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

PROPOSED FOCUS AREAS TO MITIGATE GNSS RADIO FREQUENCY INTERFERENCE FOR THE ASIA PACIFIC REGION

(Presented by Singapore)

SUMMARY

This paper recalls pertinent proposals and recommendations from the 42nd ICAO Assembly (A42) related to Global Navigation Satellite System (GNSS) Radio Frequency Interference (RFI), and the ICAO Asia Pacific Radio Navigation Symposium. It highlights some areas to focus regional efforts in mitigating GNSS RFI for the CNS SG and SEI WG to explore further.

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 GNSS is essential to international civil aviation, supporting a wide range of critical aviation operations that ensure both safety and efficiency. Key aircraft systems, such as Flight Management Systems (FMS), Automatic Flight Control Systems (AFCS), and data link communication systems, rely heavily on Global Positioning System (GPS) data. Technologies like Automatic Dependent Surveillance Broadcast Out (ADS-B Out) depend on GPS to provide accurate location data to ANSPs for ATM purposes. GNSS can be applied to both precision and non-precision approaches, contributing to fuel savings and more efficient air traffic management (ATM). Given the extensive reliance on GNSS, any disruptions caused by GNSS RFI pose significant challenges to pilots and air traffic controllers, including:

a) A potential contributing factor to three global high-risk categories of occurrence (G-HRC): a mid-air collision (MAC), a controlled flight into terrain (CFIT), and a loss of control in-flight (LOC-I).

b) A significant operational and financial impact, including flight rerouting, delays, cancellations and increased workload for both pilots and air traffic controllers.

2. DISCUSSION

2.1. The 42nd Session of the ICAO Assembly (A42) held in Montreal, Canada from 23 September to 3 October 2025, discussed global and regional efforts and requirements. Please refer to relevant extracts of A42-WP/656 (**Appendix A**) on records of the deliberations and outcome, including 'Appendix C – Ensuring the resilience of ICAO CNS/ATM systems and services' of the Assembly Resolution on 'Consolidated statement of ICAO policies and practices related to a global ATM system and CNS/ATM systems' which was adopted by A42.

2.2. Asia-Pacific recognises that GNSS RFI is an operational safety concern that should be mitigated quickly. In particular, the 12th PIRG-RASG Regional Coordination Meeting on 27 November 2024 acknowledged that enhanced coordination between APANPIRG and RASG-APAC was necessary (RASG-APAC/14-WP/22 refers) and proposed for the formation of a group to improve coordination on GNSS RFI. It was agreed by the meeting that the coordination group would be led by the APANPIRG CNS SG and APRAST SEI WG with potential members from CNS, Safety, and IATA.

2.3. Prior to A42, the ICAO APAC Radio Navigation Symposium on ***GNSS RFI: Collectively Bridging Gaps and Shaping the Path Forward*** in April 2025 developed thirty-one recommendations on how the Asia Pacific region could enhance coordination, information sharing, and develop capability to address GNSS RFI.

2.4. With the conclusion of A42, ICAO will be following up on the A42 Resolution concerning GNSS RFI in the coming triennium. At the same time, there are already best practices in the industry on GNSS RFI, including on detection, reporting, and mitigation of risks. As such it is proposed that the coordination group, in consultation with the relevant contributory bodies under PIRG and RASG, could coordinate action to collectively tackle GNSS RFI risks in this region. The coordination group's focus areas could include the following:

a) Harmonised notification of GNSS RFI events to operators – e.g. through development of common reporting procedures and templates;

b) Notification of GNSS RFI events encountered by flight crew to ATC – e.g. through collaborating with airline associations and organisations to establish reporting workflows on GNSS degradation or suspected interference;

c) Optimised navigation and communication network planning and coverage – e.g., through a regional planning framework for States and ANSPs that considers the continuing need for ground-based navigation aids especially in the critical areas (such terminal airspace) for greater resilience against GNSS RFI;

d) Clear regional guidance on GNSS RFI – e.g., through new GNSS RFI-related elements in the APAC Seamless ANS Plan across both operation and technology functions; and

e) Capable and ready operational personnel – e.g., through the Cooperative Development of Operational Safety and Continuing Airworthiness Programme – South East Asia (COSCAP-SEA) to determine regional training needs and solutions.

