

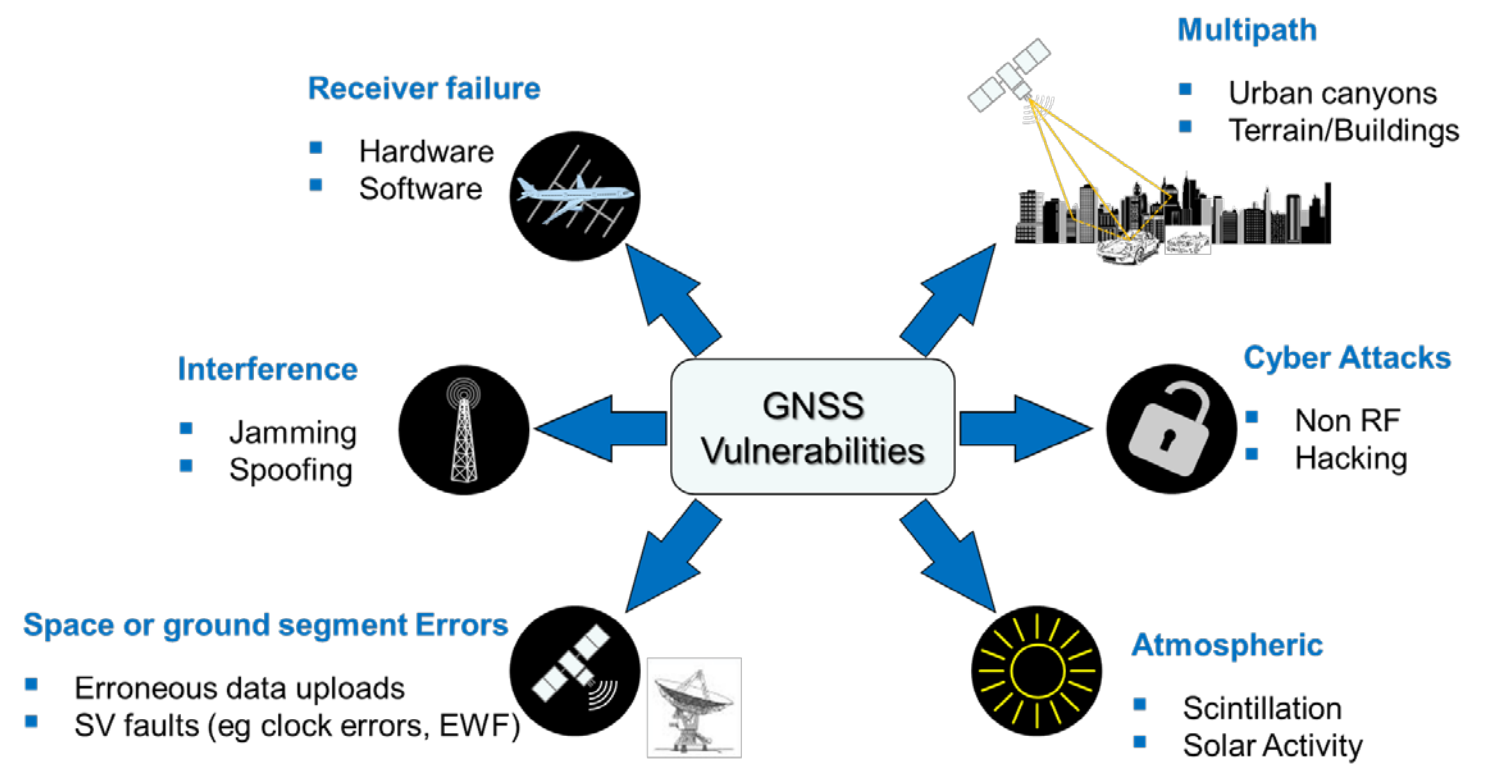
ICAO EUR/MID Radio Navigation Symposium

GNSS vulnerabilities, navigation monitoring and mitigation measures

Antalya, Turkiye
(6-8 February 2024)

