وزارة الطيران المدني
Ministry of Civil Aviation

سلطة الطيران المدني المصرية
ECAA
Egyptian Civil Aviation Authority

Egypt's GNSS Interference Mitigation Strategies

Tenth Meeting of the Performance Based Navigation Sub-Group (PBN SG/10)

Amman, Jordan 10 - 11 December 2025

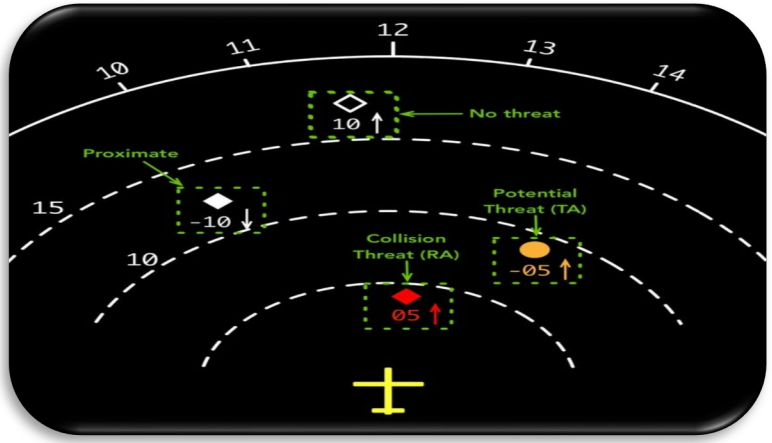
20/30 رؤية مصر VISION OF EGYPT

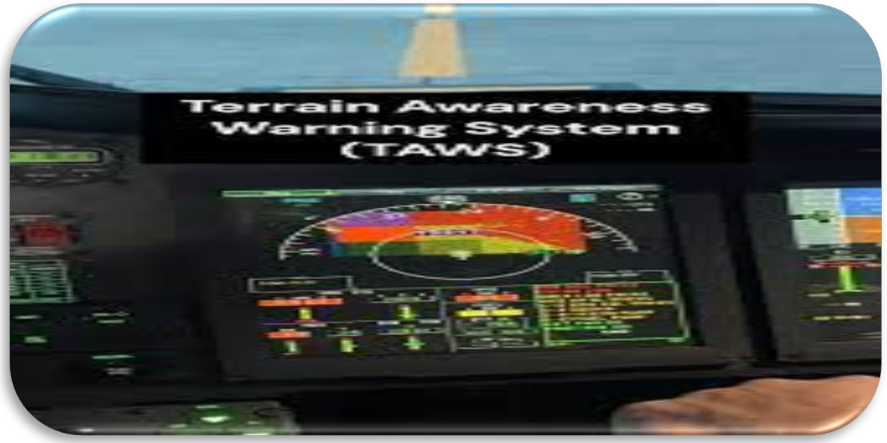
الشركة الوطنية لخدمات الملاحة الجوية
NANSC

CONTENTS

01 Introduction

- GNSS supports positioning, navigation, and timing (PNT) applications. GNSS is the foundation of PBN, ADS-B, and ADS-C.
- Dependence on GNSS is increasing as it is used in various aircraft systems, including:
  - Controller-Pilot Data Link Communications (CPDLC)
  - Flight Management Systems (FMS)
  - Terrain Awareness and Warning Systems (TAWS)
  - Transponders
  - Traffic Alert and Collision Avoidance Systems (TCAS)





02 GNSS Interference

GNSS Interference Threatens Aviation

- In recent years, there's been a rise in harmful interference with Global Navigation Satellite Systems (GNSS), posing a threat to civil aviation.
- GNSS Vulnerability has been identified as a safety issue and one of the main challenges impeding the implementation of PBN in the MID Region.

- There are two main types of interference:

  - **Jamming:** This intentional interference blocks GNSS signals, preventing receivers from providing accurate position and time information. Avionics systems can usually detect jamming and alert the flight crew. GNSS jamming has caused several GNSS outages in the MID Region.

02 GNSS Interference

GNSS Interference Threatens Aviation

- Many GNSS interference issues are happening near conflict zones due to increased use of drones and electronic warfare.
- Recent conflicts worldwide have highlighted how vulnerable the weak GNSS signals from satellites are to jamming and spoofing.
- Intentional jamming can include everything from truck drivers using $10 GNSS jammers to jam toll road tags to military equipment used to disrupt drone missiles in conflict zones.
- Pilots are alert to regional hot spots where such instances might occur and are able to fall back on other onboard navigation aids.

02 GNSS Interference

GNSS Interference Threatens Aviation

- **Spoofing:** This intentional interference tricks GNSS receivers into providing incorrect position, navigation, and timing data. Unlike jamming, spoofing is harder to detect, and there's no automatic alert to the flight crew. Spoofing, causing large position jumps, has been reported since late 2023.

- Both types of interference can significantly impact flight safety.
- Jamming causes the receiver to die, while Spoofing causes the receiver to lie.

02 GNSS Interference

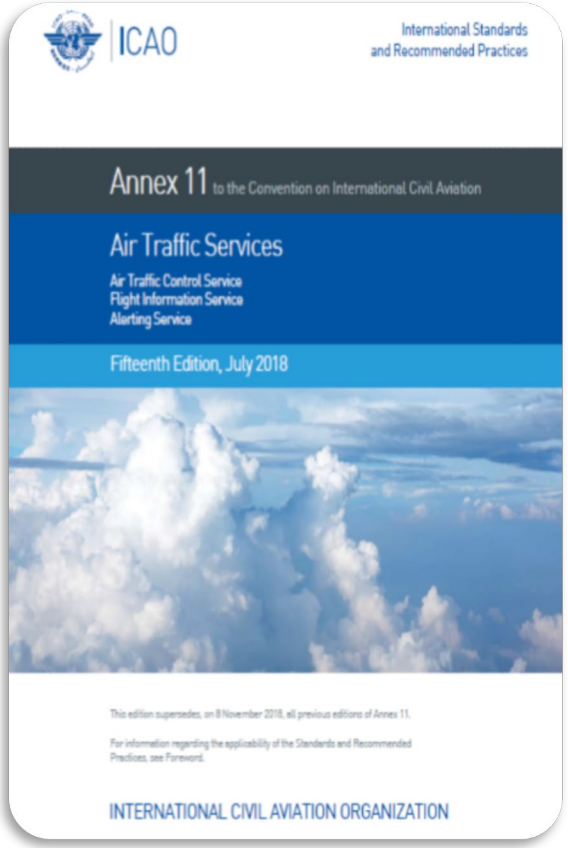
GNSS Interference Threatens Aviation

- Spoofing takes jamming to a different level of disruption by confusing GNSS receivers into reporting an incorrect position.
- In spoofing incidents, however, false signals are broadcast that cause an aircraft's electronic equipment to calculate incorrect positions and provide erroneous guidance, essentially tricking the aircraft's GPS receiver into thinking it is somewhere it is not.
- Since August 2023, crews have been reporting a new variety of GPS spoofing. The result is that within minutes, the IRS becomes unusable, and in many cases, all navigation capability on board is lost.

