

Supporting  
European  
Aviation



# NM User Forum 2023

## Session 5: European ATM infrastructure

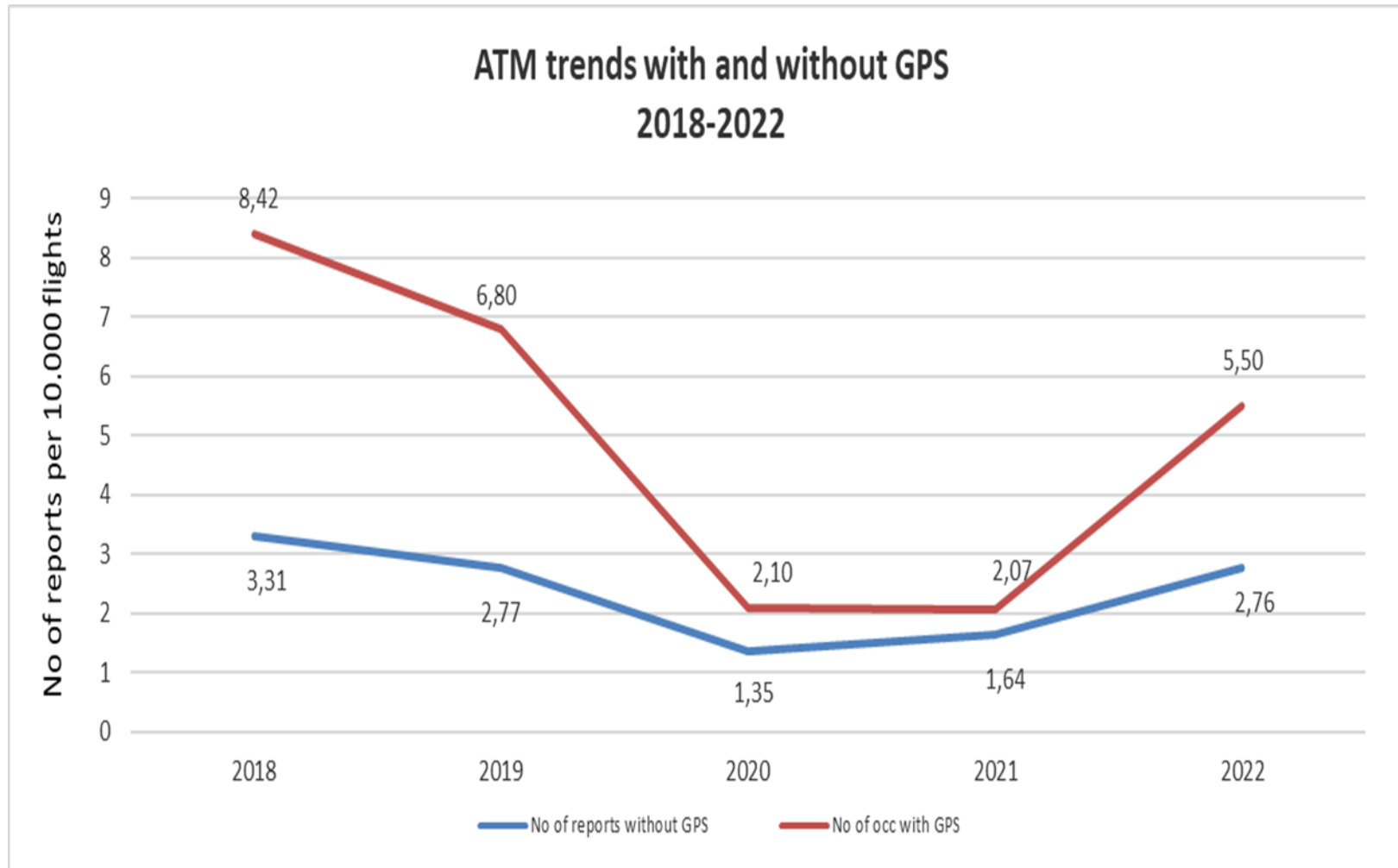
### GNSS Radio Frequency (RF) Interference