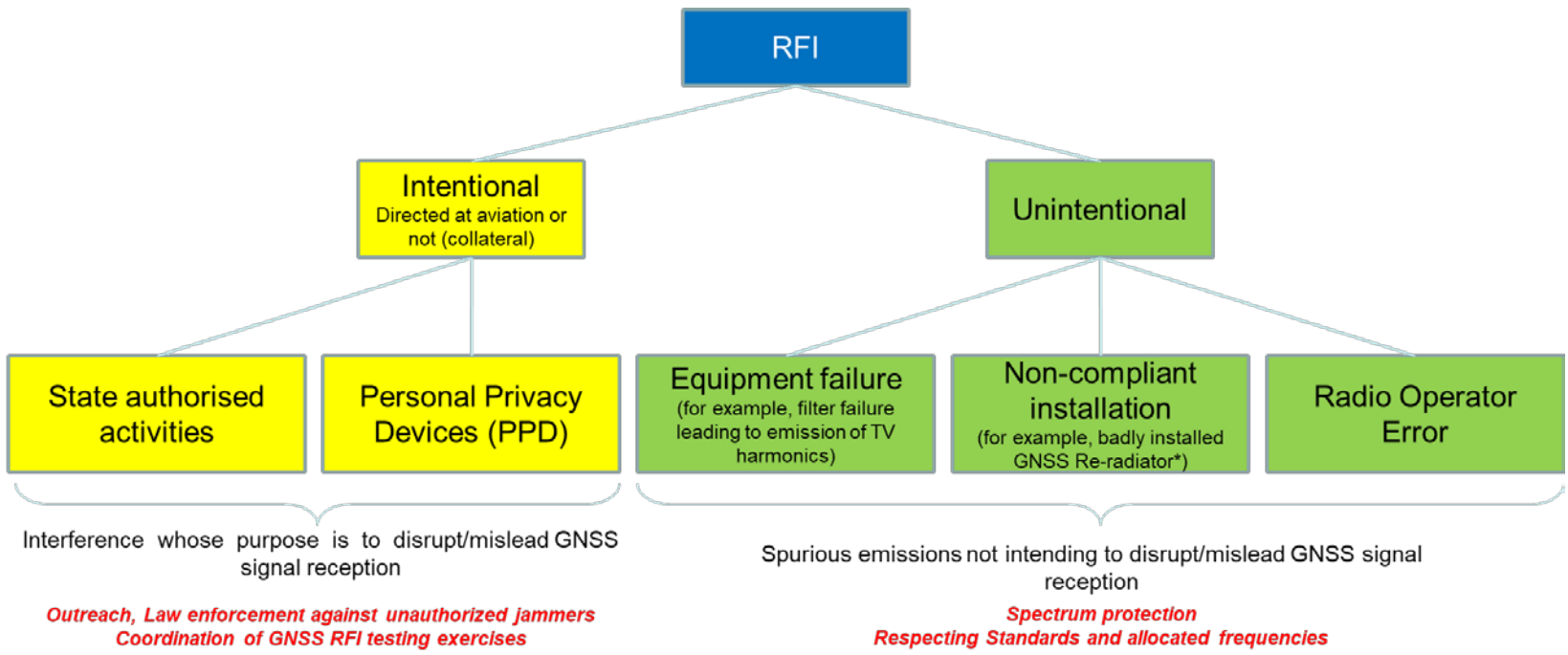
Hamdi NASSER, EUROCONTROL
hamdi.nasser@eurocontrol.int

GNSS vulnerabilities



Strategic GNSS RFI mitigation

Classification drives strategies



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)

GNSS Threat Tool

EUROCONTROL has developed a methodology to assess locally the risks of the different GNSS threats. The objective is to draw up a framework to identify high risk threats in a particular state and support the definition of the appropriate mitigation actions associated to those risks. Please see answers below for your case or [choose one example](#)

Which phase of flight is considered?

What is the traffic density?

What is the PBN application?

Which reversion infrastructure is available?

