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ASSESSMENT OF PRINCIPLES FOR RPAS INTEGRATION INTO NON-SEGREGATED AIRSPACE

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ABSTRACT

The safe and efficient integration of Remotely Piloted Aircraft Systems (RPAS) into non-segregated airspace needs to develop handling together technical and procedural means to allow them within current and future Air Traffic Management (ATM) environment. Therefore, it should be taking into account many issues such as security, safety and operational efficiency as well as capacity, environmental impact and cost efficiency regarding the examined airspace and RPAS. In this paper, some important studies doing by aviation stakeholders and regulations which is published by aviation authorities is examined related to RPAS ATM integration.

INTRODUCTION

Unmanned Aircraft Systems (UAS) or Remotely Piloted Aircraft Systems (RPAS) are future unmanned systems on which are performed significant researches and investments. UAS is consisted of unmanned aircraft vehicle (UAV), remote control station, data link and other subsystems and defined as system of systems [Marshall, 2012; FAA, 2013 ICAO, 2015, Eurocontrol, 2017]. Developments, potentials and uses of the UAV systems in applications has indicated a great benefits far beyond expectations in the world since 2000. At the same time, needs and markets for RPAS are also developing rapidly. It is reclaimed that return of national investments over made in unmanned systems will be increased and also will be considered an important export products for countries. Furthermore, it is expected that UAS will be integrated in the non-segregated airspace over the next two decades and also provisioned a great impact on global economy with a high level direct and in-direct employment.

Air Traffic Management (ATM), which is human centered, dynamic and also complicated, is a system of systems. One of those systems is RPAS which is formerly designed for military missions. Beyond military applications, it is becoming progressively significant for civilian

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applications of RPAS such as aerial photography, power line surveillance, weather and climate researches and law enforcement [SSM, 2012; Geister, 2013].

Segregated airspace which referred to here is defined as airspace of specified dimensions is allocated for exclusive use to RPAS operations [Geister, 2013; Korn, 2012]. On the other hand, non-segregated airspace is stated in the paper as the outside areas of the segregated airspace for civilian applications. Use of segregated airspace means that RPAS users require a special authorization from national aviation authority to perform flight operation of RPAS in restricted areas of airspace used by manned aviation in order to use exclusively without any other traffic. Thus, the use of segregated airspace which is today used commonly for most civilian operations of RPAS generates some drawbacks in the field of capacity and efficiency in ATM [Korn, 2012].

Although there is a considerable potential for the use of RPAS in the civilian missions, development of RPAS applications is still limited because increasing demand of civilian applications for RPAS requires to access into non-segregated airspace. The access of non-segregated airspace for RPAS used by manned aircraft is a chief challenge to be resolved for current and future ATM systems [Pastor, 2010; Geister, 2013]. Today, non-segregated airspace is usually utilized by both civil and military applications. It is envisioned that this conditions may influence current air traffic system on either safety or air traffic capacity.

Moreover, several research and development studies related to RPAS are mostly devoted to develop technical solutions in order to safe integration into non-segregated airspace. However, the safe integration of RPAS needs to develop handling both technical and procedural means to allow them into current ATM environment [Ramalingam, 2011]. Meanwhile it should be taking into account many issues such as capacity, environment, cost efficiency as well as operational efficiency, security and safety regarding the examined airspace and RPAS. Therefore, the integration of RPAS into non-segregated airspace which taken into account by both RPAS operators and ATM community is a key issue for acceptance them into future ATM system [Cordon, 2014].

RPAS-ATM INTEGRATION

Some significant studies are already under way in regards to development in concept of operations by international and regional authorities (FAA, EASA, ICAO, NextGen, SESAR, RTCA, NATO etc.). These studies pioneer the developments of unmanned regulations. When it is assessed of the legislations about RPAS integration into non-segregated airspace, it is specified the importance of proposing specific solutions for each countries' unique problems while taking into account of geographic location, airspace structure, obstacles and aircraft performance etc. In this paper it is examined how the RPAS ATM integration develops safely and efficiently.