**Gerhard Berz and Dragica Stankovic, EUROCONTROL**

**3 February 2023**



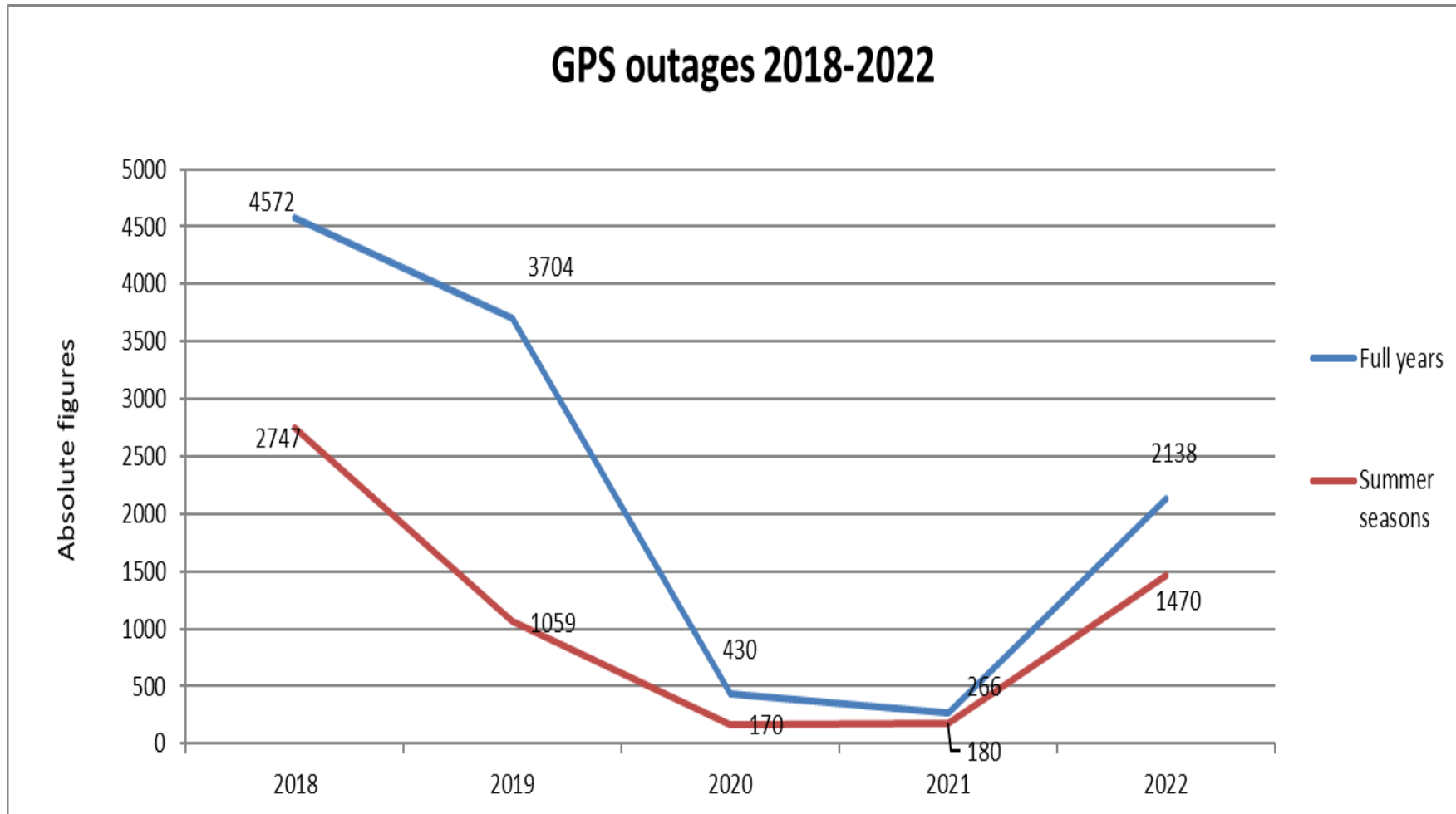
# ATM Trends with and without GPS Outages



**9139** AO/ANSPs reports

**11110** GPS Outage reports

# GPS Outages – EVAIR Pilot Reports



Airbus Flight Data  
Monitoring events  
(participating  
airlines):  
2021: 10843  
2022: 49605

