नागर विमानन मंत्रालय
MINISTRY OF CIVIL AVIATION

ICAO APAC RADIO NAVIGATION SYMPOSIUM

GNSS RFI: Collectively Bridging Gaps and Shaping the Path Forward

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List of Recommendations

The ICAO APAC Radio Navigation Symposium reviewed existing Global Navigation Satellite System (GNSS) Radio Frequency Interference (RFI) mitigation strategies with the objective of identifying gaps and offering insights into actions required to address the evolving challenges posed by GNSS RFI in terms of technological, procedural, and human-centric aspects of mitigation.

The Symposium reaffirmed the significance of the ICAO/ITU/IMO Joint Statement on the Protection of Radio Navigation Satellite Service (RNSS) from Harmful Interference and outlined a set of recommended actions and best practices to achieve the following objectives:

Objective 1: Minimize GNSS RFI occurrence through effective regulatory measures and enforcement.

1.1 States should:

1.1.1 ensure sufficient aviation representation in delegations of States to ITU WRC-27 preparatory meetings, to progress future improvements to ITU Resolution 676 and to ensure that future WRC updates of Radio Regulations do not adversely impact GNSS;

1.1.2 improve coordination with the military by facilitating the sharing of information on GNSS RFI testing and any relevant activities such as Counter-UAS operations;

1.1.3 possess the necessary technical capabilities to detect GNSS RFI, conduct Radio Frequency (RF) measurements, and geolocate the source of the GNSS RFI; and

1.1.4 utilise the ITU Radio Regulations (RR) escalation procedure (RR Article 15) to ensure proper resolution for incidents of GNSS RFI with cross-border impact that cannot be solved nationally or internationally through routine procedures;

1.1.5 States should also consider submitting reports to the respective ICAO Regional Office, which can then forward those reports to the ITU Satellite Interference Reporting and Resolution System (SIRRS) for further action.

1.2 Radio regulatory authorities of States need to step up enforcement against GNSS jamming transmitters (GPS Jammers) while educating the public about their illegality, without unintentionally exposing system vulnerabilities. Law enforcement should monitor and act against online marketplaces selling such devices. Additionally, making the ownership of GPS jammers illegal will help authorities confiscate them more effectively and strengthen regulatory control.

1.3 All stakeholders need to contribute to the development of further ICAO guidance to strengthen the link between air operator reports, air navigation services provider (ANSP) confirmation, and spectrum regulator engagement. The coordination and reporting processes must be efficient and simplified to ensure timely and effective management.

Objective 2: Support Air Crews in Operational Risk Reduction and Management

2.1 ICAO should consider the necessity of standardized radiotelephony phraseologies for specific scenarios. Establishing clear, standardized communications in these situations could greatly benefit both pilots and air traffic controllers, ensuring accurate and efficient responses.

2.2 Airlines and aircraft manufacturers should:

2.2.1 integrate GNSS RFI factors into fuel and alternate planning to ensure contingency measures are in place for potential navigation disruptions, including refining dispatch decisions based on aircraft equipment and ensuring the aircraft's capabilities match the expected interference conditions;

2.2.2 ensure pilots maintain proficiency in conventional navigation methods, supporting operational resilience in GNSS-degraded environments. This includes:

2.2.2.1 providing training to ensure pilots can operate effectively using conventional procedures, enabling them to fly without reliance on GNSS when necessary.

2.2.2.2 encouraging position cross-checking using VOR radials for situational awareness; and

2.2.2.3 ensure a full Inertial Reference System (IRS) alignment before departure if the aircraft experienced GNSS RFI during the previous flight, as indicated in the aircraft journey log.

2.2.3 clarify and streamline GNSS RFI reporting, potentially through Electronic Flight Bags (EFB) integration, to facilitate timely incident reporting; and

2.3 The symposium acknowledged IATA's initiative in providing the Turbulence Aware platform to support airline information sharing and encouraged the development of similar initiatives for GNSS RFI information exchange.

Objective 3: Ensure effective support to flight crews while maintaining safety

3.1 States should:

3.1.1 prioritize suitable staffing levels, sector workload planning, and continuous monitoring of compliance with clearances to ensure effective air traffic management;

3.1.2 ensure ATC readiness to provide radar vectors when requested navigational assistance in a surveillance environment, clock checks, and clearly define circumstances under which ATC may refuse vectoring;

3.1.3 ensure comprehensive ATCO training and awareness programs focusing on response to abnormal situations and clearance deviations, equipping controllers with the necessary skills to handle unexpected events effectively; and

3.1.4 identify critical areas for Terrain Awareness and Warning System (TAWS) climb and deconfliction advisories, ensuring controllers provide timely and accurate guidance to pilots.

Objective 4: Ensure suitable CNS capabilities are available as required

4.1 States should:

4.1.1 ensure timely and effective communication regarding GNSS RFI incidents. A warning could be issued via NOTAM, Aeronautical Information Publication (AIP), and/or Automatic Terminal Information Service (ATIS) as appropriate;

4.1.2 ensure ATSEP personnel receive training/awareness program on GNSS RFI detection, mitigation, and reporting. Simulation exercises and collaborative awareness programs could be implemented to enhance response capabilities and operational resilience;

4.1.3 establish a Resilient Operational Network (RON) by ensuring availability of sufficient navigation infrastructure to support continuous Performance Based Navigation (PBN) operations and by facilitating positional awareness through maintenance of a VOR/DME Network for reliable cross-checking; and

4.1.5 implement GNSS jamming and spoofing monitoring using ADS-B Out (ground-based or space-based) or Wide Area Multilateration (WAM).

Objective 5: Strengthen capabilities to maintain PBN and optimize operational efficiency by leveraging current technology

5.1 Aircraft and avionics manufacturers should:

5.1.1 avoid cross-contamination of aircraft/avionics sensors due to GNSS RFI;

5.1.2 augment GNSS time with precision time sources to improve resilience and mitigate disruptions;

5.1.3 enhance GNSS robustness with rapidly deployable Multi-Mode Receivers (MMR) and strategic system upgrades; and

5.1.4 enable advanced RNP operations using DME through improvements to multi-DME navigation and clarifying the DME interrogator scanning and selection criteria.

5.2 States should:

5.2.1 implement spoofing monitors in surveillance trackers while conducting a comprehensive ADS-B to SSR/WAM comparison; and

5.2.2 optimise DME transponder network planning and coverage.

Objective 6: Achieve Robust Positioning, Navigation, and Timing (PNT) through long-term C-PNT development

6.1 States should:

6.1.1 conduct a comprehensive cyber risk assessment for all CNS/ATM systems, particularly space-based systems, and implement adequate mitigation measures; and

6.1.2 enhance GNSS resilience and improve cybersecurity defenses through standardization and implementation of advanced technical improvements such as authentication mechanisms, improved Controlled Reception Pattern Antennas (CRPA) for robust interference mitigation and enhanced signal reception, GNSS RFI detection systems and downlink enhancements to identify and counter GNSS RFI in real time and ensure secure and reliable data transmission across GNSS networks.

6.2 ICAO should:

6.2.1 enhance L-Band spectrum utilization through standardization of enhanced DME (eDME) and assess other candidate PNT solutions;

6.2.2 establish a balanced CNS evolution roadmap, whereas ground, air, and space capabilities should work collaboratively within a unified framework that prioritizes spectrum efficiency as the fundamental driver; and

6.2.3 emphasize the core objective of the Integrated Communication, Navigation, Surveillance and Spectrum (CNSS), transforming common mode weaknesses into strengths through smart integration while maintaining independence across ground, air, and space systems.