

ECHO – GNSS Monitoring and Interference Detection Study and Pilot System Deployment at Romanian Airports

NAVISP Element 3



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NAVISP Industry Days
16th – 17th of June 2022

Contents

- National and international context
- Project description
- Activities and implementation
- Impact and future development



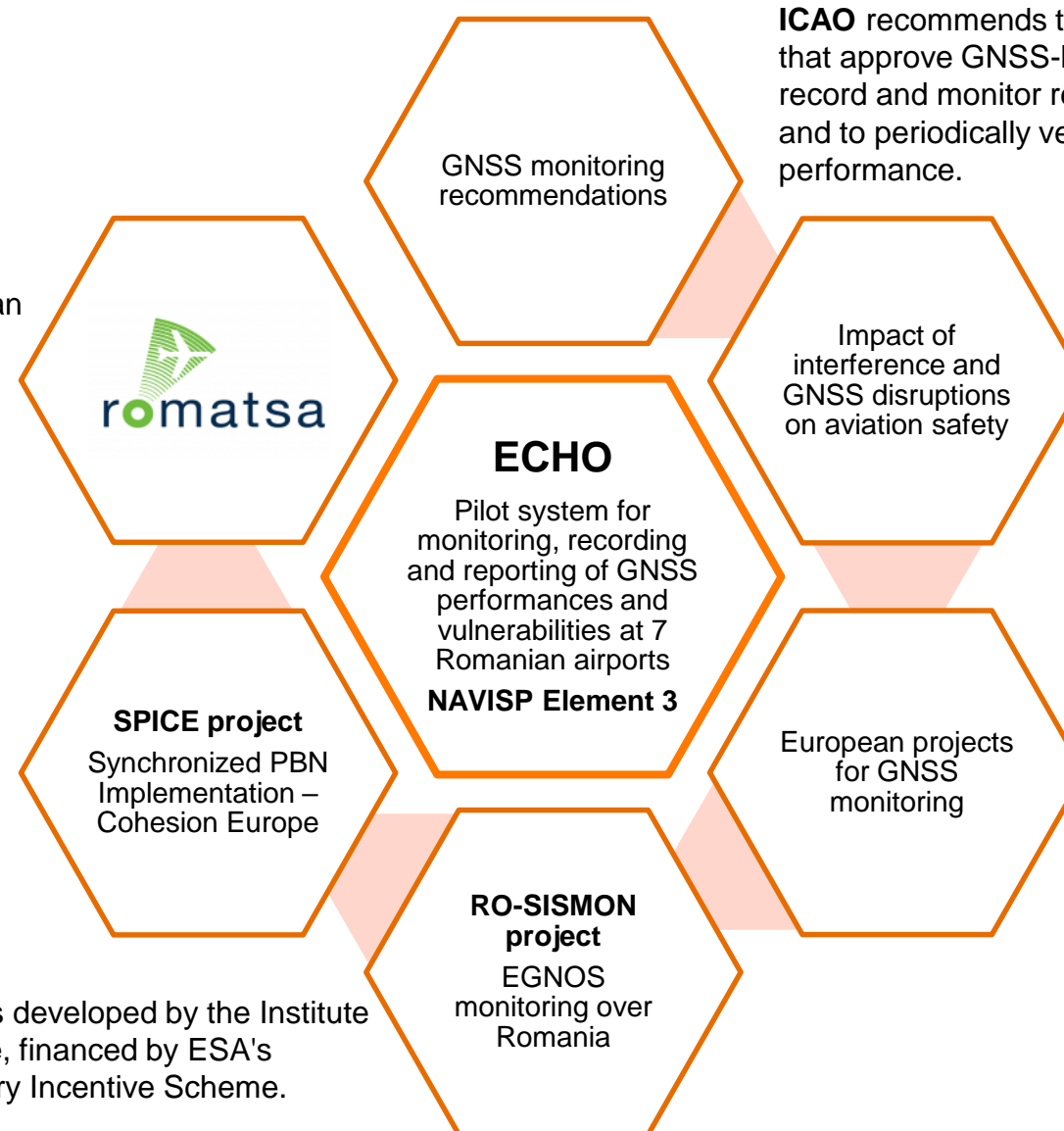
National and international context

ROMATSA is the Romanian Air Navigation Service Provider, managing the air traffic control activities in Romanian airspace.

ROMATSA is the beneficiary of this NAVISP Element 3 project.

SPICE is a project coordinated by EUROCONTROL, through which GNSS-based flight procedures are implemented at 17 Romanian airports.

RO-SISMON was developed by the Institute of Space Science, financed by ESA's Romanian Industry Incentive Scheme.



ICAO recommends to the Member States that approve GNSS-based operations to record and monitor relevant GNSS data and to periodically verify the GNSS performance.

GNSS signal degradation can seriously impact the accuracy of the aircraft's navigation system and generate false warnings.

