INTERNATIONAL CIVIL AVIATION ORGANIZATION

Fifth Meeting of the APIRG Infrastructure and Information Management Sub-Group (IIM/SG5)

(Virtual, 26 - 29 July 2022)

Agenda Item 3: ***Achievements in AIM, CNS, and MET***

3.1. Status of implementation of applicable ASBU elements

WP3.1C13 Prevention of interferences on the frequency band 1. 559 – 1. 610 GHz assigned to GNSS

(Presented by the Secretariat)

SUMMARY
This working paper presents GNSS signal vulnerabilities in light with related issues outlined by the International Civile Aviation Organization (ICAO) and recently collected by the International Telecommunication Union (ITU), and, calls for preventive and mitigation actions by Administrations/Organizations. Action by the meeting in paragraph 3
REFRENCE(S): ▪ Annex X Volume 1 ▪ Global Navigation Satellite System (GNSS) Manual (Doc 9849) ▪ APIRG/19 Report ▪ ITU RB Circular Letter Reports CR/488 Dated 8 July 2022 ▪ ICAO States Letters referred to in the document
This working document is related to **ICAO Strategic Objectives**: **A: Safety and B: Capacity and Efficiency** and all ASBU **APTA** Threads and Module provision.

1. INTRODUCTION

1.1 GNSS signals from satellites are very weak at the receiver antenna, so are vulnerable to interference. GNSS typically serves more aircraft simultaneously and the interference may affect wide geographic areas.

1.2 Current GNSS approvals use a single frequency band common to GPS, GLONASS and SBAS. This makes it easier to intentionally jam GNSS signals and it also makes unintentional interference more likely. The next generation GNSS will be based on multiple frequencies. This will reduce the likelihood of unintentional interference and will make intentional interference more difficult. Enhanced services depending upon the availability of multiple frequencies would, however, be degraded by interference with one frequency.

2. DISCUSSIONS

2.1 The ICAO Twelfth Air Navigation Conference in 2012, expressed concerns over GNSS vulnerability and approved **Recommendation 6/8** to States that reads as follows:

Recommendation 6/8 — Planning for mitigation of global navigation satellite system vulnerabilities

That States:

a) assess the likelihood and effects of global navigation satellite system vulnerabilities in their airspace and apply, as necessary, recognized and available mitigation methods;

b) provide effective spectrum management and protection of global navigation satellite system (GNSS)
frequencies to reduce the likelihood of unintentional interference or degradation of GNSS performance.

c) report to ICAO cases of harmful interference to global navigation satellite system that may have an impact on international civil aviation operations.

d) develop and enforce a strong regulatory framework governing the use of global navigation satellite system repeaters, pseudolites, spoofers and jammers.

2.2 The Council of ICAO, during the fourth meeting of its 196th Session on 18 June 2012, discussed issues of GNSS interference and its implications on the safety and security of international civil aviation, and took the following action:

a) noted with grave concern the recurrence of global positioning system (GPS) interference incidents affecting the safety of international air navigation in the Incheon Flight Information Region (FIR);

b) urged the Contracting State with the source of such GPS interference signals to ensure that any similar incidents do not take place again.

c) noted that GPS interference can cause a hazard to aviation safety and even lead to accidents through the malfunctioning of GPS receivers and the ground proximity warning system (GPWS);

d) recognized that GPS interference, if it is intended to jeopardize the safety of civil aviation, is not only in contravention of the principles of the *Convention on International Civil Aviation*, but also poses a hazard to civil aviation in a manner that undermines the objectives of Annex 17 —*Security* to the Convention.

e) requested the ICAO Secretary General to study, in collaboration with the ITU, when necessary, the implications of GNSS interference on the safety of international civil aviation with a view to preventing or addressing any similar incidents in the future. The Contracting States were informed by the ICAO States Letter Ref.: AN 13/4.5-12/50 dated 9 July 2012.

2.3 In line with the above, the APIRG/19 meeting *(Dakar, Sénégal, 28 – 31 octobre 2013)* discussed the GNSS vulnerabilities, including interference due to low power signals received from core satellite constellations or satellite-based augmentation systems, intentional corruption of the navigation signals to cause aircraft to deviate and follow a false flight path (spoofing), ionosphere and other atmospheric effects, system failure or human factors as addressed by the ICAO 12th Air Navigation Conference. APIRG/19 formulated the following conclusion:

Conclusion 19/28: Assessment and mitigation of GNSS vulnerabilities
That:
States providing GNSS services should:

- **a) Assess and report GNSS vulnerabilities in their airspace, including:**
  - **i). unintentional and intentional interference.**
  - **ii). ionospheric scintillation in equatorial regions.**
  - **iii). other vulnerabilities as may be identified; and**

- **b) Implement appropriate mitigation measures depending on**
  - **i). the airspace in question; and**

ii). the operations that must be supported.