How many aircraft are impacted?

What is the expected duration of the event?

Which type of impact is considered?

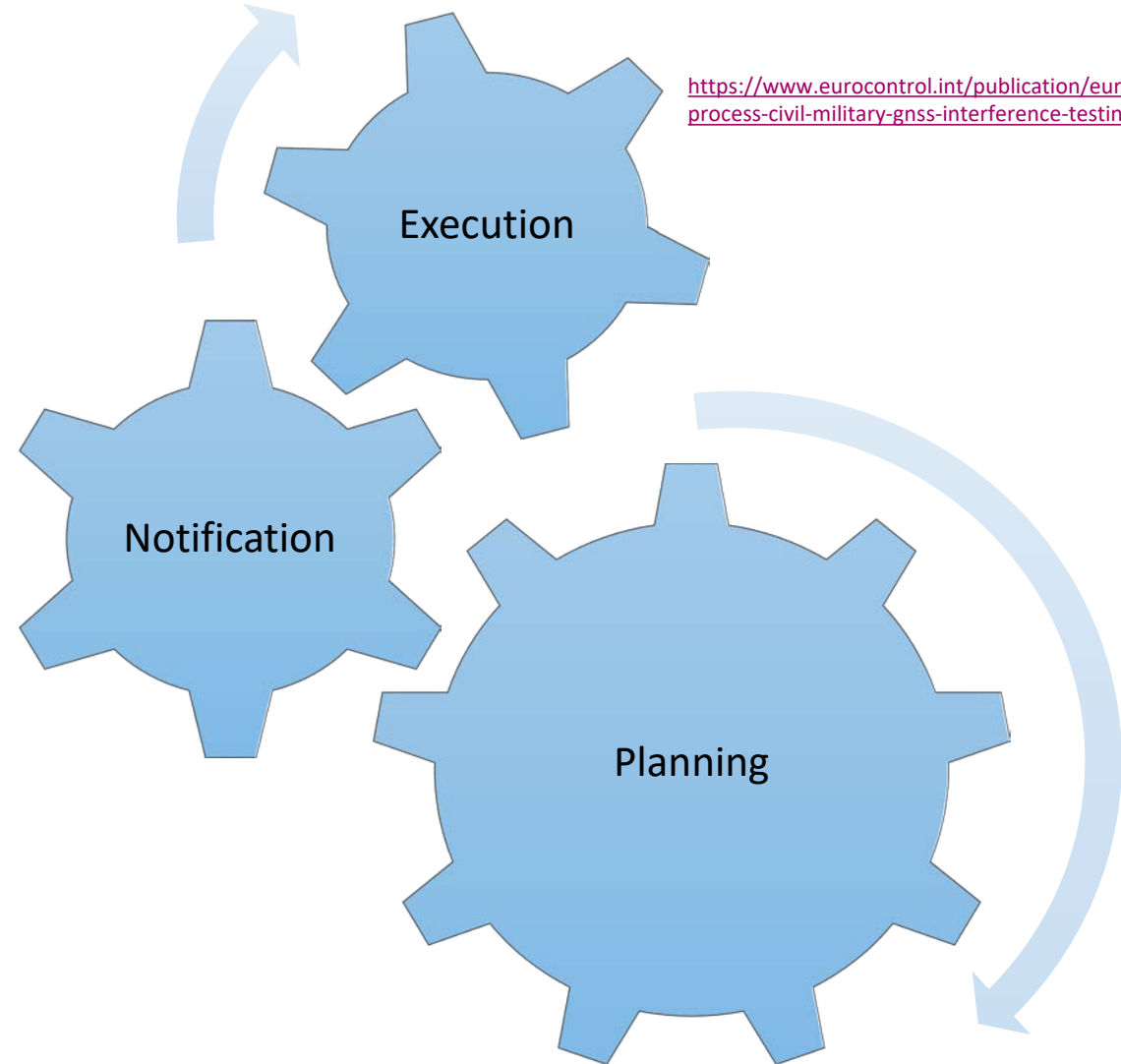
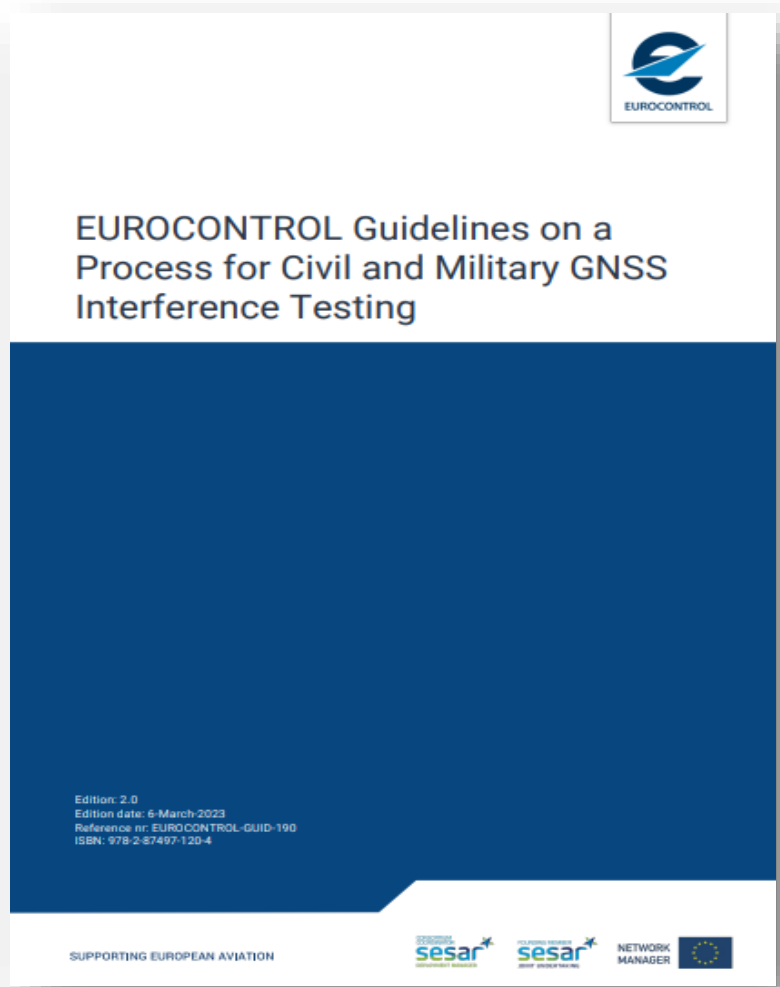
 Spoofing, GNSS repeaters, Erroneous incorrect position

