



International  
Civil Aviation  
Organization

Organisation  
de l'aviation civile  
internationale

Organización  
de Aviación Civil  
Internacional

Международная  
организация  
гражданской  
авиации

منظمة الطيران  
المدني الدولي

国际民用  
航空组织

Tel.: +1 514-315-1872

30 April 2024

Ref.: E 3/5-24/54

**Subject:** Aviation safety concerns regarding interference to the Global Navigation Satellite System (GNSS)

**Action required:** a) disseminate guidance material; and  
b) implement recommendations, as applicable

Sir/Madam,

1. I have the honour to bring to your attention the concerning escalation of jamming and spoofing activities targeting the global navigation satellite system (GNSS), which have been increasingly observed recently in various regions globally. GNSS, as one of the main enablers for performance-based navigation (PBN), provides navigation guidance for all phases of flight, from enroute through to precision approach. By providing accurate position and timing information, GNSS enables several systems critical to the safety of flight.

2. Since 2003, the International Civil Aviation Organization (ICAO) has been actively developing recommendations and guidance concerning GNSS Radio Frequency Interference (RFI). It is pertinent to recall ICAO Assembly Resolution A41-8, Appendix C: *Ensuring the resilience of ICAO CNS/ATM systems*, which serves as the latest ICAO policy on GNSS resilience.

3. To bring attention to the critical issue of GNSS interference, and to foster discussions on the management of GNSS vulnerabilities and potential mitigation measures against GNSS RFI, ICAO recently convened the ICAO EUR/MID Radion Navigation Symposium from 6 to 8 February 2024 in Antalya, Turkey. One important outcome of this symposium is the attached list of recommendations regarding Stakeholders' continued efforts towards ensuring safe, reliable, and resilient air navigation.

4. I would like to take this opportunity to refer to recent safety-related publications by the European Union Aviation Safety Agency (EASA), [Safety Information Bulletin No. 2022-02R2](#) and the Federal Aviation Administration (FAA), [Safety Alert for Operators \(SAFO 24002\)](#).

5. You are kindly requested to consider and disseminate as appropriate, the guidance material provided in the above links to all relevant entities in your State, and to consider the attached recommended actions, as applicable.

Accept, Sir/Madam, the assurances of my highest consideration.

Juan Carlos Salazar  
Secretary General

**Enclosure:**

Recommendations from the ICAO EUR/MID Radio  
Navigation Symposium (6 to 8 February 2024)

**ICAO EUR/MID Radio Navigation Symposium  
Antalya, Turkey (6 to 8 February 2024)**

**RECOMMENDATIONS**

*Recognizing with concern the impact of global navigation satellite system (GNSS) Radio Frequency Interference (RFI) on aviation safety, capacity, efficiency and security, the Symposium recalled and underlined Resolution A1-8, Appendix C: Ensuring the resilience of ICAO CNS/ATM systems and services and agreed on the need to take necessary actions to ensure continued safe, reliable, and resilient air navigation.*

The Symposium recommended:

- **All Stakeholders** to be aware of the potential safety and capacity impacts of GNSS interference, jamming, and spoofing.
- **Civil Aviation Authorities (CAAs)** to ensure that air navigation service providers (ANSPs) deploy and maintain adequate distance measuring equipment (DME) infrastructure and DME based Performance-Based Navigation (PBN) procedures and enable aircraft operators use of multi-DME and multi-DME/inertial reference system (IRS) complementary solutions as appropriate to maintain PBN operations during GNSS local or regional interference, jamming or spoofing.
- **CAAs** to ensure that air navigation services providers (ANSPs) implement and maintain necessary minimum operational networks (MON), or greater, of navigation aids and radar infrastructures (including very high frequency omnidirectional radio range (VOR), instrument landing system (ILS) Cat I/II/III and DME) to ensure the necessary levels of resilience for navigation when core constellations, satellite-based augmentation system (SBAS) or ground-based augmentation system (GBAS) are unusable.
- **ANSPs** to develop contingency procedures (technical and operational) for GNSS radio frequency interference (RFI) events, to minimize any operational impact and ensure continuous safe operation of air traffic. The contingency procedure may require the provision of reliable surveillance coverage that is resilient to GNSS interference.
- **ANSPs** to implement/maintain a GNSS-independent time source for synchronisation of relevant Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) infrastructure.
- **CAAs/ANSPs** to facilitate or deploy as appropriate real-time monitoring and detection solutions for GNSS RFI situational awareness for all stakeholders, while recognizing that only the aircraft operator is responsible for determining their ability to navigate.
- **ANSPs** to issue notice to airmen (NOTAMs) on GNSS RFI events in a timely manner; to establish coordination arrangements with neighbouring flight information regions (FIRs) on how to best to share their navigation infrastructures in the event of GNSS RFI and any resulting air traffic diversion.
- **CAAs/ANSPs** to improve civil-military coordination to address interference risks associated with GNSS testing and conflict zones, to ensure the uninterrupted and reliable operation of navigation systems in diverse applications.

- **National Military Authorities** to coordinate with National Spectrum Regulators, CAAs and ANSPs, to the extent possible, ahead of any necessary GNSS RFI activity. This will enable ANSPs to mitigate any safety impact on civil aviation.
- **CAAs** to foster collaboration with their National Spectrum Regulators regarding GNSS RFI.
- **National Spectrum Regulators** to locate and determine the source of reported GNSS RFI and attempt to resolve it, as appropriate. The GNSS RFI resolution may require coordination with other authorities at national or regional levels.
- **National Spectrum Regulators** to report frequent unresolved GNSS RFI incidents to the Radiocommunication Bureau of the International Telecommunication Union (ITU), describing GNSS RFI impact as experienced within their national borders, or as reported by their registered aircraft.
- **Aircraft Operators** to develop a procedure requesting crew to notify air traffic control (ATC) whenever GNSS RFI events are experienced and notify respective aircraft and avionics original equipment manufacturers (OEMs) and State of Aircraft design's CAA through normal safety channels when safety effects are encountered.
- **Aircraft Operators** to develop procedures and training based upon information received from aircraft and avionics OEM and State of aircraft design's CAA.
- **Aircraft Operators** to place additional emphasis on flight crews closely monitoring aircraft equipment performance for any discrepancies or anomalies, promptly informing ATC of any apparent GNSS degradation, and being prepared to operate without GNSS navigation systems.
- **Original Equipment Manufacturers (OEMs)** to improve their equipment and provide further guidance and information on the effects and mitigations of GNSS RFI (including interference, jamming and spoofing) from the perspective of aircraft equipment.
- **OEMs** to ensure that aircraft equipment quickly recovers and resumes GNSS navigation once not impacted anymore by a GNSS RFI event.
- **ICAO Navigation Systems Panel (NSP)** to develop recommendations on how to share information on GNSS RFI (NOTAM or other measures).
- **All stakeholders** to collaborate towards developing simple and automated common reporting of GNSS RFI.
- **All stakeholders** to continue to evolve solutions, while leveraging the ICAO NSP as a common focal point.
- **ICAO** to continue raising awareness and supporting States, as required.