*International Civil Aviation Organization*

**MIDANPIRG Air Traffic Management Sub-Group**

**Ninth Meeting (ATM SG/9)**
***(Sharm El Sheikh, Egypt, 14 – 16 November 2023)***

**Agenda Item 4: Planning and Implementation issues related to ATM/SAR**

# GNSS VULNERABILITIES IN MID REGION

*(Presented by the MID PBN SG Chairperson)*

**SUMMARY**

The Global Navigation Satellite System (GNSS) is a critical component of Air Traffic Management (ATM) operations and flights. However, GNSS is vulnerable to a variety of factors, including intentional and unintentional interference, space weather events, and technical issues. These vulnerabilities can have serious consequences for ATM operations, including loss of situational awareness, navigation errors, disruption of critical ATM functions, and delays and cancellations of flights.

Given the increasing threat of GNSS vulnerabilities in the Middle East, it is imperative for all MID states to develop solutions to mitigate this risk. Finding a mechanism to overcome these vulnerabilities is essential to ensuring the continued safe and reliable use of GNSS in air traffic management.

Action by the meeting is at paragraph 3.1

**REFERENCE(S)**

- ICAO DOC. 9613 4TH. EDITION
- ICAO ANNEX 11 15TH. EDITION
- ICAO ANNEX 10 - VOLUME I - 7TH. EDITION
- ICAO DOC. 9849 3RD. EDITION
- RSA 14 – APRIL 2019

## 1. INTRODUCTION

1.1 Global Navigation Satellite System (GNSS) signals vulnerability is a global challenge, affecting the Middle East region as much as any other ICAO regions. To address this challenge, concerted efforts are required from all countries and international institutions working in civil aviation. It is necessary to develop mechanisms to reduce the impact of GNSS signals vulnerability and to mitigate its effects, if it occurs. It is important to note that perfect continuity, availability, accuracy, and integrity of GNSS signals is an unattainable goal.

1.2 The Global Navigation Satellite System (GNSS) is a critical component of Air Traffic Management (ATM) operations and flights. GNSS provides precise positioning, navigation, and timing (PNT) information to aircraft, which is used for a variety of purposes, including:

a) Flight planning and navigation

b) Surveillance and separation

c) Landing and takeoff

d) Arrival and departure procedures

e) RVSM Monitoring through ADS-B in near future

1.3 GNSS has proven its benefits for ATM safety and efficiency. However, its low signal strength makes it vulnerable to interference and other effects that have the potential to affect multiple aircraft over a wide area.

## 2. DISCUSSION

2.1 GNSS vulnerabilities can be caused by a variety of factors, including:

a) Intentional interference, such as jamming and spoofing, which can be used to disrupt or manipulate GNSS signals;

b) Unintentional interference, such as from radio frequency (RF) emissions from other devices and systems such as terrestrial radio and television transmitters;

c) Space weather events, such as solar flares, Coronal Mass Ejection (CME), Solar storm, magneto storm, etc…., which can generate electromagnetic interference that can disrupt GNSS signals;

d) Technical issues, such as satellite failures and equipment malfunctions.

2.2 The impact of GNSS vulnerabilities on ATM operations can range from minor disruptions to major incidents. For example, GNSS vulnerabilities can have serious consequences for ATM operations, including:

a) Loss of situational awareness for air traffic controllers and pilots.
b) Navigation errors that can lead to aircraft deviations, overflights, and collisions.
c) Disruption of critical ATM functions, such as surveillance and separation.
d) Delays and cancellations of flights.

2.3 In addition to the safety risks, GNSS vulnerabilities can also have a significant impact on ATM efficiency. For example, if aircraft are unable to use GNSS for navigation, controllers may need to use more conservative separation standards, which can reduce the number of aircraft that can operate in a given airspace.

2.4 The requirement to rely on terrestrial navigational aids to comply with RNAV specifications has re-emerged. In the Arab Republic of Egypt, we have studied the feasibility of using terrestrial navigational aids to support RNAV5 and RNAV1 specifications during the En-route and terminal manoeuvring area (TMA) phases of flight (using VOR/DME, DME/DME, and DME/DME/IRU sensors). Terrestrial approach aids will remain the primary and backup sources for RNAV approaches.

2.5 The RASG-MID/6 (Bahrain, 26 – 28 September 2017) agreed that IATA and ICAO MID Office should develop a RSA on GNSS vulnerabilities therefore, the Regional Aviation Safety Group for the Middle East Region (RASG-MID) has issued a Safety Advisory concerning GNSS Vulnerabilities and provided guidance material to mitigate the safety and operational impact of GNSS service disruption (RSA-14 in April 2019). This Safety Advisory provides guidance on a set of mitigation measures that States would deploy to minimize the GNSS vulnerabilities impact on safety and air operations. The RSA-14 also includes the regional reporting and monitoring procedures of

GNSS anomaly with the aim to analyse the threat and its impact on performance and assess the effectiveness of the mitigation measures in place.

2.6 Establishing mechanism to override the GNSS vulnerabilities in the MID Region has become imperative for the following actions:

a) Developing a regional plan for mitigating GNSS vulnerabilities, in collaboration with States, airlines, air traffic control authorities, and other stakeholders.

b) Issuing guidance to States on how to assess and mitigate GNSS vulnerabilities in their airspace.

c) Developing and implementing GNSS augmentation systems, such as ground-based augmentation systems (GBAS) and satellite-based augmentation systems (SBAS), to improve the accuracy and reliability of GNSS signals.

d) Following up on recommendations from the International Telecommunication Union (ITU) and other organizations to protect the GNSS spectrum from harmful interference.

## 3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) discuss any relevant matters as appropriate; and

c) agree on the mechanism to achieve the actions outlined in paragraph 2.6.

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