Research and development of UAVs

Drone Center Sweden Västervik
PNK4UTM Cellular & UAV – UTM Innovation Zone
AFarCloud Aggregate Farming in the Cloud

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Research Institutes of Sweden RISE
Vinnova, EU, Trafikverket, GSA

ECSEL Joint Undertaking
Electronic Components and Systems for European Leadership

WE WELCOME YOU

TO JOIN US IN THE SWEDISH DRONE COMMUNITY

AND TESTBED IN VÄSTERVIK

PNK PROJECT

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FIND US AT:

Dronecentersweden.se/pnk

Linkedin/PNK Projektet

ERICSSON

T2 DATA

VÄSTERVIKS KOMMUN

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VATTENFALL

SÖDRA

LANTMÄTERIET

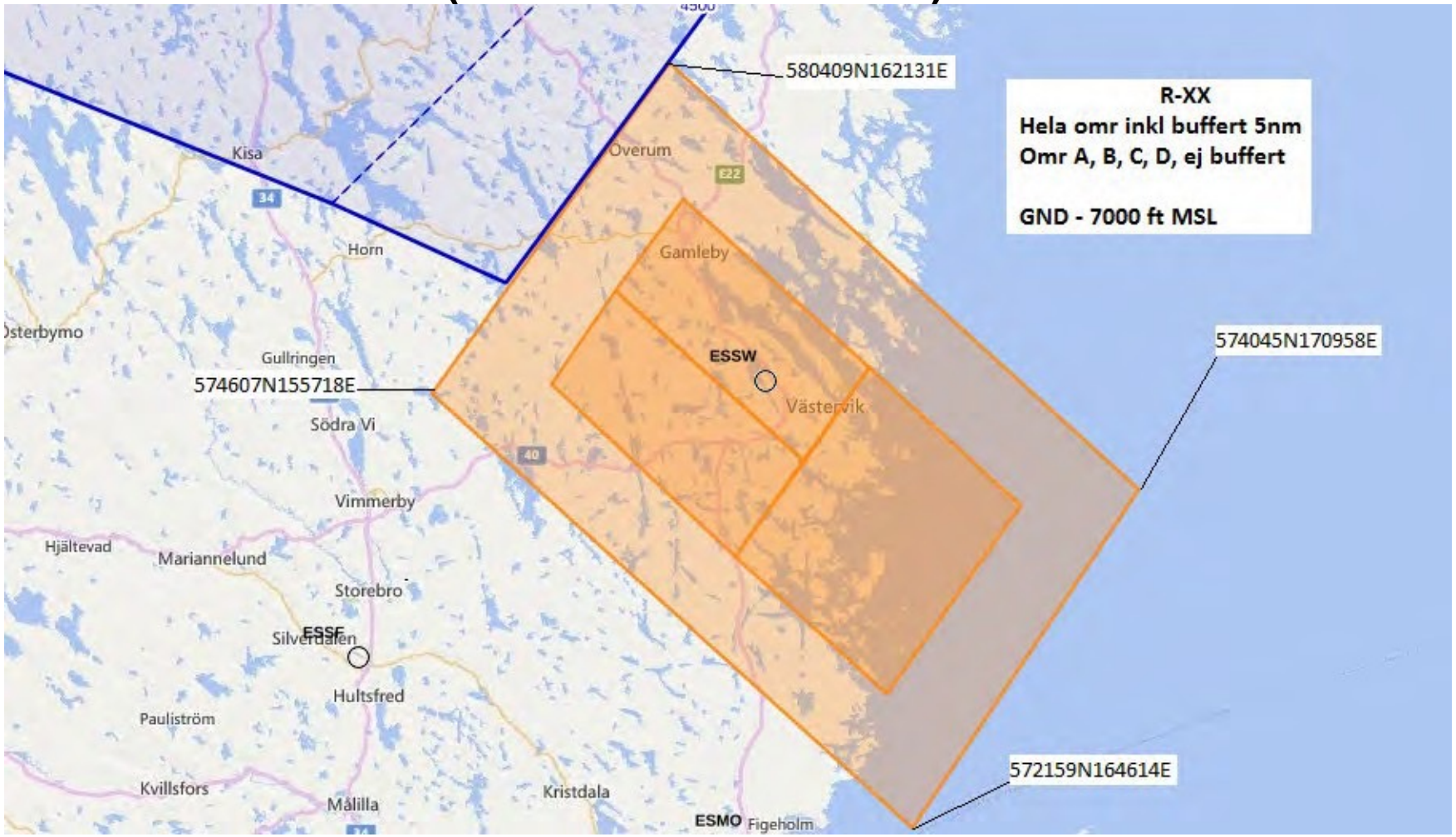
WASP WALLENBERG AI. AUTONOMOUS SYSTEMS AND SOFTWARE PROGRAM

Telia

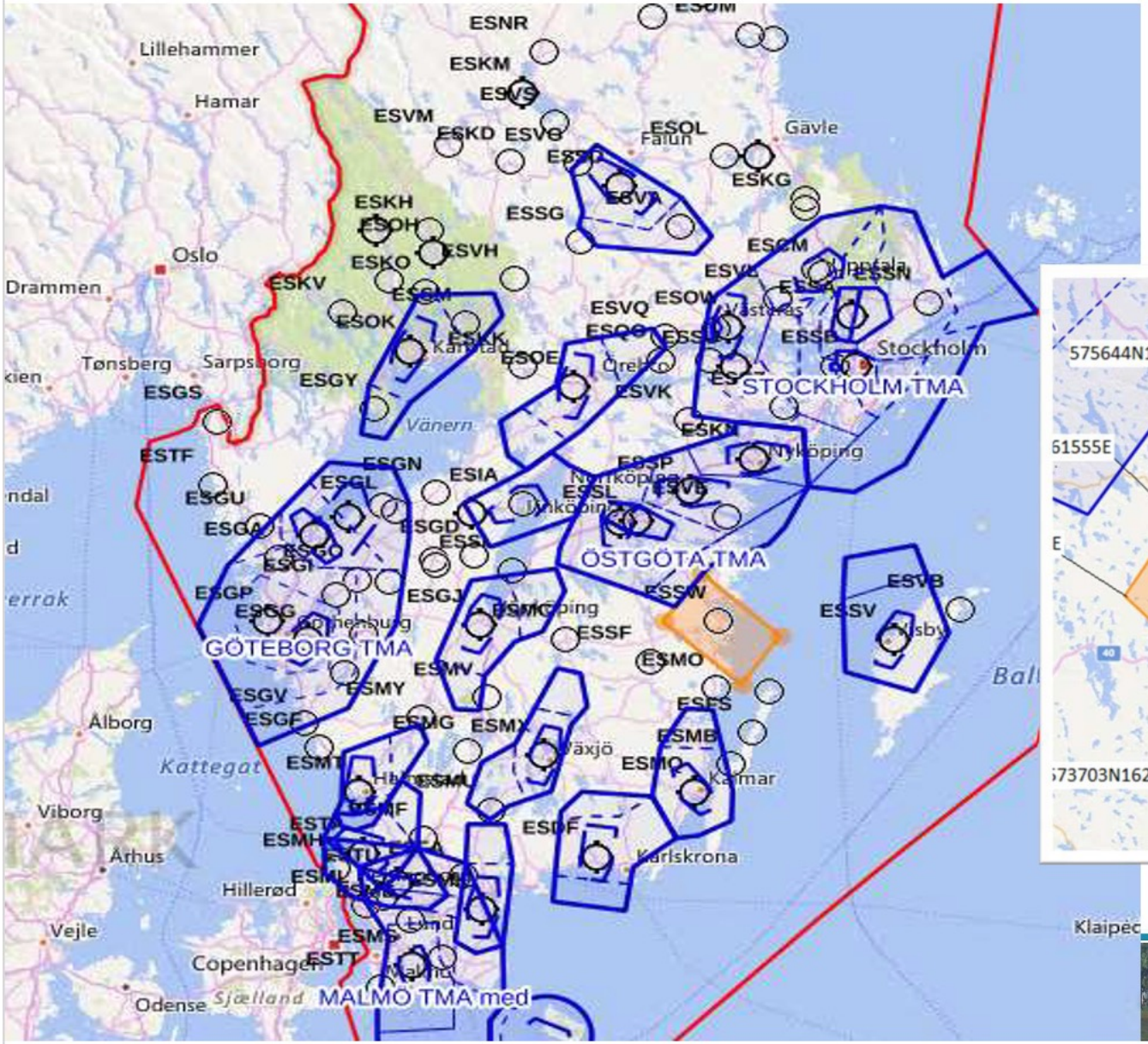
SWEPOS

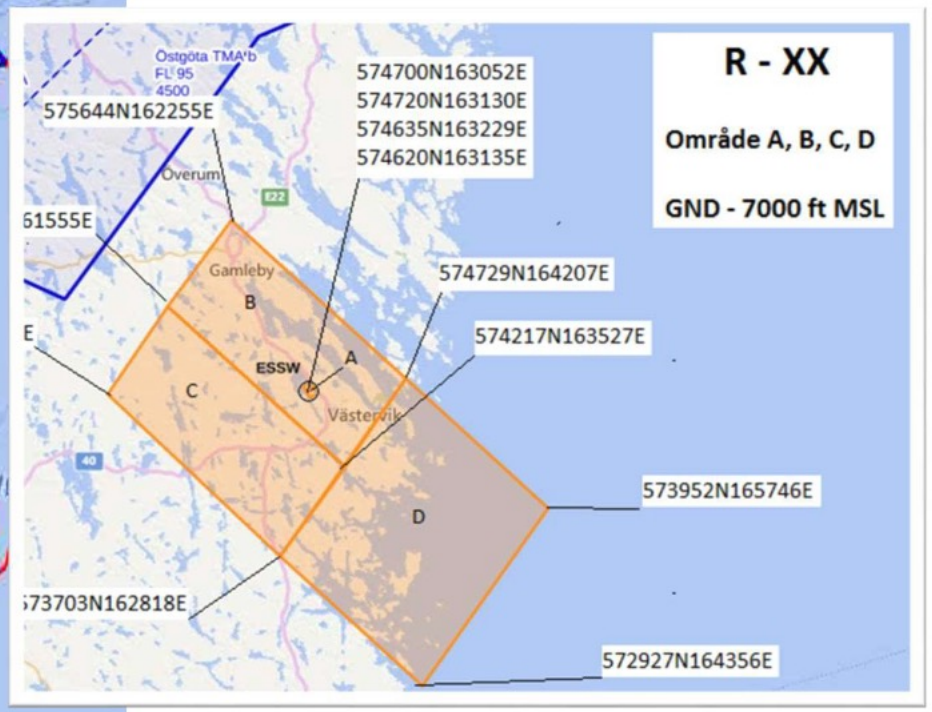
TRAFIKVERKET

To ensure that no unannounced flights enter the test area, DCS, together with the Swedish Transport Agency, has established a 40 x 60 km geographical UAS zone with a flight altitude of 500 m and the possibility of (GND-7000 ft MSL)



Västervik
Is the place important?





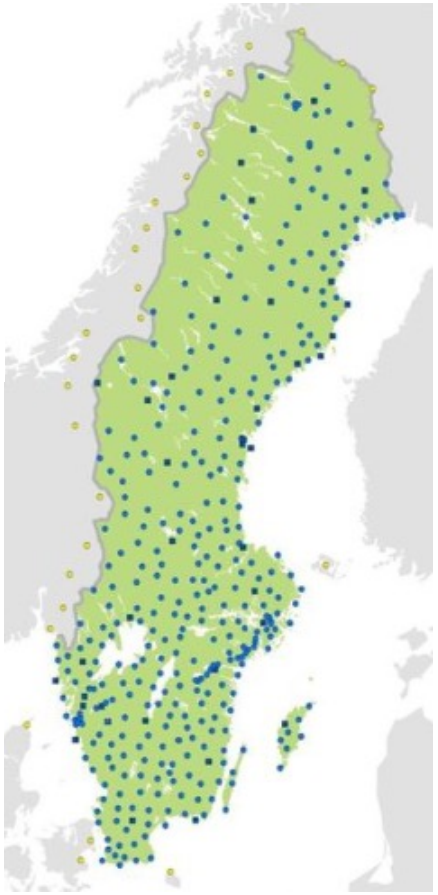
WASP WALLENBERG AI, AUTONOMOUS SYSTEMS AND SOFTWARE PROGRAM

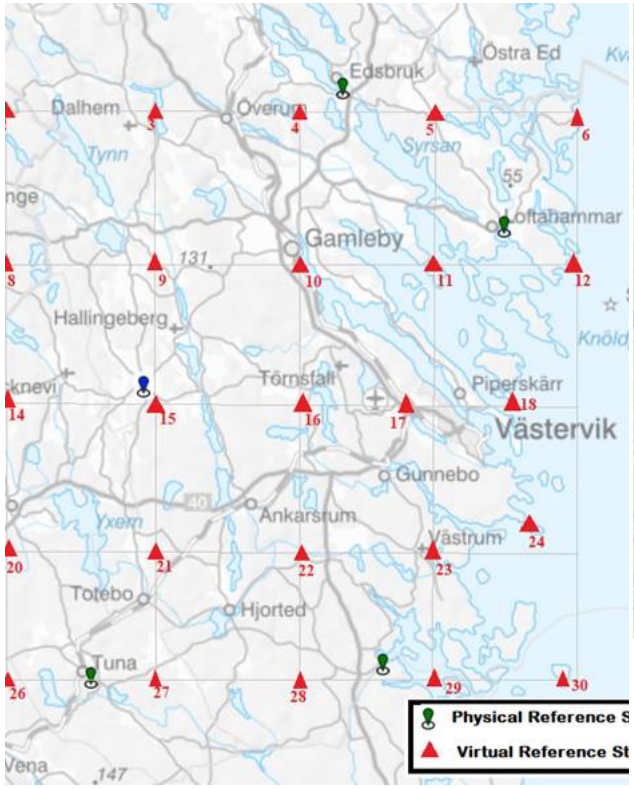
Established SWEPOS nRTK + mobile IoT & UAV for autonomous BVLOS operations

