



EUROPEAN SPACE WEEK

#EUSW2019
Helsinki, Finland
1 - 5 December 2019



E-GNSS User Assembly - Maritime

The logo for European Space Week features the text "EUROPEAN SPACE WEEK" in white, bold, sans-serif capital letters. The text is arranged in three lines: "EUROPEAN" on the top line, "SPACE" on the middle line, and "WEEK" on the bottom line. The text is centered within a circular graphic composed of multiple overlapping, semi-transparent blue brushstrokes that create a sense of motion and depth. The background of the slide is a dark blue gradient with a large, stylized image of the Earth's globe, showing continents and oceans, which is partially obscured by the circular logo and the main title text.

EUROPEAN
SPACE
WEEK

GNSS in maritime (Baltic)



Revolutionary, early deployment

- ❑ Satellites provide unrestricted line of sight path for high frequency (SHF) transmissions globally
=> **good position accuracy can be achieved throughout the journey (from port to port)**
- ❑ GPS and GLONASS receiver performance standards were adopted and both systems recognized as components of WWRNS in IMO by 1996, carriage requirement was adopted in 2002
=> **deployment in merchant vessels started from mid 1990's**

Need for augmentation

- ❑ (Before May 2000 GPS Selective Availability)
 - ❑ Currently no GNSS (FOC) system is recognised by IMO to be "suitable for navigation in harbour entrances and approaches, and other waters in which freedom to manoeuvre is limited" - only for navigation in ocean waters
 - ❑ IMO notes that
 - ❑ the use of RAIM techniques will provide the user with integrity
 - ❑ use of differential correction techniques will provide integrity and enhance the accuracy significantly
- => with augmentation, GNSS is suitable to be used for navigation also in restricted waters**

Augmentation solutions

- ❑ GBAS – limited service area, coastal, fairways, ports
 - ❑ DGPS – well established, all required standards exist
 - ❑ AIS – not established, receiver standards do not support full deployment
- ❑ SBAS – wide service area, ocean, coastal, (fairway), (ports)
 - ❑ EGNOS – establishing, supporting standards being developed



Concerns with EGNOS (Finland)



FEGNOS project (<https://fegnos.net/>) identified the following concerns with EGNOS service

Quality of correction information

- ❑ EGNOS does not offer corrections for those GPS satellites that are setting in the northeastern sky of the EGNOS coverage area.
=> **Need for an additional EGNOS RIMS (Ranging and Integrity Monitoring Station) station in the area**

SIS coverage area

- ❑ The performance of EGNOS with SIS corrections is not as good as the performance obtained through EDAS-provided EGNOS corrections.
- ❑ The percentage of EGNOS OS requirement failure with SIS corrections on a daily basis is significant. This is mostly due to the poor visibility of GEO satellites from northeastern latitudes.
=> **Need for alternative solution for broadcasting the EGNOS correction**



EUROPEAN
SPACE
WEEK

EGNOS measurements (GOF)



Equipment (provided and installed by ESSP)

- ❑ GNSS MF Antenna: Septentrio PolaNt-x MF
- ❑ GNSS/SBAS maritime Receiver: Hemisphere R330; tracking GEO 136 (SES-5)
- ❑ Laptop: logging NMEA messages: -GGA, -GNS, -GLL, -ZDA, -GSA, -GRS, -GSV, -GST



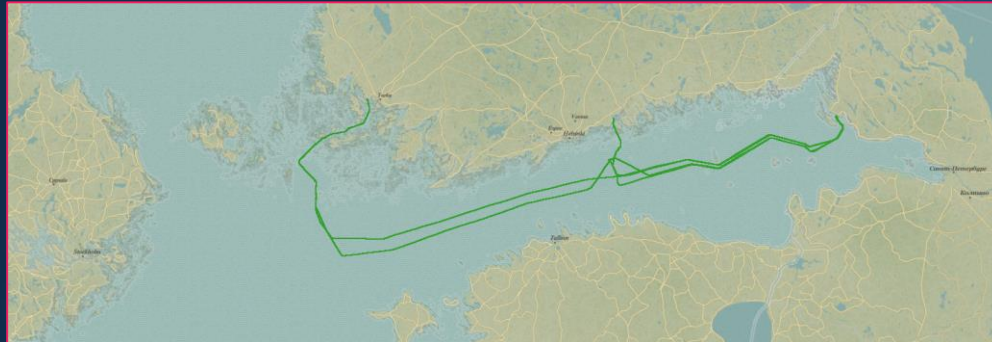
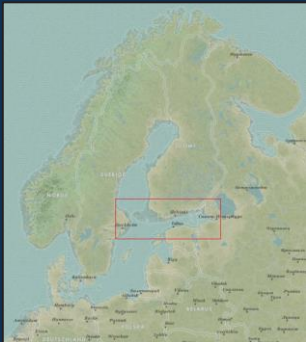
Vessel and installation (provided by OSM Ship Management Finland Oy)

- ❑ Crude oil tanker Mastera (IMO 9235892), full cargo 100 000 tons
- ❑ Antenna installed to the highest possible location (36-42m above MSL)



Route and dates

- ❑ Measurement campaign was carried out from 16:30 Nov 1st to 12:15 Nov 14th 2019
- ❑ Vessel's route was between Kilpilahdi (FISKV), Primorsk (RUPRI) and Naantali (FINLI)



Results



SIS coverage area validation

- ❑ Corrections received from GEO satellite PRN 136 (SES-5)
- ❑ Quality monitored via NMEA message "\$GPGGA, Global Positioning System Fix Data", parameter "Age of Differential GPS data"

Correction age	Percentage
3 sec	1.29%
4 sec	25.76%
5 sec	72.64%
>5 sec	0.32%
>10sec	0.04%



Planned future work



Validation of the other SIS satellite(s) in GOF area

- ☐ Planned in Q1/2020

Validation in other sea areas (all SIS satellites)

- ☐ Planned in Q3/2020

Validation in inland waterways

- ☐ TBC

Validation of other vessel types

- ☐ TBC



Further information



Finnish Transport Infrastructure Agency

- ❑ Kaisu Heikonen
- ❑ kaisu.heikonen@ftia.fi
- ❑ +358 295 34 3302

ESSP-SAS

- ❑ Rodrigo González
- ❑ rodrigo.gonzalez@essp-sas.eu
- ❑ +34 91 627 8887

Finnish Geospatial Research Institute

- ❑ Mohammad Zahidul Hasan Bhuiyan
- ❑ zahidul.bhuiyan@nls.fi
- ❑ +358 295 31 4694

The measurements have been supported by European GNSS Agency

The logo for European Space Week, featuring the words "EUROPEAN SPACE WEEK" in white capital letters. The word "SPACE" is written in a larger font size than "EUROPEAN" and "WEEK". The text is overlaid on a blue circular graphic that resembles a satellite or a stylized orbit, set against a background of a blue and white Earth globe.

EUROPEAN
SPACE
WEEK