EXPERIENCE AND LEARNINGS FROM THE DINPAS PROJECT

GENERATION OF SSR CORRECTIONS USING GNSMART AND RESULTS FROM DYNAMIC POSITIONING TESTS BASED ON SSR CORRECTIONS

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LANTMÄTERIET

PROJECT INFORMATION

The focus is on an **enhanced digital infrastructure** to support **accurate positioning of mobile GNSS clients** with a specific evaluation focus on the requirements relevant for an **autonomous airport** with a combination of ground vehicles and airborne objects such as UAVs.

Funding agency: VINNOVA Sweden's Innovation Agency

Project timing (extended 1 year): 2021-10-01 – 2024-09-30

Project Partners:

RI. SE, ERICSSON, ublox, Telia, KATLA aero, LANTMÄTERIET, ASTAZERO, IBG Independent Business Group, COMBITECH

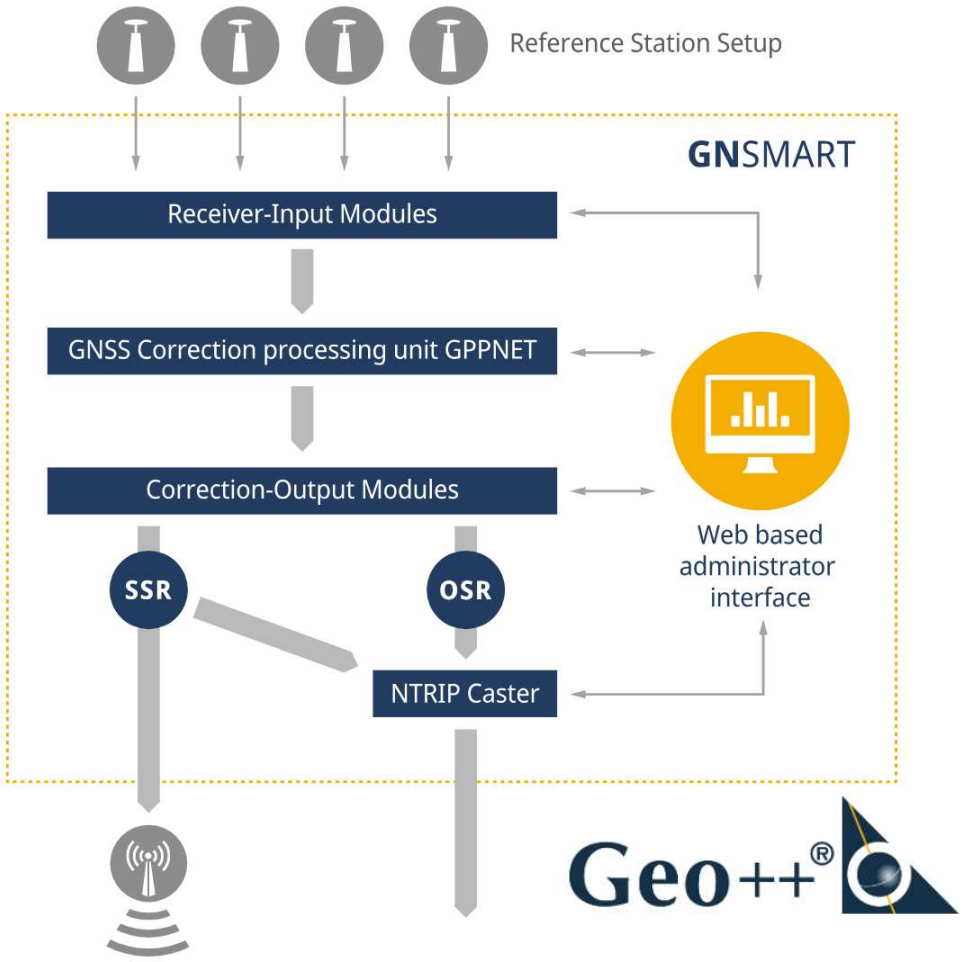
DINPAS – THE CONCEPT

The **DINPAS** project will:

- Implement GNSMART software from Geo++ for generating SSR corrections from a set of reference stations at Lantmäteriet/SWEPOS.
- Analyze design aspects of reference station network for generating SSR corrections and grid design for distribution of corrections.
- Implement GNSS SSR provisioning by converting SSR correction data to the 3GPP Release 16 format in an Ericsson distribution platform prototype and support for 3GPP format in a GNSS receiver by u-blox.
- Evaluate GNSS positioning and timing performance with correction data based on the 3GPP format in relevant autonomous airport related use cases using the reference framework at AstaZero test track.

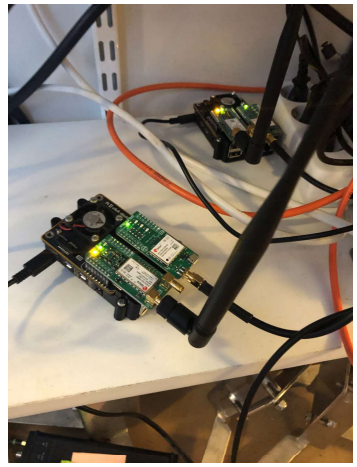
GNSMART

- Software developed by Geo++
- Running on non-commercial license for research in DINPAS
- Configured with small nets at various locations in Sweden for evaluation by the partners in the project
- Running on one single server
- Corrections published on an externally available NTRIP Caster



