



**KYSTVERKET**  
NORWEGIAN COASTAL ADMINISTRATION

# Pros and Cons of Electronic Navigation

Norwegian Coastal Administration Pilot Service

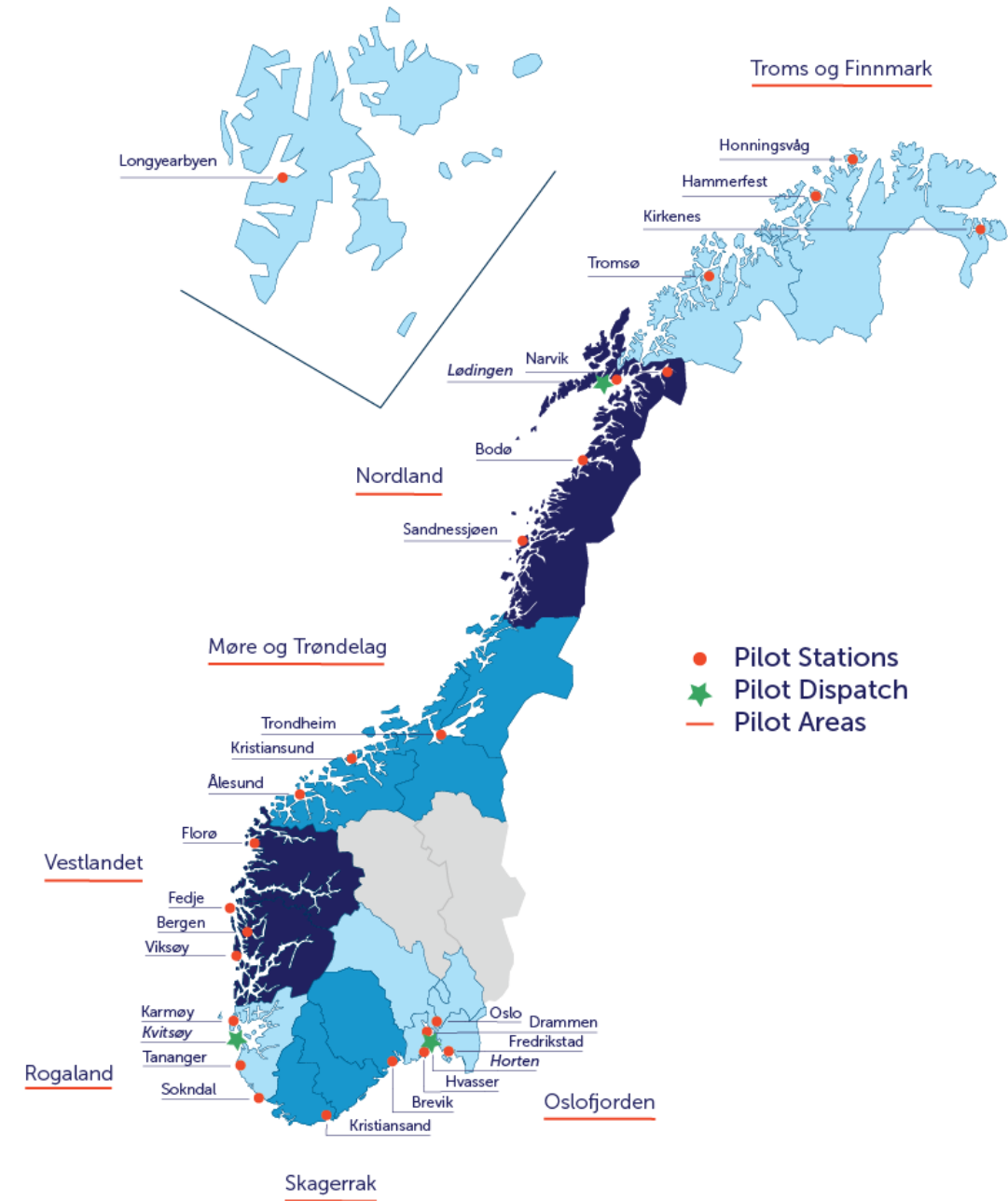
Capt. Odd Sveinung Hareide (PhD)

Cancun, 16.06.2022, IMPA 2022

– Clean, safe and efficient seaways

# NCA Pilot Service

- General compulsory pilotage on the coast:
  - Vessels over 70 meters.
- The pilot is a nautical advisor on board:
  - Operational 24 hours a day - all year round.
  - Pilot Exemption Certificate issued for those with sufficient knowledge of local waters
  - ~350 persons
  - ~280 pilots in 7 districts
  - 24 pilot stations



# Portable Pilot Unit of today (NCA)

## Portable Pilot Unit (PPU)

Sensorer

Display

Software  
(ECS)

Charts  
(ENC)

