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WORKING PAPER

ASSEMBLY — 40TH SESSION

TECHNICAL COMMISSION

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

THE USE OF UNMANNED AIRCRAFT SYSTEMS (UAS), INCLUDING REMOTELY PILOTED AIRCRAFT SYSTEMS (RPAS), FOR CONDUCTING FLIGHT TESTS AND CHECKS OF GROUND-BASED RADIO NAVIGATION FLIGHT SUPPORT SYSTEMS AND AIRPORT LIGHTING SYSTEMS

(Presented by the Russian Federation)

EXECUTIVE SUMMARY

This Working Paper takes into account the recommendations of the 13th ICAO Air Navigation Conference (AN-Conf/13) and presents a justification of the need to develop internationally agreed-upon guidance material regarding the use of unmanned aircraft systems (UAS), including remotely piloted aircraft systems (RPAS), to conduct flight tests and checks of ground-based radio navigation flight support systems and airport lighting systems. To reach this goal, ICAO and States are invited to devote attention to the development of said guidance material in coordination with existing Standards and Recommended Practices (SARPs) and Procedures for Air Navigation Services (PANS), by bringing together existing ICAO technical expert teams.

Action: The Assembly is invited to request that the Council of ICAO include in the work programme the question of developing guidance material for using UAS, including RPAS, to conduct flight tests and checks of ground-based radio navigation support systems and airport lighting systems.

Strategic Objectives:	This working paper relates to Strategic Objectives: 1) *Safety* by setting up real-time monitoring of operating specifications and parameters of ground-based radio and airport lighting systems; 2) *Air Navigation Capacity and Efficiency* by reducing time spent on flight tests and checks; 3) *Economic Development* by increasing flight test and check intervals, significantly decreasing the cost of an aircraft-laboratory used for tests; reducing the cost of its rental and associated operational expenses; 4) *Environmental Protection* by increasing testing intervals and using small UAS and RPAS, including with electric motors.
Financial implications:	No financial implications

[1] Russian version provided by the Russian Federation.

References:	Doc 8071, Manual on testing of Radio Navigation Aids, Volume I — *Testing of Ground-Based Radio Navigation Systems* www.icasc.co/sites/faa/uploads/documents/19thIFIS/IFIS2016_Proceedings.pdf (pp. 12–17; 278–288) www.icasc.co/ifis/20th-ifis-2018-monterey/20th-ifis-papers (pp. 227–295)

1. INTRODUCTION

1.1 Doing flight tests and checks of ground-based radio navigation systems, including radio navigation flight support systems and airport lighting systems, is one of the necessary conditions for ensuring flight safety in international civil aviation.

1.2 The industry of unmanned aircraft systems (UAS), including remotely piloted aircraft systems (RPAS) is advancing rapidly, but the development of applicable international Standards, rules, norms and requirements that take into account the diversity of UAS and RPAS, as well as the particulars of how they fly, has fallen far behind. Because technical progress is the driving force behind aviation, UAS and RPAS operations should be regulated in a timely and appropriate way.

1.3 Digital electronic technology has yielded technology for testing ground-based radio navigation systems and lighting systems using UAS and RPAS: measurement equipment is compact, high-functioning, and reliable because highly integrated components are used. This makes it possible to place equipment aboard UAS or RPAS to do a wide range of measurements.

1.4 Using UAS and RPAS for flight tests and checks of ground-based radio navigation support systems and airport lighting systems has many benefits for civil aviation:

a) it will save time spent on initial, periodic, and special testing by the manned aircraft lab because the parameters of ground radio navigation systems and lighting systems will be determined in advance, they will be configured properly, and that will facilitate efficiency in civil aviation;

b) it will make it possible to do real-time monitoring of operational specifications and parameters of ground-based radio navigation assets and lighting systems using trained personnel from radio navigation equipment departments and communications, limiting the use of a manned aircraft laboratory or without it, which facilitates safety;

c) it will make it possible to extend intervals of flight tests and checks and use small UAS and RPAS, including those with electrical motors, which reduces the financial costs for flight tests and checks and will markedly decrease civil aviation's unfavourable impact on the environment;

d) it will facilitate the creation of healthy competitive conditions on the market of aviation services for flight tests and checks, which makes them more accessible for customers by dramatically lowering operating expenses related to the cost of the aircraft laboratory and its rental, which boosts the efficiency of flight tests and checks and expands the geography of places where they are conducted;

e) it augments and significantly expands the functional capacity of manned aircraft laboratories while not ruling out the possibility of using them in the near- and mid-term and making it possible to stop using them in the long-term technology development horizon.

