OGC®
Making location count.

SARxUTMxG

Search and Rescue with Unmanned Traffic Management and xG 2025-2027

Åke Sivertun - RISE
Alexander Sandström -Remote Aero AB

Vinnova project 2024-01722 2025 - 2027

VINNOVA

ECSEL Joint Undertaking
Electronic Components
and Systems for European
Leadership

AFarCloud

TRAFIKVERKET

RI SE

Purpose of the Project

* Is to investigate existing infrastructure as support for several different essential services with unmanned vehicles beyond visual range in action research
* As an example, we use Sea Rescue but want general conclusions
* We study mobile networks as carriers of cyber-secure Positioning based on GNSS (GPS, Galileo, GLONASS & BeiDao) and Swepos nRTK support service etc. for secure positioning
* Mobile networks for Navigation and Communication with UXV
* Unmanned Traffic Management system (UTM) for planning and safe execution of flights

Project journey and collaboration partners

- **RISE** Collaborative Unmanned Systems – project manager **– Åke Sivertun**
- **Remote Aero AB –** builds telemetry and radio systems **– Alexander Sandström**
- **Swedish Maritime Rescue Society (SSRS) –** problem owner and test operator **– Fredrik Falkman**
- **Naviation** developing DroneRequest for airspace traffic monitoring **– Mattias Wellander**
- **Tele2** provides us with mobile IoT adapted for UXV **– Linda Ekener Mägi**
- **Tre3** provides us with 5G SA for, among other things, analysis of connection slicing **– Göran Berglund**
- **Teracom** with 450 MHz and 2.3 GHz connection in governmental networks **– Pontus Berg**
- **Ericsson Electronic Device (EDA)** for signal and QoS measurement **– Per Jarnehammar**

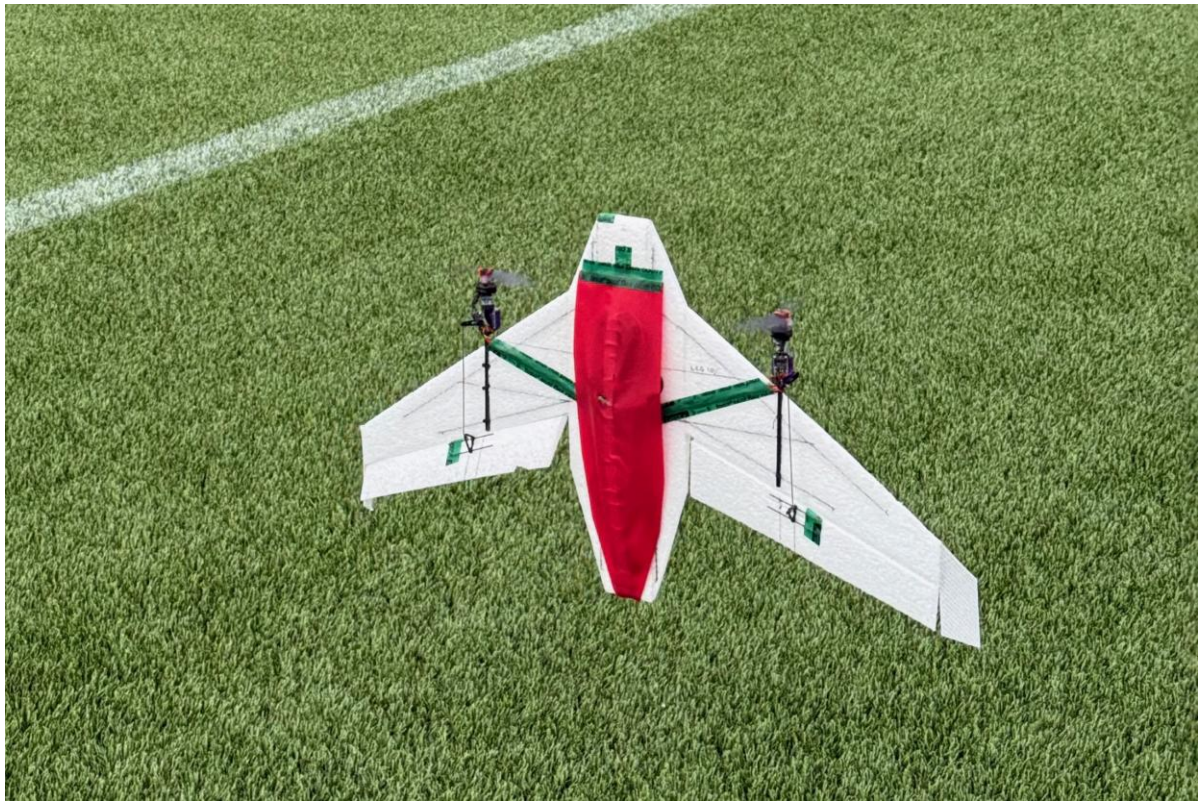
What needs should be solved? (What and for whom)

- Safe flight but also safe operation – Save Lives + All staff
- Be able to fly in most weather and other conditions beyond visual range
- Have Cybersecure PNK(t) to prevent disruption
- Communicate with control centre to avoid collisions and camera for extended Line of Sight and provide a comprehensive situational picture
- Can initially be carried by a 249g UAV
- Agile regulatory framework - does not compromise on safety but utilizes new technology
- Find the foundation to open the actors for implementation

