ICAO

INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY

ICAO WRC-27 Preparatory Workshop
Agenda item 2 & 5: GNSS Interference

Laurent Azoulai

Senior Expert Communication, Navigation,
Surveillance; ICCAIA (Airbus)

ICAO

Workshop on ITU World Radiocommunication Conference 2027
(WRC-27 Workshop)
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Presentation Overview

01 **Background**

02 **Potential Issues**

03 **ICAO Position**

04 **Conclusion**

01 Background

GNSS Interference definitions (Source: ICAO NSP/5 IP/26 - Montréal, 6-15 November 2018)

Intentional interference is generally referred to as **interference whose purpose is to disrupt signal reception**. Most effects of interferers on air navigation services are collateral and can be due to conflict zones, sensitive areas, personal privacy devices

The International Telecommunication Union (ITU) Radio Regulations (Vol 1, Art I, Sect VII) [24] define interference as

"**The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy**".

01 Background

GNSS Interference definitions (Source: ICAO NSP/5 IP/26 - Montréal, 6-15 November 2018)

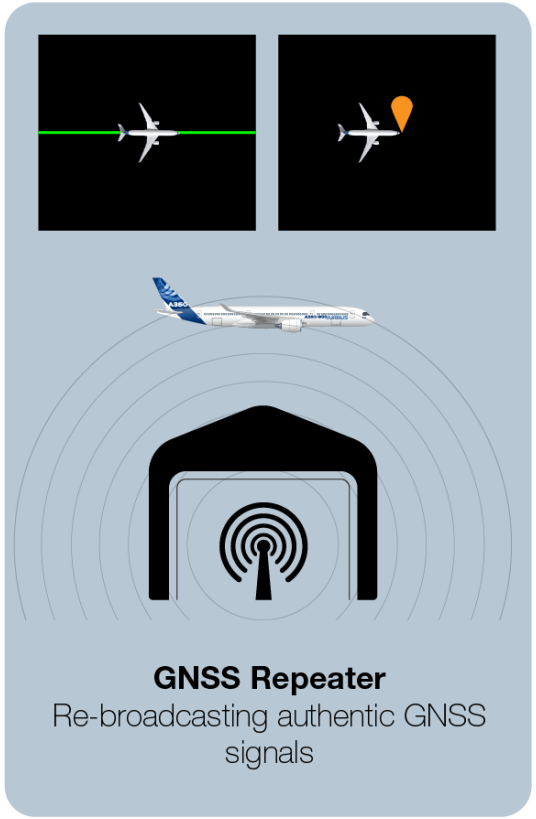
ITU classifies interference as permissible, accepted or harmful, where **harmful interference** is defined as "**Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with Radio Regulations**".

The proposed top-level types of harmful interference threats are Jamming and Spoofing, where:

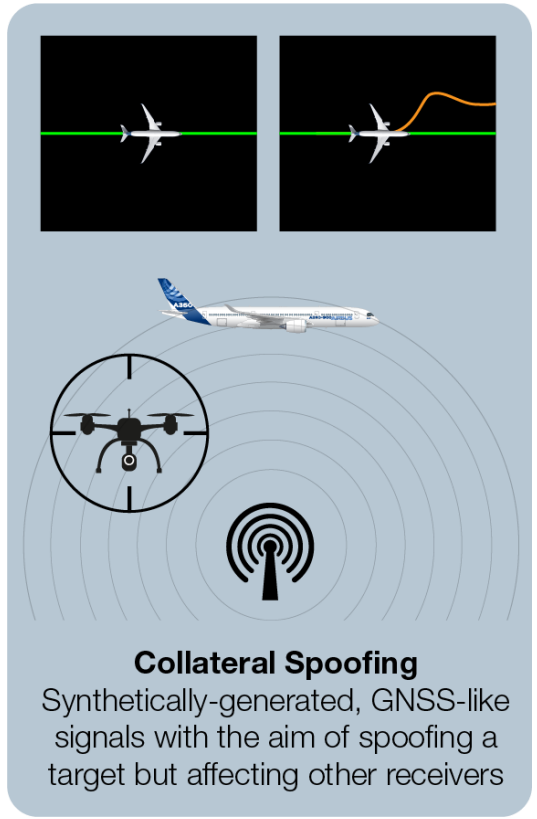
- Jamming denotes emissions that do not mimic GNSS signals, but rather interfere with the receiver's ability to acquire and track GNSS signals.
- Spoofing denotes emissions of GNSS-like signals that may be acquired and tracked in combination with or instead of the intended signals.