Pilot Plugs



ADQ-2 AIS Pilot Plug Connector

Independent  
sensor



iPad



Njord Pilot



Primar ENC



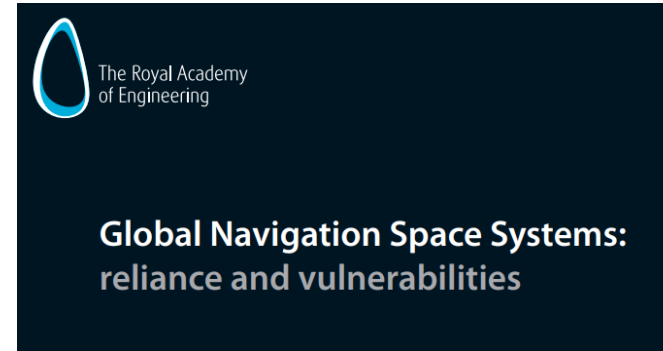


# The challenge!

- Over-reliance in GNSS (GPS)
- National and international challenge, dependence in all domains (land, sea, air), within all users of Position, Navigation and Timing (PNT)
- Known challenge
  - Volpe report 2001
  - RAENG 2011
  - NRS 2013
  - MoT 2018



## VULNERABILITY ASSESSMENT OF THE TRANSPORTATION INFRASTRUCTURE RELYING ON THE GLOBAL POSITIONING SYSTEM



**Final Report**

August 29, 2001

*Prepared by*

John A. Volpe National Transportation Systems Center

*for*

Office of the Assistant Secretary for Transportation Policy  
U. S. Department of Transportation



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# Technology assisted accidents - maritime

