



# Experiences and ideas for data sampling with Unmanned Surface Vehicles

# Background

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- A general technology optimism?
  - Yes, but at this time and for this unit the origin was Covid
  - An industry stimulation package fitted into an “Armada” strategy founded at the IMR
- Contract with Kongsberg March 2021
  - Delivery accepted in August 2024 (after considerable delay)
  - Operationally capable
- Starlink first fitted on icebreaker Kronprins Haakon June 2023
  - USVs were supposed to be controlled over radio (line of sight)
  - Idea to have Starlink on USV originated at IMR/Vessel department
- Norwegian Maritime Authority, navigational safety
  - Neither enemy nor friend, more of a load
  - Same as with electrical car ferries, regulations are trailing the technology



# USV Sounder, by Kongsberg

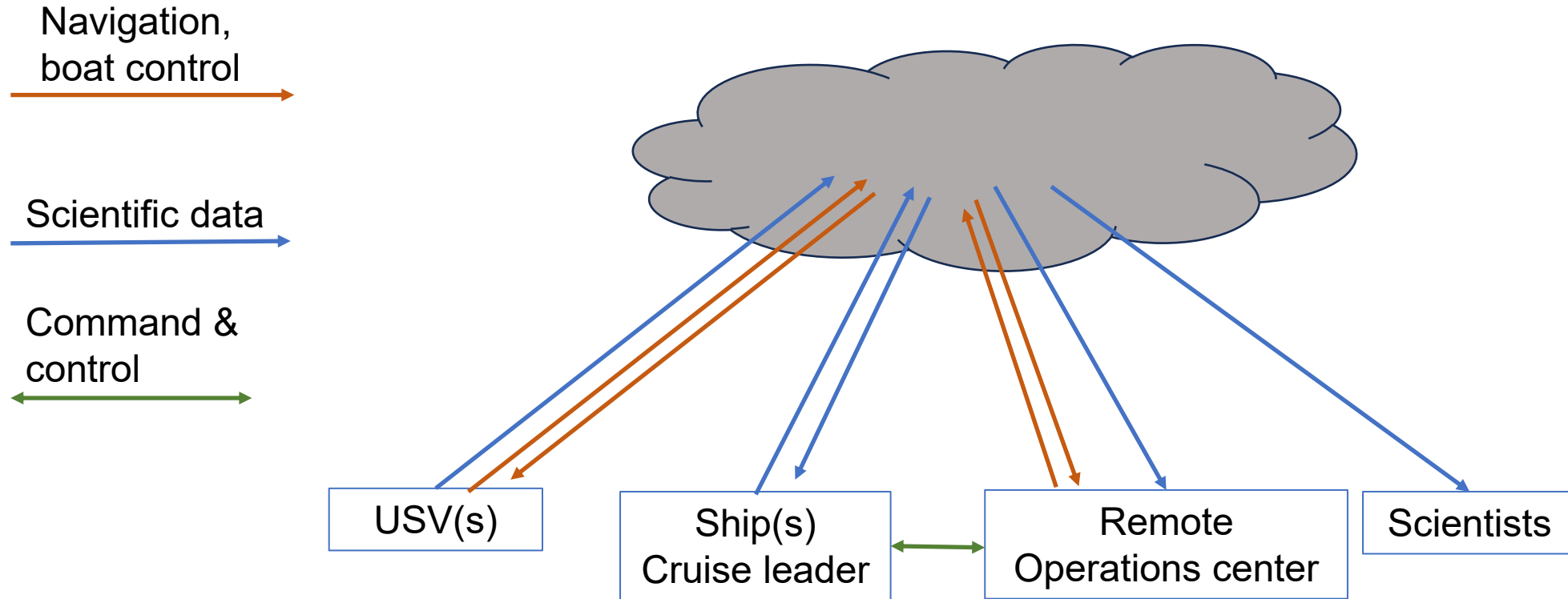
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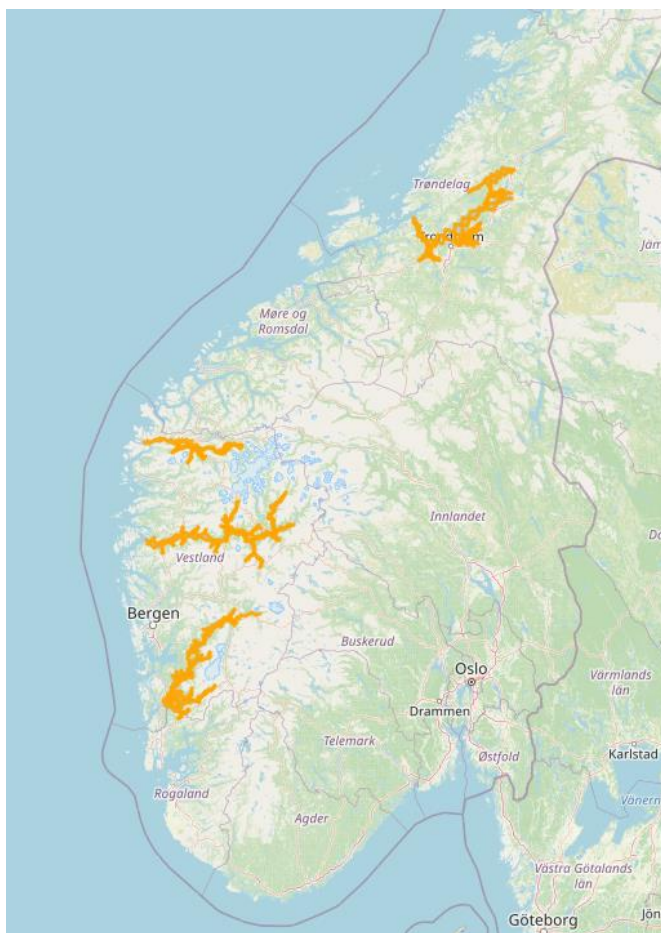
Length	7,99 m
Width	2,14 m
Draft	1,8 m
Weight	6 145 kg (fully fueled)
Op. speed	5 knots
Fuel	800 liters auto diesel
Endurance	11 days at 5 knots (+/-)
Armament	EK 80 freq 18 – 333 kHz EM 2040
Navigation	Radar Cameras IR and visible light VHF, AIS
Comms	4G, Starlink



