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CHALLENGES IN AIRSPACE MANAGEMENT RELATED TO NEW INVADERS - DRONES

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Abstract

UAV represents one of the great challenges of the 21st century. They are here and will not go away from our lives, because of the economic, social and political nature, which no longer require explanation. Mankind is not going to stop soon, its technological development although technology presents itself periodically with a payment order for its creators, the payment being made with no card but with human lives.

Keywords: Airspace management, drones, challenges.

1.Introduction

Probably the use of airspace began when homo sapiens first raised a stone and threw it into the opponent's head.

Subsequently, over time, people have gradually thrown against each other with arrows, bombs and rockets, discovered trajectories' characteristics and founded the exterior ballistics. The airspace was used only in the Earth's near area without feeling the need for specific regulations.

The appearance of first aerostats marked an important step in fulfilling the most beautiful dream of human beings: the flight.

The aerostat, that later became airship, boosted the development of the civil sector of the economy through passenger air transport services, courier, entertainment, etc. Probably, during that times appeared first air traffic rule: see and avoid (collision with another user of airspace). Seen initially in disbelief, the aerostat receives military destination, especially for observing the movement of troops columns, observation and correction of artillery fire, personal transport and courier.

One time mark in the history of the conquest of the air was created by the Romanian pilot Traian Vuia on May 18, 1906 being the first person who performed the first autonomous flight with a heavier than air. A novel invention, our Romanian inventor Traian Vuia, happily binds to that of Nicolae Tesla. The aircraft, the radio station and radio transmission became an inseparable binomial.

Mankind took full advantage of the two Romanians gifts, the propeller aircrafts giving an undeniable boost to the European and world economic development. Barriers fell down, there were born ties and there were continents united via airplane. Everything that was once thought to be impossible has become tangible. Air space and electromagnetic spectrum had become resources, their exploitation pioneering relying almost exclusively on the experiences lived by pilots daily.

For the second time in the history of the conquest of the air space, the military adopted a civil invention and turned it into the most feared weapon, military aircraft, the vector that would cause a revolution in the use of force. Subsequent developments in the field of civil and military aircrafts, both constructively and in terms of use procedures are

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made on two parallel directions without a minimum correlation of the mode of operation in common at the same period of the 2 resources.

Fortunately, the exploitation of some particularly complex resources (air space and electromagnetic spectrum) governed only by the wild lure of profit and the lack of civil-military coordination in the use of airspace field was expensively paid with hundreds of offerings.

The marking stone at the foundation of the beginning of air space management can be considered the third conference of the International Commission for Air Navigation (ICAN) held in London in 1912, when the first radio indicative was set for aircrafts.

Political and economic implications determined the subsequent transformation of ICAN in ICAO (International Civil Aviation Organization), as the UN agency that adopts standards and makes recommendations on air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation.

Airlines incidents and accidents that have continued to occur led to a more complex approach to airspace management process.

International standards and clear principles on the use of airspace have been established and implemented and states have defined and legislated their national policies in the field, covering both the economic and the military side of the issue.