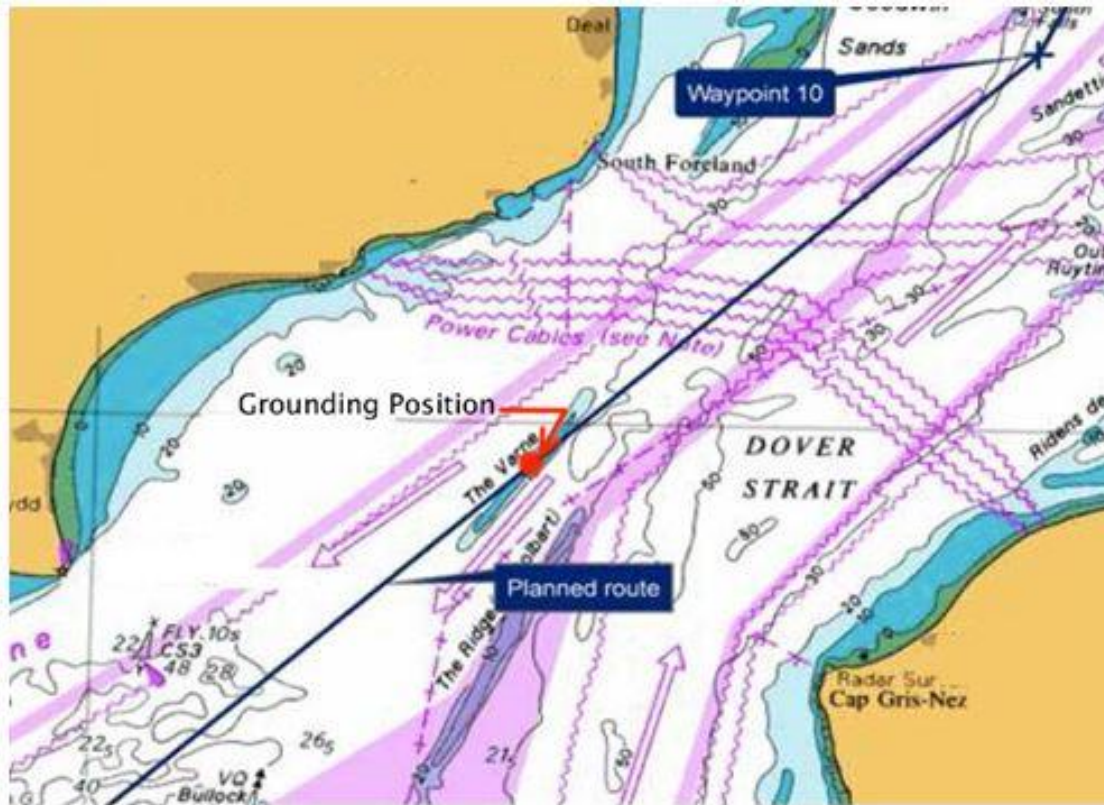
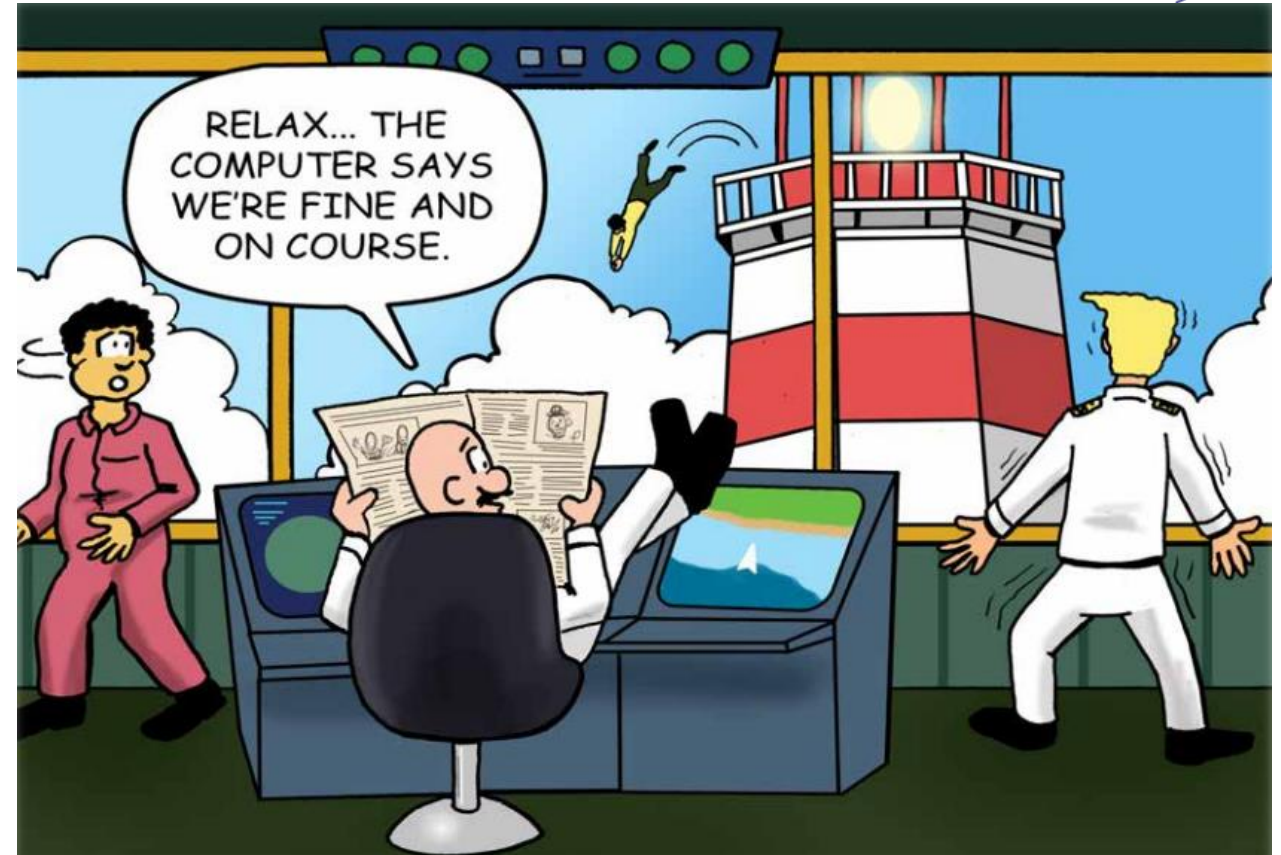
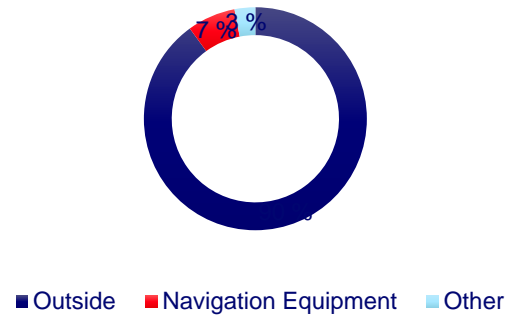


Figure 2 Image credits: nautinst.org

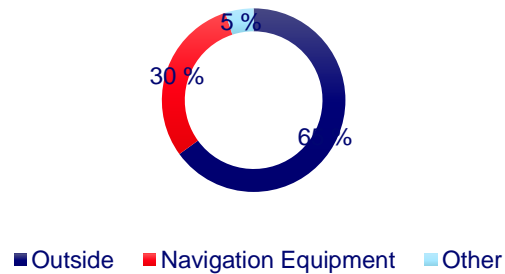


# System Trust - Digitalization

### Pilotage Rotterdam



### Littoral High-Speed Craft Navigation



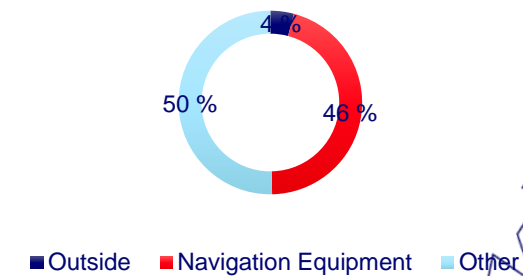
«Screen time»  
Head down time

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

Q: Primary navigation aid?



