AUTOSHIP

Autonomous Shipping Initiative for European Waters

Project Progresses

Discover what's new about AUTOSHIP reading the 7th project newsletter!

Interesting technical updates, as well as insights about the latest publication made within the project are the focus of this issue.

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Proposed regulatory, legal and liabilities frameworks amendments

Deliverable 7.4 aims to address the potential gaps identified in WP2 in the existing legal, regulatory and liabilities frameworks for the two AUTOSHIP use cases (the IWW barge and the SSS cargo ship) by comprehensive studying several sources including the pertinent literature review on international regulatory framework analysis, relevant autonomous ship projects' outcomes. The partners as well as the strategic advisory groups are expected to provide feedback to refine the proposals.

To address the identified gaps, this study refers to the outcome of the Regulatory Scoping Exercising (RSE), which was initiated by IMO to assess the degree of acceptability of MASS operations within the existing regulatory framework. RSE reports four alternative ways to address the limitations of the existing regulatory instruments, which are also adopted in this study by either: (a) Developing interpretations or equivalences as provided by the instruments (b) Amending existing instruments and/or (c) Developing new instruments and (d) None of the above. Four degrees of autonomy have been considered as identified in RSE. The performed analysis has captured some instruments that require onboard human/manual intervention to comply with the provisions and identified them highly severe, as these involve international acceptance for autonomous ships. Some instruments require human involvement actively or passively, but not necessarily on-board presence or system upgradation with key enabling technologies (KETs). These are considered of moderate severity, as trusted advanced technology could support the alternative provisions of these instruments. Last but not least, the instruments that require only wording adjusting or inclusion of new/amending definitions are characterised with the least severity level.

The existing legal framework has also been analysed, in specific UNCLOS and national conventions. Flag state jurisdiction, port and coastal state jurisdiction and other provisions, such as mandatory manning requirement, masters' obligation to render assistance in distress situations that create barriers to autonomous ships' operability have been identified and relevant proposals are presented for national and international levels.

In addition, a detailed analysis has been carried out of the liabilities and insurance aspects frameworks with regard to shipowners, system suppliers, remote operators, cargo, assets, new technologies, criminal offences, cyber risks and operations with the following subtasks: (a) Assessment of current liabilities and insurance scenarios considering the anticipated autonomous shipping growth; (b) New players with new risk and shifting of risk towards new players; (c) Identify the changes in the distribution of liabilities among current stakeholders and propose amendments to address those changes; (d) Insurance framework considering the autonomous shipping landscape.

This deliverable will fuel the development of a roadmap for autonomous ship adoption and the AUTOSHIP proposal planned for submission to IMO (both in WP8).

D7.2 Training Framework for crew, operators and designers

D7.2 aims to develop a training framework for autonomous shipping. Autonomous shipping has different working environments compared to conventional shipping regardless of autonomy level. To enable safe and reliable autonomous shipping, modifications of present training framework are necessary. The conventional training framework as well as the characteristics of the autonomous operations are analysed to identify the competences covered from existing training courses and the additional competences required for the two AUTOSHIP use cases, the operations of which are categorised into main functions.
The conventional shipping requirements (certificates and training courses) under existing international conventions are first reviewed considering basic elements of navigation and machinery operations. Competences for autonomous operations are subsequently identified, whereas new training courses for developing the competences are recommended, and conventions updates are proposed.

D7.3 Autonomous ships Socio-economic Impacts Perspective Analysis

D7.3 aims to investigate how the autonomous ships will impact the society, considering the environmental, financial, social and managerial aspects. This investigation is carried out by comparing the Key Performance Indexes (KPIs), identified in WP2, and by a Cost-Benefit analysis of scenarios that consider (a) the actual technology level (baseline, manned vessel), (b) the technology fully developed (fully autonomous and regulated vessel), and (c) the transition period (assisted autonomous operation, with human supervision). This investigation is carried out considering the Inland Waterway (IWW) and Short Sea Shipping (SSS) demonstrators considered in this project.
The impact of the autonomous vessels in the societal KPIs were qualitatively estimated considering aspects of jobs, security, public opinion and infrastructures, for both demonstrators. To quantitative evaluate the financial and environmental KPIs, a method was employed that use the real traffic data and engine monitoring data to identify the actual operation profile from the SSS vessel. This profile was used to estimate the energy and fuel consumption of the vessel, which are used to calculate the emissions impact factors (environmental KPIs) and the costs (financial KPIs).

