International Civil Aviation Organization
South American Regional Office
Twenty-Eighth Workshop/Meeting of the ICAO SAM Implementation Group (SAM/IG/28) – Regional Project RLA/06/901
(Lima, Peru, 3 to 7 October 2022)

SAM/IG/28-WP/5.3
09/27/2022

Agenda Item 5: **Other business**

TEST / DEMONSTRATION OF IN-FLIGHT INSPECTION WITH RPAS / UAS (DRONES) OF THE ILS AND VOR/DME RADIO ASSISTANCE SYSTEMS AT THE MATECAÑA DE PEREIRA INTERNATIONAL AIRPORT

(Presented by Colombia)

SUMMARY

This working paper presents for the consideration of the Meeting the experience of Colombia through the Results obtained in the first test/demonstration of Flight Inspection with RPAS/UAS (DRONES) of the ILS and VOR/DME radio aid systems of the International Airport. Matecaña de Pereira, held from April 25 to 29, 2022, through the Technical Cooperation Agency of the Inter-American Development Bank (IDB) and the Korea Airports Corporation (KAC) as beneficiary the Colombian Civil Aviation Administration.

References

- Manual on testing Radio Navigation Aids, Volume I (Doc 8071) ; and
- LAR 210 "Aeronautical Telecommunications". RAC 210 Aeronautical Telecommunications

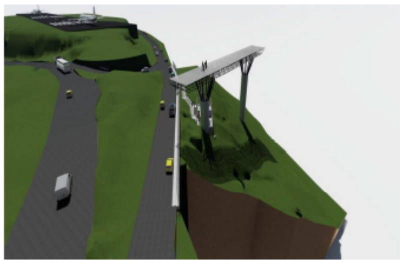
ICAO Strategic Objectives:	*A – Safety* *B – Air Navigation Capacity and Efficiency*

1. BACKGROUND

1.1 In accordance with the advances in RPAS remotely piloted aircraft systems and their use for the inspection of radio navigation aids in several States, ICAO document 8071 "Manual on the testing of radio navigation aids", in Volume I - *Testing of radio navigation aids Land-based radionavigation,* in its most recent edition 5 of 2018, already incorporates in item 1.18 the use of remotely piloted aircraft systems, for ground tests of radio aids. Likewise, it is important to evaluate the tests and demonstrations for the support of other aeronautical services within the CNS, such as radioelectric spectrum surveillance, airport systems and support for SAR (Search and Rescue).

1.2 Remotely Piloted Aircraft Systems RPAS or Unmanned Aircraft Systems (UAS) should be evaluated to determine if they have the necessary payload capacity, speed and range to cost-effectively perform flight inspection of aircraft. air navigation aids as recommended in document 8071. RPAS can be used, and have been used, in special and advanced measurement applications that are difficult to perform with traditional in-flight and ground measurement systems. Some States are studying how the use of RPAS can help to carry out more frequent measurements in order to reduce the frequency of complete flight inspections carried out with traditional flight inspection aircraft, reduce maintenance costs, flight hours, reduce the carbon footprint and have a cost/benefit in the process of fine-tuning the CNS systems.

1.3 The reasons for carrying out the tests at the Matecaña de Pereira International Airport are primarily due to the evolution in air development, a significant increase in the number of operations and the installation of aeronautical infrastructure for the provider of air navigation services that has had this Airport in the course of the last ten (10) years, as well as the complexity of conventional Visual Aids and Radio-Aids systems, such as the installation of the ILS/DME system.



RenderEstructuraAntenas ILS/LOC.

Antenas ILS/LOCALIZADOR (20).

Figure 1. ILS LOCATOR Antenna System

1.4 As can be seen in Figure 1, the complexity of the support structure of the ILS/LOC antenna system, wis located outside the airport perimeter.

Antenas Rear y Front

Antenas Clearance

Antenas Monitoras

Figure 2. ILS/GLIDE PATH Antenna System END FIRE Watts Antenna

1.5 The complexity of the ILS/Glide Path Antenna system has been a great challenge due to terrain conditions, plane of reflection and radio-propagation of the signal in space.

2. **ANALYSIS**

SUPPORT FOR THE REGISTRATION PROCESS AND FLIGHT AUTHORIZATION

2.1 These trials and calibration tests of radio aids were planned and developed in accordance with compliance with the RAC (Aeronautical Regulation of Colombia) appendix 13 of the Civil Aviation Administration of Colombia (Resolution No. 04201 of December 27, 2018): https: //www.aerocivil.gov.co/serviciosa-la-navegacion/sistema-%20de-aeronaves-pilotadas-a-distancia-rpas-drones/Paginas/default.aspx.

