



**WORKING PAPER**

**FOURTEENTH AIR NAVIGATION CONFERENCE**

**Montréal, Canada, 26 August to 6 September 2024**

- Agenda Item 2: Timely and safe use of new technologies**  
**2.2: Addressing safety risks related to evolving aviation technologies**

**GLOBAL NAVIGATION SATELLITE SYSTEM RADIO FREQUENCY INTERFERENCE  
(GNSS RFI)**

(Presented by International Air Transport Association (IATA), International Business Aviation Council (IBAC), International Coordinating Council of Aerospace Industries Associations (ICCAIA), International Federation of Air Line Pilots' Associations (IFALPA), International Federation of Air Traffic Controllers' Associations (IFATCA) and International Federation of Air Traffic Safety Electronics Associations (IFATSEA))

**EXECUTIVE SUMMARY**

During the International Telecommunications Union (ITU) World Radiocommunications Conference (2023) (WRC-23) (20 November to 15 December 2023, Dubai, United Arab Emirates), the ITU issued a resolution on global navigation satellite system (GNSS) radio frequency interference (RFI). However, that resolution recognizes the right of States, as per the ITU Constitution, to interfere with Radio Navigation Satellite Service (RNSS) for security purposes. Therefore, non-NOTAM interference with GNSS is unlikely to decrease in the near term due to the number of conflict zones, globally.

Deliberate and non-NOTAM interference with essential GNSS based navigation has drastic impacts on civil aviation operations and creates high safety risks for flight crew and passengers.

This paper proposes actions to ensure that deliberate interference with GNSS is reduced to the extent possible.

**Action:** The Conference is invited to agree to the recommendations in paragraph 4.

**1. INTRODUCTION**

1.1 Since the inception of satellite navigation, the aviation industry as well as ICAO have been moving towards an operational environment whereby global navigation satellite system (GNSS) is central to air navigation, based on the assumption that it provides required navigation and timing performance for a wide range of flight procedures and exhibits the required level of availability.

<sup>1</sup> Arabic, Chinese, English, French, Russian and Spanish versions provided by IATA.

1.2 Based on this transition to GNSS for a significant portion of navigation and timing requirements, airlines, and air navigation services providers (ANSPs) have worked to rationalize ground-based navigation aids (GBNA) towards a minimal operational network (MON).

## 2. DISCUSSION

### 2.1 GNSS RFI – persistent consequences

2.1.1 Mitigating against GNSS radio frequency interference (RFI) has become a critical risk management activity for airlines with few pragmatic options currently available to guarantee operational integrity, considering increasing levels of deliberate RFI, jamming, and spoofing. This is unlikely to change in the near term due to the number of conflict zones, globally.

2.1.2 Differences in avionic suites and disparate airline specific pilot actions adds layers of complexity to in-flight procedural mitigation, as does the varying approaches to certifying contingency procedures by State regulators.

2.1.3 The airspace where GNSS becomes unusable also plays a significant role in determining the process of reverting from GNSS to traditional ground-based navigation aids. Losing other GNSS dependent avionic capabilities and services may elevate safety concerns when operating in oceanic and remote airspace.

2.1.4 Even in continental airspace with available fallback GBNA, issues with aircraft systems such as TAWS also elevates the risks to safety of flight.

2.1.5 Using a sample size of approximately 370 000 flights, IATA data shows that when exposed to RFI, airborne GNSS receiver recovery time can, in a significant number of cases, exceed 30 minutes with consequent elevation in the risk of operational disruption. Some aircraft/GNSS receiver combinations may need a ground maintenance reset to restore normal GNSS operation.

2.1.6 In some instances, the NAT being a case in point, aircraft may be refused entry into oceanic airspace if GNSS derived services are deficient, e.g., loss of data comm prior to oceanic entry waypoint.

2.1.7 Even though the 40th Session of the ICAO Assembly urged States to coordinate with the air navigation services provider (ANSP) responsible for the affected airspace (in cases of military or other State-authorized security or defence-related operations or training potentially causing any form of jamming or spoofing), this coordination can only be pragmatically achieved if ANSPs are given timely and appropriate notice. In many cases, it is the deliberate non-NOTAM interference which presents the greatest challenge to ANSPs, airlines and controllers.

