

“Trondheimsfjorden Test Area for Autonomous Ships, World First of its kind, is a valuable asset for Norway and the development of maritime and ocean space solutions for European and global users. It is a great example of innovative initiatives in the ocean space cluster in Norway and the Technology Capital of Norway, which benefits the whole industry and its users with safe, efficient and sustainable solutions.”

Tore O. Sandvik, County Mayor, Trøndelag County

Trondheimsfjorden Test Area

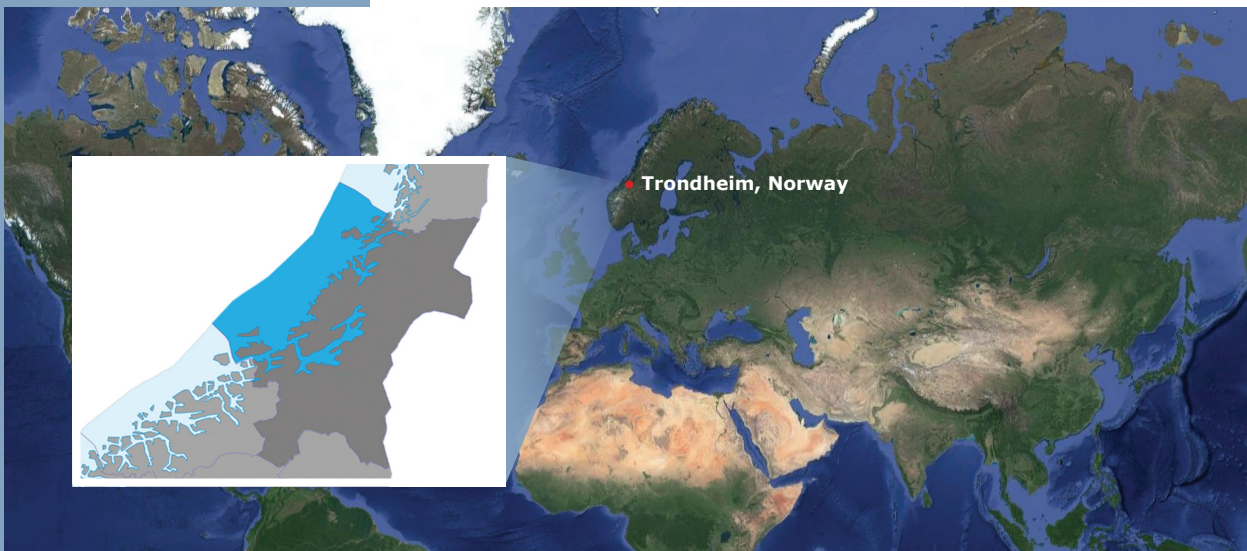
Leading the transformation of shipping



KONGSBERG

Trondheimsfjorden Test Area

The Navigation Innovation and Support Program (NAVISP) is an ESA program in navigation activities to foster innovation and competitiveness of European industry. This NAVISP¹ Element-3 supported project has established infrastructure for test activities in the Trondheimsfjorden Test Area for Autonomous Ships. The main element in this project has been to make Trondheimsfjorden Test Area a key player and facilitator in the development of technology for autonomous ships. In that connection, extending and strengthening the infrastructure in the area has been a necessity.



The project is coordinated by SINTEF Ocean and has Kongsberg Seatex as partner. The project started in 2018 and was completed in 2021.

Trondheimsfjorden Test Area for Autonomous Ships

The vision of the Trondheimsfjorden initiative is to be a valuable contributor to the development of autonomous shipping by instrumenting the fjord with sensors and facilities that can be used when testing and verifying new technology. The vision of Trondheimsfjorden is based on the need to actively drive a transformation, rather than just wait for it to happen. The maritime business is traditionally conservative and there are

¹ *ESA's Navigation Innovation and Support Programme (NAVISP), see more at <https://navisp.esa.int/>*

many obstacles for innovation and adaptation of technology. The test area will contribute to minimizing the gap between an idea to a full-scale solution that supports the industry. Verified technology for test purposes is essential for success. The fjord stimulates for new innovation of maritime technology, making it safer and more environmentally friendly for future shipping and will be a demonstration area for the providers of technology for autonomous shipping.

The project

The main objective for the project has been to establish and verify infrastructure in Trondheimsfjorden Test Area which will be used for future studies and technological innovation. Sensors for positioning, navigation and timing will in this content be important. A secondary objective is to be capable to build awareness from the site by using sensor data for planning and execution of a test. It will be important to gather data from sensors and to distribute relevant information to stakeholders.

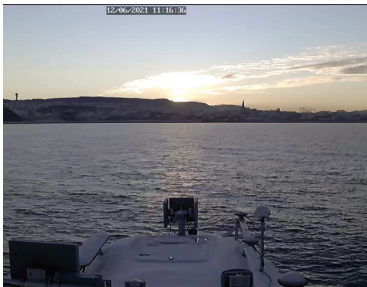
The results from this project will be important for the implementation of the fjord infrastructure, as a leading test area for maritime research and innovation. The following describes the main components that have been implemented in the project.



Test Area Control Centre at Kongsberg Seatex that operates vessels remotely.



DGNSS Reference Station: A DGNSS Reference Station located in the Trondheimsfjorden provides differential corrections for GPS and GLONASS on RTCM2 format and gives test campaign vessels more accurate position and integrity information. Also, as the existing DGNSS reference stations only use GPS, adding GLONASS as an extra GNSS constellation to the reference station, will improve the satellite availability, position accuracy and the integrity further.



GNSS Monitoring Station: A GNSS Monitoring Station includes a GNSS receiver which is able to track the present GNSS systems, including GPS, GLONASS, Galileo, BeiDou and QZSS, as well as SBAS. The monitoring station will provide a benchmark for the performance of GNSS in the test area, hence serve as a reference for performance assessment of vessel-based systems. The monitoring station will provide differential data for GPS, GLONASS and Galileo on RTCM3 format, therefore also enabling relative positioning with Galileo.



AIS Base Station: An AIS Base Station in the Trondheimsfjorden Test Area gives the test users the ability to gather data from the vessels in the area. The data gathered, during test campaigns and normal operation, will facilitate analysis of maritime data traffic in the area.

VDES satellite terminal: The test area includes a VDES satellite terminal. This satellite terminal is able to communicate with a VDES satellite, and hence will be able to represent a VDES user, allowing testing navigation services over VDES.

Maritime Broadband Radio (MBR) network: A closed communication network with MBRs allows broadband communication between test campaign vessels and TACC, and between vessels in the area.



An example of functionalities in the Data Centre showing examples of a test campaign.



Ocean Space Drone used in a test campaign.

<https://www.sintef.no/projectweb/tta/>



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