



ASSEMBLY — 42ND SESSION

TECHNICAL COMMISSION

Agenda Item 24: Aviation Safety and Air Navigation Priority Initiatives

REGIONAL CNS MINIMAL OPERATING NETWORKS

(Presented by Saudi Arabia)

EXECUTIVE SUMMARY

The Fourteenth Air Navigation Conference (AN-Conf/14) adopted Recommendation 2.2/2 on the implementation of effective global navigation satellite system radio frequency interference (GNSS RFI) mitigation measures and developing a regional GNSS interference reporting and analysis mechanism.

At the regional level, the planning and implementation regional groups (PIRGs) and regional aviation safety groups (RASGs) adopted several conclusions inviting States to implement mitigation measures, based on global navigation satellite system (GNSS) radio frequency interference (RFI) measures developed by ICAO and industry, and to maintain a sufficient network of conventional navigation aids to ensure operational safety as well as sufficient airspace capacity during GNSS RFI events.

This paper proposes the establishment of Regional Navigational Minimum Operational Network covering all CNS facilities and the interfaces between the adjacent ICAO regions. This will ensure harmonization of Regional CNS-MON and offer adequate connectivity and smooth transition when satellite-based CNS services are not available for use. The paper also supports the proposal for an amendment to Assembly Resolution A41-8, as provided in Appendix A of A42-WP/34.

Action: The Assembly is invited to:

- note the information presented in this paper;
- encourage ICAO and States to support a regional approach in defining a sufficient network of CNS to ensure continuity of air navigation services and operational safety, as well as sufficient airspace capacity when satellite-based CNS services are not available for use; and
- urge States and industry to support ICAO's initiatives in developing further guidance and introducing new concepts to enhance the resilience of the air navigation system against GNSS disruption.

<i>Strategic Goals:</i>	This working paper relates to <i>Every Flight is Safe and Secure</i> .
<i>Financial implications:</i>	Activities to be undertaken within the regular budget
<i>References:</i>	Doc 10209, Report of the Fourteenth Air Navigation Conference Doc 10184, <i>Assembly Resolutions in Force</i> Doc 10004, <i>2026-2028 Global Aviation Safety Plan</i> Doc 9750, <i>Global Air Navigation Plan</i> A42-WP/34 - <i>Global Navigation Satellite Systems (GNSS) Radio Frequency Interference (RFI)</i> MIDANPIRG/22 & RASG-MID/12 final report

1. INTRODUCTION

1.1 As defined by ICAO, the Global Navigation Satellite System (GNSS) includes navigation satellite infrastructure and various constellations that provide position, navigation, and timing (PNT) information supporting aircraft and air traffic management operations. The GNSS PNT functions are used during aircraft operations by several avionics systems such as Flight Management Systems (FMS), Terrain Avoidance Warning System (TAWS), or Enhanced Ground Proximity Warning Systems (EGPWS). Therefore, any interruption or disruption to GNSS service has a direct impact on the safety of aircraft operations.

1.2 Under Agenda item 2.2, the Fourteenth Air Navigation Conference (AN-Conf/14) held at ICAO HQ from 26 August to 6 September 2024 expressed concerns with the increase of GNSS jamming and spoofing, and the significant safety risk it poses to civil aviation operations, particularly in areas surrounding conflict zones. The Conference adopted Recommendation 2.2/2 inviting States develop regional GNSS RFI reporting procedures through the planning and implementation regional groups, leveraging the existing guidance material contained in the *Global Navigation Satellite System (GNSS) Manual* (Doc 9849) to raise awareness of geographic areas of GNSS interferences and to use this information in the context of planning contingency operations.

2. DISCUSSION

2.1 Regional Navigation Minimal Operating Network

2.1.1 Doc 9849 defines regulatory, technical, and operational measures to mitigate GNSS-RFI. A key component of the navigational Ground infrastructure is a resilient position, navigation, and timing capability independent of GNSS that will ensure safe aircraft operations while minimizing the impact of a GNSS disruption. To sustain the GNSS-independent navigational infrastructure, each State should ensure that all elements and factors needed for safety, recovery, and continued operations are maintained.

2.1.2 Under the Global Air Navigation Plan (GANP), the aviation system block upgrade (ASBU) element NAVS-B0/4 titled “Navigation Minimal Operating Networks (Nav. MON)” allows the rationalization of the ground-based conventional infrastructure through the definition of minimal networks of ground navaids. Consultations and agreements from airspace users and aircraft operators are required to define this element. ICAO recommends revisiting this element with the introduction of new navigation capabilities.