What is the probability of the event occurring?

 1 per month / 1 per year

Are there any mitigation measures available?
 Possible mitigations could include:
 GNSS Monitoring / RFI detection capability, Flight crew awareness, Police awareness, Compatibility standards, Radio regulatory action, near-Airport detection tools, Training, guidelines, Established process for GNSS degradation events, etc

EUROCONTROL Guidelines for GNSS Interference Testing

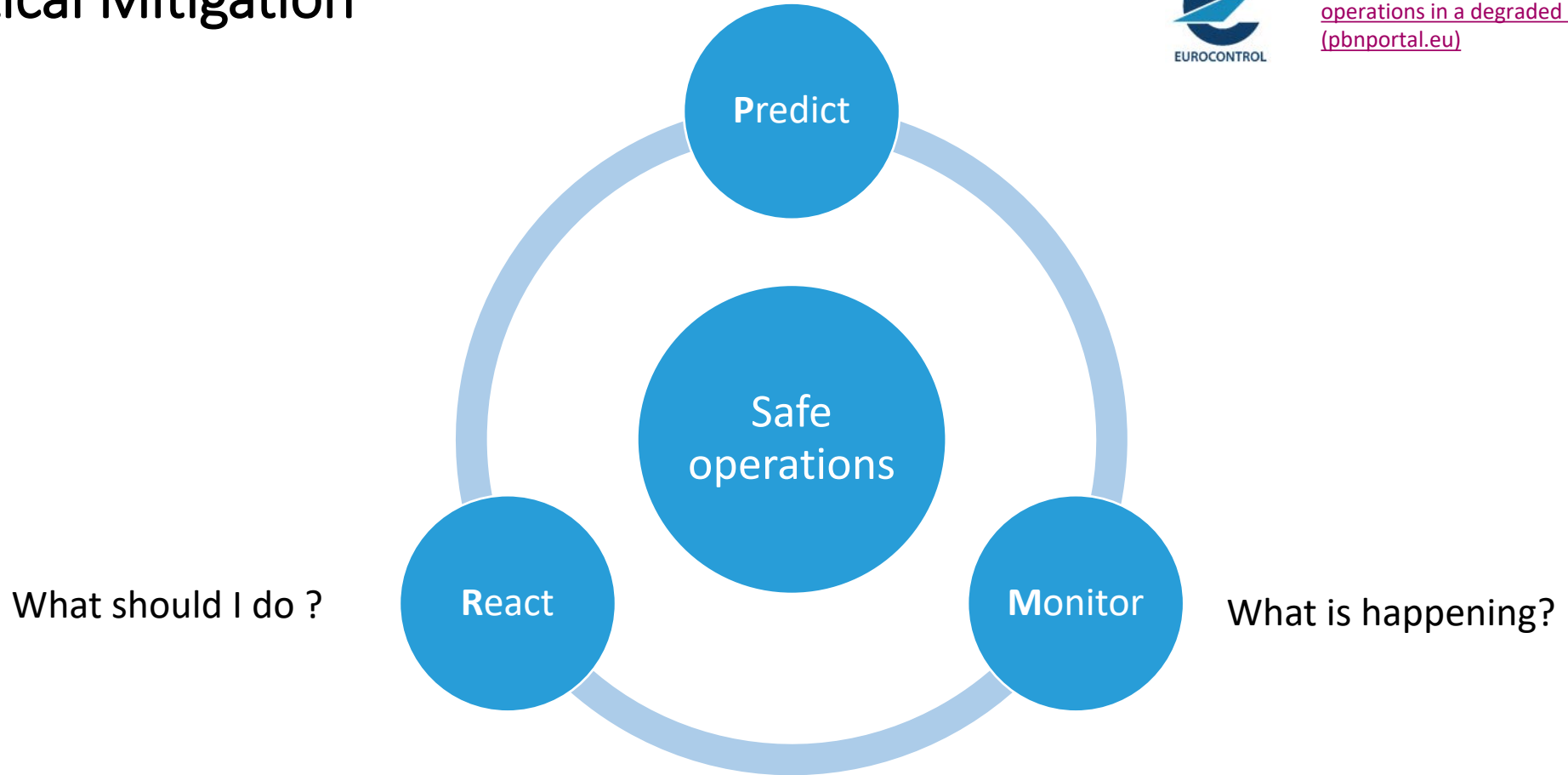


Tactical Mitigation

What do I expect ?



[Loss or Disruption of GNSS signals – Continued operations in a degraded environment \(pbnportal.eu\)](http://pbnportal.eu)



Performance prediction

AUGUR
GNSS PERFORMANCES PREDICTION TOOL

Scenario

AUGUR, a web service for GPS RAIM prediction, which enables airspace users to comply with the EASA requirements to verify RAIM availability during pre-flight planning and which supports NOTAM publication. Predicted RAIM unavailabilities are also provided to ANSPs as part of the EAD service.

Begin: 09/02/2023 08:00:00
End: 09/02/2023 08:00:00

Predicted outages (list)

No Predicted Outages:
EBBR (BRUSSELS/BRUSSELS-NATIONAL)

Share your opinion

Write your opinion.