# Communication



# Sprat-survey, Aug - Sep 2025



Distance covered

Data volume

Duration

Critical situations

Weather conditions

Waves

1800 n miles\*

720 GB

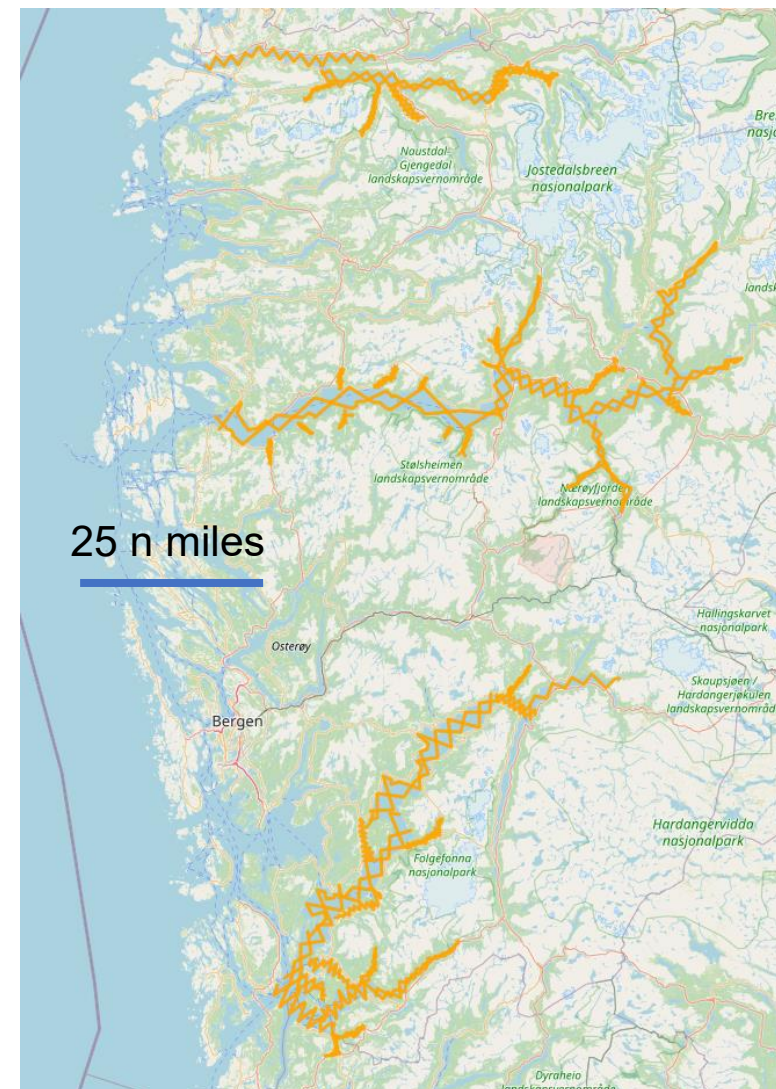
18 days

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Fair or better

Always under  
critical height

\* Two boats combined



# Major experiences

- Low signature approach
  - Noise, shadow, pressure wave
  - Does not warn fish schools as much as a ship
- Sensor data (echo sounder) holds same quality as ship mounted equipment
- Rain, wind, spray, currents, handled with only minor reductions of data quality
- Waves are a significant constraint, high angular velocity and large amplitude while rolling gives ping loss.
  - Experienced in the North Sea



Ping released



Sound travels to the bottom and returns, 1500 m/s

USV rolls in the waves to opposite heel

Ping returns, outside hydrophone open arc



# Major experiences

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- USV as a “spearhead” for a research vessel
  - Running 24/7 sweeping large areas on preplanned transects
- The ship, with cruiseleader, embarked focused on specific areas, detected by use of USV
  - Ship sailed 12 hours a day, resting in port through daylight
  - Used own echosounder and traw for physical sampling and verifications of estimates based on survey data from the USV
- Use of USV significantly increases ship time efficiency



# Remote Operations Center

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- Established in an office building, at distance
  - Two positions manned for operations with one boat (navigator, instrument / data handling technician)
  - Three positions while running two boats simultaneously (two navigators)
- Holds the responsibility of an embarked person being “captain”
- Three shifts, 8 hours + handover
- Trial 4 – safety vessel within one hour
- Trial 7 –
  - Safety vessel < two hours for two USVs in the beginning
  - Agreement with SAR-boat in the middle
  - No back up during last period (Director VD ready for punishment...)



# Remote Operations Center

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# Unmanned Surface Vehicle

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- “Unmanned” - grossly misleading
  - Gives an impression of “no people involved”
  - Is perceived as a means of saving money
- 18 persons involved in the running of one or two boats for 12 days.



# On the short term

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- Enhance boat reliability, navigational safety
  - Communications, redundancy, emergency measures should be improved
  - Mean time between mechanical failures should increase
- Data traffic should be reduced and refined
  - Machine learning to transmit interesting data to shore only, “uninteresting” data to be saved on board (or discarded)
- Firmer, more efficient tasking of all assets under Cruise Leader



# On the long term

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- Supplement ships, not replace
  - Physical sampling from the bottom or fish from the water column to remain with ships
  - Develop acoustics, optics (visual, IR) for unmanned boats
  - Water, plankton sampling is in the grey zone
- Unmanned for tasks being; Dull, Dirty or Dangerous
  - Acoustic transects with a ship are overkill
- Large scale advantages
  - More units on a mission, simultaneously



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