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Breakthrough simulator technologies for seafaring, education, and training

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Abstract:

The behavior of ships and people in different situations can be modelled in many ways in simulator environments at the Satakunta University of Applied Sciences. The maritime learning environment is equipped with state-of-the-art navigation, engine room as well as hydrostatistics and stability simulators which are combined to one training entity. SAMK's Maritime Training Centre has the only 360-degree bridge simulator in Finland. With the present software, it is possible to simulate all sea fairways in Finland, and in addition it is possible to model any fairway in the world. In our simulator it is possible to perform port maneuvers, fairway steering practicing, operating of different types and sizes of vessels, familiarization, line pilot examinations (half of the fairway navigation practicing can be done on a simulator). In Finland, we are highly skilled in ice navigation, and with SAMK simulator it is possible to arrange audited ice navigation courses: Polar Code/Azipod and DP (meets audited IMO DP3 requirements).

Keywords: navigation simulator, maritime training, maritime know-how

1. Introduction

Given the international nature of shipping, it is important to look at the autonomous impacts of shipping in a wide range of transport areas. Coastal areas in Finland provide a good perspective for the specific characteristics of the region in terms of narrow passages. Around 70% of the international fleet operating in the region is non-Finnish flagged vessels. Most of Finland's shipping traffic is liner-oriented and destined for European ports. There is also some tramp traffic in bulk. Of the non-Nordic and non-Baltic vessels, vessels flying Dutch flags and some of which are flags of convenience visit Finland relatively often. [1] In liner shipping, vessels are piloted in many ways, often the vessel engaged in line traffic has a line pilot. However, a wide range of piloted vessels arrive in Finland, from tramp freighters to passenger ships of various sizes. For vessels where the pilot is asked not only to give instructions but also to drive the vessel, remote pilotage will be a major challenge in the future. The reliability of autonomous vessels in island conditions has not been verified for cargo or passenger vessels in the archipelago. Autonomous vessels must always be placed under the control of qualified personnel.[2]

2 Methodology

The data for the article has been collected by interviewing SAMK´s simulator managers about different training sessions and by conducting a literature review on the various possibilities of simulators. A mapping of the business field in the use of simulators has been carried out as background work for the project. Qualitative interview methods have been used in this paper. The interviews have involved maritime educators from both the deck and engineer side. In addition, simulator managers from the Maritime Logistics Research Center have been interviewed and a table has been coded regarding the current state of simulators and future possibilities from a customer perspective. The interview material consists of interviews within the organisation as well as interviews with domestic shipowners and pilot officers. The methodology of the article is entirely qualitative, so in addition to the interviews, the material is based on the strata studied in the MeriLoki project. The strata studied are mixed-data and based on a literature review in Finland and Europe. The conclusions of the literature review produced during the project are summarized in this full paper.

3. Frame of reference

EU Member States are largely free to define the framework for remote sensing in their own legislation. Domestic legislation and plans for the coming years will support the development of remote sensing in shipping. Also internationally, autonomous shipping has taken significant steps towards more and more remotely operated vessels in the freight transport sector. However, freight markets and transport are international, so the adoption of remote pilotage requires not only legitimacy but also a consensus on the issue among the various stakeholders. In addition to shippers, the view of P&I insurers, for example, is a determining factor in the overall chain. [3] International development and research in the field can be seen as valid in a broader international perspective. The environmental impact of remote sensing should be assessed in detail and the cost and labor implications of remote sensing should be examined.

In Satakunta, Finland, it is possible to model remote sensing conditions: weather, chains of command, communication, in a collaboration between the ISTLAB (Intelligent Shipping Technology Test Laboratory) simulator and a 360-degree simulator. The MeriLoki project is mapping stakeholders' interests in different intelligent simulator solutions. [4]

4. The use of simulators

On the navigation side, ice navigation and dynamic ship positioning modules are the most important features of the simulators at SAMK. The management of different navigation situations under varying and changing current and wind conditions and the examination of port sections for planned industrial installations can be modelled in a simulator environment. The effects of different sea conditions on cargo handling equipment can be modelled with the help of the NAPA software. In a 360-degree navigation simulator, the manoeuvring of a ship can be practiced, before moving to the boom of a real ship in different ports in Finland and Europe. The equipment supplier's library makes it possible to obtain different types of vessels and ports for the customer's needs if they are not already on the list.

Through interviews with the most senior pilots, the study has revealed that remote pilotage still requires significant investment in Finland, for example in real-time current, wave, and sea level data. Real-time and lag-free data transfer between shore station and ship is also important in Finland's congested shipping lanes used by merchant vessels. Verifying and testing these things by adding the full potential of 5G networks to exercises is a major element in the development of networks. There is already significant development work on railways in Finland with the Finnish Transport Agency and commercial radio operators [5]. Research data on this issue, combined with the needs of the maritime sector, could be one rational solution. Finland is a pioneer in the development of train control, so the use of the data sets learned on inland waterways would be an important step in the development of maritime transport. Using a simulator to test the challenges, combined with research results from elsewhere, could be seen as an element worth experimenting with.