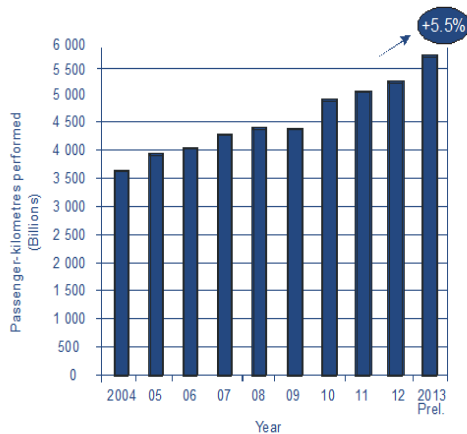


Figure 1. Total scheduled traffic, passenger-kilometres performed, 2004-2013

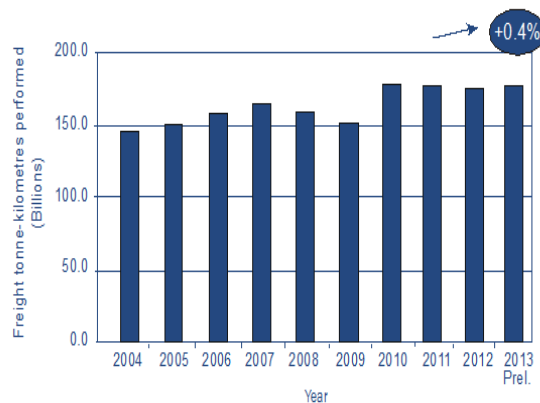
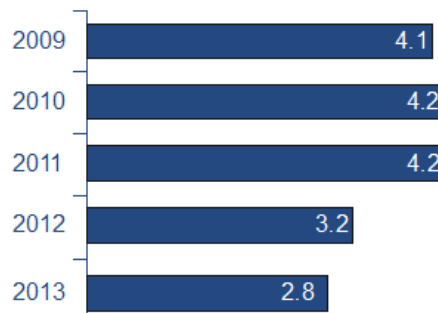


Figure 2. Total scheduled freight traffic, freight tonne-kilometres, 2004-2013



Global Accident Rate
(accidents per million departures)

Figure 3. Global accident rate and trend, 2009-2013

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On the other hand, the electromagnetic spectrum was practically invaded, particularly by exploiting the exponential radio domain, both by the civilians and the militaries, currently being almost inconceivable the existence of an electronic device that does not use the radio spectrum.

Neither the air space, nor the electromagnetic spectrum are inexhaustible resources.

Sometime it seemed inconceivable in the XXI century there are made adjustments of the use of the two areas often, in order to allow a more intense exploitation, even with the price of a huge loss or non-observance of safety measures.

And paradoxically in the middle of this cocktail appears a new toy for grown people, a toy that enchants and claims its right to attention and use: the unmanned air vehicle.

2.Challenges imposed by the UAV

2.1 Implications of air space resources and the electromagnetic spectrum exploitation

UAV systems development with military destination has gained an unexpected transparency after 1990, the military of the 21st century toy being live on TV, being ever-present in the pages of the magazines and newspapers. Observation flights, technical trends of miniaturization the systems, endurance tests and even ground attacks are mentioned almost daily. Because underneath the angelic-aura of an UAV that conquers everything, there are seen the HELLFIRE missiles. It has become a habit for an UAV to be on TV, lately, to display its strengths in achieving military objectives, especially for achieving strategic goals (the discovery of terrorist camps, the annihilation of terrorists leaders by exploiting the information obtained from the UAV, or by direct attack executed by them).

The recent deck-arrestor of the Boeing X-47prototype, a comparable-sized UAV with a classic fighter jet, has practically certified the military superpowers tendency to replace, in the not-too-distant future, even hunting and chatting with the UCAV. This is a new way to use air power, as the prime security provider!

If from the point of view of the wide range of tasks that can be executed, the flexibility of the UAV cannot be put to doubt, than in turn it requires a thorough analysis of the use in safety the air space and the security of the communication system.

How impenetrable is the connection between the navigator/pilot comfortably installed at the joystick and the aircraft in the mission, as well as which is the probability that it will not affect the evolution of classic aircraft, nobody can possibly answer. "The elegant capture" of an American UAV flying by the Iranian army has shown without any comments some of the risks associated with an aircraft without pilot. If in case of a system malfunction the pilot of a classic aircraft apply procedures tested and validated for long in order to restore the control, the emergency landing or removal of the aircraft from a populated area, in case of losing control the navigator/pilot does not have anything else to do but to engulf the cigar!

The crowd in the electromagnetic spectrum is obvious, most systems used by modern man is being based on the emission and/or reception of radio waves. Signal encoding is no longer enough; sometimes a simple interference happens to be just enough to produce noise and to disturb the electromagnetic spectrum. Interruption of connections with an aircraft without pilot can be made for a variety of reasons, starting with a voluntary action and continuing with the lack of radio coverage or even a trivial interference.

