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INTERNATIONAL CIVIL AVIATION ORGANIZATION
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ICAO EUR/NAT Briefing on GNSS RFI

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ICAO EUR/NAT

ICAO EUR/NAT/MID GNSS RFI Workshop
Doha, 18-20 November 2025

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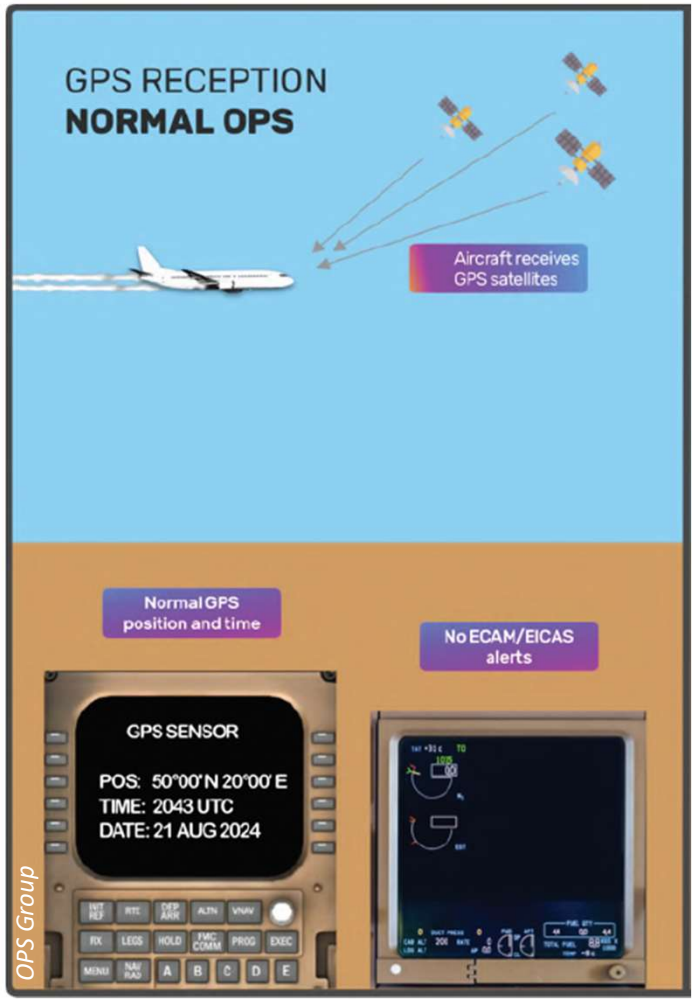
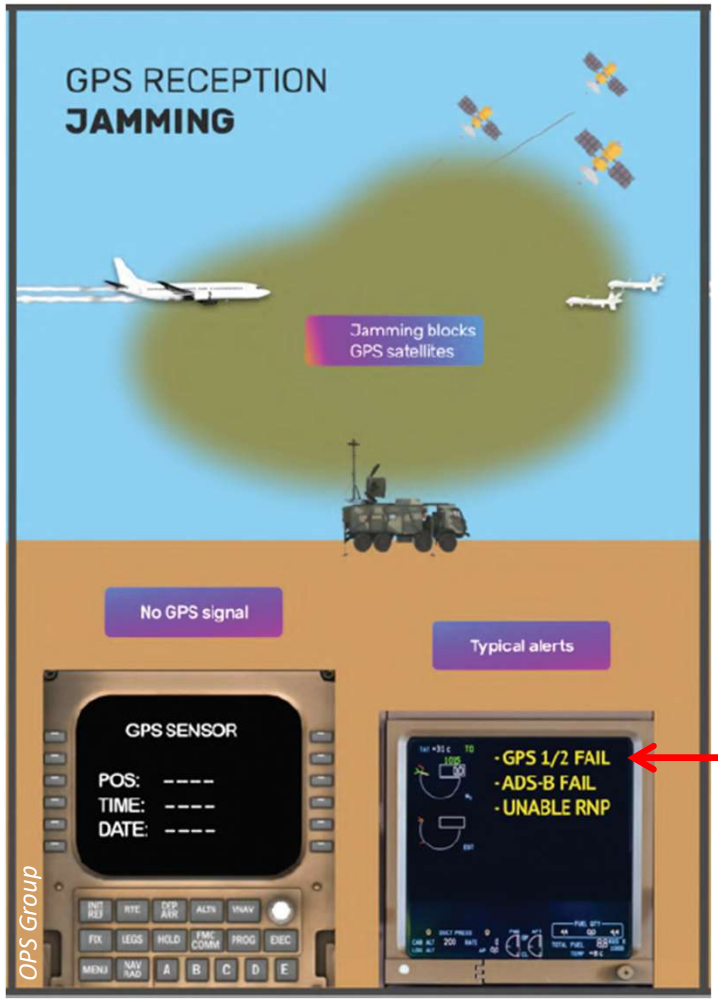
Definitions: GNSS



GNSS: A worldwide **position and time determination system** that includes one or more **satellite constellations**, **aircraft receivers** and **system integrity monitoring**, augmented as necessary to support the required navigation performance for the intended operation. (*Annex 10, Volume I*)

- **Normal operation**: Aircraft GPS receiver uses signals from multiple satellites to compute and provide accurate position, navigation, and timing (PNT) to avionics. (*OPS GROUP*)

Definitions: JAMMING



Jamming: An **intentional RFI** with GNSS which **prevents receivers from locking onto satellites signals** and has the main effect of **rendering the GNSS system ineffective or degraded** for users in the jammed area. (*ICAO NSP*)

- **GPS jamming**: A ground-based transmitter emits noise on GPS frequencies → receiver loses satellite signals and PNT becomes unavailable. (*OPS GROUP*)

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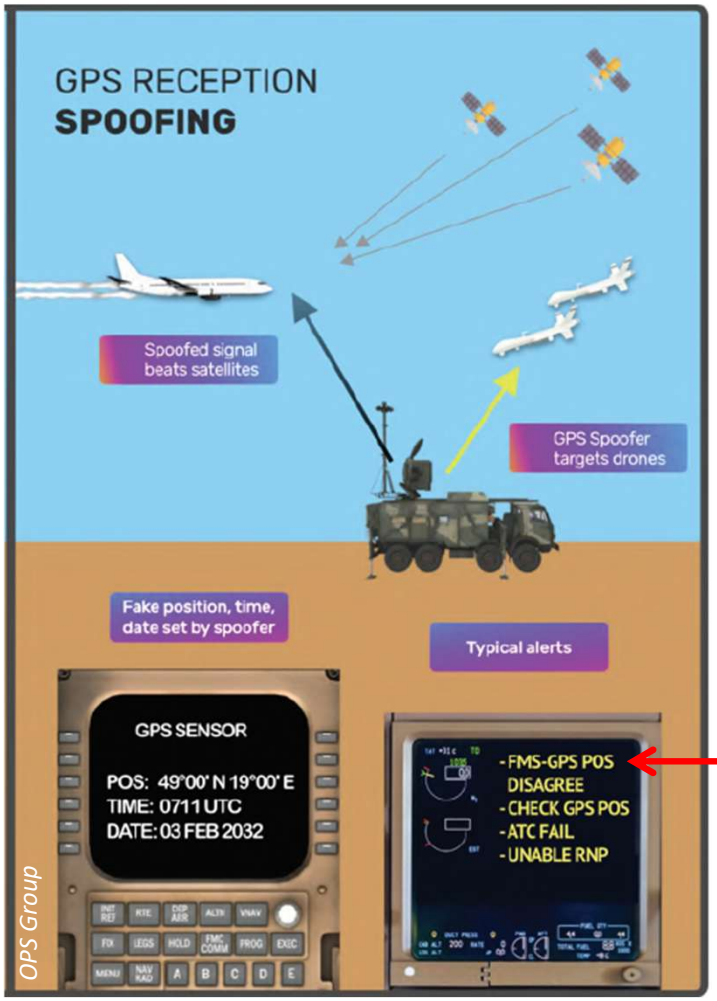
Definitions: SPOOFING



Spoofing: Broadcast of **GNSS-like signals** that cause **avionics to calculate erroneous positions** and provide false guidance. (*ICAO Doc 9849*).