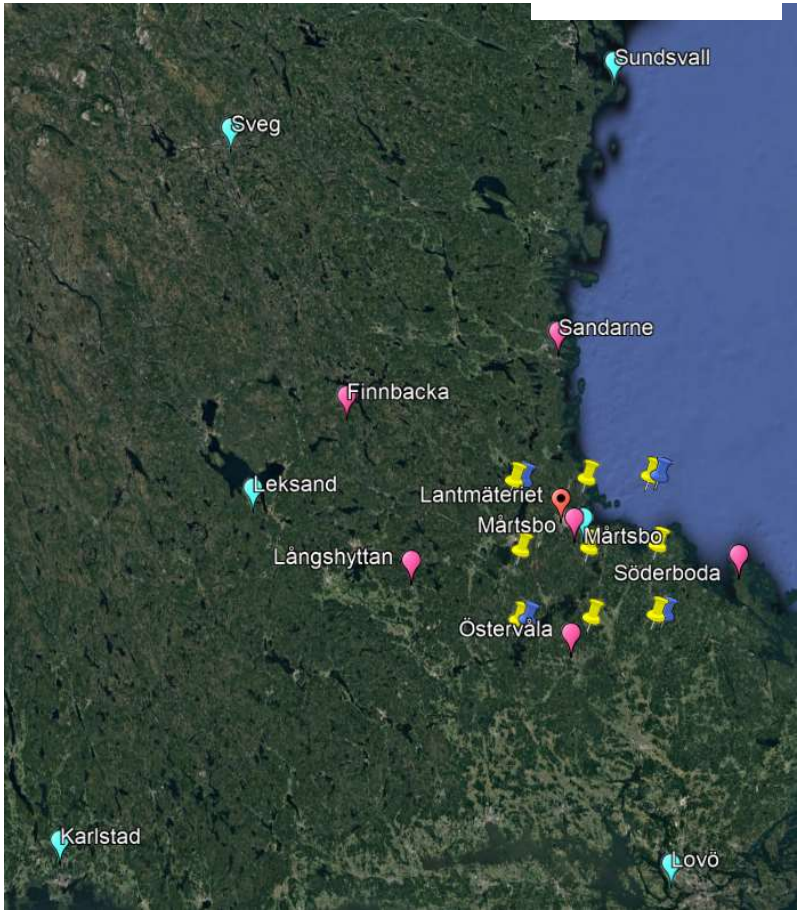
WHAT HAVE LANTMÄTERIET DONE SO FAR?

- Installed and configured GNSMART software from Geo++
- Configured 4 reference networks with different station network and grid setup for project partners in GNSMART
- Generate SSR correction streams in SPARTN and Ericsson LPP (3GPP) format from GNSMART
- Built and configured 2 GNSS-receivers based on u-blox F9P-receiver and SARA R5-modem connected to a Raspberry Pi4
- Static tests in Gävle using SPARTN format
- Dynamic tests at AstaZero using SPARTN format



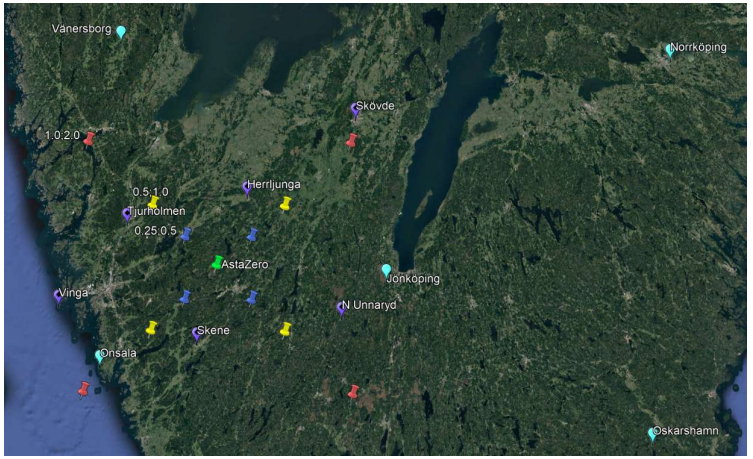
STATIC TESTS IN GÄVLE

- Station density
  - 70 and 150-200 km of network
- Grid density
  - 0.5x1 and 0.25x0.5 degree grid
- Corrections in SPARTN format
- Conclusions
  - Expanded standard uncertainty (95%)
    - Approx. 1 dm in plane
    - Approx. 1.5 dm in height
  - No major difference between different station and grid densities
  - Approx. 80% fix solutions within 1 min
  - Small jumps in time series but relatively good results right away



DYNAMIC TESTS ON ASTA ZERO

- GNSS receiver and prism on drone and car
  - Total station for tracking cars and drones
  - Standard uncertainty in the direction of travel (car), approx. 0.5 m (95%)
  - Standard uncertainty perpendicular to direction of travel (car), approx. 0.15 m (95%)
  - Standard uncertainty in height (car), approx. 0.1 m (95%)
- Conclusions (car)
  - We have followed the same route < 2 dm (95 %) in plane
  - Time synchronization of data limiting factor for the position along the route,
  - Approx. 0.1 s standard uncertainty in the TS timestamp gives approx. 0.8 m at 30 km/h.
  - No major difference in the quality of different station and grid densities
  - More non-fix with sparser nets



DINPAS

PLANS FOR 2024

- Still debugging of corrections in LPP-format for conversion of the LPP-corrections to SPARTN to be able to be used in the U-blox receiver
- Tests of repeatability at mini railway in user environment
- Installation of a rail at AstaZero for future testing
- Application send in for a new project called INTI5 with focus on integrity and time aspects in next 3GPP Release 17 format

RAILBASED TESTING IN USER ENVIRONMENT

TACK! VI FINNS PÅ…

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