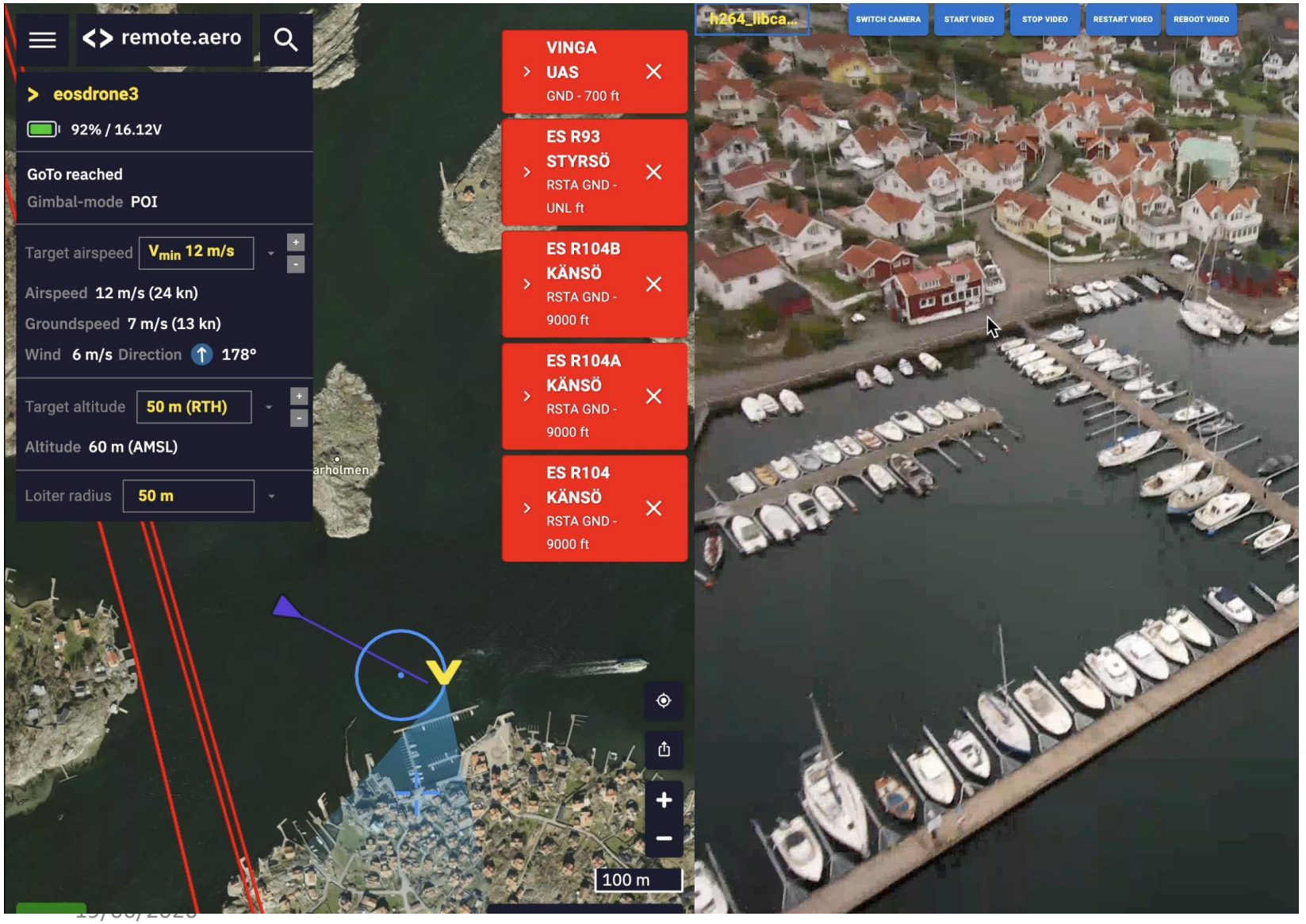
Two Test Vehicles ca 249g

Catapult rapid launch

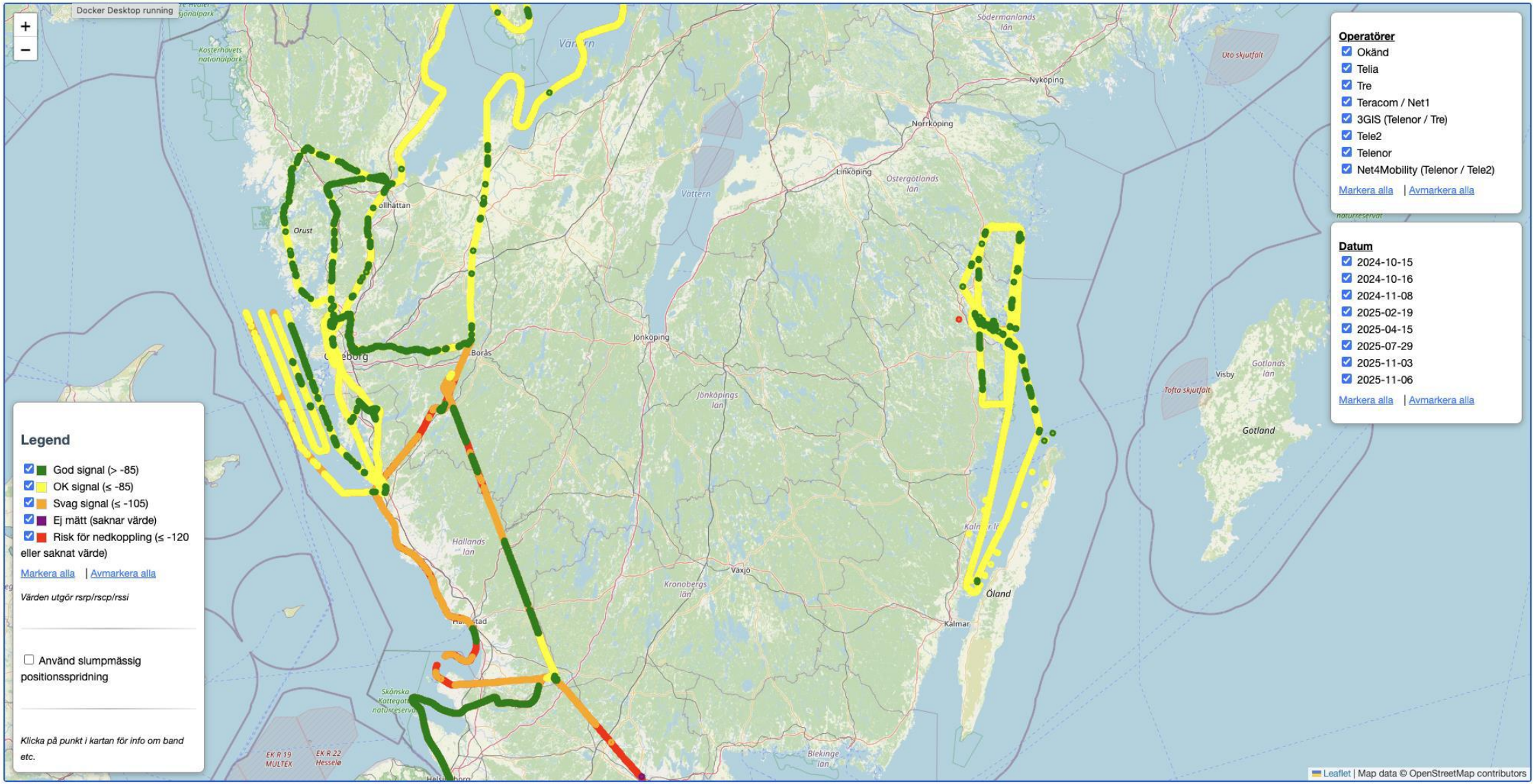
VTOL Vertical Take Off and Landing



Test Areas in Gothenburg

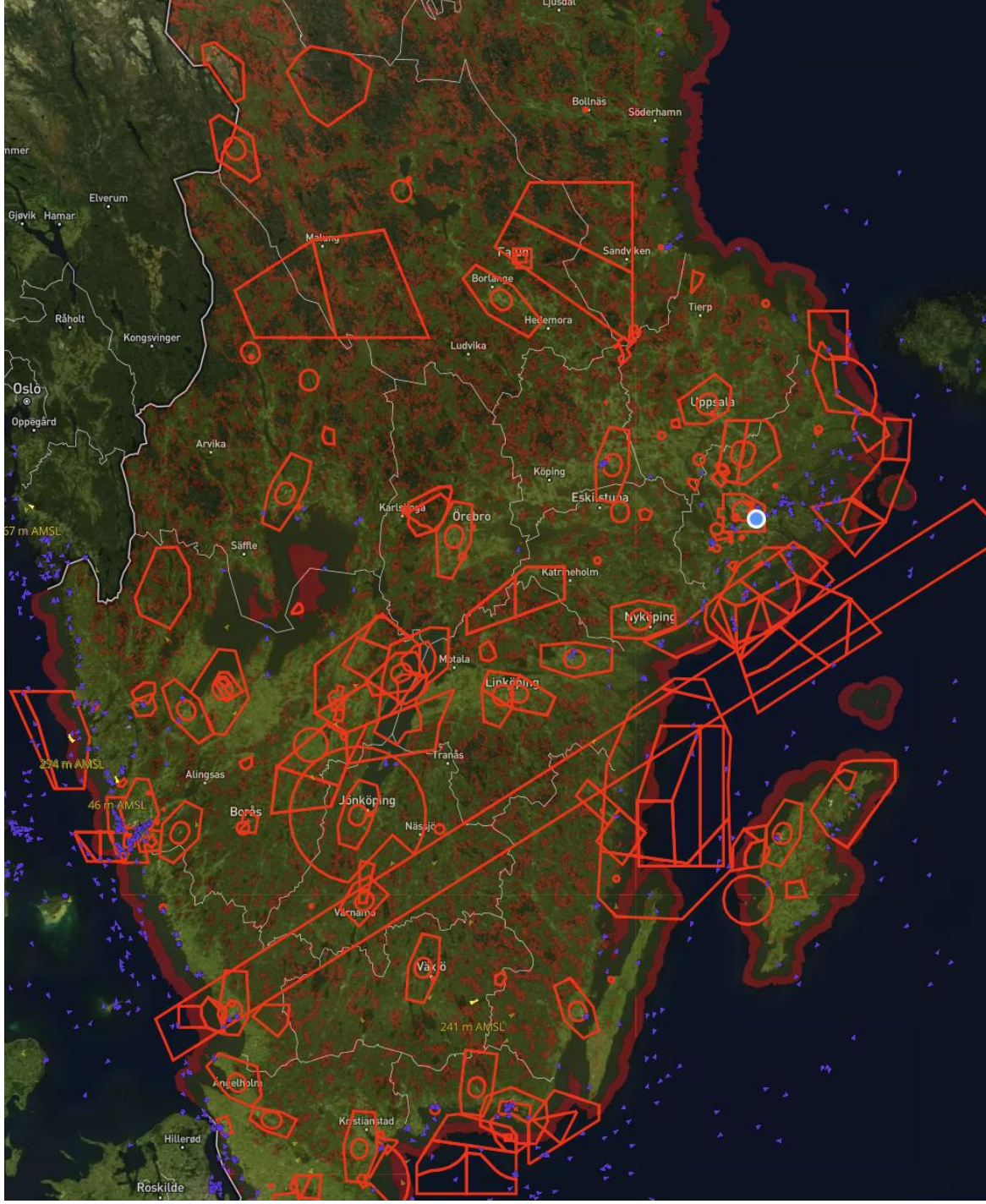


Extended Measurements of Connectivity and QoS



