



ICAO

*International Civil Aviation Organization***Twenty Ninth Meeting of the Communications/
Navigation and Surveillance Sub-group (CNS SG/29)
of APANPIRG**

Bangkok, Thailand, 16-20 June 2025

Agenda Item 7: Navigation

7.2 GNSS Interference and Mitigating Measures

OUTCOMES OF RADIO NAVIGATION SYMPOSIUM

(Presented by the Secretariat)

SUMMARY

The paper presents the key outcomes of the ICAO APAC Radio Navigation Symposium, which was held in New Delhi, India, from 07-09 April 2025.

1. INTRODUCTION

1.1 The **ICAO APAC Radio Navigation Symposium** was held in New Delhi, India, from 07-09 April 2025. The theme of the Symposium was ***GNSS RFI: Collectively Bridging Gaps and Shaping the Path Forward***. The Symposium aimed to provide a collaborative platform to exchange experiences and insights on GNSS RFI, analyze its impact and challenges, and facilitate in-depth discussion on mitigation measures and future development to build a resilient aviation system. The Symposium developed recommended actions to guide future efforts in managing GNSS RFI. It also addressed the USOAP Radio navigation flight inspection requirements and the latest developments.

1.2 The Symposium was attended by **157** participants from **10** Member States/Administrations, **6** International Organizations and 5 International Industries. The report and other documents of the Symposium can be accessed at the ICAO APAC Meeting webpage at:

<https://www.icao.int/APAC/Meetings/Pages/Radio-Navigation-Symposium.aspx>

1.3 This paper summarized the discussion of the Radio Navigation Symposium for SRWG/9 Meeting information.

2. DISCUSSION

2.1 The summary of the key presentations of the Symposium is given in the following paragraphs.

Day 1: 7 April 2025

2.2 Day 1 was divided into three sessions. The first Session, Setting the Scene, explored the global radio navigation developments, updates from the ICAO APAC Region, and GNSS vulnerabilities, providing a foundation for understanding current challenges and their implications for the aviation industry.

2.3 The session included three presentations delivered by the ICAO Secretariat team and the ICAO HQ Navigation System Panel (NSP) vice-chair. Ms. Muna Alnadaf shared details about ICAO provisions, relevant global developments and initiatives, and ongoing NSP activities. Dr. Soniya Nibhani, ICAO APAC Office, shared updates on activities done in the ICAO APAC Office on relevant topics. She introduced the ICAO APAC Office structure, its role and responsibilities, and the challenges faced by APAC States/Administrations in handling matters related to GNSS RFI and other navigation issues. Key issues raised in past ICAO APAC meetings under the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) and respective actions taken by the ICAO APAC Office were shared with the participants. The third presentation by Mr. Gerhard Berz, Eurocontrol, provided background information on GNSS vulnerabilities, their impact on both airborne and ground systems, and trends in spoofing incidents.

2.4 The second and third sessions included a panel discussion on the operational and safety impacts of RFI on GNSS-dependent systems, addressed the consequences of flight operation and air navigation service, and highlighted best practices, ongoing efforts, and recommended actions.

2.5 During the second session, the Symposium was apprised of the impact of the GNSS RFI and the associated challenges in India, Japan, Malaysia, the Philippines, and the ROK. It was noted that States have implemented the reporting procedures and form as outlined in the GNSS Manual. However, the main challenges presented include the lack of real-time monitoring and reporting, ineffective management of reported incidents, lack of awareness of GNSS RFI issues, and the proliferation and online sale of jamming devices.

2.6 In the third session, under panel discussion on the industry's perspective, Indigo and Thai Airways shared their airline viewpoints, and IATA shared APAC Airlines' outlooks on GNSS RFI challenges, impact, best practices and recommendations. Boeing presented recommended best Practices in the case of GNSS Interference from an aircraft manufacturer's view, while Eurocontrol presented GNSS RF Interference and Mitigation from an international organization perspective.

2.7 The panel emphasized the need for States to be better prepared by adopting proactive measures rather than reactive ones, as mitigating GNSS RFI has become a critical risk management activity for States and airlines. Moreover, the panel encouraged States and Air Navigation Services Providers (ANSPs) to re-evaluate GBNA infrastructure under their control and follow AN-Conf/14 Recommendation 2.2/2 – Addressing global navigation satellite system interference and contingency planning (a) States to maintain a sufficient network of conventional navigation aids to ensure operational safety as well as sufficient airspace capacity during times of global navigation satellite system interference.

Day 2: 8 April 2025

2.8 Day 2 discussion was divided into three sessions under two agenda items. The first two sessions focused on the agenda item Mitigating GNSS Interference: Current Measures and Gaps to Address, while the third on the agenda item Risks Beyond GNSS: Lessons and Broader Threats to Satellite-Based Systems.

2.9 Two panels were organized under the agenda Mitigating GNSS Interference: Current Measures and Gaps to Address to provide a comprehensive overview of existing mitigation strategies, identify gaps, and offer insights into what more needs to be done to address emerging challenges posed by GNSS RFI in terms of technological, procedural, and human-centric aspects of mitigation.

2.10 The first session focused on technological aspects of mitigation under which industries, including Aireon, Collines Airspace and Thales, shared information about innovative technical developments such as innovation embedded in the new nav aids and surveillance systems, GNSS

interference monitoring using space-based ADS-B and building resilient GNSS Systems. In addition, Saudi Arabia shared its experience with GNSS Performance Monitoring in Saudi Arabia, and the USA shared details about PNT and Innovation.

