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(Lima, Perú, 4 to 8 November 2019)

Agenda Item 2: Airspace Optimization

AIRSPACE OPTIMIZATION BY THE USE OF DYNAMIC SEGREGATION CONCEPT

(Presented by Brazil)

SUMMARY

There is no doubt that the integration of the UAS, which ICAO considers as the new era of aviation, will bring benefits to the economy, the environment and society. This issue is no longer a matter of the future and is increasingly involved in the reality of states. On the other hand, the biggest challenge is finding solutions to accommodate the flight of Unmanned Aircraft (UA) in controlled airspace and shared by other manned traffic. This Working Paper aims to present the possibility of improving UA accommodation in controlled airspace by using the concept of Dynamic Segregation.

References:

- ICAO Doc 10019
- ICAO RPAS Concept of Operations
- ICAO Doc 4444

1. Background

1.1 In Brazil, requests for Unmanned Aircraft (UA) access to airspace are managed through a system called SARPAS. In it, the user enters, online, the data of the requested operation and obtains a response. Our time span depends on the characteristics of the requested flight, as well as the aircraft to be used. With the implementation of SARPAS, by simplifying the processes, the user can quickly obtain authorization to access the airspace. From the website, the user can also consult the main legislation on this subject in the country. Around 90% of the applications involved in the operation of unmanned aircraft (UA), whose maximum takeoff weight (MTOW) is less than or equal to 25 kg, classified as Class 3. In addition, in these cases, the last few times are normally away from areas where they may pose a threat, which facilitates the process of analysis and the issuance of airspace access permits.

1.2 On the other hand, the greatest challenge occurs when the request participates in a controlled airspace and when the UA weighs more than 25 kg. Typically, traffic is accommodated by creating segregated airspace. Therefore, the UA travels in a space separated from other airplanes.

1.3 Lately, some users have been looking for new applications for UAS. They also plan to use UA with a MTOW greater than 25 kg for cargo transportation, other offshore applications and return to continental applications. To find solutions to the new problems, DECEA, as a regulatory body, is conducting feasibility studies to best understand the operation and create a standardization. Regulation and operation in these cases is a multidisciplinary work that involves industry, regulators, ANSP and other airspace users.

1.4 Current aviation procedures, infrastructure and other controlled aspects will need to be improved in order to support the new features of the UA. All this work is a great challenge for everyone involved. This Working Paper addresses possible solutions to some of the key problems that involve the operation of unmanned aircraft in controlled airspace.

2. Discussion

2.1 Compared to manned flights, there are two aspects that pose an important challenge for the UA: a) the ability to detect and avoid other aircraft; and b) the ability to remain in VMC when flying in accordance with VFR rules.

2.2 The operation of RPAS includes the use of new features. One is DAA (Detect and Avoid). The DAA is defined in Annex 2 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 RPA flight and allow full integration into all airspace classes with all airspace users. Although new DAA technologies are being developed, more objective certification criteria are lacking for the approval of this functionality. Doc 10019, item 10.4, addresses the problem of traffic conflict management through DAA functionality.

2.3 Basically, according to Doc 10019, conflict management involving RPA involves three layers of protection:

a) First level: strategic conflict management: at this level, the RPA pilot is expected to comply with the flight plan and ATC clearances;
b) Second layer: the separation can be provided by ATC or by the user. In this case where it is up to the user to separate, the term Remain Well Clear (RWC) is used;
c) Third layer: collision prevention. RPA, if the other layers are violated, it is expected to have an anti-collision system.

2.4 If there is no ATC service in the airspace, the greater the DAA functionality required. Therefore, for flight in class G airspace, for example, outside of segregated airspaces, DAA would be essential. On the other hand, in Class A airspace, where there is an ATS surveillance service, it is possible to provide a higher level of flexibility and RPA accommodation without creating an airspace segregated by NOTAM.

2.5 In the context of Doc 10019 mentioned above, DAA functionality is a necessity for total integration. As many steps remain not completed, until all the desired requirements for full integration can be safely achieved, accommodation techniques can be developed to flex and facilitate the flight of RPA out of segregated airspace under certain conditions.

