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ASSEMBLY — 40TH SESSION

TECHNICAL COMMISSION

Agenda Item 30: Other Issues to be considered by the Technical Commission

MANAGEMENT OF UNMANNED AND MANNED TRAFFIC IN CONTROLLED AIRSPACE

(Presented by Brazil)

EXECUTIVE SUMMARY

The newest and most promising protagonist of world aviation is, undoubtedly, the unmanned aircraft system (UAS). More and more institutions are interested in profiting from the benefits which may be obtained from the use of these technological resources. The integration of this new component is, without a shadow of doubt, considered by ICAO as the new era of aviation, and will bring benefits for the economy, environment and society. This topic is no longer a topic of the future, and is more and more part of the reality of States. On the other side, the biggest challenge is finding solutions for this new segment to be safely inserted in a very regulated environment with 75 years of history. This paper aims at presenting to the Assembly some possibilities to enhance the accommodation of this new technology, according to the concept of flexible use of airspace (FUA).

Strategic Objectives:	This information paper relates to the Safety Strategic Objective.
Financial implications:	This paper has no financial impact.
References:	Annex 2 — *Rules of the Air* Doc 4444, *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM) Doc 10019, *Manual on Remotely Piloted Aircraft Systems (RPAS)* ICAO UAS Concept of Operations

1. INTRODUCTION

1.1 In Brazil, requests to access the airspace, submitted by unmanned aircraft, are managed by a system named SARPAS (Solicitação de Acesso de Aeronaves Remotamente Pilotadas). In this system, the user inserts, online, the data of the intended operation, and obtains an answer, whose time lapse will depend on characteristics of the requested flight, as well as the aircraft to be employed. The implementation of SARPAS resulted in the simplification of processes, which promoted more prompt authorization for airspace access. From this site, the user may consult the main legislation on this topic, published by Brazil, ratifying the educational stance followed by Brazil. Approximately 90 per cent of requests involve operation of unmanned aircraft (UA), whose maximum takeoff weight (MTOW) is 25 kg or lower and classified as Class 3. Besides, in these cases, the intended locations are generally far from areas where it may pose threats, easing, therefore, the process of analysis and consequent issuance of authorizations for airspace access.

1.2 On the other side, the greatest challenge is when the request involves overflying a controlled airspace or when an UA weighs 25 kg or more. In general, the creation of conditioned airspace promotes some accommodation of unmanned traffic. Therefore, UA circulate within conditioned airspace and segregated from other aircraft.

1.3 More recently, users have sought new applications for UAS. They even plan the use of UA with MTOW greater than 25 kg, for cargo transportation and other offshore applications with departure and return to the continent. With the purpose of finding solutions to new problems, *Departamento de Controle do Espaço Aéreo* (DECEA), as one of the regulators, is carrying on feasibility studies in order to better understand the functioning, operation and standardization of such operations. The regulation and operation in these cases in a multidisciplinary effort which involves industry, regulators, air navigation services providers (ANSPs) and other airspace users.

1.4 Procedures, infrastructure and other aspects of the current aviation panorama will need to be adapted in order to support UA characteristics. All this effort is a great challenge for the involved stakeholders. This information paper addresses possible solutions for some of the main problems involving the operation of unmanned aircraft within controlled airspace.

1.5 From a broader perspective, and aligned with the concept of flexible use of airspace, it seeks to improve flexibility levels of accommodation criteria, promoting, in a safe and controlled environment, necessary field surveys in order to obtain, in the future, a complete integration.

1.6 Likewise, it is necessary to update ICAO Standards in order to provide guidance material to describe techniques and methods which may be employed to accommodate or segregate UA operation in a more flexible way.

2. DISCUSSION

2.1 Detect and avoid (DAA) X ATC separation

2.1.1 If we compare manned flights, there are two aspects which pose a great challenge to UA: a) capacity to detect and avoid other aircraft; and b) capacity to maintain visual meteorological conditions (VMC) when flying under visual flight rules (VFR) rules.

