Fraunhofer CML

Fraunhofer Center for Maritime Logistics and Services

News 4.21

After Sales Services in the Maritime Industry: Digital Concepts Enable Optimization

Maintenance and repair processes on merchant ships are subject to special challenges. A ship is a complex system for which, due to the large number of different components for propulsion and operation, no digital image exists to date: Predicting a system failure is difficult. The location where repairs or maintenance can be carried out cannot always be predicted with certainty. And the required service technicians as well as parts and materials are often not reliably available where they are needed. The last two points in particular characterize the maritime sector compared to other industries. All the more reason why accurate prediction of material wear and system failure would be helpful in avoiding unplanned port and shipyard calls.

These challenges are being addressed by the MARIA research project. On the one hand, a maritime service platform for the realization of digital services is being designed. In addition, AR-based assistance systems for the crew are being developed, as well as prognosis modules that monitor and evaluate relevant (sensor) data and analyze it with regard to the failure probabilities of the components.

For this purpose, various analysis methods are used at the CML, such as data mining, machine learning and AI, which recognize certain patterns in this data and thus predict expected failures at an early stage. Data availability and transfer represent another important prerequisite for this, which must be managed during the course of the project. To ensure that the results obtained can be transferred to suppliers' service concepts, the project will also develop solutions for innovative service planning and control. Depending on the current system status, these will trigger specific messages to the manufacturer. The combination of these solutions promises to raise the service level in after-sales service to a new level for the benefit of the supplier industry and customers.

MARIA is being funded by the BMBF for a period of two and a half years. In addition to the Fraunhofer CML, eight other partners are involved in the project.

Simulation and Automation of Maritime Shipping - Expansion of Competencies in Finland

The development of assistance systems for maritime shipping has been an important research focus at the CML for many years. A concept for an autonomously operating merchant ship formed the starting point for the development of a number of technologies, which have since been further developed and tested using the CML's ship handling simulators. Examples of the new solutions include a shore control station that enables comprehensive monitoring of a fleet of ships from shore, and an autonomous navigation system that detects potentially dangerous situations at an early stage and suggests rule-based responses when necessary.

To open up further dimensions of maritime simulations, researchers at the CML developed the European Maritime Simulator Network EMSN. Currently, 37 ship bridges at 13 locations worldwide can be connected to perform virtual joint maneuvers, to simulate critical situations or to test new communication solutions. The collaboration with Novia, the university in Turku, Finland, has now led to the establishment of the first Fraunhofer Innovation Platform in Finland, „Fraunhofer Innovation Platform for Smart Shipping at Novia University of Applied Sciences", or FIP-S2@Novia for short. The mission is to develop intelligent maritime systems for the Finnish maritime cluster in cooperation with companies in this field.

The extensive simulation infrastructures and the bundled know-how will initially be implemented in a mirror of the EMSN, so that large virtual maneuvers can also be initiated and carried out from Finland.

A new step towards virtual integration will be presented by FIP-S2@Novia at Nor-Shipping 2022 in Oslo: another player will be integrated in a simulation via VR goggles used to control SAR operations of a fast rescue boat.

Foreword

Dear Readers,

with 2021 in our wake, we have grown more than ever before. Soon, 100 colleagues will be working at the CML - researchers, students and administrative staff. With this growth, our research topics have also expanded.

Initial developments of digital twins - that is, the digital representation of a material object - are expected to provide new opportunities for after-sales service in the maritime industry in on-demand maintenance and repair of critical systems on board.

The observation and documentation of emission data supports the maritime industry in showing a measurable contribution to the prevention of climate change.

Last but not least, we are strengthening our maritime simulation infrastructures with the first Fraunhofer Innovation Platform in Finland, Fraunhofer Innovation Platform for Smart Shipping in Turku.

We hope you enjoy reading this issue, wish you a Merry Christmas and all the best for 2022.

Yours,

Prof. Carlos Jahn
Head of Fraunhofer CML


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Emissions in Shipping: Data Enables Control

According to the International Maritime Organization (IMO), 2.9 percent of all greenhouse gas emissions worldwide are attributable to shipping. Regulations of the IMO and the European Union have been increasing the pressure on the maritime industry to act for years. Since 2020, for example, there has been a global cap of 0.5 percent on the amount of sulfur in ships' exhaust gases. Large ships calling at European ports must monitor and report on their CO_2 emissions. This requires new systems for measuring and monitoring emissions on board.

As part of the SCIPPER project (acronym for Shipping Contributions to Inland Pollution Push for the Enforcement of Regulation), a flexible measurement system for monitoring ambient air has been developed. The Mobile Environmental Sensor Unit (MESU), a compact sensor unit developed at the CML, enables inference of ship emissions by measuring immissions using electrochemical sensors to measure selected parameters. With a maximum power of 30 W, the MESU is mobile and stores all measurement data locally, provided with a time stamp. A continuously recorded GPS signal provides additional location information. All information from the sensor unit can be clearly read and easily evaluated both directly and for later evaluation in a web portal.

In its current configuration, the MESU has sensors for NO, NO_2, SO_2 and CO_2, and can be used not only on ships but also, for example, in ports or on busy roads.

Especially the reliable measurement of emissions turned out to be a real challenge for shipowners with the EU reporting obligation of CO_2 emissions of ships during voyages from, to and within European waters, which has been in force since 2018. In global shipping, with frequent route changes due to weather conditions, trusted emissions projections are not feasible. A tool for reliable emission forecasting and estimation was missing, and became the goal of the EmissionSEA project. The software prototype for calculating CO_2 emissions is intended to support shipping companies in fulfilling their reporting obligations and at the same time show them the enormous potential for saving fuel and CO_2 emissions with even minor speed reductions.

The data basis is comprehensive. Fraunhofer CML applied its expertise in Weather Routing and Big Data Analysis to process more than 500,000,000 daily AIS data records. From the Automatic Identification System (AIS), movement information was related to vessel size, speed, and meteorological and oceanographic environmental conditions. From this data, as well as information from the meteorological service, speed, and other external influences, fuel consumption and finally emissions will be determined with hourly accuracy.

The results from EmissionSEA will serve as a reference variable for the shipping companies' calculations. In the software prototype, users can select a comparable ship type and calculate its CO_2 emissions. The user-friendly application and smart software supports shipowners in meeting their obligation to prove emissions. The simple calculation of fuel consumption for voyages to and from Europe also provides incentives for avoiding emissions.

The pressure to curb emissions in maritime transport is high. New technologies and applications for data collection and measurement offer more control and show the maritime industry room for maneuver.

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Briefly Noted

New Research Content
Information from our projects and on our current research topics is presented by our researchers once a week. The digital short presentations of our **Maritime Innovation Updates** bring solutions and ideas to the point in a quarter of an hour. Find the program on our homepage and register now!

YouTube
Thanks to the long months of the pandemic, we are creating films and recordings on many of our research projects and topics. Feel free to browse our animations, lectures, documentaries and video clips in our **new channel Fraunhofer CML**. E.g. on our research boat SeaML, our solution for the collection of maritime waste and impressions of our new building project in the Harburg inland port.

Events

Maritime Innovation Update

Our series of digital lectures,
every Friday at 12 noon

Nor-Shipping 2022

Solutions for maritime processes with the help of VR and data evaluation
January 10-13, 2022, Oslo

Maritime Innovation Insights

The CML lecture event
May 5, 2022

Imprint

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