SWEPOS

Telia

ERICSSON





Redundant cm positioning, navigation and communication In real time for UAV and other autonomous vehicles also when GNSS - GPS / Galileo Glonass / Bei Dou / Kompass are not available or disturbed

Partners are;

Telia, Tre, Ericsson, SWEPOS, RISE, AstaZero, Vattenfall, Södra skogsägarna, Västerviks kommun, T2-Data, Wabema , WASP- Wara PS

Full activities with various UAVs, sensors, radar, Pos - Nav - Kom and UTM systems

UAS RÄDDNINGSTJÄNSTEN

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Polisen

SOS Alarm

VINNOVA
Sveriges innovationsmyndighet

Västerviks Kommun

TRAFIKVERKET

SJ


ACC INNOVATION AB

SAR - UAS - Sea rescue assisted with UAS

SJÖFARTSVERKET

KUSTBEVAKNINGEN
SWEDISH COAST GUARD

WASP
WALLENBERG AI, AUTONOMOUS SYSTEMS AND SOFTWARE PROGRAM

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LUNDS UNIVERSITET

FOI PNK4UTM

VÄSTERVIKS KOMMUN

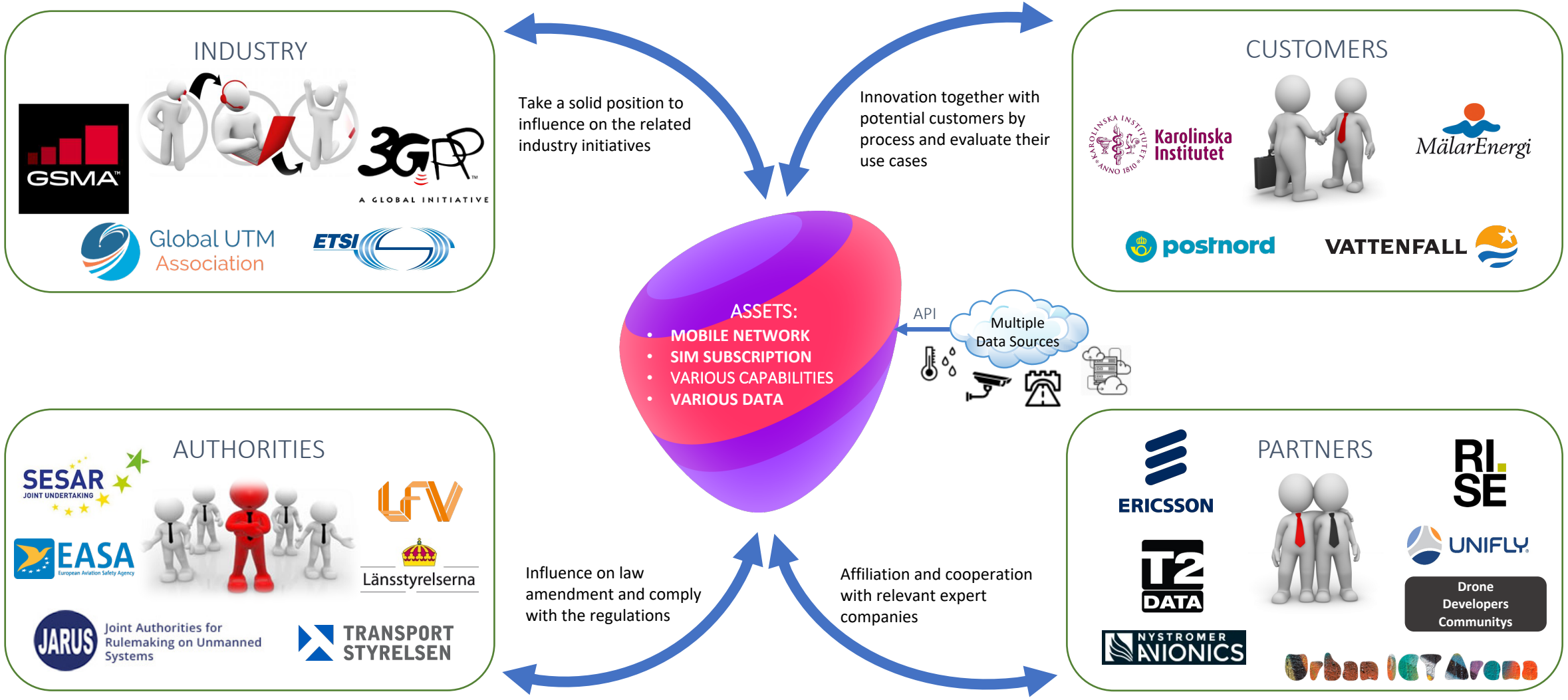
TRAFIKVERKET

Inspection of electricity production and distribution, roads, bridges and railways with UAS

The passenger transport of the future in sparsely populated areas and to islands? Thunder Wasp & Katla are tested in Västervik

UAVs can support many of the challenges of Agenda 2030 and the Global Goals!

