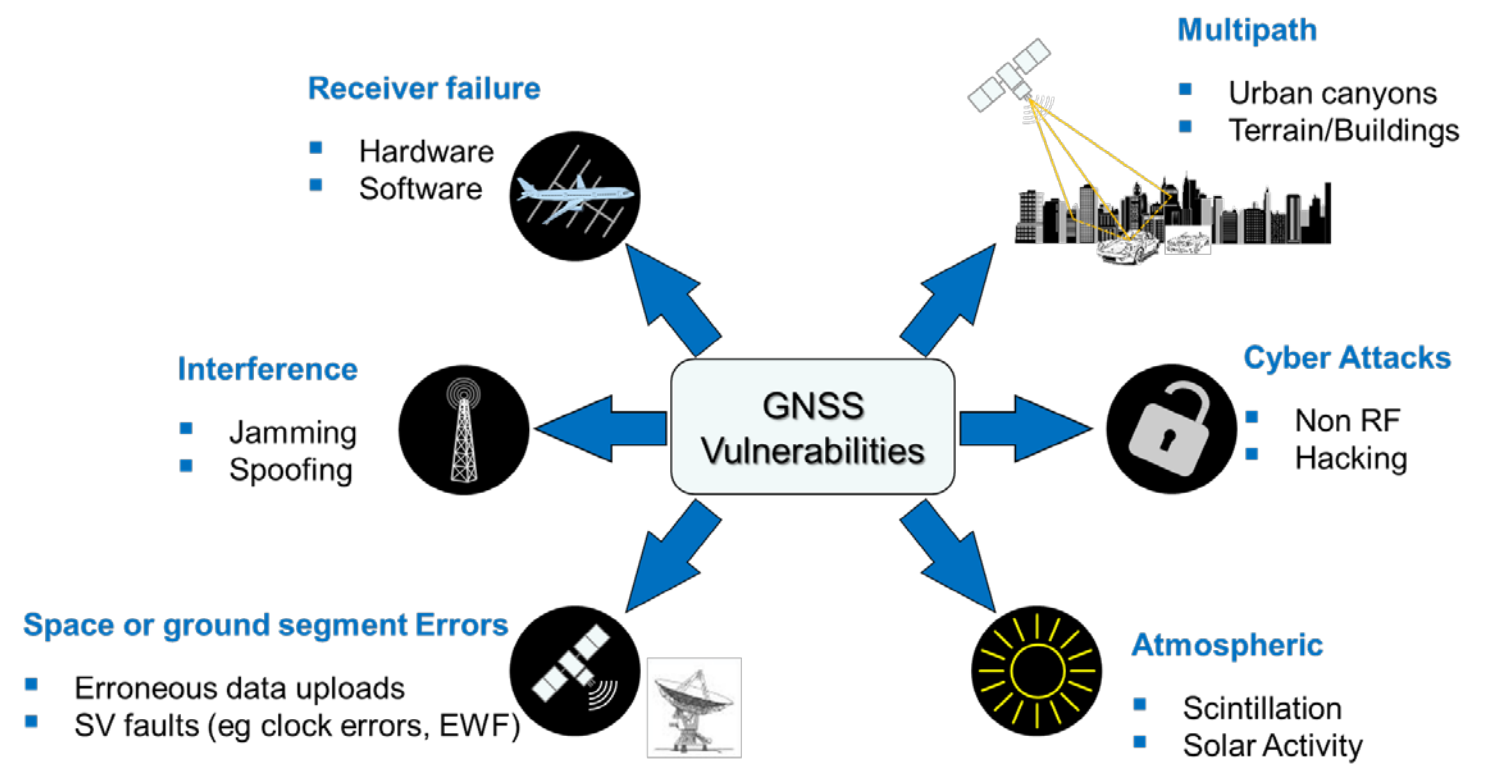# ICAO EUR/MID Radio Navigation Symposium

