International Civil Aviation Organization

Thirty-Sixth Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/36)

Bangkok, Thailand, 24 to 26 November 2025

Agenda Item 2: Global and Inter Regional Activities

COLLABORATION BETWEEN CNS SG AND SEI WG

(Presented by Co-Chairperson of APRAST SEI WG)

SUMMARY

This paper proposes a collaboration framework between the Communications, Navigation and Surveillance Sub-Group (CNS SG) and the Safety Enhancement Initiatives Working Group (SEI WG) to address safety risks associated with Global Navigation Satellite System (GNSS) Radio Frequency Interference (RFI).

Strategic Objectives:

A: ***Safety*** *– Enhance global civil aviation safety*

B: ***Air Navigation Capacity and Efficiency*** *— Increase the capacity and improve the efficiency of the global aviation system*

1. INTRODUCTION

1.1 During the Twelfth PIRG & RASG Regional Coordination Meeting held on 27 November 2024, in ICAO APAC Office, in a hybrid format (face-to-face and video teleconference), the topic of overlapping issues/initiatives that required to be coordinated between APANPIRG and RASG APAC Sub-Groups was discussed under Agenda Item 2.

1.2 One specific topic identified for necessary coordination was data sharing between the APANPIRG's CNS SG and the Asia Pacific Regional Aviation Safety Team's SEI WG regarding the emerging risk posed by GNSS RFI.

1.3 The regional imperative for ensuring radio navigation resilience was recently highlighted by the ICAO APAC Radio Navigation Symposium, jointly organized by the ICAO APAC Office and HQ from 07–09 April 2025 in New Delhi, India. The final list of recommendations from this Symposium, addressing critical technical aspects of GNSS dependency, was subsequently shared with all ICAO Member States via an ICAO Electronic Bulletin 2025/20 dated 23 July 2025.

1.4 This Working Paper builds upon the Symposium recommendations and current SEI WG work by proposing a joint APRAST/CNS framework linking GNSS RFI technical aspects with operational risks contributing to Controlled Flight Into Terrain (CFIT) and Midair Collision (MAC) in the APAC Region.

2. DISCUSSION

2.1 GNSS RFI is recognized in the ICAO Global Aviation Safety Plan (GASP 2026–2028) as a precursor contributing to Global High-Risk Categories of Occurrences (G-HRCs): CFIT, MAC, and Loss of Control In-Flight (LOC-I). As these G-HRCs represent unsafe end states, mitigating RFI as a precursor is essential to prevent accidents. The upcoming Asia Pacific Regional Aviation Safety Plan (AP-RASP) 2026-2028 will also recognize the threats posed by GNSS RFI on CFIT and MAC for the APAC region.

2.2 GNSS RFI may lead to the failure or malfunction of an aircraft's primary CNS systems, particularly through:

a) Spoofing - the transmission of counterfeit satellite signals that mislead GNSS receivers, causing erroneous Position, Navigation and Timing (PNT) data.

b) Jamming - the deliberate or unintentional emission of radio interference that prevents receivers from acquiring or tracking GNSS signals, resulting in the loss of valid PNT information.

CFIT Risks:

2.3 GNSS RFI contributes to CFIT risks primarily, but not exclusively, by degrading Terrain Awareness and Warning Systems (TAWS) and Required Navigation Performance (RNP).

a) TAWS Degradation:

Spoofing-induced corruption of PNT data compromises the integrity of TAWS, causing spurious PULL UP alerts or total system failure, which can lead to crew losing confidence and disregarding genuine alerts (EASA SIB 2022-02R3). Jamming causes an immediate loss of PNT data and GNSS-dependent systems (TAWS, ACAS, ADS-B) (ICAO A42-WP/34).

b) RNP Degradation:

Spoofing or Jamming degrades accuracy, causing the Actual Navigation Performance (ANP) to exceed the Required Navigation Performance (RNP). This results in an Unstable/Inaccurate Approach or inability to perform precise RNP/RNP-AR procedures, straying the aircraft from the required path. Deviation during RNP procedures in low visibility or complex terrain violates obstacle clearance, leading directly to the highest severity risk of CFIT (ICAO Doc 9849).

