SINTEF NTNU

The journey:

From OceanLab to Fjordlab in the Norwegian Ocean Technology Centre

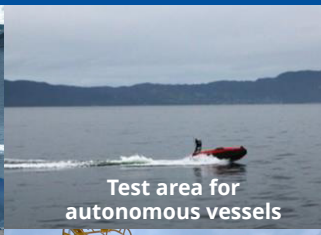
Photo: Adressa Brand Studio

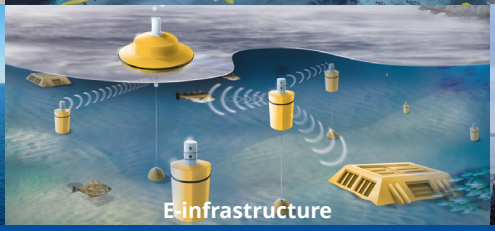
Full-scale testing and research in the ocean environment

Infrastructure in the Trondheim's fjord and Ålesund region

- Full-scale testing of subsea robots, autonomous vessels, navigation and ship traffic control technology and methods, and aquaculture.
- Marine observation: Ocean ecosystems and changes in the subsea environment.
- This infrastructure also gives answers to how subsea installations can be held secure: A coast guard underwater.
- An infrastructure with five collaborating laboratories connected with communication and e-infrastructure.

The OceanLab research and development themes





www.ntnu.no.edu/oceanlab

Photo: Colourbox

Illustration: Bjarne Stenberg

Why OceanLab?

OceanLab is an infrastructure project funded by the Norwegian Research Council, SINTEF Ocean, NTNU and Equinor. Fjordlab will be a continuation and extension of OceanLab and a part of the Norwegian Ocean Technology Centre – Norsk havteknologisenter:

- **World leading ocean research**

Enabling technology development, and education for students to the maritime industry. The infrastructure can be used both by national and international partners, academia, and industry.

- **The green shift in the blue economy**

Climate crisis and energy crisis: Transition to zero-emission shipping and autonomous shipping. Nature crisis: ocean observation is needed.

- **National security and preparedness**

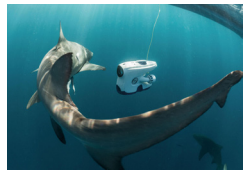
Ocean surveillance in a new security situation in Europe – war on energy systems and infrastructure.

- **From simulation to full-scale testing and verification**

Theme 1: Subsea robots and subsea facilities

Laboratory operating world-wide including in the Arctic environment with data collection, mapping, monitoring, sensor testing, and training of autonomous vessels – both subsea and unmanned surface vessels.

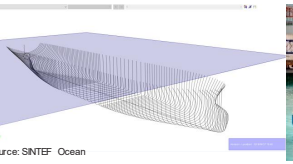
Assets:



- Remotely Operated Vehicles (ROVs).
- Autonomous Underwater Vehicles (AUVs).
- Light autonomous Underwater Vehicles (LAUVs).
- Autonomous Surface Vehicles (ASVs).
- Control room.
- Docking stations (90 and 365 m depth).
- Underwater observations and operations.
- Research, education, testing for development, simulations, and experiments.
- Subsea interventions, marine science, system approach, machine vision, Underwater navigation and communication, autonomy and cyber-physical systems.

www.ntnu.no.edu/oceanlab

From simulation to full-scale testing and verification



Ship design

Verification of ship design

Sea trials

Advanced technology and system development

Theme 2: Test area for autonomous ships facilities

The Trondheim's fjord was the world's first test area for autonomous ships. In OceanLab and Fjordlab you can go from simulation to full-scale testing and verification of vessels.

As a part of the Norwegian Ocean Technology Centre, we also have an ocean basin and a seakeeping basin in Trondheim to do model testing and verification of ship design.

Assets:

- Detection (2 x radars, cameras).
- Positioning (GNSS RTK).
- Communication (VDES, 4G/5G).
- E-Navigation (AIS, 2 x weather stations).
- Small electric work boat "Elly" available for hire.
- Ocean Info (data portal).
- Technology for autonomous ships.
- Situational awareness.
- Remote control functions and operations.
- Resilience in autonomous operations.
- Autonomy logistics and transport chains.
- Cost-benefit analysis.

Workboat "Elly"

Elly will be a key player in the future of sustainable marine and maritime research. She is available for hire by the maritime community, for instance, for maritime demonstrations in various projects.

Key data

- Electric propulsion – 4 x 63 kWh, 1 x 400 HP, Provider EVOY.
- Raymarine navigation systems.
- 5G/4G/WiFi communication.
- Emergency fleet capacity for 6 people.
- Length: 9.3 m.
- Breadth: 3.2 m.
- Lightship weight: 6.8 tonnes.
- Top speed of about 30 knots.
- Elly is designed and build by Skarsvaag Boats.
- Twine tails/light winch with a capacity of 200 kg (boom).
- Small desk for Laptop, 220 V power outlet.
- Toilet and "light" sink installed.
- Removable rows, good deck space.

www.ntnu.no.edu/oceanlab


Photo: Simo Räsänen

Theme 3: Aquaculture

Four aquaculture sites outside Hitra and Frøya for testing of instrumentation, sensors, and underwater cameras.