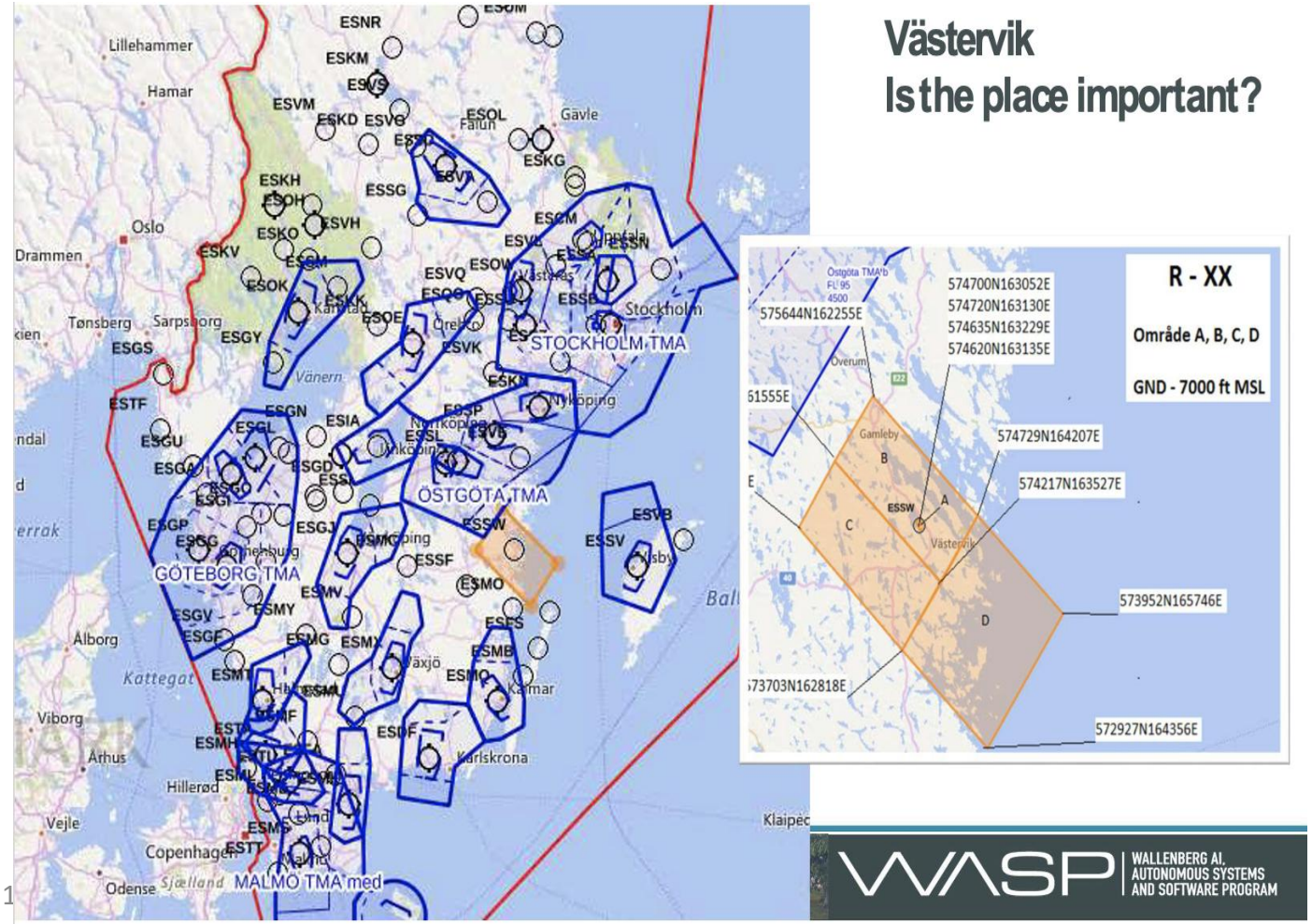
Lessens Lerned

- Many sources of error, requires robust (joint) troubleshooting
- Dynamic planning requires other tools (SA)
- Application-specific behaviours
- Operator specific conditions
- Available bandwidth/signal strength
- Link loss and latency