### Oversees passage RoRo Passenger ferry



# Vulnerabilities – Signal interference



Northern Norway seen from cockpit. Photo: Private

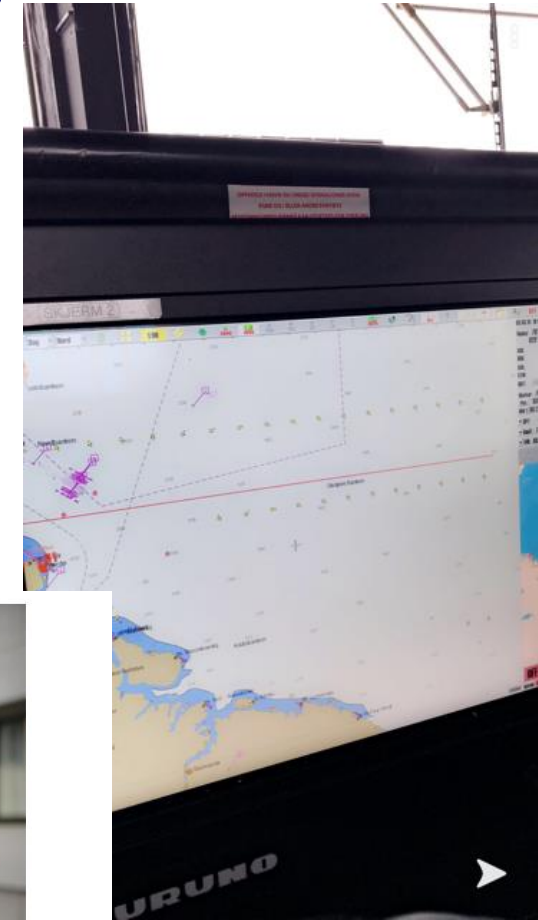
**Pilots warned of jamming in Finnmark**

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 Tangeraas)



RS Reidar von Koss, 2017 - Båtsfjord.

Source: Jon Ohrberg, RS

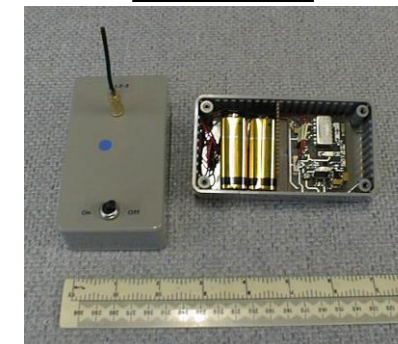
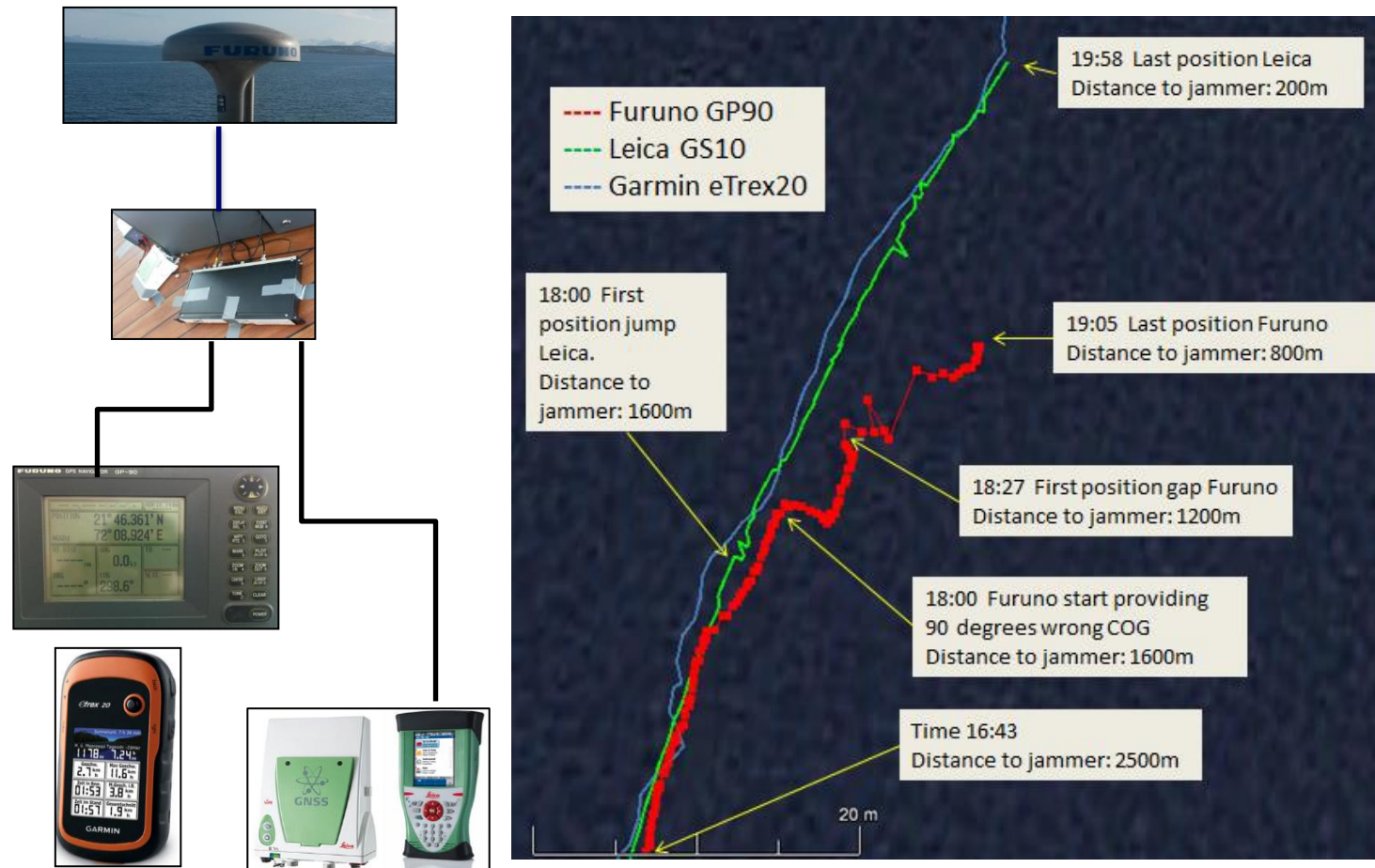
Sea



