International Civil Aviation Organization

Thirty-Fifth Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/35)

Bangkok, Thailand, 25 to 27 November 2024

Agenda Item 2: Global and Inter Regional Activities

- **Update on ICAO Fourteenth Air Navigation Conference (AN-CONF/14)**

FURTHER REGIONAL COOPERATION AGAINST GLOBAL NAVIGATION SATELLITE SYSTEM RADIO FREQUENCY INTERFERENCE (GNSS RFI)

(Presented by Japan and co-sponsored by Singapore)

SUMMARY

There has been a significant increase in the number of GNSS harmful Radio Frequency Interferences (RFI) that affects civil aviation globally including the oceanic airspace. This paper identifies required regional actions recommended by AN-Conf/14 and APAC DGCA/59 and proposes calling for GNSS and Data Link Disruption Ad Hoc Group of ATM/SG to consider additional tasks in their Terms Of Reference (TOR) and encouraging participations from various fields including CNS and Safety to newly established GNSS and Data Link Disruption Ad Hoc Group of ATM/SG.

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 The Global Navigation Satellite Systems (GNSS) has become an essential enabler for Performance-Based Navigation (PBN) and Automatic Dependent Surveillance-Broadcast (ADS-B). By providing accurate and reliable positioning and timing information, GNSS is used for various aircraft avionics systems.

1.2 While dependence on GNSS is increasing, there has been a significant increase in the number of GNSS harmful Radio Frequency Interferences (RFI) that affects civil aviation globally including the oceanic airspace. GNSS interference events will generally result in the position of the aircraft to be reflected incorrectly on the controller's display (due to erroneous returns from the onboard transponder) or missing reports/updates. Besides established procedures for ATCOs to handle such scenarios, there is a need to establish a reporting mechanism for States to track such events and activate appropriate contingency mitigation measures to ensure safe operations of air traffic.

1.3 Japan experienced multiple events of the degradation of on-board GNSS performance for around 40 aircraft on multiple routes near the southeastern offshore of Hokkaido in the oceanic airspace from September 22 to October 12 in 2021. While the detailed description was reported in the WP/198 titled "Mitigation of GNSS vulnerabilities" presented by Japan at 41st session of the ICAO Assembly in October 2022, the causes of the event have been investigated; unfortunately, the cause could not be identified.

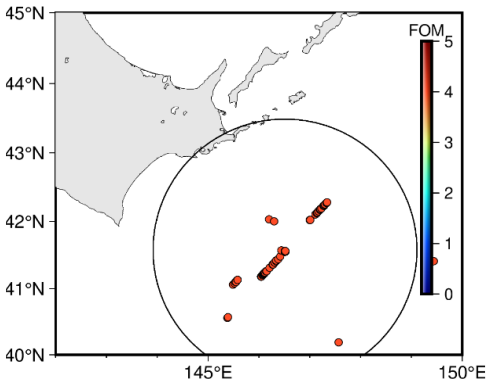

Figure 1. ADS-C degradation area

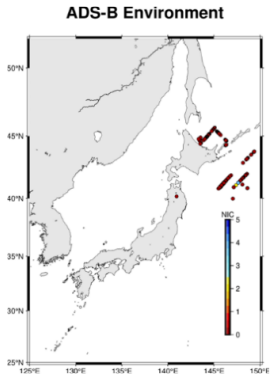

Figure 2. ADS-B degradation area

1.4 This working paper introduces several recommendations and decisions of ICAO related meetings regarding regional cooperation against RFI events and proposes further actions by APANPIRG.

2. DISCUSSION

2.1 The 14th Air Navigation Conference (AN-Conf/14), held in Montreal, Canada, 26 August to 6 September 2024, expressed concerns to the recent escalation of GNSS jamming and spoofing, and recommended as Rec. 2.2/2 that States:

a) ensure that effective global navigation satellite system radio frequency interference mitigation measures are implemented, based on measures developed by ICAO and industry, including the need 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;

b) through the mechanism of the planning and implementation regional groups, develop regional global navigation satellite system reporting mechanisms, to the extent feasible, to raise operational awareness of affected geographical areas as described in the Global Navigation Satellite System (GNSS) Manual (Doc 9849);

c) work with industry to identify means to make aircraft systems more resilient to radio frequency interference events, and to provide guidance on detecting GNSS jamming or spoofing and maintaining safe and efficient aircraft operation in case of GNSS anomalies; and

d) Review aircraft minimum equipage lists to ensure compatibility with States' implemented minimum operational networks.