To fly UAVs out of sight with autonomy requires;

* Access to the Mobile Network which makes you independent of less secure radio - transmitters w. limited range.
* Geographical area without obstacles for BVLOS but access to areas that you want to test on forest - land - sea
* No prohibited or unwanted objects/activities that make it difficult to obtain permission to fly
* Can be cancelled as an R area in the Geographical UAS zone when flying and testing without risk of collisions



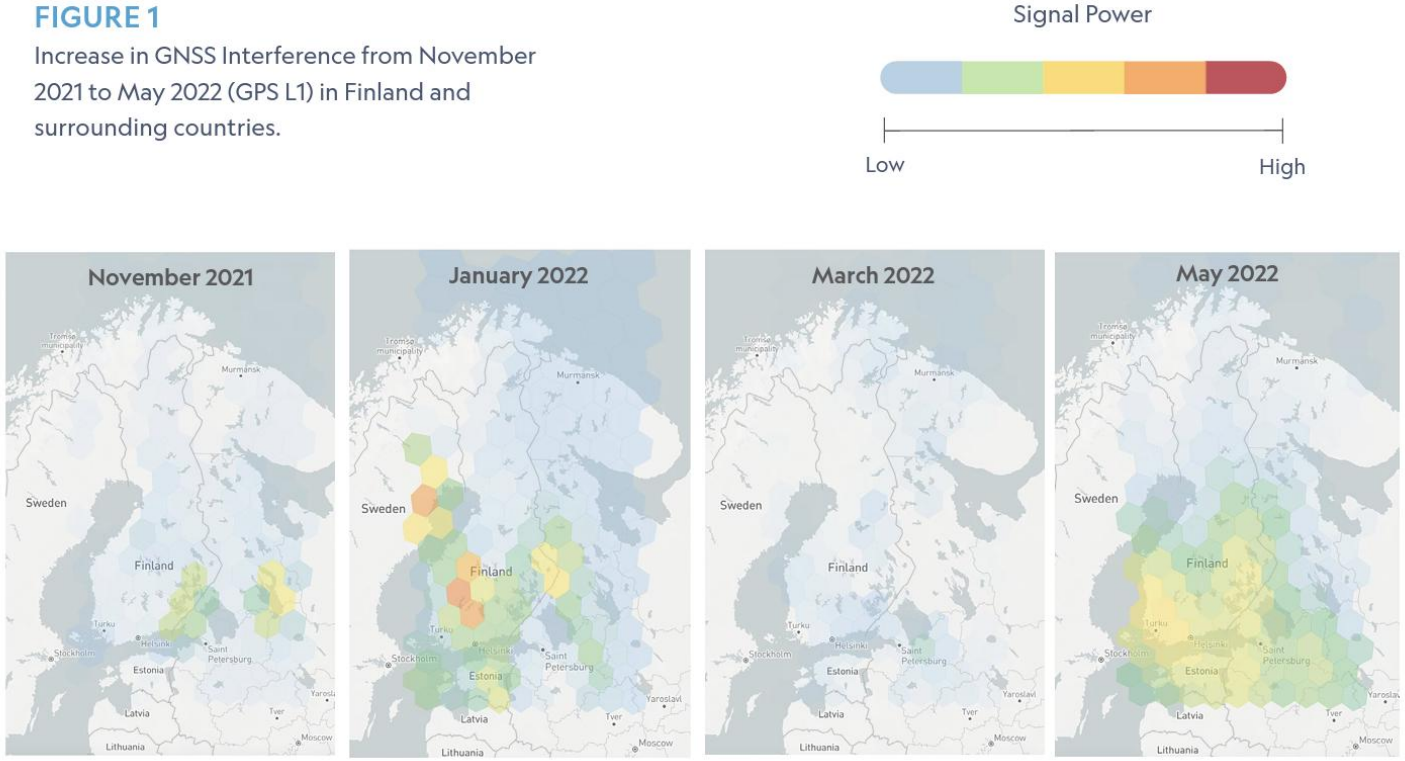
Västervik Drone Science Park, SE. Est 2017 with support from Innovation Authority VINNOVA

Acc Innovation, DroneRequest, SAAB, Combitech, Baracuda, KTH, LiU, FOI, SKYTEM (DK), Odense TB Universitetet Esbjerg WASP-WARA-PS, Trafikverket, Vattenfall, MSB, Polisen, SOS, SjV, Kustb, GB MD, Royal Marines, Luftfartsverket, Södra, Telia, Tre, Tele2, Teracom Telenor, Ericsson

The airspace is possible to use for the largest, fastest and highest - flying UAVs with different sensors and for important tasks

FIGURE 1

Increase in GNSS Interference from November 2021 to May 2022 (GPS L1) in Finland and surrounding countries.

