International Civil Aviation Organization

A41-WP/58
TE/5
20/7/22

WORKING PAPER

ASSEMBLY — 41ST SESSION

TECHNICAL COMMISSION

Agenda Item 31: Aviation Safety and Air Navigation Standardization

NEW ICAO STANDARDIZATION INITIATIVES TO IMPROVE THE EFFECTIVENESS OF THE STANDARDS DEVELOPMENT PROCESS – THE INTEGRATED COMMUNICATIONS, NAVIGATION, SURVEILLANCE AND SPECTRUM (ICNSS) PROJECT

(Presented by the Council of ICAO

EXECUTIVE SUMMARY

Today, ICAO manages over 12 000 provisions across the 19 Annexes to the Convention and six PANS. As technology advances at an accelerated rate, the timely development of international standards becomes ever more challenging. To react to this challenge ICAO must explore ways and means to actively improve the ICAO standards development and adoption process. This report presents the experience gained with the existing measures and recent standardization initiatives being implemented or under consideration; and introduces a new initiative, the integrated communications, navigation and surveillance (CNS) and Spectrum (ICNSS) project.

The ICNSS project discussed in this paper focusses on identifying a new and streamlined framework for CNSS standardization and better decision-making processes to achieve consensus and accelerate the development and rollout of state-of-the-art aeronautical CNS services. The goal is to support the medium and long-term evolution of CNS systems by providing an overall systems improvement thus continuing to serve aviation with the high uptime and resilience necessary to maintain aviation's stringent safety record while remaining a responsible user of the spectrum resource. The ultimate objective of this effort is to propose a set of recommendations for endorsement by the next Assembly.

Action: The Assembly is invited to:

a) note the progress made by ICAO to date, related to the ICNSS project;
b) encourage States, international organizations and industry stakeholders to support the continued development and implementation of a medium to long-term roadmap for the evolution of ICNSS and a new streamlined framework for CNS and frequency spectrum standardization; and
c) task ICAO to continue to develop and finalize a new streamlined framework for CNS and frequency spectrum standardization.

Strategic Objectives:	This report relates to the Safety and Air Navigation Capacity and Efficiency Strategic Objectives.	
Financial implications:	The ICAO activities referred to in this paper are expected to be undertaken within the resources available in the 2023-2025 Regular Budget and/or from extra budgetary contributions, as guided by the ICAO Business Plan 2023-2025.	
References:	Annex 10 Annex 18 Annex 19	Doc 10140, *Assembly Resolutions in Force* (as of 4 October 2019) Doc 10115, *Report of the Thirteenth Air Navigation Conference, Corrigenda Nos. 1 and 2, and Supplement No. 1*

1. INTRODUCTION

1.1 The establishment and maintenance of international Standards and Recommended Practices (SARPs), as well as Procedures for Air Navigation Services (PANS), are fundamental tenets of the Convention on International Civil Aviation (Doc 7300) and a core aspect of ICAO's mission. SARPs and PANS are critical to States and other stakeholders, given that they provide the basis for:

- a harmonized approach towards global aviation safety and efficiency;
- the worldwide standardization of functional and performance requirements of air navigation facilities and services; and
- the orderly development of airspace usage and air transport.

1.2 Today, ICAO manages over 12 000 provisions across 19 Annexes to the Convention and six PANS, many of which are constantly evolving in concert with the latest developments and innovations.

1.3 As a result of the increasing pace of technological advancement, the timely development of SARPs and other materials has become ever more challenging. Due to limited resources, States often face difficulties implementing complex SARPs and PANS into their national regulations. Taking into account the concerns raised by States and the aviation industry, ICAO has actively engaged with all stakeholders to improve the effectiveness in the delivery of ICAO's mission. This report briefly provides an insight to the experience gained with implementing existing standardization measures and presents an additional measure that ICAO is currently contemplating, not only to shorten the process for the development and adoption of CNS and spectrum related SARPs but also to further improve its content.

2. INITIATIVES TO IMPROVE THE SARPS DEVELOPMENT PROCESS

2.1 Improvement of the SARPs development process has been considered on several occasions by the executive bodies of ICAO. As a result, some significant changes have been introduced. The most salient points, as reflected in Resolution A39-22: *Formulation and implementation of Standards and Recommended Practices (SARPs) and Procedures for Air Navigation Services (PANS) and notification of differences* are:

a) SARPs and PANS shall be drafted in clear, simple and concise language. SARPs shall consist of broad, mature and stable provisions specifying functional and performance requirements that provide for the requisite levels of safety, regularity and efficiency. Supporting technical specifications, when developed by ICAO, should be translated in all working languages of ICAO in a timely manner and shall be placed in separate documents to the extent possible; and

b) The utilization of, to the maximum extent appropriate and subject to the adequacy of a verification and validation process, the work of other recognized standards-making organizations in the development of SARPs, PANS and ICAO technical guidance material.