2.1.2 The operation of unmanned aircraft comprises the use of new functionalities. One of them is detect and avoid (DAA). DAA is defined in Annex 2 — *Rules of the Air* as *"the capability to see,* *sense or detect conflicting traffic or other hazards and take the appropriate action. This capability aims to ensure the safe execution of an UA flight and to enable full integration in all airspace classes with all airspace users".* Although new DAA technologies are currently under development, they lack some more objective criteria to certify the approval of this functionality. Doc 10019, *Manual on Remotely Piloted Aircraft Systems (RPAS)*, item 10.4, approaches the question of traffic conflict management by DAA functionality.

2.1.3 Basically, according to Doc 10019, conflict management involving UA comprises three protection layers:

a) First layer - conflict strategic management - in this layer, the UA pilot is expected to follow the flight plan and air traffic control (ATC) authorizations.

b) Second layer - the separation may be provided by the ATC or the user himself/herself - in this case, when the user should use the separation, the term remain well clear (RWC) is used.

c) Third layer - collision Avoidance - in case other layers are violated, the UA is expected to have a system which avoids the collision.

2.1.4 The less services there is within the airspace, the more needed the DAA functionality will be. Therefore, for a flight within Class G airspace, for example, outside the controlled airspace, DAA will be indispensable. On the other side, within Class A airspace, where there is air traffic services (ATS) surveillance service, it is possible to provide better levels of UA flexibility and accommodation without creating conditioned airspace.

2.1.5 Within the context of Doc 10019, previously mentioned, the DAA functionality is a requirement for total integration. As many steps are missing until all intended requirements for a total integration are safely met, it is possible to improve accommodation techniques to make UA outside the conditioned airspace to be more flexible and easier under certain conditions.

2.1.6 Regarding the capacity to maintain VMC rules, the main difficulty is keeping away from clouds in distances indicated in the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444). Not following these parameters, under VFR flight, could generate risks to other users in case the flight is performed in Class C, D, E, F or G airspaces. In this way, it is considered more appropriate that UA flight under VFR is only performed within segregated (conditioned airspace) airspace created specifically for this purpose.

2.2 Higher level of flexibility using the FUA concept

2.2.1 Although it is not too complex to provide UA flight within controlled airspace by the creation of temporary conditioned airspace, a greater flexibility level is shown as necessary. Within airspace with greater flow or where there are different types of trajectories (SID, STAR, IAC, etc.) in its vicinity, the creation of conditioned airspace with the purpose of allowing the flight with an UA may generate too restrictive impact for other users. As, when using the FUA concept, the activation of a conditioned airspace will only happen when necessary, there was also the aim of optimizing the segregated airspace segment for UA use.

3. DYNAMIC SEGREGATION

3.1 On the other side, and considering the possibility of UA operation under instrument flight rules (IFR), we foresee the possibility to provide the flight in a more flexible way under certain conditions and parameters. If we consider the segments of flights under IFR, using the ATS surveillance system, within conditioned Class A, B or C airspace, it is possible to obtain operational advantages by the use of joint ATC advantages together with UA capacities.

3.2 The possibilities for improvement contained in this information paper take into consideration the following requirements:

a) operation of unmanned aircraft with MTOW greater than 25 kg;

b) possibility of communication between the remote pilot station (RPS) and the ATC unit;

c) aircraft VHF transmitter;

d) aircraft equipped with transponder modes A/C;

e) aircraft equipped with transponder modes ADS-B;

f) certified aircraft;

g) certified pilot;

h) existence of ATS surveillance system within class A, B or C airspaces flown by UA;

i) flight segments within class D, E, F or G airspaces are segregated by the creation of conditioned airspaces to avoid risk to other users; and

j) establishment of actions for contingency situations of ATS surveillance service.

3.3 A possible solution, considering the presented requirements, would be the creation of a **dynamic segregation**. This concept would only be applied within controlled airspace, since segregation would depend on ATS surveillance service to be provided. Theoretically, it is related to the creation of a fictitious airspace in the shape of a cylinder centred at the aircraft. The radius would correspond to the applied radar separation minimum. Vertically, 1 000 ft above and below the UA. This fictitious cylinder moves jointly with the aircraft and represents the dynamic segregation. In order to guarantee this minimum protection, the ATC would apply double separation, both laterally and vertically (see Figures 1 and 2).