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Project objectives

Scientific objectives

- GNSS signal quality analysis and performance characterization in Romania
- Detection and characterization of RF interference at 7 Romanian airports

Technological objectives

- Deploy a network of 7 stations for GNSS SIS monitoring compliance to the current aviation standards
- Deploy a network of stations for interference detection and source localization
- Develop a User Application for real-time warnings and periodical reporting

Safety & security objective

- Perform a safety and security assessment for the selected airports

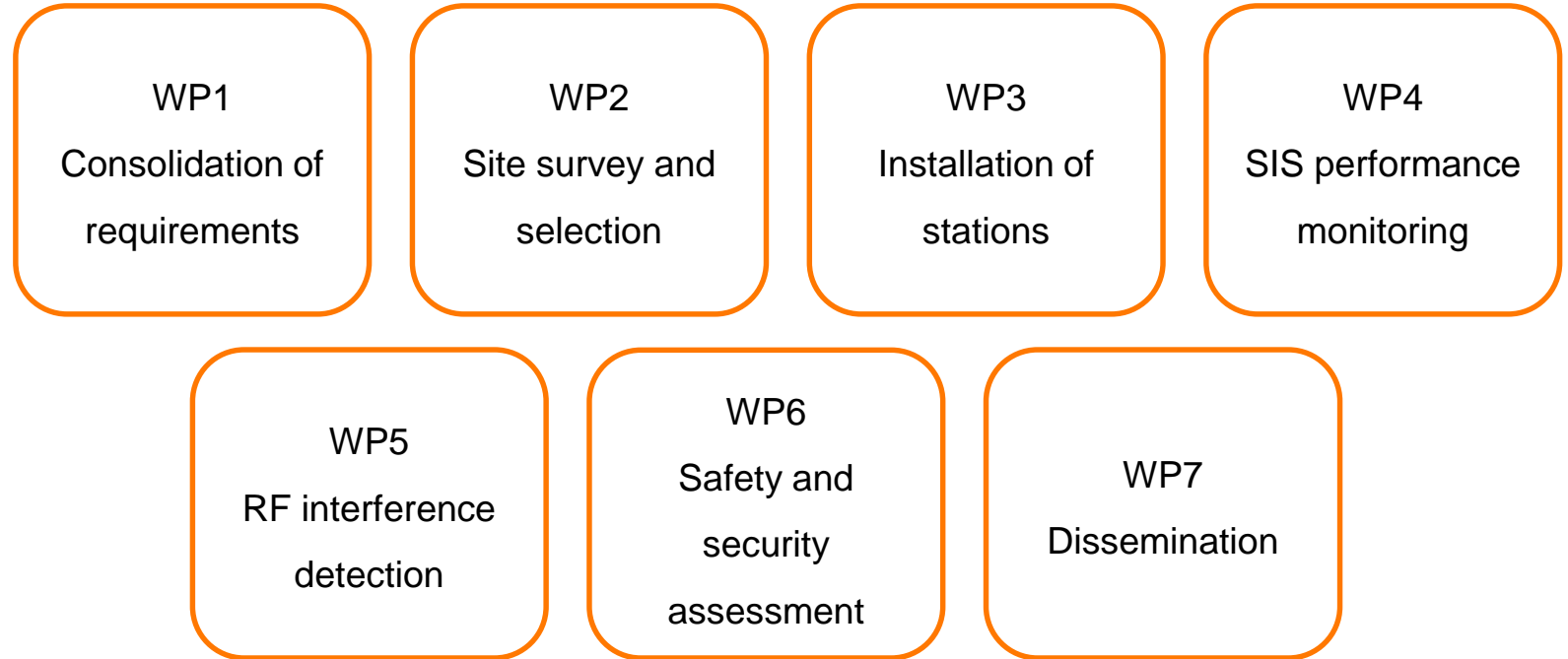
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About ECHO

