



KYSTVERKET
NORWEGIAN COASTAL ADMINISTRATION

Robust navigation in the maritime domain

Norwegian Coastal Administration (NCA)

Senior advisor Capt. Odd Sveinung Hareide (PhD)
Senior advisor Bjornar Jon Kleppe

– Clean, safe and efficient seaways

Technology assisted accidents - maritime

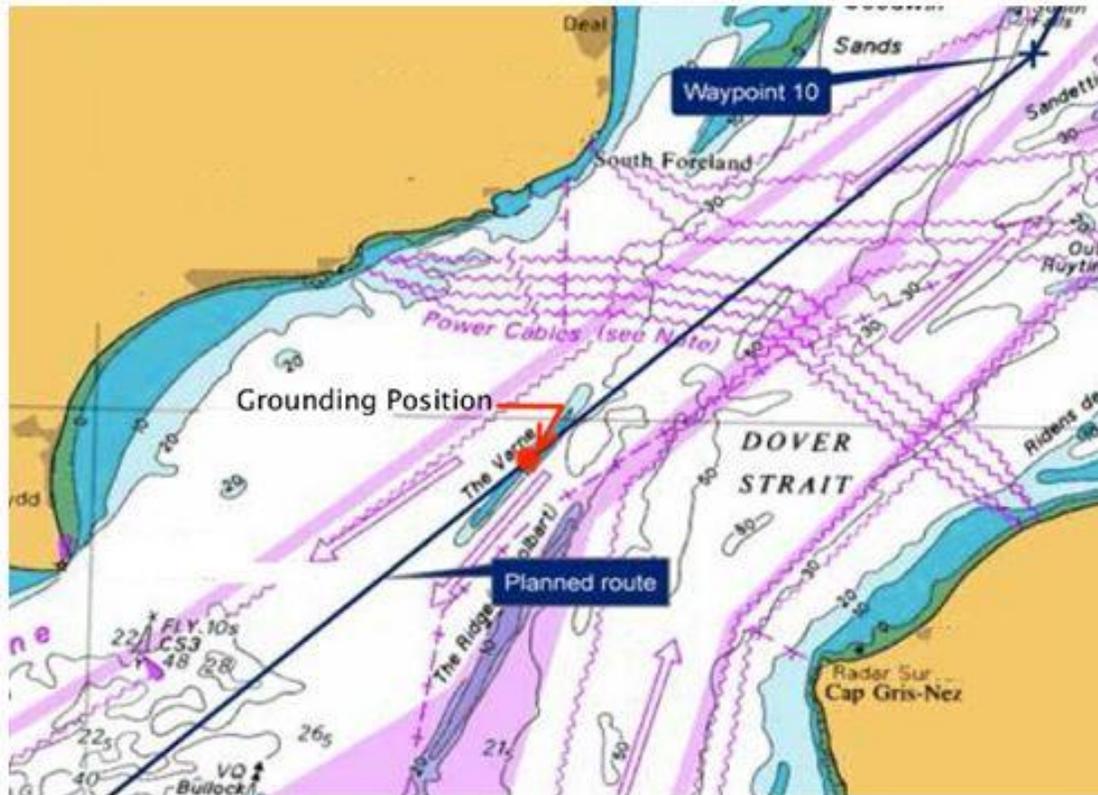
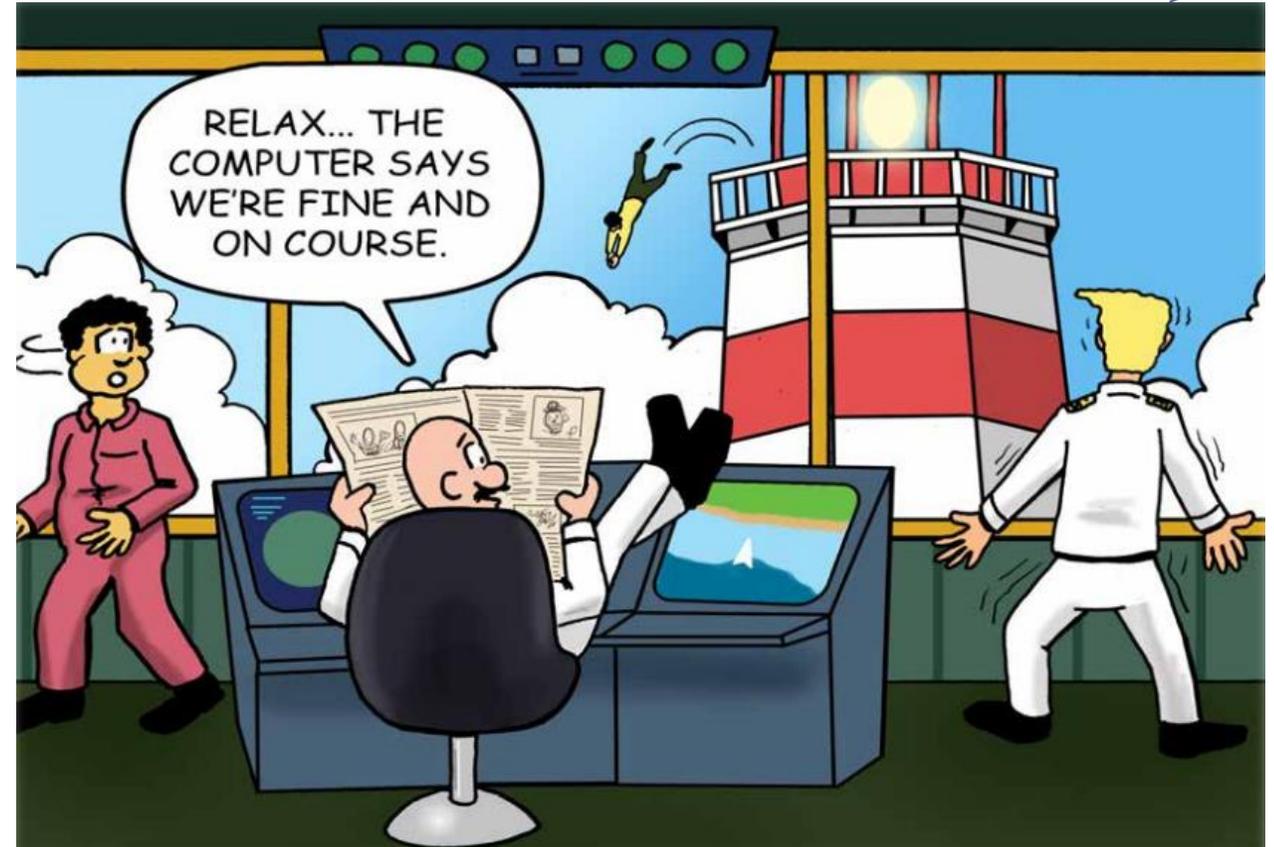
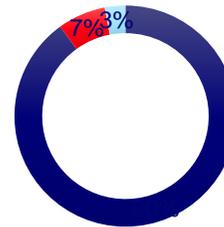


