

# CANSO GLOBAL SAFETY CONFERENCE 2025

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# GNSS SPOOFING AND JAMMING



### PRESENTER



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### **GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)**

- **Definition:** Any satellite constellation that provides global positioning, navigation, and timing services.
- GNSS Examples: Galileo (EU), GPS (USA), GLONASS (Russia), and BeiDou (China)
- Integrated GNSS Aircraft Systems: FMS, Hybrid IRS, the aircraft clock, GPWS, Weather Radar, CPDLC, ADS-B and ADS-C, etc.
- Safety Issue: GPS Interference



### **GPS INTERFERENCE**

- Normal Operations: Aircraft GPS receiver receives Position, Navigation, and Timing information from satellites.
- GPS Jamming: Radio transmitter transmits noise or interference on the GPS frequency band(s), causing aircraft GPS receiver to lose satellite signal.
- GPS Spoofing: Ground-based transmitter(s) sends fake GPS signal, causing GPS receivers to calculate incorrect position, time, and altitude.
- There are no quick or easy solutions to GNSS issues.



### **PICTORIAL EXAMPLES OF GNSS INTERFERENCE**



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### **GPS INTERFERENCE IMPACTS ON CIVIL AVIATION**

- Frequency: 500% increase in spoofing in 2024
- Location: Almost all spoofing incidents affecting civil aircraft are related to conflict zones.
- Malicious Intent: No evidence suggests civil aircraft are being deliberately targeted.



### **GNSS SPOOFING: AN INCREASING RISK SINCE SEPT 2023**

Black Sea Russia — Korea — • January 2024 ~ 300 2000 • August 2024 ~ 1500 1500 Number of Flights Between 15 July – 15 1000 August 2024: 41,000 500 Jan 2024 Feb 2024 Mar 2024 Apr 2024 May 2024 Jun 2024 Jul 2024

Daily Estimated Number of Flights Affected by GPS Spoofing by Spoofed-to Region

Source: ZHAW/SkAI Data Services, using the OpenSky Network.

flights/day

flights/day

flights.

Date

## **GNSS INTERFERENCE SAFETY RISKS**

- Susceptibility: GNSS systems are more susceptible to spoofing than expected.
- Interdependencies: GNSS data corruption can affect other aircraft systems.
- Reliability: Spoofing degrades GNSS performance and renders system unreliable.
  - System does not operate correctly after GNSS coverage is restored, sometimes requiring replacement of hardware.
  - Growing concern among pilots questioning safety of some routes and losing trust in their systems.
  - Critical safety systems such as enhanced ground-proximity warning systems (EGPWS) are being <u>intentionally disabled</u> to prevent false alarms, undoing decades of progress in reducing Controlled Flight into Terrain (CFIT) accidents.

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### **ICAO GNSS COMMENTS**

- Voiced concerns with the recent escalation of GNSS jamming and spoofing and the significant safety risk it poses to civil aviation operations.
- Expressed the need for States to reduce the likelihood of such interference and to notify aviation authorities, regulators, and ANSPs regarding any intentional GNSS interference activity.

ICAO AN-Conf/12 & GNSS: "Global Navigation Satellite System (GNSS) Vulnerabilities" ICAO EUR/MID Radio Navigation Symposium (Antalya, 6-8 February 2024) Recommendations



# **ICAO GUIDANCE TO ANSPS ON GNSS**

#### **ANSPs must:**

- 1. Develop real-time monitoring of GNSS performance in their airspace.
- 2. Develop new and innovative ways of incorporating GNSS threats into their Safety Assurance and Quality Assurance processes, including associated risk management tools like RAP/RAT, to enable analysis and trend identification.
- 3. Develop standard data-sharing processes for both regional and global data exchange.



### **CANSO'S ROLE**

- CANSO is uniquely positioned to support ANSPs by driving consensus and setting standards on their behalf.
  Likely to receive direction from ICAO if we do not develop mitigations ourselves.
- CANSO Safety Steering Committee (SSC) has approved Safety Intelligence Work Group (SIWG) leading an effort to develop mitigations, best practices, etc. to support all CANSO member ANSPs.



### **PROPOSED WORK**

- Advanced GNSS monitoring infrastructure to identify and report interference events in real time with common standards.
  - Result: timely responses to jamming and spoofing incidents: rerouting or contingency planning.
- Real-time detection systems across the network of ANSPs under CANSO's leadership would facilitate a coordinated response to GNSS interference incidents.
- Global network of early-warning systems that enhances the safety and efficiency of international airspace.
  - Strengthens operational resilience, enabling ANSPs to maintain safe navigation, despite GNSS disruptions.
- Long-term trend analysis and mitigation strategies: hotspot identification and emerging trends: Strengthens operational resilience.
- Regional safety sharing processes.



### **REQUESTS FOR ASSISTANCE**

- Requesting participation in small work group to address GNSS interference
- **Particularly desire** ANSP representatives that have experienced GNSS, developed processes to mitigate GNSS interference, etc.
- Contact Safety Intelligence Work Group (SIWG) chairs if interested.



### SAFETY INTELLIGENCE WORK GROUP (SIWG) CHAIRS







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### **RESOURCES AND REFERENCES**

- ICAO AN-Conf/12 & GNSS: "Global Navigation Satellite System (GNSS) Vulnerabilities"
- ICAO EUR/MID Radio Navigation Symposium (Antalya, 6-8 February 2024) Recommendations
- "Final Report of the GPS Spoofing Workgroup Report," Published by OPSGROUP, September 6, 2024
- CANSO AireonINSIGHTS Dashboards



# THANK YOU