*GNSS vulnerabilities, navigation monitoring and mitigation measures*

Antalya, Turkiye
(6-8 February 2024)
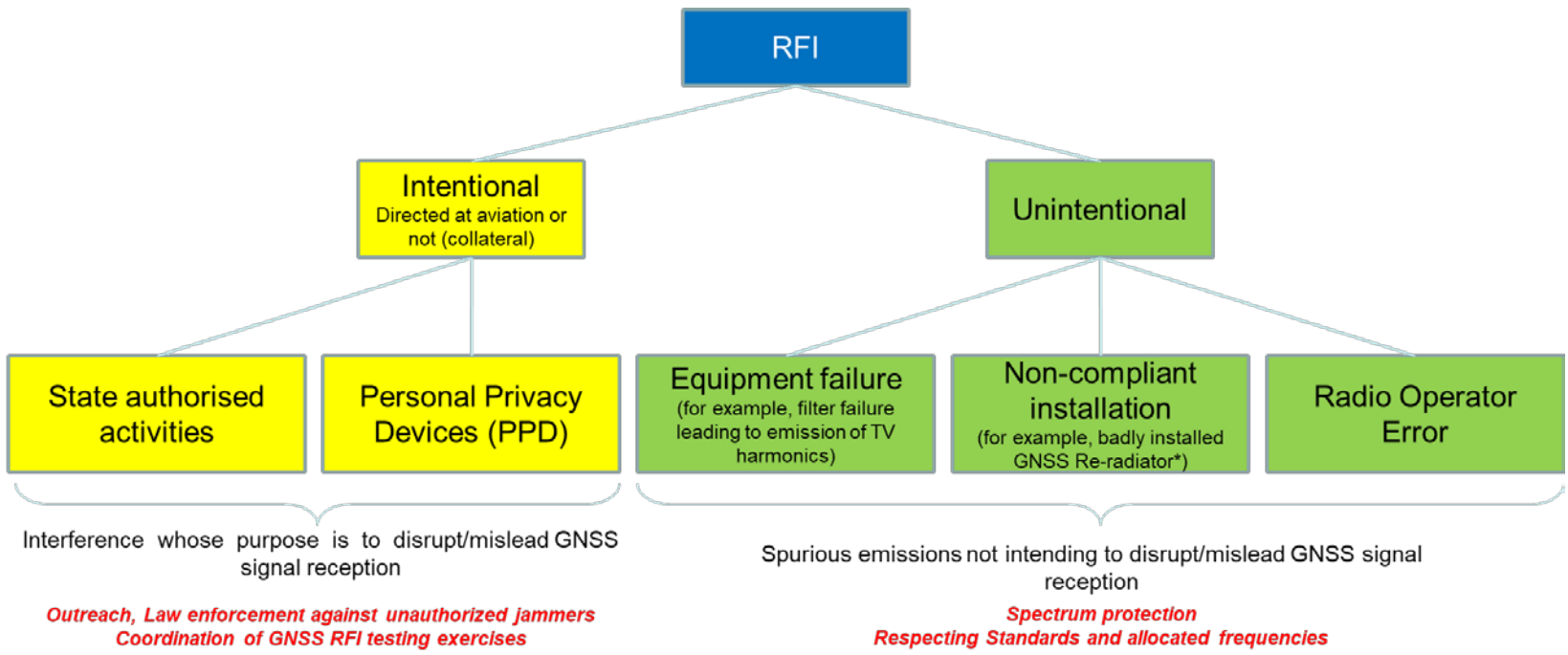
Hamdi NASSER, EUROCONTROL
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# GNSS vulnerabilities

# Strategic GNSS RFI mitigation

Classification drives strategies



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# GNSS threat tool

https://pbnportal.eu/epbn/main/PBN-Tools/GNSS-Threat.html

**Risk**

- Severity
  - Impact type
  - Number of impacted A/C
  - Duration of the event
  - Operational scenario coefficient (Type of traffic, Traffic density, GNSS back up)
- Likelihood based on past experience
- Mitigation score (Currently deployed measures)



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# EUROCONTROL Guidelines for GNSS Interference Testing

https://www.eurocontrol.int/publication/eurocontrol-guidelines-process-civil-military-gnss-interference-testing