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# Vulnerabilities – Signal interference



Glomsvoll O, Bonenberg LK.  
 GNSS jamming resilience for close to shore navigation in the Northern Sea. The Journal of Navigation. 2017;70(1):33-48.



# Vulnerabilities – Signal manipulation (spoofing)



According to AIS: all ships in the area are next to each other. There were actually no radar echo there.

Black Sea Incident Report  
22 June 2017  
<http://gpsworld.com/spoofing-in-the-black-sea-what-really-happened/>



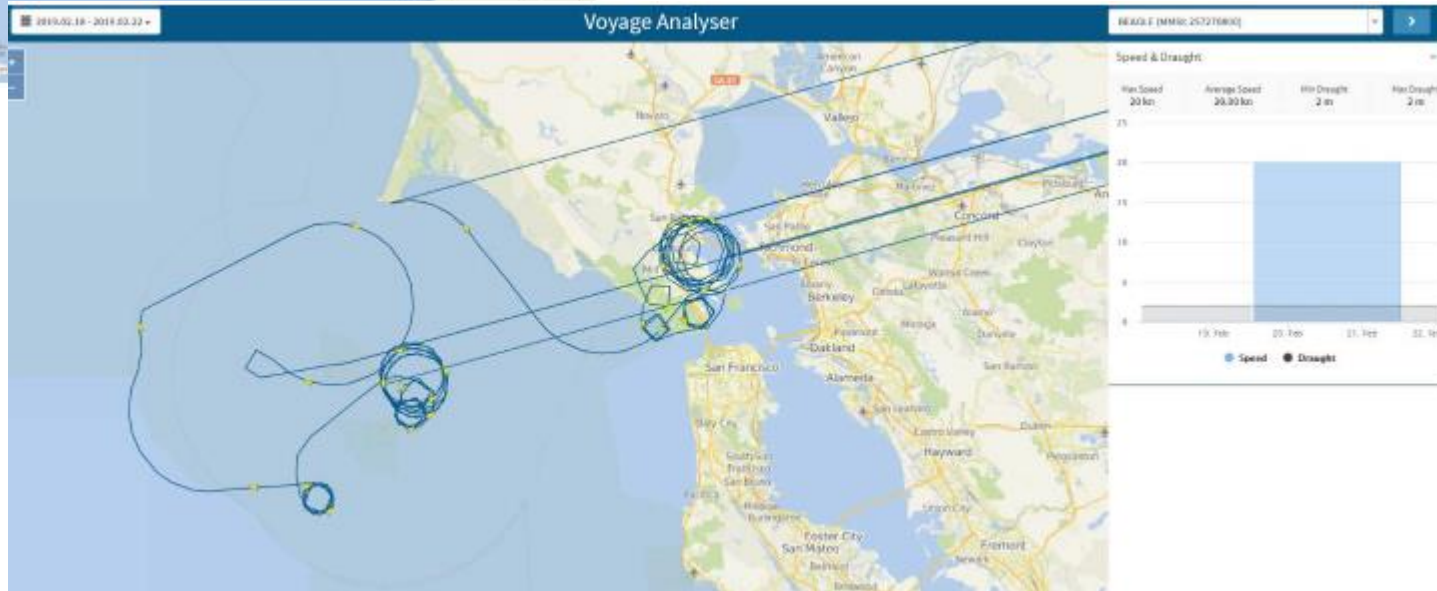
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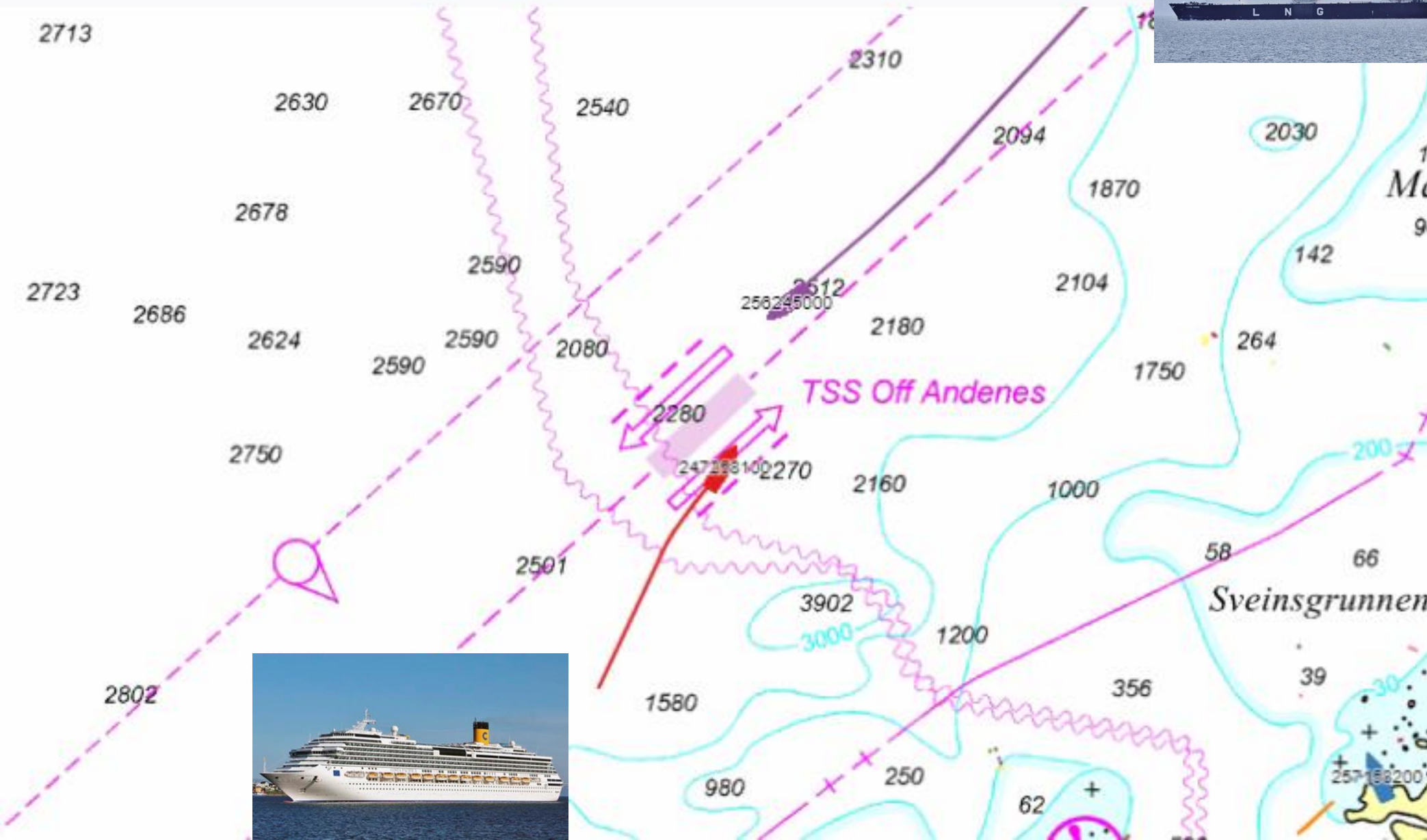
# Signal manipulation (spoofing)



Vessel/Tug "Beagle, MMSI: 257270800  
AIS information 18-22 Feb 2019

Owner: Bukser og Berging  
<https://www.bube.no/>  
Norge, Lysaker





September 2019

NavWarn:  
GNSS jamming  
excercise in area  
Andenes.