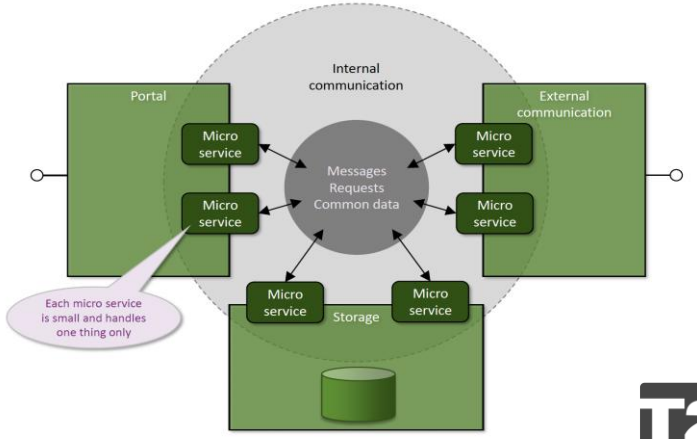


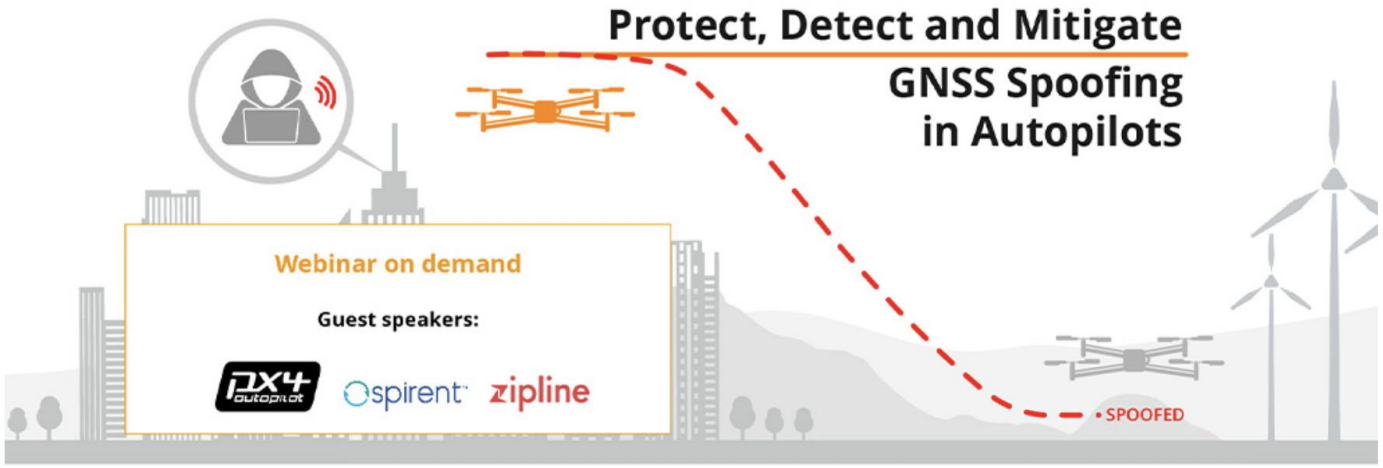
SWEPOS and STRIX to detect and correct

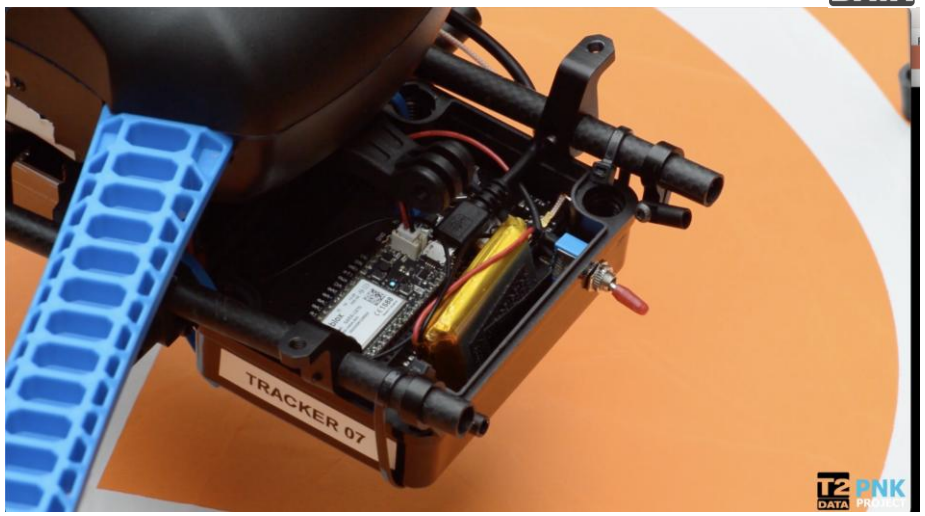
Cyber-secure eID, navigation positioning and C3

Instead of building a monolithic component the Spatmos server is broken down into a number of internal micro services, sharing well defined interfaces. This makes it easy to expand or replace parts of the system.

Micro service advantages:
- Modular
- Flexible
- Adaptable
- Scalable








Störningar i GPS-system
per dag (Källa: gpsjam.org)
Dec 26 2023
svt
ESTLAND
SVERIGE
LETTLAND
LITAUEN
Kaliningrad
POLEN
Och det är Ryssland som pekas ut
som ansvarig för attackerna.

Achieving reliable augmented GNSS performance for autonomous UAS navigation
How to get GNSS reliability forecasts for the possibility of more frequent BVLOS flights

Line of sight to four satellites is a minimum requirement for reliable GNSS performance

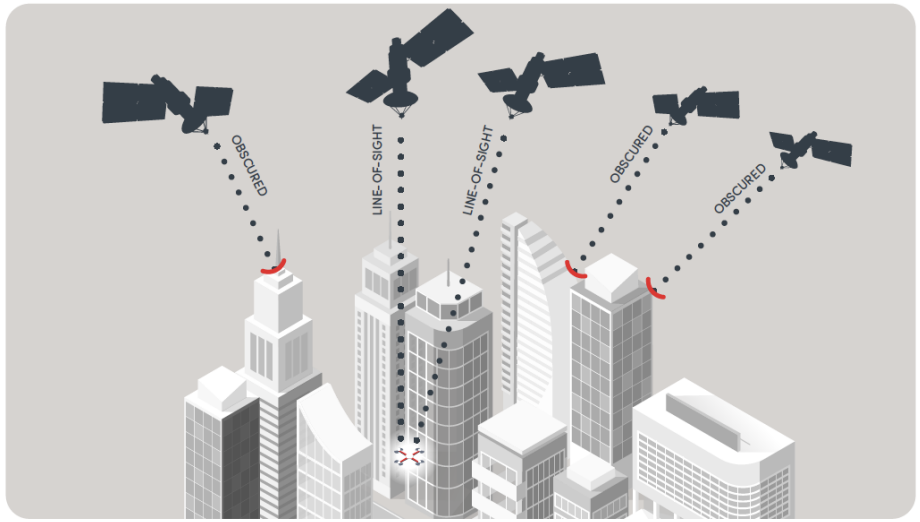
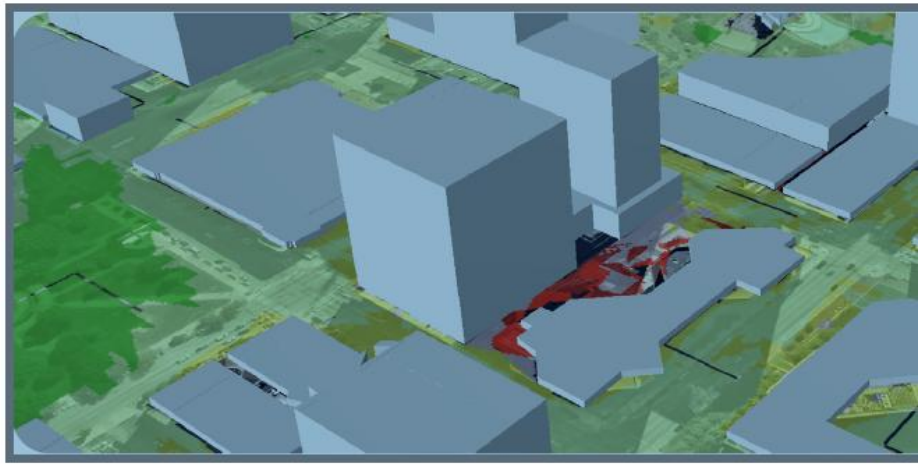


Figure 1: Satellite signals can be blocked by buildings, creating patches of poor GNSS reception



