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AERONAUTICAL ACTIVITY UNDER THE CONDITIONS OF THE FLEXIBLE USE OF AIRSPACE

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Abstract: *The present paper lays emphasis upon the importance of the flexible use of airspace. This work highlights a wide range of aspects regarding the human activity in the airspace, including the necessary infrastructure from the ground and airspace, the specific industry in this domain and the capacity of developing human activities in, from and through the airspace. What is also underlined here is the fact that the flexible use of the airspace remains the only way to bring together civil and military requirements and this implies extended civil and military cooperation when dealing with the use of the available airspace. Moreover, all the activities linked to the planning and implementation of airspace structures evolve in a coordinated way, at the international level, through cooperation actions between the civil and military authorities. This paper also brings into the spotlight the fact that working together is the only solution for both civilian and enlisted men to manage in solving all the problems regarding the togetherness of the two air traffic management systems and the creation of an integrated system which should permit the use of the existent airspace at maximum.*

Keywords: *aeronautical, airspace, civil, military, use, aircraft, management*

1. INTRODUCTION

Concerning the aeronautic activity, the necessary condition is to take into consideration both human activity in the airspace – the flight – and all the other connected activities, starting with the manufacture of different types of aircrafts and ending with the creation of the infrastructure which is specific to aeronautics and to air navigation actions. Of course, the dominant environment, in which the aeronautic activity takes place, is represented by the airspace.

Furthermore, two very important characteristics of aeronautics must be

highlighted: its very small `age` (in spite of their thousands of years of existence, humans have not begun the exploration of the air space till the beginning of the last century); its amazing development rhythm (if at the beginning, flights were only experiments at distances and altitudes measured in meters, nowadays humans can practically explore the entire airspace.

The spectacular evolution of aeronautic activities has caused not only conceptual changes and reconsiderations regarding the airspace, but also major contradictions which require certain solutions. The main challenge

arises from the exponential growth of air traffic while the airspace remains the same.

The amplification of the number of aircrafts which fly simultaneously, their characteristics and performances and those of the equipment on the ground have led to the concept of *flexible use of airspace* (FUA).

2. HUMAN ACTIVITY IN THE AIRSPACE

The term of *airspace* generally represents the shell from around the Earth, the air column from above the terrestrial territory and the area covered with water. It cannot be exactly delimited in height because of the physical proprieties of the gas from which it is composed.

At the beginning, in the specialized literature, the main thesis stated that the airspace was unlimited. The development of aeronautics requires its legal regulation. Thus, there are two types of airspace: *the airspace pertaining to states* (as a component element of their territory) and the *international airspace* (which is not submitted to the sovereignty of any state, as it is for example the airspace above a free sea). Through the *Paris Convention*, which took place on the 13th of October, 1919, the sovereignty of the subjacent states over the national airspace was assigned and regulated. Even if problems regarding the superior delimitation of airspace are still under debate, the idea that this frontier should be established, taking into consideration more or less conventional criteria, has been propelled. Moreover, in this context, what is crucial for a state is to exercise its sovereignty in its own airspace.

The sovereignty of a state upon its airspace includes the regulation of the legal system of that space, the development of activity within that space, the permission of transit and traffic of foreign aircrafts, the limitation of flight, the ban of the foreign aircrafts' entrance, the execution of the jurisdiction upon the foreign aircrafts in the airspace and the right to claim remuneration in case of damages caused by foreign aircrafts.

Besides the regulations regarding the legal status of their airspace, the states have

issued a series of documents, called *freedoms of the air* [5], regarding international air navigation. Thus, there are five *freedoms of the air*: the right of a foreign aircraft to go through the airspace of a particular country, without landing; the liberty of a foreign aircraft to land with noncommercial purposes on the territory of a state (the right to make technical stopover); a foreign aircraft has the right to disembark, on the territory of a state, passengers and goods which came from the country that owns the aircraft; the right of a foreign aircraft to embark passengers and goods for transport from a state to the country which owns the aircraft; the right of an aircraft to make transports from the state which allows them to third states.

It has been noticed that not all states recognize the five *freedoms of the air*, the last being complex having international implications. For example, in 1965, our country has adhered and to the *Airspace and Aeronautics Law* and its dispositions are applied in the Romanian airspace to all the civil/military aeronautic activities and to all the natural/ legal persons and to the international aeronautic activities which are developed in the Romanian airspace on air routes and the established areas for these activities.