- NAVISP Element 3 project
- Started in March 2021
- Duration of 2 years

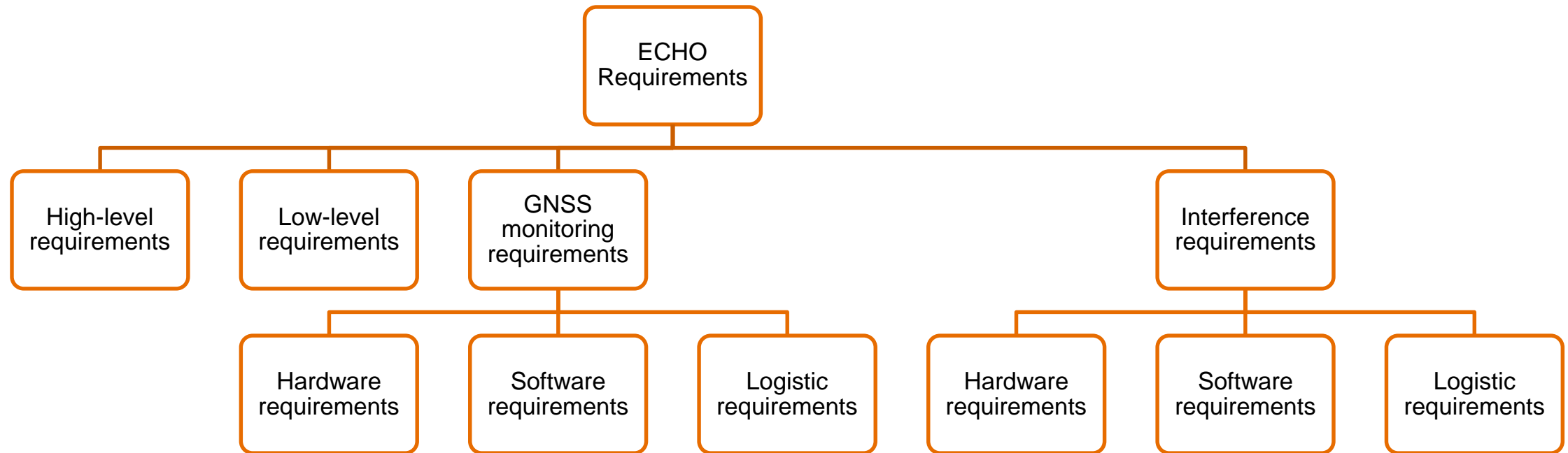
Activities



ECHO Team



Requirements consolidation

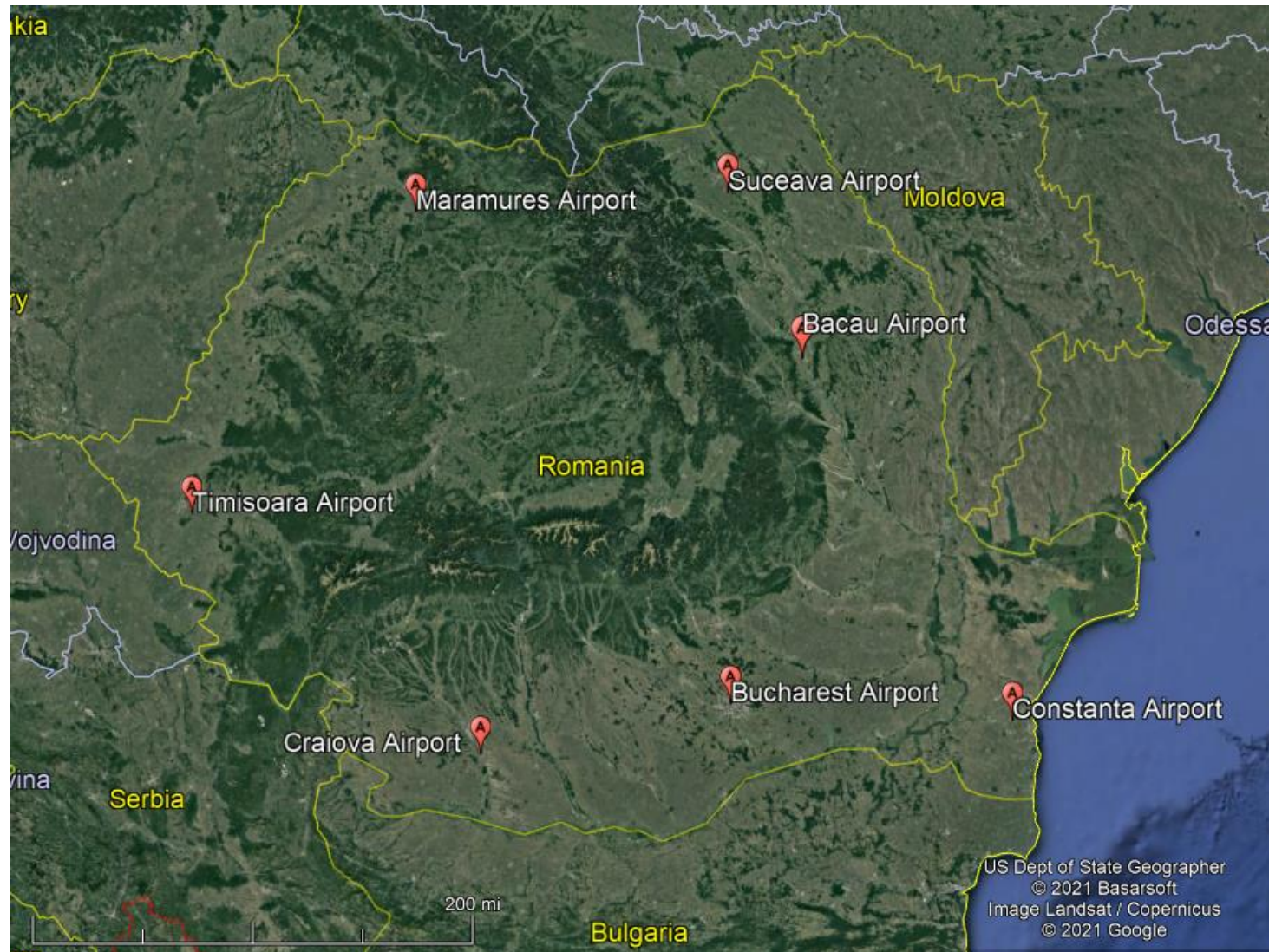


Source

Requirement type

ICAO Annex 10, ICAO GNSS Manual	GNSS monitoring, IF monitoring
EGNOS SoL SDD	SBAS monitoring
Galileo OS SDD	Galileo monitoring
IGS and NOAA CORS guidelines	Logistic requirements
ROMATSA procedures	Operational requirements