  "That means that the backup system is no longer reliable as a backup."
- Sometimes the GPS receivers can't recover even after leaving the interference zone.

03 GNSS Interference Regulation

- ICAO Annex 11 (ATS) states that any activity (Civil Or Military) that could endanger civilian flights, whether over land or sea, must be coordinated with air traffic services authority.
- International regulations, particularly those of the International Telecommunication Union (ITU), aim to minimize interference between civil and military radio systems.
- While countries have the right to operate military radio installations, they must take steps to avoid disrupting civil aviation. This includes considering the impact on neighboring countries and high seas airspace.



ITU International Telecommunication Union

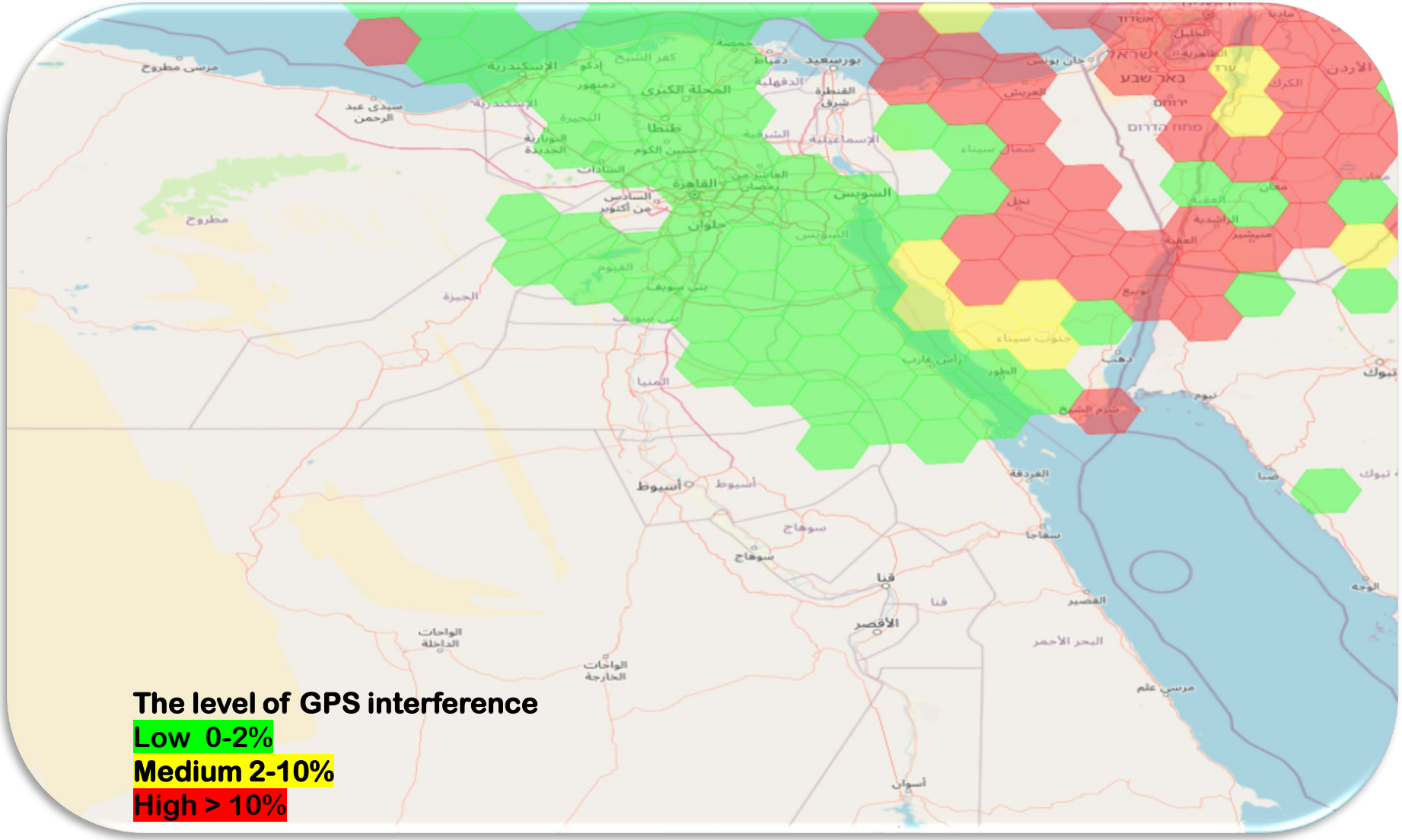
04 GPS interference affected area in Egypt

- Since October 2023, there has been a significant increase in GPS jamming and spoofing reports received by National air navigation service company (NANSC) from the airlines over the frequency while flying over Cairo FIR, in particular, the inbound traffic from Nicosia and Jeddah FIRs.

- GNSS jamming and spoofing have been detected by pilots and air traffic control during various flight phases. In some cases, aircraft have deviated from their planned routes, and this was observed by the air traffic controllers.

- Jamming and spoofing pose a significant threat to PBN applications, particularly at airports in the Sinai Peninsula such as Sharm El Sheikh and Taba. These attacks can disrupt crucial flight procedures like SID and STAR and RNP approaches.