The national airspace is defined as the space which is encountered above the sovereign territory of Romania [4]. Both the airspace from above the international area of the Black Sea, allotted to Romania through the regional agreements of air navigation and the extraterritorial airspace in which Romania was delegated, permanently or temporarily, to provide services of air navigation are also assimilated from the point of view of the navigation systems.

The evolution of human activities in the airspace is characterized by the intensification/ growth of human presence, which is more and more visible every day – all kinds of aircrafts in transit and other objects of human origin coming into being, but, in the context of congestion they cannot be eluded: different types of projectiles with air trajectories, different types of missiles flying in the cosmic space or coming back to Earth



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and remaining pieces of meteorites which fall. Furthermore, in the present-day airspace, a multitude of man-built objects evolve simultaneously.

Firstly, some criteria are required in order to make a nonconventional classification of the issues regarding human activity in the airspace, aircrafts and all man-made objects in the airspace.

The first criterion refers to the *transparency of the activity*, by which we understand the completeness and correctness of the information regarding the already mentioned activity/ aircraft and the opportunity of the dissemination towards all the participants in the activity. According to this criterion, there are: *known activities*, when the one who initiates, plans and develops the activity transmits all the data of common interest to those involved with the purpose of correlation, coordination and assurance of flight security, e.g. the flight of an aircraft pertaining to a certain flight company from airport A to airport B; *secret activities*, when the one who initiates, plans and develops the activity does not deliberately transmit the data regarding its own flight activity or transmits false data to some of those who develop aeronautic activities in the same volume of airspace, e.g. the flight of a combat aircraft in the area where military operations take place.

Moreover, this criterion allows us to determine to which extent the activity is sustained and supported in order to have a successful and secure outcome. Whereas in the former case, all the participants contribute to this goal, in the latter, they might appear hostile participants ceasing the activity, also by knocking down the involved aircraft.

A second criterion refers to *the control upon the activity* regarding the evolution of the aircraft or object which can be controlled or not in real time. From this perspective, there

can be encountered several types of activities, such as: *controllable activities*, when man can intervene upon the aircraft/object through the modification of flight parameters e.g. trajectory, speed; *uncontrollable activities*, when man cannot intervene upon the evolution modification. Thus, the aircraft/object should fly according to a predictable trajectory (for example, a cannon projectile has a ballistic trajectory), or to an unpredictable trajectory (for example an aircraft which exploded in the air).

Furthermore, regarding control, there has to be determined by which extent the other activities developed simultaneously in the same volume of airspace are or can be affected.

The analysis of the aeronautic activities, through the two criteria mentioned above, permits drawing conclusions and acting in order to optimize air traffic and flight security, respectively. Usually, in official documents or documents with normative character on aviation or, more generally, on aeronautic activity, two domains are taken into account - *civil and military* – with distinct peculiarities highlighted by specific regulations.

The complexity of actions in the airspace and their advantages represent the motivation of the permanent concern of the states, including armies, for the improvement of technologies and activities developed in, from and through air.

Concerning the equipment specific to aviation and human activities in the airspace, there is the necessity for military – nonmilitary compatibility for at least two reasons: nowadays, on the one hand, the production industry in this domain can no longer belong to one state only, thus a transfer of technology with obvious military and civil connotations is required and on the other hand, the aeronautic

activity needs large airspaces, high fly speeds and togetherness in the activities of the states. An aircraft takes off from an airport situated on the territory of one state to operate on airports situated in other states, geographically disposed at a distance of hundreds and thousands of kilometers. This fact has determined the development of relationships among states, the creation of a complex of systems regarding air navigation and facility systems which are compatible as well as the creation of a law system relating to the specific activities in this domain.

Obviously, these problems gain new meanings when speaking about military activities. In the case of activities with nonmilitary character, there is the supposition that cooperation and mutual support are involved. By contrast, when military aspects appear, lots of problems with secret character will emerge. These problems go beyond the confidentiality framework, which is specific to the economic organisms. Thus, there is a shift from the status of competitors to that of combatant adversaries.