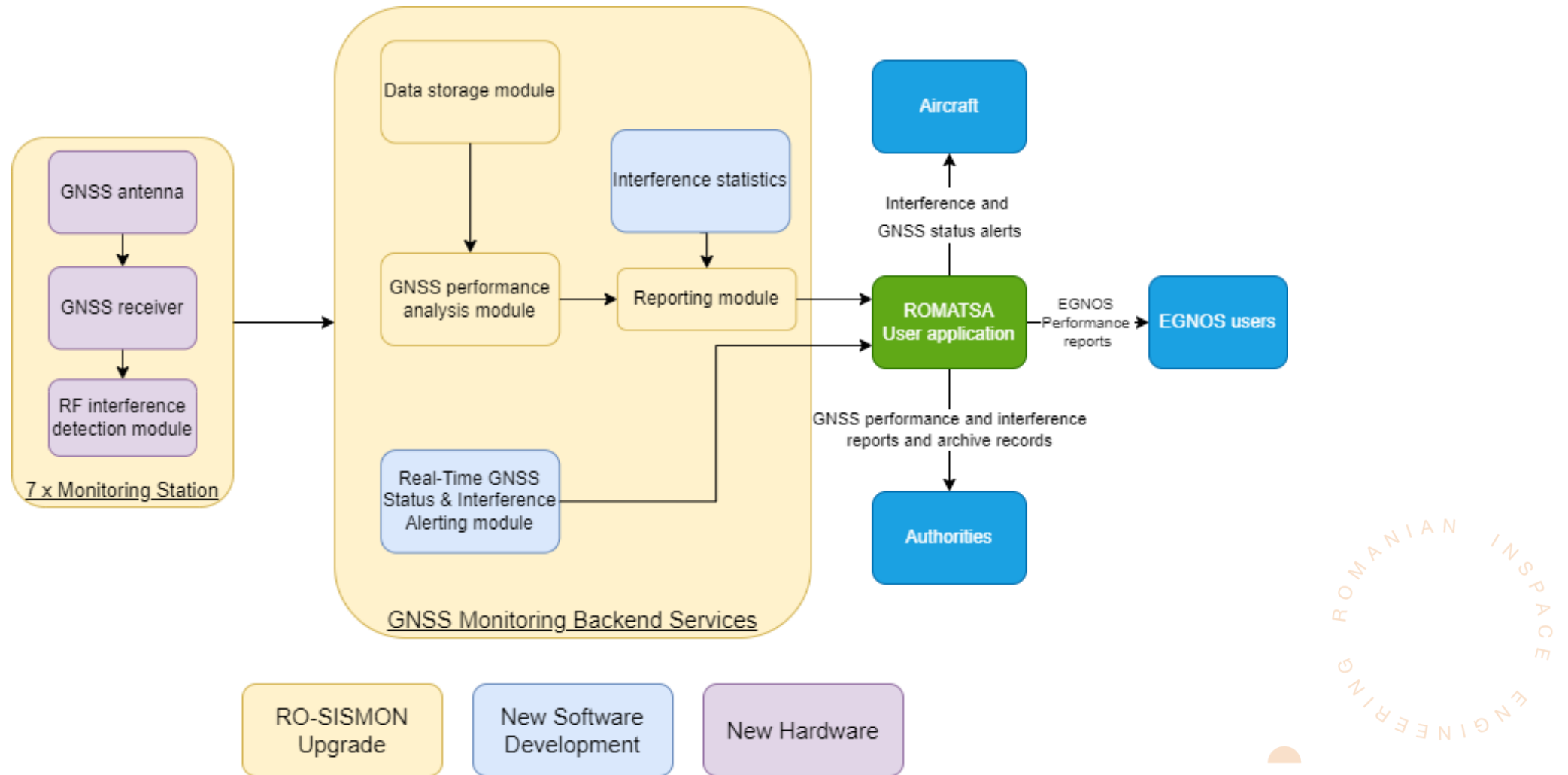
Site survey and selection



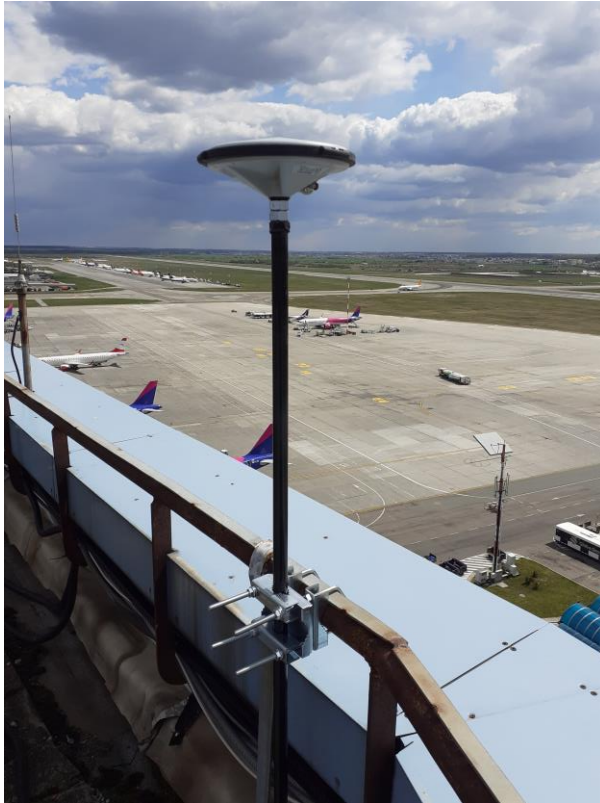
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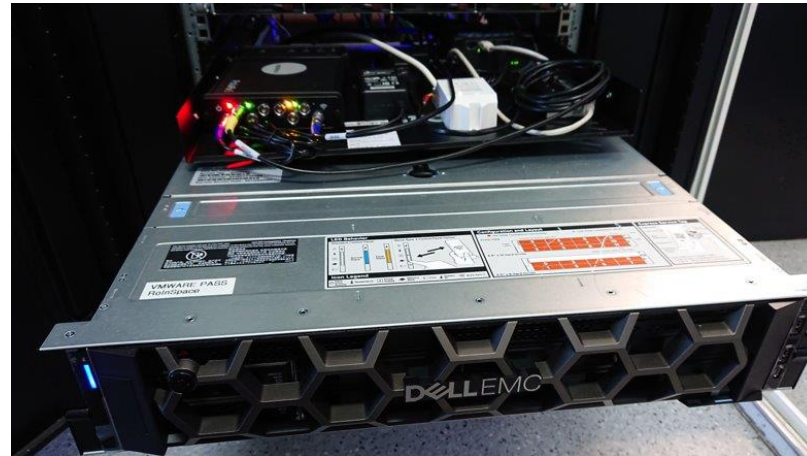
ECHO system architecture



