic gaps can be also found when future schemes of behavioral doctor-patient empathy, according to Cohen-Cole (1991) are based on:

- reflection;
- legitimating;
- respect;
- support;
- partnership.

Encountering communication barriers characterize both the effectiveness and efficiency, which causes cognitive new strategy in terms of communication, in this context, characterizing the doctor-patient relationship act.

Removing these shortcomings, we report, thus to Holdevici I. (2000) to communicate effectively with the following features:

- the subject express their feelings openly and directly;

- encourages his partner to do the same,

namely, the communication partner say what he feels and thinks and tries to understand what the interlocutor thinks and feels. However, effective communication involves listening and open expression, while ineffective communication is related to parties refusing to share their feelings openly and refusal to listen to what the other has to say.

Also, the patient's social role has triggered several concepts regarding its reporting to the community through new social role acquired for a limited time or not. IB Iamandescu (1997), based on the idea that the situation of a sick man is characterized by five main features such as:

- the marginal situation of the patient between health and disease, denying one or another, rendering it unstable, dominated by conflicting situations;
- the state of distress surrounding the patient and thereby to seek protective techniques for making threading situation;
- restricting horizons (concerns ambience);
- egocentrism;
- the long time perspective of a disease.

To these boundaries, we can add the idea of temporality or not, the role of sick person, which according to Parsons (1951) are characterized on four features, namely:

- relieving normal duties and responsibilities depending on the nature and severity of the disease;
- the patient can not recover alone, by an act of his own decision, therefore, he is not held responsible for his inability;
- the disease of the patient should be considered as undesirable and must be willing "to get well", which is a conditional legitimacy of its role;
- the obligation of the patient to seek competent help and cooperate with those responsible for his healthcare.

As a quintessential to the information mentioned above, the type of the patient's role in the community depends on a number of factors such as:

- the typology of the disease;
- the severity of the diseases.
- chronicity of the disease;
- the kind of treatment: ambulatory, hospital.

Basically, according to Lupu, Zanc, Săndulescu (2004), it legitimizes the social role of the patient, his vulnerable condition and his inability while obliging him to seek healing. It may be that the patient tries to profit from its status and considers the disease as a means to escape the responsibilities that cannot or will not take. The doctor must keep this balance between the two options to help the sick and refusing it. The therapeutic relationship to help overcome addiction caused by disease and deny him attempt to "manipulation by rewards" aimed at applications that do not arise from the illness.

We believe that, the cognitive sequence ranges include category of patients who come from a certain structure such as the prison being unique and specific turning to an attitude and conduct special communication with these patients assuming professional standards of high class. We are making such information because situation related to can appear:

- spirit of observation;
- acting;
- self-control;
- tolerance;
- acceptance of the situation;
- accountability;
- quickness in decisions;

- calm;
- security,

and the list can continue, giving successful doctor-patient communication endorsement in special situations mentioned above.

Deprivation of liberty involves restricting the right of movement, freedom of expression, the exercise of rights for a period of time or by a person. The doctor has at least minimum knowledge of the evolution of language in this compartment. Language demonstrates that the world in which they operate is different, if we look at the institution as such. In fact, the philosophy is that it: “Why punish? act or perpetrator? “so our perception, those outside incarceration must be fair and just, without putting force first.

In the same philosophical view Noica said: “There are three kinds of adversity: war - sports - dialogue”. In the first one must defeat the other. In the second, the ideal is not to be winners and losers. In the third both can be losers, state which demonstrates the power of words and knowledge in communication and relationship between people.

It is necessary for the doctor to know that the state of deprivation of liberty, time and space, according to Gh. Florian (2001); especially because they are perceived implications in maintaining balance of the detainee’s personality and his health in all aspects. Thus, there are various behavioral disorders that require prior knowledge of the patient pathogenic personality. In direct communication, the doctor will need to demonstrate:

- professionalism;
- balance;
- seriousness;
- respect;
- self-confidence;
- attitude,

without letting himself be caught in the slippery and ambiguous game of some prisoners for which the prison if is not their first home, or a safe place where “if you had where and who’s good”, I mean ... backup address.

Most often the doctor will be confronted with elements of personality restructuring (frustration, aggression, risk behaviors, etc.), according to Gh. Florian (2003) all prompting an attitude that is needed to get away from the fact that even if a person is incarcerated, first of all, he is a human being, and when his health is precarious, the aid requested will be granted immediately without any reluctance or unprofessional approach, trust capital from detainees being extremely important.