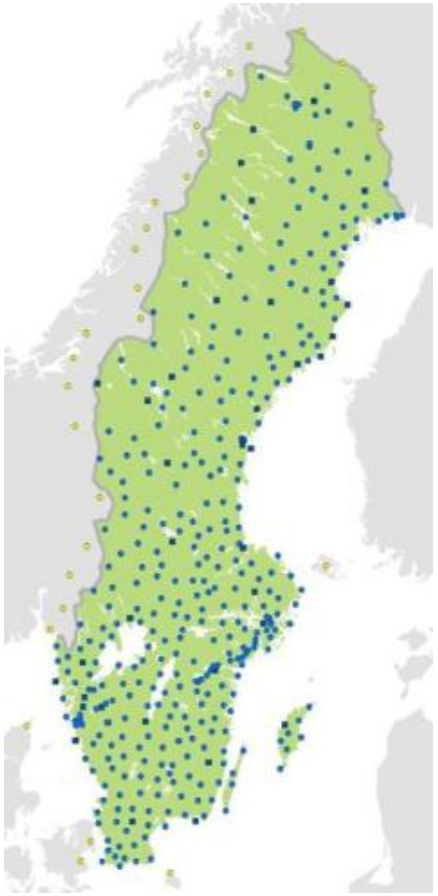
Signal dynamics are constantly changing

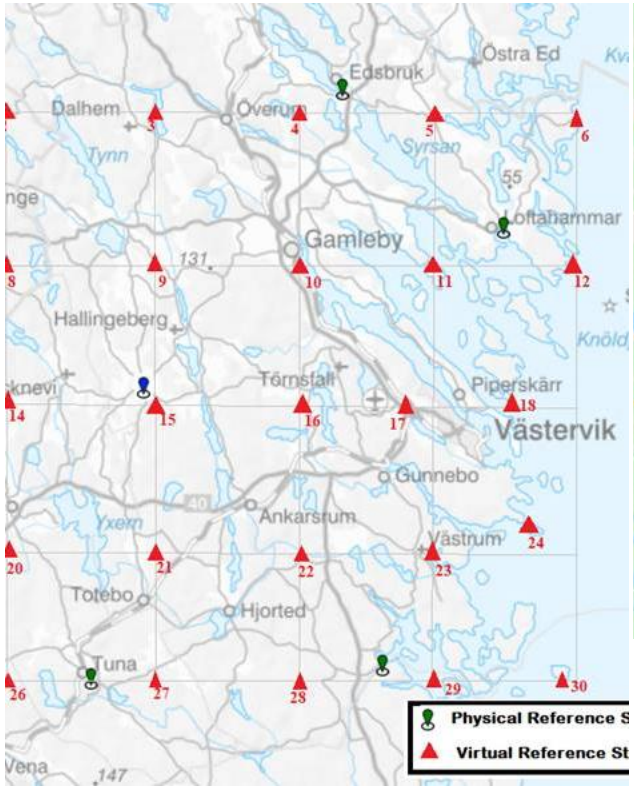
Quality of Service assured & Cybersafe GNSS Positioning via SWEPOS nRTK and 3GPP

SWEPOS

Telia

ERICSSON

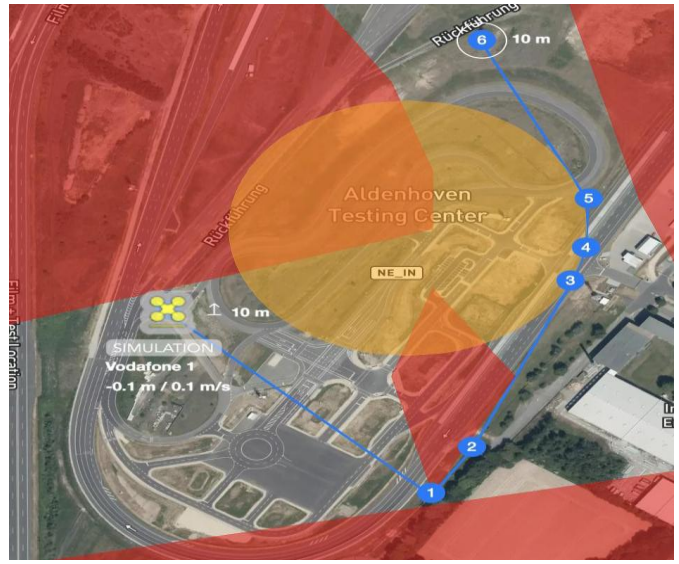


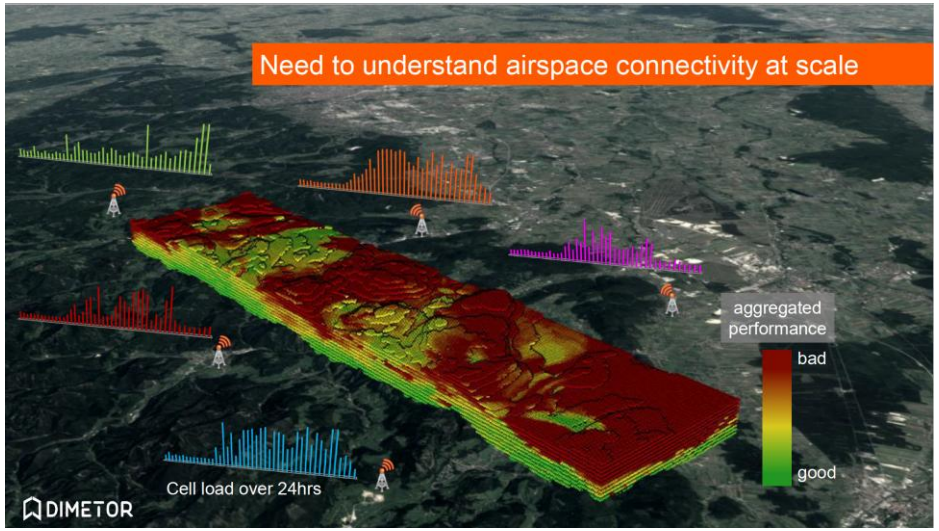


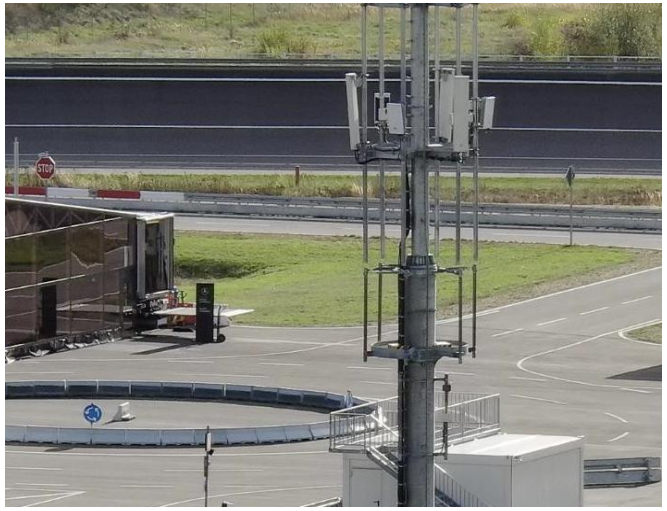
Redundant cm positioning, navigation and communication in real Time for UAVs and other autonomous vehicles also when GNSS – GPS/ /Galileo /Glonass / Bei Dou / are not available or disrupted

