International Civil Aviation Organization

MIDANPIRG/22 & RASG-MID/12 Meetings

(Doha, Qatar, 4 – 8 May 2025)

Agenda Item 2.2: ICAO Global and Regional Aviation Safety and Air Navigation development

ENHANCING GNSS RESILIENCE IN THE MID REGION: COLLABORATIVE STRATEGIES AND MITIGATION MEASURES AGAINST JAMMING AND SPOOFING

(Presented by Egypt/ NANSC)

SUMMARY

This paper examines the concern posed by GNSS RFI (GPS jamming and spoofing) to civil aviation and air traffic management in the Region. It highlights the mounting risks to aviation safety underscoring the urgent need for coordinated regional strategies and proactive mitigation measures to address these vulnerabilities.

Action by the meeting is at paragraph 4

REFERENCE

- DOC 9849, GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) MANUAL
- RASG-MID SAFETY ADVISORY (RSA-14) ON GNSS VULNERABILITIES
- PBN SG/8 MEETING REPORT
- PBN SG/9 MEETING REPORT

1. INTRODUCTION

1.1 The Global Navigation Satellite Systems (GNSS), particularly GPS, have become fundamental to modern civil aviation and Air Traffic Management (ATM) within the ICAO Middle East (MID) Region, including Egypt. Their reliance spans navigation, surveillance, communication, and air traffic control procedures. However, the increasing prevalence of GNSS interference, encompassing both jamming and spoofing, poses a significant and growing risk to the safety, efficiency, and regularity of air operations within the MID Region.

1.2 This working paper addresses the growing risks of GNSS interference (jamming and spoofing) by examining its potential effects on the MID Region, particularly focusing on challenges observed in Egyptian airspace. It also proposes actionable strategies for regional collaboration to reduce vulnerabilities to these disruptions.

2. DISCUSSION

2.1 The Growing Reliance on GNSS in the MID Region and Egypt: GNSS supports positioning, navigation and timing (PNT) applications. GNSS is the foundation of navigation (PBN), surveillance (ADS-B and ADS-C) and communication (CPDLC).

2.2 The MID Region, strategically positioned as bridging Europe, Asia, and Africa, serves as a nexus for long-haul international flights. This geographic significance, combined with rapid air traffic growth, heightens its exposure to GNSS interference risks. Recent reports and evidence indicate a concerning rise in both unintentional disruptions and deliberate jamming/spoofing activities, which undermine critical flight operations. Such interference can result in:

- **Loss of navigational accuracy:** Compromising area navigation (RNAV) capabilities and potentially leading to airspace infringements.
- **Erroneous aircraft position reporting:** Affecting surveillance systems like ADS-B and potentially creating hazardous situations for air traffic controllers.

- **Compromised safety:** Increasing pilot and air traffic controller workload, potentially leading to disorientation, and necessitating reversion to less precise navigation methods. Also, its effect on various aircraft systems, including
  - Controller-Pilot Data Link Communications (CPDLC)
  - Flight Management Systems (FMS)
  - Terrain Awareness and Warning Systems (TAWS)
  - Transponders
  - Traffic Alert and Collision Avoidance Systems (TCAS)

2.3 Egypt, with its vital role in regional air transport and its complex airspace structure, faces unique challenges related to GNSS interference. Factors such as geopolitical instability in the surrounding areas and potential unintentional interference sources necessitate a focused assessment and proactive mitigation strategies.

2.4 Many GNSS interference issues are happening near conflict zones due to increased use of drones and electronic warfare. Recent conflicts worldwide have highlighted how vulnerable the weak GNSS signals from satellites are to jamming and spoofing.

2.5 Pilots are alert to regional hot spots where such instances might occur and are able to fall back on other onboard navigation aids.

2.6 Spoofing tricks GNSS receivers into providing incorrect positions, navigation, and timing data. Unlike jamming, spoofing is harder to detect, and there's no automatic alert to the flight crew. Spoofing causing large position jumps to have been reported since late 2023.

2.7 Since August 2023, a new variety of GPS spoofing has been reported by crews The result is that within minutes, the IRS becomes unusable, and in many cases, all navigation capability on board is lost. That means that the backup system is no longer reliable as a backup,”. Sometimes the GPS receivers can't recover even after leaving the interference zone.

2.8 A coordinated regional framework is imperative for MID States to systematically report, analyze, and respond to GNSS interference events. This requires establishing standardized reporting mechanisms and efficient communication channels to ensure timely data sharing and collaborative decision-making. Concurrently, ICAO’s role is pivotal in fostering regional cooperation by harmonizing strategies, providing technical guidance, and supporting Member States in implementing robust mitigation measures, such as enhanced monitoring systems and adaptive operational measures.

2.9 Conventional aids can provide alternative sources of guidance. DME is the most appropriate conventional aid available in the near- to mid-term for supporting PBN operations, since it

currently provides input to multi-sensor navigation systems that allow area navigation in both En-route and terminal airspace. VOR/DME currently provides a useful backup capability for En-route flight.

2.10 ICAO currently provides no standardized guidance on how to publish alternative navigation sensors (e.g., DME/DME) within the AIP ENR sections to formally designate them as backup systems for GNSS-dependent ATS routes. Without clear criteria for procedural notation in AIP ENR Part, ANSP and operators lack harmonized references to utilize DME/DME during GNSS outages, undermining contingency planning.

3. PROPOSED RECOMMENDATIONS

3.1 This working paper proposes the following recommendations to maintain safe and efficient aircraft operations in case of disruption caused by GNSS RFI, calling for collaborative action and stakeholder engagement:

- Establish a Regional GNSS Interference Reporting and Analysis Mechanism: Develop a standardized system for Member States to report GNSS interference incidents, allowing for regional analysis of trends and patterns.
- Promote Information Sharing and Best Practices: Facilitate the exchange of information, lessons learned, and best practices related to GNSS interference mitigation among MID States.
- Encourage the Adoption of Dual/Multi-Constellation GNSS Receivers: Advocate for the increased use of receivers capable of utilizing multiple GNSS constellations in aircraft operating within the MID Region.
- Develop and Harmonize Contingency Procedures: Support the development and harmonization of robust contingency procedures for navigation and surveillance in case of GNSS degradation or loss, including the potential utilization of DME/DME infrastructure where feasible.
- Develop explicit instructions and guidance for publishing backup sensors in AIPs, ensuring global consistency in ENR contingency route design and operational readiness.
- Enhance Training and Awareness Programs: Recommend the inclusion of comprehensive training modules on GNSS interference risks and mitigation strategies for all relevant aviation personnel.
- Foster Collaboration with International Organizations: Encourage collaboration with other international bodies and research institutions involved in addressing GNSS interference.

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

a) note the information contained in this paper;

b) discuss the growing threat of GNSS interference in the MID Region and its potential impact on aviation safety and efficiency;

c) discuss and endorse the recommendations presented in paragraph 3;

d) encourage Member States to prioritize the development and implementation of national GNSS interference mitigation strategies; and

e) support initiatives aimed at enhancing regional collaboration and information sharing on GNSS interference events.

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