Figure 2 Image credits: nautinst.org



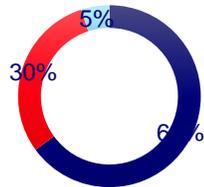
System Trust - Digitalization

Pilotage Rotterdam



■ Outside ■ Navigation Equipment ■ Other

Littoral High-Speed Craft Navigation



■ Outside ■ Navigation Equipment ■ Other

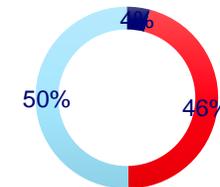
«Screen time»
Head down time

Is trust in the system and lack of system awareness an issue?

Q: Primary navigation aid?



Oversees passage RoRo Passenger ferry



■ Outside ■ Navigation Equipment ■ Other



Vulnerabilities – Signal interference

RS Reidar von Koss, 2017 - Båtsfjord.

Source: Jon Ohrberg, RS



Northern Norway seen from cockpit. Photo: Private

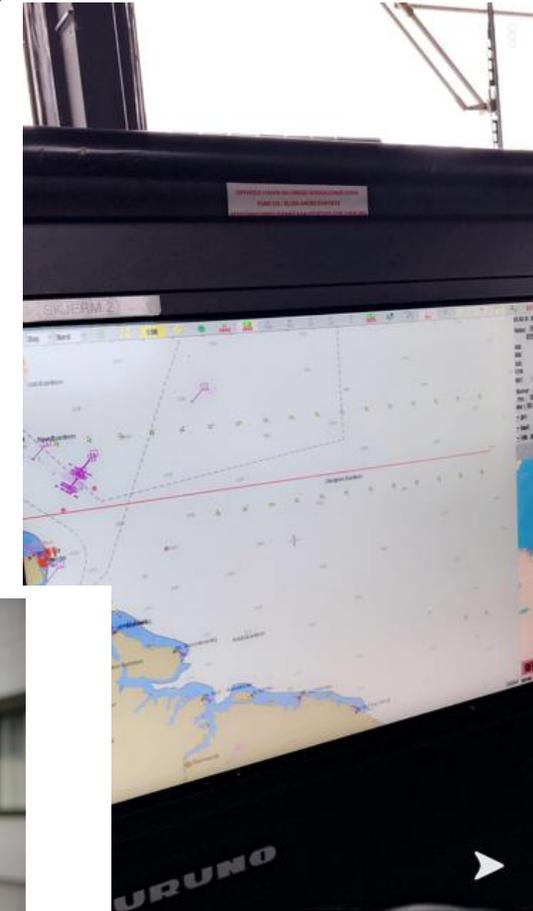
Pilots warned of jamming in Finnmark

Air

Land/Road



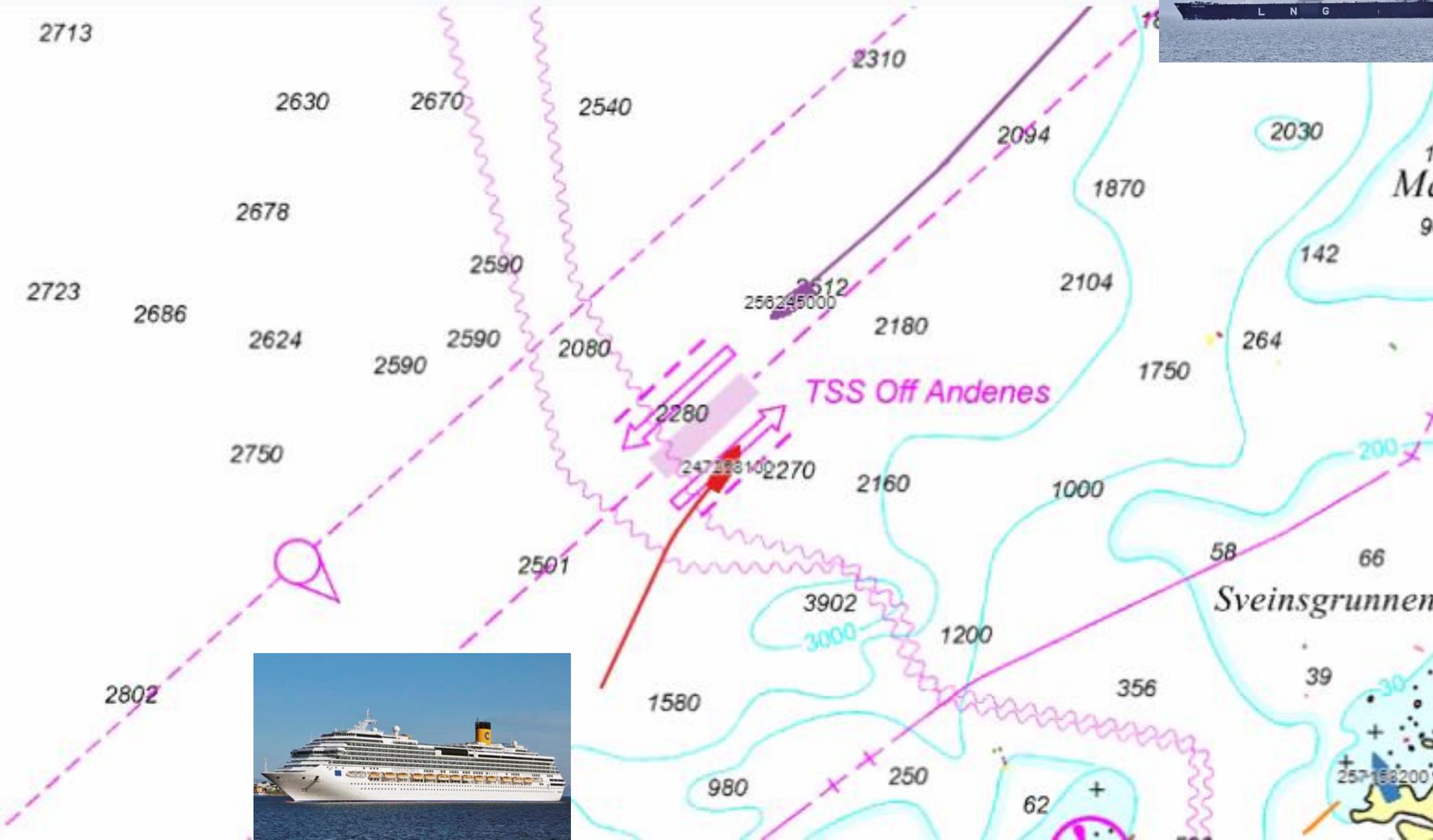
Richard B. Olsen tenker seg at det kan være yrkessjåfører som vil hindre arbeidsgivere som har flåtestyringssystemer å se hvor de er, som bruker GPS-jammere. Her med to ulike modeller. (Erlend Tangeraaas)



