

National Presentation SWEDEN

PosKEN Communication workshop 26-27 April 2018

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**Lantmäteriet, the National Mapping, Cadastral and
Land Registration Authority**

Main focus at the Geodesy department

- Provision of national horizontal- and vertical height systems
- Implementation of national horizontal- and vertical height systems (SWEREF 99 och RH 2000)
- Provide transformations between local and national systems
- Provide a national geodetic infrastructure
- An efficient use of GPS/GNSS, e.g. through network-RTK and SWEPOS®
- Research, advise and support
- Best practice documents

SWEPOS®

- A national network of permanent reference stations and a part of the national geodetic infrastructure
- The investment is covered mainly by governmental funds
- The operation costs including future upgrades are covered by user fees
- Established in cooperation with Onsala Space Observatory/Chalmers and SP Technical Research Institute of Sweden

SWEPOS - Purpose

A national network of permanent reference stations that provides



- connections to the national reference system SWEREF99
- data for scientific studies, crustal motion, metrology, etc.
- data to International organizations, IGS/EPN
- real-time and post-processing data for GNSS application
- 41 class A- and 355 class B-stations
- 24/7 service with support 06.30-20.30 weekdays. On-duty call all other time on a weekly schedule

Partners



- Partners for increased and widen the use of SWEPOS data
- Cooperation with Trimble VRS now, Leica SmartNet, TopNet Live and CNH Industrial to increase the use of SWEPOS data.
- One common geodetic infrastructure for GNSS, no need to finance several separate geodetic infrastructures.
- Dataexchange with Norway, Finland and Denmark



SWEPOS™ services



- Real time services
 - Network RTK
 - **DGNSS free of charge from January 2016**
- Post processing data (RINEX data)
- Virtual RINEX data
- SWEPOS Automatic Processing service
- On www.SWEPOS.se
 - Ionospheric monitor
 - Satellite prediction
 - Monitor stations