2.2 In the field of aviation safety and air navigation, an increasing emphasis is being placed on achieving an effective implementation that supports improved performance. This has been debated intensely within ICAO, the outcome being a shift in the focus of its resources to prioritize assistance in the implementation of existing Standards, rather than the development of new Standards, and to develop performance-based Standards, where appropriate, rather than detailed technical specifications. Such measures have been implemented in updates to several Annexes and PANS. One example is Annex 19 — *Safety Management*, where a large portion of the provisions are written using a performance-based approach. Similarly, when Annex 18 — *The Safe Transport of Dangerous Goods by Air*, was established, it was agreed that only high-level and stable requirements would be contained in the Annex, complemented by a separate publication of a detailed and prescriptive Technical Instructions.

2.3 Co-operation with standards-making organizations and other external entities has also been considered with the goal of utilizing their work in the ICAO -Standards-making process. Significant achievements include the establishment of the Standards round table (SRT) as a coordination platform between ICAO and the Standard-making organizations (SMOs) and other stakeholders. The SRT has shown some promise in aiming at the best use of available resources and expertise and at intensifying the technical coordination efforts to promote more balanced implementation of the advanced technologies on a global basis. This effort has been further complemented by the document exchange platform established in March 2021, to facilitate access to material developed by SMOs, thereby improving the overall quality and efficiency of the process and supporting the development and implementation of ICAO provisions.

2.4 Another new initiative under consideration is termed “direct submission.” This initiative will allow duly accredited external entities to propose SARPs and PANS amendments directly to ICAO based on detailed evidence of successful implementation, including a documented safety risk assessment and the outcome of research.

2.5 It is expected that these new measures will provide benefits for the aviation community. However, at the same time, the utilization of the work of other organizations has proven to be more complex for several reasons, such as the potentially ambiguous legal status of the material, the frequency of updates, the scope, the intended target audience, and the level of involvement of ICAO in their deliberations.

2.6 In addition to the above and in line with AN-Conf/13, Recommendation 2.2/1 — *Long-term evolution of communication, navigation and surveillance systems and frequency spectrum access*, ICAO has now undertaken a new initiative, the integrated CNS and spectrum project, with the goal being to ensure that aviation can best use the advantages that the rapid pace of technology provides, while continuing to secure access to the frequency spectrum resource it needs. Also, to attain this goal, there is a need to improve the processes for achieving global consensus for future CNS infrastructure requirements, and importantly, for streamlining of the Standards-making framework in order to fulfill these requirements in a timely and efficient manner. This is further discussed in the following paragraphs.

3. INTEGRATED CNS AND SPECTRUM PROJECT

3.1 Innovation in telecommunications and aviation

3.1.1 CNS systems and the services they provide are core enablers for the high level of safety required by aviation. Compared to their equivalents in other industries, existing aeronautical CNS systems are robust with overall uptime and reliability, which are generally orders of magnitude better than those experienced by other users of the frequency spectrum. However, most current CNS system designs are quite old, many of them having been introduced over fifty years ago. Incremental updates to these systems over the years have efficiently accommodated the increasingly complex and busy use of airspace. These systems remain sufficient for most of aviation’s current needs. However, technological innovation within the telecommunications industry is very rapid and is driven by the ever-increasing requirements of a user base consisting of billions of people. Capitalizing on current state-of-the-art radiocommunications technology could result in some remarkable gains in aviation efficiency and sustainability by reducing the size, weight and power required, while increasing the capability and overall performance of the CNS systems and spectral efficiency. This opportunity led to the AN-Conf/13, Recommendation 2.2/1 which challenged ICAO and the whole aviation industry to develop an action plan to evolve with the advancement of technology, while increasing overall performance of CNS systems and spectral efficiency.

3.2 Long-term evolution of CNS systems and frequency spectrum access

3.2.1 Aeronautical CNS has traditionally been seen as three distinct and separate functions but these three functions all rely on the same scarce natural resource – continued and interference-free access to the frequency spectrum. Access to spectrum is managed by the International Telecommunication Union (ITU) through a four-year process of World Radiocommunication Conferences that are the only mechanism

by which the Radio Regulations, that govern international spectrum usage, can be changed. Availability of the necessary protected radio frequency spectrum is a critical prerequisite for the safe and efficient implementation of CNS systems. As demand for radio spectrum from non-aviation users continues to grow, aviation faces an ever-increasing competition for this finite resource, particularly from the mobile and broadband wireless services. A better way forward is to demonstrate excellence in the planning and efficient use of aeronautical spectrum, while ensuring robustness of CNS systems.

3.2.2 Unless aviation can continue to prove that the aeronautical CNS systems are spectrum-efficient, aviation will increasingly be forced to share protected aeronautical frequency allocations with non-aeronautical users, resulting in a reduction in the quality and availability of service of those systems due to potential interference, potentially degrading the safety, regularity and/or efficiency of flight. Due to ever increasing pressures on the precious and finite spectrum resource, aviation could lose access altogether to certain frequency bands critical for the current provision of CNS, ultimately resulting in an overall reduction in the safety and efficiency of airspace operations as a whole. It is therefore critical to facilitate a continuing and timely evolution of the aeronautical CNS systems.