GSMA Partners i PNK4UTM for BVLOS operations 4 - 5 - 6G

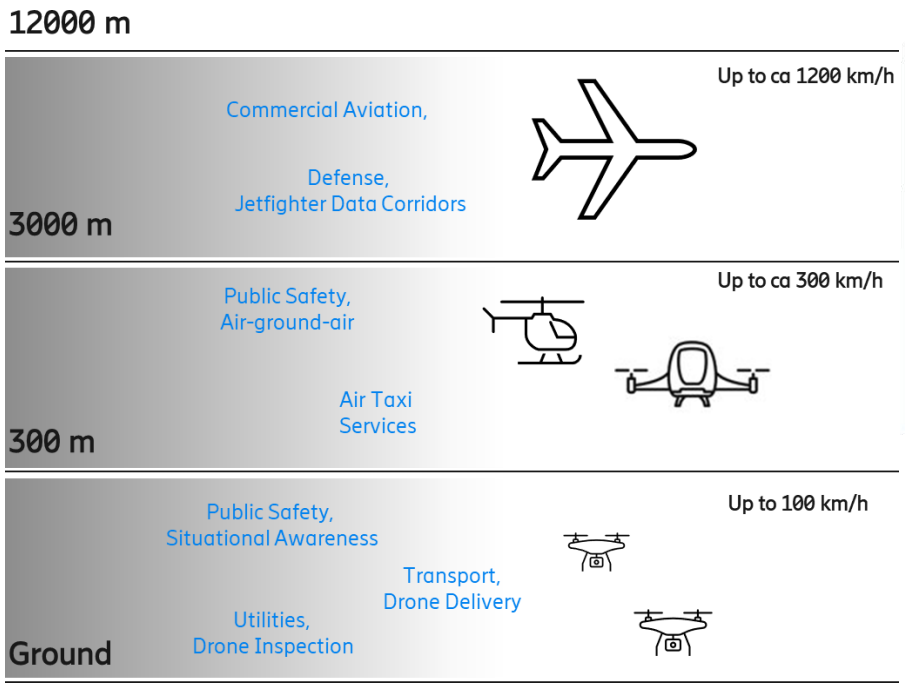
Telia, Tre, Telenor, Tele2, Teracom, Ericsson, RISE, AstaZero,

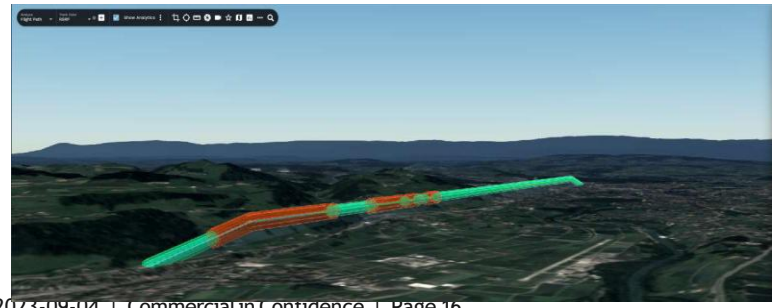






The result from the PNK4UTM shows that UXS can use the 4-5G networks





Medium Altitude AIRSPACE (up to 3000 m)

- Dedicated network designed for coverage in the air. Dedicated spectrum license.
- Existing Ericsson 5G RAN and 5G core portfolio. Massive MIMO beamforming is required.
- Doppler effect compensation for high speed
- Potential new Ericsson Digital Airspace Software Product to enhance performance (not mandatory)

Low Altitude AIRSPACE (up to 300 m)

- Utilization of existing CSP networks with enhancement
- Reuse existing spectrum license
- Upgrade RAN hardware to massive MIMO and beamforming to enhance coverage and quality
- Potential new Ericsson Digital Airspace Software Product to enhance performance (recommended but not mandatory)

