



KONGSBERG

KONGSBERG has a long and unique history

Our history spans over two
centuries

More than 11 000 people



Est.
1814





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USV Otter Pro+EM2040P IHM

Introduction of presentation

- What is the Otter Pro
- Equipment installed on Veril-01:
 - EM2040P
 - Seapath 130 50
 - Mini MRU 50
 - SVP winch
- IHM Veril 01
 - Normal operation
 - Deployment time and personnel
 - Survey
 - Data transfer
 - SAT
 - Data Quality
 - Support KM and MR

SHELTERED WATERS



OTTER





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USV Otter Pro+EM2040P IHM

Equipment onboard

▪ Equipment installed

- EM2040P
 - Seapath 130 50
 - Mini MRU 50
 - SVP winch

150° swath width and 7.5 times water depth on flat bottom

170° swath width up slopes and pier sides



512 bathymetric measurements per swath
1024 per ping with Dual Swath
Up to 50 pings per second
1°x 1° @ 400 kHz

TECHNICAL SPECIFICATIONS

- Frequency range: 200 to 700 kHz
- Beam patterns: Equiangular, equidistant and density and ultra high density
- No. of beams per ping: 512 (Single Swath) 1024 (Dual Swath)
- Roll stabilised beams: $\pm 15^\circ$
- Pitch stabilised beams: $\pm 10^\circ$
- Yaw stabilised beams: $\pm 10^\circ$



WORLD CLASS – Through people, technology and dedication

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Seapath[®] 130 – Features



- Compact and robust integrated INS/GNSS system
- 0.008° to 0.08° roll and pitch accuracy dependent on MRU model
- 5 cm real-time heave output for periods up to 25 seconds (MRU H, 5 and 5+)
- 120-channel dual frequency GPS/GLONASS receiver
- Robust against GNSS dropouts due to the inertial sensor part of the product
- Logging of raw satellite and IMU data possible for post-processing
- Meets IHO special order requirements



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IHM Veril 01

- IHM Veril 01

- Operation

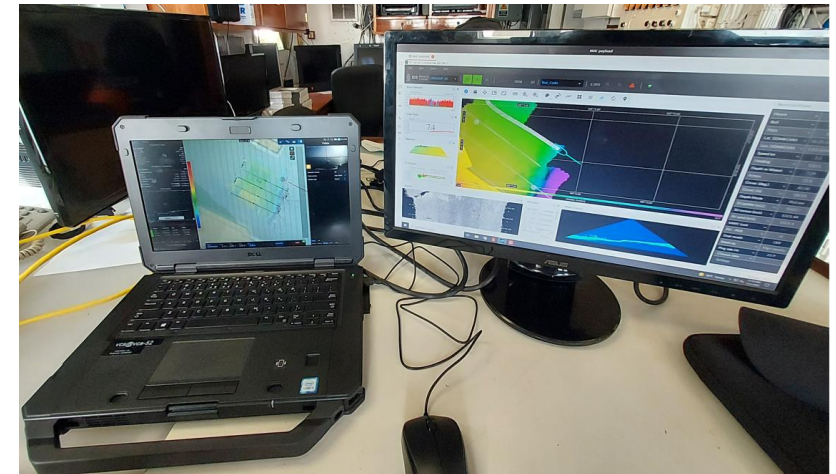
- Deployment time and personnel
 - 3 or 4 people. 2 for deployment, 1 or 2 hours