- **GPS spoofing**: One or more ground transmitters broadcast fake GPS signals that overpower satellites; the receiver accepts false position/ time/ altitude and feeds those incorrect values into aircraft systems. (*OPS GROUP*)

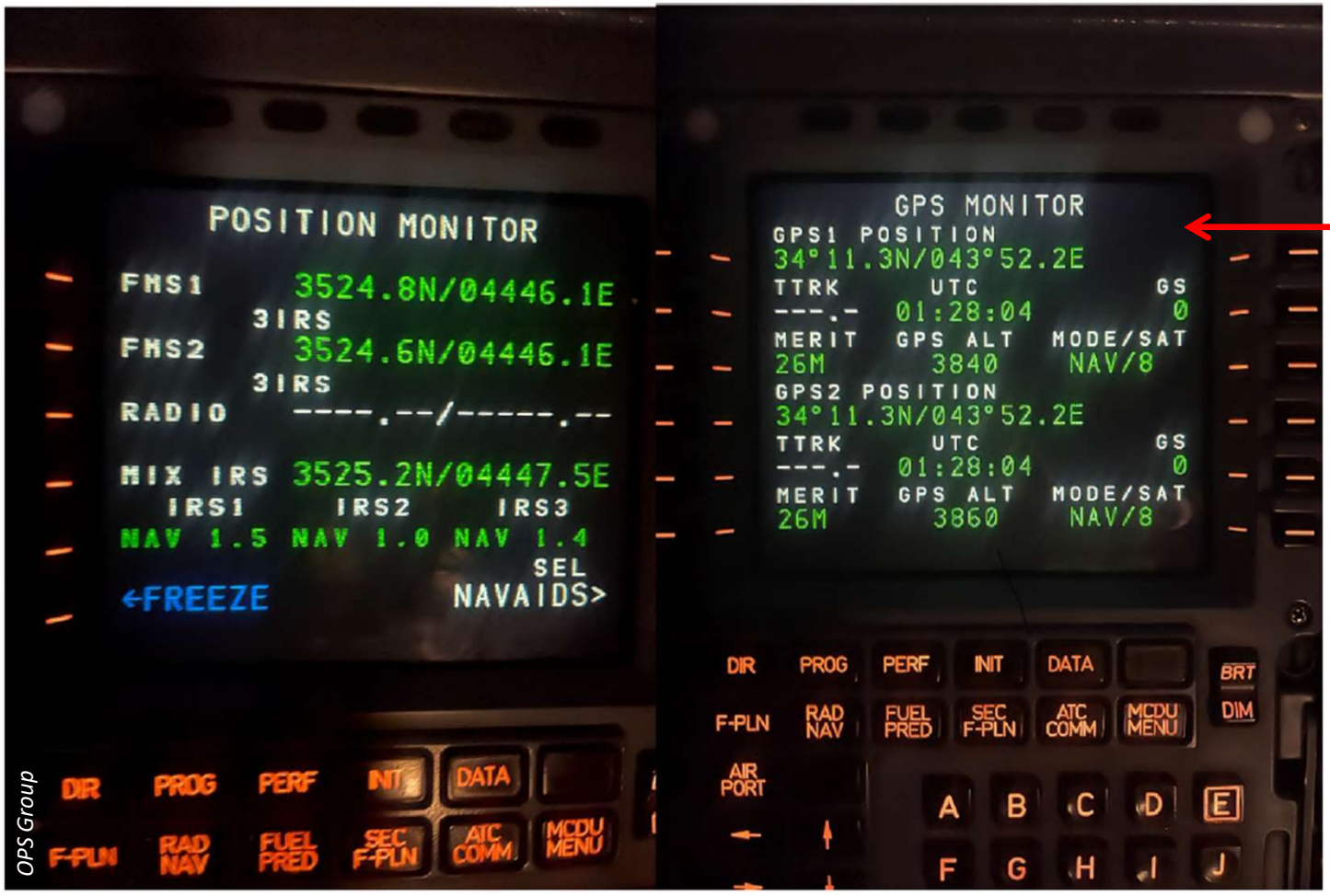
Spoofing Classification *(Doc 9849 – GNSS Manual)*

S1 – Repeaters	**(Unintentional) rebroadcast genuine GNSS signals with slight delay*
S2 – Errant signals	**(Unintentional) caused by faulty, misused, or misconfigured equipment*
S3 – Collateral spoofers - simulators	**(Collateral) GNSS simulators emitting artificial signals that affect nearby, non-targeted aircraft*
S4 – Collateral re-radiating spoofers	(Collateral) re-radiation of real GNSS signal based on real-time reception of the signal
S5 – Targeted spoofers	**Purpose-built transmitters generating false GNSS signals to deliberately mislead a specific aircraft*
S6 – Targeted re-radiating spoofers	(Targeted) re-radiation of real GNSS signal based on real-time reception of the signal
S7 – Targeted sophisticated spoofers	(Targeted) multiple signals from different direction in coordinated manner; or using ground and air-based transmitters

- **Collateral**: aircraft is not the intended victim of the emission.
- **Targeted**: the emissions are intended to specifically affect one or more aircraft.

** Definitions marked by (*) are not from Doc 9849. Only the classification comes from GNSS Manual.*

An example of GPS Spoofing during cruise



OPS Group

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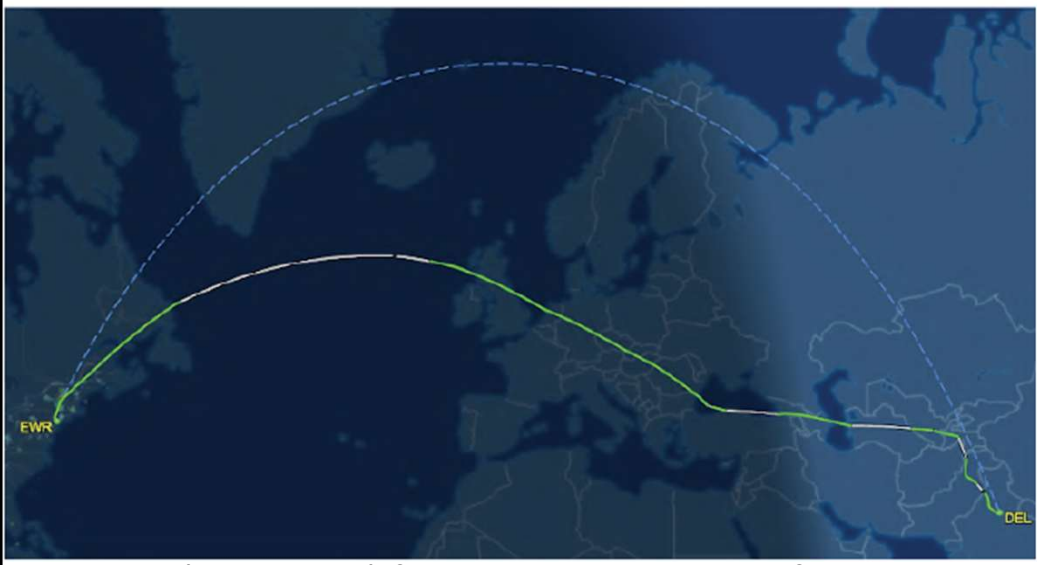
A Significant concern: *corrupted GPS receiver appearing normal*

- After spoofing exposure, a GPS receiver may appear recovered but still retain corrupted data.
- False satellite data and timestamps can persist in memory, causing delayed reappearance of position errors hours later.
- Only a full power cycle or cold restart guarantees recovery; warm restarts often preserve corrupted data.