2.4 Following an initial report to the 2019 World Radiocommunication Conference, the ITU Radiocommunication Bureau (**RB**) has been recently informed of a significant number of cases of harmful interference to the radionavigation-satellite service (**RNSS**) in the **1 559 – 1 610 MHz frequency band** affecting receivers onboard aircrafts and causing degradation or total loss of the service for passenger, cargo, and humanitarian flights. In some cases, this has also led to misleading information provided by RNSS receivers to pilots. Based on in-flight monitoring of air transport category aircraft GNSS receivers by one major aircraft manufacturer, 10 843 radio-frequency interference events were detected globally in 2021. Most of these events occurred in the Middle East region, but several events were also detected in the European, North American, and Asian regions.

2.5 At its 89th meeting in March 2022, the ITU Radio Regulations Board (**RRB**) considered the situation and instructed the Bureau to issue a circular letter to disseminate to the ITU Member States, its decisions and other background information about the prevention of harmful interference to RNSS receivers.

2.6 The 89th RRB meeting decided to request Member States to ensure that their operating agencies complied with the applicable provisions of the ITU legal instruments, as emphasized inter alia below:

a) "All stations, whatever their purpose, must be established and operated in such a manner as not to cause harmful interference to the radio services or communications of other Member States or of recognized operating agencies, or of other duly authorized operating agencies which carry on a radio service, and which operate in accordance with the provisions of the Radio Regulations." (Article 45 of the ITU Constitution);

b) "to take the steps required to prevent the transmission or circulation of false or deceptive distress, urgency, safety or identification signals, and to collaborate in locating and identifying stations under their jurisdiction transmitting such signals." (Article 47 of the ITU Constitution);

c) "Recognizing that transmissions on distress and safety frequencies and frequencies used for the safety and regularity of flight (see Article 31 and Appendix 27) require absolute international protection and that the elimination of harmful interference to such transmissions is imperative, administrations undertake to act immediately when their attention is drawn to any such harmful interference." (RR No. 15.28)

2.7 The Board further decided to request Member States to continue to exercise their utmost goodwill and mutual assistance in the application of the provisions of Article 45 of the Constitution and of Section VI of Article 15 of the Radio Regulations.

2.8 With respect to unnecessary transmissions, which represent one of the important sources of interference to RNSS, the RB pointed out that the use of devices commonly referred as "GNSS jammers" or any other illegal interfering equipment, which may cause harmful interference to aircraft, are prohibited by provision No. 15.1 of the Radio Regulations:
15.1 § 1 All stations are forbidden to carry out unnecessary transmissions, or the transmission of superfluous signals, or the transmission of false or misleading signals, or the transmission of signals without identification (except as provided for in Article 19).

2.9 In addition, the BR recalled that Administrations are encouraged to consider the following additional measures decided by the International Civil Aviation Organization (**ICAO**) at its 40th Assembly in October 2019 and disseminated by **ICAO State Letter AN 7/5-20/89 dated 28 August 2020** to address this critical issue:

a) reinforcing navigation systems resilience to interference.

b) increasing collaboration between radio regulatory and enforcement authorities.

c) reinforcing civil-military coordination to address interference risks associated with RNSS testing and conflict zones.

d) increasing coordination between aviation, military, and radio-regulatory authorities.

e) retaining essential conventional navigation infrastructure for contingency support in case of RNSS outages, and developing mitigation techniques for loss of services

2.10 Further to the RB ITU RB Circular Letter CR/488 dated the WACAF Regional Office disseminated the Letter Ref: T 7/7.8.1- 0343 dated 15 July 2022 on the ***Prevention of harmful interference to Radio Navigation Satellite Service Receivers in the 1559 – 1610 MHz frequency band*** calling upon Administrations to share this information with service providers (*Airlines, Air Navigation Service Providers, Aerodrome Operators, and all stakeholders operating in the aviation sector including the Air Force units*), sensitize the national Authority of Regulation of Telecommunication on the risk encountered by the civil aviation industry and provide feedback of actions taken to the Regional Office.

3. ACTIONS BY THE MEETING

3.1 The meeting is invited to:

a) Take note of the information provided in this Working Paper
b) Conduct the appropriate actions called upon by APIRG ICAO and ITU States Letters.

3.2 Draft Conclusion5/xx : ***Prevention of harmful interference to Radio Navigation Satellite Service Receivers in the 1559 – 1610 MHz frequency band and mitigation of their impact***

That.

In reference to APIRG/19 Conclusion 19/28: ***Assessment and mitigation of GNSS vulnerabilities,*** **and in accordance with ICAO SARPs the guidance materials provided respectively by th ICAO Annex X Volume 1 and the Global Navigation Satellite System (GNSS) Manual (Doc. 9849), Administrations endeavor to plan, conduct and monitor the appropriate actions aiming at preventing harmful interferences or mitigation the risk of the impact of such interferences to the Radio Navigation Satellite Service Receivers in the 1559 – 1610 MHz frequency band, in order to ensure the safety, capacity, efficiency and continuity of GNSS based air operation. In so doing they will:**

a) liaise with service providers (*Airlines, Air Navigation Service Providers, Aerodrome Operators, and all stakeholders operating in the aviation sector including Air Force units*),

b) sensitize the national Authority of Regulation of Telecommunication, on the risk encountered by the civil aviation industry, and,

c) provide feedback of actions taken to the ICAO Regional Offices

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