- Survey

- Very Simple, easy usability in single software (USV+MB)
 - Very good stability

- Data transfer

- Wireless to laptop



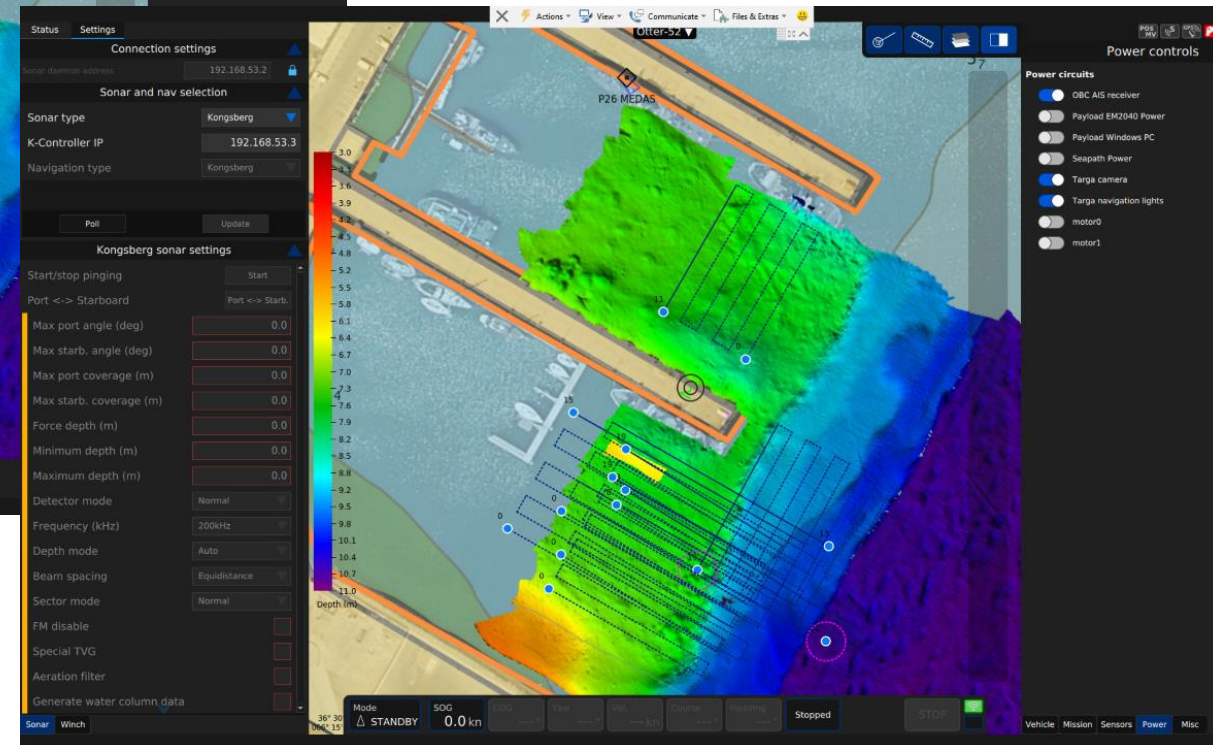
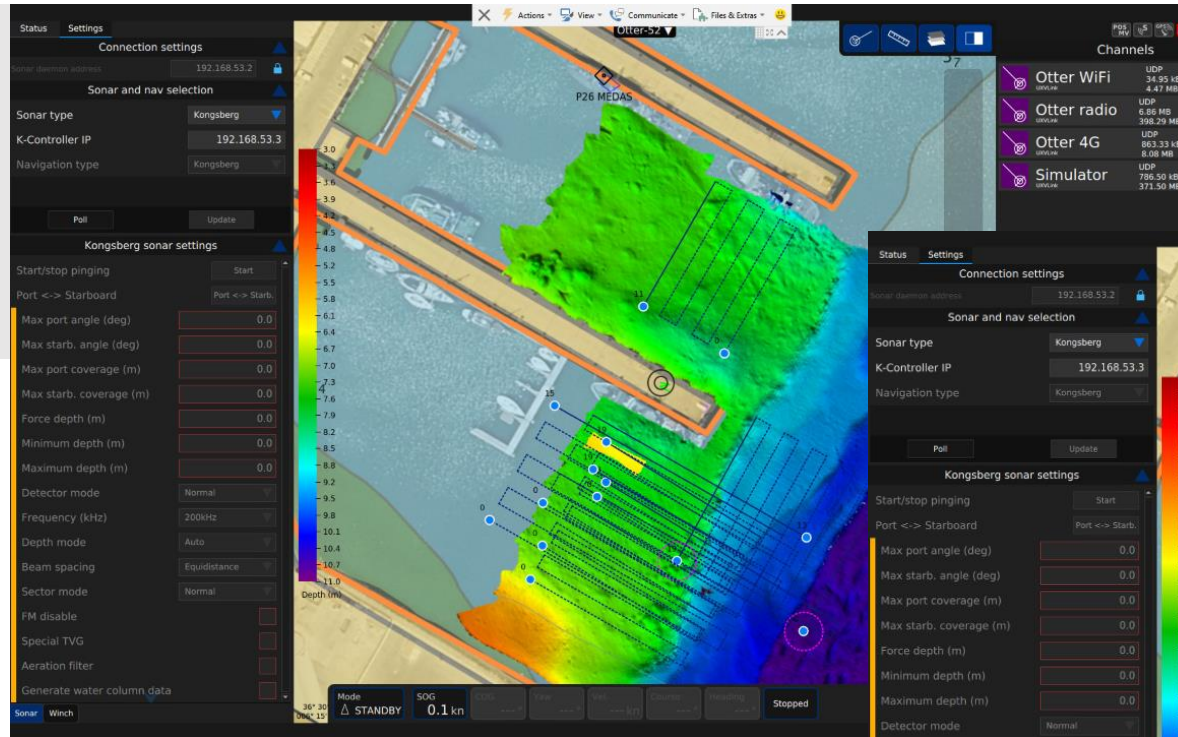