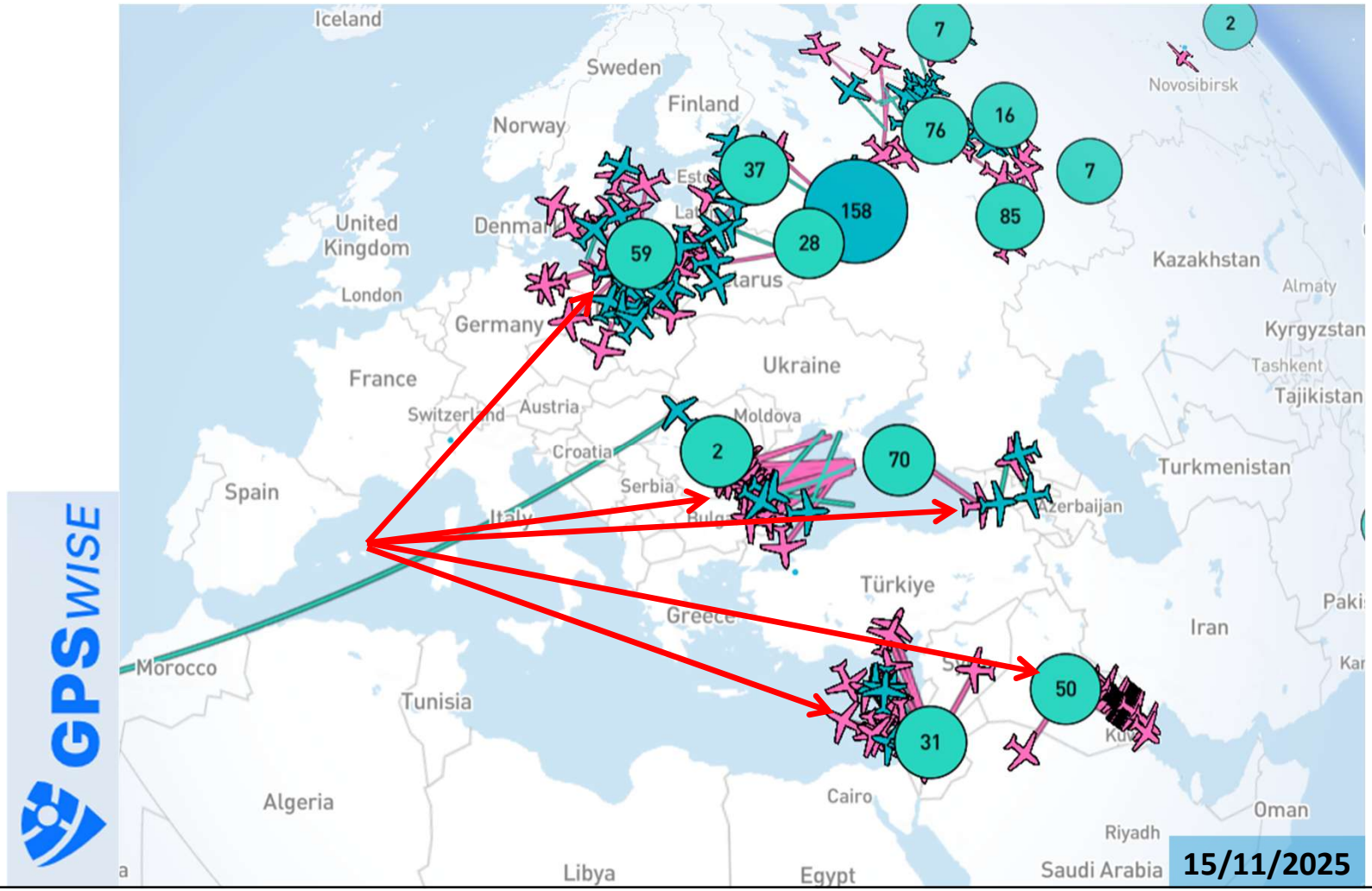


UAL83 (DEL–EWR) flight on 22 May 2024 followed its normal route

On 1 August 2024 flight showed major tracking disruptions, caused by GPS spoofing early in the flight

Source: OPS Group

Where is GPS spoofing happening?



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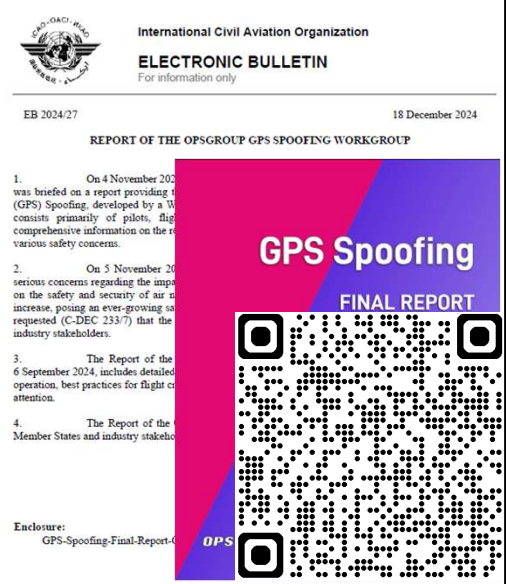
GPS Spoofing Impacts

-GPS receiver failure	FMS position degraded or failed	Unable RNP
-Weather Radar	-IRS (inertial reference system)	-HUD & SVS (Synthetic Vision)
GPWS (Ground proximity warning system)	Aircraft Clock	-Map Shift
ADS-B	Datalink (CPDLC), ADS-C	-ELT (Emergency locator transmitter)
RAAS (Runway awareness and advisory system)	ROPS (Runway overrun protection system)	-SATCOM
-EFB	Internet/Wi-Fi	Overall: Complexity of multiple interconnected failures



International Civil Aviation Organization

ELECTRONIC BULLETIN

For information only

EB 2024/27 — 18 December 2024

REPORT OF THE OPSGROUP GPS SPOOFING WORKGROUP

1. On 4 November 202 was briefed on a report providing (GPS) Spoofing, developed by a W consists primarily of pilots, flig comprehensive information on the r various safety concerns.

2. On 5 November 20 serious concerns regarding the impa on the safety and security of air t increase, posing an ever-growing sa requested (C-DEC 233/7) that the industry stakeholders.