1.5 Right now there is no globally accepted practice for using UAS and RPAS for doing flight tests and checks of ground-based radio navigation assets and lighting systems. Nonetheless, the world has more and more organizations offering services in this arena, for example: SkyGuide (The Swiss Confederation), Aerodata (The Federal Republic of Germany), CANRAD (The Kingdom of Spain), SISCEAB (The Federal Republic of Brazil), National Key CNS/ATM Lab (The People's Republic of China), and Cursir (The Russian Federation). Mindful of the global, growing interest on the part of the international aviation community in services for flight testing and checks of ground-based radio navigation aids and lighting systems using UAS and RPAS, and considering the emergence in this area of aviation services at new organizations with varying levels of training, competence, and material/technical resources, we need a coordinated creation of single internationally-approved approaches, methods, criteria, and requirements at a high level that would make it possible to effect harmonious regulation of air transport so that it will develop in an orderly, safe and reliable way.

2. DISCUSSION

2.1 ICAO's existing guidance material (Doc 8071, *Manual on testing of Radio Navigation Aids*, Volume I — *Testing of Ground-Based Radio Navigation Systems*), while declaratively allowing the use of UAS and RPAS for flight tests and checks of ground-based radio navigation aids and lighting systems, does not contain clear approaches, requirements, and indicators that would reflect the particulars of operating UAS and RPAS.

2.2 The modern practice of doing flight tests and checks of ground-based radio navigation flight support and lighting systems (which involve temporarily closing (segregating) some of the airspace needed to do the tests) doesn't address matters related to the limitations that flow from the task of safely integrating RPAS into the non-segregated airspace and at airports. In connection with this, the development of appropriate guidance material for the use of UAS, including RPAS, to conduct the tests of ground-based radio support systems and lighting systems does not today require consideration within the framework of existing SARPs and PANS concerning RPAS integration into the non-segregated airspace and at airports, but it must be done in coordination with them.

2.3 Pursuant to Recommendation 5.3/1 of the report of Committee A to the 13th Air Navigation Conference on Agenda Item 5 (AN-Conf/13-WP/311), States and ICAO are invited to "support the development at an interdisciplinary level of SARPs and guidance material relating to RPAS, by bringing together different ICAO expert teams" and "to continue to develop guidance material to support the safe operation of RPAS", respectively.

2.4 The world has approximately 10 000 airports with ICAO or International Air Transport Association (IATA) codes. If we accept that to conduct flight tests and checks of ground-based radio navigation flight support systems and lighting systems for one airport, one needs, on average, about 10 hours (including the flight of the manned aircraft-laboratory to the destination), then about 100 000 hours total is spent on flight testing radio navigation systems throughout the world. Using UAS and RPAS with an electric motor to do flight tests and checks, taking into account that the average-world level of aviation fuel consumption equals 270 kg/h, it is possible to reduce the environmental impact of civil aviation by saving, on average, 27 000 000 kg of aviation fuel annually.

2.5 To ensure the necessary accuracy when measuring characteristics and parameters of ground-based radio navigation flight support systems and lighting systems using UAS and RPAS, we use certified onboard radiometric and navigation equipment, observing the terms of regular servicing and testing it. Measurements obtained during flight tests and checks using UAS and RPAS must not conflict with and must, to a sufficient degree, correlate with data obtained during manned aircraft-laboratory flight tests and checks.

2.6 Much work has been done in the Russian Federation to create and implement the capability to use UAS and RPAS for flight tests and checks of ground-based radio navigation flight support systems and airport lighting systems. The mobile radiomeasuring complex (MRC) was created by the company Cursir and is being successfully used at several civil aviation airports in the Russian Federation. It was first used to test the accuracy of the landing system at the Chelyabinsk city airport, where it fully confirmed its ability to preliminarily test parameters to detect any irregularities in the radio beacon landing system. The MRC also makes it possible to diagnose ground-based radio navigation flight support systems when they are being brought online, to detect flight obstacles, sources of radio interference, monitor the radio ether, take diagrams of antenna directivity, and examine the status of antenna masts and hardware.

3. CONCLUSION

3.1 UAS and RPAS can be used and are being used right now in the world to do flight tests and checks of ground-based radio navigation flight support systems and airport lighting systems to make technically modern measurements that are difficult to obtain using traditional ground-based and onboard equipment and typical carrier aircraft, and it would increase the level of flight safety, effectiveness, the economic development of civil aviation, and environmental protection.

3.2 It’s worth acknowledging that the question of using UAS and RPAS to conduct flight tests and checks of ground-based radio navigation flight support systems and airport lighting systems is currently in the discussion stage, which is insufficient to ensure the safe, effective, and internationally harmonious implementation of this practice using existing ICAO guidance material.

3.3 Right now, it is possible to make efforts to develop within the framework of existing ICAO technical expert teams guidance material on how to use UAS, including RPAS, to perform flight tests and checks of ground-based radio navigation flight support systems and airport lighting systems, which will make it possible to create single methodological approaches and develop internationally agreed-upon requirements for these checks, in coordination with existing SARPs and PANS.

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