International Civil Aviation Organization

AN-Conf/13-WP/37
20/8/18

WORKING PAPER

THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 2: Enabling the global air navigation system
2.2: Integrated CNS and spectrum strategy

INTEGRATED CNS AND SPECTRUM STRATEGY

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper advocates a shift from the traditional technology-based segregated communication, navigation and surveillance (CNS) infrastructure to a cross-domain integrated CNS architecture and performance-based framework which combines physical infrastructure and the delivery of CNS through services to enable key operational concepts such as trajectory-based operations (TBO), whilst maintaining and enhancing safety and security.

The CNS enabling services and infrastructure evolution need to strengthen the development of civil-military cooperation and interoperability, the integration of new entrants such as unmanned aircraft systems (UAS) and sub-orbital operations and to enable full cross-fertilisation and synergies. This should be ensured through an efficient and effective ICAO-facilitated global collaboration with States and regional modernisation programmes from research and development to deployment of interoperable systems.

The realisation of this change of path benefits all aviation stakeholders, whilst delivering performance-based and cost-efficient infrastructure services that can support the expected traffic growth. Furthermore, it allows for the development of a pro-active global aviation radio spectrum strategy with the aim of ensuring a safe and efficient use and long-term availability of adequate radio spectrum embracing new opportunities in line with the needs of the global air navigation plan (GANP)/aviation system block upgrade (ASBU) evolution.

The Conference is invited to agree to the recommendations in paragraph 5.

1. INTRODUCTION

1.1. The current communication, navigation and surveillance (CNS) infrastructure has evolved in silos on the traditional principle that the CNS constituents should only meet at the controller

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

and pilot level to avoid single points of failure. The introduction of global navigation satellite system (GNSS) and its use in all three domains has challenged this principle in the sense that integrated CNS systems, where one system supports functions from more than one domain, can be considered allowing synergies between the various domains to be leveraged.

1.2. At the Twelfth Air Navigation Conference (AN-Conf/12), several recommendations laid the foundation for the development of a new globally harmonised air traffic management system upon which this Conference can further build.

1.3. The benefits in terms of tangible operational improvements are expected to include increased safety, airspace capacity, improved flight profiles, cost savings for aircraft operators and service providers, equitable access to airspace for all users, sustainability (e.g. cybersecurity, service resilience and reducing environmental impact), clearly defined and integrated roadmaps for communication/navigation/ surveillance/spectrum (CNSS), and a flexible migratory path that addresses regional needs and that ensures no country is left behind.

2. A GLOBAL VISION FOR INTEGRATED CNS

2.1. As part of the evolution of the global air navigation plan (GANP), an integrated and consolidated vision spanning across CNS domains that looks beyond current state and regional modernisation programs is now needed. This would require the development of a comprehensive CNSS strategy with a roadmap showing a stepped evolution of airborne, space- and ground-based C, N, S capabilities and associated radio spectrum requirements. Such a vision needs to accommodate the seamless integration of new entrants, such as unmanned aircraft and suborbital flights, whilst delivering a performance-based and cost-efficient infrastructure that can support the expected growth in traffic, whilst reducing the overall environmental impact.

2.2. Access to radio spectrum is a vital underlying enabler for all CNS capabilities and it is widely acknowledged that spectrum is a scarce resource. In order to retain or gain further access to new allocations, aviation must compete with other spectrum users that equally provide visible societal benefits. For aviation to ensure access to suitable spectrum allocations it needs to ensure its systems are spectrally efficient, avoid unnecessary duplications supported by robust and evidence-based arguments. It is therefore a necessity that ICAO together with States, regions and aviation stakeholders develop and maintain a pro-active global aviation radio spectrum strategy which supports the safe and efficient use and long-term availability of adequate radio spectrum as well as embracing new opportunities in line with the needs of the GANP/ASBU evolution.

2.3. Aviation’s demand for existing radio spectrum access continues to outpace frequency availability in busy regions. Civil aviation operates with old and sometimes inefficient technologies that need to evolve for a better usage of protected spectrum. Therefore, the modernisation of aviation CNS systems is essential for sustainable growth, and to continue meeting the high standards of safety, which is the fundamental principle and expectation of the aviation system. This need was acknowledged already at AN-Conf/12. Since then, the European States have continued investing and engaging in close cooperation with ICAO and the International Telecommunication Union (ITU), recognising that aviation CNS systems will need to evolve in the medium and long terms to increase efficiency in the interest of the entire user community. Nevertheless, transition from legacy to new systems continues to be a challenge for the entire civil aviation sector. So far, it has been established that technical measures alone, such as greater use of bandwidth efficient systems, are unable to meet projected future aeronautical demands. It is therefore a need to collectively investigate alternative measures to optimise aviation’s spectrum footprint, including CNS infrastructure rationalisation. Improvements have to be made in the processes of allocation, the release of frequencies, the deployment of newer and more efficient technologies in the current bands, and in exploring the potential future use of other frequency bands for aeronautical purposes.

2.4. All radio systems are vulnerable to interference and may also be subject to cyber threats and attacks. The impact of interference on space-based systems could, for instance become very significant. CNS resiliency and robustness will need to specifically mitigate such vulnerabilities through a combination of short- and long-term technical and operational measures.

