International Civil Aviation Organization

MIDANPIRG Communication, Navigation and Surveillance Sub-Group (CNS SG/15)

(Doha, Qatar, 11 – 14 May 2026)

Agenda Item 3: Navigation Issues

IMPLEMENTATION OF GNSS SIGNAL MONITORING AND REPORTING SYSTEM TO SUPPORT RFI MITIGATION

(Presented by Saudi Arabia)

SUMMARY

This paper presents the establishment of a GNSS Signal Monitoring and Reporting System in Saudi Arabia covering Jeddah FIR to support the detection, analysis, and mitigation of Radio Frequency Interference (RFI), including intentional jamming and signal spoofing. The system will automatically detect GNSS degradation events using ground-based sensors serving the Kingdom's airspace, analyse them, and provide timely notifications to airspace users and to the Saudi Air Navigation Services (SANS). The initiative aims to enhance operational safety, improve situational awareness for all airspace users, and strengthen national and regional efforts to manage GNSS interference.

Action by the meeting is at paragraph 5 of this WP.

REFERENCES

- ICAO Annex 10 — Aeronautical Telecommunications.
- ICAO Doc 9849 — GNSS Manual.
- Doc 9718 — Handbook on Radio Frequency Spectrum Requirements for Civil Aviation.
- ICAO Doc 8071 — Testing of Radio Navigation Aids.
- ICAO State Letter AN 7/5-23/67 on GNSS Interference and Spoofing.

1. INTRODUCTION

1.1 The Global Navigation Satellite Systems (GNSS) are essential for modern aviation navigation, surveillance, and timing services. However, the increasing GNSS interference, intentional and unintentional, has resulted in frequent loss of signal (jamming) and false positioning/timing (spoofing) events affecting aircraft operations worldwide.

1.2 The GNSS RFI are currently reported through flight reports. This results in reactive management of GNSS RFI, delayed awareness, incomplete data, and limited ability to identify interference patterns or assess operational impact.

1.3 To address this gap, this paper provides information on the establishment of a national automated GNSS Signal Monitoring and Reporting System that will record real-time data, analyse interference events, and distribute timely alerts to SANS, airlines, and relevant national authorities.

2. BACKGROUND

2.1 GNSS interference has become a significant operational challenge in many ICAO regions. Loss of signal and spoofing events have resulted in:

1) Degraded RNP capability.
2) Loss of ADS-B data.
3) False cockpit alerts (e.g., EGPWS PULL-UP WARNINGS, ERRONEOUS CLOCK READINGS)
4) Increased ATC workload.
5) Flight delays, diversions, and rerouting.

2.2 International bodies, including ICAO, have highlighted the growing need for enhanced GNSS interference monitoring, standardized reporting processes, and effective mitigation strategies to safeguard and maintain navigation and surveillance services.

2.3 Therefore, there is a need for improved GNSS interference monitoring, reporting, and mitigation mechanisms. A unified or centralized monitoring system is required to consolidate GNSS RFI data, improve situational awareness, and enable timely and coordinated mitigation actions by ANSPs and airspace users.

3. DISCUSSION

3.1 **Concept of the Proposed System**: The proposed GNSS Signal Monitoring and Reporting System should be designed as an integrated national architecture that consolidates GNSS degradation data from multiple operational sources. The system will automatically collect, process, and correlate GNSS-related events to provide a unified operational picture of interference events affecting the airspace. The main data inputs include:

1) Aircraft-based data: RAIM alerts, ADS-B integrity flags, and onboard GNSS performance indicators.
2) Ground-based GNSS monitoring stations: Continuous signal quality monitoring and integrity checks.
3) ATM automation systems: Monitoring of Surveillance and navigation integrity data from SANS systems.
4) Airline operational reports: Post-flight and real-time operational reporting.

3.2 The system will apply automated analysis to detect anomalies, identify interference patterns, and classify events based on severity and operational impact on the airspace users. Alerts will be disseminated to relevant stakeholders through standardized interfaces and automated notification channels, such as systematic issuance of GNSS NOTAMs.

3.3 **Operational Benefits:** The implementation of a unified and centralized GNSS interference monitoring capability will deliver significant operational advantages, including:

1) Real-time situational awareness: Immediate visibility of GNSS degradation across the whole airspace

2) Enhanced ATC decision-support: Air traffic Controllers can anticipate navigation or surveillance degradation and adjust ATC procedures accordingly.
3) Improved airline operational planning and awareness: Early warnings allow flight crews and dispatch centers to prepare for potential navigation limitations and use of alternatives.
4) Support for PBN continuity and resilience: Ensures resilience of navigation by using A-PNT and surveillance services critical to aircraft operations.
5) Enhance safety by reducing the operational impact of GNSS outages.
6) Improve operational efficiency and predictability for airlines.
7) Support PBN and ADS-B resilience and continuity.
8) Provide a foundation for long-term CNS modernization and resilience.

3.4 **Implementation Plan:** The proposed implementation will follow a phased approach to ensure operational readiness and stakeholder involvement and contribution:

A. **Phase (1) Requirements and System Design:**
   1- Define system architecture and governance framework.
   2- Identify all GNSS data sources and integration requirements.
   3- Establish data-sharing agreements among GACA, SANS, airlines, and CST (Communications, Space & Technology Commission (CST)).

B. **Phase (2) Deployment and Integration:**
   1- Install or upgrade GNSS monitoring sensors, starting with observed and critical volumes of airspace.
   2- Integrate aircraft-based and ATC system data feeds.
   3- Develop warnings and alerting interfaces for airlines and operational units.
   4- Conduct system testing and validation.

C. **Phase (3) Operational stage:**
   1- Launch the national GNSS interference platform and dashboard.
   2- Provide training for SANS, airlines, and all affected personnel.
   3- Conduct periodic performance reviews and refine detection and monitoring algorithms.

4. CONCLUSION

4.1 GNSS interference is a growing threat to civil aircraft operations. Establishing a GNSS Signal Monitoring and Reporting System will significantly improve situational awareness, support mitigation efforts, and enhance safety across the Kingdom's airspace may be extended to other FIRs with the MENA region. Saudi Arabia will update the CNS SG during the upcoming meetings on the progress made for GNSS Signal Monitoring and Reporting System.

5. ACTION BY THE MEETING

5.1 The meeting is invited to:

a) Note the information presented in this paper;
b) Support the establishment of a Saudi Arabia GNSS Signal Monitoring and Reporting System by;
c) Encourage States, ANSPs, and airlines to share their experiences in managing GNSS RFIs;
d) Urge the MID ICAO Regional Office to establish a centralized regional database or dashboard for sharing GNSS RFI events,

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