Investing in the development of chains of command by exploiting better cooperation between deck and engine simulators is one way of identifying problems in shipping and communication. Responding to and

communicating problems is another area where cross-departmental cooperation is relevant. Setting up a command centre and practicing rescue operations and going through search patterns with students, maritime officers and crew can be done in a simulator. Especially on passenger vessels, falls into the water occur with regularity, so it is important to have a Williamson reversible translation in the backbone for different types of vessels.

5. Modelling carbon neutrality in shipping

Ship owners and communities have been actively working towards a lower carbon footprint. In addition to major technological changes and fuel options, shipowners are working hard on issues such as route optimization or optimal speeds. Smart port concepts are looking for opportunities to reduce ship anchorage times where charter contracts allow. In liner shipping, ways of optimizing routes can be seen in terms of optimal port calls, route options and economy speed. Experiments have been widely adopted by ship owners and simulators allow for cost-effective modelling on a vessel-by-vessel basis. In SUAS, it is possible to optimize the routing of different types of vessels in different weather conditions. In addition to weather conditions, ice navigation and dynamic spot-fixing can be verified in advance, for example when modelling port infrastructures (Figure 1).

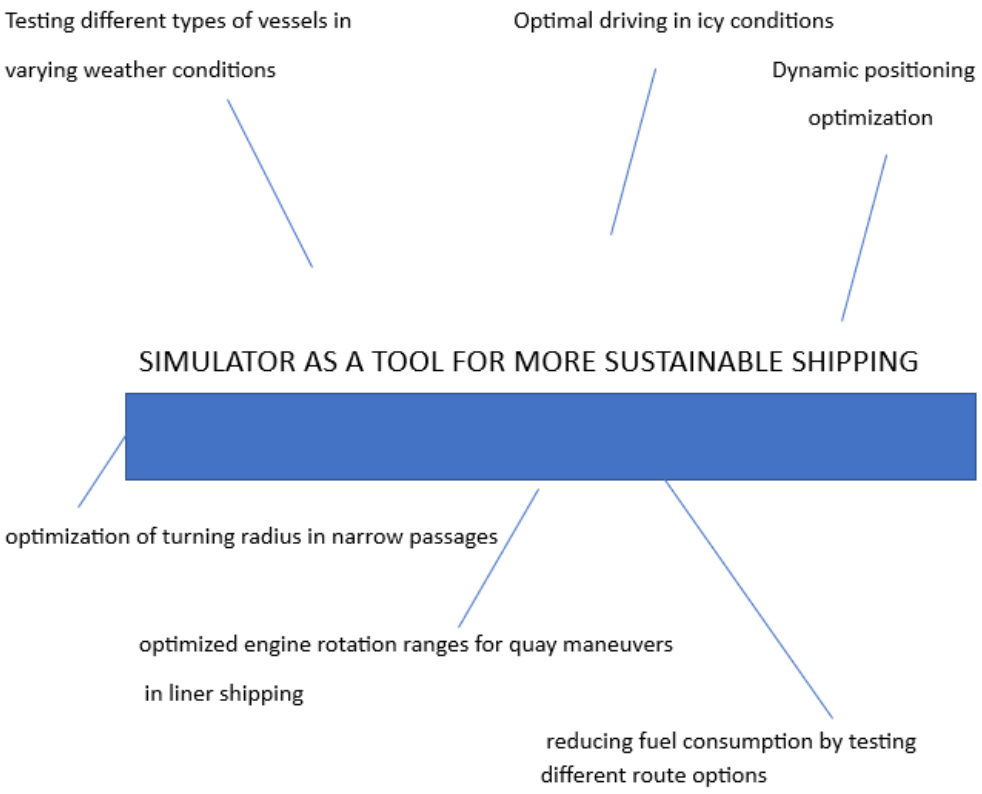

Figure 1: Optimizing the running of different types of ships is an important task for simulators.

6 Conclusions

The maritime simulators can help reduce the risks associated with on-the-job training, such as accidents, injuries, and environmental damage. They can also provide a controlled environment for practicing emergency response scenarios. The role of simulators is manifold: in addition to route planning, the initial parts of safety

and accident training, as well as further work on the practical parts, can be carried out in a variety of ways in simulators. The development of infrastructure and the suitability of different types of ships for different ports can be verified using simulator solutions. In addition, cooperation with the authorities and on-board cooperation between the engine room and the bridge are topics that are generally being considered for the further use of simulators. The construction of different sub-systems for the business environment is nowadays easily feasible. More research on the benefits of simulators is needed. It is also important to model the CO2 savings of the role of simulators. It would be important to map the emissions of simulators on a simulator-by-simulator basis and include this in the company's environmental protection programme. Aiming for zero emission electricity and the ICT sector's low-carbon communication is key as simulators and smart technologies proliferate. Automation and remote pilotage can play a major role in certain forms of transport. Complete remote sensing requires the ship's crew to have considerable detailed knowledge of the fairway. The role of simulators as a teaching and research tool is a step that would reveal the precise challenges in different geographical areas. The second part is the role of simulators in modelling ship consumption data. The role of different fairway sections in liner shipping may play an important role in the future as shipowners collect their data for EU and IMO collection systems. [2]

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