3. THE NECESSITY FOR A UNIFIED PERFORMANCE-BASED FRAMEWORK

3.1. The development of a performance-based CNS framework is expected to support the sustainable evolution of the air navigation service provision business, as it enables the adaptation of business models that best suit the needs of the different States and regions. The framework would also benefit the airlines by enabling the rationalisation of some airborne systems providing for the suitable aggregation of airborne CNS capabilities.

3.2. To implement an agile and performance-based CNS infrastructure, a full understanding of the overarching air traffic management (ATM) architecture with clear (cross-cutting and combined) CNS and spectrum requirements (CNSS) that recognise the needs of all airspace users and stakeholders is an essential pre-requisite. In practice, this requires the coming together of all the three disciplines to review assumptions and challenge the status quo. In an increasingly connected environment, a combination of dedicated CNS systems, automation, and commercial services will work together to deliver an infrastructure that can support the evolving key operational concepts whilst ensuring global interoperability, safety and security. This approach, together with requirements defined as performance statements, should support the acceptance of performance equivalence, inter alia, for military CNS systems.

3.3. To ensure that the evolving CNS infrastructure delivers the expected benefits, it will need to take advantage of new concepts, capabilities and applications in a flexible manner that meets demand and leverages inter-domain synergies whilst maintaining global harmonisation. It is expected that this will under the foreseen architecture involve higher levels of automation and full connectivity allowing for new producers and consumers of data and information. These trends will drive the underlying CNS services and infrastructure toward a digital and more collaborative environment that uses the minimum number of systems to achieve the overall mission. The migratory path to this target environment will need to be flexible, globally interoperable and respect the principle of no country left behind allowing regions to progress as appropriate, and avoiding unnecessary intermediate steps in line with the ICAO GANP and the ASBU framework.

4. BENEFIT AND SUSTAINABLE GROWTH FOR ALL REGIONS

4.1. If aviation is to succeed in sustaining the expected global growth in air traffic as well as to accommodate airspace access requirements from airspace users whilst reducing costs and environmental impact, the current CNS infrastructure needs to evolve. The global CNSS strategy and roadmap need to cater for civil-military interoperability and the optimum re-utilisation opportunities from State and military aviation technologies, new entrant technologies such as UAS and sub-orbital vehicles and the challenges and opportunities they present taking advantage of synergies where possible. ICAO has in this context an important role to play in working together with States and regional modernisation programmes to establish an effective collaboration from research and development through to deployment of interoperable systems.

4.2. A managed evolution to a performance-based CNS infrastructure will allow States and regions, air traffic service providers, manufacturers and aircraft operators to safely benefit from cost savings, improved airspace access and long-term planning certainty. To also ensure an efficient use of spectrum, such evolution will require that synergies between domains and market sectors are leveraged.

4.3. Following such an approach requires greater co-ordination and synchronisation between the CNSS components. An integrated CNSS strategy should be guided by the GANP vision and a conceptual roadmap and be flexible enough to accommodate States and regional differences where necessary, ensuring no-country-left-behind. Under a performance-based scheme, new services and infrastructure (with its underpinning technology components) can be deployed as and when necessary to meet the demands of local airspace. However, unless the performance framework is unified and harmonized, requirements for C, N and S will continue to evolve in silos.

4.4. Therefore, capitalising on the ICAO GANP vision, and new focus on operational improvements and ambitions for performance-based Standards, an opportunity now presents itself for States, regions and aviation stakeholders to pool requirements for CNS and spectrum. We believe that ICAO has a pivotal role and a responsibility to facilitate this work. To achieve this goal, Europe advocates the establishment of a multi-disciplinary group of global experts from States and regional modernisation programmes working alongside the Air Navigation Commission (ANC) panel framework facilitated by the ICAO Secretariat. Supported with the necessary remit, the group can be tasked to deliver the initial vision and CNS and Spectrum strategy and roadmap for integration into the GANP and ASBU framework of ICAO.

5. CONCLUSION

The Conference is invited to agree to the following recommendations:

a) request ICAO to develop and maintain, in collaboration with States' and regional modernisation programmes (such as the Single European Sky ATM Research Programme/SESAR), an integrated consolidated communications, navigation and surveillance and spectrum strategy and roadmap illustrating the necessary transitions as part of the evolution of the global air navigation plan (GANP), enabling the implementation of key concepts such as trajectory-based operations (TBO) whilst securing resilience and robustness, operational and economic benefits, as well as a coherent rationalisation of legacy CNS capabilities;

b) request ICAO to work in a multi-disciplinary manner developing an integrated, consolidated and phased approach to a performance-based and service-oriented CNS framework in line with the GANP vision, by grouping and harmonising existing performance-based concepts enabling stakeholders to adapt to new business models for CNS services provision whilst fostering global interoperability;

c) request ICAO, to develop provisions, in collaboration with States' and regional modernisation programmes; supporting increased civil-military interoperability and synergies with the optimum re-utilisation opportunities from State and military aviation technologies; opportunities arising from the new entrants, such as unmanned aircraft systems (UAS) at all levels and suborbital operators’ digital technologies and to enable the use of internationally recognised Standards as means of compliance; and

d) request ICAO to develop and maintain a pro-active global aviation radio spectrum strategy which supports the safe and efficient use and long-term availability of adequate radio spectrum embracing new opportunities in line with the needs of the GANP/aviation system block upgrade (ASBU) evolution.

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