3. The Report of the 6 September 2024, includes detailed operation, best practices for flight cr attention.

4. The Report of the Member States and industry stakeho

Enclosure:
GPS-Spoofing-Final-Report-

Source: OPS Group

SECTION 2: HIGH-LEVEL PROVISIONS
(RESOLUTIONS, RECOMMENDATIONS AND DECLARATION)

Resolution 42-8: Consolidated statement of continuing ICAO policies and practices related to a global air traffic management (ATM) system and communications, navigation, and surveillance/air traffic management (CNS/ATM) systems

…

3. Declares that this resolution supersedes Resolution A41-8.

…

APPENDIX C

Ensuring the resilience of ICAO CNS/ATM systems and services

…

The Assembly:

1. *Encourages* States to transition towards optimized, secure CNS systems based on complementary integration of suitable and independent aircraft capabilities, satellite- and ground-based infrastructure which maximize resiliency and robustness to any type of interference;

2. *Encourages* standardization bodies and industry to develop appropriate interference detection, mitigation and reporting capabilities for the aircraft on-board, satellite- and ground-based CNS system components, in order to ensure higher CNS resiliency, continuity of operations and prevent any cascading effects from the use of compromised position, velocity or time data;

3. *Encourages* States to ensure that resilient terrestrial CNS capabilities remain available to ensure safe operations and complement aircraft-level integration of position, navigation and time (PNT) with independent surveillance information supporting resilient and safe operations;

4. *Invites* ICAO to develop high-level principles on how to integrate CNS ground, space and on-board systems and capabilities and evolve PNT solutions to obtain more resilient positioning and timing services;

5. *Encourages* standardization bodies and industry to collaborate with ICAO in advancing PNT solutions that align with ICAO initiatives;

6. *Invites* ICAO to establish a comprehensive review framework to enhance the CNS/ATM resilience;

7. Urges States to apply necessary measures to avoid the commercialization/proliferation, purchase, possession and the use of illegal transmitters such as jammers and the misuse of test and maintenance equipment which may impact CNS systems;

8. *Urges* States to ensure close collaboration between aviation authorities, military authorities, service providers, radio regulatory and spectrum enforcement authorities to put in place any special measures required to ensure that the spectrum used by all CNS systems, and GNSS in particular, is free from harmful interference;

9. *Urges* States to refrain from any form of jamming, or spoofing affecting civil aviation;

10. *Urges* States to coordinate and notify to the maximum extent possible in advance with the air navigation services provider (ANSP) responsible for the affected airspace in case of military or other State-authorized security or defence-related operations or training, potentially causing any form of jamming, or spoofing affecting civil aviation; and

11. *Urges* States and operators, when assessing the interference risks associated with conflict zones, to consider that the use of satellite-based CNS systems can potentially be impacted beyond those zones.

Components of the Assembly Resolution 42-8 (APPENDIX C)

Encouraged/Invited

1. Transition to resilient CNS, based on integration of independent aircraft capabilities, satellite- and ground-based infrastructure	2. Develop detection, mitigation, and reporting capabilities	3. Terrestrial CNS availability & Integration of A/C PNT with independent SUR information	4. Develop principles on CNS ground / space / on-board integration	5. Collaborate on advancing PNT solutions	6. Establish a comprehensive review framework to enhance CNS/ATM resilience
States	**Standardization bodies & industry**	**States**	**ICAO**	**Standardization bodies & industry & ICAO**	**ICAO**

URGED

7. avoid commercialization/ proliferation, purchase, possession and use of illegal transmitters	8. Ensure spectrum free of harmful interference through collaboration aviation, military, service providers, radio regulatory and spectrum authorities	9. Refrain from any jamming or spoofing	10. Coordinate with ANSP in advance for military operations or training potentially causing jamming/spoofing	11. Assess interference risks beyond conflict zones
States	**States**	**States**	**States & military**	**States & operators**

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 GNSS interference;

b) through the mechanism of the planning and implementation regional groups, develop regional or global navigation satellite system reporting mechanisms, as described in the *Global Navigation Satellite System (GNSS) Manual* (Doc 9849); and

c) work with industry 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;

that **ICAO**:

d) 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;

e) develop guidance on civil-military coordination in relation to harmful interference to global navigation satellite system(s) originated or detected by military authorities; and

f) review aircraft minimum equipage lists to ensure compatibility with States' implemented minimum operational networks.

International Telecommunication Union (ITU) – WRC-23 – RESOLUTION 676

Prevention and mitigation of harmful interference to the radionavigation satellite service in the frequency bands 1 164-1 215 MHz and 1 559-1 610 MHz

resolves to urge administrations

1 to apply necessary measures to avoid the proliferation, circulation and operation of unauthorized transmitters that cause, or have the potential to cause, harmful interference to RNSS systems and networks operating in the frequency bands 1 164-1 215 MHz and 1 559-1 610 MHz, including possible measures that might need to be taken with respect to *recognizing j)*;

2 to take the following actions to prevent and mitigate harmful interference affecting the RNSS operating in the frequency bands 1 164-1 215 MHz and 1 559-1 610 MHz without prejudice to the right of administrations to deny access to the RNSS, for security or defence purposes:

2.1 to encourage collaboration between spectrum regulators, enforcement authorities and RNSS stakeholders, in particular in the aeronautical and maritime domains;

2.2 to encourage cooperation between aeronautical, maritime and security authorities, as well as spectrum regulators, as appropriate, to address interference risks to RNSS systems that may stem from the activities of these security authorities;

3 to report cases, as the affected administration deems appropriate, of harmful interference to the RNSS, in accordance with Article 15,

Joint Statement by ITU/ICAO/IMO on Protection of RNSS from harmful interference

Five pillars of the Statement

e) Report Interference

Report cases of harmful interference affecting RNSS to appropriate authorities and to the ITU Radiocommunications Bureau for monitoring

c) Retain Infrastructure

Maintain sufficient conventional navigation infrastructure for contingency support during RNSS outages and develop mitigation techniques

d) Increase Collaboration

Enhance cooperation between radio regulatory, civil aviation, maritime, defense and enforcement authorities

a) Protect RNSS

Protect Radio Navigation Satellite Systems from transmissions that can adversely cause harmful interference degrading, interrupting or misleading signals used for civilian and humanitarian purposes

b) Reinforce Resilience

Strengthen the resilience of systems which rely on RNSS for navigation, positioning and timing in relation to interference

March 2025

JOINT STATEMENT

by

The Secretary General of the International Telecommunication Union,

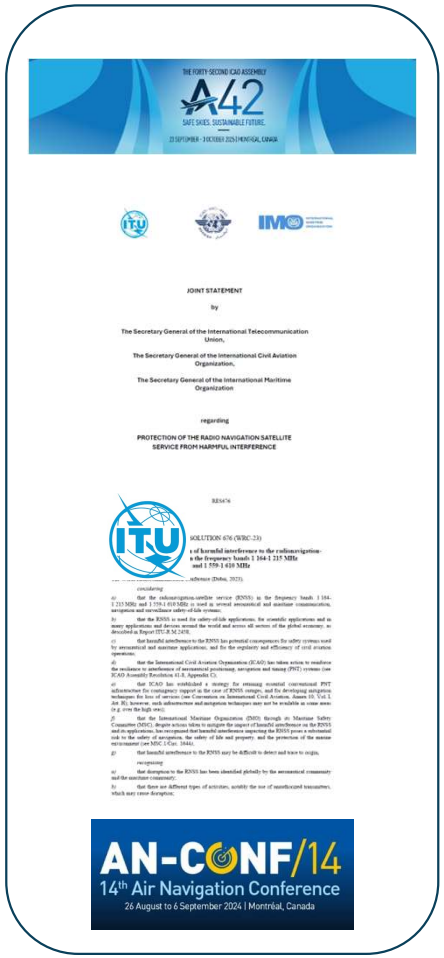
The Secretary General of the International Civil Aviation Organization,

The Secretary General of the International Maritime Organization

regarding

PROTECTION OF THE RADIO NAVIGATION SATELLITE SERVICE FROM HARMFUL INTERFERENCE

Main/Common elements of the resolutions, declaration and recommendations?