GNSS SIS monitoring station



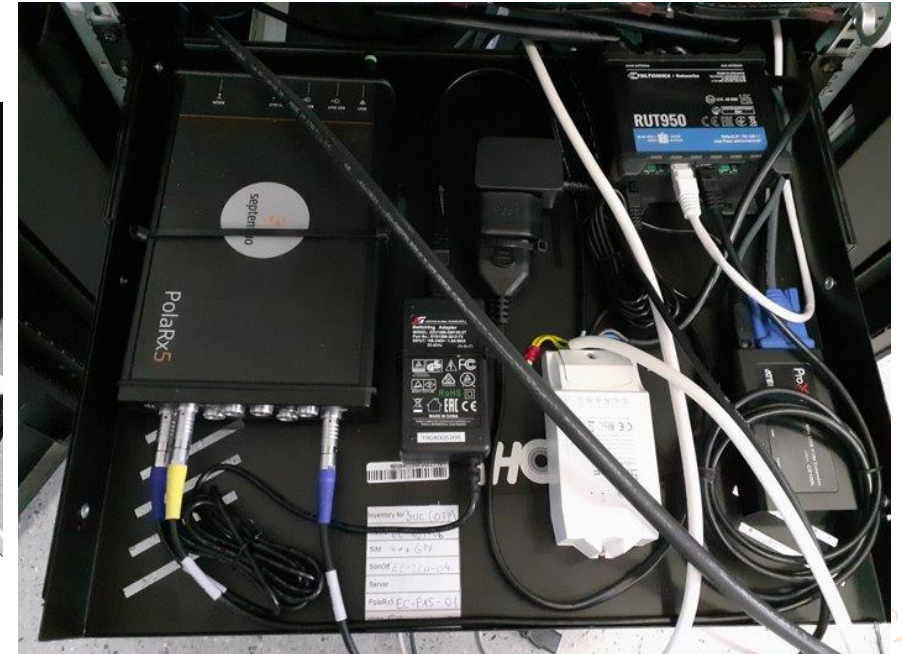
Septentrio PolaNt-x MF antenna



Server PowerEdge

Septentrio PolaRx
GNSS receiver

4G router



Smart switch

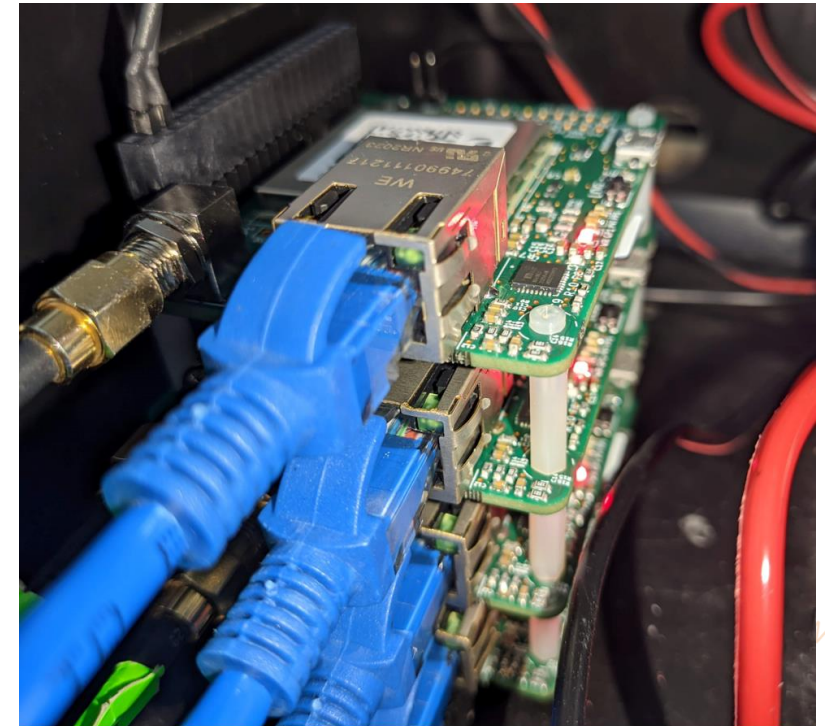
Interference monitoring station



4 x Tallysman TW7972 antennas

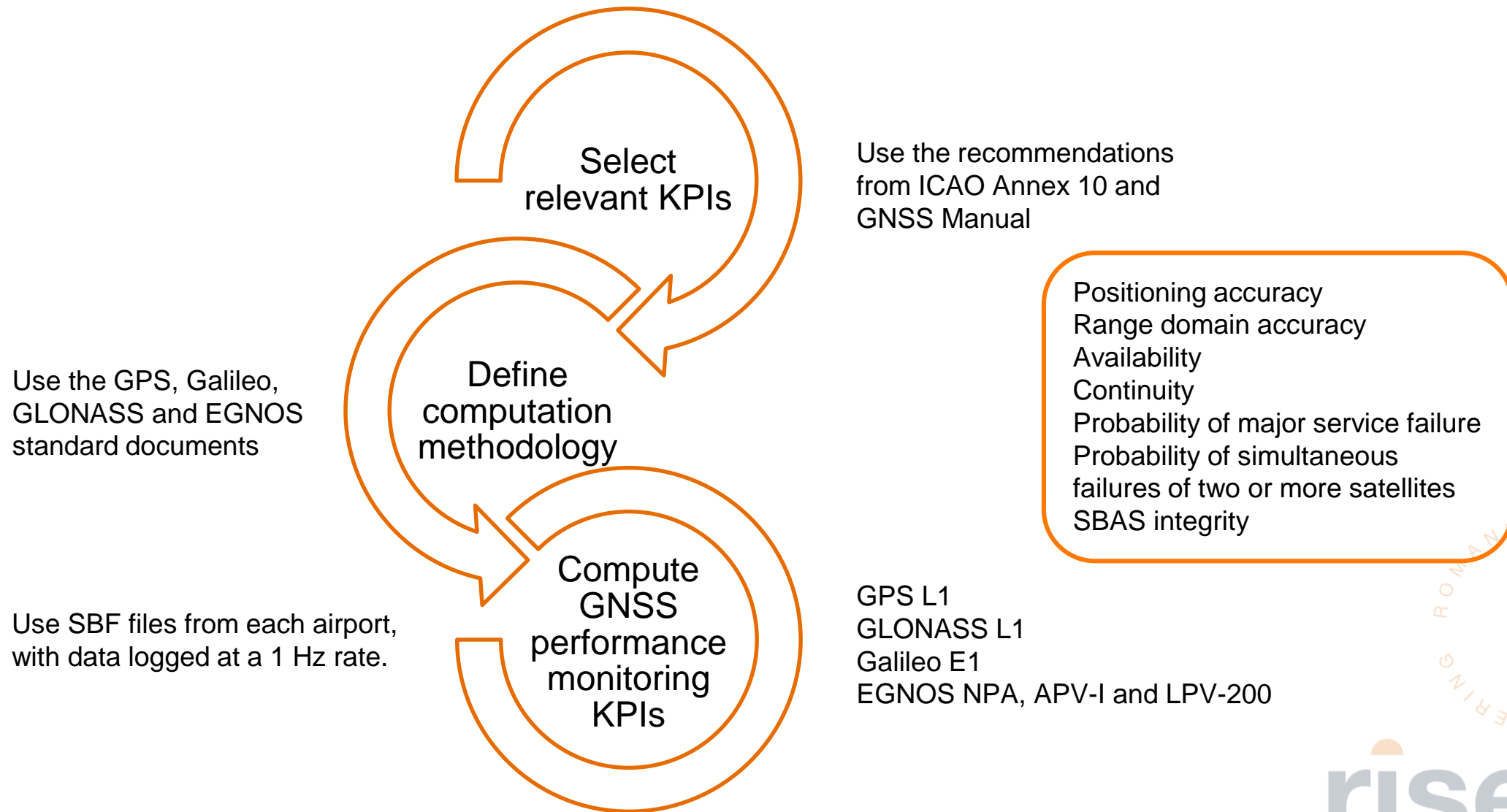


