

Optimized Logistics Processes for Operation and Maintenance of Offshore Wind Farms

Over the past decade, offshore wind energy has evolved from a new renewable technology to a central component of the global energy transition. With the European offshore expansion target of 450 gigawatts (GW) in 2050, the market for operation and maintenance (O&M) will also grow. This will increase the need for optimized logistics concepts as well as cost-effective solutions, for example through:

- Developing O&M cluster concepts for offshore wind parks (OWP) by using artificial intelligence (AI);
- Increasing maritime safety through research & development (R&D) of new collision safety estimation methods;
- Improving the carbon footprint by optimizing existing O&M logistics processes.

This is where [the LogReview research project](#) comes in: Together with our project partners, we are evaluating Automatic Identification System (AIS) data from vessels sailing in and

AI in Port Logistics: Better Process Flows for Transport and Handling

Congested logistics chains are not uncommon in the maritime industry. Especially around the Port of Hamburg, there are often delays and traffic jams. This leads to planning uncertainty and increased personnel requirements. In order to reduce the traffic load, it is therefore necessary to focus in particular on existing logistics hubs.

[The KIK-Lee project](#) aims to make truck handling at empty container depots more efficient. KIK-Lee stands for „AI-supported key figures of empty container depots with the help of public data“. On the premises of HCS Hamburger Container Services, the few parking spaces and the location directly on the road quickly lead to problems during traffic jams. We are working with the company on an artificial intelligence (AI)-based solution to better predict the utilization of the empty container depot. On the one hand, these forecasts will enable the depot to better adjust to peaks in demand, and on the other hand, the trucking companies to avoid arrivals at peak times. In addition, the forecasted processing time will be used to calculate the length of stay of individual trucks at the depots. This facilitates route planning, so that the hub at the location

around OWPs. AIS is a radio system that continuously transmits data such as position, course and speed. In addition, we are evaluating Automatic Dependent Surveillance-Broadcast (ADS-B) data from aircraft such as helicopters involved in these logistics processes. One subproject goal of the CML is to increase collision safety in and around OWPs. Using historical AIS data and AI methods, we identify vessel routes in this sea area. By comparing the AI-based prediction of individual ship movements around OWP with the usual routes, we will be able to identify anomalies in ship routes. We will also use it to create an easy-to-use simulation environment for traffic around OWP. Routes could thus be modified to be less risky and also more economical.

Are you interested in this project? Please contact Manfred Constapel, team leader Maritime Informatics at Fraunhofer CML (manfred.constapel@cml.fraunhofer.de).

and thus also the logistical situation in Hamburg are relieved.

By using AI, significantly more reliable forecasts are achieved than with previous model-based approaches. External influences and causes for congestion and delays vary greatly in practice and must be taken into account in the AI system. For the development of the AI system, we therefore perform comprehensive analyses that include public data such as traffic conditions in addition to information such as container type or day of the week.

The developed AI system offers decisive advantages for the operators of the empty container depots, the haulage companies, and the logistics industry in Hamburg as a whole: utilization rates, arrival times, and processing periods can be better predicted and are directly linked. The successful methodology can be equally applied to other elements of the transport chain, such as packing stations and transshipment companies.

If you have any questions about the project, please contact Anisa Rizvanolli, team leader Maritime Scientific Computing and Optimization (anisa.rizvanolli@cml.fraunhofer.de).

Preface



Dear Readers,

In the last newsletter of the year, we again present very different projects that have one thing in common: They are exciting, promising and application-oriented. For example, KIK-Lee can be used to make truck handling at empty container depots more efficient, and LogReview can be used to optimize logistics concepts for the operation and maintenance of offshore wind farms. Keyword: cost-effective solutions through artificial intelligence. Digitalization can also reduce costs when it comes to the education and training of nautical personnel: for example, when situations can be trained realistically through simulation, thus eliminating the need for business trips to the training location. Unfortunately, there is often not enough space in the newsletter to present the practicality of our projects in detail. Many of our projects can be individually adapted to the tasks and requirements of industry and logistics. Please feel free to contact us!

I hope you enjoy reading this newsletter, wish you a Merry Christmas and a good start into a healthy year 2023.

Prof. Carlos Jahn
Head of Fraunhofer CML



The ship's bridge of the future is digital. © Denys Yelmanov/Shutterstock.com

More Efficiency and Higher Safety during Maneuvers - Nautical Education and Training 4.0

In maritime shipping, parts of education and training have long taken place in simulators, as in many areas of training aimed at the safe control of expensive real equipment and infrastructure. **Training in simulators provides sound preparation for common and uncommon situations** that cannot be practiced in reality in this number and variety. In addition, there are complex maneuvers and situations with other actors.

