AUTOSHIP

Autonomous Shipping Initiative for European Waters

News from the participants companies: focus on KET & Simulators

Discover what's new with AUTOSHIP reading the 5th project newsletter!

Technical progresses related to KET and Simulators are being successfully achieved from Kongsberg, Kongsberg Digital and SINTEF Ocean.

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KONGSBERG IS DEVELOPING KEY ENABLING TECHNOLOGY FOR AUTONOMOUS VESSEL TO BE DEMONSTRATED IN SHORT SEA SHIPPING AND INLAND WATERWAYS

The Remote Operation Center (ROC) for both Short sea shipping (WP4) and Inland waterways (WP5) is under development. Ergonomic design of the workstation has been done, and the architecture and design of the technical solution for the Workstation and the backend servers and network has been done. The Remote Operation Workstation (ROWS) is designed to be operated by one person for monitoring, supervision and intervention and includes a desktop with control panels and displays and a curved large screen display behind the desktop. The backend servers will be hosting all the software that will be available for the operator at the ROWS. The first version of the ROC is now being assembled for initial testing, and later this year the materials for the WP4 and WP5 ROC will be purchased for assembly in our labs and later deployment at the demonstration sites in 2022.

Figure 1: Remote Operation Centre

The Situation awareness (SA) is using cameras, radar and positioning data to detect objects around the vessel. The cameras have been installed on the WP4 demonstration vessel and started to capture data for test & development purposes. The cameras for the WP5 demonstration vessel are currently in the process of being installed. The object detection algorithms powered by Artificial Intelligence is currently in development and test and has recently been field-tested in a scaled demonstration for WP4 in the Trondheimsfjord test area. Tuning of the object detection based on recorded test data will continue as we move forward with the Autoship project.

The autonomous navigation system (ANS) is using input from the SA system to perform collision avoidance according to COLREGS. The ANS has recently been tested in a scaled demonstration

for WP4 together with the SA system. Development & test of the ANS will continue. An HMI for the ROC operator is under development to support monitoring and intervention during autonomous sailing.

The Communication and Cyber security solution have recently been tested with optional wireless communication carriers like Maritime Broadband Radio (MBR), Wireless Gigabit (WiGig) and satellite to be integrated in the Kongsberg connectivity solution. Testing of 4G and 5G is planned later. Several carriers will be supported simultaneously to provide redundant and robust communication between the vessel and the ROC.

KONGSBERG DIGITAL IS DEVELOPING ITS K-SIM SIMULATOR SOLUTION INTO A TESTBED FOR PROTOTYPING, VALIDATION AND VERIFICATION FOR AUTONOMOUS VESSELS, COMPONENTS AND REMOTE OPERATIONS CENTERS.

The K-Sim validator is a simulator which has been specifically developed for autonomous vessel research and study, providing a safe environment for testing autonomous operations. The simulator includes a digital model of an autonomous barge which replicates hydrodynamic, mechanical, visual and sensor behaviors. In addition, a barge test area with inland waterways, locks and other traffic has been modelled, allowing complete and realistic test scenarios to be constructed.

The K-Sim validator has recently been updated with advanced hydrodynamic effects for river and lock maneuvers, enabling realistic test scenarios to be carried out. This allows virtual tests to be used when in situ verification and demonstration with a real vessel is impossible, for example when lock architectural conservation restrictions prohibit such activity. In these situations, the K-Sim validator may be used for demonstration purposes.

Figure 2: Image from K-Sim validator showing two simulated unmanned Zulu barges in the Wintam sea lock, together with a conventional manned barge

One of the recent studies carried out using the K-Sim validator has focused on finding the best location for cameras on the barge. This includes simulating the results that would be obtained from various camera cluster positions pending different weather and sailing conditions. In these studies, the simulated camera images of the virtual test area were produced in real time during the simulation, as input to the situational awareness system.

Figure 3: K-Sim validator used to find the best position for camera clusters

Work is now being undertaken to interface the K-Sim validator to a prototype of the remote operations center (ROC), which will make the simulator a powerful aid for test and verification of the system. This interface will also support the training of ROC-operators, enabling training scenarios to be developed using the simulator before the operator trains in a real ROC environment. Digital twin functionality is also being developed as part of the K-Sim validator project, using the simulator as a foundation. The digital twin will be integrated into the ROC and will use live signals from the barge and real weather data as inputs to the K-Sim validator. This will form the basis for decision support and is work in progress for Autoship.

NEW ISO TECHNICAL SPECIFICATION ON TERMINOLOGY FOR AUTONOMOUS SHIP SYSTEMS

One important activity in AUTOSHIP has been to define concepts and terminology for autonomous ship systems. The results of the work in AUTOSHIP were published by SINTEF Ocean in the open deliverable D3.1 - Autonomous ship design standards in June 2019. These results were also proposed into international standardization through ISO TC8 – Technical Committee 8 on Ships

and marine technology. Since the publication of D3.1, working group 10 on smart shipping has worked on a technical specification, ISO/TS 23860 "Terminology related to Autonomous Ship Systems" that was completed in October 2021. The final text is now being prepared by the ISO secretariat in Geneva and will be made available to the general public later this year. A technical specification addresses work still under technical development and is published for immediate use but is also a means to obtain feedback. The aim is that it will eventually be updated and republished as an International Standard.

MASS ANALYSIS TOOL

The MASS Analysis Tool is intended for early phase concept exploration. It can be used to study the effects of high-level design choices on transport costs and emissions, enabling comparison of concepts. The design choices which can be made are the hull model, machinery, cargo handling on ship or at a location, and key enabling technologies. The available hulls are the short sea use case vessel, with and without superstructure, and a bulkier version of the short sea ship. The inland water ways vessel with and without the small deck house for the captain is almost ready and will be added to the tool soon. A future version will support uploading of own ship models.

The MA tool calculations are based on simulations of one voyage for one ship. The configured voyage should therefore be based on a typical shipment consisting of typical deliveries along a typical route, under typical weather conditions. The user must also enter the percentage of a year which the ship will be operating on the typical voyage. The non-operational part of the year will be simulated and used to adjust the average transport cost and emissions.

This allows the user to compare different ship concepts by bench marking them on the same voyage, that is the same operational conditions and the same shipments. It is possible to do the bench marking by either defining shipments of a specified number of cargo units, or by defining the shipments as a percentage of the ship capacity. The latter allows for better studying the effect of removing the superstructure and obtaining increased cargo capacity.

In one study, it is possible to configure more than one ship such that all configured ships are simulated under the same conditions. The results from each ship can be compared in KPI graphs or charts.

The location and route configuration are done in a map-based user interface. Routes between locations are generated:

SINTEF Ocean had a recent demo of the MASS Analysis Tool, and it's now shifting focus from the MA tool to the Logistics Analysis Tool (LA tool) development. This is an important step towards the deliverable D8.3 Decision Support Tool.

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