Airbus activities and roadmap to address GNSS RFI

ICAO GNSS RFI Workshop

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Presented by : **Nassim ZELMAT**

Surveillance & Radio-Navigation Systems Product Leader

Airbus Customer Care Center

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Presentation Agenda

- 1. Problem Statement
- 2. Impact on Aircraft Systems
- 3. Enhance Awareness & Monitoring
- 4. In-Service Support
- 5. Enhance Resilience
- 6. Conclusion

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GNSS Interferences – Introduction

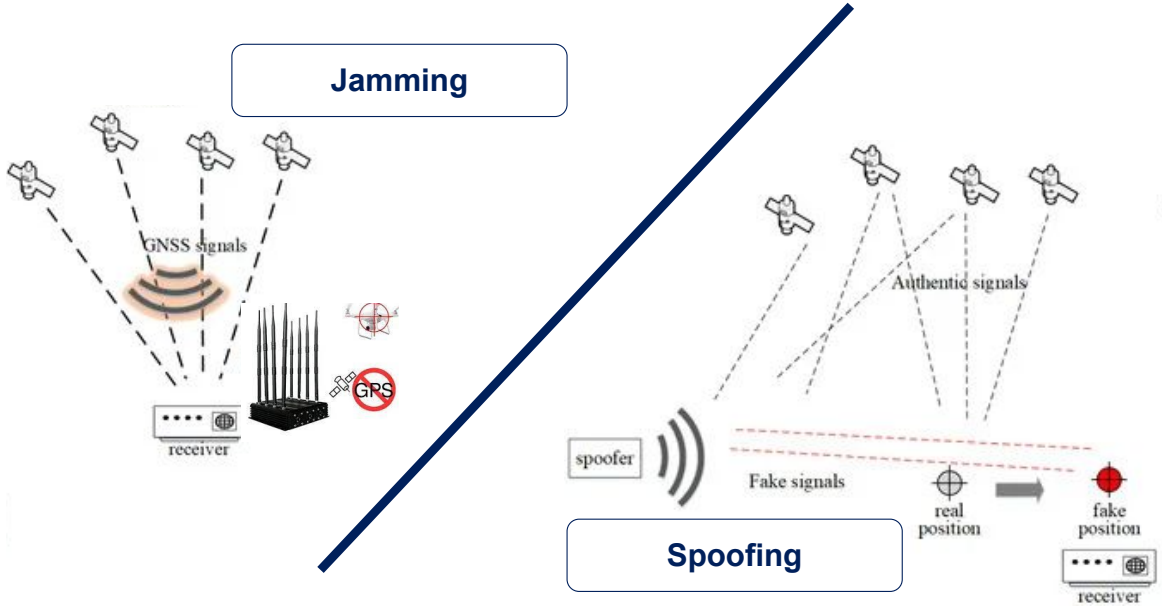
Airbus regularly receives a significant number of event reports and questions related to GNSS interferences. This phenomenon is worldwide, affecting navigation in key hotspots.

Stabilization of reported events to Airbus vs 2024 : GNSS interference effects remain stable while affected zones are evolving (and not reduced).

Two types of interferences:

- **Jamming**: prevents receiver from receiving GPS signal. No position and timing available.
- **Spoofing**: intentional broadcasting of counterfeit GPS signals. Computed position and timing are incorrect.

Example of areas affected by GNSS Interferences



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Main effects of GNSS Interference (Jamming & spoofing)

Navigation:

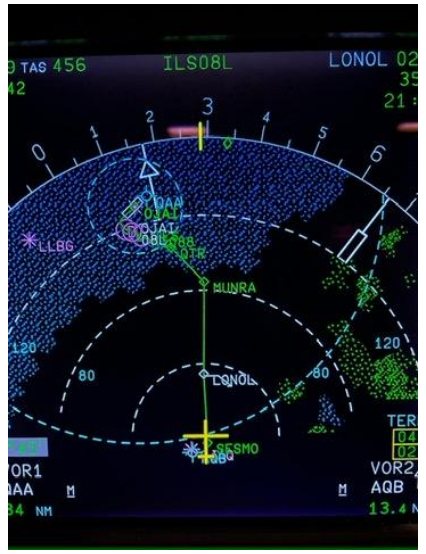
- GPS Receivers remaining in **degraded mode** (Lock-up) after crossing GNSS RFI area until maintenance actions on ground or shop visit.
  On A320, thanks to possibility to reset MMRs in-flight, MMRs can be recovered.
- GPS information (Latitude, Longitude, Altitude, Time and Ground Speed) **not consistent** with A/C position
- **Erroneous Inertial Reference (IR) auto-alignment** on spoofed GPS data.
- **Erroneous computed aircraft position** (possibly erroneous GPIRS position leading to FMS position shift and A/C position map shifted on ND).
- **Unexpected A/C roll** with AP engaged in NAV mode.
- **Erroneous wind speed** and **direction.**

Main effects of GNSS Interference (Jamming & spoofing)

Communication & Surveillance:

- Unjustified alerts (**TAWS**, **ROW/ROP** and **ALTSM**), erroneous TERR map display on ND,
- Loss of weather radar or erroneous weather info on ND.
- Loss of **TCAS**
- Loss of **CPDLC** application
- Erroneous **ADS-B** information.
- Erroneous **A/C clock** due to erroneous GPS time

Erroneous weather on ND



Erroneous TERR map on ND

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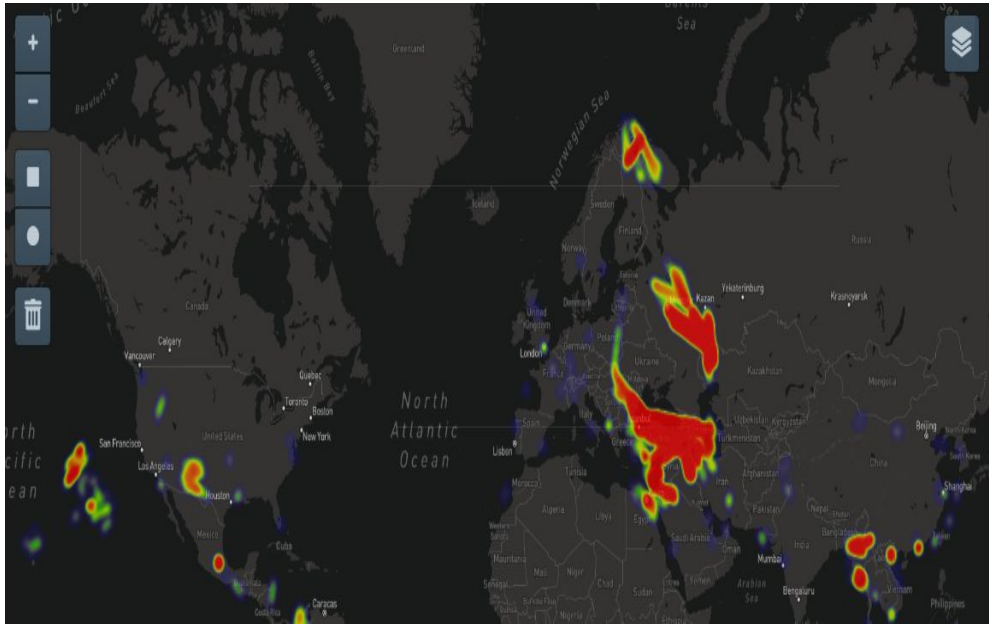
Enhance situational awareness

Awareness: Use of data to improve airline awareness about the affected areas to help flight preparation and pilot briefings.

GNSS degradation dashboard: Built by merging all monitored flight trajectories to identify degradation areas.

Data Acquisition: Enhance data acquisition to build monitoring dashboards (e.g., Skywise).

GNSS Degradation Dashboard" available (Jamming detection) for Skywise Core users.



To come: Enhancement of the dashboard including Spoofing detection.