01 - Background

Types of GNSS interferences affecting Aviation Services



GNSS Repeater
Re-broadcasting authentic GNSS signals

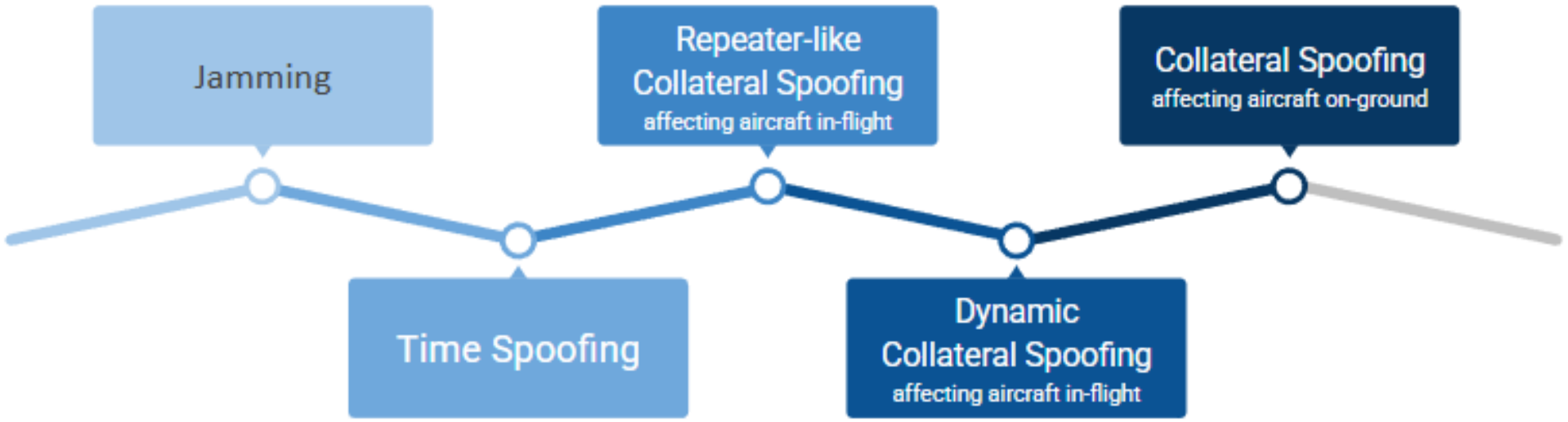


Collateral Spoofing
Synthetically-generated, GNSS-like signals with the aim of spoofing a target but affecting other receivers

Targeted Spoofing
GNSS-like signals based on real-time reception of authentic signals aiming to spoof a target