This work has covered several aspects concerning the human activity in the airspace, including the necessary infrastructure from the ground and airspace, the specific industry (aircraft factories, equipment factories, etc.) and the capacity of developing human activities in/ from/ through the airspace. As a consequence to these realities, there have been identified two development directions of cooperation in the domain: military cooperation and civil cooperation.

The first aspect implies leading military actions in/ from/ through airspace and supposes the realization of the conditions of leading the states' own military forces in safety conditions and the annihilation of the adversary's actions, especially those directed to the states' own forces. Thus, there are structures and organisms, specific to the military system, both at national level and at the collective structures of security level.

Furthermore, the interoperability of equipments and procedures applied in Romania must be in accordance with those of the other member states of NATO – NATO

Integrated Extended Air Defense System – NATINEADS [6].

The second aspect implies all aeronautic activity and supposes the realization of flight conditions and the connected activities development under safety conditions. Moreover, the place and role of national organisms in the management of the national airspace and their relationship with the European organism – EUROCONTROL – assures the compatibility of aeronautic activities management. Romania has signed the documents for adherence in 1997, and confirmed the signature in 1999 [2].

Civil/ military cooperation is a key factor in the management of civil air traffic under the most propitious conditions of security and efficiency and in the fulfillment without restraints of the Air Force missions.

Because of the fact that the airspace is a limited resource and the requirements of its use are higher and higher, as a result of the spectacular rise of both civil air traffic and the military necessities to assure national sovereignty and the involvement in international military activities, the only solution is to provide a good management of airspace and the necessary technical resources.

3. THE FLEXIBLE USE OF THE AIRSPACE

The implementation of the concept of the flexible use of the airspace (FUA), as a solution for the above mentioned contradictions, has generated many controversies between the civilian and military representatives of the air traffic services.

The implementation of the concept of the flexible use of the airspace, based on the creation of certain temporarily reserved areas to perform certain training flights with military combat aircraft, has turned into a necessity for the safety of air traffic. It is worth to mention the efforts of the European Organization for the Safety of Air Navigation - EUROCONTROL – and of the European Union Council in this field.

In the European airspace, there are registered about 26,000 flights per day at present and the forecasts indicate the doubling



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of the figure in the next 10 years [8]. The existence of several States, with their own airspace management systems, determines increased spending (about 2-3 billion euros per year) in comparison with other similar systems all over the world. By its initiative – 'A Single European Sky' – the high-level group of the European Commission aims at examining the reform of the European air traffic management system, at supporting and strengthening the role of EUROCONTROL optimizing the European airspace organization and implementing FUA.

The aim of this approach is to satisfy the air traffic demand and to assure the maximum use of the available airspace capacity in the context of a uniform European Air Traffic Management System (EATMS) that will be achieved by the European Air Traffic Management Programme (EATMP). In this field, the main objectives of the European Commission initiatives are [7]: developing certain requirements harmonized for the safety of the ATM systems; restrengthening the cooperation between the civilian and military authorities; creating a strong regulating organism; drawing up certain regulations applicable and consistent all over Europe; creating an integrated airspace management system; increasing the interoperability and standardizing the ATM systems; getting a uniform staff training in the ATM field and developing a programme for the air traffic safety.

Providing specific activities at safety and quality levels in accordance with the European standards, under the conditions of the increasing civil air traffic forecast for the beginning of the third millenium, is conditioned by a very close civilian/ military cooperation for solving the aspects of flight coordination in a mutually beneficial way to both parts, assuring the secure, efficient and

economic operability of civil aircrafts and the fulfillment of training tasks of the military aviation. This cooperation must have as a starting point the rephrasing of the actual conception regarding the assurance of coordination of Air Force flights with the civil traffic. This involves giving up the procedural coordination system that is currently used applying a dynamic coordination system based on directing operational air traffic. These directions are given by the air traffic organs from ACC/APP during the flight.

The application of the FUA concept is based on the creation of some temporary reserved areas for the flights of Air Force aircrafts which cannot be coordinated with the civil air traffic in real time. It is worth to mention this procedure of temporary segregation of the airspace which implies both the declaration of some air routes as being conditioned and the definition of some alternative routes in order to engage civil flights when the temporary reserved areas are activated.