Aireon RFI  
Monitoring events  
(global, large area  
impact):  
2021: 1077  
2022: 1247

Further confirmed  
by LEO RF  
Detection  
(HawEye360)

# Flights and FIRs Affected by GPS Outages



- More than 100 FIRs affected
- Turkish airspace for the traffic to/from Europe – Middle East and the traffic to/from the East to the South East Mediterranean – about 36%
- South – East Mediterranean for the traffic to/from Europe - about 15%
- Middle East – Mainly the traffic to/from Europe - about 20%
- Middle East – Canada and America via Cross polar routes - about 6%
- European airspace during approach to main hubs- about 1%
- For about 22% of flights this **information is not available**.

# Frequent Problems Associated with GPS Outages

- Failure of one or both GPS boxes
- Disagreement between GPS positions and NAV FMSs
- Terrain warnings – pull up requests.
- Unable to fly RNP and request for radar vectoring
- In a few cases lack of situational awareness and requests for the assistance of radar vectoring to reach the destination
- Wind and ground speed wrong presentations
- Lost ADS-B L/R, wind shear, terrain and surface functionalities
- Aircraft clocks L/R/both failed or began to count backwards
- EICAS Transponder L/R

# Strong High Level Support for GNSS RFI Mitigation

- ICAO Assembly Resolution 41-8C
- ITU Circular CR/488
- Operational Community IFATCA / IFALPA / IATA



International Civil Aviation Organization

WORKING PAPER

ASSEMBLY — 41ST SESSION

TECHNICAL COMMISSION

Agenda Item 31: Aviation Safety and Air Navigation Standardization

**IMPROVING COMMUNICATION NAVIGATION AND SURVEILLANCE (CNS) RESILIENCE  
THROUGH GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) INTERFERENCE  
MITIGATION**

(Presented by Czechia on behalf of the European Union and its Member States<sup>1</sup>,  
the other Member States of the European Civil Aviation Conference<sup>2</sup>, the  
Member States of the African Civil Aviation Commission<sup>3</sup>, and  
EUROCONTROL)

A41-WP/97  
TE/23  
28/7/22

## IMMEDIATE SHORT-TERM ACTIONS

3.2 Aircraft manufacturers should continue to assess the cascading effects of GNSS RFI on their systems, consider the on-board detection of interference and reporting through automated data collection systems, publish suitable guidance to manage any operational issues and recommend suitable training for pilots. Pilots should continue to report GNSS performance issues and associated cockpit effects.

### *The Assembly:*

2. *Encourages* standardisation bodies and industry to develop appropriate interference detection, mitigation and reporting capabilities for the aircraft on-board, satellite- and ground-based CNS system components, in order to ensure higher CNS resiliency, continuity of operations and prevent any cascading effects from the use of compromised position, velocity or time data;