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In-Service Support

- **FCOM Updates:** Extensive updates with supplementary procedures.
- **Webinars:** 6-monthly flight ops webinars.
- **Maintenance:** Improved maintenance tasks for GNSS interference observations.
- **Ops Considerations:** GPS deselection, TAWS inhibit, and system resets.

FCOM Supplementary Procedure

Training recommendations for GNSS Interference in the FCTS (Flight crew Training Standards)

EFFECTS

- Cockpit Effects Table
- Effects of Erroneous GNSS (spoofing)
- Persistent Effects

PROCEDURE

Flight Preparation	Anticipate and Plan
Preliminary Cockpit Preparation	Consider IRS full alignment For airports affected by spoofing: Procedure on ground
Before Interference Area	Protect A/C time
Within Interference Area	Monitor A/C position. Consider GPS deselection* Management of TAWS, ROW/ROP and approaches
After Interference Area	Restore systems to nominal Management of persistent effects
Parking	IRS performance procedure adapted to spoofing*

* Depending on A/C type

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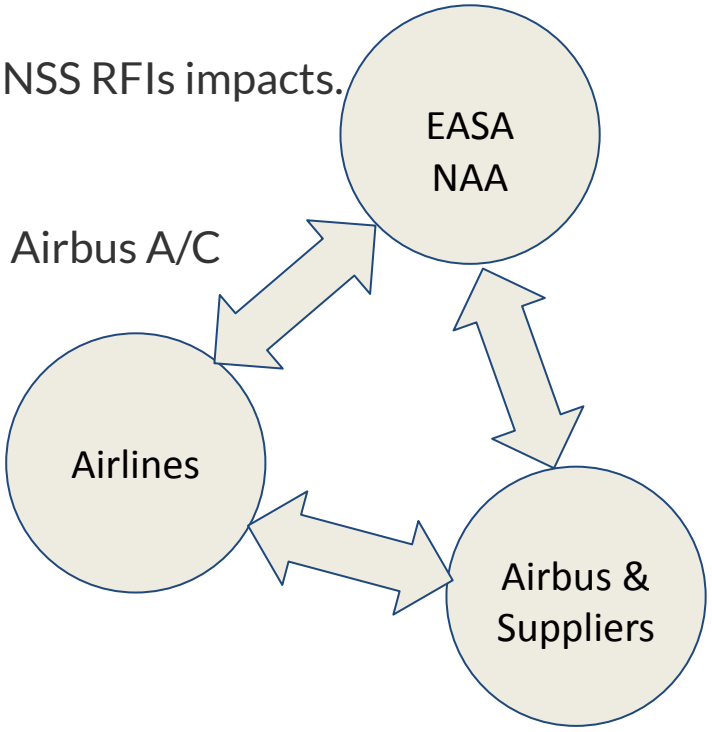
Reporting & Communication

Occurrences Reporting: Continuous reporting of all occurrences related to GNSS RFI events to EASA, triggering thus Engineering support and Design Office analysis. Suppliers are informed as well to conduct analysis either for further recommendations or for system improvement purpose (ex: Interim fix, etc.)

Technical Data: Continuous improvement of AMM/TSM and MP/AFI tasks to address GNSS RFIs impacts.

ISI Articles: Regular update of In-Service deliverables on GNSS loss and interference on Airbus A/C

→ Ex: ISI 34.36.00049 - **51,000 views** (58 pages).