DIMETOR
AirborneRF
Telia
ERICSSON
TERACOM SAMHÄLLSNÄT
RI. SE

SAR – UAS - Maritime rescue assisted with UAS

SJÖFARTSVERKET

KUSTBEVAKNINGEN
SWEDISH COAST GUARD

WASP | WALLENBERG AI, AUTONOMOUS SYSTEMS AND SOFTWARE PROGRAM

Västerviks Kommun

RI SE

LUNDS UNIVERSITET

FOI PNK4UTM

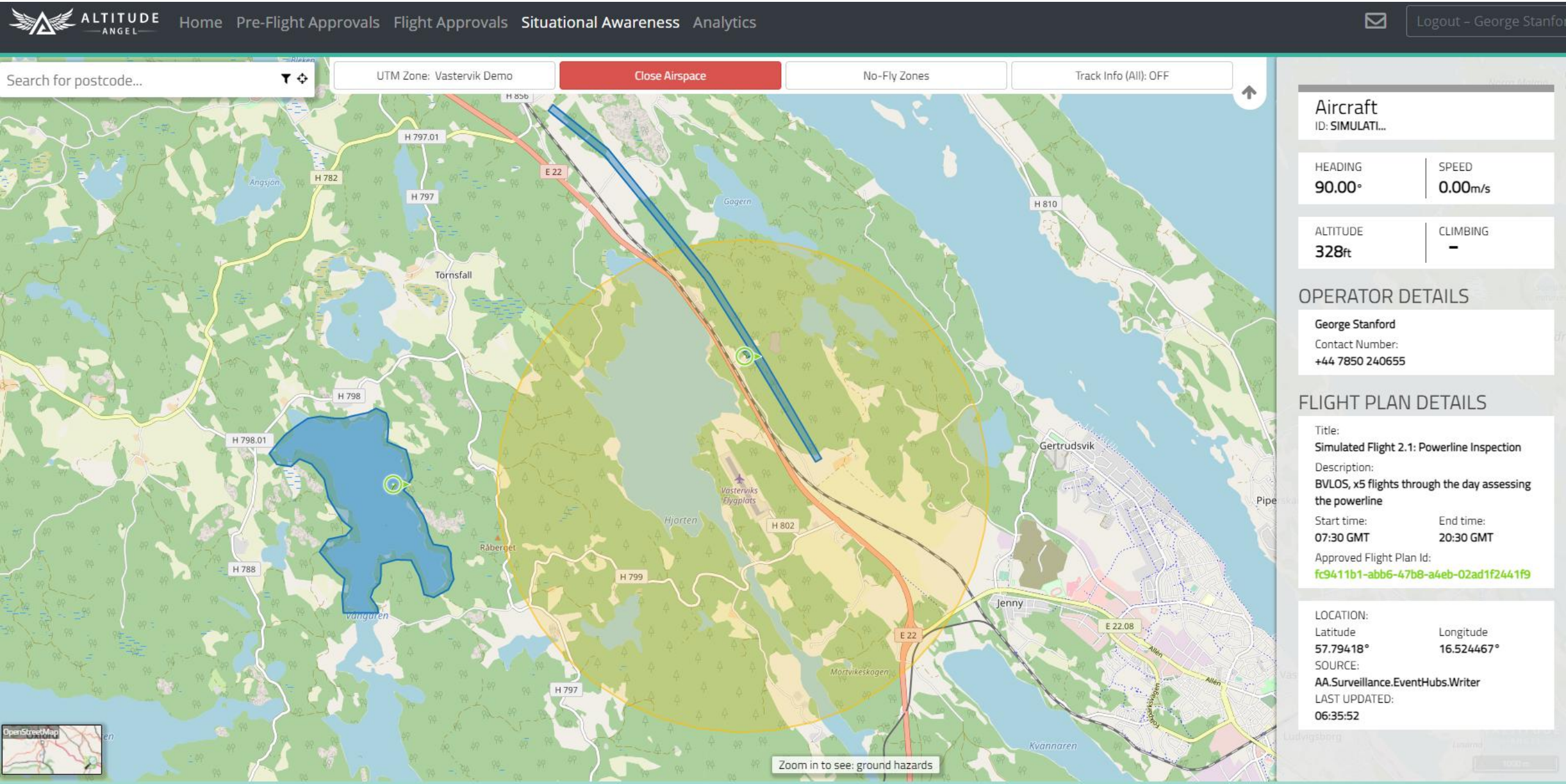
VÄSTERVIKS KOMMUN

TRAFIKVERKET

Polisen

SOS Alarm

Shared airspace UAV and Air Force with Guardian UTM



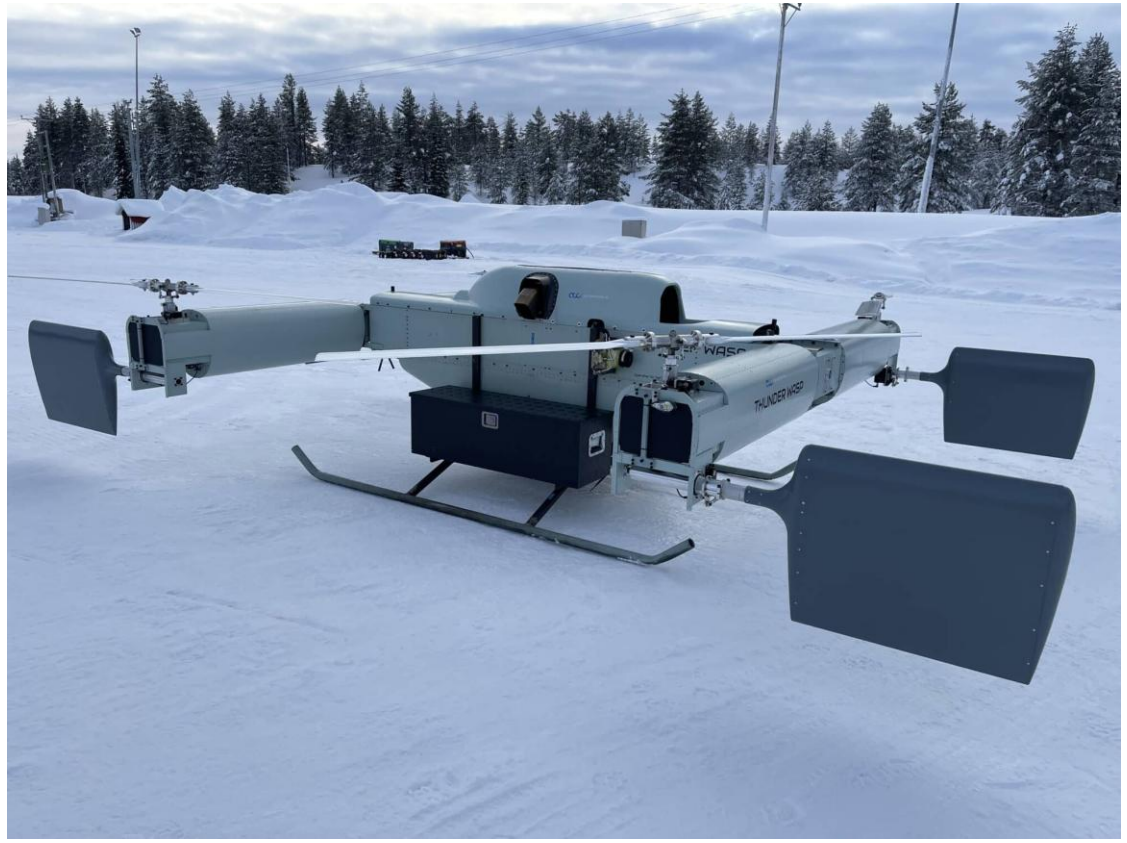
Congratulations ACC - Innovation & Västervik Drone Science Park SE

Thank You!

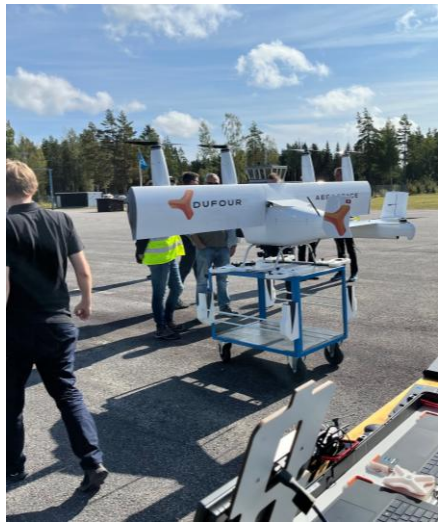
Telia, Tre, Telenor, Tele2, Teracom, Ericsson, Dufour, Lantmäteriverket/SWEPOS, T2-data, Västerviks kom. RISE, WASP Wara PS, MSB, Swedish Police, SOS-alarm, SjV, Coast Gard, FOI, TrV, Altitude Angle, DIMETOR Vinnova, EU ECEL JU and all other participants….

Finnish defence company Patria and Swedish drone maker ACC Innovation AB

have signed a cooperation agreement to jointly develop a military version of the quadcopter-style Thunder Wasp GT drone for military use by NATO member nations.



Thunder Wasp in firefighting lifting 800 l water for use in Canada or maintenance of wind power mills in Europe


DUFOUR


DUFOUR
AEROSPACE


DUFOUR
AEROSPACE

Thank you for your attention!

And thanks to the Swedish Transport Administration Vinnova and our project partners for your contributions!

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