The doctor will have to look into the face of the person / patient who needs its services and not to see a criminal, offense (deed) or punishment, even if in the prison “detainees do not live in prison, but staying somewhere; they stay; while the free live”.

At the same time the doctor is a man in the team, together with the: psychologist, educator, priest, social worker, being involved in terms of maintaining physical and mental health of the prisoner so that reintegration into the community to become as normal as possible, removing states isolation and marginalization that are usual in this situation.

Labeling it as “paria” is attributed to the failure of an inadequate communication, because “when you do not communicate, you communicate” and in our situation is conclusive, remembering that “Hippocratic oath” applies in all circumstances, the job having no prejudices and disease, pain and suffering ... have no choice after “glory, power and wealth” instead of its existence, even when talking about deprivation of liberty.

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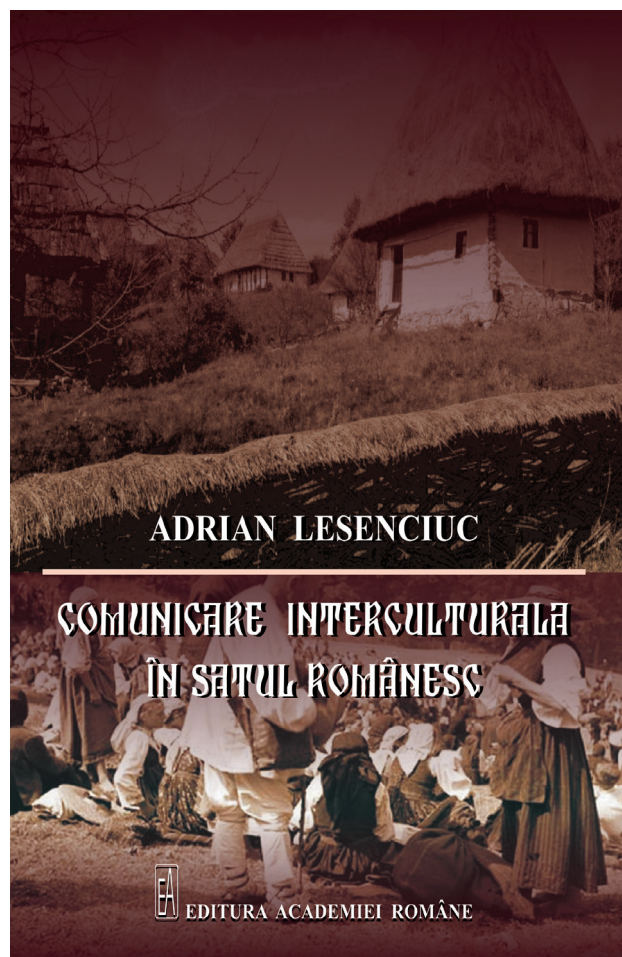
PATTERNS OF INTERCULTURAL COMMUNICATION WITHIN THE ROMANIAN VILLAGE

Review of the volume *Comunicare interculturală în satul românesc*
by Adrian Lesenciuc, Bucharest, The Romanian Academy Publishing House, 2015

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Adrian Lesenciuc, *Comunicare interculturală în satul românesc*. Front cover.



Mr. Adrian Lesenciuc's work, *Comunicare interculturală în satul românesc* [*Intercultural communication within the Romanian village*] is an outstanding book, dense in ideas, thoroughly developed, and written with passion and responsible involvement. It is a book that refines rich and appropriate Romanian and foreign references. Although it was written with the mark of an author inclined to philosophical introspections and reflections, the work has its centre of gravity and interest in its applied part, which is Adrian Lesenciuc's original contribution to the inter-cultural communication in rural areas research.

The theoretical framework proposed by the author to highlight various aspects of the approached issues is interdisciplinary, connecting areas of related knowledge, such as philosophy of culture, anthropology, sociology, communication and language theories, history of scientific ideas, discourse analysis and ethnography of communication. These combined approaches are necessary because the theoretical stake of the author is to find underground correlations between:

a) cultural openness of a human community (its receptiveness to other cultural models and its capacity to take and adapt them to its own needs);

b) predisposition of a human community to interethnic and intercultural communication (its willingness to develop comprehensive relationships and to establish harmonious forms of cohabitation with the “others”);

c) openness to social and cultural change, existence of some favourable attitudes towards new social practices and lifestyles.