Execution

Notification

Planning
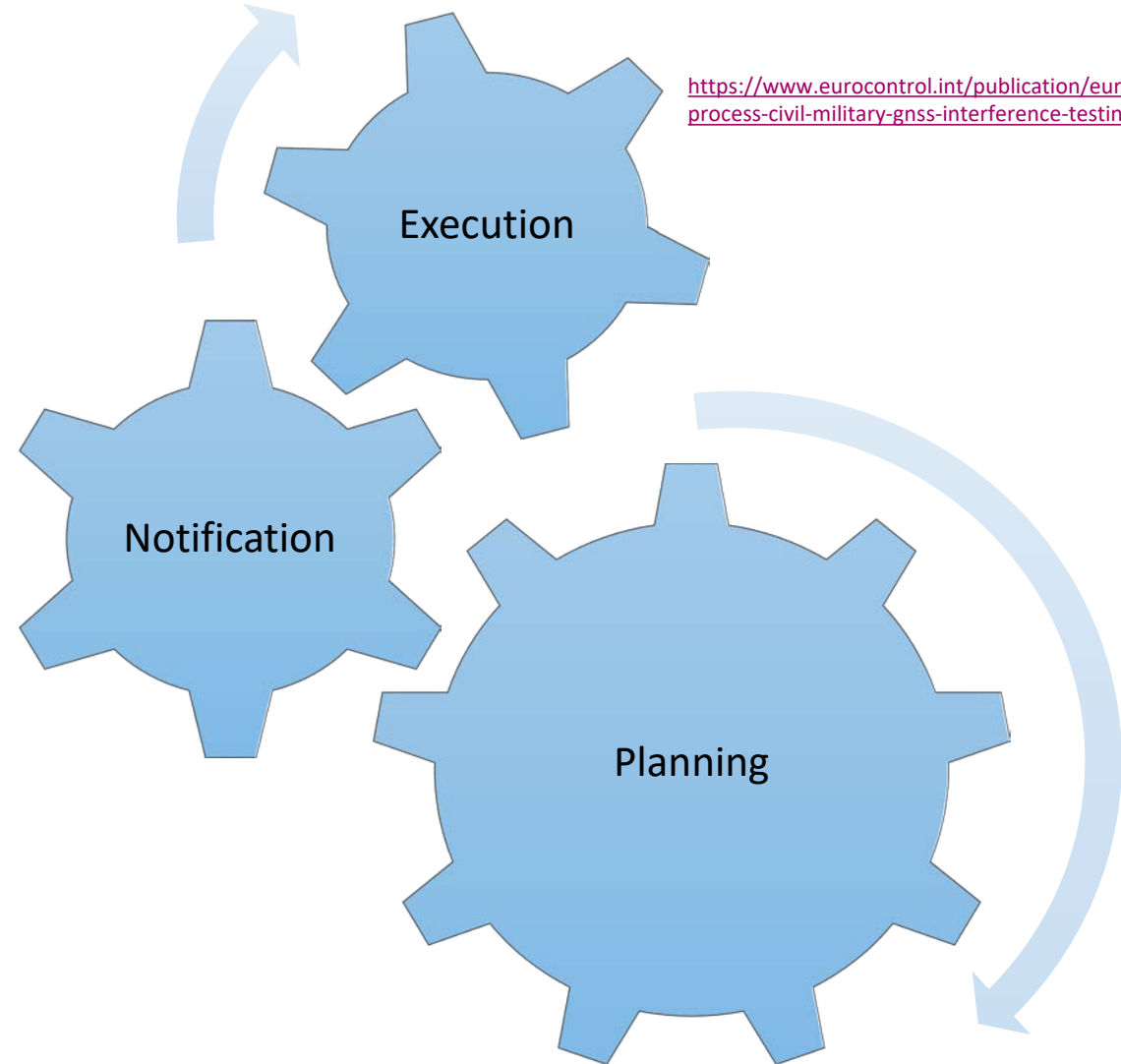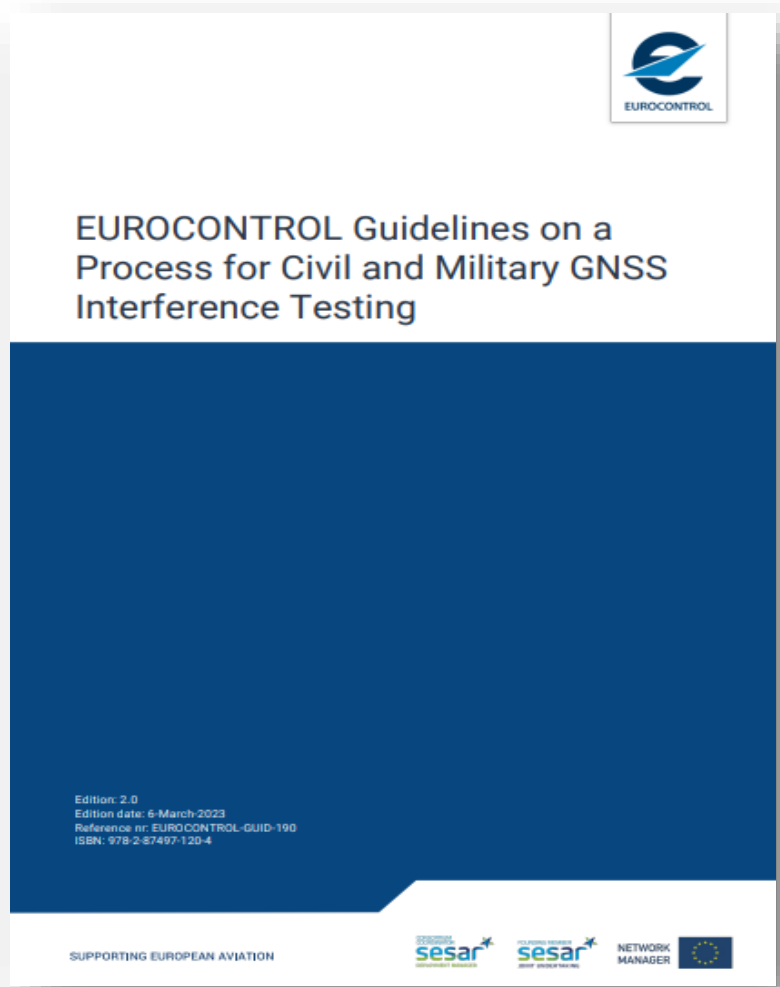
# Tactical Mitigation