Studies and Regulations of RPAS ATM Integration

A critical interest of the Federal Aviation Administration (FAA) is to develop regulations, policy, procedures, guidance material and training requirements in order to reinforce safe and efficient UAS operations in the National Airspace System (NAS). FAA is also coordinating with related stakeholders doing by this [FAA, 2013]. The main aim of the studies is to integrate UAS into the NAS without reducing existing capacity, decreasing safety, negatively impacting current operators and increasing the risk to airspace users etc.

Moreover, FAA is planning for Next Generation Air Transportation System (NextGen) program in order to realize the goals such as increment of capacity and efficiency, improvement of user access and safety, and also decrement of environmental impacts [DeGarmo, 2008; NextGen, 2007]. As stated in the Operational Concept (ConOps) for NextGen [NextGen, 2007] future systems will be able to allow a wide variety of flights and new types of operations such as RPAS which will be handled in an integrated fashion.

Single European Sky Air Traffic Management (ATM) Research (SESAR) program is coordinated by European Commission in Europe. RPAS integration into non segregated airspace is an objective for the future of safe and efficient ATM systems by SESAR [SESAR, 2015]. RPAS operations are executed in segregated airspace or under strict conditions. Although the segregation of RPAS from other airspace users supports a safe environment, this process causes to reduce the flexibility of operations and limits the range and capabilities of operations for all ATM community. RPAS ATM integration involves a list of general requirements in the view of SESAR which are presented in [Cordon, 2014]:

- RPAS shall comply with current and future regulations and procedures
- RPAS operations should not increase risk to other ATM users
- RPAS integration should not bring any additional equipment's to other ATM users
- RPAS operations should be equivalent to manned aircraft as much as possible.
- The human operator is responsible for RPA operations

European Aviation Safety Agency (EASA), drone name is used to speak of RPAS by EASA, is considering the broad range of drone operations and types of drones while it is proposed to establish 3 categories of operations as [EASA, 2015]:

- Open,
    - Drones should not require an authorization by an aviation authority (AA) for operation, but stay within defined limitation
- Specific
    - Drones will require an Operation Authorization by an AA with specific limitations adapted to the operation
- Certified
    - Certification will be required for operations.

It is stated in RPAS ATM CONOPS document published by Eurocontrol that the uses of RPAS is now more popular below 500 ft. because of economic issues. This is the lowest altitude available for VFR flights according to ICAO Annex 2. Thus it creates a possible boundary between smaller RPAS and manned aircraft. It is foreseen that RPAS will operate in a mixed environment adhering to the requirements of the specified airspace it is operating in. RPAS will be able to operate as shown Figure 1. [Eurocontrol, 2017]:

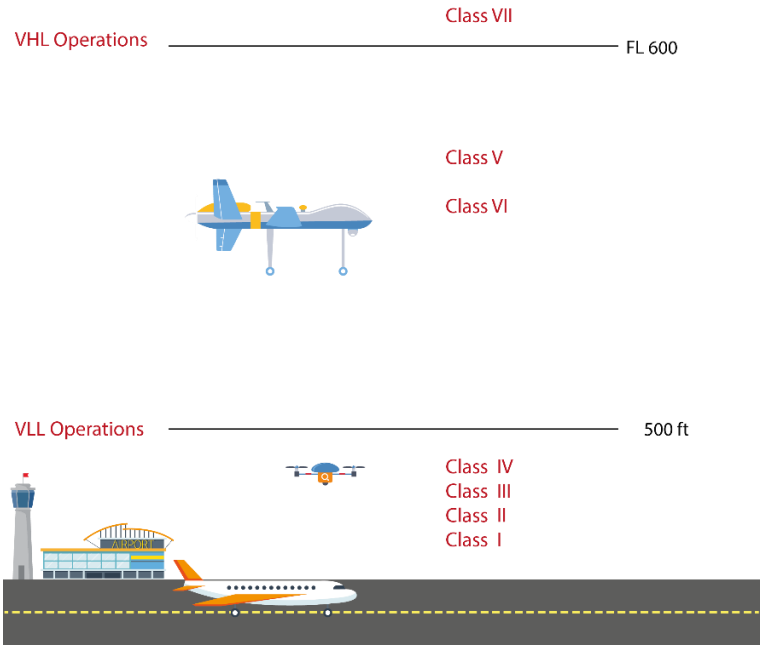

Figure 1. Classes of Unmanned Traffic

- Very High Level operations (IFR operations above FL600).
- IFR (instrument flight rules) or VFR (visual Flight rules): following the same rules that apply to manned aircraft. These can be conducted in RLOS or B-RLOS conditions.
- Very low level (VLL) operations.

On the other hand International Civil Aviation Organization (ICAO)'s goal is to provide an international regulatory framework while harmonization of other activities in civil airspace doing by other stakeholders. As a result of these harmonization studies, Doc 10019 Manual on RPAS document is published by ICAO for aiming to harmonize notions, concepts and terms [ICAO, 2016].

CONCLUTIONS

In this paper, principles of operational concepts for RPAS integration into non-segregated airspace is examined considering need and challenges of the safe integration in the view of aviation authorities and leading stakeholders. The requirements and challenges for RPAS flight operations into non-segregated airspace need deeply develop in order to integrate them safely and efficiently into future ATM.

In the paper, the general view of RPAS integration into current and future ATM is evaluated considering international and national boundaries. The main objective is to integrate RPAS into current ATM in order to develop and accelerate the potential use of RPAS in civilian applications. Moreover, it is noted that safe integration could take place with definition requirements of RPAS flight operations in current ATM as well as harmonization international civil aviation authorities such as ICAO, EASA, Eurocontrol etc. Also it is emphasized that RPAS should be treated like manned aircraft and so that no additional requirements and risks are not charged over existing ATM.

References

Cordon, R.R., Nieto, F.J.S. and Rejado, C.C. (2014) *RPAS Integration in Non-segregated Airspace: the SESAR Approach*, 4th SESAR Innovation Days, Nov 2014

DeGarmo, M. and Maroney, D. (2008) *NEXTGEN and SESAR: Opportunities For UAS Integration*, 26th Congress of International Council of the Aeronautical Sciences (ICAS), Sep 2008

EASA (2015) *Concept of Operations for Drones*, May 2015

Eurocontrol (2017) *RPAS ATM CONOPS*, 4th Edition

FAA (2013) *Integration of Civil Unmanned Aircraft Systems (UAS) in the Natioanl Airspace system (NAS) Roadmap*, 1st Edition,

Geister, D., Korn, B. and Edinger, C. (2013) *Operational Integration of UAS Into ATM*, System, Guidance, Navigation, and Control and Co-located Conferences, Aug 2013

ICAO (2015) *Doc 10019: Manual on Remotely Piloted Aircraft Systems (RPAS),* 1st Edition, Canada

Korn, B., Tittel, S. and Edinger C. (2012) *Stepwise Integration of UAS In Non-Segregated Airspace –The Potential of Tailored UAS ATM Procedures*, Integrated Communications, Navigation and Surveillance Conference (ICNS), Apr 2012

Marshall, D.M. (2012) *UAS Standards, Regulations and Developmental Strategies: A Global Effort,* Infotech Aerospace, Jun 2012

NextGen (2007) *Concept of Operations for the Next Generation Air Transportation System*, 2nd Version, Jun 2007

Pastor, E., Prats, X., Royo, P., Delgado, L. and Santamaria, E. (2010) *UAS Pilot Support for Departure, Approach and Airfield Operations*, Aerospace Conference, Mar 2010

Ramalingam, K., Kalawsky, R. and Noonan C. (2011) *Integration of Unmanned Aircraft System (UAS) in Non-segregated Airspace: A Complex System of Systems Problem*, Systems Conference (SysCon), Apr 2011

SESAR (2015) *European ATM Master Plan*, Edition 2015

SSM (Undersecretariat for Defence Industries) (2012) *Turkiye Insansız Hava Aracı Sistemleri Yol Haritasi (2011-2030)*, 2012