SWEPOS® network RTK service for high precision applications

- More than 4000 users
- Now also support for **Galileo**



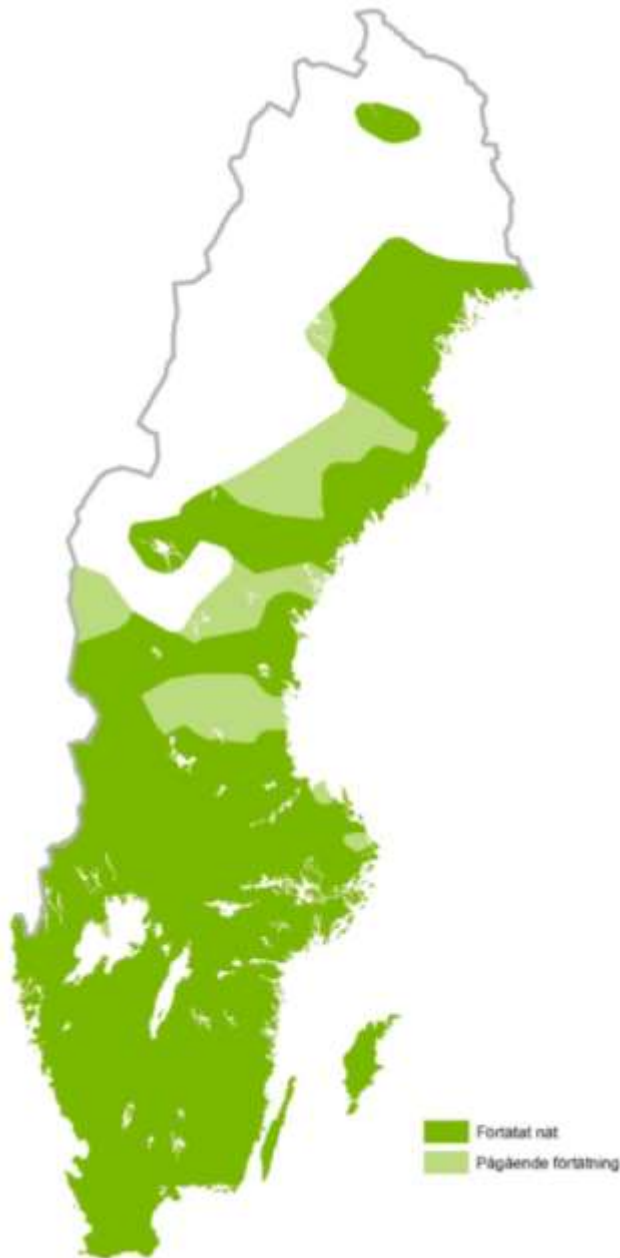
Expectations from GNSS users



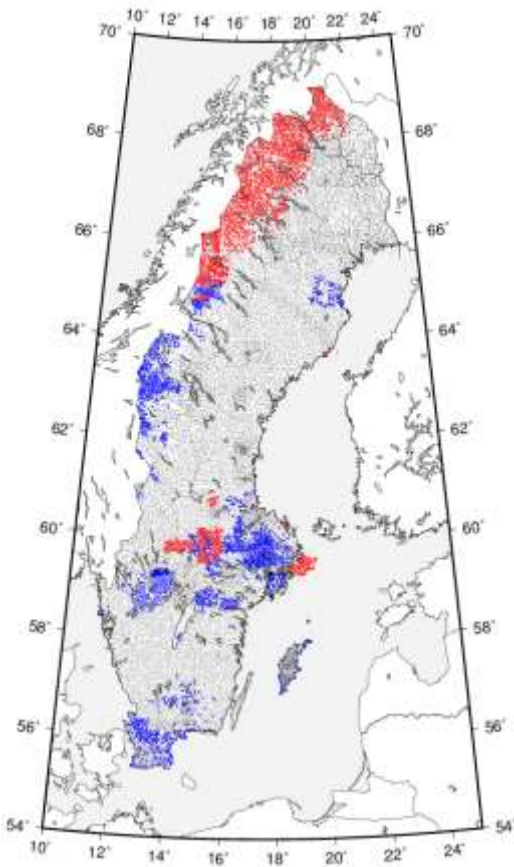
- Better height accuracy
- Improved availability of GNSS in difficult environment, urban areas, forrests e.g.
- Increased availability to the services, no planned (or unplanned) outages

Improved accuracy and redundancy by densification of the network

- **Green areas** – densified to 35 km, in some areas to 10-15 km
- **Lightgreen areas** – ongoing densification
- **White areas** – no planned densification



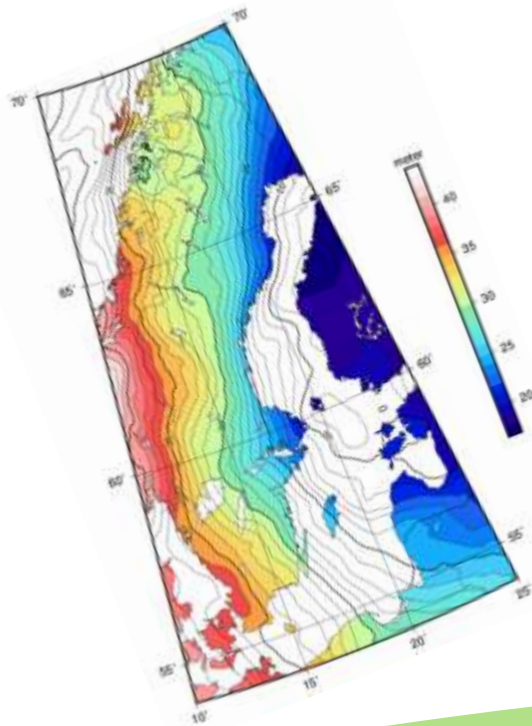
3441 new gravity measurements performed (blue 2010-2013, red 2014-2017)



SWEN17_RH2000 – a new National geoid model , important for accurate GNSS height measurements