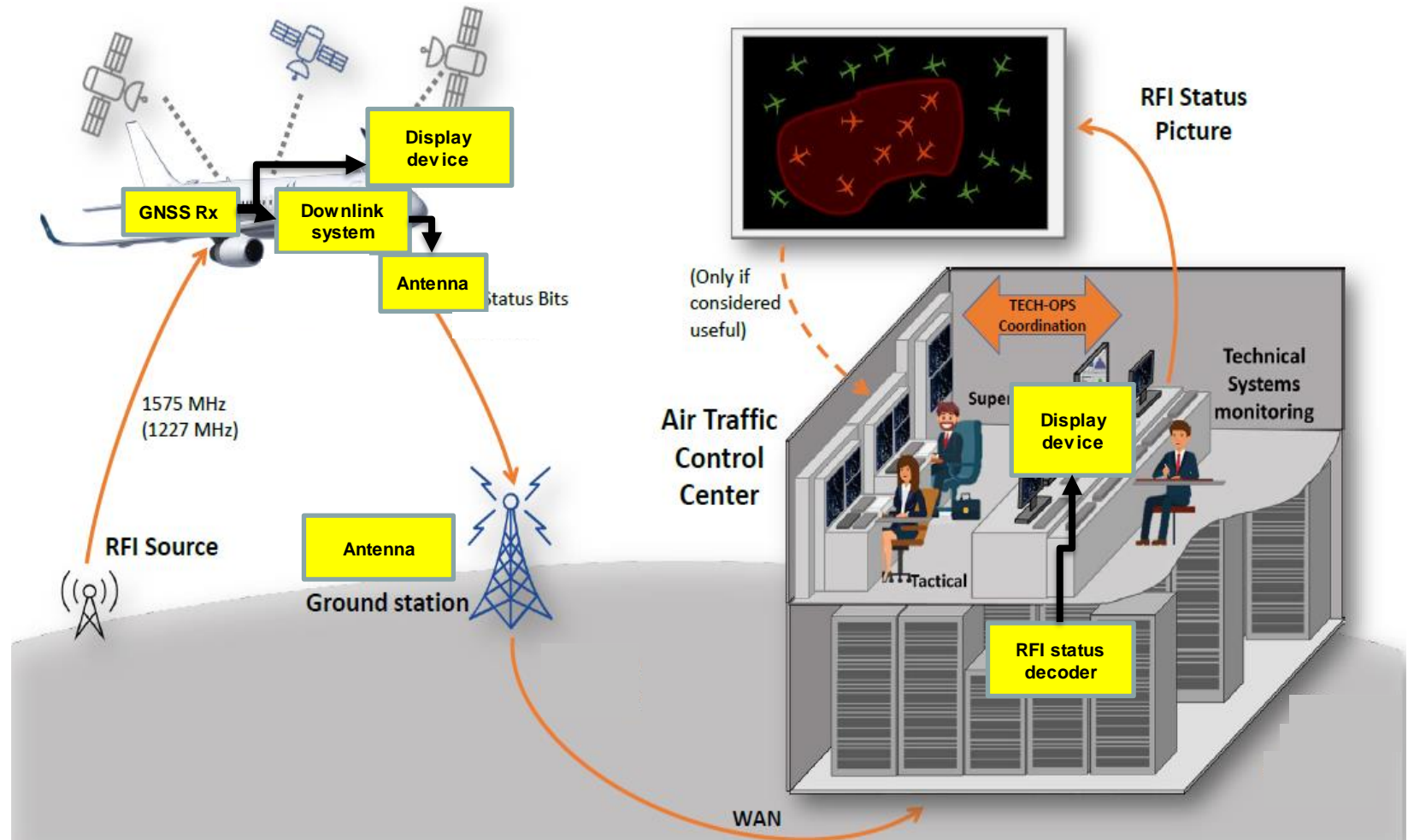
# Envisioned Next Generation RFI Mitigation Function

## Functional architecture (initial version enabled by ADS-B today)

### Steps

1. GNSS Receiver **detects** RFI and **reports** it to the **ground**
2. Ground stations **process** **RFI status** and allow generating an integrated RFI status picture for multiple aircraft
3. TECH services coordinate with OPS on impacted areas and launch **operational mitigation measures**
4. Report to the **radio regulator**