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IHM Veril 01

- IHM Veril 01
 - Operation
 - VCS software



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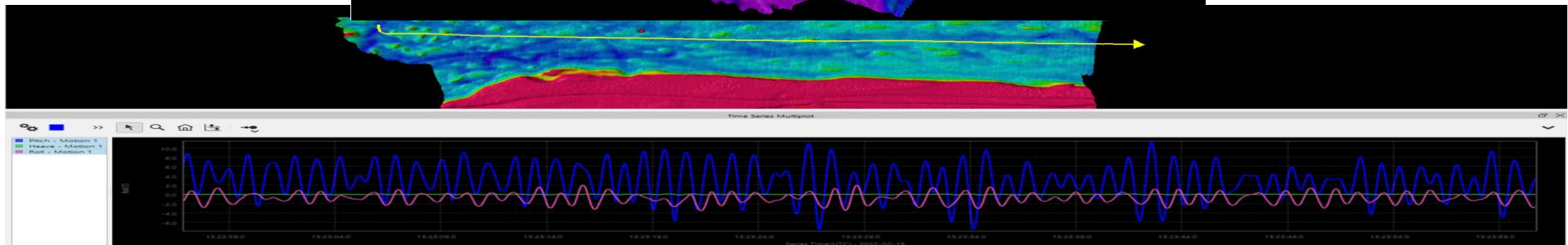
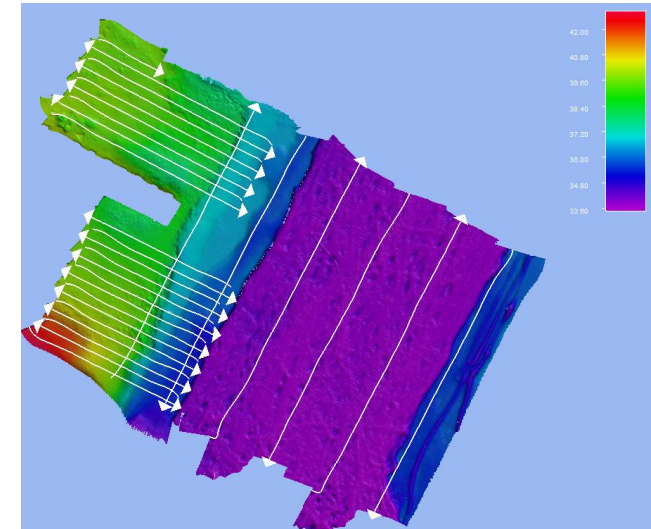
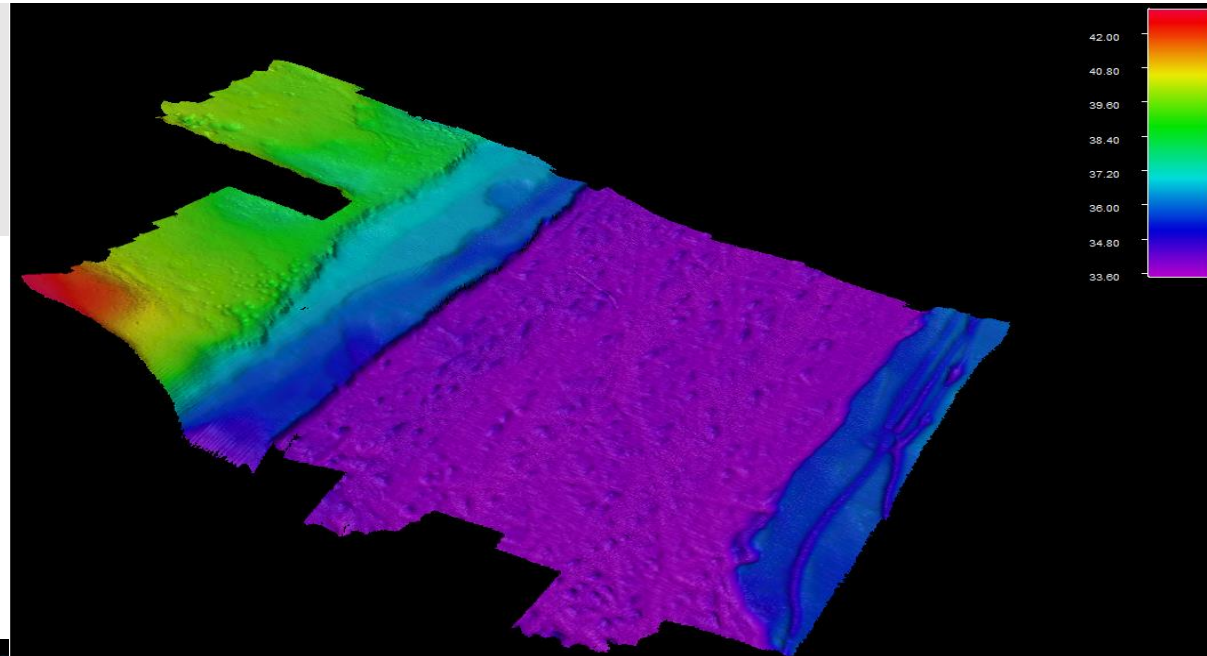