2.6 With respect to the ability to remain in VMC, the main difficulty is to stay away from the clouds at the distances indicated in Doc 4444. Failure to comply with these parameters when flying VFR could create a risk for other users if the flight is made in Class C, D, E, F or G airspace. In this sense, the RPA flight according to the VFR rules is considered more appropriate only in segregated airspaces created specifically for this purpose.

Higher flexibility level

2.7 While it is not too complex to provide UA flight in controlled airspace by creating temporary segregated airspace, a greater degree of flexibility has been required. In high-flow airspace or where there are different types of paths (SID, STAR, IAC, etc.), creating a segregated airspace to allow the flight of a UA may be too restrictive for other users. Just as using the FUA concept, where the activation of a conditioned airspace only occurs when necessary, we seek to optimize the portion of the separate airspace for the use of UA.

Dynamic Segregation

2.8 Otherwise, considering the possibility of UA operation according to the IFR rules, we anticipate the possibility of providing a more flexible flight under certain conditions and parameters. If we consider the flight phases according to the IFR rules that use the ATS surveillance system in the controlled airspace of Class A, B or C, operational advantages can be obtained by jointly using the advantages of ATC with the UA capabilities.

2.9 The possibilities for improvement contained in this document consider the following requirements:

a) operation of Remotely Piloted Aircraft (RPA) with a MTOW greater than 25 kg;
b) possibility of communication between the Remote Pilot Station (RPS) and the ATC facility;
c) VHF transmitter in the aircraft;
d) aircraft equipped with A/C mode transponder;
e) aircraft equipped with ADS-B technology;
f) certified aircraft;
g) qualified pilot;
h) existence of an ATS surveillance system in airspace class A, B or C flown by the RPA;
i) the parts of the flight in class D, E, F or G airspace are separated creating segregated airspace to avoid risks to other users; y
j) establishment of contingency actions of the ATS surveillance service.

2.10 One possible solution, considering the requirements presented, would be the creation of Dynamic Segregation. This concept could only be applied in controlled airspace, since segregation would depend on the ATS surveillance system provided. In theory, it is the creation of a fictional cylinder-shaped airspace whose center is the plane. The radius would correspond to the minimum radar separation applied. Vertically, 1000 feet above and below the UA. This fictional space moves along with the plane and represents segregation. To ensure this minimum protection, the ATC would apply double lateral and vertical separation (see Figures 1 and 2).