Key-Stakeholders MAP - Telia



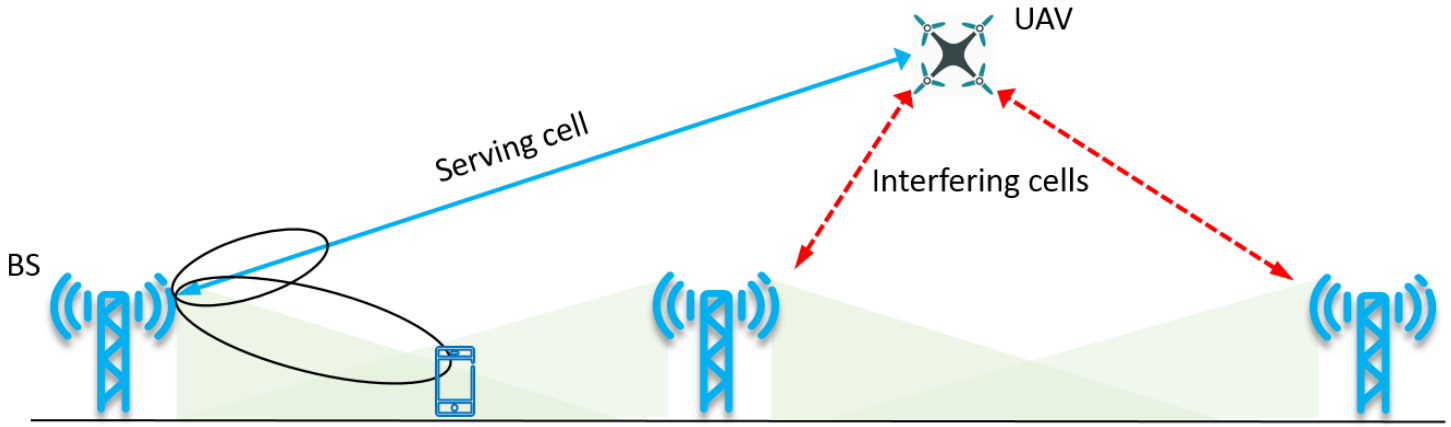
3D coverage and knowledge of performance

Cellular Technology challenges

a few examples

- Sufficient coverage
  - UAV's may be served by the side-lobes of BS antennas due to down-tilted BS antennas

- Up -and downlink Interferences
  - With close-to-free-space propagation in the sky, UAV's may generate more uplink interferences to the network while experiencing more downlink interferences



Source: 3GPP TR 36.777

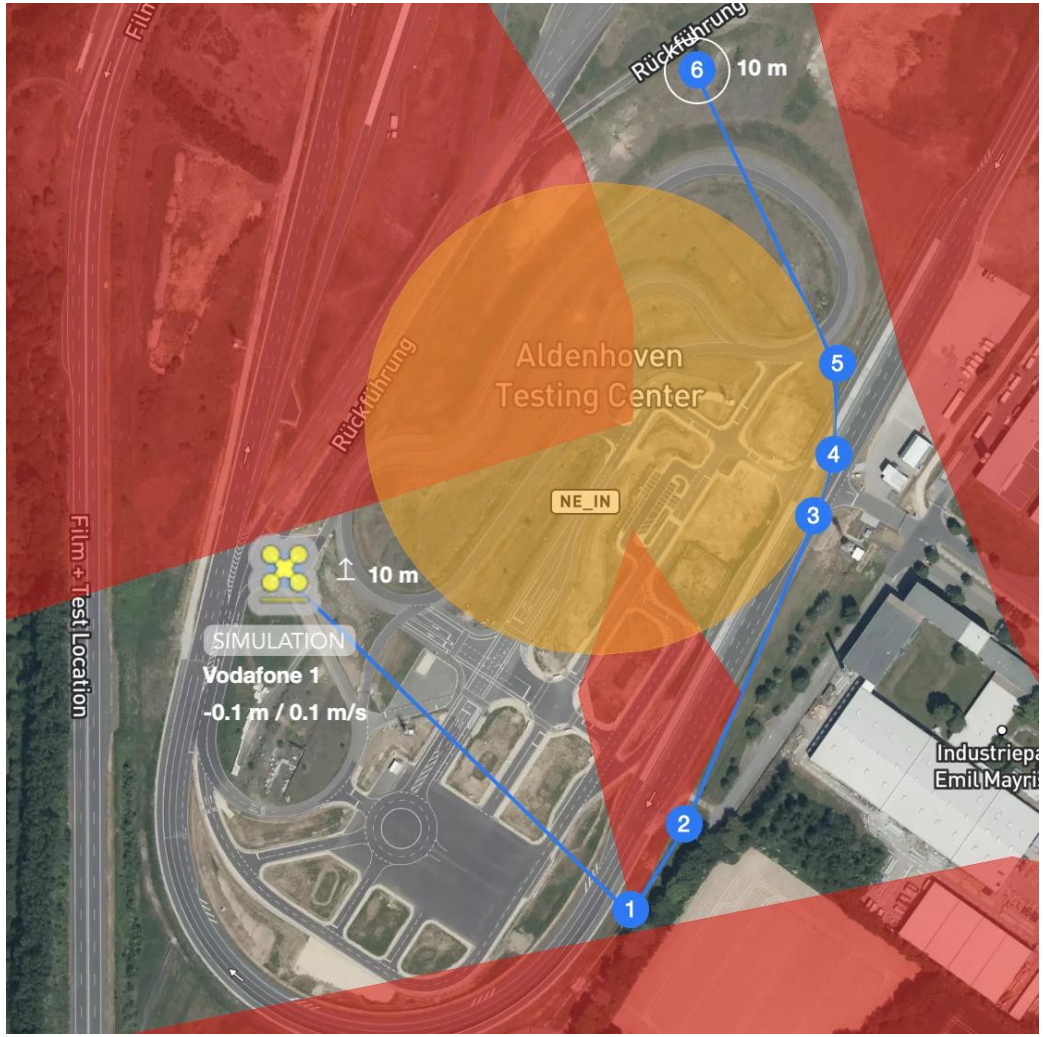
Ericsson and 3GPP support for UAS-UAV

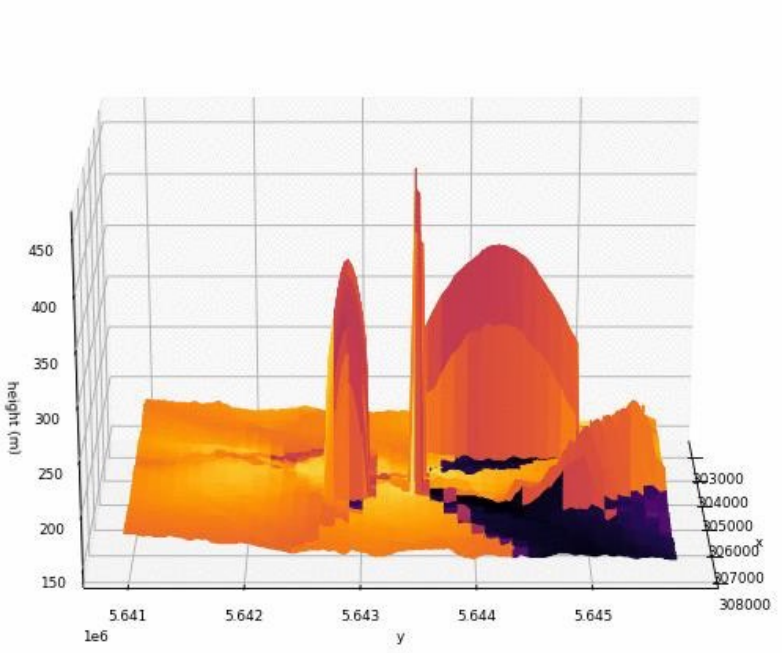
Fredrik Gunnarsson, Ericsson Research
Fredrik Flyrin, Ericsson Emerging Business