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USV Otter Pro+EM2040P IHM

IHM Veril 01

- IHM Veril 01
 - SAT



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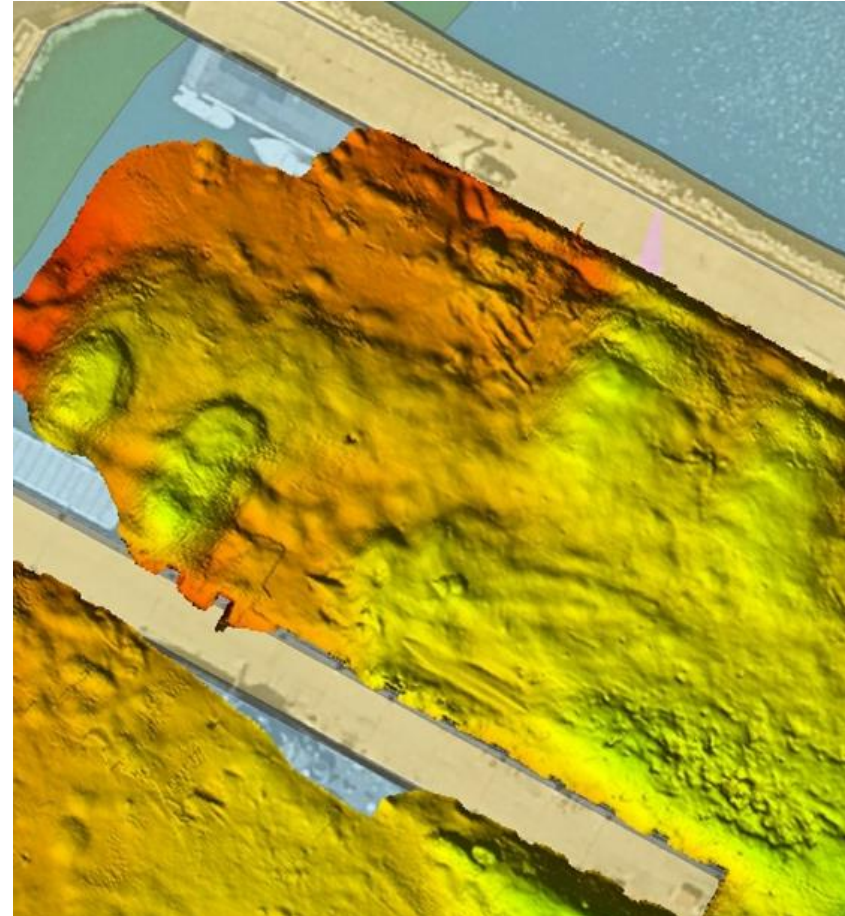
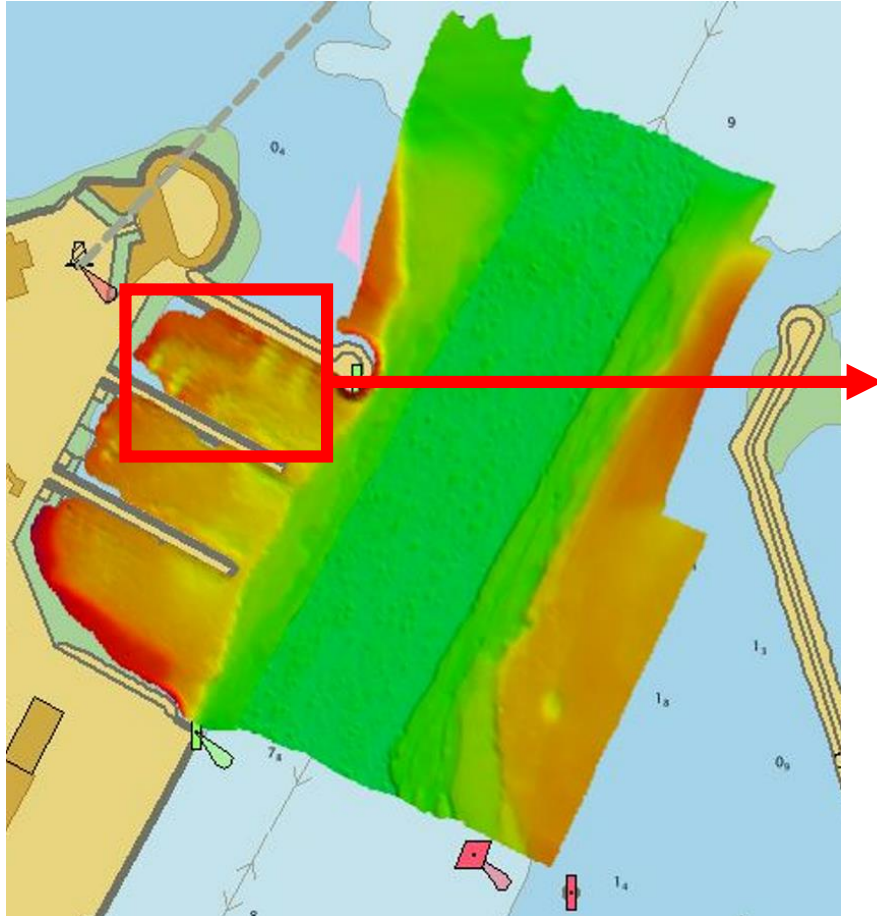