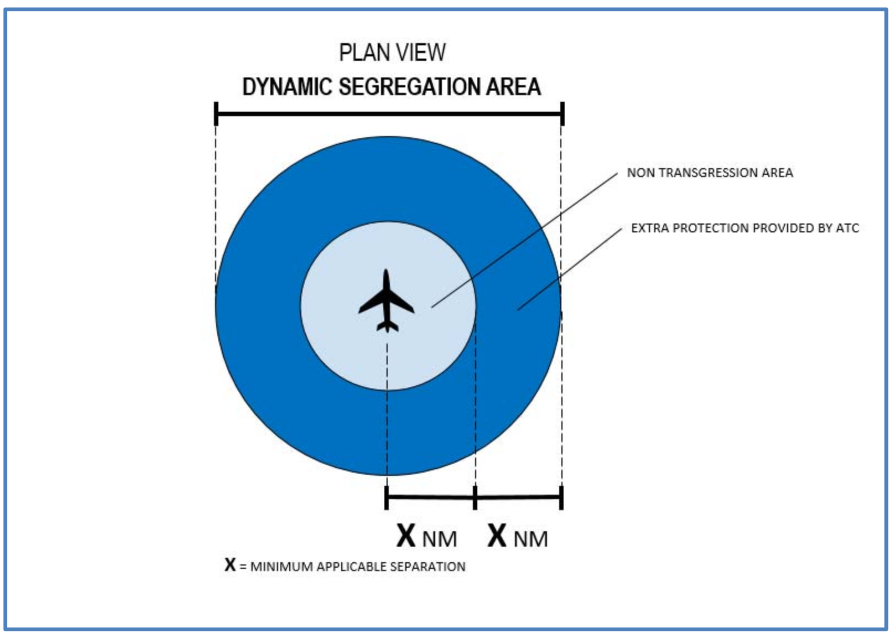

Figura 1 - Dynamic Segregation in plain view

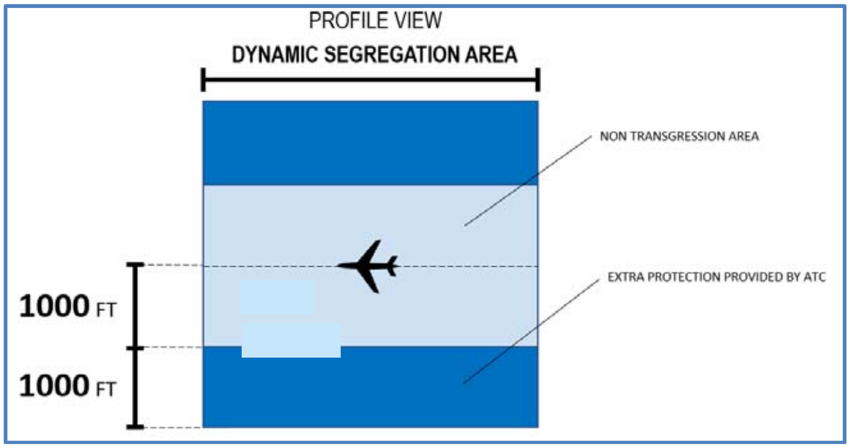

Figura 2 - Dynamic Segregation in profile view

2.11 This technique could be used in class A, B or C airspace. Specifically, in class C airspace, which is quite common in our country, the UA flight plan should be IFR. As defined in Doc 4444, in Class C airspace, ATC provides separation between IFR flights or between IFR and VFR, but no separation between VFR and VFR is provided. To ensure segregation, the ATC would use the ATS surveillance system to segregate the UA from other aircraft.

2.12 An equally important requirement is contingency planning for the ATS surveillance system. In principle, conventional double separation would apply and new flights with RPA would not be allowed in the airspace until service is restored.

2.13 Currently, the number of users interested in operating remotely piloted aircraft beyond the line of sight (BVLOS) is growing. Therefore, the main element in the operation of the aircraft is safety. For this reason, it was decided to carry out tests in the maritime regions to maintain the security of property and people.

2.14 Since 2009, Brazil has been practicing UA segregation in controlled airspace through the creation of segregated airspace. Recently, considering new user requests, we are improving techniques to better accommodate UA. The use of Dynamic Segregation can drastically reduce the portion of segregated airspace, maintain security and better satisfy users' wishes.

Planning of new operations in the coast and ocean region

2.15 In the light of new user requests, Brazil is making plans to run tests considering the use of Dynamic Segregation. As this is new content, we initially intend to apply this concept in airspace on the high seas where there is ATS surveillance is available.

2.16 Users intend to transport cargo between offshore platforms using UA. Only the base needs to be on the continent. For this, an airfield near the coast with low movement will be used.

2.17 Unlike other works, in this case, simple segregation through the creation of segregated airspace will not be enough to meet the proposed objectives. Therefore, the use of the concept of Dynamic Segregation could be better adapted to the UA. Test planning also includes the training of those involved. The purpose is to disseminate knowledge, thus providing the standardization of the security actions inherent in the operation.

2.18 In initial tests, flights will be provided only in segregated airspaces exclusively for use by unmanned aircraft. In addition, tests will be carried out to evaluate the behavior of the remote pilots and the ATC.

2.19 Additional security measures are being planned for future phases of testing: a) publication of AIC informing the aeronautical community about the operation of UA in the region; b) determination of geofences to establish a boundary area where UA operation is possible with special conditions. Therefore, ATC facilities and airspace users can learn about unmanned aerial activities and increase situational awareness during operations.

3. Conclusion

3.1 Collaboration between regulatory authorities, industry and other airspace users is essential to increase the level of flexibility and accommodating of UA's operations in Brazil. We are encouraged to improve regulations, general guidelines and train those involved. Because full UA integration into the current ATM context is a major challenge and requires further progress, it is possible to refine techniques and processes to make UA accommodate more flexible in controlled airspace.

4. Suggested actions

4.1 The Meeting is invited to:

a) Take note of the information in this Working Paper;

b) evaluate the criteria presented; and

c) make suggestions to improve the concept.

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