**– replaces old model
SWEN08_RH2000**

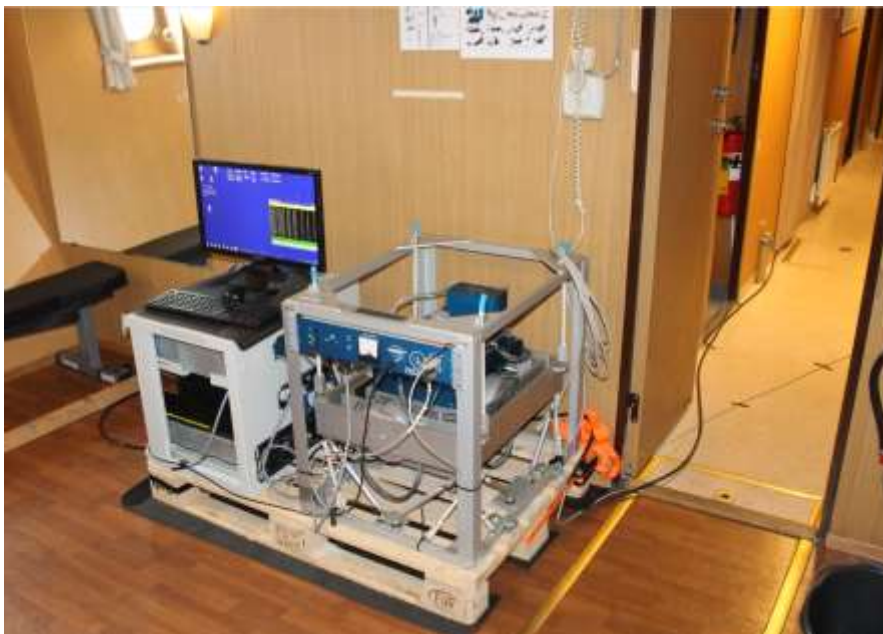
Standard error (68 %)
approximately 8-10 mm over land