MAC Risks:

2.4 GNSS RFI affects MAC through the direct corruption of onboard surveillance systems which can degrade Air Traffic Control (ATC) separation capabilities, among other factors.

a) TCAS Degradation:

Spoofing supplies corrupted position data to the Flight Management System (FMS), generating major position errors for TCAS. This leads directly to either spurious Resolution Advisories (RAs) or the dangerous inhibition of genuine collision alerts, increasing the likelihood of pilots maneuvering unnecessarily into conflict (EASA SIB 2022-02R3).

b) TCAS Inaccuracy (Jamming):

Jamming corrupts the time source, leading to Ranging Errors and inaccurate calculation of threat proximity. This degrades TCAS's ability to issue a timely and correct RA and increases the risk of MAC (ICAO A42-WP/34).

c) ATC Surveillance and Separation:

GNSS RFI severely degrades aircraft systems which use GNSS as a time reference or source of position information, leading to loss of, or unreliable Automatic Dependent Surveillance-Broadcast (ADS-B) and Automatic Dependent Surveillance-Contract (ADS-C) data, and loss of Controller Pilot Data Link Communication (CPDLC). This results in Degraded ATC capability, forcing ATCs to use procedural separation, increasing separation minimums and MAC risk due to unpredictable aircraft behavior and loss of high-precision surveillance.

2.5 With the introduction of GNSS-based operations in the 1990s, the APAC Region has been discussing various challenges and measures for resolving GNSS RFI. Several APANPIRG conclusions have been adopted on this matter. It included APANPIRG Conclusion 8/43 - GNSS Frequency Based Interference (1997), APANPIRG Conclusion 9/32 - GNSS Frequency Protection (1998), APANPIRG Conclusion 22/28 - Protection of aviation utility of GNSS (2011), and APANPIRG Conclusion 27/36- Protection of GNSS signal against jamming (2016). However, GNSS RFI has been a significant point of discussion at the Spectrum Review WG (SRWG) and CNS SG meetings over the last few years.

2.6 ATM/SG/12 (23 to 27 September 2024) acknowledged the significance of GNSS and data link disruptions, and their major impact on Air Traffic Services (ATS) and airspace users. As a result, ATM/SG/12 formed an Ad Hoc Group through ***Decision ATM/SG/12-8: Establish Procedures for GNSS and Data Link Disruption Ad Hoc Group***. The objectives of this Ad Hoc Group were to collect data on GNSS and data link disruption in the APAC region, develop operational procedures for air traffic controllers, pilots, airspace users and air navigation service providers (ANSPs) to report GNSS and data link disruptions, as well as mechanisms for sharing information among stakeholders. The Ad Hoc Group had convened two meetings (1 October and 10 November 2025), with regular meetings planned monthly.

2.7 From the technical side, there are a lot of significant topics related to GNSS RFI that require more research to get a comprehensive understanding. For instance, identifying GNSS RFI as the root cause of a particular occurrence is key. In other instances, such as issues in satellite constellations and avionics problems, the same effect can be observed, and it is not easy to isolate the real cause of the identified problems. In addition, how to correct GNSS RFI issues and associated legal implications is a significant point of discussion.

2.8 From ICAO HQ meetings, several guidance materials and other documents have been published for mitigation measures and other relevant issues. A compilation of relevant ICAO references has been shared with States in various CNS meetings, such as WP/05 presented in SRWG/08 meeting (05 – 07 March 2024).

2.9 The APANPIRG/34 (11 - 13 December 2023) and APANPIRG/35 (25 to 27 November 2024) meetings urged States and airspace users (through IATA) to report GNSS occurrences to the ICAO APAC Office using the reporting templates, which were circulated in a State Letter Ref.: T 8/5.10 – AP052/24(CNS) dated 23 April 2024. The GNSS Interference Reporting Form for APAC was prepared by the CNS section with reference to the RASG-MID SAFETY ADVISORY – 14 (RSA-14).