What do I expect ?

**P**redict

Safe operations

**M**onitor

**R**eact

What should I do ?

What is happening?

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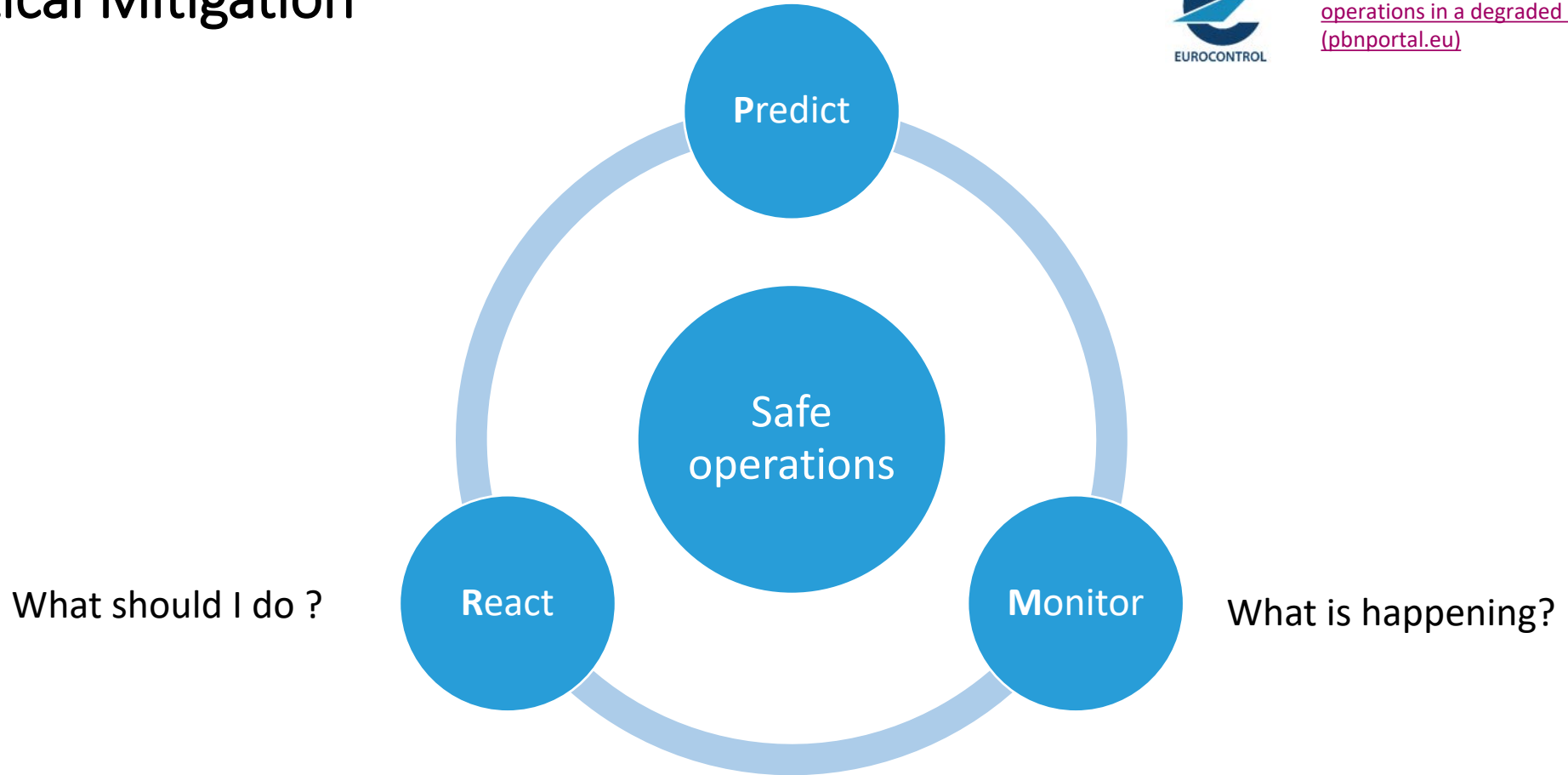
# Performance prediction