DSS DECISION SUPPORT SYSTEM (SOFTWARE AND DOCUMENTATION)

The AUTOSHIP project has been working towards a goal of reducing the uncertainty related to investing in the development of MASS based transport system concepts. The challenge is to decide if a transport system idea is worth moving forward with to develop a concept that can be realised. Key questions are: is it feasible to realize the idea? Will it result in a viable transport system in terms of economy, emissions, logistical and societal factors? The idea for solving this problem is to create a tool where it is possible to design an early phase MASS and transport system concept model, and to estimate key performance indicators (KPIs) for that concept model. These KPIs can be used in cost benefit analysis of investing in the MASS-based transportation system concept.

The AUTOSHIP development towards this strategic goal has been structured through a set of deliverables building on each other and creating the foundation from which a tool could be implemented. This started at the beginning of the project with deliverable D2.1 *Complete supply chain mapping & identification of interactions between SSS and IWW demonstrators, where the project demonstrator* supply chains were mapped and a generic supply chain model for waterborne supply chains were developed. This was used in deliverable D3.1 Autonomous ship design standards, which provided a framework for autonomous ship system development and assessment methods called the AUTOSHIP reference architecture (AURA). Both D2.1 and D3.1 were used in deliverable D3.2 *Autonomous ship design methods and test principles*, where a high-level autonomous ship design framework structure was outlined. Including an outline of tools for analysing MASS concepts and MASS based transport system concepts. Based on this, an initial version of a tool that could estimate energy, cost and emission, for a MASS concept, was developed in D3.3 *Cost-benefit analysis tool for early design phases*. All of this was the basis for deliverables D7.5 *Complete supply chain and logistics* model and D8.1 Generic Business case model and KPIs. Finally, all this work came together in the development of deliverable D8.3 DSS decision support system, which is a tool that generates the input to cost benefit analysis of investing in the MASS based transport system concept. The CBA method, and application on the project demonstrators, will be given in the upcoming deliverable D7.3 Autonomous ship Socio-economic Impacts Perspective Analysis.

The DSS tool is made by two sub-tools that work on the same project (i.e., transportation system concept) and share data. One is the Logistics Analysis tool, where the logistic system is modelled and adjusted until it performs satisfactory in terms of cargo flow, and in terms of the capacity utilization of the logistic system components (and some other logistical KPIs). The result of using this tool is twofold, firstly an initial feasibility check of the idea; is it all possible to realize (not considering costs, emissions, etc.)? And secondly, input to the second sub-tool, which is the MASS analysis tool. The MASS analysis tool is designed for estimating costs, emissions, and societal costs (external costs). Here one can trade of the various transportation system component design choices (parameters of the ship concept, the cargo handling concept, etc.) to obtain satisfactory performance in terms of cost, emission and societal costs, for the designed logistics system. The workflow involves some iterations over the design between the two tools as changes in one may have impacts on the other. In the end, the output is estimated quantitative KPIs that are input to a final CBA for deciding whether one moves forward or not.

The DSS tool development has now reached a point where SINTEF is ready to demonstrate the tool. The first demonstration will be to the project partners and the European Commission on the 31st of May. Then, it will be presented at a Norwegian Forum for Autonomous Ships seminar the first week of June, and to the AUTOSHIP Strategic Advisory Committee the second week of June.

NEW PUBLICATIONS

Journal publications

- Bolbot V, Theotokatos G, Wennersberg L A. (2022) A novel method for identification of hazardous interactions for the autonomous navigation system on ships. Journal of Navigation. Online 2/5/2022.

- Bolbot V, Gkerekos C, Theotokatos G, Boulougouris E. (2022) Automatic traffic scenarios generation for autonomous ships collision avoidance system testing. Ocean Engineering. 254; 15 June 2022, 111309.

- Molica Colella, M (2022) Autonomous shipping initiative for European waters, The Project Repository Journal, Online January 2022.

Publications in international conferences proceedings

- Theotokatos G, Bolbot V, Lee P, Wennersberg L A, Nordahl H. (2022) Key performance indicators for autonomous ships characterisation. The International Maritime and Port Technology and Development Conference (MTEC) & The 4th International Conference on Maritime Autonomous Surface Ships (ICMASS) 6-7 April 2022

Presentations in international conferences

- Lee P, Theotokatos G, Boulougouris E (2022) Autonomous Collision Avoidance Control Using Deep Reinforcement Learning for Maritime Autonomous Surface Ships. The International Maritime and Port Technology and Development Conference (MTEC) & The 4th International Conference on Maritime Autonomous Surface Ships (ICMASS) 6-7 April 2022

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The project has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement N°815012.