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USV Otter Pro+EM2040P IHM

IHM Veril 01

- IHM Veril 01
 - Data Quality





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USV Otter Pro+EM2040P IHM

IHM Veril 01

■ Conclusions:

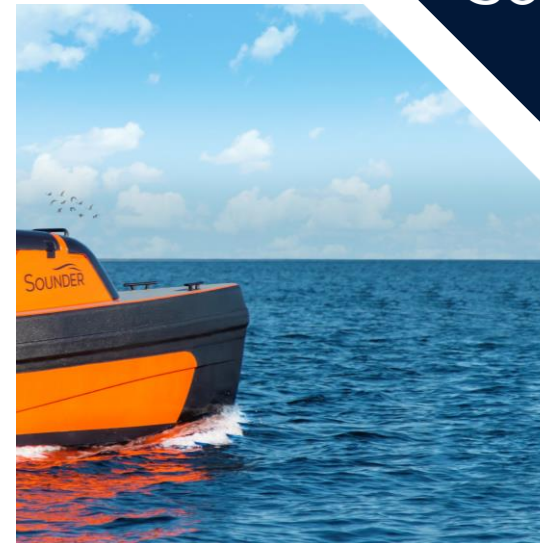
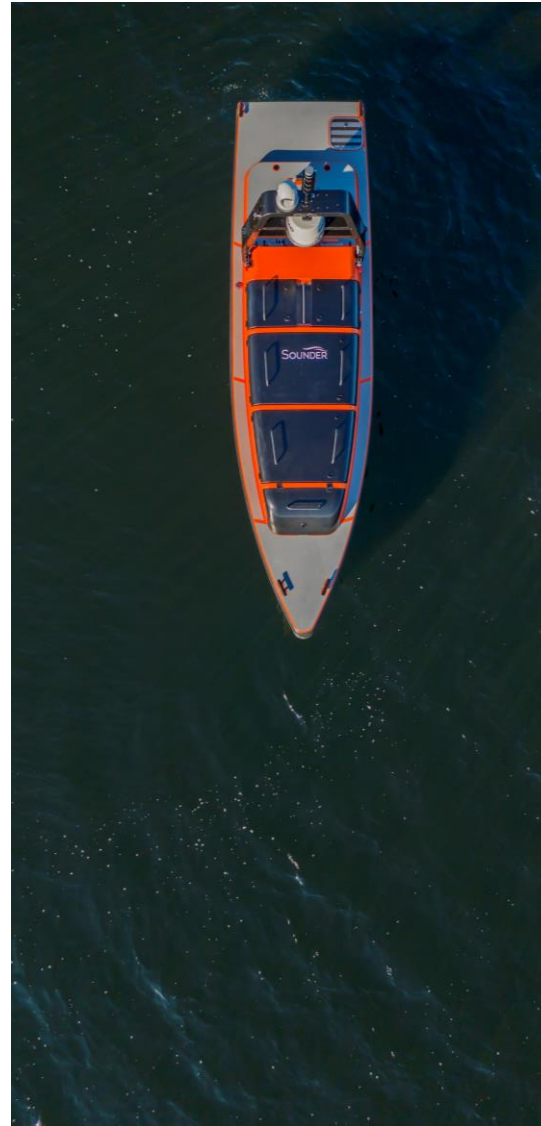
- Great performance in shelter waters even with strong winds.
- VCS software easy to use to plan lines and control the USV.
- Very tight intergration in hardware and software between USV and sensors.- KM-Maritime Robotics.
- Solution to a limited number of hydrographers and surveys to perform.
 - Main hydrographer can control the Otter data quality doing shallow surveys, even from the office using SIS Remote.