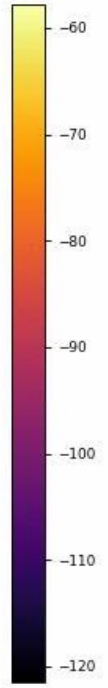
Objective of Ericsson Drone Mobility Use The Mobile Network to:

- Authentication & Authorization of Drones and drone mission control system using the network
- To Connect A Drone Mission Control System that can be the consumer of telecom grade insights and be the receiver of a video stream directly from the drone
- Expose Network Coverage maps to a Drone Mission Control System to enable route planning that avoids bad network coverage
- Expose SIM Density maps to a Drone Mission Control System to enable route planning that avoids flying over crowds of people
- To Change QoS (through Exposure service) for good quality video streaming through SCEF

Exposure of SIM Density and Network Coverage to DMC through exposure API







- Poor Coverage Data

- SIM Density Data

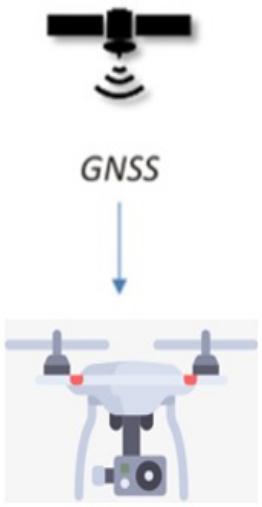
Quality of Service for altering video stream resolution from DMC through exposure API