Sea



KYSTVERKET
NORWEGIAN COASTAL ADMINISTRATION



September 2019

NavWarn:
GNSS jamming
excercise in area
Andenes.

AIS trace from
Costa Pacifica
(4000 pax)
Clean Vision
(70000t LNG)

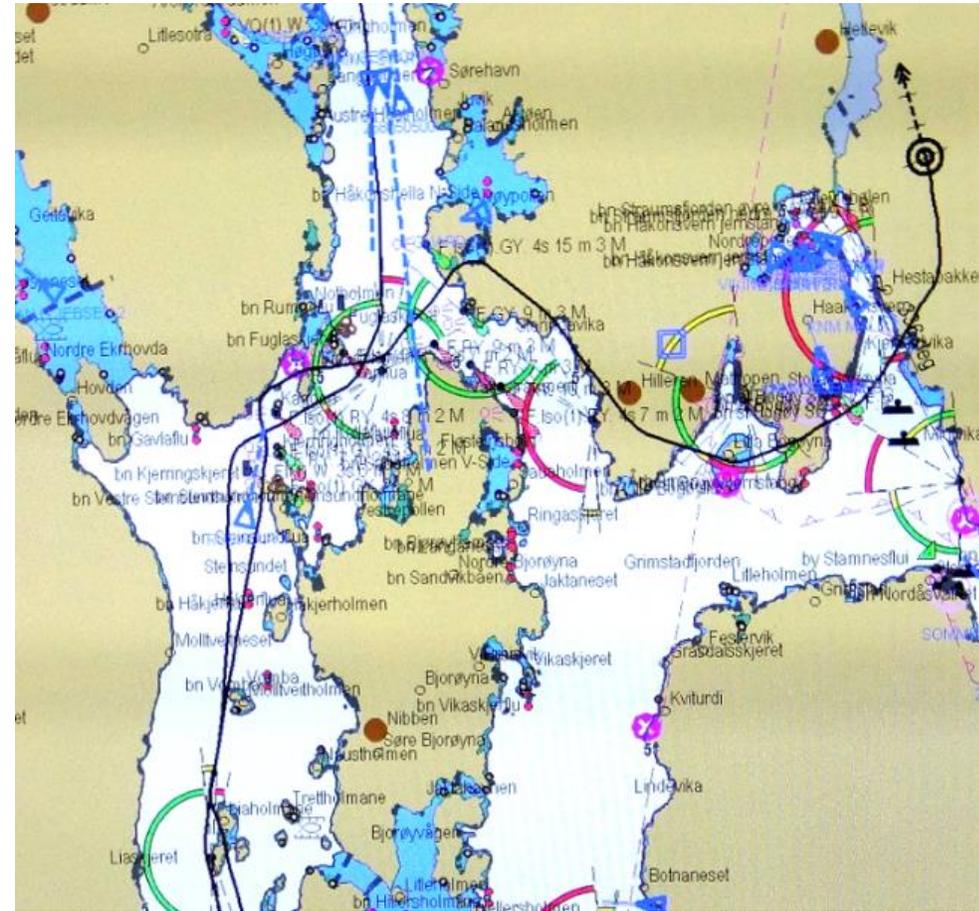
Source:
Kystdatahuset.no

Maritime Cyber Security

Correct position

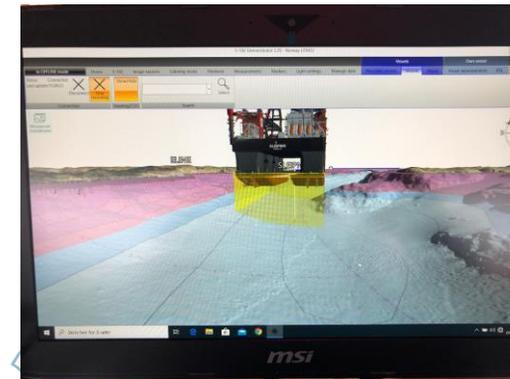
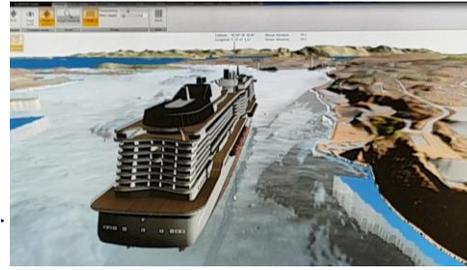