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

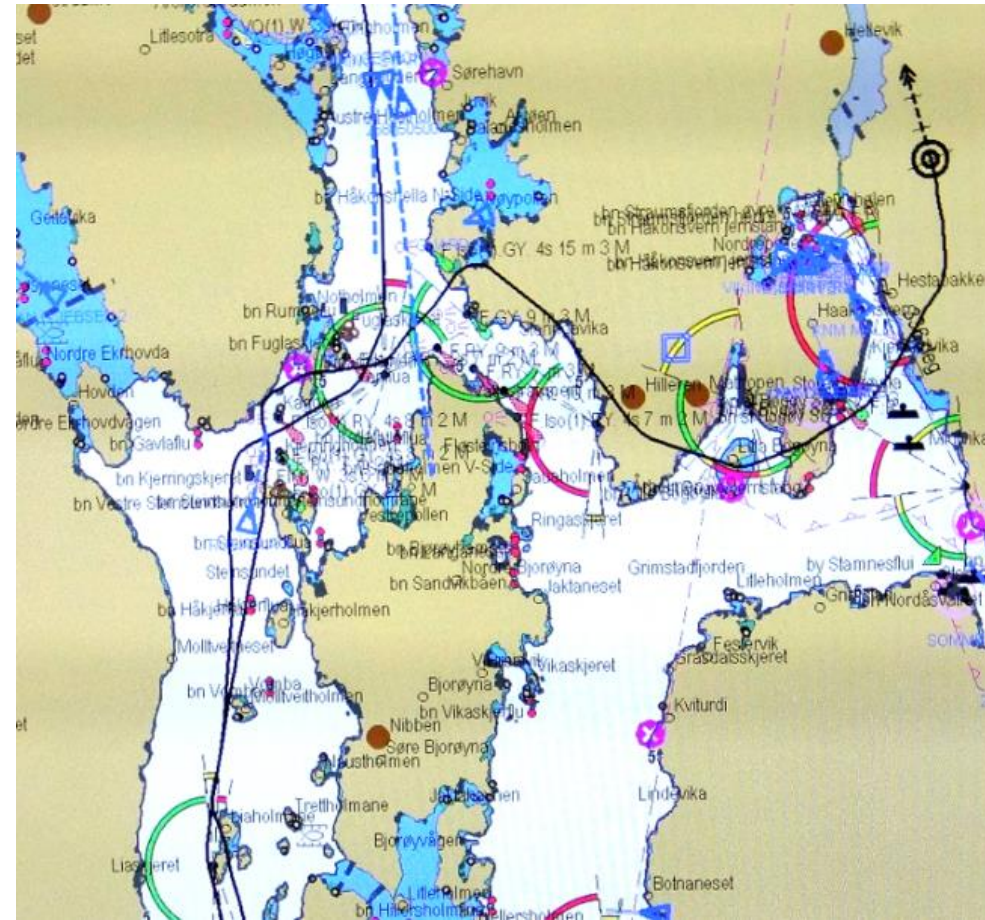
Source:  
Kystdatahuset.no

# Maritime Cyber Security

Correct position

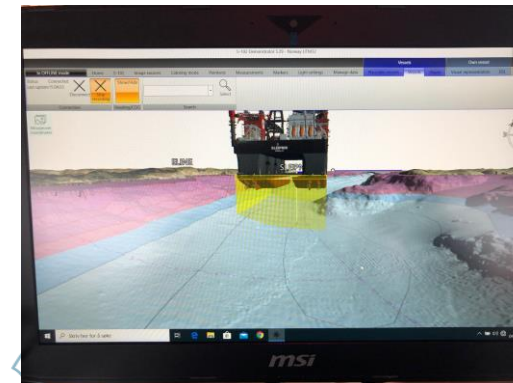
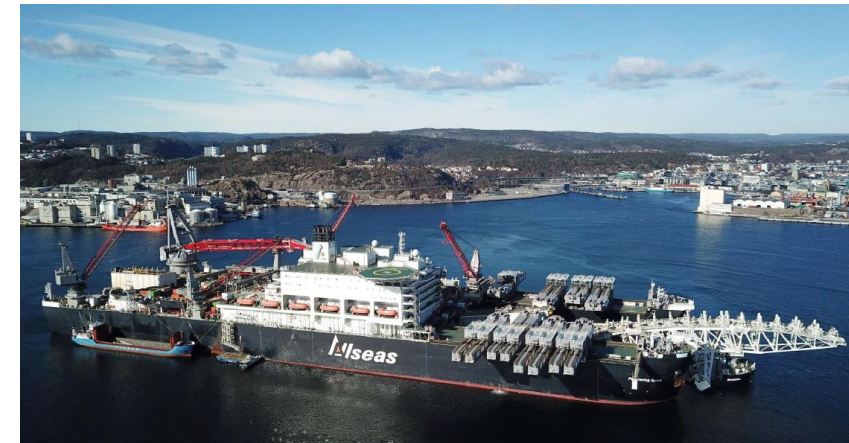
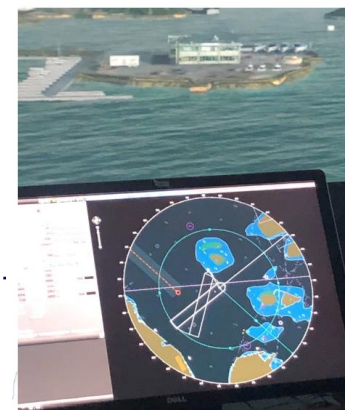
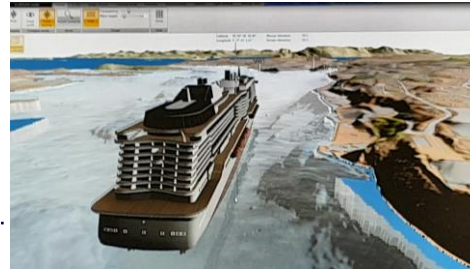