2.11 The Symposium noted that new features are being developed for DME, referred to as Enhanced DME (eDME), within the framework of the SESAR project. These enhancements are expected to contribute to more efficient spectrum utilization and enable an increase in the number of available DME channels.

2.12 Furthermore, the discussion emphasized the importance of a robust and resilient time source for both airborne and ground systems to support aviation safety and security. It was recommended that aviation systems adopt independent clocks or oscillators as the primary means to ensure secure and reliable time and frequency synchronization.

2.13 The Symposium was apprised of the Collins GNSS receiver roadmap and noted the ongoing efforts to enhance airborne GNSS resiliency by leveraging advancements in both GNSS sensor technology and antenna techniques.

2.14 During the second session, a panel discussion on procedural and human-centric aspects of mitigation was conducted under which ITU shared ITU regulations and actions to protect the RNSS from harmful interference and IFATSEA shared ATSEP's Role in Detecting, Diagnosing, and Mitigating GNSS RFI for a Human-Centric ATM System.

2.15 The Symposium emphasized that harmonized communication between ATC and pilots, through standardized radiotelephony (RT) phraseology and well-defined contingency procedures, can significantly enhance safety. In support of this, it was recommended that recommendations for improvements in RT phraseology be submitted to the relevant ICAO experts group for consideration and further evaluation.

2.16 The last panel on day 2 focused on the agenda item Risks Beyond GNSS: Lessons and Broader Threats to Satellite-Based Systems. This panel discussion explored lessons learned from the challenges faced by GNSS and examined the risks posed to other satellite-based systems that share similar vulnerabilities. Panellists debated what lessons can be applied to safeguard the resilience of other satellite-based systems and what collaborative efforts and proactive steps were necessary to mitigate the growing threats to these vital technologies.

2.17 This panel considered a total of four presentations. Singapore presented ADS-B spoofing and mitigating measures due to GNSS RFI. At the same time, Thales informed about Space-based Surveillance used for delivering a real-time, continuous and safety-certified ATC surveillance data flow whenever the areas. Aireon presented Space-based Surveillance and its experience based on the first 6 years of Global ATC operations and evolution into Satellite Time Difference of Arrival (TDA) to mitigate GNSS interferences, and Japan shared its experience on research activities for investigating onboard electronic magnetic compatibility issues in current radio environments.

Day 3: 9 April 2025

2.18 On the last day, an expert panel deliberated on Key Takeaways, Recommendations, and the Path Forward. The expert panel, composed of five members from Singapore, ICAO, IATA, USA and Collins airspace, reflected on the insights shared during the first two days, considering the major themes and challenges. Panellists provided a synthesis of the most important takeaways related to radio regulatory topics, flight deck, ATC operations, service provision aspects, short-term C-PNT development, and long-term C-PNT Development. This session offered a collaborative opportunity to chart a path forward, ensuring that the momentum generated throughout the Symposium was translated

into recommended action. The list of key recommendations discussed during the Symposium can be accessed by [this link](#).

2.19 The last session of this day was dedicated to the agenda item Radio Navigation Flight inspection. The panel discussed the critical role of Radio Navigation Flight Inspection in ensuring the safety of air navigation services. It highlighted the ICAO USOAP audit requirements and addressed the latest developments, including the use of UAS-based flight inspection and relevant ICAO provisions.

2.20 A total of four presentations were discussed under this panel. Japan shared flight inspection using drones in Japan and details of ILS drone propeller modulation. Indonesia shared about flight inspection in Indonesia, while the NSP vice chair shared details of ICAO provisions for flight inspection.

2.21 The Symposium was informed of recently developed guidance material aimed at reducing flight inspection volume, with a particular focus on minimizing the number of inspection runs for ILS procedures. Furthermore, it was noted that ongoing efforts will include a new chapter on GNSS RFI and flight inspection capabilities for geolocating interference sources in the ICAO doc 8071, Vol II.

Q&A Sessions

2.22 Dedicated Q&A sessions were conducted at regular intervals based on available time. In addition, a link to Slido was provided for asking questions. A total of **122 questions** were asked using Slido, and most of them were answered during the Symposium. For some questions, the answers were added to the Slido for the participant's reference.

Key Outcomes of the Symposium

2.23 The final list of recommendations resulting from the Symposium, along with the safety bulletin, will be published by ICAO HQ in due course.

Closing of the Session

2.24 The Symposium recommended organizing such sessions in the future and ensuring that all APAC member States/Administrations participate and contribute in such sessions so that comprehensive regional requirements can be formulated to address GNSS RFI issues in the region.

2.25 In closing, the ICAO Secretariat expressed sincere appreciation and gratitude to the Ministry of Civil Aviation, India, for the excellent organization and smooth conduct of the Symposium. Appreciation was also extended to all participants and panelists for their valuable contributions and active engagement throughout the event. The Secretariat requested continued collaboration and information sharing among States to support ongoing efforts in mitigating GNSS interference and enhancing regional aviation safety and resilience.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the outcome of the ICAO APAC Radio Navigation Symposium;
- b) take any necessary follow-up actions; and
- c) discuss any relevant matter as appropriate