Studying the intercultural relationships and the social change within the Romanian modernity, the author stresses, in flexible manner based on critical reflexivity, a particular type of syllogism, through which he builds a chain of expressive correlations, links and conditionings between factors and processes expressing the complex equation of the investigated phenomenon: the Romanian rural intercultural communication.

The first chapter is an original theoretical construct. The author reveals thorough knowledge of the Romanian culture and the streams of ideas that critically approached the Romanian society's transition to modernity, including the one of Romanian village. The general assumption that directs the research is the following one: in the case of a community built on open cultural structures, such as the Romanian nation or such as some well structured Romanian rural communities, „identificarea predispoziției spre anumite forme ale schimbării culturale este convergentă cu identificarea predispozițiilor etnopsihologice spre comunicarea interculturală” [the identification of the predisposition toward particular forms of cultural change is convergent with the identification of ethno-psychological predispositions to intercultural communication] (Lesenciuc, 2015:1).

Chapter II is dedicated to the methodological apparatus. The author formulates the research main questions and research objectives, the selection of the research methods, techniques and procedures in relationship with the characteristics of the social and human environment under investigation. As theoretical and methodological pattern, Mr. Lesenciuc's approach could be placed in the perspective offered by the ethnography of communication, which is the ambitious project of anthropologists Dell Hymes (1972; 1974) and John Gumperz (see Gumperz & Cook-Gumperz, 1982).

Chapter III, „Pattern-uri ale comunicării interculturale în localitățile Cața și Breaza” [Patterns of intercultural communication in the villages of Cața and Breaza] is the most consistent and original part of the entire work. Two models of standardized communication practices “în două sate în care experiența interculturală face parte din istoria acestora” [in two villages where intercultural experience is part of their history] were studied in the third chapter. The research is very complex and rigorously follows the methodology. After presenting the geographic background, the demographic and ethnic structure, and many other historical and cultural relevant data of the two villages, appealing to statistics, tables and graphs, the author describes and illustrates specific elements of the intercultural communication based on the S-P-E-A-K-I-N-G scheme and analyzes the eight components of the communication act in Dell Hymes' perspective (Hymes, 1974). The author behaves like a true anthropologist, interested observing on the spot people's attitude toward other cultures, religions, traditions and habits, particular ways of reporting to others and intercultural communication practices specific to these two villages. He organizes and groups these specific attitudes and communication behaviours in ‘patterns’, perennial structures of values, beliefs and attitudes, that have an identity function for the Romanian cultural space, well known as a space of tolerance and convergence between different cultural models.

The author is unrestricted to consider that the members of these multiethnic communities, under the pressure of some pragmatic imperatives, with many common social goals, developed “transetnică, translingvistică și transconfesională” [trans-ethnic, trans-linguistic and trans-religious] forms of communication and social solidarity, even built distinct discourse communities, despite the primary level of ethnic differences.

It is appropriate to notice a remark of the author concerning the meanings of the cultural openness and closeness of Romanian villages: “Există, mai degrabă, o formă a închiderii în raport cu exterioritatea comunității, cu societatea și civilizația care îmbie la schimbarea vechilor forme de organizare rurală, decât o închidere în raport cu celălalt, locuitor al satului, dar îmbrăcând haina culturală a altei etnii” [There is, rather, a form of closeness related to the exteriority of community, to the society and the civilization that tempt to change the old rural organizing forms, than a closeness in relationship with the other, inhabitant of the same village, but wearing the cultural costume of a different ethnic group] (Lesenciuc, 2015:204). This is an important conclusion which the author rightly points out. Mr. Adrian Lesenciuc warmly and convincingly pleads for the role of intercultural communication as a factor that decisively contributes to the non-conflicting cohabitation and to the harmonious collaboration between ethnic groups that differ from each other in language and cultural endowment.

Mr. Adrian Lesenciuc’s work distinguishes by a high degree of conceptualization, an appropriate critical apparatus, and a very expressive manner of writing.