Box with GNSS receivers,
4G router, power supply
and smart switch



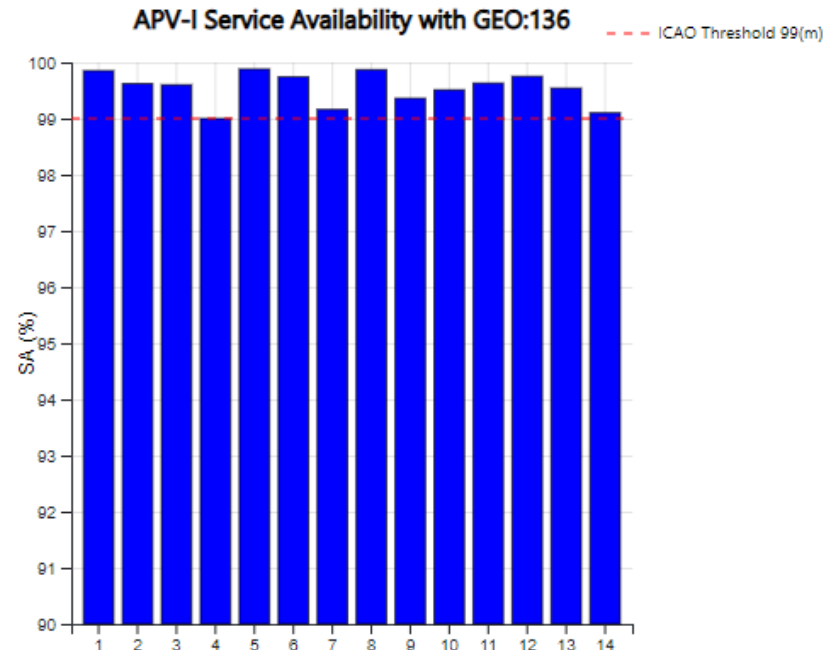
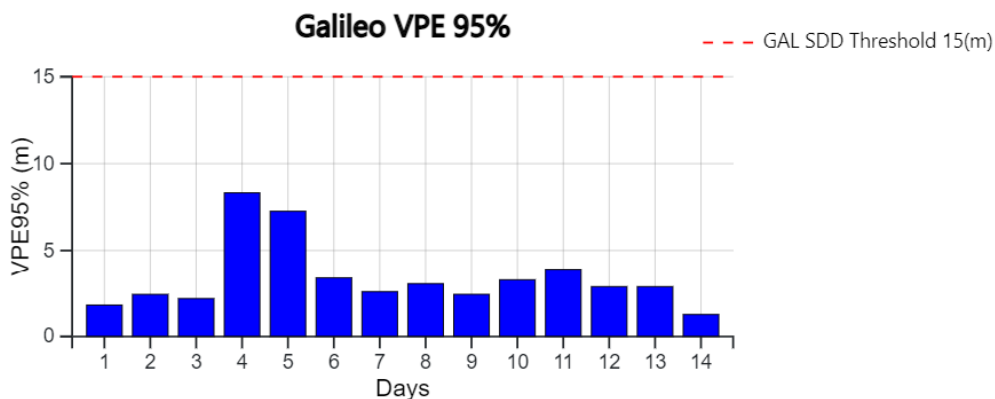
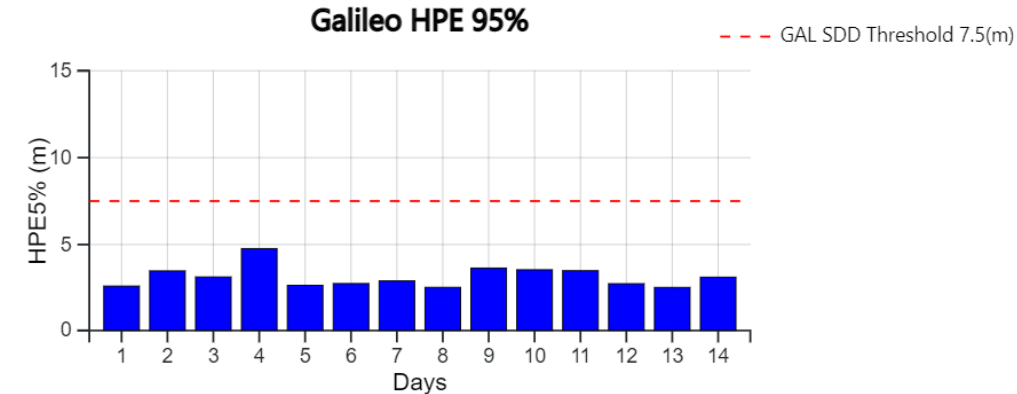
4 x interference monitoring receivers

GNSS performance monitoring



GNSS performance reporting