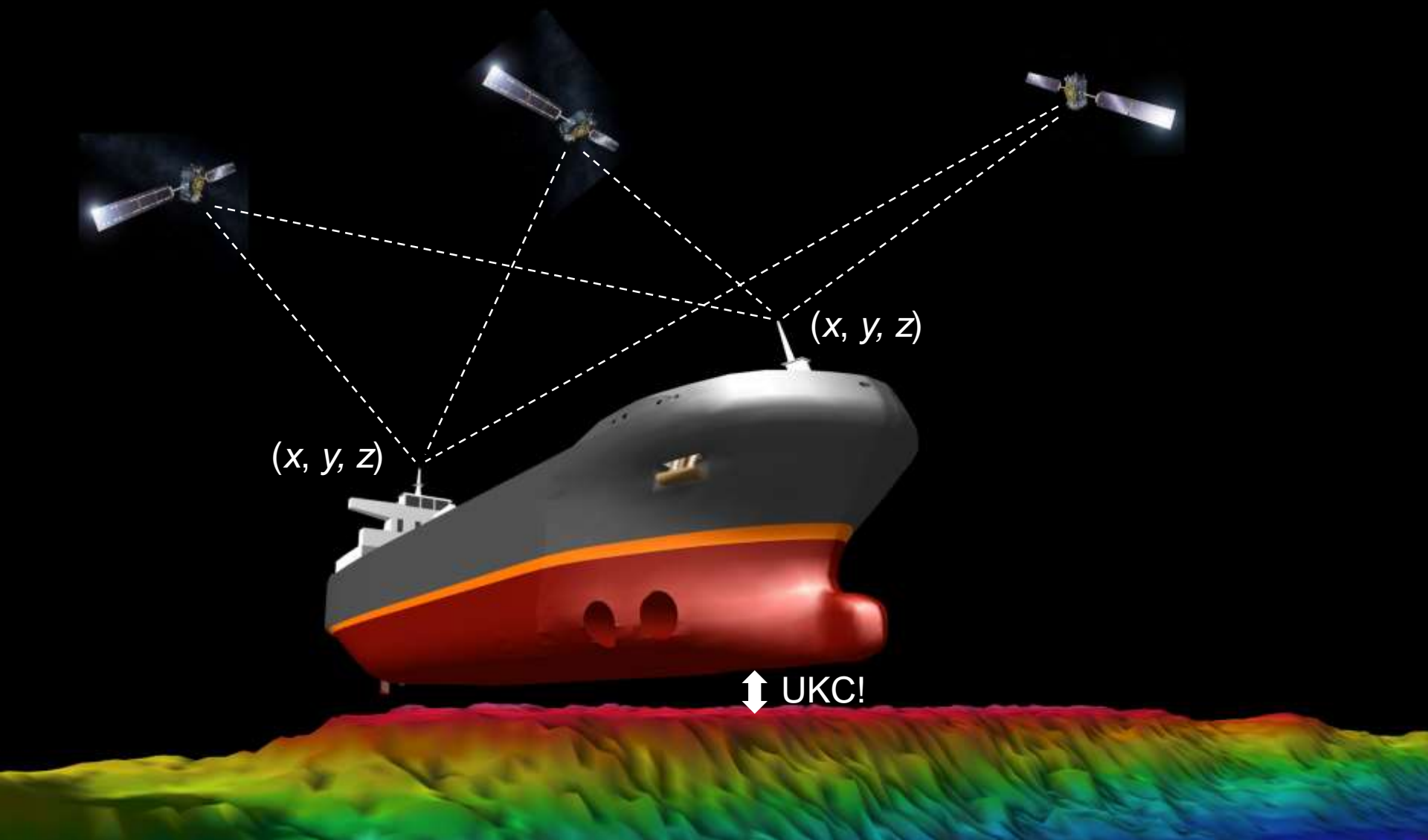
FAMOS Activity 2

Harmonising vertical datum/
Improving vessel navigation for the future

- Purchase of a marinegravimeter during 2017 (from the company ZLS in Texas)
- Installed on the "survey vessel" Jakob Hägg