Spoofed position



Future demands

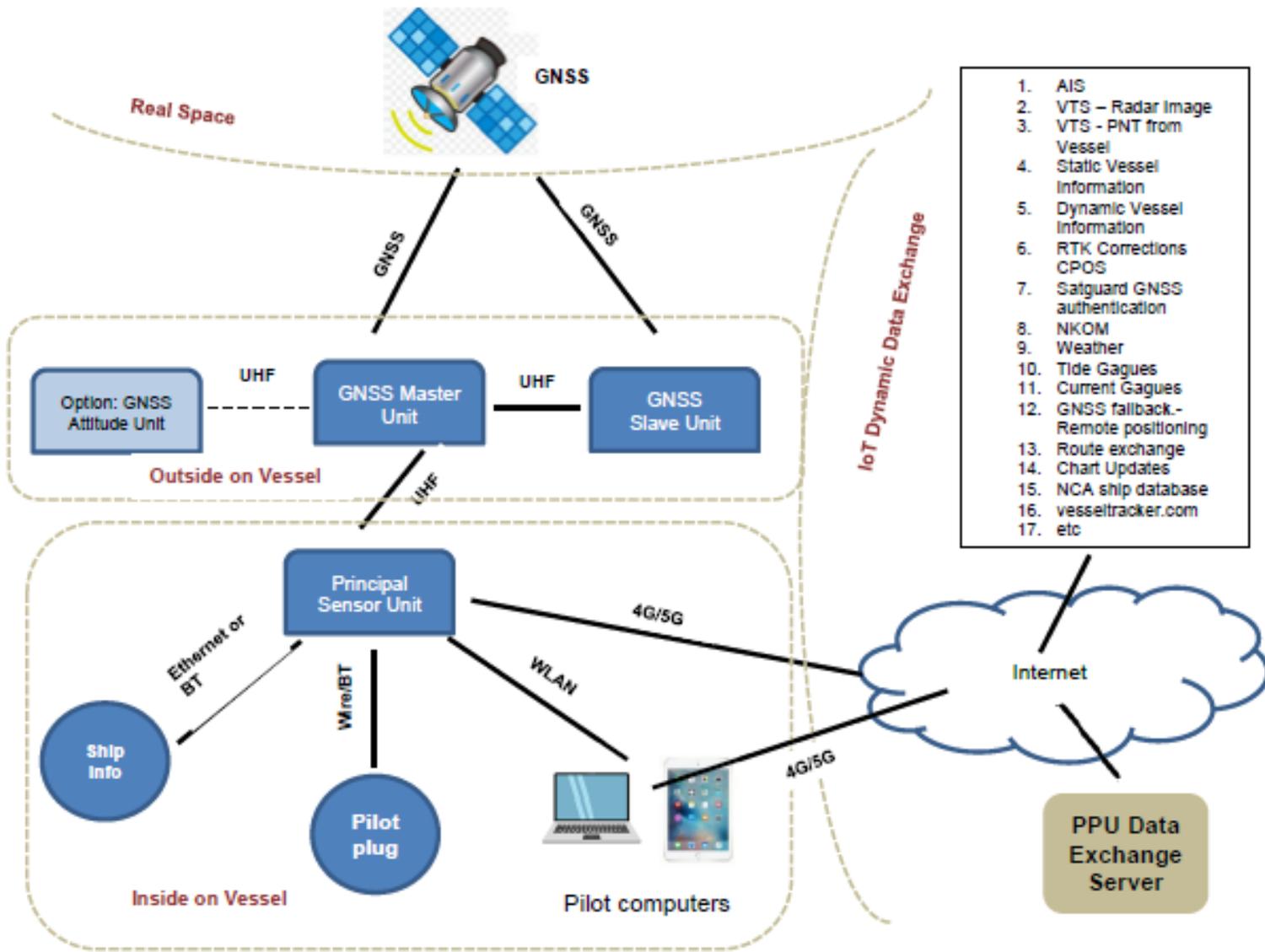
- More demanding operations
- Captains/operators asking for redundant sensors
- Maritime Cyber Security
- Size, Weight and Power (SWAP)
- Technological development
 - Human Machine Interface (HMI)
- More automated operations in the maritime
 - Redundant and robust sensors
 - Resilient PNT



Innovation partnership (2021-2024)



AD NAVIGATION

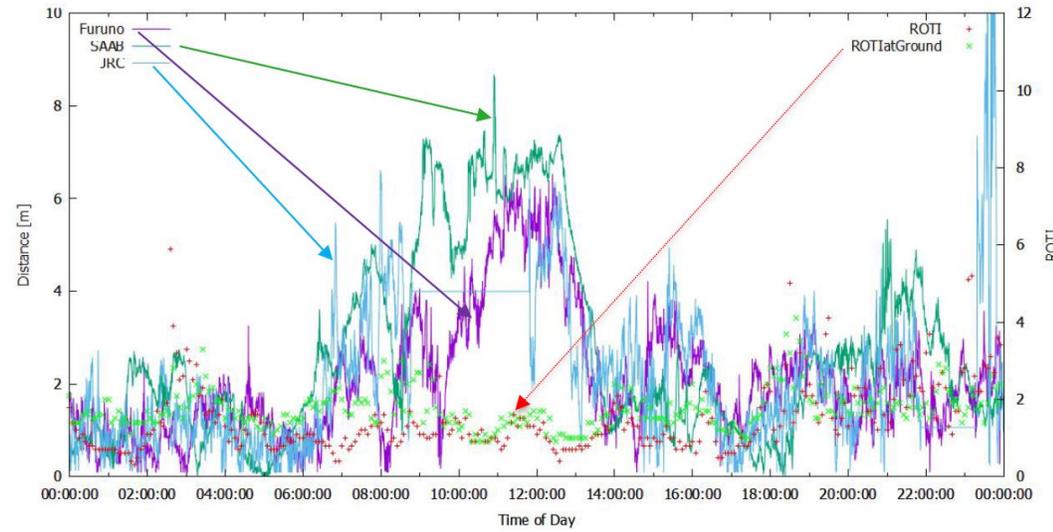


1. AIS
2. VTS - Radar Image
3. VTS - PNT from Vessel
4. Static Vessel Information
5. Dynamic Vessel Information
6. RTK Corrections CPOS
7. Satguard GNSS authentication
8. NKOM
9. Weather
10. Tide Gagues
11. Current Gagues
12. GNSS fallback-Remote positioning
13. Route exchange
14. Chart Updates
15. NCA ship database
16. vesseltracker.com
17. etc