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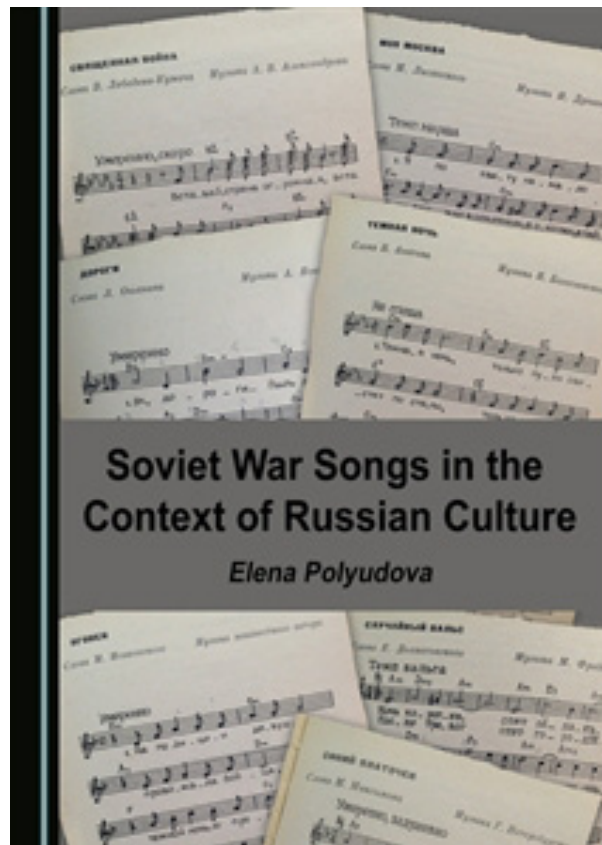
WAR SONGS AS A TREASURE OF COLLECTIVE MEMORY

Review of the volume *Soviet War Songs in the Context of Russian Culture*
by Elena Polyudova, Newcastle upon Tyne, Cambridge Scholars Publishing, 2016

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Elena Polyudova, *Soviet War Songs in the Context of Russian Culture*. Front cover.



This volume provides valuable insight into a topic which is less known for the contemporary Western public, the Soviet war songs. A strength of the volume derives precisely from the topic discussed, as the book fills a significant gap regarding English-language studies on Russian musical culture. A second strong point consists in the bibliography used by the author, which is widely in Russian language. The volume therefore provides the readers with a large amount of scientific and documentary information which would have been difficult to access otherwise.

The division of the content in four chapters is well-structured and balanced. The first two chapters have an introductory function, providing the theoretical basis for the analysis. The first chapter is the most general one, presenting the significance of songs in the Russian culture, while the second one focuses on war songs.

It is important to note that the volume does not discuss the messages of the Soviet propaganda, but the creations which have enjoyed the appreciation of the public and become a part of the identity of modern Russian culture. The topic selected allows an interdisciplinary analysis, which the author fruitfully applies in the third chapter, the most extended one of the volume.

The originality of the work is clearly manifest in the analytical section, which encompasses the selection of the musical pieces, the presentation of their background, the context of their creation and the analysis of the text. The historical period chosen is that of the World War II, which is further divided in more subsections, regarding the pre-war, the years of the war and the post-war period. For each year between 1941 and 1945, an outline of the major events in the unfolding of the war is given. The historical background serves as an anchor for the ulterior introduction and analysis of the songs composed in each period. Elena Polyudova proposes here an interesting selection of some of the most famous songs of the time, such as “Sinij platochek” (“Blue Scarf”), “Moya Moskva” (“My Moscow”), “Ogonek” (“Glimmer”), “Sluchainyi Val’s” (“Accidental Waltz”), “Temnaya noch” (“Dark night”), “Dorogi” (“Roads”) and others.

A special strength of the volume consists in the author’s ability to link each piece analyzed not only to the history of events, but, more important, to the cultural frame. A very interesting direction of analysis is represented by the various references to Russian literature, ranging from the world of Russian folklore, with such information as the representation of the heroes in the folk tales or the personalization of death as an old woman, to canonic Russian authors such as Pushkin or Gogol. Another direction of research exploited by the author regards the linguistic level, as Elena Polyudova selects specific terms appearing in the texts of the songs and explains, in a clear but scientifically grounded manner, their etymology, their polysemitism and discusses the problems of their translation to English language. Such is the case, for instance, with the term *svyashchennyi* (“holy”) or with *dolya* (“fate”). In other cases, she explains linguistic features of Russian lexis, such as the use of the diminutive suffixes. Literary and linguistic references are further connected to the visual arts, as in the section presenting the image of the road in the Russian culture. Moreover, the author enriches the analysis by introducing references to the real and symbolic geography of the Russian territory, as it happens in the section on historical places in Moscow, and information regarding general knowledge, like the explanation of the assignment of the name *Katyusha* to a rocket-launcher. The varied cultural data provided make the analysis interesting not only for specialists in musicology, but also for the wide public, even to those who are not familiar with Russian language.