~500 Kbps

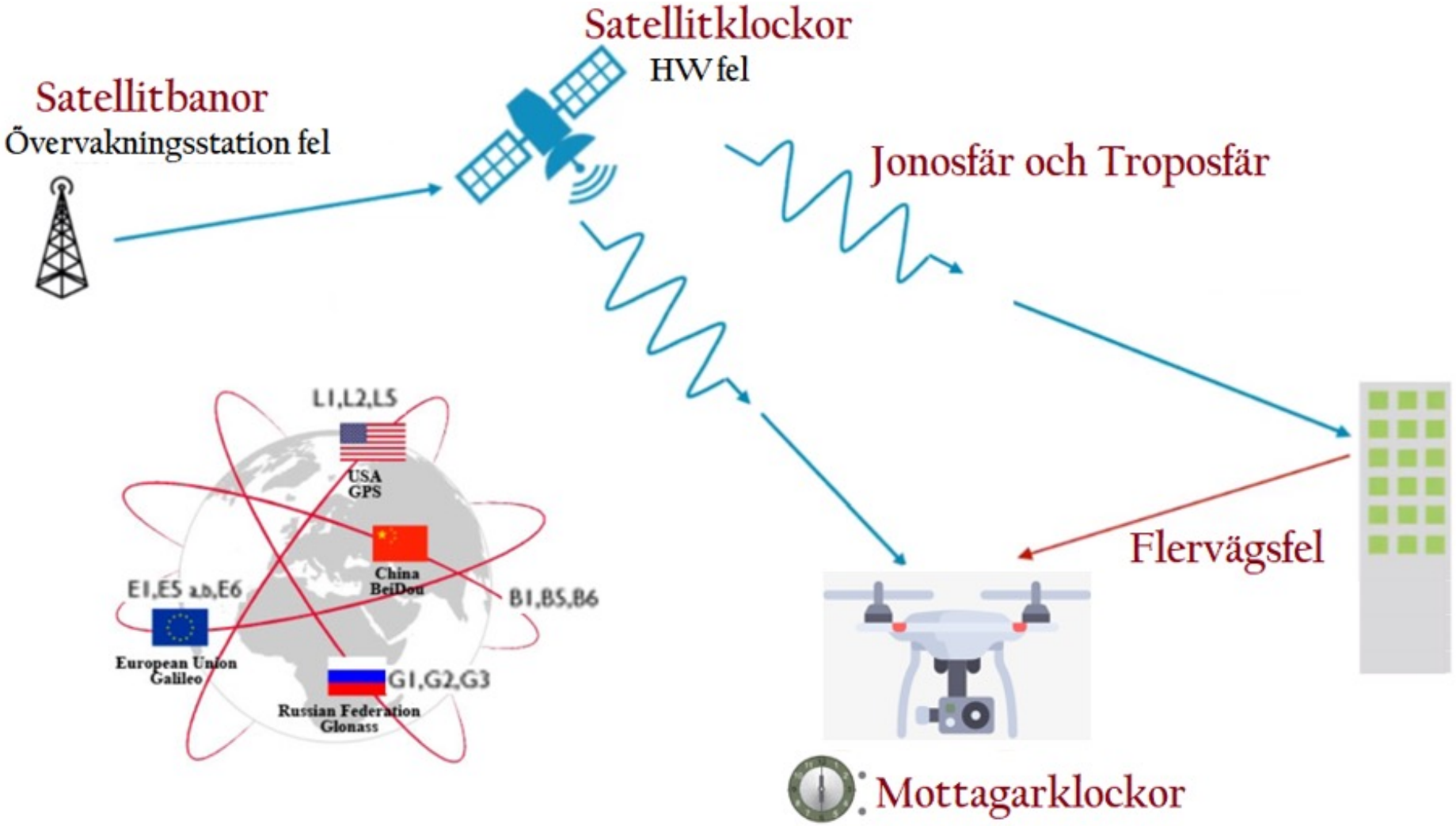
~6-8 Mbps

Accurate GNSS positioning: For autonomous vehicles & UAVs

The Accuracy is to low



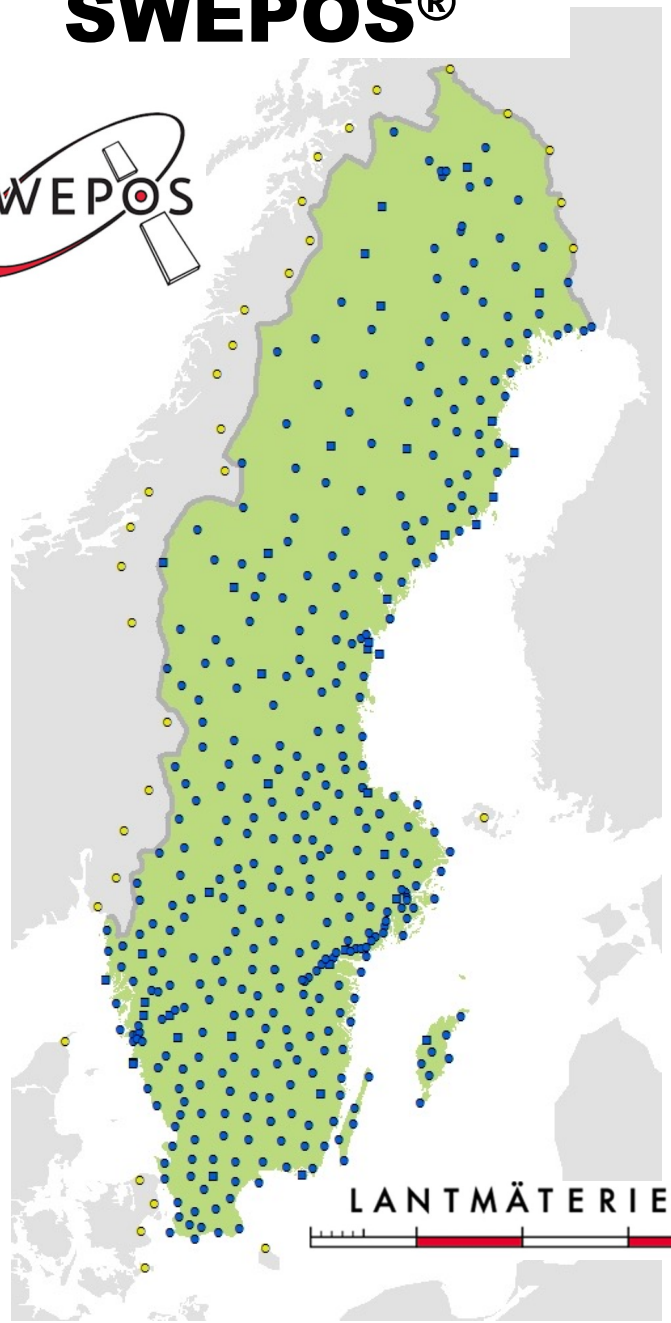
Only between 2 – 10 m



SWEPOS

Need for correction service

SWEPOS®



Most of the recievers in SWEPOS stations are:

- Trimble Alloy
- Septentrio PolaRx5

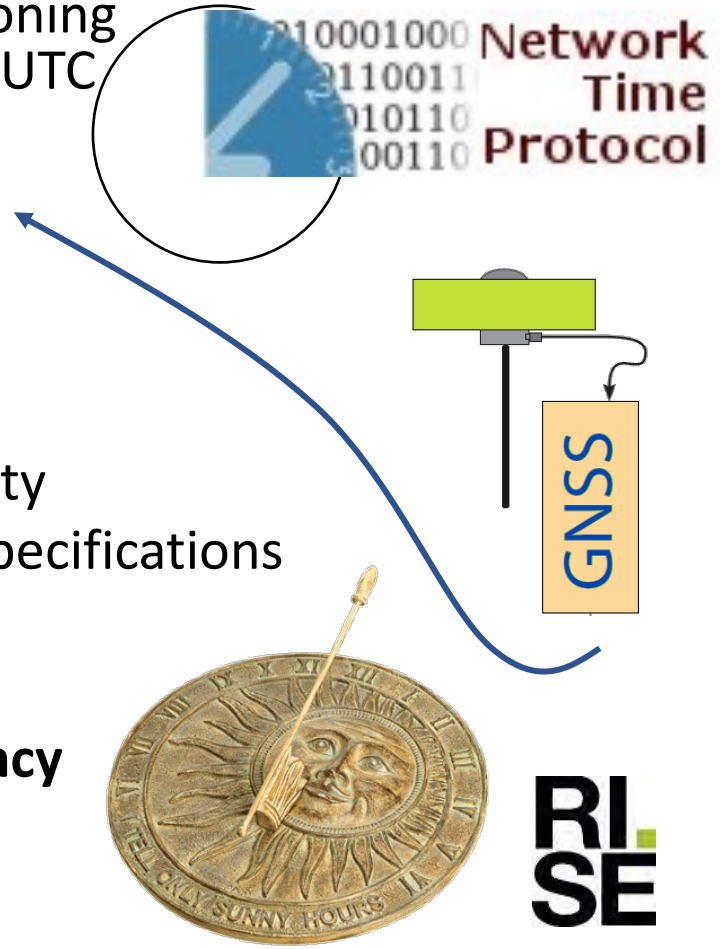
- Introduced, GPS only, 2004
- GPS+Glonass, 2006
- GPS+Glonass+Galileo, februari 2018
- GPS+Glonass+Galileo+BeiDou 2021 (Planed)

- RTCM SC 104 & 134

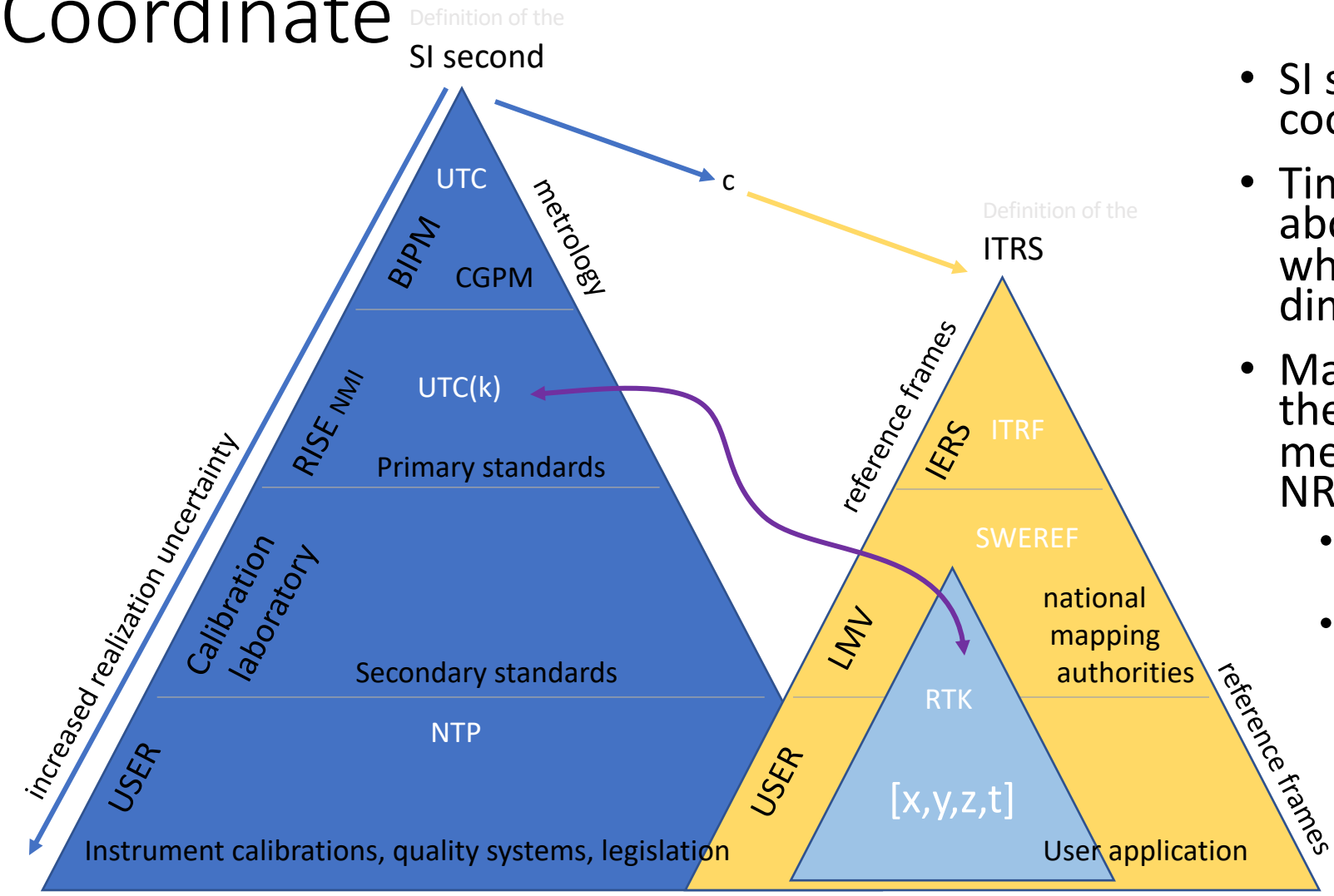
Accurate Time Coordinate – Easy to Get Hold Off ?