04 GPS interference affected area in Egypt



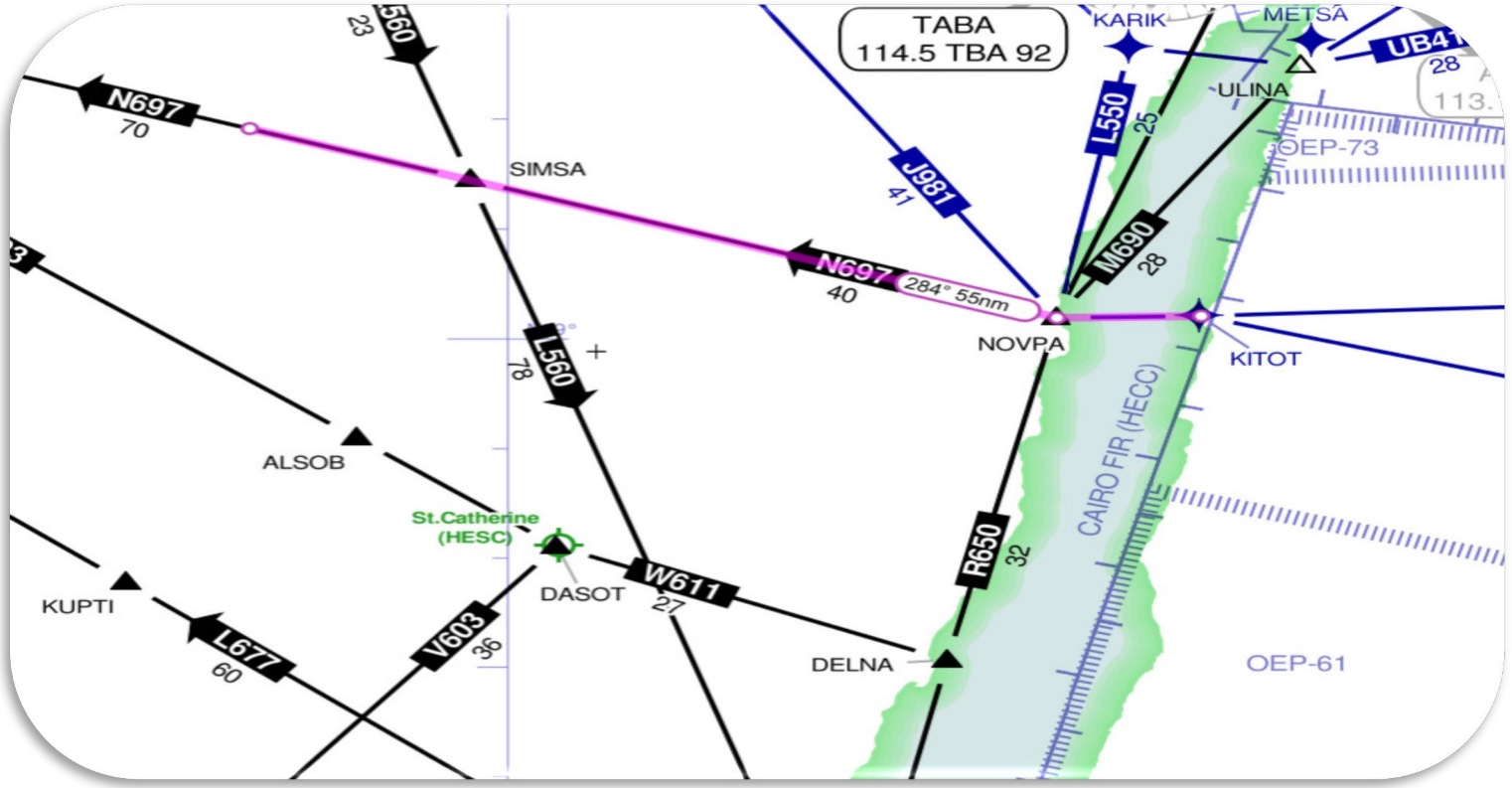
Source: https://gpsjam.org

05 Cairo FIR's affected airways by GPS interference

- The GNSS Interference affects the traffic from Jeddah FIR to Cairo FIR via Entry point **PASAM**.
- The pilots normally start reporting when they approach **SHM** and the interference last for **140**NM.

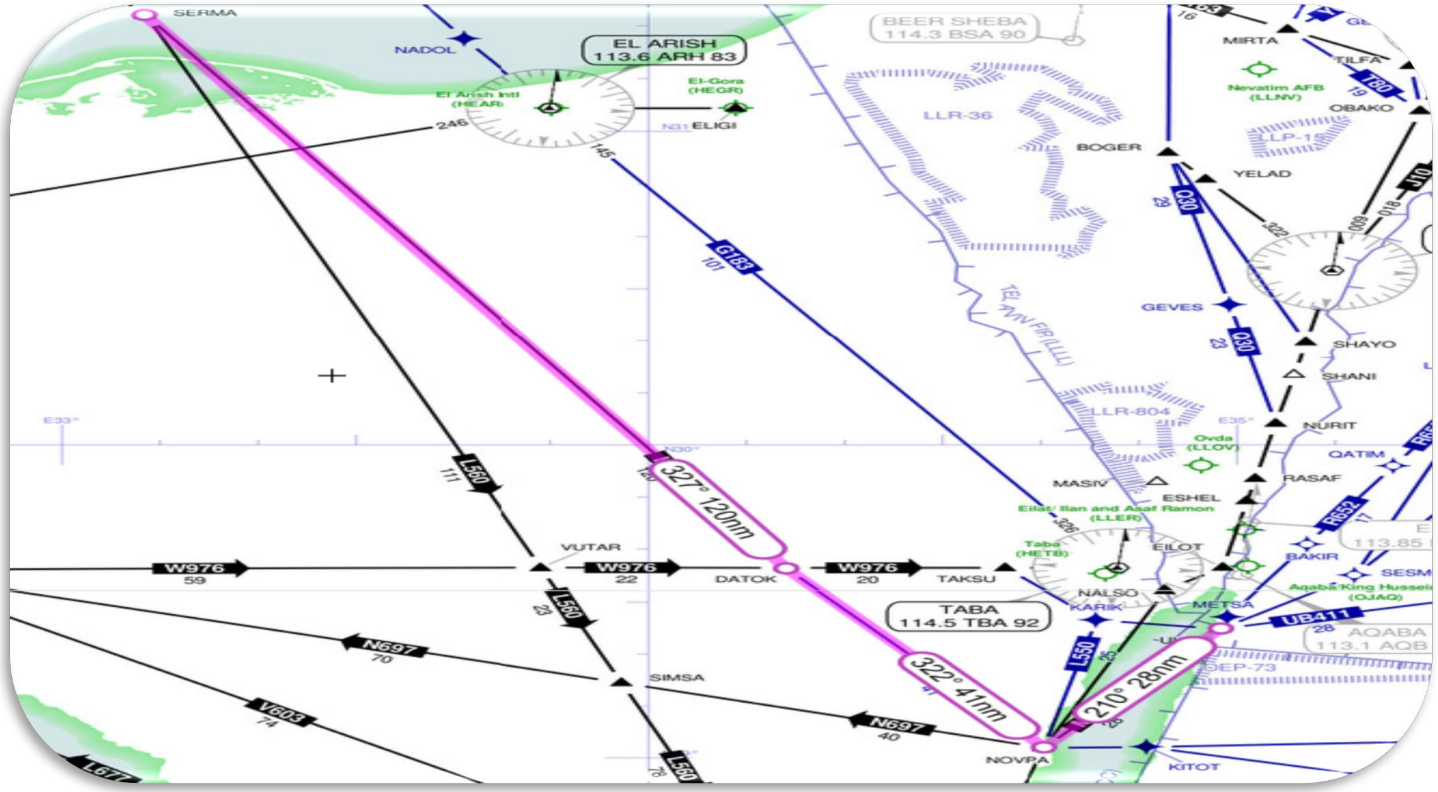
05 Cairo FIR's affected airways by GPS interference

- The GNSS interference affects the traffic from Jeddah FIR to Cairo FIR via Entry point **KITOT**.
- The pilots normally start reporting when they pass **KITOT** heading to **NOVPA** and the interference last for **65**NM.