Assets:

- Instrumentation for digitalized and autonomous operations.
- Underwater cameras and split beam sonars.
- Automated crane and ROVs.
- Load shackles and accelerometer.
- GPS/motion reference unit.
- Sensors for measurement of oxygen, temperature, salinity, turbidity, current, waves and weather conditions.
- Facility for research in biomarine production, fish farming, fish welfare monitoring, remote operations and safety.


Photo: Live Oftedahl


Photo: Sintef Ocean

Theme 4: Marine observation

Buoys and gliders with the option to attach environmental sensors, both standard and custom made in combination with monitoring instruments. Two buoys located in the Trondheim's fjord.

- High-spec environmental data buoys: covering Trondheim's fjord – Frøya – Ålesund.
- A suite of mobile oceanographic environmental monitoring systems.
- Gliders for offshore long-term monitoring.
- Long-range AUV for week-long deployments.
- USVs for environmental monitoring in Ålesund area.

Theme 5. Communication and e-infrastructure facilities

- Communication networks – both surface and subsurface.
- Systems for data storage.
- Management and data integration/interoperability.
- Restricted access where necessary.
- Communication at sea (radio) and under water (acoustics).
- Connecting and secure storing of the data from all the other nodes. Digital twins of the ocean. Machine learning and AI.

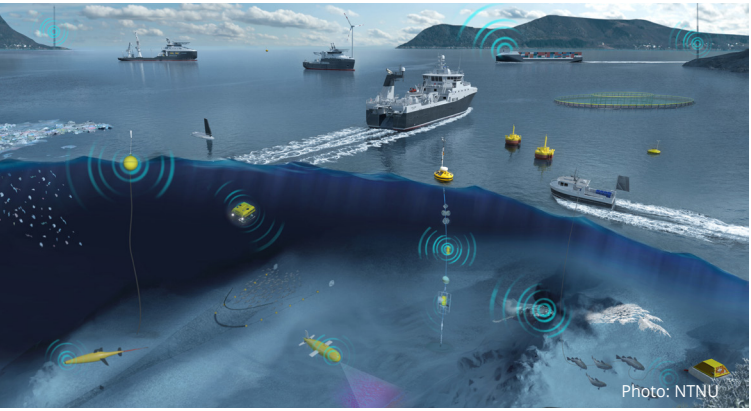
www.ntnu.no.edu/oceanlab

Theme 6: Full-scale maritime testing

Maritime technologies and operations, navigation, and ship traffic control technology and methods. Search, rescue and safety technologies. Impact on ocean coastal infrastructure. For research, education, and industrial cooperation.

Assets:

- Work boat.
- Sensor platforms as USV, drones, buoy, and sea-bed installations.
- Remote control centre.
- Visualisation centre.
- Quay and workshop facilities.
- Sensors packages for metocean, bathymetry, radars, echosounder, e-navigation, hydrophones etc.
- Technology for harvesting ocean energies (wind, wave, current).
- Technology for harvesting and cultivation of bio resources.



Kristin R. Sørheim
+47 98 24 34 70
kristin.r.solheim@sintef.no
Project leader OceanLab
Unit: SINTEF Ocean AS
Department: Climate and Environment
Office: Trondheim

Martin Ludvigsen
+47 91 89 77 27
martin.ludvigsen@ntnu.no
Subsea R&D
Unit: NTNU
Department of Marine Technology
Office: Trondheim

Beate Kvamstad-Lervold
+47 92 22 22 40
beate.kvamstad-lervold @sintef.no
Unit: SINTEF Ocean AS
Department: Energy and Transport
Office: Tiller

Kay Fjørtoft
+47 90 05 70 68
kay.fjortoft@sintef.no
Autonomy testing
Unit: SINTEF Ocean AS
Department: Energy and Transport
Office: Tiller

Finn Olav Bjørnson
+47 97 72 64 90
finn.a.bjornson@sintef.no
Aquaculture
Unit: SINTEF Ocean AS
Department: Aquaculture
Office: Trondheim

Emlyn Davies
+47 93 00 43 39
emlyn.davies@sintef.no
Marine Observatory
Unit: SINTEF Ocean AS
Department: Climate and Environment
Office: Trondheim

Øyvind Kåre Kjerstad
+47 97 74 51 47
oyvind.k.kjerstad@ntnu.no
Maritime testing
Unit: NTNU
Department of Ocean Operations and Civil Engineering, Ålesund