- **Yes**, in principle: have a clock and compare it to a source of reference
  - with respect to performance and costs, GNSS stand-alone positioning solutions can distribute constellation system time as a source of UTC
    - **Lack of traceability** – quality system needs
    - Spamming, spoofing, …
    - Insufficient hold over – local clocks do not meet application needs
    - Redundancy – lack of, dependability
- **No**, it is difficult and possibly expensive
  - Need for comparison methods that **can be calibrated** - traceability
  - Hold over capacity – local clocks that meet application specific specifications
  - Wired methods using the two way principle
  - Traceable **real-time**
  - Combination of redundant methods for increased **timing resiliency**

  - Carsten Rieck RISE



Traceability – The Essence of Metrology – Scale vs Coordinate



- SI system defines scale not coordinates
- Time metrology is concerned about coordinates – UTC … whereas dimensional metrology is not
- Mapping agencies can distribute the local reference frame by means of NRTK as a national infrastructure
  - convenient to distribute also the time coordinate
  - Large scale 4D traceability supporting legislation needs

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Maps to navigate by and to do Vulnerability and Risk Analyzes (SORA) for permission to fly BVLOS & Autonomous

To drive autonomously on roads, in the field or in the forests very good and detailed maps are required to avoid collisions with objects at low altitudes and vulnerable populations and know where you can Not, or should not travel.

Erik Bäckman

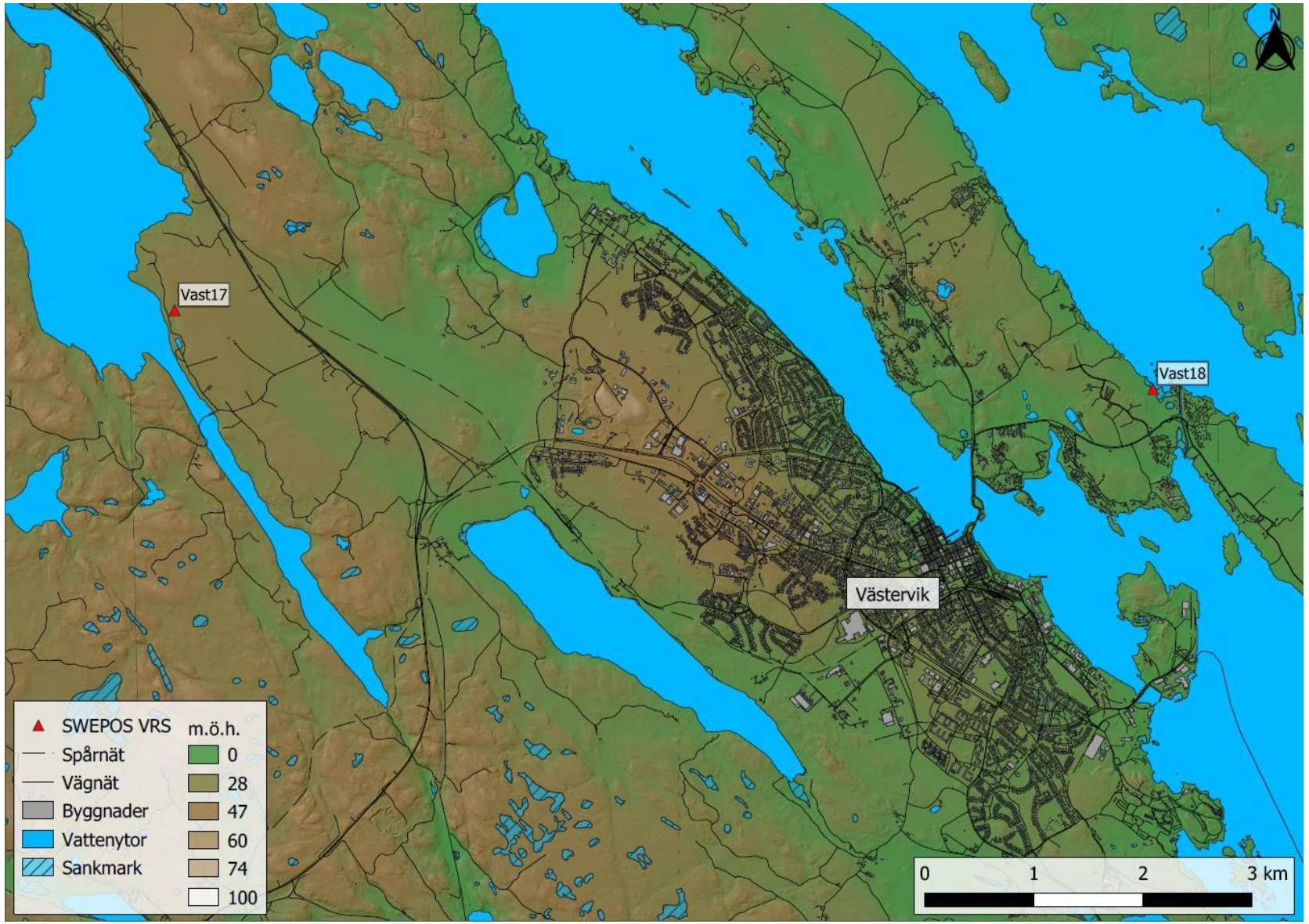
RISE - Safety & Transport
Measurement Science & Technology

Research Institutes of Sweden

Base map for U-space, navigation and SORA

The topography is created from the the National Land Survey's ALS data (Air-borne Laser Scan). Other data shown come from the Swedish Trans-port Administration, SMHI, SWEPOS and Västervik municipality.