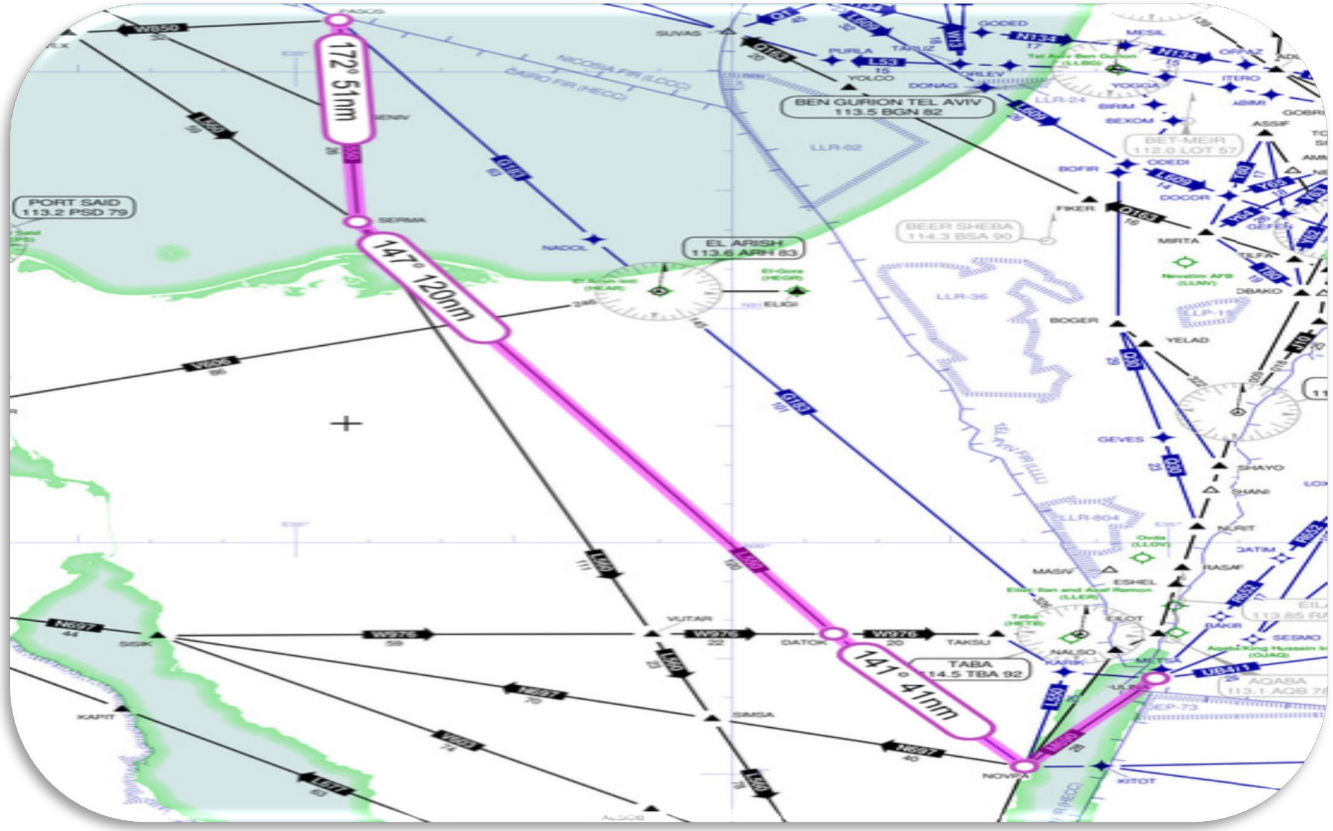
05 Cairo FIR's affected airways by GPS interference

- The GNSS Interference affects the traffic from Amman FIR to Cairo FIR via Entry point ULINA.
- The pilots normally start reporting over ULINA or coordinate with Amman controllers to transfer the traffic in a proper Heading.
- The interference lasts for 190NM from ULINA until waypoint SERMA.



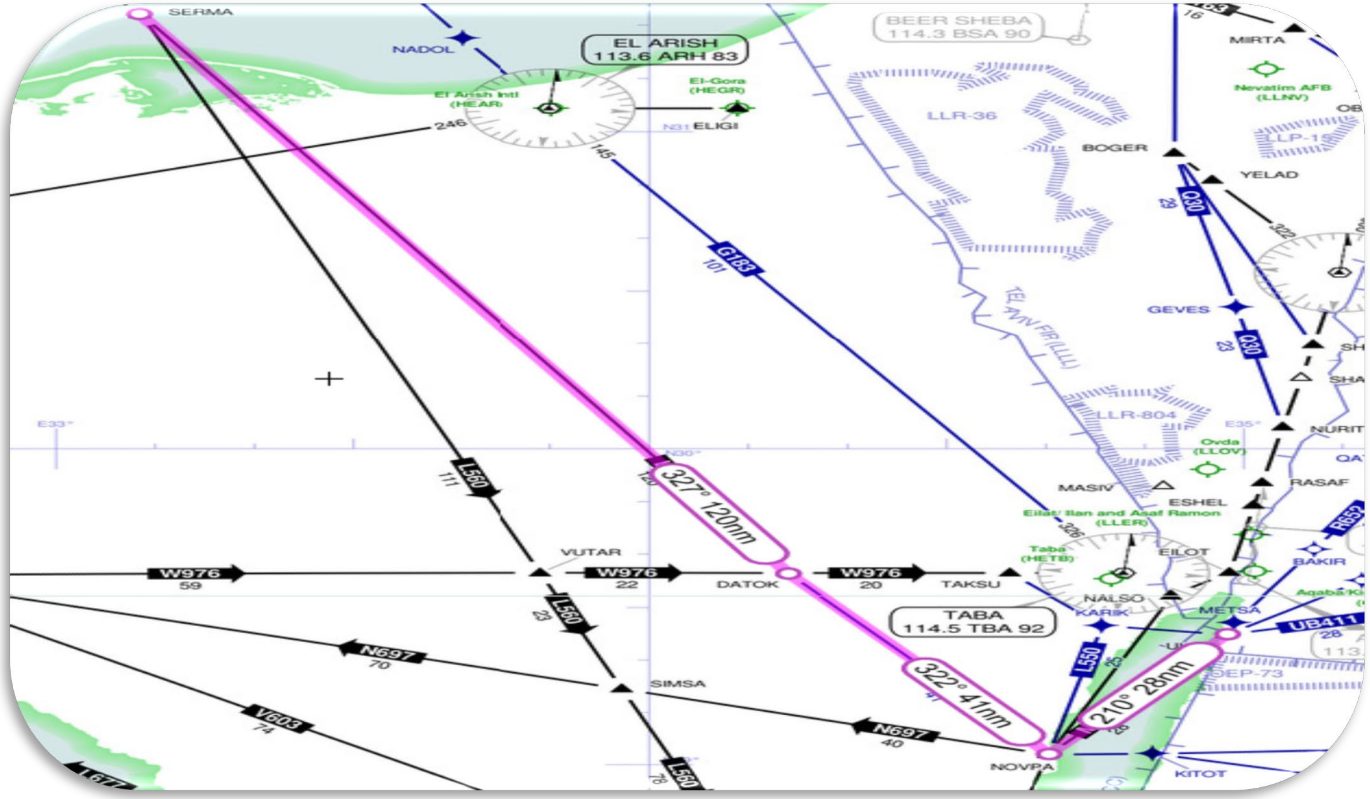
05 Cairo FIR's affected airways by GPS interference

- The GNSS Interference affects the traffic from Nicosia FIR to Cairo FIR via Entry point PASOS.
- The pilots normally start reporting after passing PASOS or coordinating with Nicosia controllers to transfer the traffic in a proper heading.
- The interference lasts for 200:240NM from Entry point PASOS heading to Amman FIR via ULINA.