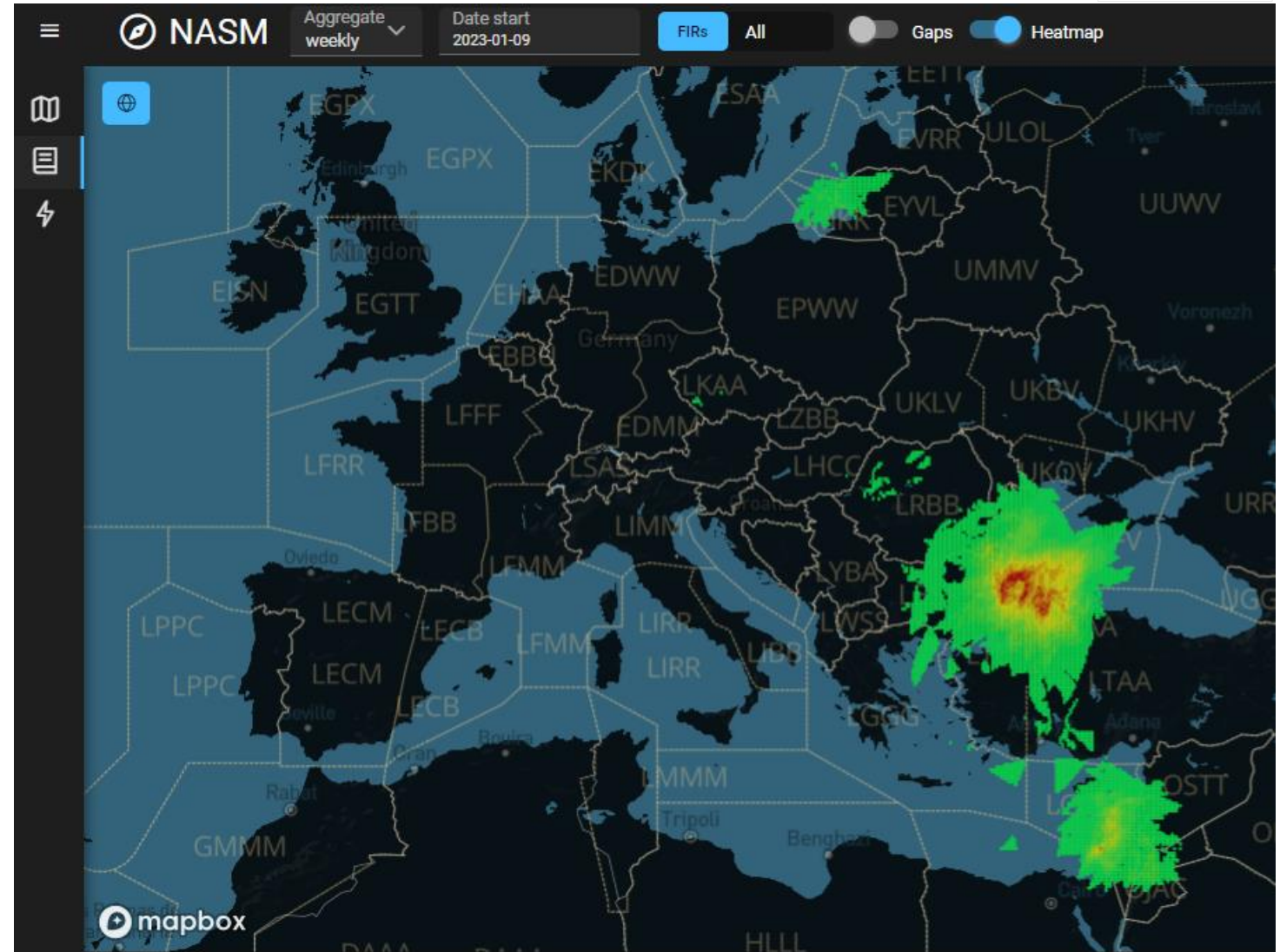
*Incorporation in next generation GNSS and ADS-B equipment standards under development*



# EUROCONTROL ADS-B Monitoring of GPS Outages

- Week 2 in 2023, all ADS-B equipped aircraft
- Initial OPS Capability

FIR	Total flights	Impacted flights	%
LTBB	18514	826	4.46 %
LBSR	11101	677	6.1 %
LTAA	13191	655	4,97 %
LRBB	9274	251	2.71 %
LCCC	5351	208	3.89 %
LLLL	2622	90	3.43 %
EYVL	2145	48	2.24 %
UMKK	328	41	12,5 %
OLBB	548	23	4.2 %
EVRR	2377	22	0.93 %
UKFV	27	14	51,85 %
OSTT	164	41	7,93 %





# Conclusions

- Aircraft flying at altitude will continue to be exposed to GNSS RFI
  - Safety issue being worked on in cooperation with EASA, FAA, aircraft manufacturers, operators, ANSP
  - Compromises realization of operational benefits (PBN, ADS-B – best trajectories)
  - Next generation aircraft avionics will bring improvements
- NM can now monitor GNSS RFI across all of Europe continuously (when aircraft are flying)
  - OPS Coordination currently based on a full week of data
  - Plus subsequent fleet and ANSP capability analysis
  - Working on maturing operational concept and interfaces