The fourth chapter connects the theoretical information and the analysis with the field of pedagogy and art education. Here, the author discusses the possibilities to employ the war songs presented in classroom teaching and gives suggestions for teachers. Further, Elena Polyudova presents a project implemented recently at the Music School in Moscow, which functions both as an example and a demonstration of the relevance of the topic for the younger generations of students.

The general impression is that this a work which may serve as a reference for future studies on Soviet music and for applied linguistics or teaching materials. As the author herself mentions, the topic treated regards the general area of humanities, with a focus on history, literature and world art culture. The information given and the manner of presentation have indeed the merit of connecting the ‘official’ history, which encompasses the chronological succession of events, with the “history of the private life”, in the terms proposed by Philippe Ariès and Georges Duby. One of the most interesting sections of this work consists in the description of the context in which the analyzed songs have been created. The histories of the songs impress because of the richness of the information and the clear presentation. Moreover, they are also touching, as Elena Polyudova manages to depict fragments of the lives of officers and soldiers fighting in the “Great War”.

Book review

She points out the connection between each musical piece and real events, like the battles, the episodes of fierce fight or desperate resistance in front of the enemy. Whether the context of creation is provided by a tragic and heroic battle, like for the song “On the Nameless Height”, or by a brief encounter between an officer and a beautiful girl, as in “Accidental Waltz”, the author demonstrates that history is, above all, a story, created and carried on by real people, with their dreams and hopes, with sorrows and joy, fears and ideals. From this perspective, an idea outlined by Elena Polyudova needs to be mentioned, for its truth: the war songs were no instruments of propaganda, but served to remind to the army people on the battlefield and to the population at home that they had a reason for fighting, a personal motivation given by love, whether it was love for the country or for the dear ones. A paradoxical conclusion thus emerges, that love and sensibility can be found even in the most unexpected contexts, nurturing resistance and survival.

In fact, the general message of the entire work can be interpreted as a appeal for an approach that is personalized and centered on moral values, either in the specific act of teaching, or in the interpretation and transmission of cultural information. The domains to which this work contributes are, therefore, varied, ranging from musicology, educational sciences, art teaching or Russian language teaching to more general areas such as cultural studies, cultural history, European modern history or the modern history of Eastern Europe. The volume will be of interest for diverse audiences, encompassing teachers and scholars in the fields mentioned above, but also graduate or undergraduate students and a general public, interested in modern Russian culture and language.

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***Abstract:** Papers must be prefaced by an abstract up to 250 words. The text will be written in 11pt high, Italic, justified, left-right alignment. A number of maximum 8 keywords will be written 12pt below the abstract. The words will be 11pt high, Italic, left alignment, and separated by a comma.*

***Keywords:** first keyword, second keyword, third keyword...*

1. INTRODUCTION

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2. MAIN TITLE

Font: Times New Roman, 14, bold, centered, in Upper cases, spacing: before – two lines of 14 pt., after – two lines of 14 pt.

3. AUTHORS

Names, style. Font: Times New Roman, 12 pt., bold, centered; first name – regular, family name – all caps; alignment: centered; spacing: after – 12 pt. A comma separates the names.

For a single affiliation, no superscript is necessary. In case of different authors, from different institutions, one marks every name by a superscript asterisks (like exponents). The legends of these superscript numbers (the affiliations and email address), will be indicated under authors lines. For affiliation use the style: Font: Times New Roman, 12 pt., regular, centered, after – two lines of 12 pt.

4. ABSTRACT AND KEYWORDS

Font: Times New Roman, 11 pt., italic. Paragraph: justify; line spacing: single. The **Abstract** is followed by the **Keywords** and the spacing between abstract and the keywords is 11 pt.

5. CHAPTERS TITLES

The chapters are countered beginning with Arabic figures and printed in capitals (**1. XXXXXXXX**), using the style: font: Times New Roman, 12 pt., bold, all caps; paragraph: alignment: centered; spacing: after – 12 pt.

7. PAPER TEXT

Font: Times New Roman, 12 pt. Paragraph: alignment: justified. Paragraphs will be 6 mm indented. Line spacing: single.

7.1 The main part of the text. Original and high-standard scientific papers shall be drawn up in a concise style, avoiding any oversized introduction.

8. FIGURES, TABLES

Figures and Tables shall be introduced at their appropriate place in the text and shall not be larger than a page width each. The legend of figures is included below the figure (centered) and for tables before (align text right), both with the style: Font: Times New Roman, 10 pt., regular; paragraph: spacing: before – 10 pt., after – 10 pt.