05 Cairo FIR's affected airways by GPS interference

- The GNSS Interference affects the traffic from Nicosia FIR to Cairo FIR via Entry point **LAKTO**.
- The pilots normally start reporting after passing **SERMA**
- The interference lasts for 190NM from point **SERMA** until leave Cairo FIR via **ULINA**.



06 Egypt's GNSS mitigation strategies

Egypt started to assess the situation, and we figured out that :

1. There is a deficiency in the phraseology in PANS-ATM, Doc 4444 to allow the pilots make an effective communication and reporting GNSS interference.
2. No clear procedures for controllers after the pilots report GNSS gamming or spoofing.
3. The current GNSS reporting format used by ATC units is too complex, discouraging controllers from reporting jamming and spoofing incidents. As a result, many incidents are only reported orally to supervisors, leading to underreporting.
4. The controllers need for awareness about the GNSS RFI.

06 Egypt's GNSS mitigation strategies

- NANSC conducted a comprehensive training sessions for Cairo ACC Air Traffic Controllers and Controllers at Sharm El Sheikh, Hurghada, Taba, and Alexandria Airports. This training focused on:
  - PBN Basics: Introduction to Performance-Based Navigation.
  - GNSS Technology: Global Navigation Satellite Systems.
  - Jamming and Spoofing Threats: Understanding and mitigating these risks.
  - PBN and Flight Planning: How PBN integrates with the flight plan.
  - Pilot-ATC Communication: Real-world scenarios and phraseology.

- This training aimed to enhance awareness of potential threats and improve response strategies.

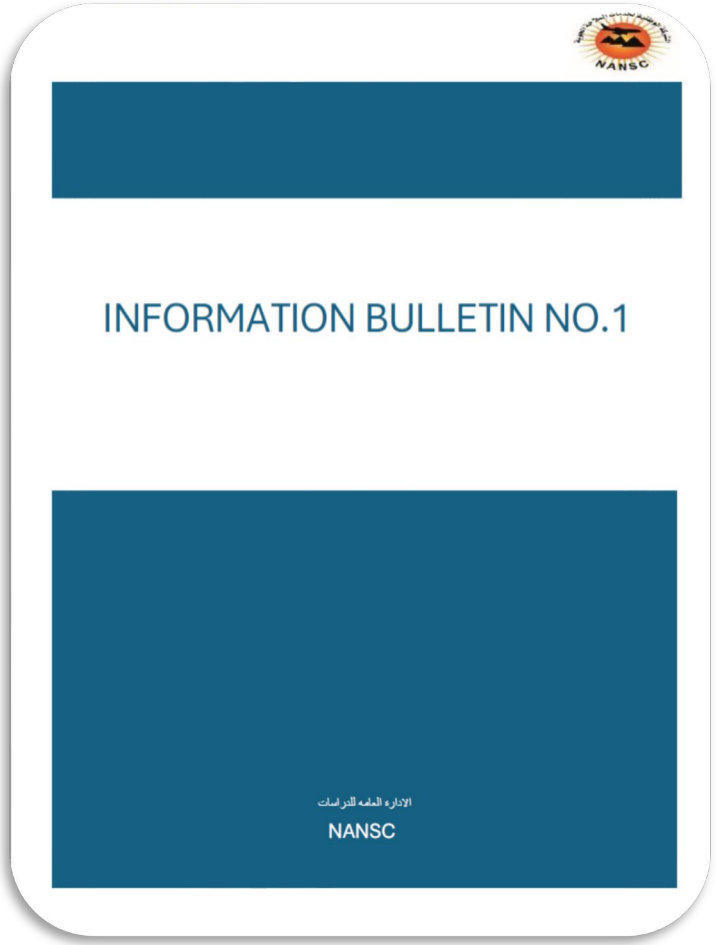
- An extensive awareness course was delivered virtually to the affected airports (Sharm El Sheikh, Hurghada, Taba, and Alexandria) via a Zoom meeting.

06 Egypt's GNSS mitigation strategies

- NANSC Information bulletin aims to raise awareness about the potential risks of Global Navigation Satellite System (GNSS) Jamming and Spoofing issued in May 2024 and prepared by the Research and Development Department (R&D), distributed to Cairo ACC unit and all ATC units at the Egyptian Aerodromes.

- The Conclusion of the Bulletin

  By understanding the risks of GNSS jamming and spoofing and implementing appropriate mitigation measures, we can significantly reduce the potential impact of these threats on aviation safety.



06 Egypt's GNSS mitigation strategies

- A new GNSS interference reporting form was prepared by The Research and Development Department (R&D) and distributed to all the ATC units in Egypt. To allow the controllers to report all the GPS Jamming and Spoofing incidents.

- Lesson learned: By providing a clear and concise form, you can encourage ATC units to report incidents promptly and accurately.

Ministry of Civil Aviation
Egyptian Holding Company for Airports and Navigation
National Air Navigation Service Company
PBN Committee

GNSS Interference form
Unit:

Date: / /20	Time: ....UTC	FL:	Type of Interference: ☐ Jamming ☐ Spoofing
Callsign:	Type:		Interference Location: ☐NWB – SISIK ☐ SHM - KAPIT ☐ DATOK – SERMA ☐ A16 ☐Other:
Date: / /20	Time: ....UTC	FL:	Type of Interference: ☐ Jamming ☐ Spoofing
Callsign:	Type:		Interference Location: ☐NWB – SISIK ☐ SHM - KAPIT ☐ DATOK – SERMA ☐ A16 ☐Other:
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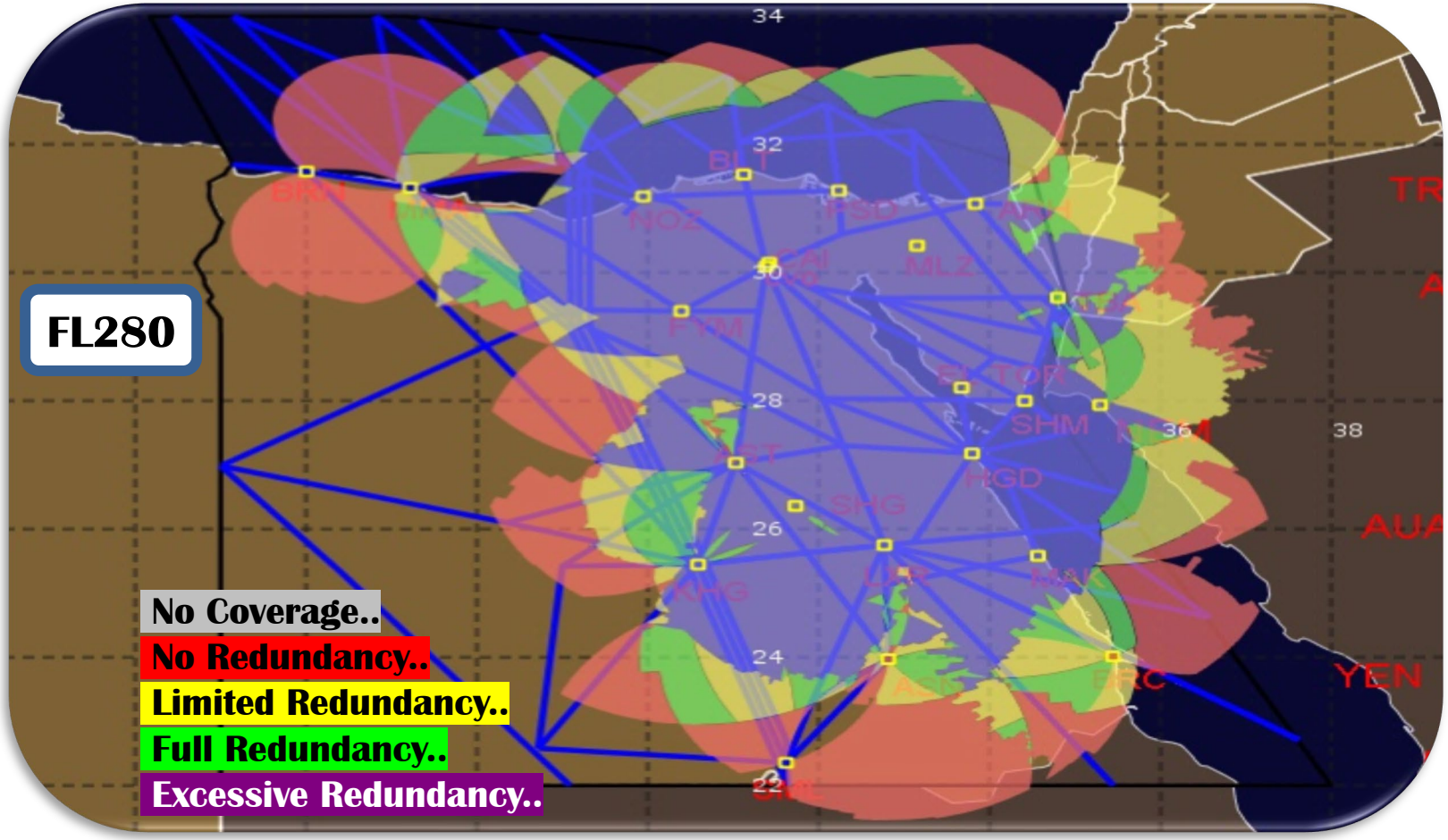
06 Egypt's GNSS mitigation strategies

- NANSC conducted a study using EUROCONTROL's DEMETER tool to assess the feasibility of flying **RNAV 5** routes using DME/DME sensor within Cairo FIR.



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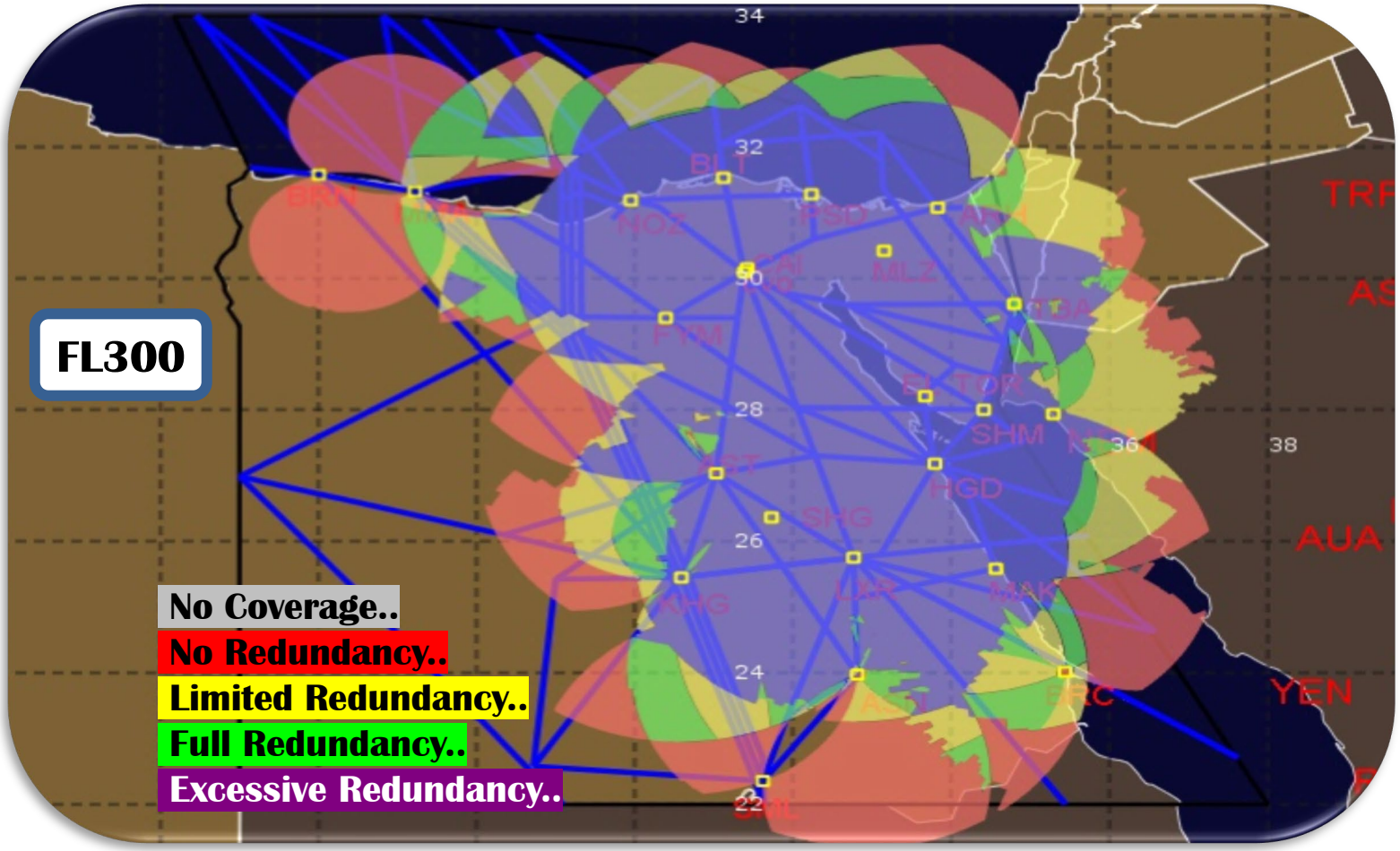

