



ICAO MID

الهيئة العامة للطيران المدني
Civil Aviation Authority
دولة قطر • State of Qatar



الاجتماع الثامن للمدراء العاميين للطيران المدني في منطقة الشرق الأوسط (DGCA-MID/8)

Eighth Meeting of the Directors General of Civil Aviation-Middle East Region (DGCA-MID/8)



ICAO MID



GNSS Radio Frequency Interference (RFI)

Muna Alnadaf
Technical Officer/ CNS

Air Navigation Bureau, ICAO HQ



What are jamming and spoofing?



Jamming

Overpowers the authentic signal

The broadcast of a signal that overpowers the authentic signals coming from GNSS satellites and denies authentic GNSS signals use by the aircraft's GNSS sensors.

It can result in denial of:

- GNSS navigation, positioning and timing
- Aircraft GNSS-dependent functions



Spoofing

Imitates the authentic signal

The broadcasting of GNSS-like signals that may be acquired and tracked in combination with or instead of the authentic/intended signals.

Key points:

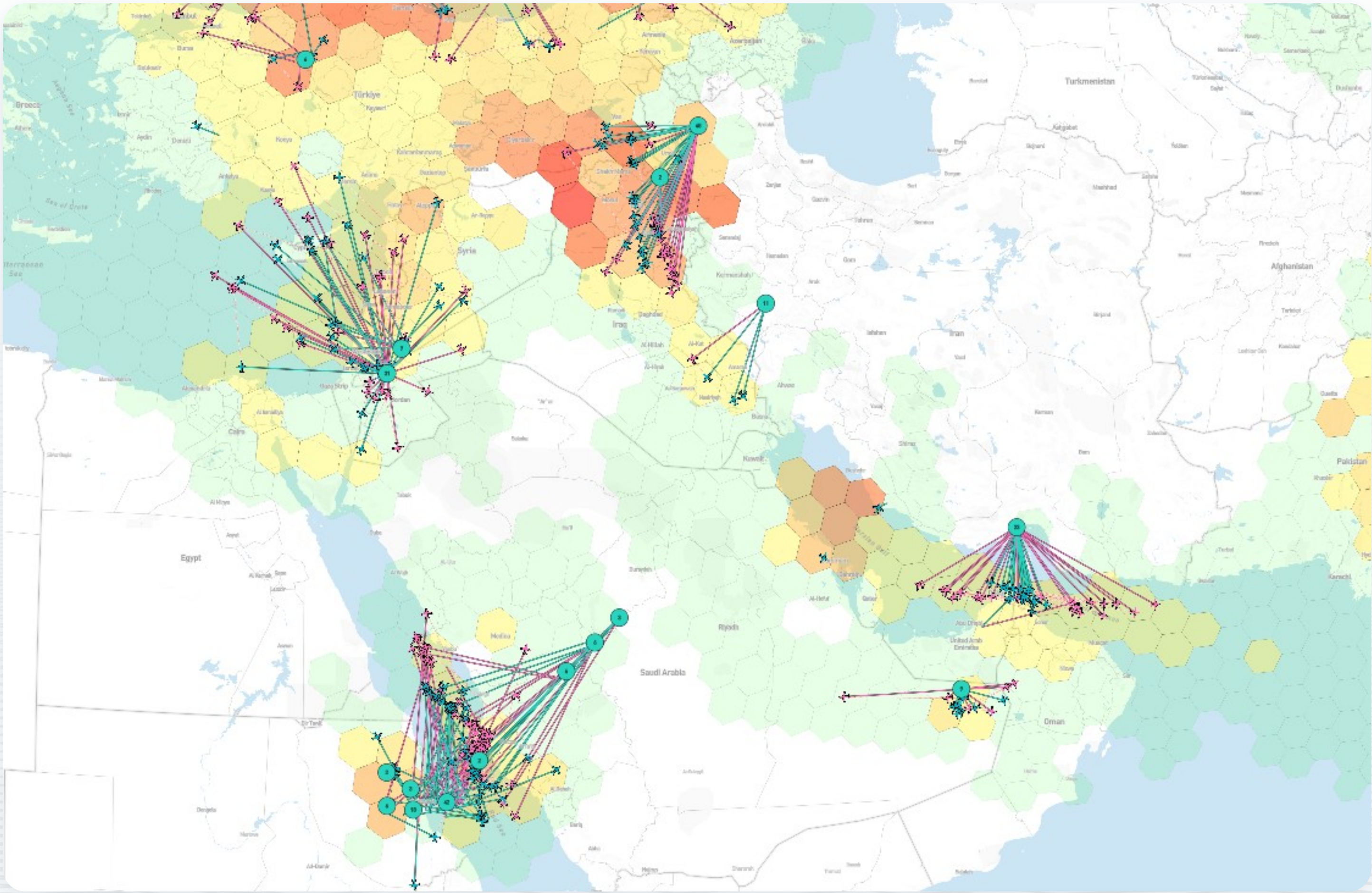
- Onset can be instantaneous or delayed, and effects can persist after the spoofing has ended
- Can result in false and potentially confusing, or hazardous misleading, position, navigation and/or date/time information
- Can also result in loss of GNSS use

Jamming denies GNSS. Spoofing deceives it.