2.5. Direction from the coordination group and relevant work outcomes, especially those that contribute towards safety enhancement should be presented at subsequent APANPIRG and RASG-APAC meetings to ensure regional alignment. Subsequently these could inform the work of ICAO global objectives on GNSS RFI mitigation.

3. ACTION BY THE MEETING

3.1. The Meeting is invited to:

a) Request the coordination group led by the CNS SG and SEI WG, in consultation with the relevant contributory bodies under PIRG and RASG, coordinate action to collectively tackle GNSS RFI risks in this region and present joint updates to APANPIRG and RASG-APAC in 2026.

b) Discuss any relevant matters as appropriate

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EXTRACTS OF A42 – WP/656
DRAFT TEXT ON THE REPORT ON AGENDA ITEM 24

GNSS vulnerabilities and resilience

24.70 The Commission reviewed A42-WP/34, presented by the Council, which highlighted the risks and consequences associated with global navigation satellite system (GNSS) radio frequency interference (RFI), and outlined an ICAO roadmap that includes short-term mitigation measures and long-term solutions. The Commission expressed grave concerns regarding the potential impacts of GNSS RFI on aviation safety, specifically noting that it has been identified as a contributing factor to three global high-risk categories of occurrence, while also recognizing the ongoing technical efforts made to mitigate its adverse effect.

24.71 The Commission also noted actions taken to address GNSS RFI and urged States, international organizations, donors and relevant stakeholders to support ICAO's ongoing efforts, through means such as providing voluntary contributions toward the validation and deployment of an implementation package (iPack) for the mitigation of GNSS RFI.

24.72 Noting the improved reporting procedure between ICAO and ITU, the Commission urged States to report GNSS RFI occurrences which cannot be resolved through routine national or international procedures to their accredited ICAO Regional Office, in addition to following the procedures outlined in the ITU Radio Regulations.

24.73 The Commission reviewed A42-WP/108, presented by ICCAIA, CANSO, IFALPA and IBAC, and co-sponsored by Flight Safety Foundation (FSF) and IFATCA; and A42-WP/204, presented by Denmark on behalf of the EU and its Member States21, the other Member States22 of ECAC, and by EUROCONTROL, and co-sponsored by Algeria, Bahrain, Canada, Comoros, Djibouti, Egypt, Iraq, Japan, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Singapore, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates, Yemen, IFALPA and FSF. The Commission agreed on the need for ICAO to expedite efforts to standardize GNSS RFI related solutions including complementary position, navigation and timing (C-PNT), signal authentication for GNSS core constellations and augmentation services.

24.74 The Commission also agreed on the need to coordinate with standards making organizations to make aircraft avionics architectures more robust and resilient to GNSS RFI and to develop requirements and supporting performance standards for time synchronization across all airborne and ground-based automated systems The Commission further invited industry to accelerate the development and implementation of the resulting solutions.

24.75 The Commission was informed that a new concept called "Digital Operational Reporting Information Service" is being developed to replace the NOTAM system and other temporary aeronautical information. This service would enable real-time and systemic collection and dissemination of GNSS interference events. Furthermore, the Commission noted that, while phraseology to be used by pilots and air traffic controllers in case of GNSS interference is published in the *Procedures for Air Navigation Services — Air Traffic* Management (PANS-ATM, Doc 4444), such phraseology is not intended to be exhaustive and pilots and ATS personnel were expected to use plain language when necessary. Nevertheless, consideration of phraseologies is included in the work

programme of the Organization. The Commission reviewed A42-WP/335, presented by IATA, IBAC and IFATCA and co-sponsored by IFALPA; and A42-WP/134, presented by China and co-sponsored by Singapore; and A42-WP/171, presented by Japan. The Commission supported the multi-faceted approach for mitigating GNSS RFI, including the development of real-time GNSS monitoring and analysis systems. The Commission also agreed that mitigation measures must be multilayered and adaptable to different operational environments. The Commission acknowledged the need to establish a comprehensive review framework to ensure the overall resilience of CNS/ATM systems and services.