2.2 The documentation required by the Civil Aviation and presented by KAC, the Directorate of Air Operations, issued the UAS Exploiter, Operators and Equipment Registration Certificate to Korea Airports Corporation – KAC: http://www.aerocivil.gov.co/servicios- a-la-navigacion/system-%20of-aircraft-piloted-a-distance-rpas-drones/Paginas/Explotadores-Registered.aspx, RPAS equipment is subject to weather conditions, especially rains, electrical storms, moderate winds and line-of-sight (VLOS) visual range conditions.

MATRIX OF OPERATIONAL SAFETY RISKS BY THE OPERATOR

2.3 Possible dangers and risks to operational safety were referenced, as well as mitigation actions, for authorized flight inspection patterns, especially when flying over populated areas, guaranteeing a minimum horizontal and vertical separation of the DRONE of 100 m from any person for their protection. A site survey was carried out prior to the actual operation to clear natural and artificial obstacles and loss of communication cones. The RPAS equipment was equipped with Obstacle Proximity Sensors and ADS-B, which allows it to be identified by other aircraft. NOTAMs were published with the authorized dates and times for five (5) consecutive days for the Inspection of the ILS and VOR/DME radio aids systems, which were subject to weather conditions, especially rains, electrical storms, moderate winds and line-of-sight (VLOS) visual range conditions. Inspections of the ILS radio aids system were carried out at the closing of the airport, in the early morning hours with NOTAMs published and without affecting Air Operations. A workshop was held with the Stakeholders ANS, Authority, Airport Operator, Air Force where Colombian regulations related to RPAS/UAS (DRONE) technology were socialized.

FLIGHT PATTERNS AND INTERVAL EXTENSIONS BETWEEN INSPECTIONS

2.4 The flight patterns made with the DRONE were in the near field. It must be provided that there is correlation between the ILS measurements on the ground and in flight, on the same date or approximately on the same date. In this way, the responsibility lies with the ground personnel, with the flight personnel, and common measurement errors can be determined. Another requirement to extend the intervals between flight inspections is to consider the influence of the near-field and far-field environments on the signals. These effects can then be determined with a flight inspection aircraft. The performance "performance" of the laboratory aircraft and the DRONE vary with the weather conditions.

2.5 Far field measurements of the laboratory aircraft are in accordance with ICAO Doc 8071. The measurements in the near field with the KAC DRONE recorded values in tolerances close to those of the far field, which we consider to be valid as support for the flight inspection system of the Air Navigation Radio Aids systems. The Flight Inspection software of the DRONES of the ILS and VOR/DME radio aids systems, as well as the hardware, are subject to updates and improvements to the users by the manufacturer.

3. CONCLUSIONS

3.1 It is suggested that the Meeting form a Regional Working Group, which has the purpose of sharing its acquired knowledge and learning in these techniques, which has the purpose of developing a regional initiative that seeks to share information and data obtained from tests and inspections in flight with DRONES to the ILS, VOR/DME, Airport Systems, for the periodic surveillance of inspection and certification on the ground, preventive and corrective maintenance and pre-flight calibration of the operating parameters of the equipment.

3.2 Flight inspection with drones is very useful for prior calibration of the ILS and VOR/DME systems and prior preparation for flight certification, because it would allow a considerable reduction in the flight time of the laboratory aircraft and obviously a significant reduction of the costs for the commissioning of the facilities.

3.3 In accordance with the experience of the Colombian State in the tests carried out and the processes for approving the extension of flight test intervals for radio aids with RPAS, the States are invited to participate in a Regional initiative, to receive the cost/efficiency benefits in improvement of Operational Safety and Capacity and efficiency in the provision of services to air navigation, which is expected with the implementation of RPAS.

4. SUGGESTED ACTIONS

4.1 The Meeting is invited to:

a) Take note of the information presented;

b) promote the tests and demonstrations of Flight Inspections with RPAS/UAS (Drones) as an integrated regional initiative of the CNS;

c) develop the update of the Aeronautical standards in the States of the SAM Region regarding the use of RPAS/UAS;

d) Analyze other considerations that the Meeting deems pertinent.

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