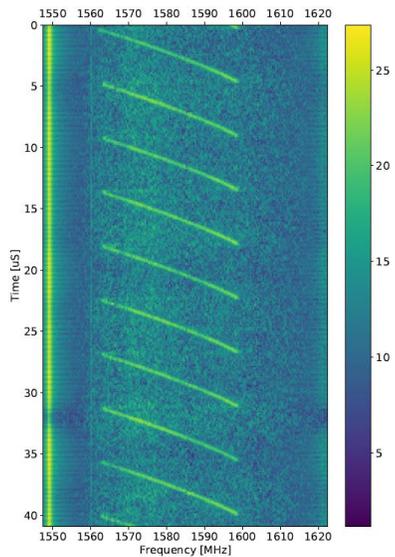
- Modular design
 - Small – up to four units
- Resilient PNT
- Signal interference detection
 - Provided to national service (NavWarn)
- Utilization of Cloud service (PPU Data exchange server)



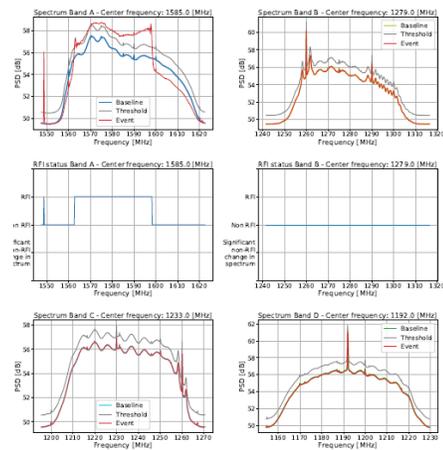
Knowledge building projects NCA



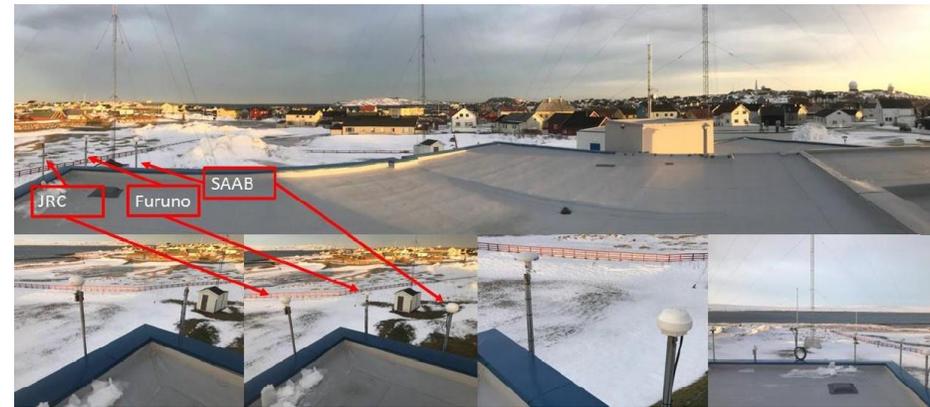
Interference from space weather on SOLAS receivers



GNSS AIS RFI



Interference in maritime domain (Aalesund)



Varsel om GNSS-hendelse [pågående, luftrom] – GPS-utfall i Øst-Finnmark

 gnss <gnss@nkom.no>



KYSTVERKET
NORWEGIAN COASTAL ADMINISTRATION

Jammetest Bleik 2023



KYSTVERKET





KYSTVERKET
NORWEGIAN COASTAL ADMINISTRATION

Thank you for your attention

Q&A

Contact: odd.sveinung.hareide@kystverket.no

www.kystverket.no