24.76 The Commission reviewed A42-WP/210, presented by Brazil; and A42-WP/237, presented by Saudi Arabia and reaffirmed the importance of States adopting comprehensive strategies to enhance the resilience of navigation systems through the integration of ground-based CNS infrastructure. The Commission also emphasized the need for further guidance in defining adequate and resilient networks of CNS to ensure continuity of air navigation services, and the importance of strengthening regional and inter-regional coordination on this issue through the PIRGs.

24.77 The Commission was informed of ongoing efforts by ICAO expert groups to develop new provisions related to resilient navigation operational network (NAV RON), aiming at optimizing conventional navigation infrastructure and establishing more resilient networks. These efforts focus on defining “sufficient NAV network” and its relationship with minimum navigation operational network (NAV MON). Additionally, the NAV RON will include provisions to enhance aeronautical digital data and charts that allow pilots to fully utilize the available navigation infrastructure, based on accurate facility types and coverage. The Commission noted that capacity building activities related to NAV RON will be carried out to support States in planning and implementing the new concept.

24.78 The Commission reviewed A42-WP/190, presented by India; and A42-WP/423, presented by Argentina and supported by Belize, Bolivia (Plurinational State of), Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, Peru and Uruguay. Both papers emphasized the need for more targeted research into the performance of ground-based augmentation systems (GBAS), especially in equatorial and low-latitude regions where unique ionospheric disturbances pose significant challenges to GNSS.

24.79 The Commission was informed that the development of SARPs and guidance material related to GBAS operations in ionospherically active low-latitude regions and consideration of maintenance updates to improve GBAS performance in these areas, are already included in the work programme of the Organization. In this regard, the Commission encouraged States and research institutions to collaborate in developing required equatorial GNSS performance models. The Commission recalled that ICAO has introduced dual frequency multiple constellation (DFMC) GNSS SARPs which can improve aviation safety and resilience against space weather effects like ionospheric disturbances.

24.80 The Commission noted the need for enhancement of monitoring capabilities for solar activities and ionospheric disturbances in equatorial and low-latitude regions, which may have significant impacts on GNSS accuracy and availability. The Commission also recalled that there is an ongoing effort led by the relevant expert groups for the enhancement of space weather monitoring and forecast capabilities on a global basis.

24.81 Furthermore, the Commission agreed that the contents of A42-WP/108, A42-WP/204, A42-WP/190, A42-WP/335, A42-WP/134, A42-WP/171, A42-WP/237, A42-WP/210 and A42-WP/423 should be referred to the relevant expert groups for further consideration, with due regard to existing priorities and available resources.

24.82 In view of the overall discussion on GNSS RFI, the Commission agreed to submit, for adoption by the Plenary, the following resolution to supersede Assembly Resolution 41-8, Appendix C:

Resolution ~~A41-8~~A42-x: Consolidated statement of continuing ICAO policies and practices related to a global air traffic management (ATM) system and communications, navigation, and surveillance/air traffic management (CNS/ATM) systems

Whereas it is considered desirable to consolidate Assembly resolutions on the Organization's policies and practices related to CNS/ATM in order to facilitate their implementation and practical application by making their text more readily available *and* logically organized;

The Assembly:

1. *Resolves* that the Appendices attached to this resolution constitute the consolidated statement of continuing ICAO policies and practices related to CNS/ATM, as these policies exist at the close of the ~~41st~~42nd Session of the Assembly;

2. *Resolves* to continue to adopt, at each ordinary session of the Assembly for which a Technical Commission is established, a consolidated statement of continuing ICAO policies and practices related to CNS/ATM; and

3. *Declares* that this resolution supersedes ~~A35-15~~A41-8.