- Periodical 14 days reports to be generated for each airport
- Assess the compliance of the monitored KPIs with the relevant thresholds
- Summary of GNSS degradation and interference events

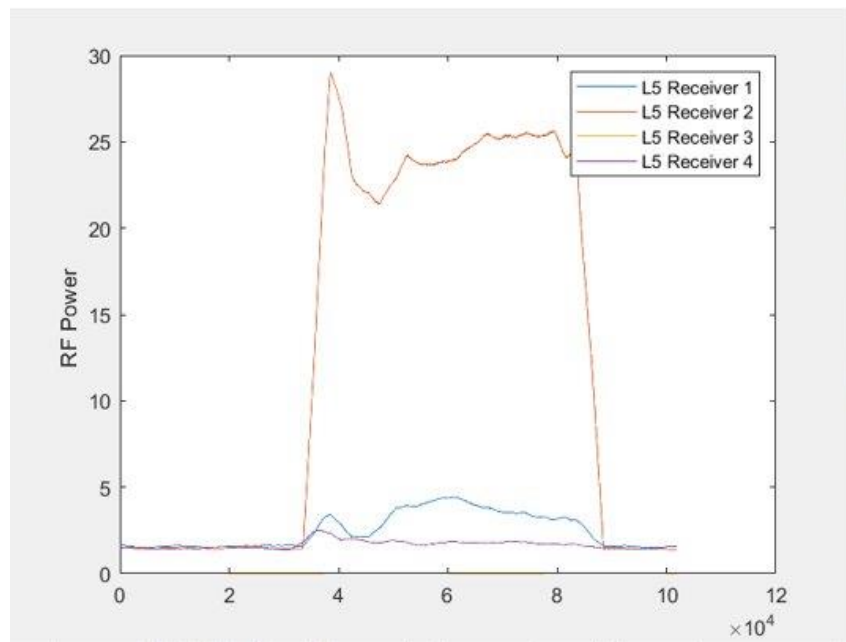


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Interference detection and localization