1. Protect RNSS & Refrain from jamming/spoofing
2. Retain navigation infrastructure
3. Reinforce resilience / PNT
4. Detection and reporting
5. Collaboration and coordination
6. Illegal transmitters

SECTION 3: ICAO GLOBAL DEVELOPMENTS ON GNSS RFI

ICAO Guidance material on GNSS RFI - GNSS Manual (ICAO Doc 9849)

Included in the Fifth Edition, 2025:

- Chapter 5: GNSS Vulnerability
  - unintentional, intentional, spoofing classifications and their impacts on receivers, spectrum regulations, ionosphere, solar activities and troposphere effects)
- Chapter 7: Implementation of GNSS-based services
  - 7.11 & 7.12: GNSS status notification & Anomaly reporting
  - 7.13: GNSS vulnerability: mitigating the impact on operators
- Appendix F: GNSS Radio Frequency Interference Mitigation Plan

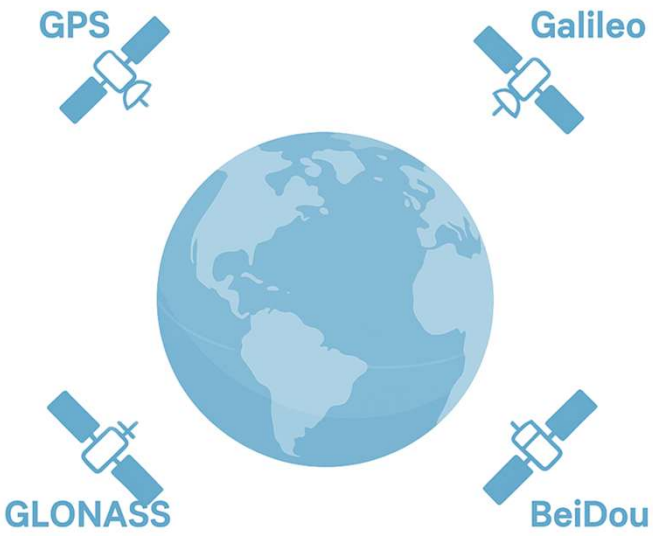
Upcoming

Update to GNSS Manual (Doc 9849): guidance on the detection, reporting, and resolution of GNSS RFI

ICAO Global Developments on GNSS RFI

Dual Frequency Multiple Constellations (DFMC) GNSS

DFMC GNSS uses signals from multiple constellations and two frequency bands (L1/E1 and L5/E5a) to enhance positioning accuracy, integrity, and availability.
Mitigates ionospheric delay errors by combining measurements from two frequencies, improving reliability compared to single-frequency systems.
Provides global redundancy and robustness by integrating constellations such as GPS, Galileo, GLONASS, and BeiDou.
Forms the basis for future aviation navigation applications, supporting Performance-Based Navigation (PBN) and Approach with Vertical Guidance (APV) operations.
Implementation Timeline: Amendment 93 to Annex 10, Volume I introduced provisions to support DFMC GNSS
- Initial operational introduction: 2032-2035

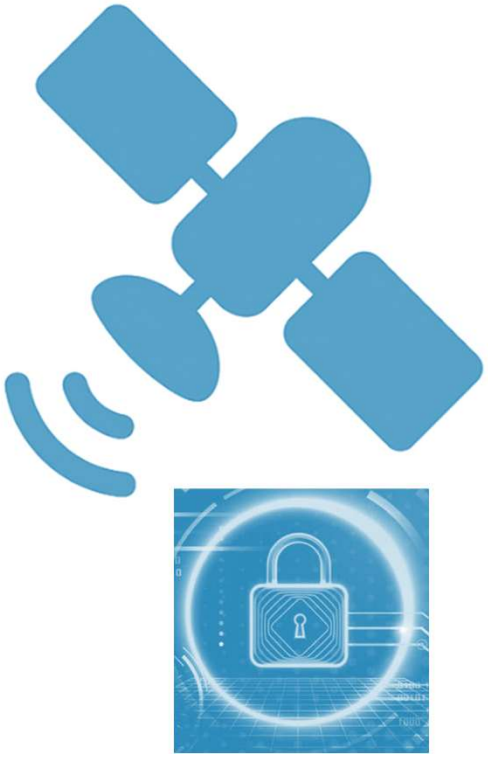


ICAO Global Developments on GNSS RFI – Cont'd

GNSS RFI NOTAM

- Standardized NOTAM codes (interference & spoofing)
- Recommended text for NOTAM Item E
- Guidance on NOTAM interpretation
- New concept called "Digital Operational Reporting Information Service" (**DORIS**) to replace the NOTAM system and other temporary aeronautical information
- Enable real-time and systemic collection and dissemination of GNSS interference events

ICAO Global Developments on GNSS RFI – Cont'd



Authentication solutions

Galileo Open Service Navigation Message Authentication (OSNMA)

- Provides authentication of Galileo satellite navigation messages to ensure that the received data originates from genuine Galileo satellites and has not been altered.
- Enhances user trust and resilience against spoofing and data manipulation by adding digital signatures within the Open Service signal-in-space.
- SARPs for Galileo OSNMA expected: 2029

SBAS Authentication

- Provides authentication of SBAS messages through digital signatures to ensure that integrity and correction data received by users originate from an authorized SBAS provider and have not been tampered with.
- ICAO SARPs on the optional authentication feature: expected 2027

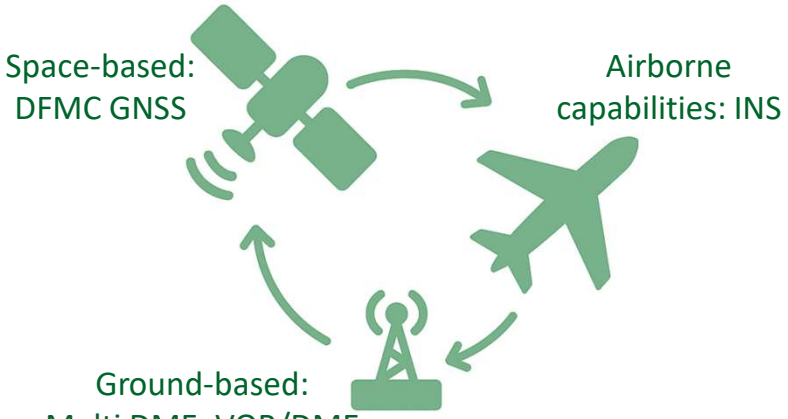
ICAO Global Developments on GNSS RFI – Cont'd

Complementary PNT (C-PNT)

- Multi-Sensor Integration
- Balanced Capabilities
- Precise Time Sources

The Technical Commission of A42 agreed on the need for ICAO to expedite efforts to standardize GNSS RFI related solutions including complementary position, navigation and timing (C-PNT), signal authentication for GNSS core constellations and augmentation services.

❑C-PNT provisions expected by 2030



ICAO Global Developments on GNSS RFI – Cont'd

GNSS interference Reporting

- Improved reporting procedures between ICAO and ITU (ITU's Satellite Interference Reporting and Resolution System (SIRRS))
- Guidance for regional reporting through SIRRS

The Technical Commission of A42 urged States to report GNSS RFI occurrences which cannot be resolved through routine national or international procedures to their accredited ICAO Regional Office, in addition to following the procedures outlined in the ITU Radio Regulations.