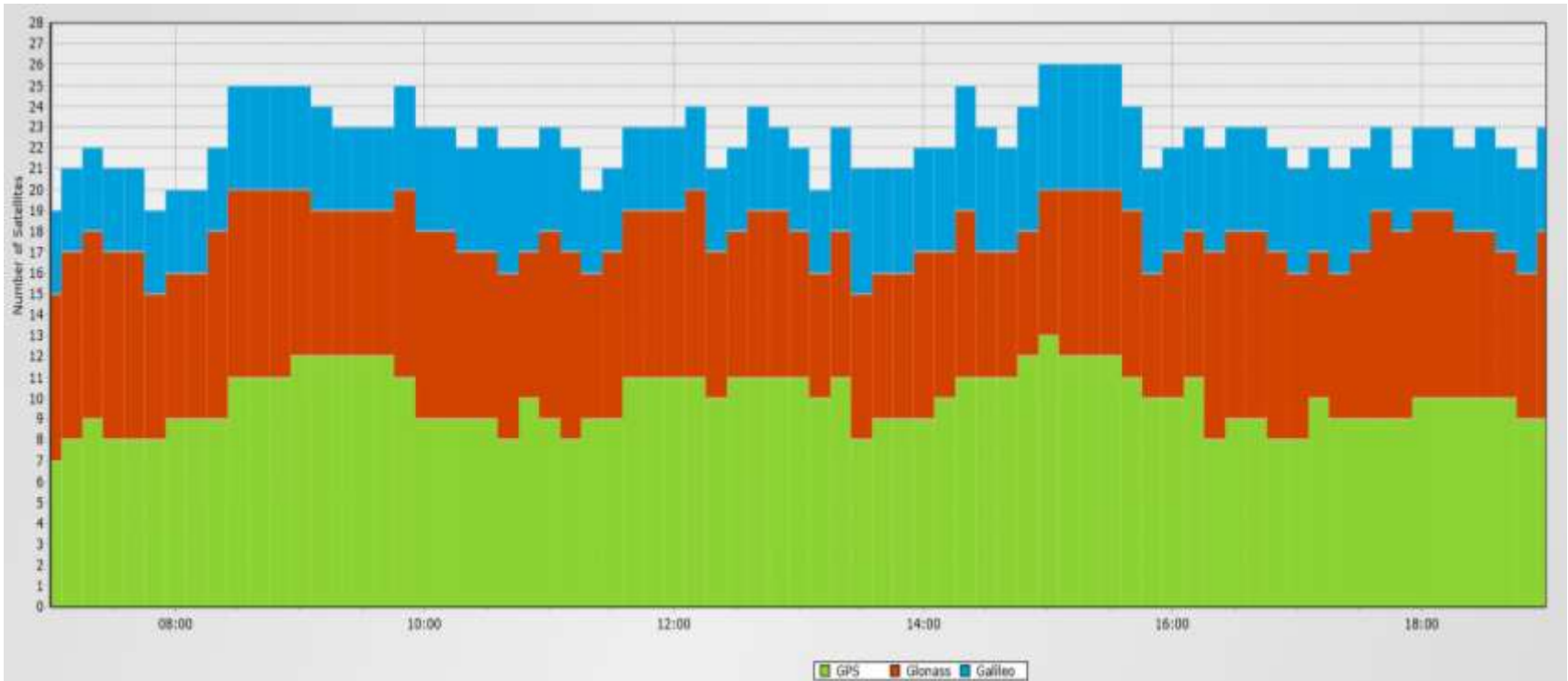


The vision: 3D-navigation with GNSS and the FAMOS geoid model



More satellites!

Availability of G+G+G



Galileo - Implementation process

Initial single station
RTK test including
Galileo data

Beta version of
TPP 3.10

Releases TPP
3.10

2016

apr

maj

jun

jul

aug

sep

okt

nov

dec

2017

feb

2017

Small network
established for
testing

Upgraded
production
system (still
using old
config)

Galileo Initial
Services

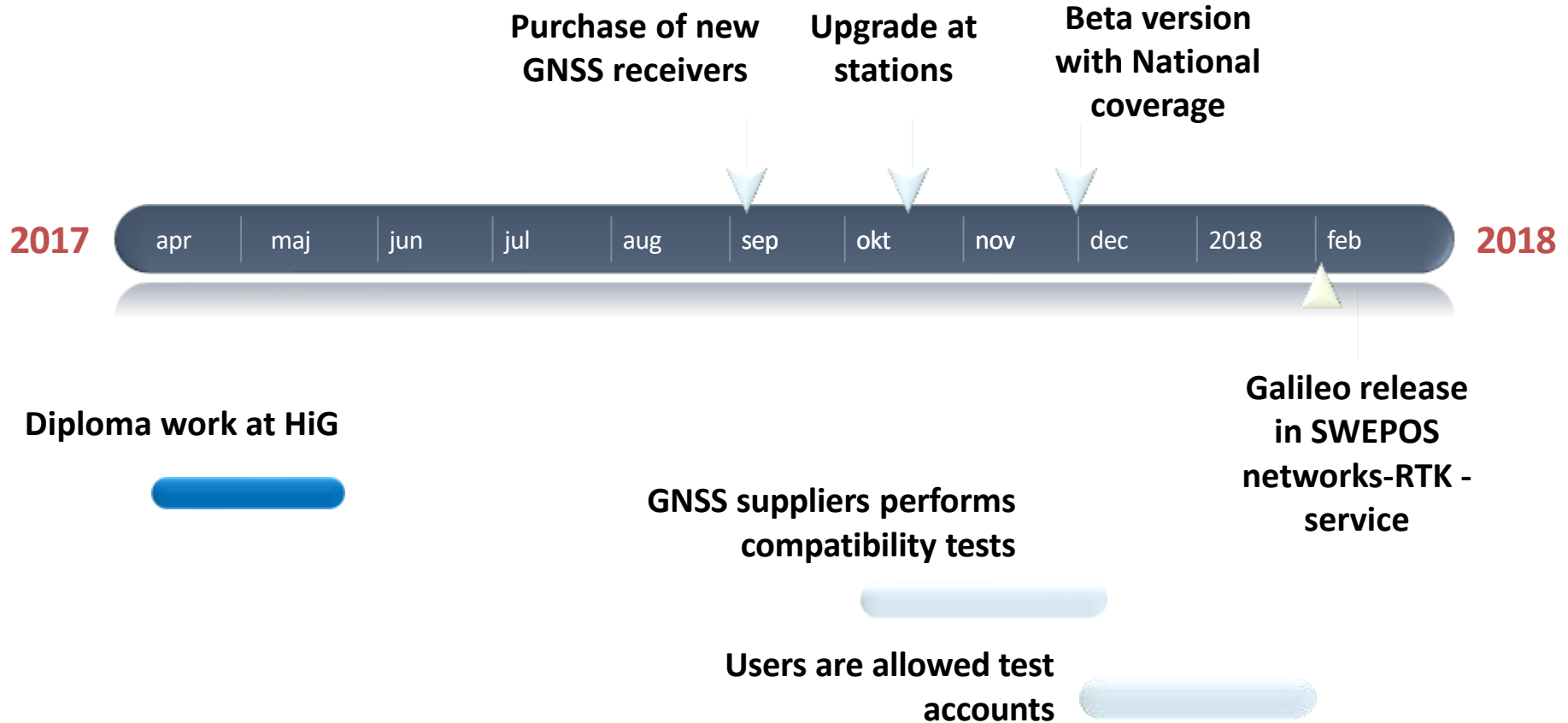
Further single station
RTK tests in Gävle

