



International Civil Aviation Organization

MIDANPIRG/21 and RASG-MID/11 Meetings

(Abu Dhabi, UAE, 4-8 March 2024)

---

---

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

**GNSS RFI AND NAVIGATION MINIMAL OPERATING NETWORKS**

*(Presented by Saudi Arabia)*

**SUMMARY**

As defined by ICAO, the Global Navigation Satellite System (GNSS) includes navigation satellite infrastructure and various constellations which provide position, navigation, and timing (PNT) information supporting aircraft and air traffic management operations. Therefore, any interruption or disruption to GNSS service has a direct impact on the safety of flights.

This paper proposes to task the CNS and ATM sub-groups to identify Navigation Minimal Operating Networks (Nav. MON) that constitute a resilient position and navigation service in the MID region. It also invites MIDANPIRG to support the drafting of WP to ICAO 14<sup>th</sup> Air Navigation Conference planned from 26 August 2024 to 6 September 2024 on the need to define technical and operational criteria for phasing out the legacy ground-based infrastructure and to consider resilience against GNSS RFI.

**Action by the meeting is under paragraph 4 of this WP.**

*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.](#)
- ICAO Doc 9750, Global Air Navigation Plan, 7th Edition.
- ICAO Doc 9849, Global Navigation Satellite System (GNSS) Manual.
- [ICAO EUR/MID Radio Navigation Symposium \(Antalya, Türkiye, 6-8 February 2024\).](#)

**1. INTRODUCTION**

1.1 As defined by ICAO, the Global Navigation Satellite System (GNSS) includes navigation satellite infrastructure and various constellations which provide position, navigation, and timing (PNT) information supporting aircraft and air traffic management operations. The GNSS PNT are used, during the 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 direct impact on the safety of aircraft operations.

1.2 The GNSS signals can easily be compromised intentional or unintentional 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.

1.3 With jamming, the GPS signal is interrupted and cannot be used for the conduct of the flights. With spoofing, a false GPS signal is broadcasted, causing aircraft systems to produce false positioning without warning. It is always challenging to anticipate GNSS-RFI occurrences.

## **2. DISCUSSION**

### **2.1. Resilience against GNSS RFI**

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

2.1.3 As PBN operations is 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 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.

2.1.4 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 recommend to re-visit this element with the introduction of new navigation capabilities.

2.1.5 The provisional agenda item 3.2 of ICAO 14th Air Navigation Conference planned from 26 August 2024 - 6 September 2024 will discuss phasing out legacy systems which include mainly the ground-based infrastructure. Therefore, it will be an opportunity for MID States to express their views, and recommendations related to this subject.

2.1.6 As regional initiative, ICAO MID Office may initiate a consultation activity involving MIDANPIRG CNS and ATM Sub-groups where a regional Nav. MON is identified, and the list of ground based conventional infrastructure that should be retained is captured under MID eANP Volume III as part of the monitoring of the status of implementation of ASBU element NAVS-B0/4.

## **3. CONCLUSION**

3.1 In coordination and collaboration with States, users, and the industry ICAO should identify the best methods for Alternative Position, Navigation and Timing (APNT) capabilities. These methods will allow aviation operations to continue in the event of a GNSS RFI or outage in a way that maintains safety, security, and a reasonable level of capacity and efficiency. All solutions researched and implemented will be for all aviation stakeholders with harmonization throughout the international community. The efforts on Alternative Position, Navigation, and Timing should be translated into a global strategy aiming the continuity of flights and ATM operations during interruptions of GNSS.

3.2 The agenda item 3.2 of the ICAO 14<sup>th</sup> Air Navigation Conference is covering the phasing out of legacy systems which should be tackled carefully considering the operational risks associated to harmful interference to GNSS.

**4. ACTION BY THE MEETING**

4.1 The meeting is invited to:

- a) note the information provided in this WP;
- b) task MIDANPIRG CNS and ATM Sub-groups to identify the regional Nav. MON constitutes a resilient position and navigation service in the MID region; and
- c) support the drafting of WP to ICAO 14<sup>th</sup> Air Navigation Conference to define technical and operational criteria for phasing out the legacy systems and to consider resilience against GNSS RFI.

—END —