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Unique

Multi purpose USV platform, optimal for hydro acoustic applications





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Modular and detachable

High precision ocean science data acquisition

- Gondola is a **three-piece** construction
 - Stainless steel skeleton secures the gondola to the hull, plenty of space to run **cables** which enter the vehicle **through the moonpool**
 - Stainless steel **cassette** holds the transducers
 - Fibreglass body is designed to minimize drag
- Developed in **collaboration** with hydrodynamic and hydroacoustic specialist to provide **best possible data acquisition**.
 - Slightly **positive pitch angle** at the transducer face to facilitate **homogenous water flow**
 - Optimal longitudinal centre of gravity to **reduce pitch movements**
 - **Water inlet and outlet** to allow water to ingress faster during launch and recovery
 - Gondola weight further improves vehicle dynamics



Gondola Option

Cassette may fit various setups, examples include:

- Full wideband EK80
- EM 2040-04
- TOPAS PS120
- EK 80 ADCP
- HiPAP 602

**Moonpool may be fitted with various equipment
at clients request**

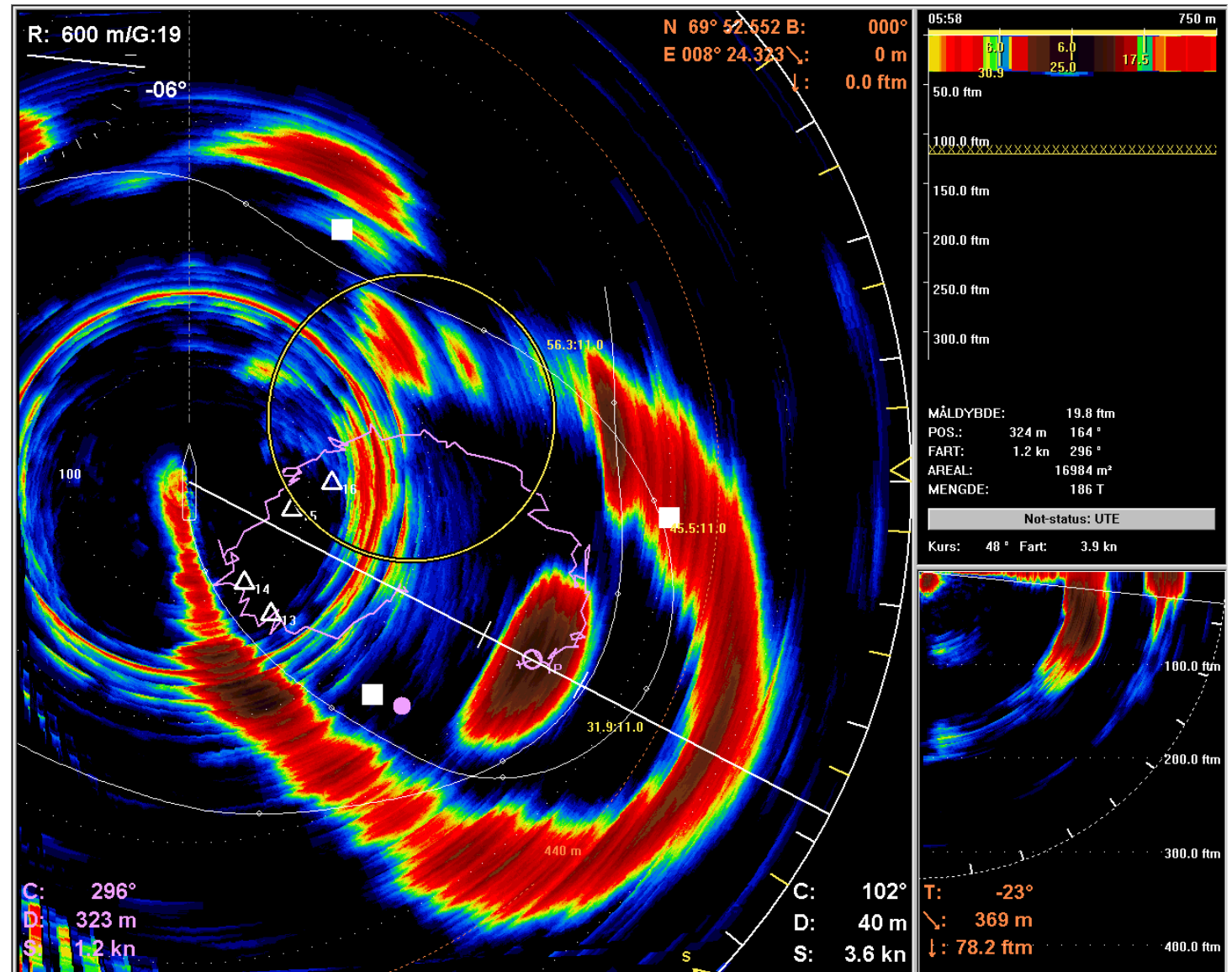




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Fishery Payloads

Simrad SX90 Sonar
Simrad ES80 Echosounder(s)
Wide Bandwidth Transceiver
CTD Winch and sensor
Weather Station
Data Logging