APPENDIX C

Ensuring the resilience of ICAO CNS/ATM systems and services

Whereas the CNS/ATM systems are evolving and so are the associated CNS interdependencies, threats and vulnerabilities;

Whereas the occurrences of interferences against satellite-based CNS systems and global navigation satellite system (GNSS), in particular, have significantly increased;

Whereas CNS resiliency to interference needs to be addressed at a global level with a holistic approach, ensuring an efficient and coordinated evolution between the infrastructure architecture, improved technological capabilities, civil and military operational procedures, radio regulatory authorities and civil military coordination;

Recognizing that resiliency to interference needs to be improved by maximizing the integration of all suitable ground infrastructure, space infrastructure and airborne components in a complementary and cooperative manner, to be as robust as possible to cases of satellite-based service disruption or environments where false or deceptive signals are present;

Recognizing that both the aircraft on-board and ground infrastructure complementing the satellite-based CNS systems need to be adapted to include, where appropriate, interference detection, mitigation and reporting functions to support the resolution of operationally encountered performance anomalies;

Believing that, combined with the use of the appropriate legal framework, such capabilities and measures will allow for the relevant authorities to act upon harmful interferences caused by the illegal operation of transmitters and avoid the proliferation and the use of such illegal transmitters and the misuse of test and maintenance equipment;

Believing that, with appropriate coordination and application of best practices, military and State authorities can conduct GNSS-related testing and other interventions using radio equipment as necessary and without causing an undue impact on civil aviation;

Believing that civil-military coordination should facilitate the sharing of relevant information with airspace users, especially when flying in the vicinity of a conflict zone; and

Acknowledging that loss of crew's situational awareness from malicious origin is classified as a cybersecurity threat and cannot be tolerated in civil aviation; and that intentionally sending misleading signals to replace the accurate signal is a far more serious threat to flight safety than the loss of this signal.

The Assembly:

1. *Encourages* States to transition towards optimized, secure CNS systems based on complementary integration of suitable and independent aircraft capabilities, satellite- and ground-based infrastructure which maximize resiliency and robustness to any type of interference;

2. *Encourages* standardization bodies and industry to develop appropriate interference detection, mitigation and reporting capabilities for the aircraft on-board, satellite- and ground-based CNS system components, in order to ensure higher CNS resiliency, continuity of operations and prevent any cascading effects from the use of compromised position, velocity or time data;

3. *Encourages* States to ensure that ~~sufficient~~ resilient terrestrial CNS capabilities remain available to ensure safe operations and complement aircraft-level integration of position, ~~velocity~~ navigation and time (PNT) with independent surveillance information supporting resilient and safe operations;

4. *Invites* ICAO to develop high-level principles on how to integrate CNS ground, space and on-board systems and capabilities and evolve PNT solutions to obtain more resilient positioning and timing services;

5. *Encourages* standardization bodies and industry to collaborate with ICAO in advancing PNT solutions that align with ICAO initiatives;

6. *Invites* ICAO to establish a comprehensive review framework to enhance the CNS/ATM resilience;

~~5~~ 7 Urges States to apply necessary measures to avoid the commercialization/proliferation, purchase, possession and the use of illegal transmitters such as jammers and the misuse of test and maintenance equipment which may impact CNS systems;

~~6~~ 8. *Urges* States to ensure close collaboration between aviation authorities, military authorities, service providers, radio regulatory and spectrum enforcement authorities to put in place any special measures required to ensure that the spectrum used by all CNS systems, and GNSS in particular, is free from harmful interference;

~~7~~ 9. *Urges* States to refrain from any form of jamming, or spoofing affecting civil aviation;

~~8~~ 10. *Urges* States to coordinate and notify to the maximum extent possible in advance with the air navigation services provider (ANSP) responsible for the affected airspace in case of military or other State-authorized security or defence-related operations or training, potentially causing any form of jamming, or spoofing affecting civil aviation; and

~~9~~ 11. *Urges* States and operators, when assessing the interference risks associated with conflict zones, to consider that the use of satellite-based CNS systems can potentially be impacted beyond those zones.

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