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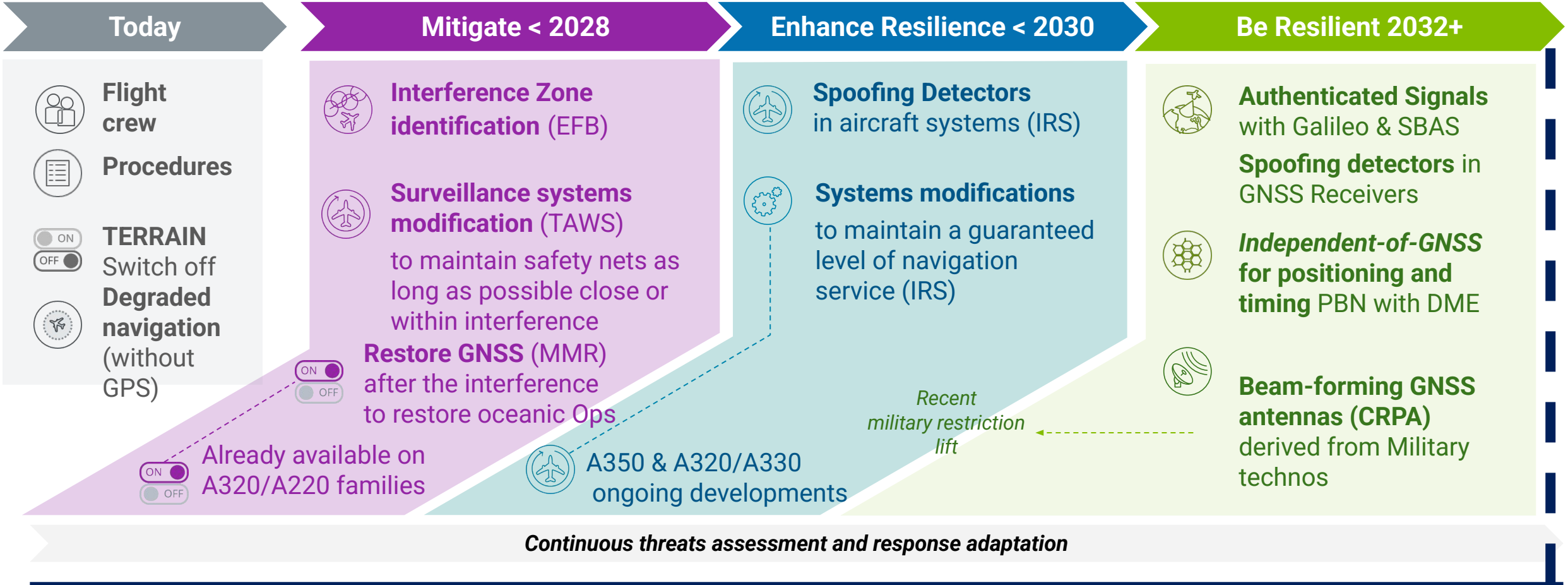
Airbus Roadmap to address GNSS interference



GNSS: Global Navigation Satellite System
PNT: Positioning, Navigation and Timing

PBN: Performance Based Navigation
EFB: Electronic Flight bag

IRS: Inertial Reference System
DME: Distance Measuring Equipment

TAWS: Terrain Awareness Warning System
MMR: Multi-Mode-Receiver

CRPA: Controlled Reception Pattern Antenna

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Jammertest

- Jammertest in Norway known environment with jammers/spoofers (and other industrial stakeholders including Airbus suppliers).
- Recording of RF signal (for replay in lab) with robustified Flight Test Instrumentation.
- Expose in flight new technologies/solutions on A330 flight test A/C.

Identification of GNSS RFI areas

Application on EFB/Tablet

Beam forming antenna (CRPA: Controlled Reception Pattern Antenna)

New Stds or prototypes (e.g. ADIRU, MMR)

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Conclusion

Major Concern:

- GNSS RFI is a major and growing concern for all operators.
- Operators are encouraged to share their events with Airbus as In-service feedback remains essential for situation monitoring, evolution of system design and procedures:

Industry Engagement:

- Participation in standardization Working Groups.
- Regular technical review meetings with Operators.
- Webinars to address main updates to a large audience.
- Maintain up-to-date in-service documentation (Ops, Eng & Maint).

Continuous Improvement

- Proactive enhancement roadmap : mitigate, enhanced resilience and resilience.
- Support ICAO and Standards Making Organizations (EUROCAE/RTCA/ARINC) actions for future resilient positioning, navigation, and timing (PNT).

Thank you

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