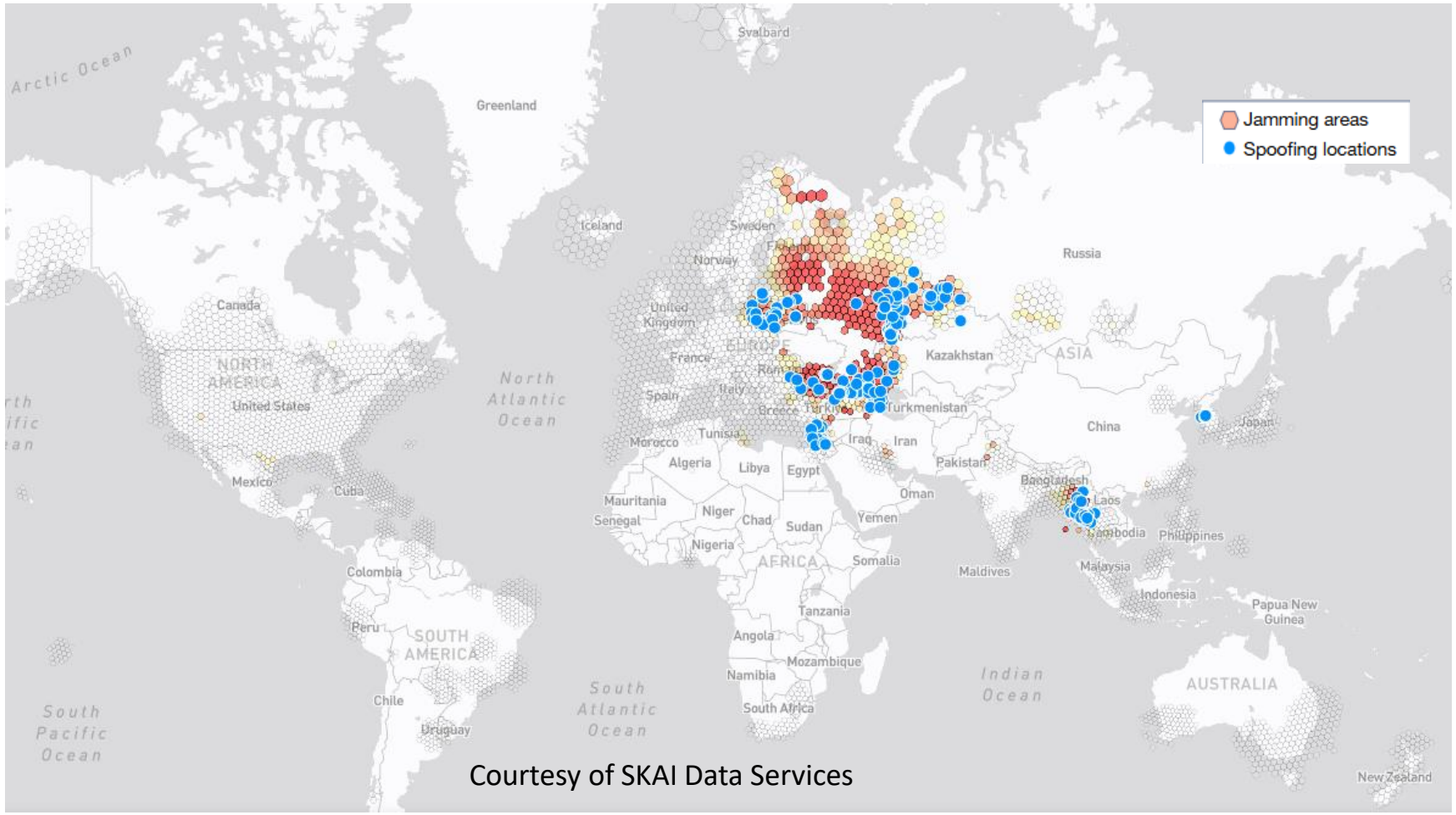
02 Potential issues

GNSS Interference evolutions near conflict zones



02 Potential issues

GNSS Interference jamming and spoofing zones

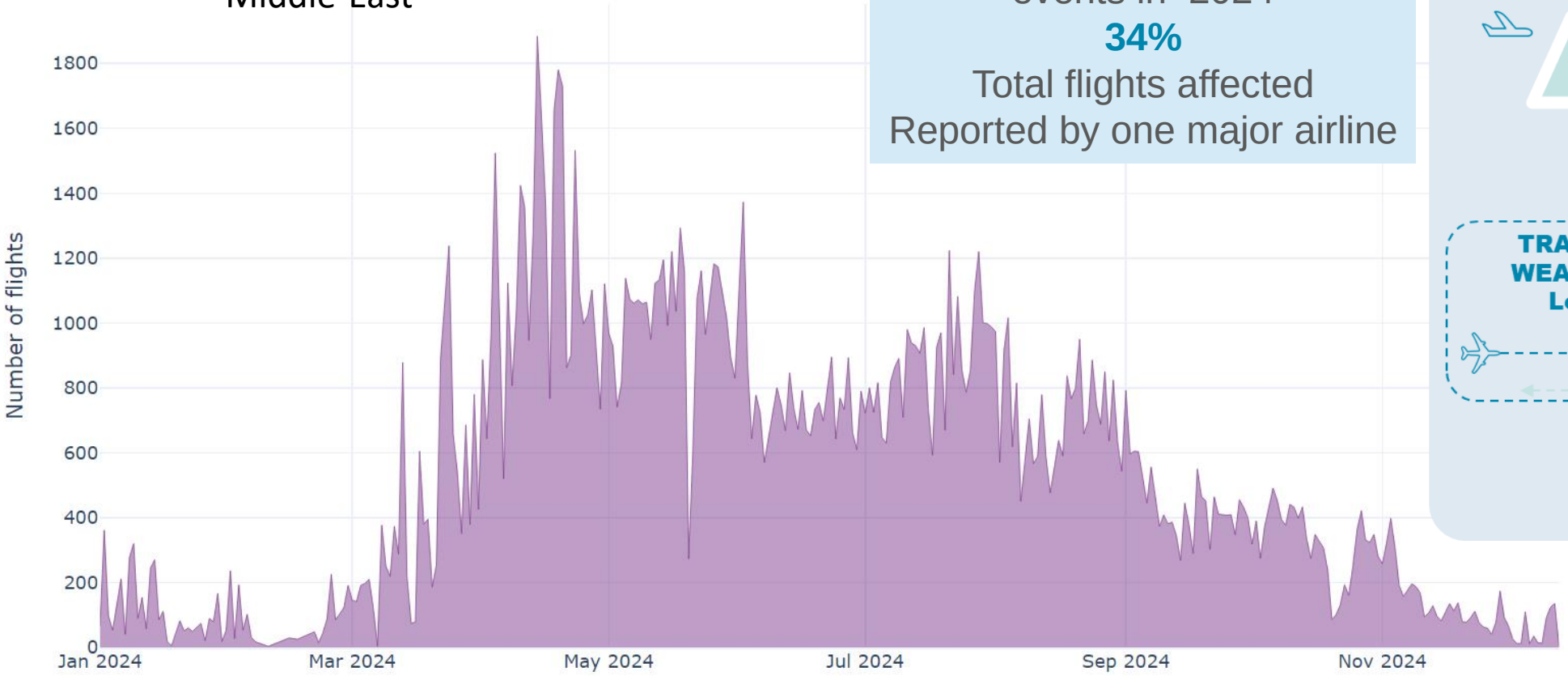


Courtesy of SKAI Data Services

02 Potential issues

Daily Number of Affected Flights per Spoofed-to Area

Middle-East



15000+
events in 2024
34%
Total flights affected
Reported by one major airline

AIRCRAFT IMPACTS

TERRAIN
Loss or
Nuisance alerts

TRAFFIC, WEATHER Loss

Temporary or permanent loss of GPS-based Navigation

Incorrect Aircraft Position & Timing

Example: oceanic operations adversely affected

02 Potential issues

Possible effects of GNSS interferences (Sources: EASA SIB 2022-02R3 - 05 July 2024)

- Loss of or misleading surveillance function (corrupted Automatic Dependent Surveillance-Broadcast (ADS-B), TAWS, TCAS, ACAS;
- Loss of or misleading information on a Synthetic Vision Systems (SVS), weather uplink functions, predictive wind shear, and other surface functionalities;
- Inconsistent flight guidance possibly resulting in route divergence, uncommanded turns, and deviations from the ATC clearances or instructions received, which could potentially lead to airspace infringements, loss of traffic separation, insufficient terrain/obstacle clearance, etc.;
- Inconsistent, or potentially misleading aircraft position, GNSS altitude, and calculated ground or wind speed on the navigation display or on the Electronic Flight Bag (EFB);
- Inconsistent, or potentially misleading aircraft position and/or GNSS altitude, later in the flight after having exited the affected area, e.g., during approach;
- Loss or misleading time and/or date dependent systems (e.g., clock, fuel computation system, flight management system, discarded Controller Pilot Data Link Communication (CPDLC) messages)