3.3 Need for streamlining of the CNS standards-making framework

3.3.1 The lack of resources and well experienced experts to support the Standards-making process experienced by ICAO and State regulators when attempting to address new requirements such as those necessary to accommodate new entrants using innovative technologies (e.g. advanced or urban air mobility), has already indicated that improvements to the standards-making framework are necessary. Therefore, in order to better align aviation with the high-paced evolution of technologies in other industry sectors and considering 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. This is also highly relevant to the ICNSS project. To address the increasing pressure on the spectrum resource and the rapid rate of innovation in telecommunications, the related ICAO CNSS standards framework needs to be streamlined to facilitate the evolution of CNS systems at a faster rate. This includes ICAO's methods of working with aviation and aerospace industries and other standards-making organizations.

3.4 The integrated CNS and spectrum project

3.4.1 To address the challenges described above, the Integrated CNS and Spectrum Task Force (ICNSS-TF) was established in May 2020. Recognizing the need for an overall action plan for technological development (in the form of roadmaps), as well as the streamlining of the CNS standards-making framework itself, including SARPs and detailed specifications, the ICNSS-TF has undertaken the task to produce a report which would include the following deliverables:

a) a roadmap of CNSS evolution including a blueprint for CNS systems evolution; and

b) a new and streamlined framework for CNSS standardization which delivers:

   1) a clear proposal for a minimal, performance-based approach to the SARPs in Annex 10 — *Aeronautical Telecommunications*; and

   2) a clear proposal on how to develop and validate the technical specifications based on industry inputs for global interoperability.

4. PROGRESS OF THE ICNSS-TF

4.1 The ICNSS-TF is currently working on the development of a high-level roadmap of CNSS evolution (which builds on several specialized roadmaps) and a new, streamlined framework for CNSS standardization. Collectively, these outline the necessary strategic milestones and end goals in the medium (2040+) and long term (2050+). The CNS and avionics technology evolutional roadmaps include new

concepts, such as flexible system design, that offer the opportunity to maximize the effectiveness with which aviation uses its allocated frequency spectrum. The result will assist: (a) early identification of spectrum-related issues and technology gaps between aviation and other spectrum related industry; and (b) development of specific technical and performance specifications to support the implementation of future systems in a globally harmonized manner.

4.2 ICAO has prioritized the implementation of existing Standards over the development of new Standards. Performance-based Standards have been favoured over prescriptive Standards and detailed technical specifications, where appropriate. Faced with the rapid advancement of CNSS technology, the related ICAO CNSS standards framework needs to evolve. Otherwise, one cannot ensure that SARPs, industry standards and detailed technical specifications will be developed in a harmonized manner and at the pace necessary to secure global interoperability and continued high safety levels. Achieving this will be a considerable challenge. However, the best approach needs to be defined in a timely manner, by ICAO, States, and the aviation community as a whole, including new entrants.

4.3 With the goal to have a draft Assembly Resolution available for scrutiny by the 42nd Assembly and in order to identify the best methodology to balance “minimal essential CNS SARPs” and “detailed technical specifications”, the ICNSS-TF has undertaken to a) scrutinize and develop potential new standardization frameworks to better support system development by industry and b) to categorize required CNSS standards frameworks for new systems as well as any required validation activity of the resulting industry inputs within ICAO. For further information, an initial draft report of the integrated CNS and spectrum global concept can be found at the ICNSS project website.

5. CONCLUSION

5.1 Modern-day aviation is not the same as a few years ago. Technological innovation and modernization are advancing at an ever-increasing pace. However global consensus as well as timely and harmonized deployment of those new technologies is becoming increasingly difficult to achieve. To avoid unequal and incompatible implementation of new CNS/ATM technologies, ICAO needs to continue improving the process of development/adoption of ICAO regulatory provisions and achieving consensus for timely and effective rollout.

5.2 In line with recent Assembly Resolutions and AN-Conf/13 recommendations, ICAO has undertaken the integrated CNS and spectrum project, focussing on a medium and long-term evolution of CNS systems and spectrum efficiency while improving global harmonization of the CNS infrastructure and identifying a new and streamlined framework for CNSS standardization. While remaining firmly focussed on aviation safety and efficiency, this new framework would utilize input from industry in an effective and fully validated manner, thus ensuring that the aviation sector remains a responsible user of the spectrum resource, while also delivering overall systems improvement.

5.3 Noting the considerable progress already made by the ICNSS project (see ICNSS project website), States, international organizations and industry stakeholders are encouraged to support the continued development and implementation of a medium to long term roadmap for the evolution of ICNSS and a new streamlined framework for CNS and frequency spectrum standardization, with the ultimate objective of this effort being to propose a set of recommendations for endorsement by the next Assembly.

— END —