Discussions for accessing a
beta version of TPP

Further single station
RTK tests in Gävle

Network RTK tests
including Galileo data

Galileo – Implementation process



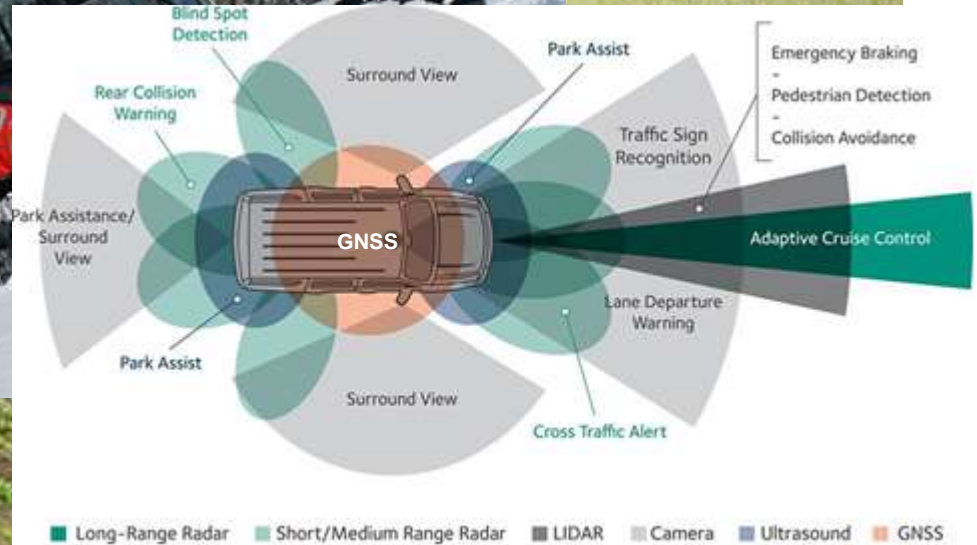
Experiences from Galileo testmeasurements



- Testmeasurements so far do not show any great improvements by adding the Galileo satellites
- But testmeasurements indicate improved availability when adding the Galileo satellites
 - More fixed solutions and shorter time to initialisation, especially at 25 – 35 degree elevation cutoff angle

What can we expect in the future

NOW



Vinnova project

- Network-RTK for autonomous driving
- Project together with RISE Research Institute of Sweden and the automobile industry with financial support by Vinnova
- The objective of the project is to enable cm-level Network-RTK GNSS positioning for a large number of automated vehicles or other mobile platforms by applying the standard developed by 3GPP and adapting the existing infrastructure provided by Lantmäteriet/SWEPOS.

ENC 2018

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ENC 2018

The European Navigation
Conference 2018
14-17 May,
Gothenburg, Sweden.

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The European Navigation Conference 2018

On behalf of the **Chalmers University of Technology**, **RISE Research Institutes of Sweden**, **Lantmäteriet** (The Swedish Mapping, Cadastral and Land Registration Authority), the **Swedish Board of Radio Navigation** and the **Nordic Institute of Navigation** it is our pleasure to invite you to Gothenburg for the 2018 European Navigation Conference. ENC 2018 is a conference organized annually by the **European Group of Institutes of Navigation**

LANTMÄTERIET



Thank you for your attention