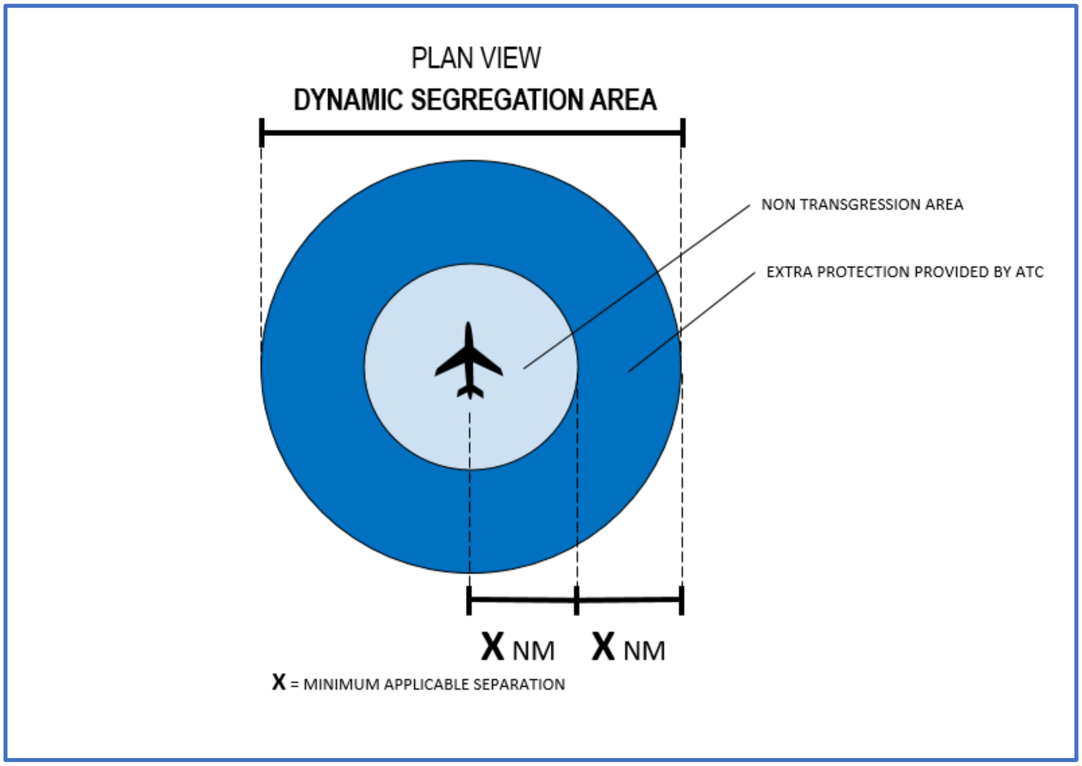

Figure 1. Dynamic segregation in plan view

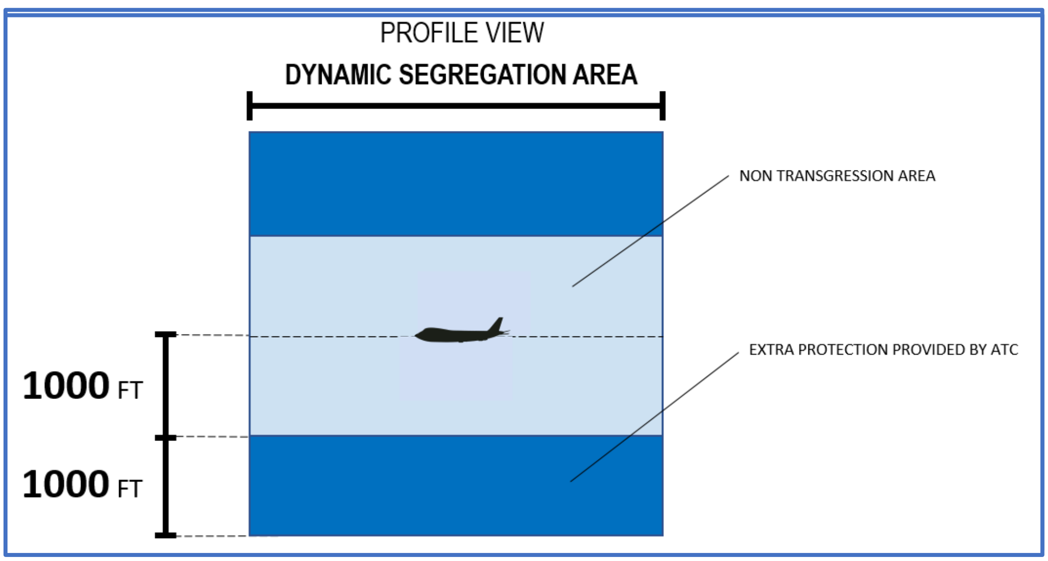

Figure 2. Dynamic segregation in vertical view

3.4 This technique could be used within Class A, B or C airspace. Specifically, within the Class C airspace, broadly used in Brazil, the UA flight plan would need to be IFR. As Doc 4444 prescribes, within Class C airspace, there is separation between IFR flights or between IFR and VFR flights, but separation between VFR and VFR is not foreseen. In order to ensure segregation, the ATC would use the ATS surveillance system to segregate UA from other aircraft.

3.5 An equally important requirement is planning for contingencies of the ATS surveillance service. From a first glance, the double conventional separation would be applied and new UA entries to the airspace would not be authorized until the service is re-established.

3.6 The number of users interested in operating remotely piloted aircraft beyond-visual-line-of-sight (BVLOS) is currently increasing. Therefore, the main element regarding aircraft operation is safety. For this reason, it was decided to perform tests in maritime regions in order to maintain safety of property and people.

3.7 Since 2009, Brazil has been practicing UA segregation within controlled airspace by creating conditioned airspace. More recently, due to new requests from users, we have been improving techniques to best accommodate UA operations. The use of dynamic sectorization may drastically reduce the portions of segregated airspace, maintain safety and best address issues from the users.

4. PLANNING OF NEW OPERATIONS WITHIN COASTAL AND OCEANIC REGIONS

4.1 Given the new requests from users, Brazil has been planning to execute tests taking into consideration the use of dynamic segregation. As it is new content, at first we intend to apply this concept in offshore airspace where there is automatic dependent surveillance — broadcast (ADS-B) coverage, ATS surveillance service.