03 ICAO Position

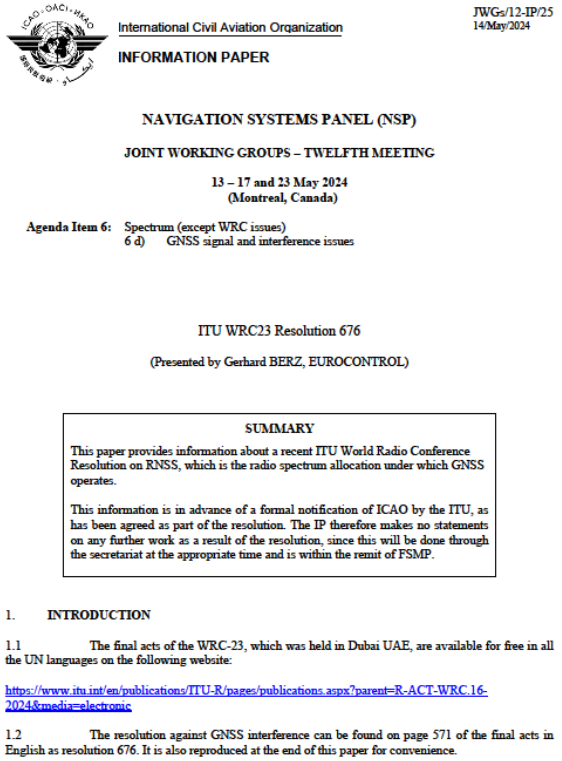
WRC-23 Resolution 676

Extract from ICAO NSP JWGs/12 Report:

6d26) The history of this ITU WRC23 Resolution 676 started with letters from ECTL. Resolution went a quick path.

6d27) It was not possible to get States to agree to this resolution without making reference to the right of States to interfere with any radio service, as per the ITU Constitution, for security purposes. That part of the resolution is just restating a right for states to generate RFI that had been existing at ITU since the 1950s.

6d28) What this resolution is suggesting is that if there is not a zone of conflict, then this zone should not be having RFI



International Civil Aviation Organization

JWGs/12-IP/25
14/May/2024

INFORMATION PAPER

NAVIGATION SYSTEMS PANEL (NSP)

JOINT WORKING GROUPS – TWELFTH MEETING

13 – 17 and 23 May 2024
(Montreal, Canada)

Agenda Item 6: Spectrum (except WRC issues)
6 d) GNSS signal and interference issues

ITU WRC23 Resolution 676

(Presented by Gerhard BERZ, EUROCONTROL)

SUMMARY

This paper provides information about a recent ITU World Radio Conference Resolution on RNSS, which is the radio spectrum allocation under which GNSS operates.

This information is in advance of a formal notification of ICAO by the ITU, as has been agreed as part of the resolution. The IP therefore makes no statements on any further work as a result of the resolution, since this will be done through the secretariat at the appropriate time and is within the remit of FSMP.

1. **INTRODUCTION**

1.1 The final acts of the WRC-23, which was held in Dubai UAE, are available for free in all the UN languages on the following website:

https://www.itu.int/en/publications/ITU-R/pages/publications.aspx?parent=R-ACT-WRC.16-2024&media=electronic

1.2 The resolution against GNSS interference can be found on page 571 of the final acts in English as resolution 676. It is also reproduced at the end of this paper for convenience.

03 ICAO Position

WRC-27 Agenda Item 4

In accordance with Resolution 95 (Rev.WRC-19), to review the resolutions and recommendations of previous conferences with a view to their possible revision, replacement or abrogation.

ICAO Position:

676 (WRC-23)	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.	Modify to remove formal recognition that Administrations can deny access to RNSS.

03 ICAO Position

ICAO 14th Air Navigation Conference Recommendations

Recommendation 2.2/2 – Addressing global navigation satellite system interference and contingency planning

That States:

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 global navigation satellite system interference;

through the mechanism of the planning and implementation regional groups, develop regional global navigation satellite system reporting mechanisms to raise operational awareness of affected geographical areas, to the extent feasible, as described in the *Global Navigation Satellite System (GNSS) Manual* (Doc 9849);

work with industry to identify means to make aircraft systems more resilient to radio frequency interference events, and 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; and

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

03 ICAO Position

ICAO 14th Air Navigation Conference Recommendations

Recommendation 2.2/2 – Addressing global navigation satellite system interference and contingency planning

that ICAO:

continue to assess the impact of global navigation satellite system interference on aviation safety and continuity of civil aviation operations and define adequate mitigation measures, while reminding States of their obligations;

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;

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

develop recommendations for globally harmonized minimum aircraft equipage lists to ensure that provided navigation infrastructure can be used by airspace users in line with available air traffic services.

04 Conclusion

- The GNSS interference threat is active and evolving
- It is a global problem that is considered at industry level
- Evolution of regulations, standards and recommended practices have started in order to address short term challenges as well as develop long term solutions
- ICAO 14th Air Navigation Conference has identified recommendations to be investigated by relevant panels

Thank You

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