The digitalization push of recent years and the special conditions of the COVID pandemic have spurred the development of additional operational fields. In the field of education and training of nautical personnel as well as on board, **the use of augmented and virtual reality (AR/VR applications) opens up new solutions and possibilities**, the implementation of which is being developed and advanced at the CML.

The use of digitalization enables the optimization of scarce resources in the personnel area in ship and port operations. Simulator training increases the safety of operations and selected maneuvers. Gamification, the game character of the applications, increases sustainable learning success and demonstrably boosts motivation among employees. The **ability to conduct courses on the road or from the home office** further expands the range of use and reduces the amount of travel required by trainees. The first developments in this area are demonstrated by the „Fast Rescue Boat“ training application, in which maneuvers such as lowering a Fast Rescue Boat from the mother ship, traveling to the scene of the accident and then returning on board can be practiced externally with the aid of AR glasses and a laptop. This joint development by CML and the Finnish-German innovation platform FIP-S2@Novia is the basis of the i-Master research project, in which other important training courses for nautical training are being developed in virtual formats in a structured manner. In addition, the concept is geared toward efficient learning. AI-supported test runs are analyzed and identified knowledge gaps and application difficulties of the learner are taken into account for the next run, so that the focus is on content still to be learned.

Digitalization is also bringing a wealth of innovations on board. Data availability from navigation systems, about ship opera-

tions and the environment has multiplied in recent years. In contrast, crew sizes are often tight due to a lack of personnel and for cost reasons. New solutions are required here to process and make this increase in information available in a meaningful way. The use of VR/AR applications on the bridge can support and relieve the nautical personnel by reducing the amount of information and focusing on relevant tasks, especially in situations where valid decisions have to be made quickly. The technical prerequisites for this are cameras as well as optical and other sensor systems that record and monitor the ship's environment and operations.

To develop such solutions, **we analyze workflows of frequent maneuvers and determine the required data and information.** Docking and unmooring maneuvers are the focus here. They are very complex due to the involvement of various people such as pilots, tug personnel, mooring personnel, crew and nautical personnel.

In addition to the selection, the preparation of the information is a decisive factor in the implementation: **Only if the information is displayed in a suitable form and in the „right“ place, the user can perceive and use it in time.** The programming of these user interfaces is also carried out at the CML and evaluated by tests. An initial implementation shows: Based on the use of cameras and other sensor technology, information on the position of the ship, tug and lines can be provided to the responsible nautical officer as AR information in a pair of data goggles, making the maneuver more transparent, efficient and safe for him.

Conclusion: Digital solutions for maritime training and education offer efficiency gains through result-oriented and adaptive learning processes. Improved training through gamification increases safety. And the use of AR/VR applications on board improves complex maneuvers to the benefit of crew and ship operations. Last but not least, optimized workflows usually hide significant savings potential.

Curious about possibilities that can be implemented in your company? **Contact Robert Grundmann**, team leader Nautical Solutions at the CML (robert.grundmann@cml.fraunhofer.de).

Briefly Noted

*The time has finally come: We are moving into **our new building at the Harburg Lotsekanal**. Up to 100 employees will be able to use the new offices, laboratories and workshop areas on around 2,400sqm. Modern concepts of creative and flexible collaboration are planned as well as rooms for presentations and meetings. We look forward to welcoming you at one of our events next year!*

*Fraunhofer CML is investigating the use of quantum computing to solve complex logistics problems such as route, personnel and congestion planning. In our white paper „Quantum Computing in Maritime Logistics“ we present many ways in which companies can benefit from the new technology. We are delighted to be part of the **quantum technology initiative Hamburg Quantum Innovation Capital (hqic)**!*

Dates

4 May, 2023: **Maritime Innovation Insights 2023**, CML's annual lecture event, Hamburg

9-12 May, 2023: **transport logistic**, Munich

Fridays at 12 pm: **Maritime Innovation Update**, digital lectures of CML



@fraunhofercml



Fraunhofer CML

Imprint

Fraunhofer Center
for Maritime Logistics and Services CML

Blohmstraße 32
21079 Hamburg

Telefon 040-7941681-1001

info@cml.fraunhofer.de
www.cml.fraunhofer.de