https://augur.eurocontrol.int/

https://pecasus.eu
NOAA / NWS Space Weather Prediction Center

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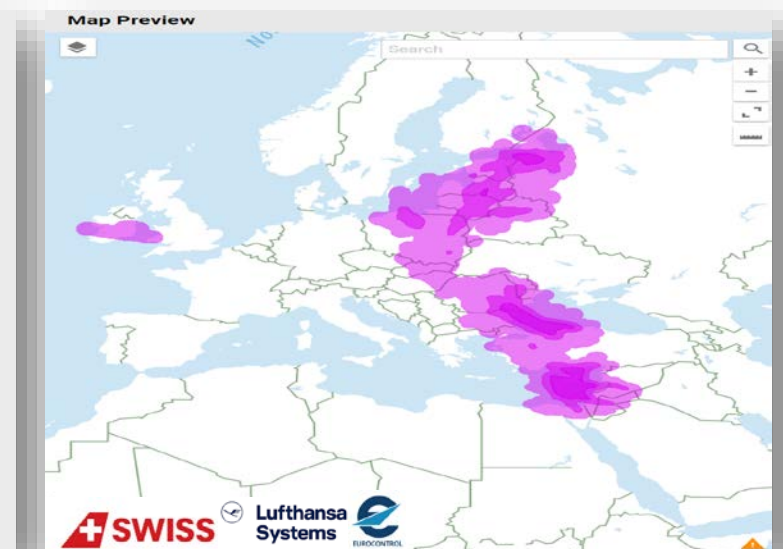
# Monitoring
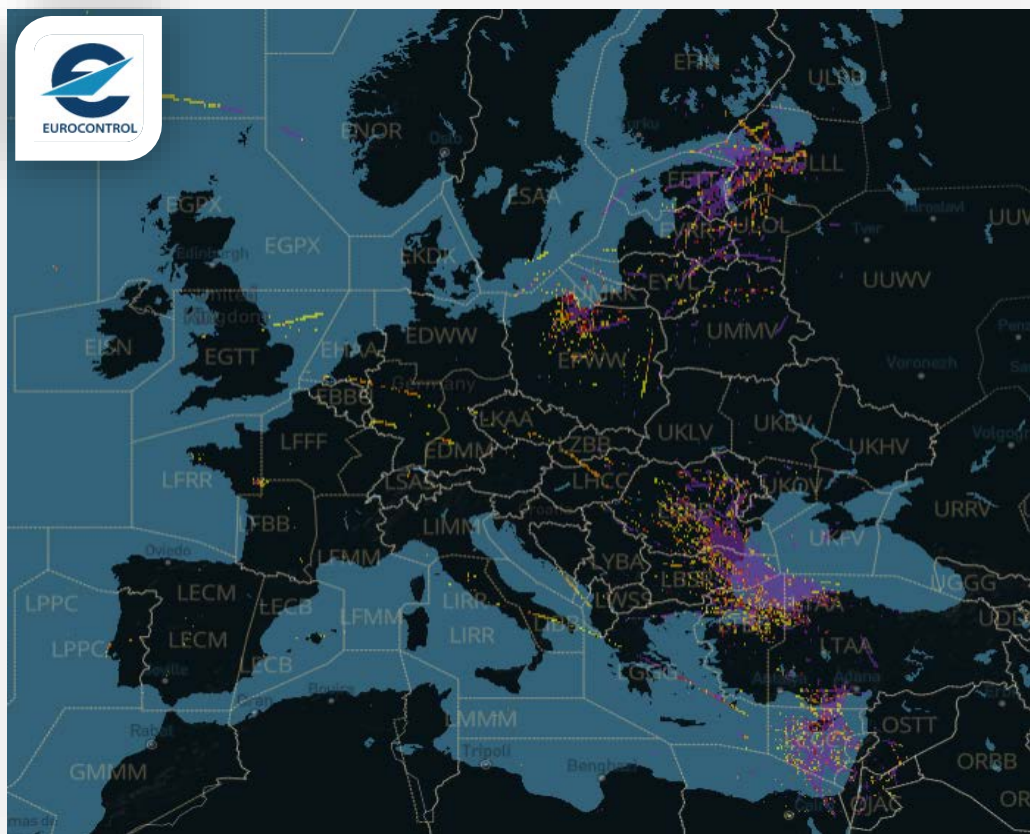
**Reporting**