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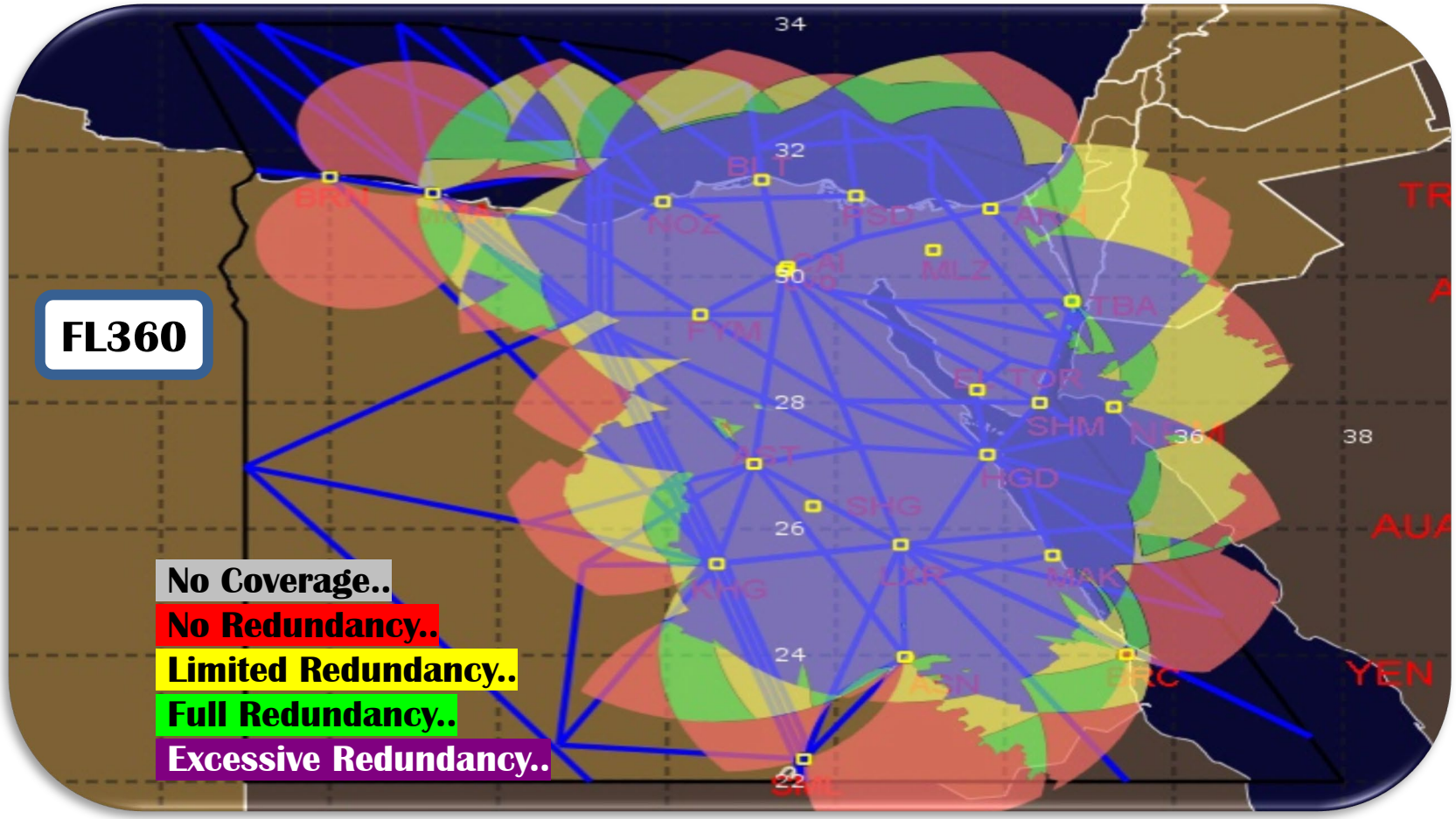

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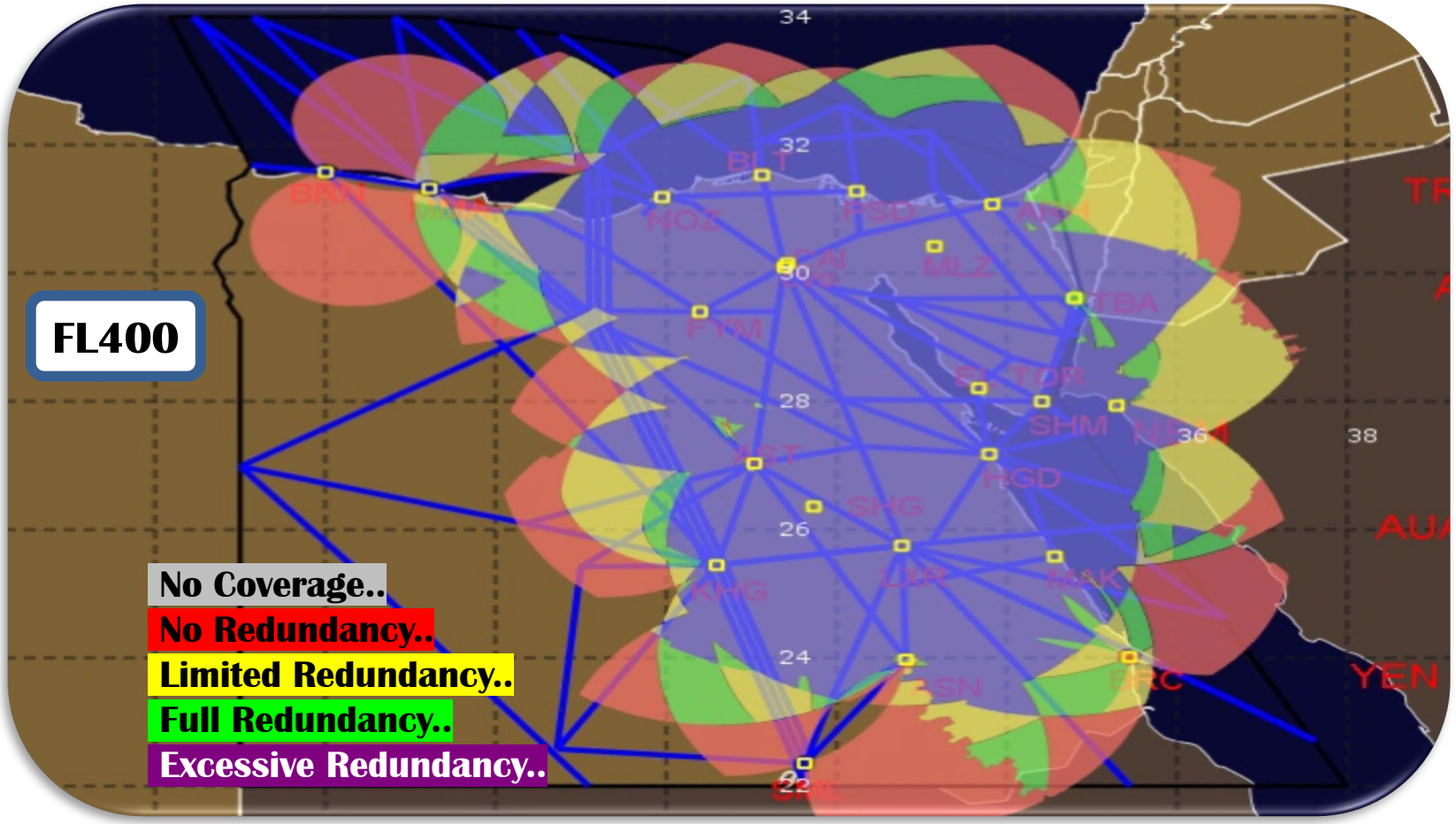
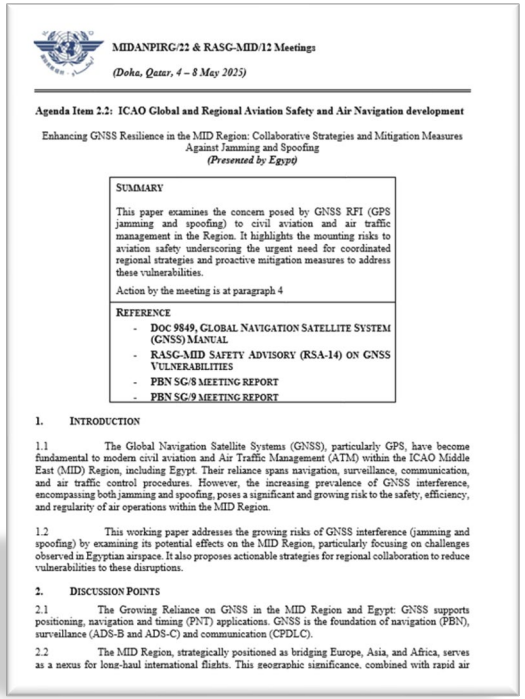