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In terms of airspace resource, the key word is still, "crowded area". The Single European Sky's initiative and the vertical reducing of minimum space required between two flight levels have facilitated an unprecedented intensification of the European air traffic, with a huge profit, of course, but at the same time they reduced to the minimum the time required for carrying out safety measures in case of an incident. A special case is Romania, which received additionally in the national air space most of the flow diverted from Simferopol, following the events in Ukraine.

The giant Google's intention to use the UAV as a mean of transport/messaging seemed to have opened widely the eyes of structures responsible for airspace management.

Funny thing, the UAV has become a trend and for the young generation who loves the mobile phone. More and more youngsters have the Apple application that allows the management of a mini UAV with the mobile phone. *And if God made the world, he can sit quiet and watch how the Chinese deals for the rest, today!* The profile stores are already full of mini UAVS that can be purchased at a low price, without requiring authorization. New toys are handled anywhere you can, because there are not too many restrictions. It is nearly impossible to determine which will be the situation in case of some crowded additional bands of frequency and what incidents might occur in the air close to the ground.

So, the civil society reserves its right to claim the aircraft without pilot. Starting as a security generator, UAV turns to be a profit source. A huge profit if we will take into account the use of aircraft without pilot of high capacity for carrying goods. The UAV does never get tired, does not require a salary raise, does not organize strikes, it is a model employee, the dream of every patron. How much it will cost this dream and what are the consequences of it, it is hard to predict. The possibilities of using UAVS are limited only by the imagination: from surveillance and aerial photography, entertainment, spying, transport of goods and people, to fight autonomous aircrafts in a not very distant future.

2.2 Implications of terrorism expanding

It has been 14 years since the attack on the Americans' "Twin towers" and globally the security situation does not give any signs of improvement. Bomb attacks, aircrafts jacking or kidnappings have existed before this unfortunate milestone but the terrorist phenomenon had no strategic coverage. Nowadays there are terrorist organizations with the financial power of a State, with tens or hundreds of thousands of followers, who fight with modern weaponry for the conquest of the territories.

It is unlikely that the 21st century "toy" will not come to the attention of those who are already targeted by the aircrafts without pilot. If the leaders of terrorists are hunted with UAVS, what do you think can stop them to acquire the idea to develop their own fleet of UAVS and to use these objects as vectors of terrorist attack? No one, perhaps.

A terrorist attack with an UAV can be catastrophic. Taking off and departing almost from anywhere with a relatively small charge of explosive, difficult to be detected with radars but being accurately guided to targets, UAV can become the perfect weapon.

Laws of Big Brother have sparked a wave of protests and indignation in many countries, mostly European. The modern man hardly give up on the privacy of the mobile phone and the Internet, the secret services and authorities are pressing on the need to control the terrorism ... the truth is somewhere in the middle. Hard to predict what will be the reaction of the modern man who, although accepting the "rape of his privacy", finds himself in the head with an UAV full of explosive.

2.3 Airspace sovereignty

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In the midst of this Madhouse of the 21st century, the militaries have enough reasons to worry. The air space control is assigned by law to the Ministry of Defence, almost in all States of the world. Airspace sovereignty of each State is a matter of major importance, both military and political.

Regardless of the type of mission, destination, as users of air space and electromagnetic space the aircrafts without pilot must be found, tracked on the correct use of the paths of the two resources, or determined to enter the legality if it is noticed a violation of the law.

UAV will pose a real challenge to NATINADS and will determine the most likely, massive investments in modernization of air monitoring system, the standardization of data packet transmissions, as well as the taking into account of some new interception vectors.

3.The UAV phenomenon approach

3.1 At the international level

As it has been expected ICAO provided the guidelines for approaching the concept of the aircrafts without pilot. In circular 3284, in 2011 it was made a recommendation for a unitary approach to the aircraft status, regardless of whether they are manned or are ordered remotely, under the aspect of licensing the operators with the compliance of technical standards and standards of using the airspace. In order to have a unitary approach there was proposed an update of the UAV definition and this was defined as Remotely-Piloted Aircraft-RPA1.