Send

<https://augur.eurocontrol.int/>

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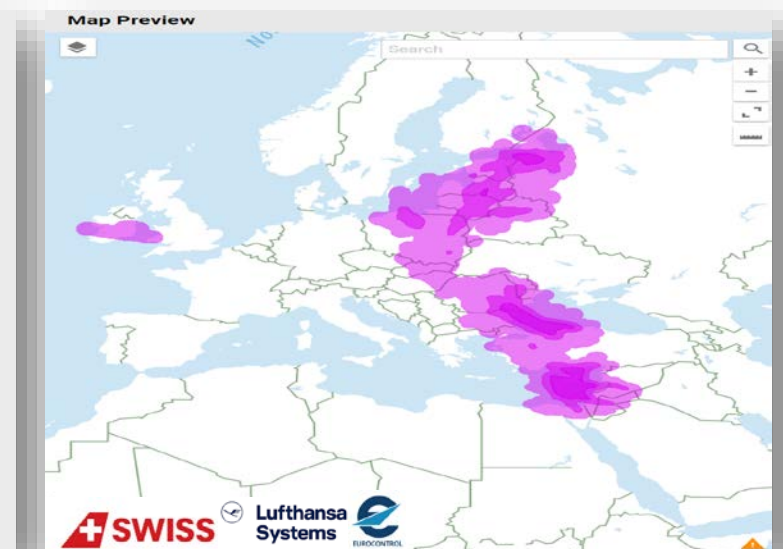
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FNXX01 EFKL 091813
SWX ADVISORY
DTG: 20231009/1816Z
SWXC: PECASUS
ADVISORY NR: 2023/243
NR RPLC: 2023/242
SWX EFFECT: GNSS MOD
OB5 SWX: 09/1802Z EQN E05 E030 - E060
FCST SWX +6 HR: 10/0100Z NOT AVBL
FCST SWX +12 HR: 10/0700Z NOT AVBL
FCST SWX +18 HR: 10/1300Z NOT AVBL
FCST SWX +24 HR: 10/1900Z NOT AVBL
RMK: SPACE WEATHER EVENT (IONOSPHERIC
DISTURBANCE) IN PROGRESS. IMPACT ON GNSS PERFORMANCE
POSSIBLY LEADING TO LOSS OF GNSS SIGNALS AND/OR DEGRADATION
OF TIMING AND POSITIONING PERFORMANCE.
NXT ADVISORY: WILL BE ISSUED BY 20231010/0002Z=

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FNXX01 EFKL 091311
SWX ADVISORY
DTG: 20231009/1311Z
SWXC: PECASUS
ADVISORY NR: 2023/242
SWX EFFECT: GNSS SEV
OB5 SWX: 09/1254Z HSH W180 - E180
FCST SWX +6 HR: 09/1900Z NOT AVBL
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NXT ADVISORY: WILL BE ISSUED BY 20231009/1854Z=

