International Civil Aviation Organization

MIDANPIRG/22 & RASG-MID/12 Meetings

(Doha, Qatar, 4 – 8 May 2025)

Agenda Item 5.3: ANS (AIM, PBN, AGA-AOP, ATM-SAR, CNS and MET)

GNSS RFI AND REGIONAL NAVIGATION MINIMAL OPERATING NETWORKS

(Presented by Saudi Arabia)

SUMMARY

The 14th 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, 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 sufficient airspace capacity during GNSS RFI events.

This paper provides an overview of GNSS RFI MIDANPIRG and discuss the need to establish and maintain a sufficient network of conventional navigation aids to ensure operational safety as well as sufficient airspace capacity during GNSS RFI. It invites MIDANPIRG to endorse the decision proposed by CNS SG to establish the MID NAV-MON Action Group to develop a proposal for a Regional Navigational Minimum Operational Network to ensure operational safety as well as sufficient airspace capacity during GNSS RFI events;

Action by the meeting is at paragraph 4.

REFERENCE(S)

A41-8: Consolidated statement of continuing ICAO policies and practices related to a global air traffic management (ATM) system and (CNS/ATM) systems, Appendix C
AN-Conf/14 – Conference Report on Agenda Item 2.
ICAO Doc 9750, Global Air Navigation Plan, 7th Edition
ICAO Doc 9849, Global Navigation Satellite System (GNSS) Manual
Report of the Twenty-First Meeting of the Middle East Air Navigation Planning and Implementation Regional Group and Eleventh Meeting of the Regional Aviation Safety Group-Middle East (MIDANPIRG/21 & RASG-MID/11)
Report of the Thirteenth Meeting of the MIDANPIRG CNS Sub-Group (CNS SG/13)
Report of the Tenth Meeting of the MIDANPIRG ATM Sub-Group (ATM SG/10)

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 The GNSS signals can easily be compromised intentionally or unintentionally due to Radio Frequency Interference (RFI), including signal interference, jamming, and spoofing, and/or manipulating position and timing information. The jamming and spoofing can have serious impacts on the accuracy of navigation systems and, in some cases, result in abnormal system behavior. It is always challenging to anticipate GNSS-RFI occurrences.

1.3 Under Agenda item 2.2, the 14th 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 recalled the need for States to abide by the measures adopted under the International Telecommunication Union (ITU) Constitution and Convention and the ITU Radio Regulations to reduce, where possible, the likelihood of such interference and to notify aviation authorities, regulators, and air navigation services providers regarding any intentional GNSS interference activity.

1.4 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 The ICAO 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 GANP, the 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 The 14th Air Navigation Conference (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 equipage lists would need to be updated to reflect this requirement.

2.1.4 During GNSS interference, the Navigation service within the MID region should rely on the ground NAVAIDS infrastructure, which should support the needed resilience. In particular, the DME coverage in the en-route and terminal areas can provide an effective complementary system to support PBN operations in the event of a GNSS disruption. The DME/DME RNAV coverage will constitute a resilient position and navigation service. However, additional alternatives for position and navigation should be identified as technologies and capabilities advance.

2.1.5 As PBN operations are expanding in the MID region, the ground-based infrastructure, including facilities and conventional instrument flight procedures, will be reduced, and consequently, this infrastructure may be rationalized, maintaining the necessary safety backup capability. With the increase of GNSS RFI occurrences observed recently, MID 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.

2.1.6 To implement effective GNSS RFI measures, and progress the establishment and maintenance of a sufficient network of conventional navigation aids in the MID region, the MIDANPIRG/21 & RASG-MID/11 adopted the following main conclusions:

- CONCLUSION 11/3: GNSS INTERFERENCE AND SPOOFING, which invited ICAO, with the support of States and IATA, to establish a regionally determined minimum operational network (MON) of conventional navigation aids for use in case of GNSS interference /Spoofing;
- CONCLUSION 21/27: GNSS RFI MITIGATION, which tasked the ATM SG in coordination with AIM, CNS, and PBN SGs to address the reported GNSS RFI occurrences and review the MID RSA 014 on GNSS Vulnerabilities.
- CONCLUSION 21/26: NAV MON Plan Template, which tasked the CNS SG in coordination with ATM SG and PBN SG to review and update the NAV MON Plan Template developed as guidance for MID States to support the planning and implementation of rationalization of the conventional navigation aids.

2.1.7 During the 13th meeting held in Saudi Arabia from 20 to 23 October 2024, the CNS SG reviewed the consolidated NAV-MON template emanating from CNS, PBN and ATM Subgroups, and agreed to establish a Regional Navigational Minimum Operational Network Action Group (NA-MON AG) to collect data on existing navaids infrastructure, assess operational needs, and identify facilities that can be relocated or decommissioned. The role of the NAV-MON AG is to develop a proposal for the Regional Navigational Minimum Operational Network to ensure the continued provision of air navigation services in the MID region during both normal and contingency/reversion operations, especially in case of GNSS interference. CNS SG adopted the decision 13/4 - MID NAV-MON ACTION GROUP (Report of CNS SG/13, Page 6-5 Refers).

2.1.8 The ICAO Assembly 42nd session will be held from 23 September to 3 October 2025. The provisional agenda of the technical commission, item 24, will discuss matters that may affect the safety of air transport and the reliability of air navigation systems, such as GNSS interference. Therefore, it will be an opportunity for MID States to express their views and recommendations related to this subject.

3. CONCLUSION

3.1 The increase of GNSS RFI occurrences raises concerns at the regional and global levels. The 14th 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.

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 sufficient airspace capacity during GNSS RFI events.

3.3 The proposal to set a regional NAV-MON Action Group should be supported. This forum will allow MID States to progress their plans for the rationalization of ground-based conventional navigation infrastructure, reducing unnecessary facilities while maintaining critical navigation services in a harmonized manner.

3.4 The agenda item 24 of the technical commission of the Assembly will discuss GNSS RFI, and it may be an opportunity to submit a proposal inviting ICAO to harmonize the Regional Navigational Minimum Operational Networks to support the continuity of air navigation services between all ICAO regions.

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

a) note the information provided in this WP, and in particular, Recommendation 2.2/2 adopted by AN-Conf/14, inviting States to develop a regional GNSS interference reporting and analysis mechanism; and

b) endorse the decision proposed by CNS SG to establish the MID NAV-MON Action Group to develop a proposal for a Regional Navigational Minimum Operational Network to ensure operational safety as well as sufficient airspace capacity during GNSS RFI events.

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