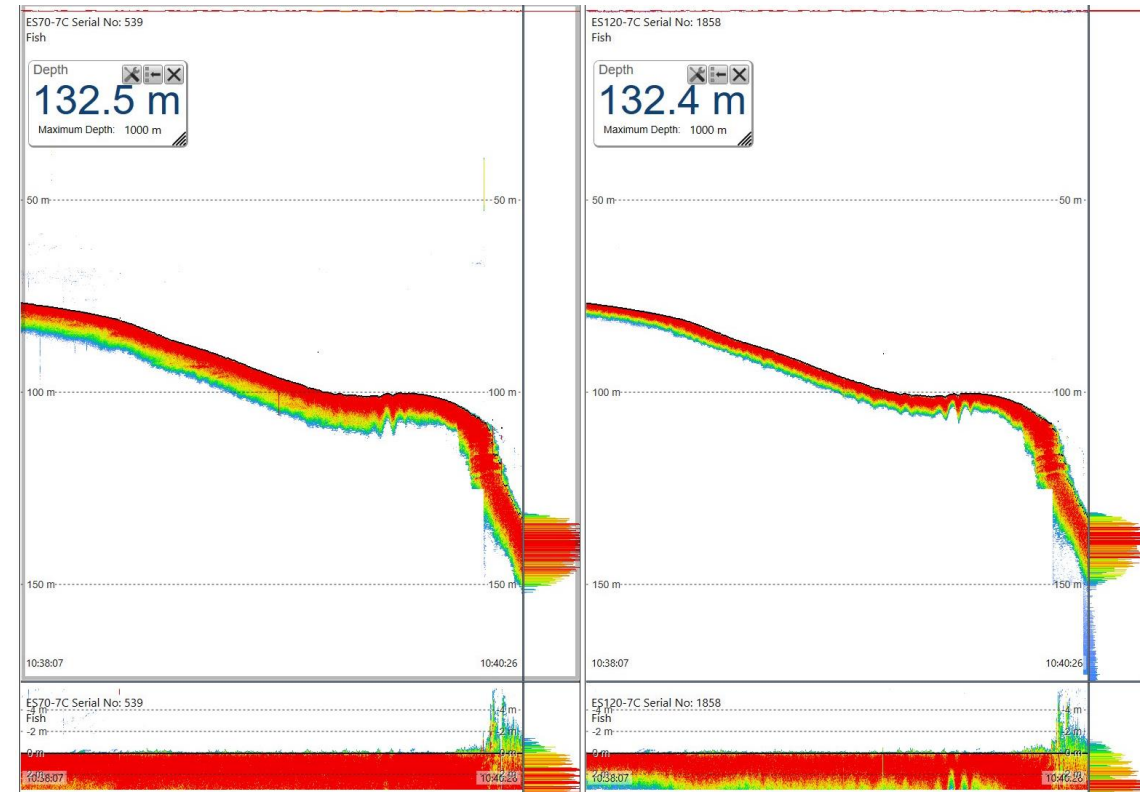
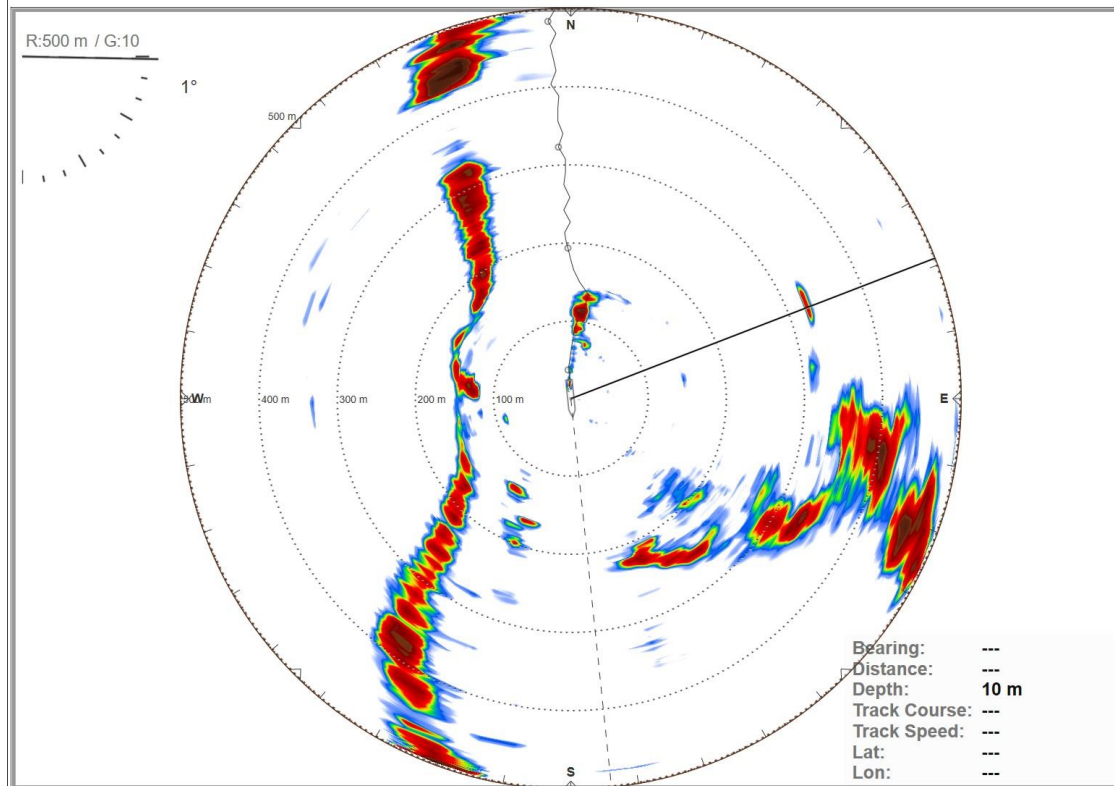




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Sonar and echosounder performing well in sea state 3

Sonar provides clear picture of land, sea marker and breakwater – echosounder with clear bottom track





*The Sounder USV System provides fish
school detection and classification at less
than \$50 fuel cost per day*



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Anti-submarine warfare

The Sounder USV System may be outfitted for anti-submarine warfare and mine detection applications with the SS2030C sonar



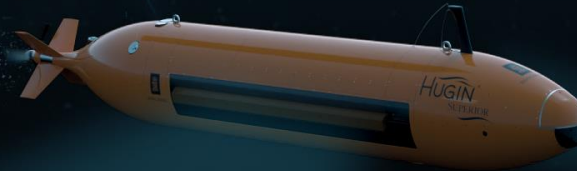
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Underwater Navigation Applications

The Sounder USV System may be outfitted with a USBL/SSBL system for AUV support or underwater positioning applications.



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Endurance & Range

20 days @ 4 knots* = 1 920NM / 3 500km

Lindesnes to Nordkapp: 1 700 km in air

Norwegian coastline excl. fjords: ~2 500 km

*With extra 400L fuel tank