2.10 The SRWG/9 Meeting (7-9 May 2025) discussed the next step recommended for States to handle GNSS RFI issues. It was recommended that an ad-hoc group be formed to study the current situation of GNSS interference in the region, analyse it, and propose a way forward.

2.11 The ICAO Secretariat of SRWG/9 meeting informed that since last year, not a single incident report has been shared with the ICAO APAC Office. Therefore, there was insufficient data for the group to begin working on this. It was agreed that it is imperative to first collect some incident reports from APAC States/Administrations. It was suggested that States/Administrations share their incident reports and details at the SRWG/10 Meeting, which is planned for 2026. Based on inputs from reports from States/Administrations, the need to form an ad-hoc group will be deliberated in the SRWG/10 Meeting.

2.12 The ICAO Secretariat (CNS section) was recommended to coordinate with other Ad Hoc Groups formed in the region for GNSS RFI matters and understand their scope of work. It was recalled that the Procedures for GNSS and Data Link Disruption Ad Hoc Group had already been formed by ATM SG/12. It will help to avoid duplication of efforts.

2.13 Currently, the CNS section has approached all GNSS RFI affected States to share GNSS RFI occurrence. To date, only two States (Malaysia and Thailand) have shared some data. Most of these data are a compilation of various incidents without detailed information. The suitability of the provided information and its use will be further discussed at the SRWG/10 Meeting in 2026.

2.14 Close coordination with the ATM section is being maintained by the CNS section on the progress of the Procedures for GNSS and Data Link Disruption Ad Hoc Group. The progress of the Procedures for GNSS and Data Link Disruption Ad Hoc Group will be presented to the SRWG/10 meeting in 2026, which will enable the SRWG/10 meeting to assess the need for another ad hoc group under SRWG, define its scope of work, and outline its way forward.

2.15 Senior leaders at the 60th APAC Directors General of Civil Aviation Conference (7 July – 1 August 2025) unanimously recognized the increasing risk and the complexities associated with mitigating it. To continue to draw attention to the issue, the Conference developed specific action items for the region (Action Items 60/18 and 60/23).

Potential Future Collaborations

2.16 To manage GNSS RFI effectively, collaboration between the CNS SG (technical mitigation) and the SEI WG (operational safety) is proposed. This coordination is driven by operational safety needs, whereby SEI WG identifies the highest severity operational threats, and CNS SG applies the most effective and prioritized technical mitigating strategies. The CNS SG would provide technical data (e.g., RFI location, signal intensity) to SEI WG, while SEI WG would share prioritized risk analyses to help CNS SG focus technical responses and monitoring, thereby maximizing safety outcomes.

2.17 To operationalize this collaboration, SEI WG proposes the following APRAST actions aligned with the AP-RASP 2026–2028 objectives:

a) In coordination with APANPIRG, identify geographic areas of concern and analyze the underlying factors specific to the APAC region that contribute to GNSS RFI risk.

b) Based on this analysis, prioritize the highest-severity threats and subsequently develop focused regional SEIs and/or RASG-APAC Safety Advisories (RSAs).

c) Develop a comprehensive, holistic understanding of Original Equipment Manufacturer (OEM) guidance and existing regional efforts on managing the risk of GNSS interference.

d) In coordination with the appropriate APANPIRG contributing bodies, identify and implement additional efforts to mitigate the risk of GNSS interference within the region.

3. ACTION BY THE MEETING

3.1 The Meeting is invited to:

a) note the impact of GNSS RFI on CNS systems and associated safety risks related to the G-HRCs (CFIT and MAC); and

b) note the current and potential collaborations between PIRG and RASG; and

c) discuss any relevant matters as appropriate.

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