**Detection**
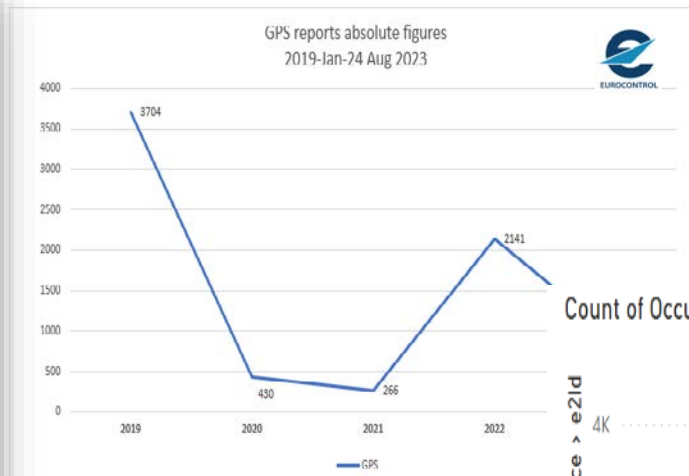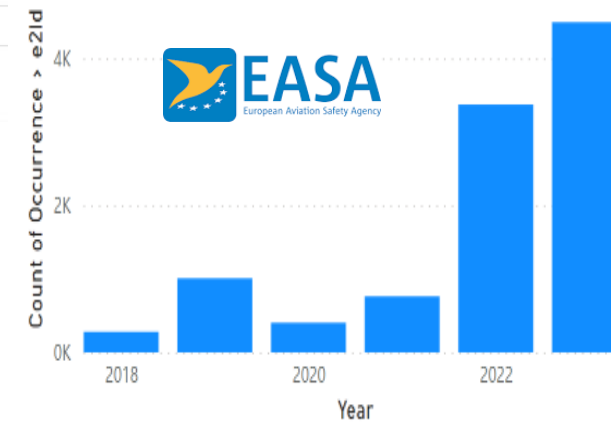
# How to react

**Impact** — What is observed and what do I have to tackle it

- Loss of RNP APCH, AC with only GPS require assistance, Workload increase
- Reversion capabilities: DME, ILS, IRS

**Information** — Who should be informed

- ATCo, Airspace users
- Radio regulators
- CAA

**Contingency procedures** — What are my "back up" procedures?

- Non GNSS based procedures
- Radar Vectoring, Capacity implications
- Missed Approach, Diversion
- Flight plan rejection

European GNSS Contingency/
Reversion Handbook for
PBN Operations

PBN HANDBOOK No. 6

SUPPORTING EUROPEAN AVIATION   SESAR

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# Tools supporting decision making