2.2 The 59th APAC DGCA Conference (DGCA/59), held in Cebu, Philippines, 14-18 October 2024, also acknowledged that GNSS RFI and spoofing events jeopardize the safety and resiliency of airspace operation, and agreed with Action Item 59/15 that the conference urged States/Administrations to:

a) take appropriate actions to detect and mitigate GNSS RFI sources;

b) monitor, report, and share GNSS spoofing/RFI events and best practices of mitigation measures through APANPIRG;

c) maintain adequate conventional Ground Based Navigation Aids (GBNA)/minimal operational networks (MONs) to support aircraft navigation;

d) foster enhanced cooperation and collaboration with military; and

e) bring proposals for improvement in RT phraseology to relevant ICAO forum.

2.3 Prior to An-Conf/14 and DGCA/59, the CNS SG/28 of APANPIRG, held in July 2024, noted that its Spectrum Review Working Group (SRWG/8) agreed to adopt the example forms for GNSS RFI Reporting to the States in Attachment to Appendix F of Global Navigation Satellite System (GNSS) Manual (Doc 9849) Edition 4. The SRWG/8 also develops the APAC Regional Aeronautical Radio Frequency Management Guidance Material Edition 1.1.

2.4 The ATM SG/12 of APANPIRG, held in September 2024, also decided to establish Procedures for GNSS and Data Link Disruption Ad Hoc Group. The initial tasks identified for the Ad hoc group are:

a) collect data on GNSS and data link disruption in APAC Region; and

b) develop the procedures for GNSS and data link disruption that include (but not limited to) the need for:

- reporting process by airspace users to ATS units; and
- sharing of information between stakeholders.

2.5 The following table summarizes the actions requested by AN-Conf/14 and DGCA/59 and the current status of tasks for SRWG of CNS/SG and GNSS and Data Link Disruption Ad Hoc Group of ATM/SG.

Table. Comparison table between required actions and tasks of APANPIRG subgroups

No.	Rec 2.2/2 of AN-Conf/14 or *Action Item 59/15 of DGCA/59 (in italics)*	SRWG of CNS/SG	GNSS and Data Link Disruption Ad Hoc Group of ATM/SG
1	• Develop regional global navigation satellite system reporting mechanisms. • *Monitor, report, and share GNSS spoofing/RFI events.*	Established forms for GNSS RFI Reporting	Included
2	• Work with industry to identify means to make aircraft systems more resilient to radio frequency interference events, and to provide guidance on detecting and mitigate GNSS jamming or spoofing. • *Share best practices of mitigation measures.*	Not included	Not included
3	• Work with industry to provide guidance on maintaining safe and efficient aircraft operation in case of GNSS anomalies. • *Bring proposals for improvement in RT phraseology to relevant ICAO forum.*	Not included	Not included

4	• Review aircraft minimum equipage lists to ensure compatibility with States' implemented minimum operational networks. • *Maintain adequate conventional Ground Based Navigation Aids (GBNA)/minimal operational networks (MONs) to support aircraft navigation.*	Not included	Not included
5	• *Foster enhanced cooperation and collaboration with military.*	Not included	Not included

*GNSS and Data Link Disruption Ad Hoc Group of ATM/SG will also address datalink disruption issues in addition to GNSS disruption.

2.6 While the AN-Conf/14 calls for the planning and implementation regional groups (PIRG) to develop regional global navigation satellite system reporting mechanisms (No. 1 item in the above table), other items (No. 2 – No.5) are asked each State to address by itself. Japan believes it better that APANPIRG initiate to consider not only No.1 item but also other No.2-No.5 items and produce (not limited to) common guidance material to harmoniously and effectively address GNSS RFI as a region.

2.7 Japan and Singapore welcome the establishment of GNSS Data Link Disruption Ad Hoc Group (hereafter called Ad Hoc Group) of ATM SG and is ready to contribute to this activity. While the current task of the Ad Hoc Group only covers No.1 item on the above table, but No.2-No.5 items are not yet specifically described. Therefore, Japan and Singapore propose that the Ad Hoc Group consider the inclusion of items No.2-No.5, or parts thereof, in their Terms Of Reference (TOR). Since developing a methodology for detecting and mitigating GNSS jamming or spoofing etc. may require CNS and Safety expertise, States should consider sending participants from various fields including CNS and Safety, on top of ATM experts.

3. ACTION BY THE MEETING

3.1 The Meeting is invited to:

a) note the information contained in this paper;

b) recognize the importance of a regional cooperation against GNSS RFI;

c) call for GNSS and Data Link Disruption Ad Hoc Group of ATM/SG to consider if No.2-No.5 items on Table in the section 2.5 can be included in their terms of reference; and

d) encourage participations from various fields including CNS and Safety to newly established GNSS and Data Link Disruption Ad Hoc Group of ATM/SG.

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