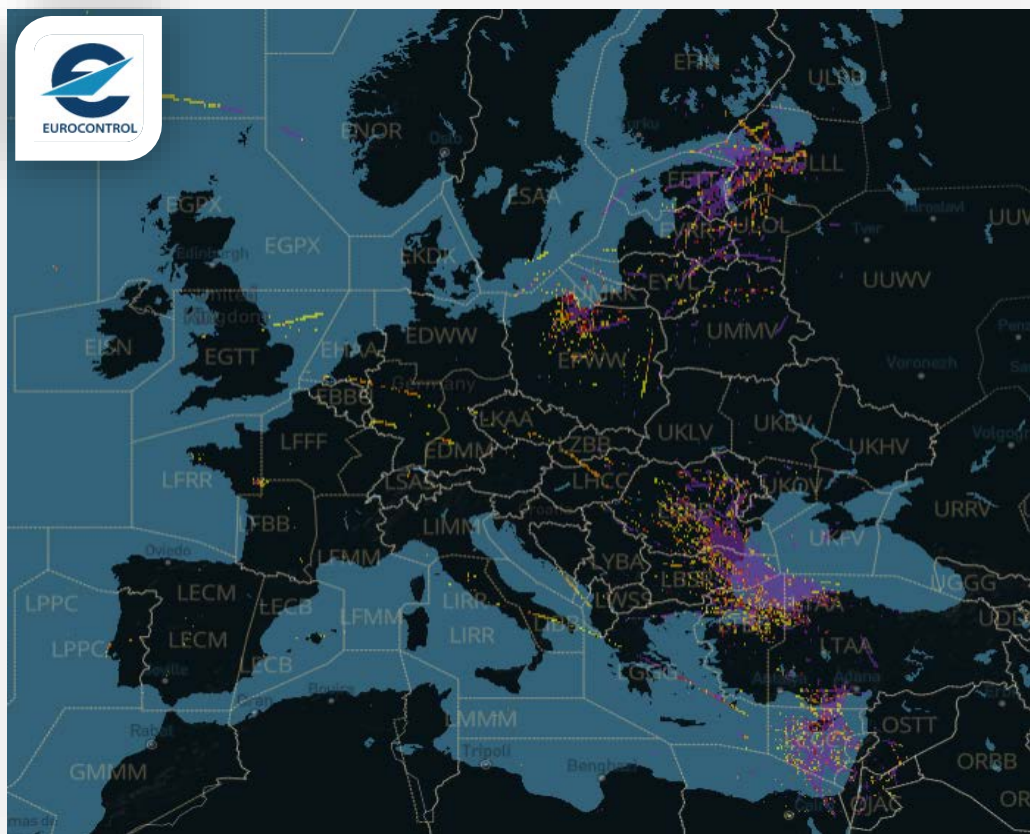
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<https://pecasus.eu>

