*International Civil Aviation Organization*

**Thirteenth Meeting of the Air Traffic Management Sub-Group (ATM/SG/13) of APANPIRG**

Singapore, 25 – 29 August 2025

**Agenda Item 5: ATM Systems (Modernization, Seamless ATM, CNS, ATFM)**

# IMPACT ASSESSMENT OF GNSS RFI

(Presented by Pakistan)

**SUMMARY**

The paper highlights the importance of conducting impact assessment for portion of airspace and/or aerodrome to mitigate existing challenge of GNSS RFI. The impact assessment can enable the States and ANSP to analyze gaps and taking appropriate mitigation measures to ensure safety and efficiency. This working paper invites the States to share their best practices and request ICAO Asia/Pacific Regional Office to provide further guidance on the subject.

## 1. INTRODUCTION

1.1 The importance of GNSS being key enabler for Performance-based Navigation (PBN) cannot be overemphasized. However, the ongoing GNSS RFI issue has created a new challenge for aviation industry. Various international forums have highlighted the need to create awareness of GNSS RFI, including jamming and spoofing, and proposed various recommendations for mitigation. It is imperative that airline operators and ANSP analyze their existing airline operational planning and CNS/ATM infrastructure respectively for anticipating possible effects, analyze available alternate options, perform gap analysis and possible additional action to further strengthen and support seamless aircraft operation and navigation.

## 2. DISCUSSION

Assessing the Impact of GNSS Outage/Interference

2.1 While the recommendation as an outcome of various forums are enabling the handling of increasing challenge of GNSS RFI, it is also important that GNSS outage/Interference impact is assessed in particular airspace and/or at an aerodrome. The impact may depend on various factors, including but not limited to:

a) type of airspace – Controlled, Uncontrolled;

b) air traffic density – low, medium or high number of affected aircraft;

c) level of service – Air Traffic Control Service, Flight Information Service;

d) extent of outage;

e) weather conditions; and

f) communication, navigation and surveillance infrastructure (detail in para 2.1.4).

2.2 The impact of GNSS outage/interference may vary from airline operator's perspective to ANSP's perspective. However, there may be some common considerations for both with respect to aircraft operation for different phases of flights.

2.3 The airline operator's perspective may include taking into account followings:

a) required PBN navigation specification for enroute, terminal and approach such as RNP 10, RNAV 5, RNP APCH etc.;

b) minimum equippage requirements for portion of airspace concerned such as ADS-B, ADS-C, CPDLC;

c) types of airspace – remote and/or oceanic;

d) GNSS RFI affected areas in enroute and destination/alternate aerodrome, generally notified through NOTAM, AIP Supplements or otherwise known; and

e) navigational aids infrastructure in enroute and destination aerodrome including alternate aerodromes.

2.4 The **Table 1** has been used by Pakistan for impact assessment and the relevant outcomes made for portion of airspace around and at Jinnah International Airport, Karachi, Pakistan (JIAP), with respect to impact of GNSS Interference and availability of alternate arrangements.

**Table 1: Impact Assessment of GNSS Interference and Alternate Arrangements Around JIAP**

| Karachi FIR/ TMA /Aerodrome | Communication | | Navigation | | Surveillance | | Remarks/ gap analysis (if any) | Outlook/ Action Items (if any) |
|---|---|---|---|---|---|---|---|---|
| | Conventional | GNSS (Dependent) | Conventional | Area Navigation /PBN NAV Specification | Conventional | GNSS (Dependent) | | |
| Enroute (ATS Route structure) | VHF ✓<br>HF □ | ADS-C □<br>CPDLC □ | VOR/DME ✓ | GNSS✓<br>DME/DME<br>VOR/DME ✓<br>RNP 10 ✓<br>RNAV 5 ✓<br>RNP 4 □<br>RNP 2 □ | SSR ✓<br>PSR □ | ADS-B ✓ | • Surveillance coverage on G452 beyond Kalat is based on ADS-B<br>• VOR/DMEs located at RK, NH, PG, KC<br>• VHF Full coverage AVBL | Environment is resilient with existing CNS infrastructure |
| Terminal (STARs) | VHF ✓ | ADS-C □<br>CPDLC □ | VOR/DME ✓ | GNSS✓<br>DME/DME<br>VOR/DME ✓<br>RNP 1 ✓<br>RNAV 1 □ | SSR ✓<br>PSR ✓ | ADS-B ✓ | • Both PBN & conventional STARs AVBL<br>• PBN holdings & conventional holding AVBL | Environment is resilient with existing CNS infrastructure<br><br>Improvement may be made with DME/DME navigation solution. |
| Final Approach | VHF ✓ | ADS-C □<br>CPDLC □ | ILS ✓<br>VOR/DME ✓ | GNSS✓<br>RNP APCH✓ | SSR ✓<br>PSR ✓ | ADS-B ✓ | • ILS & VOR/DME App for RWY 25L/25R AVBL<br>• RNP Approach for all 4 Ends of two runways AVBL<br>• VOR/DME App not available for 07R/07L | **For 25L/R**<br>Environment is resilient with existing CNS infrastructure<br><br>**For 07R/07L**<br>VOR/DME App not feasible due to airspace constraints, Radar vectoring for visual approach & circling approach AVBL as alternate. |

| Karachi FIR/ TMA /Aerodrome | Communication | | Navigation | | Surveillance | | Remarks/ gap analysis (if any) | Outlook/ Action Items (if any) |
|---|---|---|---|---|---|---|---|---|
| | Conventional | GNSS (Dependent) | Conventional | Area Navigation /PBN NAV Specification | Conventional | GNSS (Dependent) | | |
| Terminal/ Departure | VHF ✓ | ADS-C □<br>CPDLC □ | VOR/DME ✓ | GNSS RNP1 ✓ | SSR ✓<br>PSR ✓ | ADS-B ✓ | • RNP 1 SIDS for all 4 ends of two Runways<br>• Conventional SIDS for all 4 ends of two runway AVBL | Environment is resilient with existing CNS infrastructure & ATM procedures Improvement may be made with DME/DME navigation solution. |

2.5 The use of any suitable framework/tool for impact assessment can enable the ANSPs to create a generic outlook and assess the current status of Minimum Operational Networks (MON) of conventional navigational aids and its retention and further strengthen, where required as per the recommendations out of various global events. The tool can identify requirement for additional Instrument Flight Procedures (IFPs) and/or ATM procedure for particular aerodrome/airspace.

2.6 It is clarified that impact assessment discussed herein may not replace the need to carry out safety risk assessment (if required) due to any emerging safety risk in particular airspace and/or aerodrome such as increase number of low-level go around due to false Enhanced Ground Proximity Warning System (EGPWS) warning, incidents of loss of separation due to uncoordinated climb etc. However, it provides an opportunity for ANSPs to identify gaps, analysis and taking appropriate mitigation actions in the form of alternate arrangement to manage the existing challenge of GNSS RFI.

## 3. ACTION BY THE CONFERENCE

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) share the best practices and lesson learned on subject;

c) request ICAO Asia/Pacific Regional Office to arrange workshop/webinar for stakeholders to share best practices and lesson learned especially with regards to conduct of generic impact assessment and/or safety risk assessment vis-à-vis GNSS RFI from ATM/CNS perspective; and

d) discuss any relevant matters as appropriate.

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