Thus, it is recommended that Nations should have the general framework considered necessary for the new systems to meet in order to operate in the same air space with the conventional aircrafts:

- Certification: RPA, operator, remote pilot
- Approval: RPAS as a complete system
- Collision and hazard avoidance
- Interact with ATC and other aircraft
- Security: data links, RPA, remote pilot station
- Predictable actions (not autonomous!)
- Contingency procedures

The implications of these guidelines will determine changes in two directions:

- companies producing RPA will have to adapt their production to meet the technical standards;
- companies that will operate the RPA will have to provide the training and certification of their operators, as well as certification of RPAS as a whole.

A wide range of individual users of UAVS that use these aircrafts, both for entertainment or for small scale business, it is likely to consider that these regulations are particularly harsh and made to hinder their freedom. It is expected that they will not obey the rules or will not operate at their limit, creating a risk area.

In some NATO Member States civil aircrafts without pilot had already been identified as being extremely useful tools of terrorist groups or of some groups which have as their objective the mission to make vulnerable and unclassified the national security objectives.

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Following the repeated survols/air inspections of some important strategic objectives (nuclear power plants), France has banned the use of airspace by civil aircrafts without pilots.

3.2 In Romania

The aircraft without pilot has been in the attention of the Romanian specialists, military, and civilians since its apparition. Discussions were held with representatives of all institutions with responsibilities in the field of management of airspace and the electromagnetic spectrum during the Working Group sessions established at the initiative of MoND.

Free flight aircraft without pilot that exceed the weight of 1 kg has been forbidden from flying through an order of the Minister of transports, this year, in January. "Aircrafts without pilot on board", as they are officially called, need an official certificate of registration and flight authorization to be lifted up in the air and if they have over 150 kg they can fly in "areas of temporarily segregated airspace that have been established, assigned and activated in accordance with the regulations in force".

However, any miracle lasts three days, because a modification of this order is already projected through a ministerial order that is in full process of debating and this order will give more freedom for users of UAVS.

4. Conclusion

UAV represents one of the great challenges of the 21st century. They are here and will not go away from our lives, because of the economic, social and political nature, which no longer require explanation. Mankind is not going to stop soon, its technological development although technology presents itself periodically with a payment order for its creators, the payment being made with no card but with human lives.

For Romania the UAV can represent an opportunity for strategic interest, both from the civil point of view and for the military. Having a civil aviation working far below actual/real possibilities, a military aviation that survived during hard times, chronically badly financed, transformed and retransformed during 25 years, the Romanian authorities, the Government should take full advantage of the opportunities created by the phenomenon of UAVS - opportunities such as international recognition and high rate employment.

Firstly, legislation adopted by Romania must be an example worldwide/internationally. Even if the national legislation has restrictions, as it is normal to be, regarding the UAV, it must be supported by proper laws, made by experts in the field. It is not normal in a State of law that an order issued by a national authority in its field of responsibility could be attacked and rescinded in justice of any merchant. Furthermore, amending and completing the law, for the purposes of restrictions relaxation, it may be appropriate to be carried out only at the initiative of experts, after completing some technical and procedural steps, not at the proposal of any individuals whose contact with the issue is just the airplane ticket.

Secondly, the involvement of State or private Romanian specialists, under a single coordination in the development of some technical solutions for UAVS. Romania has internationally recognized very good experts in the field of aerodynamics, in the field of software, in the management of airspace and the electromagnetic spectrum. Their effort in the national service could generate an exponential gain, both politically and economically

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and could take Romania from the area of exporting labor force and put it in the circle of the KNOW HOW exporters.

Active involvement in the two above mentioned directions could generate a correct, optimal result in the field of National Security that should be the number one priority of political decision makers.

Just being part of the solution to a problem, not just a chibit on the edge, a modern State has the possibility to adapt permanently national security strategy, to be able to face any challenges successfully.

5. References

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