Both are forms of GNSS Radio Frequency Interference (RFI)

GNSS jamming and spoofing snapshot

21 October 2026



Reading the map



Jamming

Coloured hexagons show the level of GNSS interference, from low (green) to high (red)

12

Spoofing

Circles with lines show spoofing events, linking affected aircraft to the false position they received

The number inside the green circle represents the number of aircraft spoofed to this location

Impact and Potential Consequences of GNSS RFI

GNSS RFI can adversely affect aviation safety, security, capacity, and efficiency, highlighting the need for preparedness, resilience, and effective mitigation measures.



Navigation

- FMS position degraded or lost entirely
- Loss of ability to comply with RNP
- Map shifts on navigation displays
- False ground proximity (terrain) warnings
- Off-course deviations: risk of mid-air collision and entry into restricted airspace



Timing and data

- Datalink communication breakdowns and loss of contact between aircraft and ground
- ADS-B surveillance gaps and tracking errors
- Reduced situational awareness for controllers



Operations and cost

- Flight rerouting
- Delays and cancellations
- Increased workload for pilots and controllers
- Significant operational and financial impact

Safety impact
GNSS spoofing may contribute to:

CFIT

Controlled Flight Into Terrain

LOC-I

Loss of Control In-Flight

MAC

Mid-Air Collision

ICAO iPack for GNSS RFI mitigation

Implementation Package (iPack) to support States in managing GNSS RFI incidents and to ensure the continuous provision of safe and efficient ANS

iPACKS

Implementation Packages



Every Flight is Safe and Secure

Mitigating
Global Navigation Satellite System
Radio Frequency Interference





Raise Awareness

Educate stakeholders on GNSS RFI effects on CNS/ATM systems, operations and GNSS-based services



Risk Mitigation Framework

Methods for threat monitoring, risk assessment and mitigation tailored to each operational environment



Expert Support

Hands-on guidance on policies, procedures and training requirements for managing GNSS RFI events



Infrastructure Assessment

Assess conventional navigation infrastructure to maintain the necessary backup capabilities



ICAO GNSS RFI Roadmap

Scan the QR code to view the full roadmap

icao.int/air-navigation-bureau/gnss-rfi/roadmap

Regional Efforts

MIDANPIRG/23 conclusions and decision on GNSS RFI

Conclusion 23/29

Strengthening regional preparedness against GNSS RFI disruptions

States urged to implement A42-8 Appendix C and consider establishing a GNSS RFI monitoring system

Conclusion 23/30

Revision of the GNSS-related documents in the MID Region

ICAO MID DOC 11 and RSA14 on GNSS Vulnerabilities to be updated for CNS SG/16 review and MIDANPIRG/24 endorsement

Decision 23/31

Navigational Operational Networks: NAV MON Action Group

Assist States with NAV-MON and NAV-RON implementation and facilitate sharing of resources and best practices

MIDANPIRG CONCLUSION 23/29: STRENGTHENING REGIONAL PREPAREDNESS AGAINST GNSS RFI DISRUPTIONS

That, in order to strengthen regional preparedness for responding to disruptions caused by GNSS RFI, States are urged to:

- a) implement Assembly Resolution A42-8 Appendix C to ensure timely and effective measures are taken; and*
- b) consider establishing a GNSS RFI monitoring system to enhance situational awareness and mitigate safety and security risks.*

MIDANPIRG CONCLUSION 23/30: REVISION OF THE GNSS-RELATED DOCUMENTS IN THE MID REGION

That, in order to ensure alignment of regional guidance with global developments, emerging threats, and ongoing international and regional efforts, the ICAO MID DOC 11 & RSA14 on GNSS Vulnerabilities, be updated and presented to the CNS SG/16 meeting for review, before presentation to MIDANPIRG/24 for endorsement.

MIDANPIRG DECISION 23/31: NAVIGATIONAL OPERATIONAL NETWORKS-NAV MON ACTION GROUP

That, in order to assist States with the implementation of the required conventional infrastructure, NAV-MON and the forthcoming, NAV-RON, the NAV MON Action Group:

- a) undertake the necessary actions to assist States with the NAV-MON and NAV-RON implementation, and facilitate the sharing of resources and best practices among States;*
- b) is composed of:*

Action by the Meeting

The Meeting is invited to:



a)

Prioritize mitigation

Prioritize national efforts to mitigate the impact and likelihood of GNSS RFI events



b)

Ensure resources

Ensure the availability of adequate resources to support preparedness and mitigation measures



c)

Seek ICAO assistance

Encourage States facing challenges in enhancing preparedness to GNSS interference to seek ICAO assistance, including through the deployment of the ICAO GNSS RFI iPack, as appropriate



| ICAO MID

الهيئة العامة للطيران المدني
Civil Aviation Authority
State of Qatar • دولة قطر



Thank You