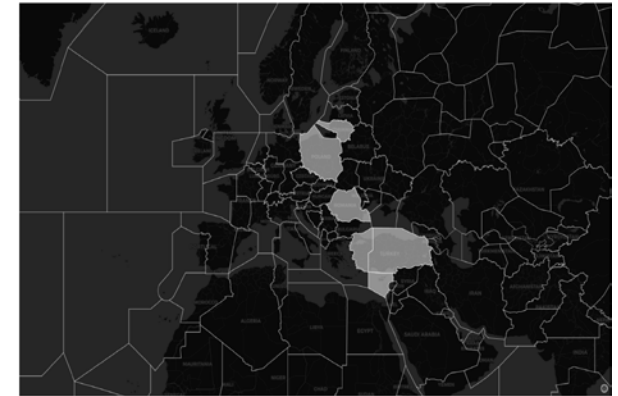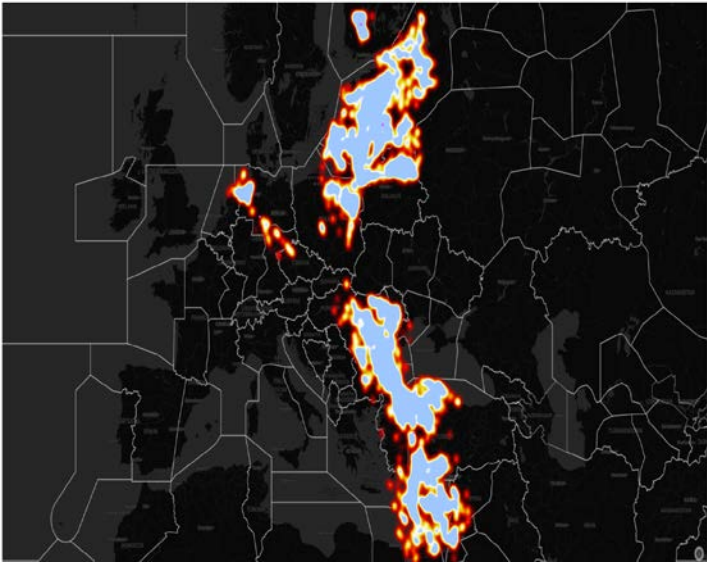
https://www.eurocontrol.int/service/navigation-systems-monitoring

https://www.eurocontrol.int/dashboard/communication-navigation-and-surveillance-dashboard

https://www.eurocontrol.int/online-tool/distance-measuring-equipment-tracer

# GNSS vulnerabilities and mitigation - Summary
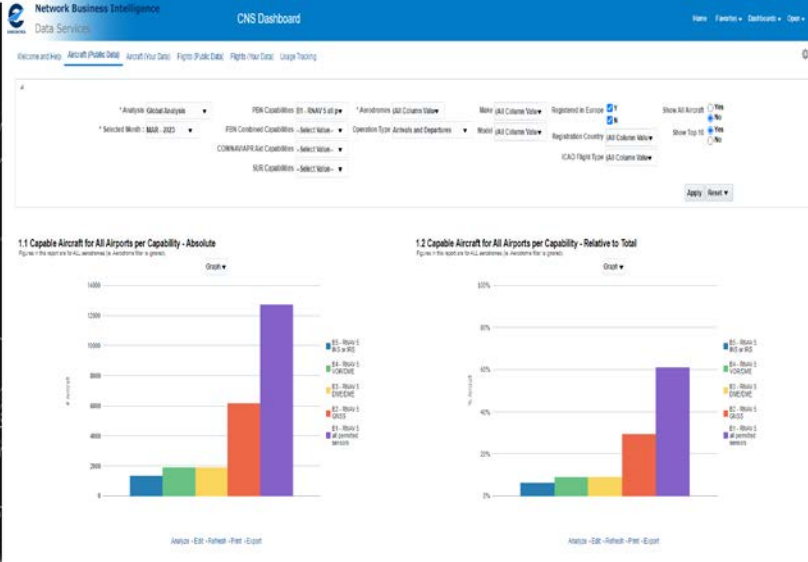
**Mitigations**

- ❖ <u>Aircraft design</u>: security features, better integration of airborne systems  GNSS resilience, redundancy

- ❖ Authority <u>oversight</u>

- ❖ <u>Coordination</u> between authorities

- ❖ GNSS <u>monitoring</u>, <u>reporting</u> and <u>alerting</u>

- ❖ Infrastructure: GNSS <u>back-up </u>& <u>CPNT</u>

- ❖ Operational <u>contingency</u>: ATM and Pilot <u>Procedures</u>

Thank You!