ICAO Global Developments on GNSS RFI – Cont'd

Implementation Package (iPACK) for GNSS RFI

The implementation packages (iPacks) are a comprehensive solution, designed to provide a standardized package of expert consultation, guidance material, and training tools that States need to implement ICAO Standards and Recommended Practices (SARPs), across different projects, effectively.

GNSS RFI iPACK:

- Raise Awareness
- Risk Mitigation Framework
- Expert Support
- Infrastructure Assessment

Technical Commission of A42 urged States, international organizations, donors and relevant stakeholders to support ICAO's ongoing efforts, through means such as providing voluntary contributions toward the validation and deployment of an implementation package (iPack) for the mitigation of GNSS RFI.

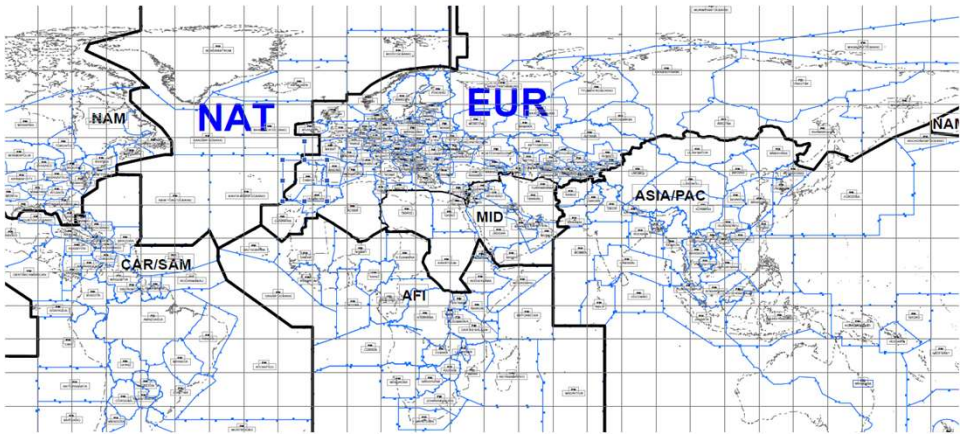
SECTION 4: EUR AND NAT REGIONAL ACTIVITIES

INTERNATIONAL CIVIL AVIATION ORGANIZATION
European and North Atlantic Office

ORGANIZACIÓN DE AVIACIÓN CIVIL INTERNACIONAL
Oficina Europa y Atlántico Norte

ORGANISATION DE L'AVIATION CIVILE INTERNATIONALE
Bureau Europe et Atlantique Nord

МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ГРАЖДАНСКОЙ АВИАЦИИ
Европейское/Североатлантическое бюро



ICAO Regional Activities to address GNSS RFI

1. ICAO EUR/MID Radio Navigation Symposium (Antalya, Turkiye, 6-8 February 2024) – *Presentations*
   - The Symposium recommendations led to ICAO State Letter 24/54
2. ACAO/ICAO Radio Navigation Workshop (Rabat, Morocco, 24-26 February 2025) – *Presentations*
3. ICAO APAC Radio Navigation Symposium (New Delhi, India, 7-9 April 2025) – *Presentations*
4. ICAO Radio Navigation Workshop for NAM/SAM (Mexico City, Mexico, 2-4 September 2025) – *Presentations*
5. *ICAO EUR/NAT/MID GNSS RFI Workshop (Doha, Qatar, 18-20 November 2025) – Documentation*

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ICAO State Letter 2024/54 (following the EUR/MID NAV Symposium)

International Civil Aviation Organization | Organisation de l'aviation civile internationale | Organización de Aviación Civil Internacional | Международная организация гражданской авиации | منظمة الطيران المدني الدولي | 国际民用航空组织

Tel.: +1 514-315-1872 30 April 2024

Ref.: E 3/5-24/54

Subject: Aviation [illegible] interference to the Global Navigation Satellite System (GNSS)

Action required: ~~a) disseminate guidance material; and~~
b) implement recommendations, as applicable

Sir/Madam,

1. I have the honour to bring to your attention the concerning escalation of jamming and spoofing activities targeting the global navigation satellite system (GNSS), which have been increasingly observed recently in various regions globally. GNSS, as one of the main enablers for performance-based navigation (PBN), provides navigation guidance for all phases of flight, from enroute through to precision approach. By providing accurate position and timing information, GNSS enables several systems critical to the safety of flight.

2. Since 2003, the International Civil Aviation Organization (ICAO) has been actively developing recommendations and guidance concerning GNSS Radio Frequency Interference (RFI). It is pertinent to recall ICAO Assembly Resolution A41-8, Appendix C: *Ensuring the resilience of ICAO CNS/ATM systems*, which serves as the latest ICAO policy on GNSS resilience.

3. To bring attention to the critical issue of GNSS interference, and to foster discussions on the management of GNSS vulnerabilities and potential mitigation measures against GNSS RFI, ICAO recently convened the ICAO EUR/MID Radion Navigation Symposium from 6 to 8 February 2024 in Antalya, Turkey. One important outcome of this symposium is the attached list of recommendations regarding Stakeholders' continued efforts towards ensuring safe, reliable, and resilient air navigation.

4. I would like to take this opportunity to refer to recent safety-related publications by the European Union Aviation Safety Agency (EASA), Safety Information Bulletin No. 2022-02R2 and the Federal Aviation Administration (FAA), Safety Alert for Operators (SAFO 24002).

Recommendations to:

ATTACHMENT to State letter E 3/5-24/54

ICAO EUR/MID Radio Navigation Symposium
Antalya, Turkey (6 to 8 February 2024)

RECOMMENDATIONS

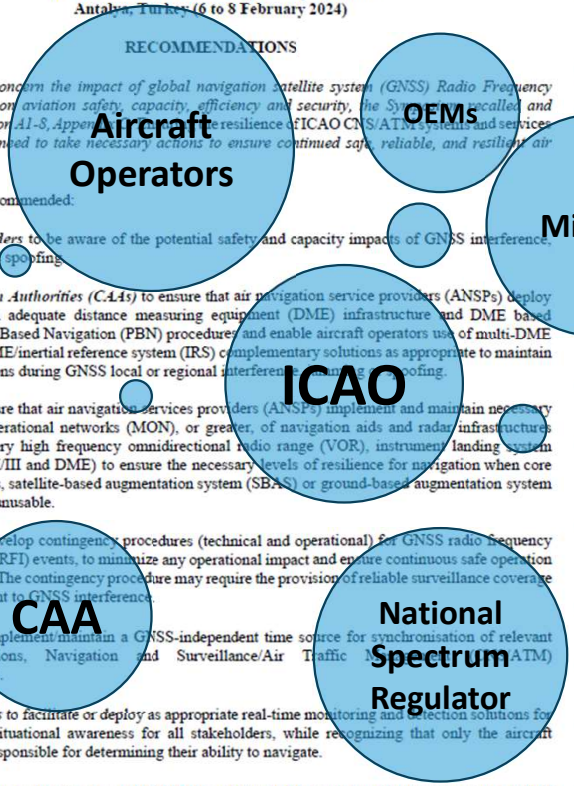
Recognizing with concern the impact of global navigation satellite system (GNSS) Radio Frequency Interference (RFI) on aviation safety, capacity, efficiency and security, the Symposium recalled and underlined Resolution A1-8, Appendix C: Ensuring the resilience of ICAO CNS/ATM systems and services and agreed on the need to take necessary actions to ensure continued safe, reliable, and resilient air navigation.