4.2 Users intend to perform cargo transportation between maritime platforms using UA. Only the base is required to be in the continent. For that, an aerodrome with low movement and close to the coast will be used.

4.3 Differently from other works, in this case, the simple segregation by the creation of conditioned airspace will not be enough to meet the proposed objectives. Therefore, the use of dynamic segregation concept may best accommodate the UA. The planning of tests also comprises training of involved parties. The purpose is publicizing the knowledge provided and, in this way, standardizing the safety actions inherent to the operation.

4.4 In initial tests, flights will be foreseen only in conditioned airspace and for exclusive use of unmanned aircraft. In addition to that, simulations will be performed to evaluate the behaviour of remote pilots and the ATC.

4.5 Additional safety measures are being planned for the future test phases: a) aeronautical information circular (AIC) publication informing the aeronautical community of the UA operation within the region; and b) setting of geofences to establish a limited area where it is possible to have UA operation under special conditions. In this way, the ATC units and airspace users may become aware of unmanned air activities and increase the situational awareness during operations.

5. CONCLUSION

5.1 The collaboration among regulating authorities, industry and other airspace users is essential to increase the level of flexibility and accommodation of UA operation in Brazil. We are engaged in improving regulations and general guidelines, and training involved parties. Taking into consideration the total UA integration within the current ATM context is a great challenge and it requires other advances, it is possible to enhance techniques and processes to make UA accommodation more flexible within controlled airspace.

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