06 Egypt's GNSS mitigation strategies

- Egypt presented a working paper at the MIDANPIRG 22 titled "Enhancing GNSS Resilience in the MID Region: Collaborative Strategies and Mitigation Measures Against Jamming and Spoofing" the working paper highlighted the following:
  1. GNSS interference in the MID Region and its potential impact on aviation safety and efficiency.
  2. Acknowledge the need for standardized ICAO guidance for publishing alternative navigation sensors as backups for GNSS in AIP part 2 and 3 (ENR and Aerodromes) sections.
  3. Encourage Member States to prioritize the development and implementation of national GNSS interference mitigation strategies.
  4. Support initiatives aimed at enhancing regional collaboration and information sharing on GNSS interference events.



MIDANPIRG/22 & RASG-MID/12 Meetings

(Doha, Qatar, 4 – 8 May 2025)

Agenda Item 2.2: ICAO Global and Regional Aviation Safety and Air Navigation development

Enhancing GNSS Resilience in the MID Region: Collaborative Strategies and Mitigation Measures Against Jamming and Spoofing

(Presented by Egypt)

SUMMARY

This paper examines the concern posed by GNSS RFI (GPS jamming and spoofing) to civil aviation and air traffic management in the Region. It highlights the mounting risks to aviation safety underscoring the urgent need for coordinated regional strategies and proactive mitigation measures to address these vulnerabilities.

Action by the meeting is at paragraph 4

REFERENCE

- DOC 9849, GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) MANUAL
- RASG-MID SAFETY ADVISORY (RSA-14) ON GNSS VULNERABILITIES
- PBN SG/8 MEETING REPORT
- PBN SG/9 MEETING REPORT

1. INTRODUCTION

1.1 The Global Navigation Satellite Systems (GNSS), particularly GPS, have become fundamental to modern civil aviation and Air Traffic Management (ATM) within the ICAO Middle East (MID) Region, including Egypt. Their reliance spans navigation, surveillance, communication, and air traffic control procedures. However, the increasing prevalence of GNSS interference, encompassing both jamming and spoofing, poses a significant and growing risk to the safety, efficiency, and regularity of air operations within the MID Region.

1.2 This working paper addresses the growing risks of GNSS interference (jamming and spoofing) by examining its potential effects on the MID Region, particularly focusing on challenges observed in Egyptian airspace. It also proposes actionable strategies for regional collaboration to reduce vulnerabilities to these disruptions.

2. DISCUSSION POINTS

2.1 The Growing Reliance on GNSS in the MID Region and Egypt: GNSS supports positioning, navigation and timing (PNT) applications. GNSS is the foundation of navigation (PBN), surveillance (ADS-B and ADS-C) and communication (CPDLC).

2.2 The MID Region, strategically positioned as bridging Europe, Asia, and Africa, serves as a nexus for long-haul international flights. This geographic significance, combined with rapid air

07 Recommendations

- **Technological Countermeasures:** Encouraging the adoption of dual-constellation receivers within the aviation industry, We urge IATA to prioritize the implementation of dual-constellation GNSS receivers as a critical measure to mitigate the growing risks posed by GPS jamming and spoofing attacks.
- **Emergency procedures:** Develop and implement emergency procedures for situations where GPS signals are unavailable or compromised. These procedures should outline alternative navigation sensors like DME/DME.
- **Regulatory and Legal Frameworks:** Support the development and enforcement of strong regulatory frameworks to deter and punish GPS jamming and spoofing activities.
- **Awareness and training**: Raise awareness about GPS jamming and spoofing threats among pilots and ATCOs. Provide training on recognizing signs of interference, implementing mitigation strategies, and reporting incidents.
- **Collaboration and information sharing:** Collaborate with other organizations and agencies to share information on GPS jamming and spoofing incidents and best practices.
- **International Cooperation:** Foster international cooperation to address cross-border GPS jamming and spoofing challenges.

Action by the meeting

The meeting is invited to :

1. **Take note Egypt GNSS RFI Mitigation actions; and**

2. **discuss any relevant matters as appropriate.**

References

- RASG-MID SAFETY ADVISORY – 14 (RSA-14), April 2019.
- EASA Safety Information Bulletin, July 2024.
- Fourteenth Air Navigation Conference Montréal, Canada, 26 August to 6 September 2024.
- GNSS Radio Frequency Interference Safety Risk Assessment by IATA , September 2024.

Thank You

ANY Questions?

R & D

Directorate

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