The Symposium recommended:

- *All Stakeholders* to be aware of the potential safety and capacity impacts of GNSS interference, jamming, and spoofing.
- *Civil Aviation Authorities (CAAs)* to ensure that air navigation service providers (ANSPs) deploy and maintain adequate distance measuring equipment (DME) infrastructure and DME based Performance-Based Navigation (PBN) procedures and enable aircraft operators use of multi-DME and multi-DME/inertial reference system (IRS) complementary solutions as appropriate to maintain PBN operations during GNSS local or regional interference [illegible] spoofing.
- *CAAs* to ensure that air navigation services providers (ANSPs) implement and maintain necessary minimum operational networks (MON), or greater, of navigation aids and radar infrastructures (including very high frequency omnidirectional radio range (VOR), instrument landing system (ILS) Cat I/II/III and DME) to ensure the necessary levels of resilience for navigation when core constellations, satellite-based augmentation system (SBAS) or ground-based augmentation system (GBAS) are unusable.
- *ANSPs* to develop contingency procedures (technical and operational) for GNSS radio frequency interference (RFI) events, to minimize any operational impact and ensure continuous safe operation of air traffic. The contingency procedure may require the provision of reliable surveillance coverage that is resilient to GNSS interference.
- *ANSPs* to implement/maintain a GNSS-independent time source for synchronisation of relevant Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) infrastructure.
- *CAAs/ANSPs* to facilitate or deploy as appropriate real-time monitoring and detection solutions for GNSS RFI situational awareness for all stakeholders, while recognizing that only the aircraft operator is responsible for determining their ability to navigate.
- *ANSPs* to issue notice to airmen (NOTAMs) on GNSS RFI events in a timely manner; to establish coordination arrangements with neighbouring flight information regions (FIRs) on how to best to share their navigation infrastructures in the event of GNSS RFI and any resulting air traffic diversion.
- *CAAs/ANSPs* to improve civil-military coordination to address interference risks associated with GNSS testing and conflict zones, to ensure the uninterrupted and reliable operation of navigation systems in diverse applications.

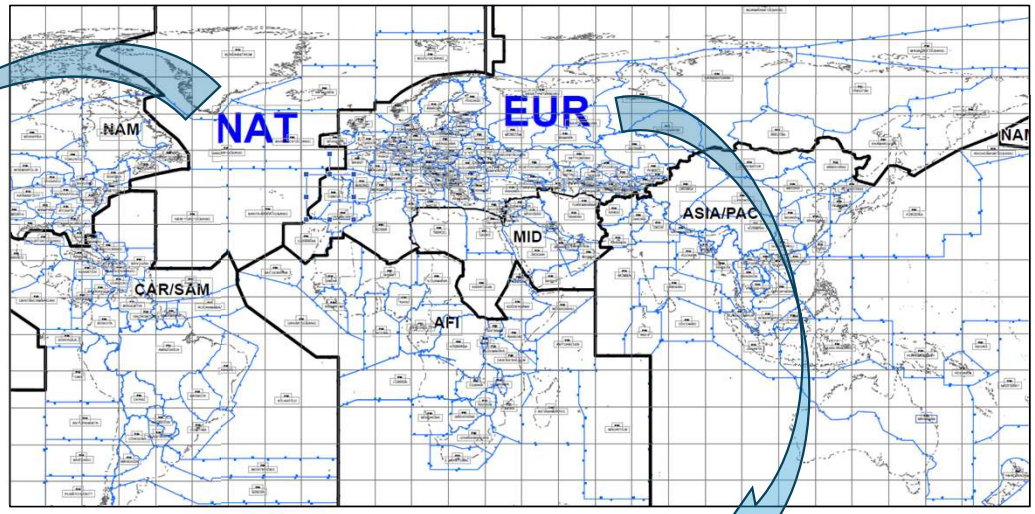
- *National Military Authorities* to coordinate with National Spectrum Regulators, CAAs and ANSPs, to the extent possible, ahead of any necessary GNSS RFI activity. This will enable ANSPs to mitigate any safety impact on civil aviation.
- *CAAs* to foster collaboration with their National Spectrum Regulators regarding GNSS RFI.
- *National Spectrum Regulators* to locate and determine the source of reported GNSS RFI and attempt to resolve it, as appropriate. The GNSS RFI resolution may require coordination with other authorities at national or regional [illegible]
- *National Spectrum Regulators* to report frequent unresolved GNSS RFI incidents to the Radiocommunication Bureau of the International Telecommunication Union (ITU), describing GNSS RFI impact as experienced within their national borders, or as reported by their registered aircraft.
- *Aircraft Operators* to develop a procedure requesting crew to notify air traffic control (ATC) whenever GNSS RFI events are experienced and notify respective aircraft and avionic original equipment manufacturers (OEMs) and State of Aircraft design's CAA through normal safety channels when safety effects are encountered.
- *Aircraft Operators* to develop procedures and training based upon information received from aircraft and avionics OEM and State of aircraft design's CAA.
- *Aircraft Operators* to place additional emphasis on flight crews closely monitoring aircraft equipment performance for any discrepancies or anomalies, promptly informing ATC of any apparent GNSS degradation, and being prepared to operate without GNSS navigation systems.
- *Original Equipment Manufacturers (OEMs)* to improve their equipment and provide further guidance and information on the effects and mitigations of GNSS RFI (including interference, jamming and spoofing) from the perspective of aircraft equipment.
- *OEMs* to ensure that aircraft equipment quickly recovers and resumes GNSS navigation once not impacted anymore by a GNSS RFI event.
- *ICAO Navigation Systems Panel (NSP)* to develop [illegible] on GNSS RFI (NOTAM or other measures).
- *All stakeholders* to collaborate towards developing [illegible] GNSS RFI.
- *All stakeholders* to continue to evolve solutions, w[illegible] focal point.
- *ICAO* to continue raising awareness and supporting [illegible]