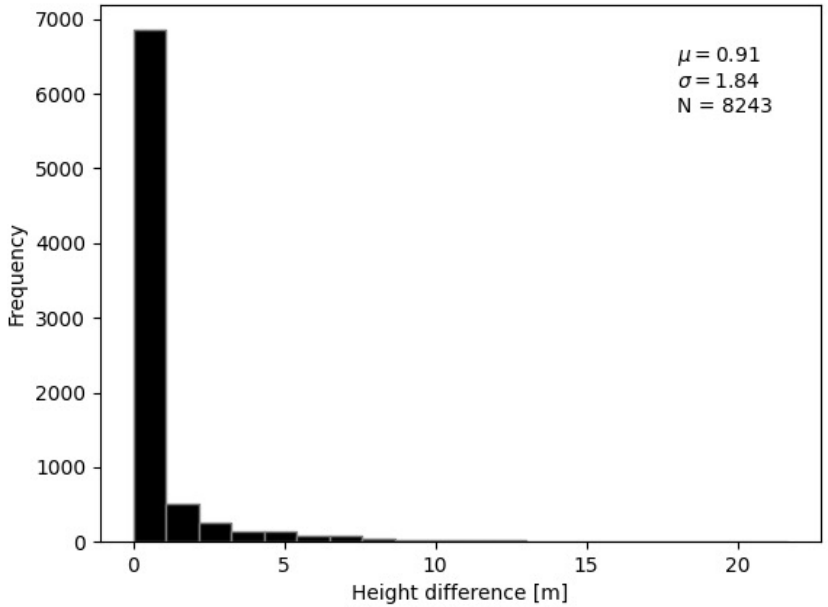
The purpose is to ensure topography in line with SWEPOS positions so that planned and completed routes can be carried out safely and efficiently in the geographical UAS zone. Methods and algorithms can - when verified here - be used throughout Sweden and elsewhere.

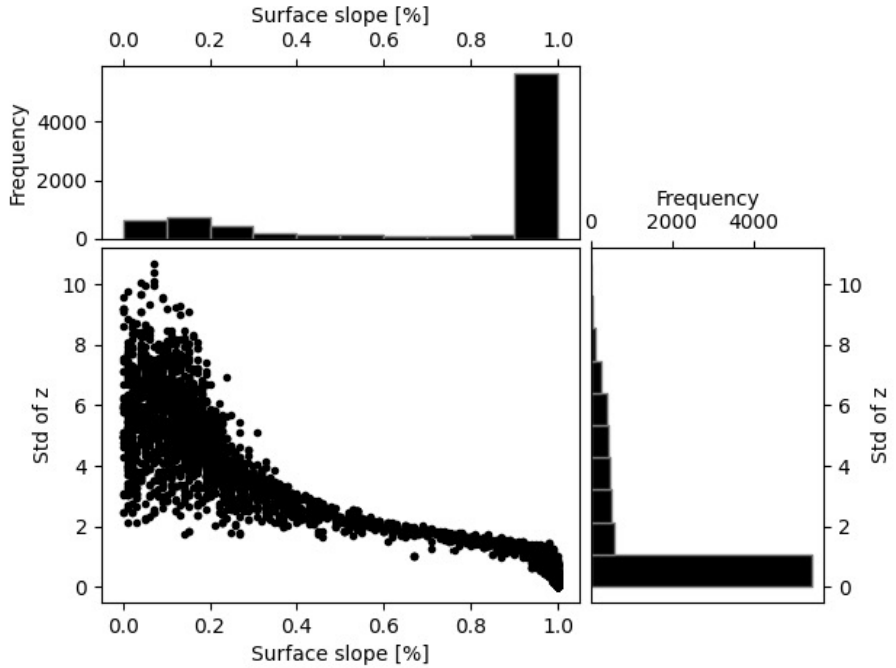


Analysis of Geosptial data

An algorithm has been developed whose purpose is to statistically examine the quality of large point clouds (eg Lantmäteriet's ALS data). The algorithm compares estimate data with reference data, and in this way the vertical data quality can be estimated for a given x, y point.

Based on estimate data, the algorithm also estimates vertical standard deviation and ground slope at each x, y point. Any relationship between parameters such as these two is investigated for further development of the algorithm.





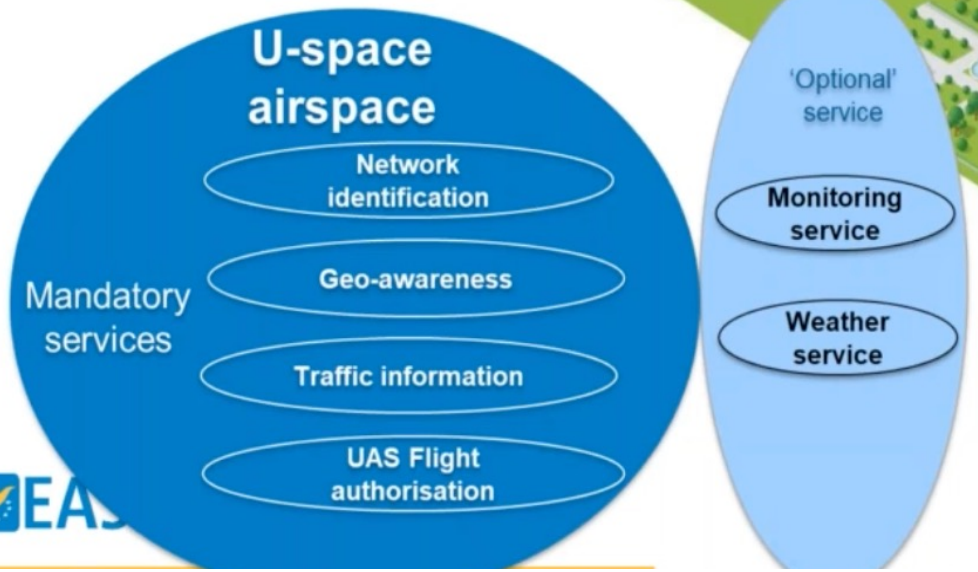
GuardianUTM® Enterprise

Service Overview for RISE Sweden

The U-space

Airspace where some services are provided.

Regulation (EU) 2021/664
Applicability date 26 January 20



Up and running Guardian UTM from Altitude Angel