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WORKING PAPER

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TECHNICAL COMMISSION

Agenda Item 31: Aviation Safety and Air Navigation Standardization

A ROADMAP FOR INTEGRATED CNS AND SPECTRUM (ICNSS)

(Presented by the International Coordinating Council of Aerospace Industries Associations (ICCAIA), Airports Council International (ACI), International Air Transport Association (IATA), International Federation of Air Line Pilots Associations (IFALPA), International Federation of Air Traffic Controllers Associations (IFATCA), Civil Air Navigation Services Organization (CANSO))

EXECUTIVE SUMMARY

Aviation Communication, Navigation and Surveillance systems need to embrace emerging technologies for the purpose of safe, efficient, and sustainable aviation. Aviation will embrace new entrants, each placing a demand on CNS resources including radio frequency spectrum. Due to the high demand for radio spectrum from non-aviation users, aviation faces ever-increasing competition for this limited resource. Facing such competition and observing the rapid technology advancements of other sectors of industry, the aviation community has started to rethink the original CNS concept, resulting in a paradigm shift for CNSS, from "segregation" to "integration" while at least maintaining the same level of safety.

Further to the AN-Conf/13 Recommendation 2.2/1 c), endorsed by the 40th Assembly, an Integrated CNS and Spectrum Task Force (ICNSS-TF) was established in 2020 and led by subject matter experts from a broad cross-section of the aviation industry to develop roadmaps for CNS in the near, medium, and long terms. The proposed roadmaps prepared by the ICNSS Task Force, will leverage recent advances in CNS technologies, to ensure that the aviation sector remains a responsible user of the spectrum resource while also focusing on safety, security, efficiency, and sustainability of global aviation.

Action: The Assembly is invited to direct ICAO to:

a) define an implementation roadmap to support the concepts defined by the ICNSS Task Force;
b) identify a mechanism to ensure the roadmap and concept are considered across all ICAO activities in reviewing existing panels activities (e.g., CP, NSP, SP,FSMP, RPASP, etc.) to ensure objectives, CONOPS and work plans are aligned with the new harmonized vision for CNS; and
c) engage industry to access expertise, share and leverage ongoing research and development activities, and lessons learnt from demonstrations to help accelerate roadmaps and implementation.

[1] English, Arabic, Chinese, French, Russian and Spanish versions provided by ICCAIA.

Strategic Objectives:	This working paper relates to Strategic Objectives safety, air navigation capacity and efficiency, Environmental Protection and Economic Development of Air transport.
Financial implications:	The activities referred to in this paper will be undertaken subject to the resources available in the Regular Budget, Voluntary funds and/or from extra-budgetary contributions.
References:	Doc 10115, *Report of the Thirteenth Air Navigation Conference* (AN-Conf/13), Corrigenda Nos. 1 and 2, and Supplement No. 1. Doc 9718, *Handbook on Radio Frequency Spectrum Requirements for Civil Aviation* Annex 10 — *Aeronautical Telecommunications*

1. INTRODUCTION

1.1 Civil aviation has witnessed significant growth in recent decades and this trend, is expected to resume in the years following the COVID-19 pandemic. The communication, navigation and surveillance (CNS) systems used in aviation support safety critical functions and are therefore required to meet stringent operational requirements. Over the years these systems have evolved to meet industry needs and remains sufficient for most of aviation's current needs.

1.2 The current CNS systems, however, will not be able to support the projected growth in aviation, including the introduction of new airspace users (e.g., urban air mobility). The demand for radio spectrum from both aviation and non-aviation users continues to grow, and aviation is facing an ever-increasing competition for the limited spectrum available, particularly from the mobile and broadband wireless services.

1.3 This requires the aeronautical industry to embrace new technologies that offer increasing CNS system performance, capacity and efficiency.

1.4 To achieve this, ICAO, along with the aviation industry, need to develop an action plan to address these needs. The plan needs to identify methods to develop new systems, using new technologies, in a shorter timeframe than is typical, while maintaining global harmonization.

1.5 Noting Assembly Resolution A40-27: Innovation in aviation, the Council has requested the Secretariat to assess the need and the resources required to evolve the processes of the Organization, including its methods of working with the aviation and aerospace industries in order to keep pace with innovations that may affect the sustainable development of civil aviation.

