



Agenda Item 6: Other Matters

BRAZILIAN PLAN FOR THE IMPLEMENTATION OF A MINIMUM OPERATIONAL NETWORK (MON) IN RESPONSE TO GNSS DISRUPTIONS

(Prepared by Brazil)

SUMMARY

This Information Paper presents the initiative undertaken by Brazil for the establishment of a Minimum Operational Network (MON), aligned with ICAO recommendations and based on DECEA's official plan (PCA 100-5), to ensure safe and continuous air navigation services in the event of GNSS interference or failure.

References:

- ICAO 41st Assembly Resolution A41-8
- Doc 10209, Report of the Fourteenth Air Navigation Conference
- Doc 9750, Global Air Navigation Plan (GANP)
- PCA 100-5, Minimum Operational Network (MON) Implementation Plan in Response to GNSS Failure, DECEA - Brazil

1. Background

1.1 Modern aviation relies heavily on the Global Navigation Satellite System (GNSS) for precise navigation, positioning and time synchronization, which contributes to the safety and efficiency of air operations. However, civil aviation faces a growing threat from Radio Frequency Interference (RFI). ICAO has recognized the need for Member States to implement mitigation strategies, including terrestrial-based contingency infrastructures.

1.2 In line with Block ASBU NAVS-B0/4 – Navigation Minimal Operating Networks (Nav. MON), ICAO Resolution A41-8 and ANC Recommendation related to Global Navigation Satellite System Interference and Contingency Planning, Brazil has developed and approved a National Plan - PCA 100-5 - to implement a Minimum Operational Network (MON). This network aims to ensure the continuity of airspace operations in the event of partial or total loss of the GNSS signal, through ground-based navigation aids and conventional procedures.

2. Analysis

2.1 Since 2003, ICAO has recognized the threat of interference in GNSS and, through resolution A41-8, highlighted the need for resilience in CNS/ATM systems.

2.2 GNSS RFI has become increasingly frequent and sophisticated, potentially affecting multiple CNS/ATM systems. Jamming (signal blocking) and spoofing (sending false signals) events rose dramatically since 2022. These disruptions may compromise onboard systems like Automatic Dependent

Surveillance-Broadcast (ADS-B), Controller-Pilot Data Link Communications (CPDLC), Terrain Avoidance and Warning System (TAWS), with cascading impacts on air traffic capacity and safety margins.

2.3 Aircraft equipped with highly integrated avionics are especially vulnerable. Responses are not always automatic and can propagate across FIR boundaries, demanding cross-border contingency coordination and robust ground infrastructure.

2.4 The 14th ICAO ANC recommended that States ensure the implementation of effective mitigation measures for radiofrequency interference with the global navigation satellite system, 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 periods of interference with the global navigation satellite system. Furthermore, it was directed that, through the mechanism of regional planning and implementation groups, they develop regional global navigation satellite system reporting mechanisms, to the extent possible, to increase operational awareness of affected geographic areas, as described in the Global Navigation Satellite System (GNSS) Manual (Doc. 9849).

2.5 In this context, Brazil has developed and approved the **PCA 100-5**, a comprehensive plan that establishes the structure, procedures and responsibilities for the implementation of a **Minimum Operational Network (MON)**. The MON aims to ensure the **continuity and safety of air navigation operations in case of GNSS failure**, using terrestrial navigation infrastructure and conventional procedures such as DME/DME, DME/DME/IRU, VOR/DME, ILS and SID OMNI.

2.6 DECEA has invested in expanding the DME aid network, aiming to provide complementary/backup ground infrastructure to GNSS for PBN navigation (relying on the use of aircraft inertial sensors).

2.7 The **MON structure includes procedures for all phases of flight** — departure, en-route, arrival, and approach — ensuring a robust contingency environment. The Plan also provides for radar vectoring and adjustment of aircraft separation when necessary, training of air traffic controllers and pilots, and the publication of NOTAM templates to inform stakeholders about GNSS interference events.

2.8 The MON implementation plan in Brazil is comprehensive and encompasses:

- a) Strategic positioning of terrestrial aids to cover critical traffic flows and major aerodromes;
- b) Development and publication of MON procedures by the Aeronautical Charting Institute (ICA);
- c) Revision of contingency plans by Area Control Centers (ACC), Approach Control (APP), and the Air Navigation Management Center (CGNA);
- d) Monitoring and operational readiness of DME/VOR/ILS infrastructure;
- e) Training programs and simulation exercises through Simulation Laboratory Employment Program; and
- f) Continuous maintenance and periodic review of MON assets.

2.9 The Brazilian Plan establishes that full implementation of the MON should be completed **by December 31, 2026**, following a phased approach and actions defined in a responsibility matrix. Intermediate milestones include the design and publication of air navigation procedures for terminal areas such as Belo Horizonte (TMA BH), Brasília (TMA BR), Curitiba (TMA CT), Porto Alegre (TMA PA),

São Paulo (TMA SP), Rio de Janeiro (TMA RJ), and others, as well as the publication of RNAV 5 routes based on DME/DME and DME/DME/IRU.

2.10 It is important to emphasize the importance of airlines being prepared for this scenario of navigation based exclusively on ground aids, with aircraft equipped to operate with **ILS, VOR/DME** and **DME/DME/IRU**, ready to act as primary backup in case of GNSS failure.

3. **Suggested actions**

3.1 The meeting is invited to recognize Brazil's progress in establishing a Minimum Operational Network of Air Navigation Aids and other related actions aimed at ensuring aviation safety in cases of GNSS failures or interference.

— END —