- Array of four antennas
- Oriented at increments of 90 degrees
- Additional shielding for EM radiation masking
- Direction of arrival is computed from the power levels received by the antennas



Testing Results

- Mean error: 10.0360°
- Standard deviation: 5.5749°

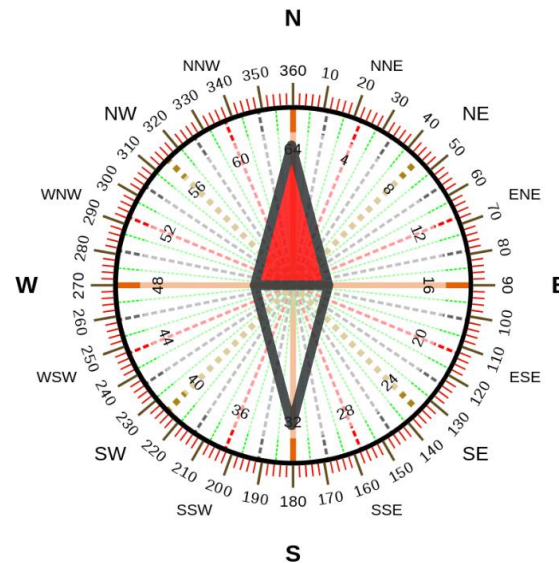
Computed Angle	Actual Angle	Error
3.3497°	0°	3.3497°
1.5419°	10°	8.4581°
23.7061°	20°	3.7061°
8.3344°	30°	21.6656°
26.4507°	40°	13.5493°
42.5323°	50°	7.4677°
75.4148°	60°	15.4148°
80.7256°	70°	10.7256°
87.4361°	80°	7.4361°
81.4127°	90°	8.5873°

Real-time alerting

Normal operations

International Airport "Traian Vuia" Timișoara - Realtime Performance Status

Interference Status

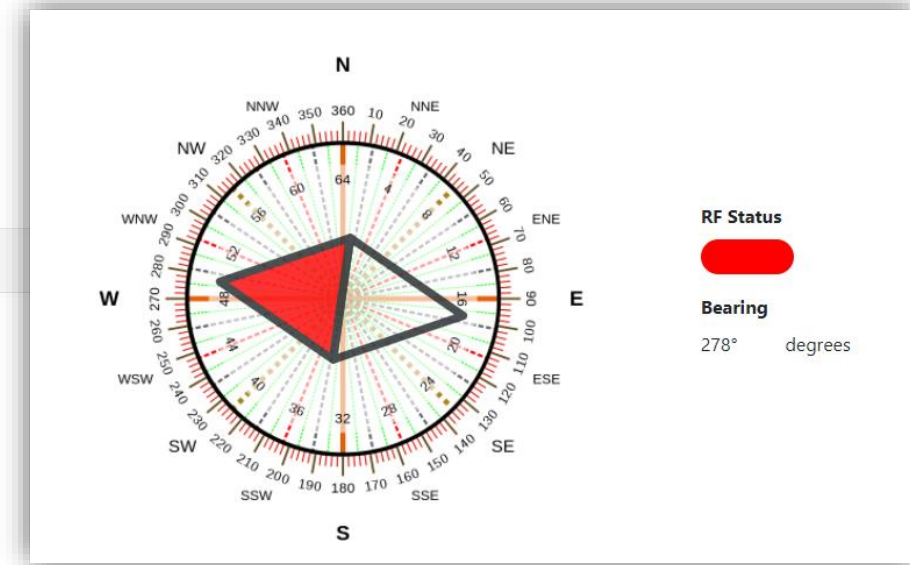


RF Status



Bearing

0° degrees



RF Status



Bearing

278° degrees

Interference detected

GNSS Status

GNSS core constellations status			
	GPS	GLONASS	GALILEO
HPE			
VPE			



Impact and future development

- The purpose of this pilot project is to develop a GNSS monitoring system capable to be scaled and maintained at all Romanian airports, in order to support space-based PBN operations.
- ECHO creates the framework that shall allow Romania to align with the ICAO recommendations regarding the GNSS monitoring activities that support the adoption of PBN flight procedures, by complying with the necessary requirements and system specifications.
- The interference detection and analysis shall provide inputs regarding the threats at the airports and possible mitigation measures.
- Continuous updates maintaining full compliance to aviation standards, regulations and recommendations



Thank you!

For questions and ideas, contact us:

alexandru.pandele@roinspace.com

www.roinspace.com