1.6 The frequency spectrum allocation and needs of civil aviation must be protected internationally within ICAO. The Frequency Spectrum Management Panel (FSMP) is directed to ensure sufficient access to the resource for the provision of aeronautical CNS. If not properly mitigated, harmful interference from deployments like 5G telecommunication or new Long Term Evolution systems, will potentially pose a serious safety risk to passengers, crew, and people on the ground. This is highlighted by the recent example of impact of 5G on radio altimeters in some countries. As a reminder, in ICAO State Letter dated March 25th, 2021, ICAO Secretary General notes that "harmful interference to the function of the radio altimeter during any phase of flight may pose a serious safety risk to passengers, crew and people on the ground" and encourages "Administration[s] to consider as a priority, public and aviation safety when deciding how to enable *cellular broadband/5G services in radio frequency bands near the bands used by radio altimeters*"

2. DISCUSSION

2.1 Facing the problem statements highlighted above, the CNS community is confronted for the first time in the modern era by long-term challenges requiring a paradigm shift, from "segregation" to "integration while maintaining safety". This requires rethinking the CNS concept. For example, the introduction of state-of-the-art technology could allow for the efficient and flexible use of the spectrum resource by eliminating boundaries between the traditionally separate communication (C), navigation (N) and surveillance (S) functions. Such an approach could, for example, enable innovative use of precise timing.

2.2 The avionics industry is already looking into the development of distributed radio architectures on-board aircraft. The challenges the aviation community faces has resulted in the development of a concept for the use of integrated CNS and spectrum where appropriate, to deliver multiple services, making use of common hardware platforms which function is software defined, enabling flexible use of spectrum.

2.3 As aviation CNS systems evolve, the applicable industry standards necessary to ensure the interoperability of those systems have become increasingly complex. As a result, the development of ICAO Standards and Recommended Practices (SARPs) has similarly become increasingly complicated.

2.4 In accordance with Assembly Resolution A39-22: Formulation and implementation of Standards and Recommended Practices (SARPs) and Procedures for Air Navigation Services (PANS) and notification of Differences, SARPs are often accompanied by notes which reference industry standards for more detailed information. Referencing applicable industry standards or detailed technical specifications prepared by other Standard Making Organisations with the industry and other stakeholders, while useful, does not ensure sufficient performance and global interoperability, as the notes do not have the authority of SARPs.

2.5 Technology is advancing at a pace that exceeds the resources to develop applicable aviation CNS standards within appropriate timeframe. Therefore, there is a need to streamline the standardization process within ICAO and industry, it is important that ICAO and its Member States take measures to foster CNS technology advancement such that aviation remains a responsible and sustainable user of the frequency spectrum and by doing so supports aviation's case for access to sufficient, and suitably protected spectrum needed to meet future demand.

2.6 The Thirteenth Air Navigation Conference (AN-Conf/13, 2018) recommended that ICAO:

- *launch a multidisciplinary study to "evolve the required CNS and frequency spectrum access strategy and systems roadmap in the short, medium and long term, in a performance based and service-oriented manner, to ensure that CNS systems remain efficient users of the spectrum resource (Recommendation 2.2/1)*;

- *review and enhance its standards-making processes in order to meet the requirements of the rapid pace of technological developments (Recommendation 5.5/3).*

2.7 The ICAO Assembly, during its 40th Session held in 2019, reaffirmed Recommendation 2.2/1, thus leading to the establishment of the Integrated CNS and Spectrum Task Force (ICNSS-TF) to address those difficult challenges in a proactive manner.

2.8 The ICNS and Spectrum Task Force was established in 2020 and led by subject matter experts from a broad cross-section of the aviation industry. The two main tasks are as follows:

1) Prepare CNS and Spectrum Roadmaps. The Roadmap Task will focus on drafting an initial CNS and spectrum roadmaps for the medium and longer term, leveraging recent advances in the state-of-the art of CNS technologies, to ensure that the aviation sector remains a responsible user of the spectrum resource while also focusing on safety, security, efficiency, and sustainability of global aviation.

2) Propose a Standardization Framework for CNS Systems and Spectrum. This framework includes the definition of a new approach for the development of Standards and Recommended Practices (SARPs) and Detailed Technical Standards, by leveraging a more performance-based approach.

2.9 The intermediate draft Integrated CNS and Spectrum Global Concept describes the progress of the work conducted by the task force thus far and includes two main conceptual deliverables:

a) a roadmap of CNS and Spectrum evolution;

b) a new, streamlined framework for CNS standardization.

3. CONCLUSION

3.1 The proposed roadmaps prepared by the ICNSS Task Force, will leverage recent advances in the state-of-the art of CNS technologies, to ensure that the aviation sector remains a responsible user of the spectrum resource while also focusing on safety, security, efficiency, and sustainability of global aviation.

3.2 A mechanism needs to be identified that will ensure that the foreseen ICNSS roadmap and concepts are considered across all ICAO activities.

3.3 Mechanisms should be utilized to enable ICAO to engage industry to access expertise, share and leverage ongoing R&D and lessons learnt from demonstrations to help accelerate roadmap development and implementation.

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