The coordination of airspace use implies taking decisions and developing specific activities in the three phases corresponding to the competence level: strategic, pre-tactic and tactic. According to the fundamental principles, which represent the basis of the activities enclosed in the three phases, the use of airspace must have characteristics, such as: an on-going character; the airspace allocation which must equally satisfy the needs of all users.

In order to optimize the use of the available airspace, the existence of a civil/military system is needed to assure: the collection and evaluation of all airspace use requirements; the planning and allocation of airspace, including that of the segregated

areas; the activation and deactivation of segregated areas in real time in order to minimize the unavailability periods of some airspace structures; the distribution of detailed information regarding the use of airspace in real time to all the interested users.

If these functions are fulfilled, the system will assure both the coordination of activities for the allocation with priority of some areas in the airspace for some users, civilian or enlisted men, and the development of air traffic under safety conditions and efficiency. Thus, the airspace will be allocated for the use in real time and the civil-military coordination will also be made.

All the activities linked to the planning and implementation of airspace structures will evolve in a coordinated way, at an international level, through cooperation actions between the civil and military authorities.

The airspace management unfolds on various levels, having different responsibilities. Thus, at the first level, the national one, the main task consists of defining and revising the national policies regarding airspace, taking into consideration the users' requirements and the international organizations' recommendations. In order to assure the coordination in this phase, which is considered to be a strategic one, civil and military aeronautic authorities have different tasks, such as: establishing the use policy of airspace; periodically reassessing the airspace structure; defining negotiation procedures, national principles and priorities of airspace allocation; coordinating the important military exercises which impose the temporary closure of a route; periodically revising the specific procedures and operations to next levels.

In the next level there are established, according to the predicted air traffic figures, the flight coordination procedures by making a preliminary coordination at the flight planning level. In this phase, the activities which are assured are: receiving airspace temporary reservation requests from the military units, air traffic organs and other authorized aeronautic

agents; allocation of the available airspace according to priority procedures and regulations established at the first level; elaboration of the Airspace Used Plan (AUP) and the Updated Used Plan (UUP).

During the last phase, the tactical one, the civil air traffic organs coordinate, in real time, the flights of the Air Force aircrafts. The real time coordination of the flight activity in a space and a unit of time are made possible by the permanent exchange of information between the two systems: civil and military.

Management, at this third level, consists of the use of airspace in real time with the goal of concrete, secure, economically efficient operations of air traffic. It is divided into civil and military units of traffic assurance services i.e. civil and military air traffic controllers by activating, deactivating and reallocating, in real time, the airspace allotted at a superior level in order to solve concrete problems.

The real time access to the flight data, including the intentions of the air traffic controllers, optimizes airspace use and reduces the necessity of airspace reservation. Thus, airspace use becomes flexible, efficient and secure. At the third level, certain airspace areas are activated/ deactivated or reallocated and this is the solution for concrete coordination in dynamics.

4. CONCLUSIONS

The basis of the activities which take place in the three phases is represented by the concept of flexible use of the airspace. In its turn, this concept is based on the fundamental principle according to which the use of airspace must have a continuous character and by its implementation, an obvious rise of the coordinating capacity of the airspace systems is assured.

It is worth to highlight the fact that air traffic management activities are closely linked to the existence of three subsystems: that of the on-board equipment, that of the ground equipment and that of human resources. Referring to the aviation equipment



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and those specific to human activities in the airspace, the conclusion is that it is necessary to establish a compatibility between them due to two reasons: at present, the production industry in the domain can no longer belong to one state and this imposes a technology transfer; the aeronautic activity requires large airspaces, high flight speeds and togetherness between the states while developing activities [1]. The three previously mentioned subsystems interact in order to achieve the goals of the air traffic management and, unfortunately, the system's capacity is limited by the capacity of the weakest loop chain which defines it. For this reason, working together is the only solution for both civilian and enlisted men to manage in solving all the problems regarding the togetherness of the two air traffic management systems and the creation of an integrated system which should permit the maximum use of the existent airspace by all the categories of users.

All in all, the flexible use of the airspace remains the only way to bring together civil and military requirements. This fact implies extended civil-military cooperation, it assures the possibility of executing all civil and military flights and optimizes both technical and airspace resources and airspace security.

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