2.2 At a regional level ICAO has issued State Letters referencing airspace subject to GNSS RFI and encouraging relevant State rectification action. ICAO State letter E 3/5-24/54, dated 30 April 2024 and Corrigendum of 13 May 2024, addresses the issue at a global scale since, GNSS RFI is now a widespread phenomenon across multiple regions and airspace blocks.

### 2.3 GNSS RFI – NOTAM code limitation

2.3.1 NOTAM selection criteria for CNS facilities are prescribed in the ICAO *Aeronautical Information Services Manual* (Doc 8126), Appendix G — *NOTAM selection criteria*, particularly the fourth and fifth letters, which contain a code (LF) that specifies that an interference event is impacting the CNS

facility. Unfortunately for the category: CNS - GNSS Services (G), there is no code for GNSS interference events.

2.3.2 As a result, in the event of GNSS RFI, issued NOTAMs contain variant Q Codes and non-uniform significations. For example, GNSS RFI are described in these NOTAMs with words like: “GPS Unreliable,” “GPS Jamming,” “GPS signal interference,” “GNSS interference,” and lack an appropriate code dedicated to interference. This diversity creates challenges for operators attempting to identify and search in NOTAMs for information about GNSS interference events since there is no standardized code format. Doc 8126 should therefore be modified to include a standardized mechanism to report GNSS RFI. Further, as the operator response to reported interference may differ to that for spoofing, different codes should be formulated for the two categories.

#### **2.4 ICAO State Letter Ref.: E 3/5-24/54 dated 30 April 2024 — Aviation safety concerns regarding interference to the Global Navigation Satellite System (GNSS) and Corrigendum of 13 May 2024**

2.4.1 ICAO issued this State Letter to again highlight the critical operational issues associated with GNSS interference, and to foster discussions on the management of GNSS vulnerabilities and potential mitigation measures.

2.4.2 At the ICAO EUR/MID Radio Navigation Symposium, held from 6 to 8 February 2024 in Antalya, Turkey, a list of recommendations regarding stakeholders continued efforts towards ensuring safe, reliable, and resilient air navigation was developed. This list of recommendations is included as an attachment to the April 2024 ICAO State letter E 3/5-24/54 and Corrigendum of 13 May 2024.

### **3. CONCLUSION**

3.1 A significant portion of current GNSS RFI is military in nature and advanced coordination with civil aviation authorities is not always possible. Therefore, safety of flight consideration is driving additional investigation into alternate positioning navigation and timing (APNT) options. However, pragmatic implementation of globally applicable APNT is not a viable near-term solution to GNSS RFI.

3.2 Despite ICAO and ITU resolutions, the aviation sector is still suffering from GNSS RFI, and therefore additional measures and actions are needed to ensure safety.

### **4. ACTION BY THE MEETING**

4.1 The Conference is invited to agree to the following recommendations:

That States:

- a) ensure that necessary action is taken to reduce to the extent possible interference with essential global navigation satellite system (GNSS) based navigation and timing services in the interests of the safety of civil aviation;
- b) continue to update operators regarding what conventional ground-based navigation aids (GBNA) are available and what alternative procedures can be used based on those GBNA should an aircraft experience interference;
- c) maintain adequate infrastructure to enable aircraft operator use of conventional navigation aids during GNSS radio frequency interference (RFI) jamming or spoofing;

- d) work with aircraft and avionics manufacturers to provide additional recommendations for pilot mitigations to in-flight GNSS RFI;
- e) foster enhanced civil-military coordination and cooperation to mitigate GNSS RFI;

that ICAO:

- f) in recognition of the serious threat to civil aviation, elevate its engagement with Member States to ensure effective mitigation and contingency planning measures are implemented where and when needed;
- g) amend relevant documentation including:
  - 1) safety advisories to reflect the latest statistical data on GNSS RFI occurrences to include location, operational impact, and assessed mitigation effectiveness; and
  - 2) NOTAM selection criteria for GNSS services at *Aeronautical Information Services Manual* (Doc 8126), Appendix G — *NOTAM selection criteria*, to include specific signification for GNSS interference and spoofing conditions.

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