Spoofed position



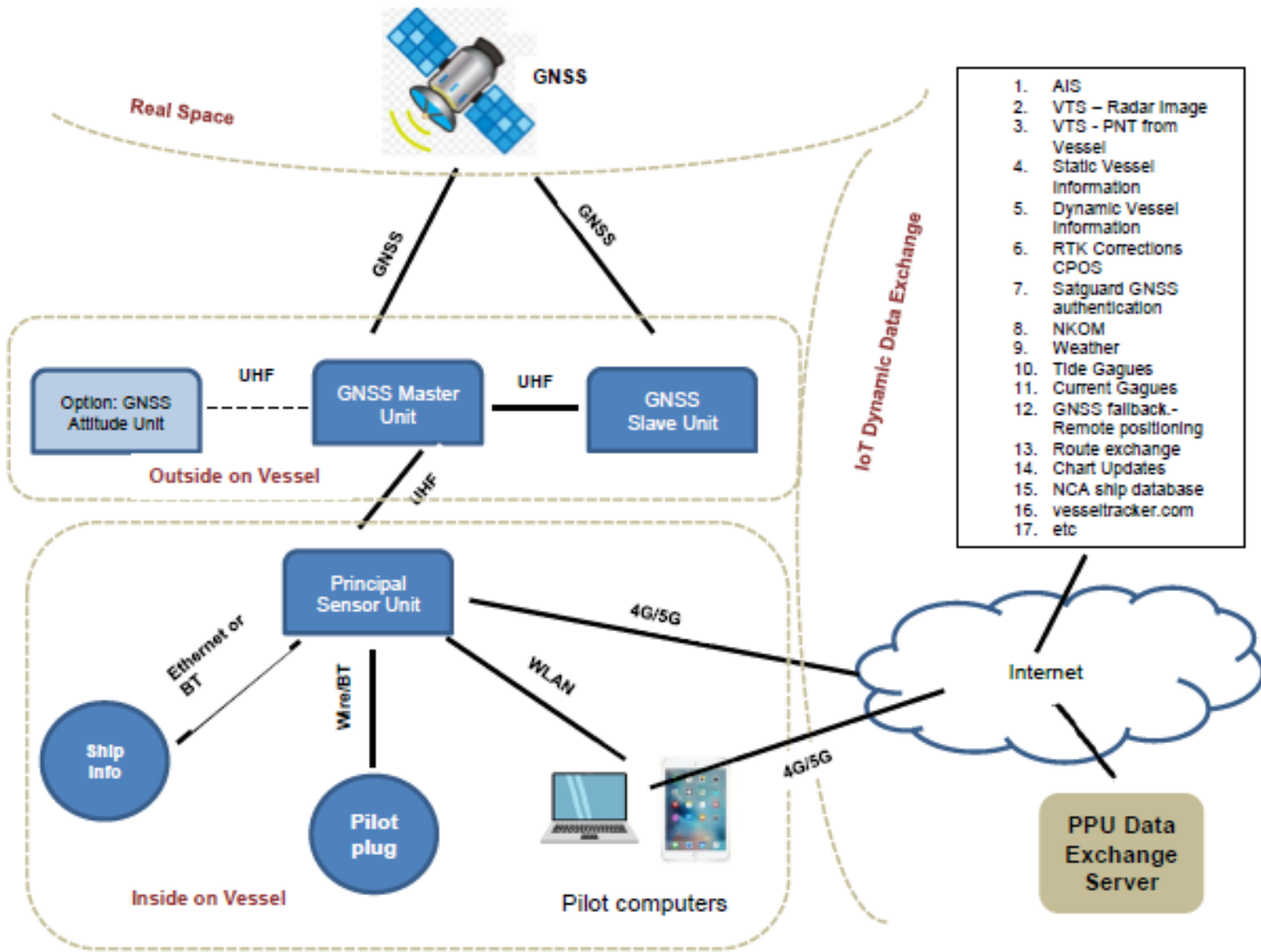
# Future demands

- More demanding operations
- Captains/operators asking for redundant sensors
- Maritime Cyber Security
- Size, Weight and Power (SWAP)
- Technological development
  - Human Machine Interface (HMI)





# Innovation partnership (2021-2024)



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







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# Thank you for your attention

Q&A

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[www.kystverket.no](http://www.kystverket.no)