2.1.3 AN-Conf/14 agreed on the importance of establishing and maintaining a sufficient network of conventional navigation aids, supported by very high frequency omnidirectional radio range, distance measuring equipment, and instrument landing system facilities, to ensure operational safety as well as sufficient airspace capacity during times of GNSS interference. Considering the need to phase out legacy navigation systems, the Conference agreed that the removal of such systems should take into account the need for effective GNSS RFI mitigation, and that aircraft minimum equipment lists would need to be updated to reflect this requirement.

2.1.4 As performance-based navigation (PBN) operations are widely implemented, the ground-based infrastructure, including facilities and conventional instrument flight procedures, is considered for optimization, and consequently, this infrastructure may be rationalized, maintaining the necessary safety backup capability. With the increase of GNSS RFI occurrences observed recently, States should consider operational risks during their planning for rationalization of ground-based navigation and surveillance infrastructures and engage airspace users while developing a CNS rationalization plan.

2.1.5 During the twenty second meeting of the Middle East Air Navigation Planning and Implementation Regional Group (MIDANPIRG/22) and the twelfth meeting of the Regional Aviation Safety Group - Middle East (RASG-MID/12) held in Doha, State of Qatar, from 4 to 8 May 2025, the meeting reaffirmed the importance of supporting the development of a regional navigational MON supporting the ANS operations and invited States to contribute by sharing information and data on their navigation facilities and CNS rationalization plans. The MIDANPIRG/22 & RASG-MID/12 also adopted PIRG/RASG Conclusion 2: Consolidated Regional Approach to GNSS RFI Management.

2.1.6 The proposal for the development of a Regional Navigational Minimum Operational Network supporting the ANS operations is an opportunity for States to identify alternatives for PNT supporting operational resilience and maintain airspace capacity during GNSS outages at the regional level. To ensure the continuity of air navigation services, it is proposed to set Regional Navigational Minimum Operational Network to cover all CNS facilities and the interfaces between the adjacent ICAO regions. This will ensure the harmonization of Regional CNS-MON and provide adequate connectivity and a smooth transition when satellite-based CNS services are unavailable for use.

2.1.7 To support this approach, global harmonization efforts should be undertaken to advance PNT and Alternative-PNT solutions, considering ICAO initiatives described in A42-WP/34.

2.2 **Aeronautical information publication on alternative navigation means**

2.2.1 The MIDANPIRG/22 & RASG-MID/12 meeting also noted the absence of standardized ICAO guidance on the publication of alternative navigation sensors (e.g., DME/DME) in the AIP ENR section, to formally describe the backup systems for GNSS-dependent air traffic services (ATS) routes. To address this gap and enhance contingency planning, the meeting invited the ICAO MID Office to coordinate with the relevant ANC panels, specifically the Instrument Flight Procedure Panel (IFPP), Information Management Panel (IMP), and Navigation Systems Panel (NSP), to develop guidance for the inclusion of backup sensor information (e.g., DME/DME, VOR/DME, etc.) in States' Aeronautical Information Publication (AIPs).

3. **CONCLUSION**

3.1 The increase in GNSS RFI occurrences raises concerns at the regional and global levels. AN-Conf/14 adopted Recommendation 2.2/2 on the implementation of effective GNSS RFI mitigation measures and developing a regional GNSS interference reporting and analysis mechanism.

3.2 At the regional level, MIDANPIRG and RASG-MID adopted several conclusions inviting States to implement mitigation measures, based on GNSS RFI measures developed by ICAO and industry, and to maintain a sufficient network of conventional navigation aids to ensure operational safety as well as adequate airspace capacity during GNSS RFI events.

3.3 The proposed amendment to Assembly Resolution A41-8, Appendix C, provided in A42-WP/34, includes a new operative clause encouraging standardization bodies and industry to collaborate with ICAO in advancing PNT solutions, considering ICAO initiatives. While this clause is supported, it may be extended to include the development of Regional CNS Minimum Operational (CNS-MON) Network supporting the Air Navigation Services and ensuring that the ICAO Offices coordinate the harmonization of these Regional CNS -MON networks at the interfaces to support service continuity and maintaining adequate airspace capacity when satellite-based CNS services are not available for use.