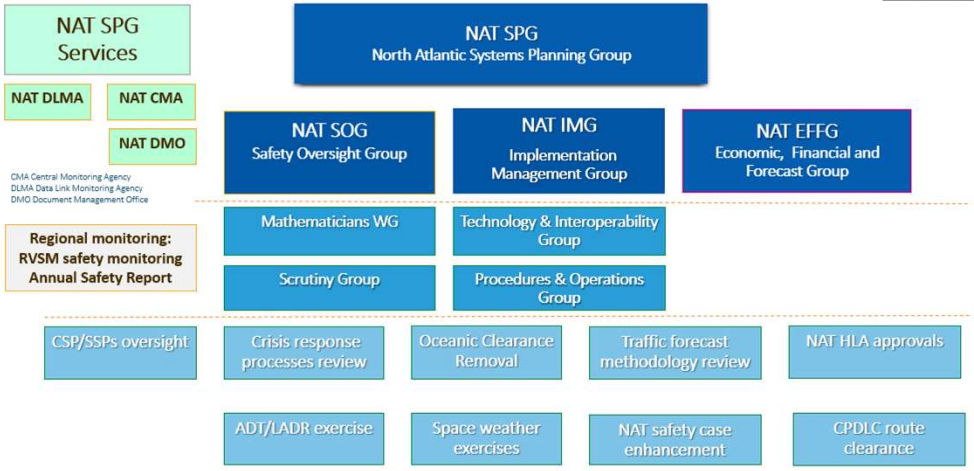
— END —

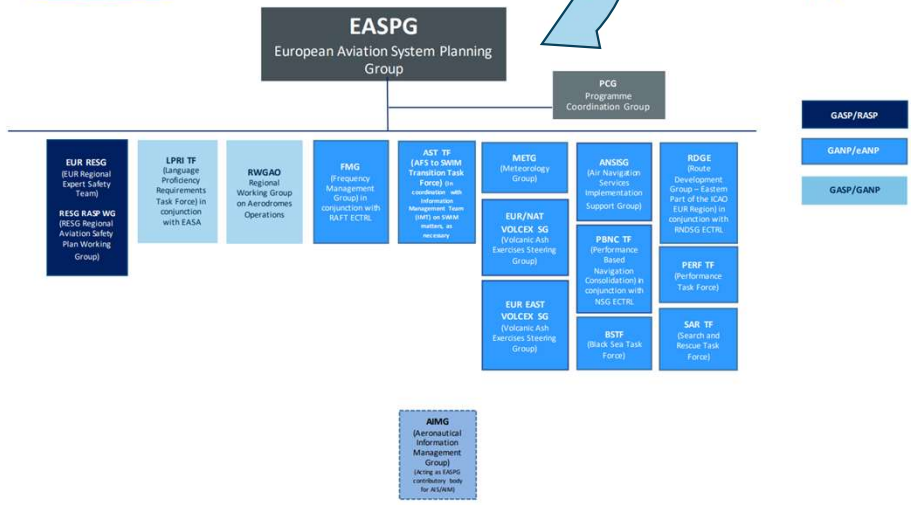


EUR and NAT Overview

- **56 States** across 3 Regions (**Europe, Central Asia, North Africa) and the North Atlantic Oceanic area**, with **diverse situations, needs, and priorities**
- ICAO EUR/NAT Office Serving **2 merged PIRGs/RASGs** for the ICAO EUR & NAT Regions
- Navigating numerous **coordination channels** for effective collaboration, including with ACAO, AFCAC, EASA,EC, ECAC, EUROCONTROL and IAC







ICAO EUR/NAT Directors General of Civil Aviation (EUR/NAT-DGCA/2025) (Paris, 17 June 2025)

…

6.5 With respect to GNSS RFI, the Meeting was informed that, in order to follow up on the inter-regional ICAO Europe/Middle East (EUR/MID) Radio Navigation Symposium held in Antalya, Türkiye, in February 2024, and in order to support the development and implementation of mitigation measures, a second inter-regional ICAO EUR/MID workshop would be held in Doha, Qatar, from 18 to 20 November 2025.

6.6 Therefore, the Meeting adopted the following conclusion :

EUR/NAT-DGCA Conclusion 2025/9 – Addressing Risks associated with GNSS RFI

That the ICAO Regional Director, Europe and North Atlantic, invite States, regional and international organisations to participate in and actively contribute to the planned joint ICAO EUR/NAT and MID regional event on GNSS RFI to be held in Doha, Qatar, from 18 to 20 November 2025.

European Aviation System Planning Group (EASPG)

- Contributory bodies of the EASPG discuss GNSS RFI issues in the ICAO EUR Region:
  - EUR PBN Consolidation Task Force (PBNC TF) / ECTL NSG
  - EUR Frequency Management Group (FMG) / ECTL RAFT
  - EUR Air Navigation System Implementation Support Group (ANSISG)
  - EUR Regional Expert Safety Group (RESG)

EASPG/6 (3-6 December 2024)

EASPG Conclusion 6/1 – Regional GNSS Reporting

That the ICAO Regional Director, Europe and North Atlantic, take necessary action to invite States to use the existing mechanisms for reporting of operational impacts of GNSS RFI through the EUROCONTROL EVAIR and discussions on technical impacts through the EASPG Frequency Management Group (FMG) and Performance Based Navigation Consolidation Task Force (PBNC TF) umbrella.

EUR MON PT (GNSS RFI Minimum Operational Network Project Team)

- Project Objectives: In close coordination with the developments in the EUROCONTROL area, develop a regional GNSS RFI Minimum Operational Network (MON) for the Eastern part of the ICAO EUR Region, especially for the FIRs which are not covered by the EUROCONTROL MON area.
- Project High-Level Tasks:
  1. Collect data on the existing ground based NAV infrastructure (type of NAV system, ranges, coverage, etc.) from all FIRs in the ANSISG area which are not covered by the EUROCONTROL MON area
  2. Consider the proposed recommendations from the Antalya Symposium (Feb 2024)
  3. Collect the individual NAV Spec Requirements, as published in the AIP, in the involved FIRs
  4. Study and include relevant EUROCONTROL MON developments
  5. Develop a comprehensive and compatible MON proposal for the ANSISG Area
  6. Verify the proposal with all involved airspace users, including State aircraft, business aviation and general aviation
  1. Actively support the coordination and review of the proposal with the regulatory entities in each ANSISG State

North Atlantic System Planning Group (NAT SPG)

- Contributory bodies of the EASPG discuss GNSS RFI issues in the ICAO EUR Region:
  - NAT Technology and Interoperability Group (NAT TIG)
  - NAT Procedures and Operations Group (NAT POG)
  - NAT Safety Oversight Group (NAT SOG)

NAT SPG Conclusion 61/12 – Strengthening the NAT resilience to GNSS RFI

That, while acknowledging the growing operational impact of GNSS RFI on the NAT operations, ATC workload and service delivery, the ICAO Regional Director, Europe and North Atlantic take appropriate actions to invite:

a) NAT airspace users, IATA, International Federation of Air Lines Pilots Associations (IFALPA) and International Business Aviation Council (IBAC) to promote awareness and ensure training for flight crews related to the variations in specific aircraft capabilities in detecting and recovering from the effects of GNSS interference carried over from other Regions;

b) NAT ANSPs:

i) to continue monitoring and reporting on impacts from GNSS interference on NAT operations;

ii) make the information available within the NAT structure to support improvement of aircraft capabilities, and

iii) Develop and implement tools and procedures to assist in identifying and managing GNSS impacted aircraft.

NAT OPS Bulletin 2025_001 (NAT GNSS Interference Procedures)

- GNSS RFI effects on aircraft flying over NAT:
  - ➢Loss/unreliable ADS-B surveillance data
  - ➢Loss/unreliable ADS-C data
  - ➢Loss of CPDLC connection
  - ➢Inability to maintain RNAV/RNP → inability to maintain performance-based separation
- Published in January 2025:
  - ➢Procedure for flight crew: early notification to ATC / type of observed failure / phrases for notification
  - ➢Procedure to ATC: contingency procedures for each type of failure

NAT OPS BULLETIN

Serial Number: 2025_001 — **Issued: 7 January 2025**
Subject: NAT GNSS Interference Procedures — **Effective: 7 January 2025**
Originator: NAT SPG

The purpose of North Atlantic Operations Bulletin 2025-001 is to provide background information and guidance to aircraft operators in the North Atlantic (NAT) on the requirement to notify ATC of GNSS interference, and the Air Navigation Service Provider (ANSP) procedures that will be applied to aircraft that have been exposed to Global Navigation Satellite Systems (GNSS) interference (GNSS jamming and/or spoofing) during their flight.

Any queries about the content of the attached document should be addressed to:
ICAO EUR/NAT Office: icaoeurnat@icao.int

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Thank You!

ICAO