NOAA / NWS Space Weather Prediction Center

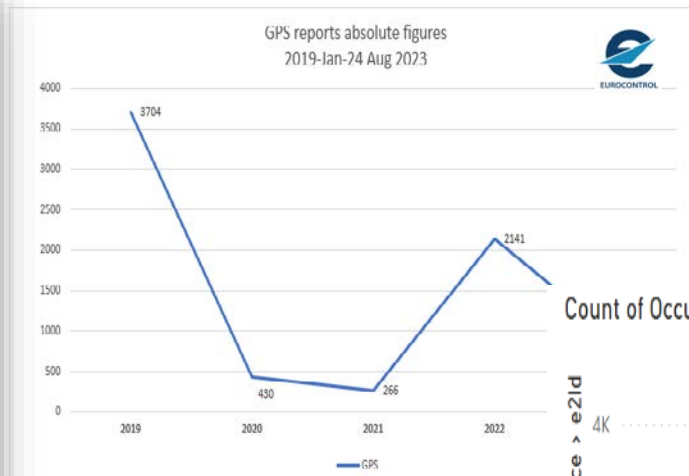


Monitoring

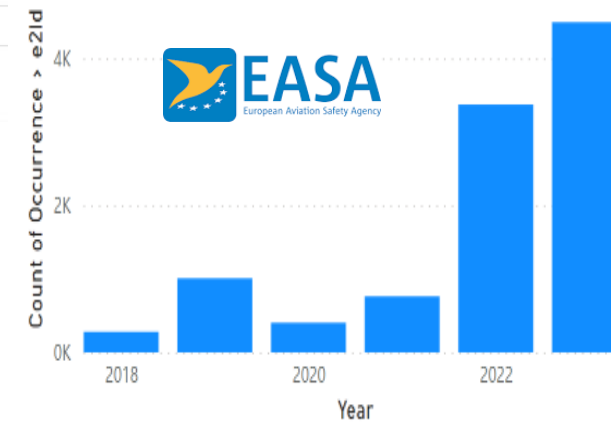


Detection

Reporting



Count of Occurrence > e2Id by Year



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

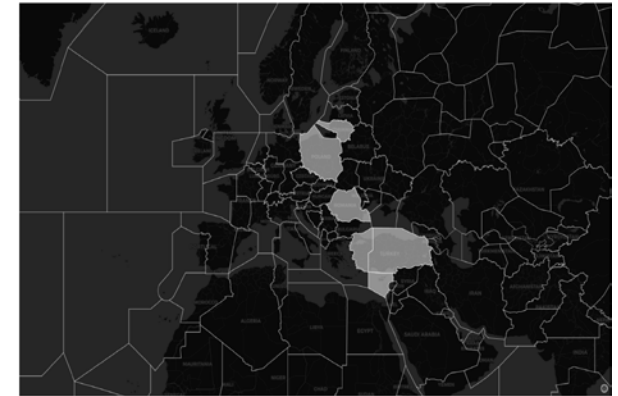
Who should be informed

- 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

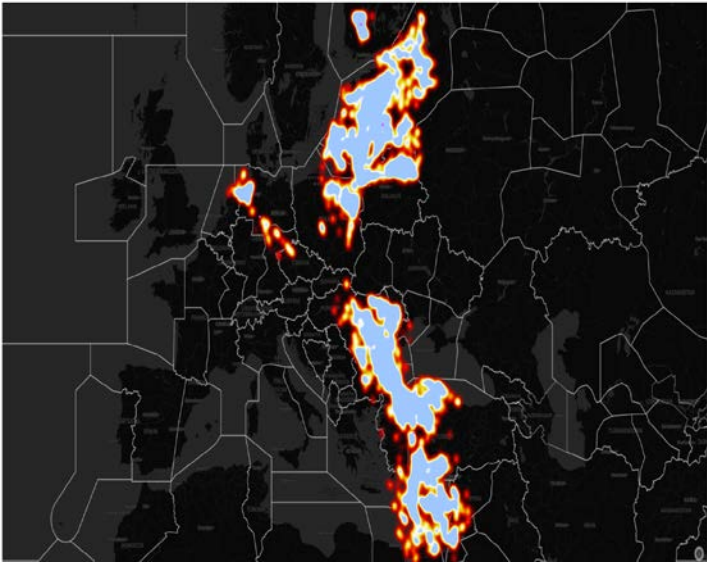
PBN HANDBOOK No. 6



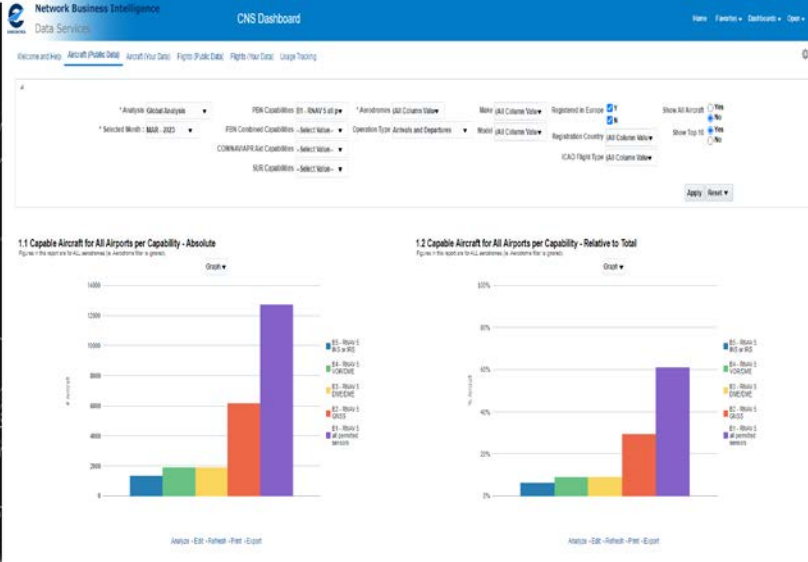
SUPPORTING EUROPEAN AVIATION



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>



Mitigations

- ❖ Aircraft design: security features, better integration of airborne systems GNSS resilience, redundancy
- ❖ Authority oversight
- ❖ Coordination between authorities
- ❖ GNSS monitoring, reporting and alerting
- ❖ Infrastructure: GNSS back-up & CPNT
- ❖ Operational contingency: ATM and Pilot Procedures



Thank You!