



INTERNATIONAL CIVIL AVIATION ORGANIZATION

Twenty-Seventh Meeting of the Africa-Indian Ocean Planning and Implementation Regional Group (APIRG/27)

5 - 6 November 2024

Agenda item 3: Implementation of air navigation objectives, targets and indicators, including the priorities set out in the regional air navigation plan

Navigation infrastructure: Global Navigation Satellite System (GNSS) Interference and contingency planning

(Presented by the Secretariat)

SUMMARY	
<p>This working paper reports on the deliberations of the Fourteenth ICAO Air Navigation Conference (AN-Conf/14) on Agenda item 2.2 (Safe and timely use of new technologies - Addressing safety risks related to evolving aviation technologies), with a focus on interference to the Global Navigation Satellite System (GNSS) and contingency planning.</p> <p>Action by the meeting is contained in paragraph 3.</p>	
REFERENCE(S)	<p>Fourteenth ICAO Air Navigation Conference (AN-Conf/14), Montreal, 26 August to 6 September 2024</p> <p>ICAO State Letter ref. E 3/5-24/54 dated 30 April 2024</p>
<i>Strategic Objectives</i>	<p>A- Aviation Safety</p> <p>B- Air Navigation Capacity and Efficiency</p>

1. INTRODUCTION

- 1.1. The satellite navigation system forms an integral part of the radionavigation strategy in the Africa-Indian Ocean (AFI) Region and plays a central role in air navigation, based on the assumption that it provides the required navigation and synchronization performance for a wide range of flight procedures, and that it meets the required reliability level.
- 1.2. As a result, the rationalization of terrestrial navigation aids with the aim of establishing a minimum operational network includes the increased use of GNSS procedures, the main objective being to reduce the number and type of ground aids, as well as their maintenance costs, and to improve the accuracy and reliability of navigation. However, the increase in unpublished GNSS radio frequency interference (RFI) on a global and regional scale is jeopardizing the achievement of this goal.

- 1.3. In view of the associated high safety risks, the Conference considered the effects of radio frequency interference (RFI) to the Global Navigation Satellite System (GNSS), as presented in several working papers submitted by Member States, international and regional organizations and professional associations of the aviation industry.
- 1.4. The meeting may wish to recall that the ICAO Secretary-General's State Letter ref. E 3/5-24/54 dated 30 April 2024, calling the attention of States to the crucial issue of interference to GNSS and informing them of the results of the EUR/MID Symposium on Radio Navigation held from 6 to 8 February 2024, in Antalya (Türkiye). Important outcomes of the said symposium include relevant recommendations on the efforts that all stakeholders are called upon to continue to ensure the safety, reliability and resilience of air navigation.

2. DISCUSSION

Interference to the Global navigation satellite system

- 2.1. The Conference expressed significant concerns with the recent escalation of GNSS jamming and spoofing, and the significant safety risk it poses to civil aviation operations, particularly on areas surrounding conflict zones. The Conference recalled the need for States to abide by the measures adopted under the International Telecommunication Union (ITU) Constitution and Convention and the ITU Radio Regulations to reduce, where possible, the likelihood of such interference and to notify aviation authorities, regulators and air navigation services providers regarding any GNSS jamming.
- 2.2. The Conference also recommended that States develop regional GNSS RFI reporting procedures through the planning and implementation regional groups, leveraging the existing guidance material contained in the Global Navigation Satellite System (GNSS) Manual (Doc 9849) to raise awareness of geographic areas of GNSS interferences and to use this information in the context of planning contingency operations.
- 2.3. The Conference was informed that work was ongoing within ICAO to develop a concept of operations for next generation equipment functions to enable an aircraft on-board detection of GNSS RFI and the provision of a status downlink to air traffic control units. Furthermore, it encouraged States to consider deploying monitoring and reporting mechanisms for GNSS RFI events. The Conference noted the ongoing work to develop a related update to the GANP navigation systems Aviation System Block Upgrade thread.
- 2.4. The Conference requested ICAO to continue assessing the impact of GNSS interference on aviation safety and continuity of civil aviation operations; define adequate mitigation measures while reminding States of their obligations; and to develop guidance material to facilitate, to the extent feasible, the exchange of GNSS RFI information through a centralized repository, as well as the notification about GNSS harmful interference from military authorities to civil aviation, and additional NOTAM codes for GNSS interference events.
- 2.5. Considering the impact of GNSS RFI on aircraft in-flight, the Conference agreed with the proposal for States to work with aircraft and avionics manufacturers on providing further guidance to maintain safe and efficient aircraft operations in case of disruption caused by GNSS RFI. It also agreed to consider how aircraft systems may be made more resilient to RFI events and ensure that GNSS navigation capability is resumed as quickly as possible.

Navigation infrastructure and contingency planning

- 2.6. The Conference also discussed rationalization of existing navigation infrastructure and the need for contingency planning, particularly in respect of GNSS outages.
- 2.7. The Conference agreed on the importance of establishing and maintaining a sufficient network of conventional navigation aids, supported by VHF Omnidirectional Range (VOR), Distance Measuring Equipment (DME) and Instrument Landing System (ILS) facilities, to ensure operational safety as well as sufficient airspace capacity during times of GNSS interference. Considering the need to phase out legacy navigation systems, the Conference agreed that the removal of such systems should take into account the need for effective GNSS RFI mitigation, and that aircraft minimum equipage lists would need to be updated to reflect this requirement.
- 2.8. The Conference was informed that work was ongoing within ICAO on developing an implementation package (iPack) for mitigation of GNSS RFI to assist States in managing GNSS RFI incidents and to ensure continued, safe and regular provision of air navigation services during disruptions caused by GNSS RFI.
- 2.9. The Conference requested ICAO to continue awareness activities on GNSS RFI and noted the planned regional workshops.
- 2.10. As a result of the discussion, the Conference agreed on the recommendations provided in Appendix to this working paper.

3. ACTION BY THE MEETING

- 3.1 The meeting is invited to:
 - a) Take note of the information contained in this working paper; and
 - b) Urge Member States to implement the recommendations of the Fourteenth Air Navigation Conference (AN Conf/14) on interference to the Global Navigation Satellite System (GNSS) and contingency planning.

APPENDIX

FOURTEENTH AIR NAVIGATION CONFERENCE (ANCONF/14)

Recommendation 2.2/2 – Addressing global navigation satellite system interference and contingency planning

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 raise operational awareness of affected geographical areas, to the extent feasible, 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 global navigation satellite system jamming or spoofing and maintaining safe and efficient aircraft operation in case of global navigation satellite system anomalies; and
- d) review aircraft minimum equipage lists to ensure compatibility with States' implemented minimum operational networks.

That ICAO:

- e) continue to assess the impact of global navigation satellite system interference on aviation safety and continuity of civil aviation operations and define adequate mitigation measures, while reminding States of their obligations;
- f) develop a standardized implementation package to assist and guide States in implementing effective global navigation satellite system radio frequency interference mitigation measures, including optimization and rationalization of conventional navigation aids, commensurate with their local conditions, to ensure continuity in the provision of air navigation services;
- g) develop guidance on GNSS interference information exchange and civil-military coordination in relation to harmful interference to global navigation satellite system(s) originated or detected by military authorities; and
- h) develop recommendations for globally harmonized minimum aircraft equipage lists to ensure that provided navigation infrastructure can be used by airspace users in line with available air traffic services.