Landscape tables are not accepted. If you need to arrange a number of figures, a good tip is to place them in a table, which gives you additional control of the layout. Leave a line space (12 pt.) between your figure and any text above it, like this one:

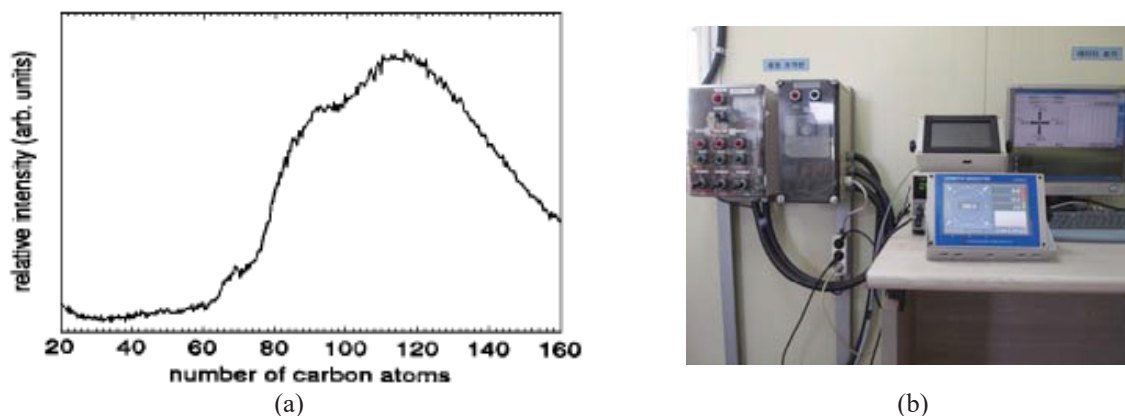


FIG. 1. The text “**FIG. 1.**,” which labels the caption, should be bold and in upper case. If figures have more than one part, each part should be labeled (a), (b), etc. Using a table, as in the above example, helps you control the layout

Cite all figures in the text consecutively. The word “Figure” should be spelled out if it is the first word of the sentence and abbreviated as “Fig.” elsewhere in the text. Place the figures as close as possible to their first mention in the text at the top or bottom of the page with the figure caption positioned below, all centered. Figures must be inserted in the text and may not follow the Reference section. Set figure captions in 10 point size, Times Roman font. Type the word “**FIG. 1.**” in bold uppercase, followed by a period. Authors are welcome to use color figures within their article.

Table 1. Example of table

	f_1	f_2	f_3	f_4
First set of values	0.8	0.6	0.4	0.2
Second set of values	1.1	1.0	0.9	0.8

9. EQUATIONS AND FORMULAS

It is strongly recommended to use a table with one row and two columns: in the first column, one writes the equation and in the second, the equation’s number. Table: Insert table: number of columns: 2; number of rows: 1; alignment column 1: align text left, alignment column 2: align text right, format border: none, spacing after: 12 pt.,

$$f(x) = a_0 + \sum_{n=1}^{\infty} \left(a_n \cos \frac{n\pi x}{L} + b_n \sin \frac{n\pi x}{L} \right) \quad (1)$$

Table 2 – For formulas and equation, use only a Microsoft Equation Editor 3.0 with these settings:

Format + Spacing	Line spacing	150%
	Matrix row spacing	150%
	Matrix column spacing	100%
	Superscript height	45%
	Subscript height	25%
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Style + Define	Text	Times New Roman
	Function	Times New Roman
	Variable	Times New Roman italic
	LC. Greek	Symbol italic
	UC. Greek	Symbol
	Symbol	Symbol
	Matrix + Vector	Times New Roman bold
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AKNOWLEDGMENT

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Inside the text, the books or the revues from REFERENCES are referred between square brackets: [1], [3, 4, 7].

The formats for references without authors and for referencing articles in journals, books, articles in books and proceedings are:

- [1] *** European Aviation Safety Agency. *CS-25, Airworthiness codes for large aero-planes*, October 2003. Available at www.easa.eu.int, accessed on 10 Oct. 2015;
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- [8] F. Rudin, *The method of statistical linearization for nonlinear stochastic vibration*, in F. Ziegler and G. I. Schuller (Eds), *Nonlinear Stochastic Dynamic Engineering Systems*, pp. 45-56, IUTAM Symposium on Nonlinear stochastic dynamic engineering, Innsbruck, Austria, June 21-26, 1987, Springer Verlag, 1988.

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