MARIA

- **Augmented reality and AI services for the maritime after sales**

- **Off-shore data exchange and connectivity**

- **Innovative business models and service products**

Research Groups at Fraunhofer CML

Sea Traffic and Nautical Solutions
The Sea Traffic and Nautical Solutions Group addresses issues related to nautical safety and control: Are existing port layouts suitable for future developments? Which technologies are required for the autonomous control of a ship? And how can an autonomously operating ship be monitored from shore? Among other equipments, the scientists are using three ship handling simulators to develop answers to these questions.

Ship and Information Management
In Ship and Information Management, solutions are being developed for tasks in optimization situations and for maritime communication issues. Modern information management on board and ashore offers considerable potential for efficiency and economy. The focus is on personnel and procurement processes, which often account for a large proportion of operating costs. For this reason, the CML has developed a solution for optimizing crew deployment on board.

Ports and Transport Markets
Ports and Transport Markets development is all about analyzing and forecasting maritime transport chains and port locations. Strategic location concepts for ports and terminal layouts are developed here. These are displayed two- or three-dimensionally on a smartboard for further analysis.

Port Technologies
The Port Technologies group deals with research questions relating to automation and digitization in the port environment. The focus here is on the safe, economical and low-emission design of processes and structures with regard to cargo handling in port terminals.

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Motivation of the MARIA project

Ships exhibit a high degree of individualization and technical complexity. Uninterrupted operating times over several weeks are crucial here for economic use. Ideally, the crew must be able to carry out maintenance processes independently, for example, in order to prevent expensive breakdowns. However, the immense number of shipbuilding suppliers means that, unlike the digital factory, a complete digital ship model is rarely available to support operations and maintenance tasks.

Just as the maintenance of industrial plants on land is increasingly being improved by augmented reality (AR) and intelligent assistance systems, the joint project „MARIA" aims to implement these technologies economically and technically for the maritime sector as well.

Project Partners:

Solutions of the MARIA project

The central interface
The datahub developed by InMediasP is a software-based, centrally located service within the system of all MARIA products. Its tasks include the provision of application-related data such as telemetries, anomalies and other data coordinated with the project partners, the receipt and storage of data, and data transformations. The datahub is accessed via secure, rights-based interfaces. It also serves as a registry for all existing services provided by project partners.

Intelligent monitoring of critical systems
The condition monitoring service product developed by Fraunhofer CML and Zeppelin Power Systems GmbH makes it possible to maintain an overview of the condition of on-board systems and to initiate countermeasures in good time in the event of damage by monitoring the individual components of the machines under consideration in real time using over 50 data-based AI algorithms. As soon as such anomalies occur, relevant stakeholders are notified directly and receive automated condition diagnostics as well as textual and graphical descriptions of the irregular condition.

Free hands for the ship's mechanics
FoP Consult GmbH has developed two AR-based software products: The „Universal AR Information Delivery & Tagging" product and the „Field Knowloedge Capture and AR Work instructions" product. Mixed reality glasses are used in these research results. The glasses ensure hands-free operation of the service technician and enables the implementation of the advanced localization system based on the existing tracking. The solution obtains its data from the datahub via a KAFKA/MQTT connection. Only a connection to the planned ship server is required to operate the system. An internet connection is not mandatory, meeting an important requirement for the maritime industry.

AR-powered aftersales communication
Wärtsilä is planning an AR-enabled service assistance system for technical and commercial communication between all the players involved in maritime aftersales. With a „Vessel's Value

Vault," a Wärtsilä assembly fed with data can illustrate the information needed to find a solution to the crew on board, as well as to the operator on shore and service partners such as a shipyard or diving team. This helps the decision makers to choose within minutes the technically and financially well-balanced solution.

No more incomprehensible maintenance instructions
The Machine@Hand-AR solution developed by Fraunhofer IGD supports the worker with step-by-step 3D/AR maintenance instructions that describe his further procedure directly on the corresponding system or machine. In this way, even untrained personnel are enabled to perform these activities with the support of a tablet. The Interactive Visualization of Machine-Related Data (IViMaD) module is used to visualize and interact with operating data with a spatial reference. The machines are marked with a QR code, which is recognized and enables access to linked data and specific information with spatial assignment.

The data highway to the ship and back
A high-performance, flexible and requirement-oriented communication infrastructure for the ship-to-shore connection is the basis of the platform. Within this framework, DRYNET GmbH has developed the "BRYTE" Smart Edge Node. BRYTE communicates via API with the ship applications, provides them with connectivity and network information.
BRYTE orchestrates the network infrastructure on the ship, as well as all wide area networks available on the ship. This includes standard and broadband satellite links via LEO and GEO systems, public mobile networks in 4G and 5G standards, as well as WLAN systems in port.

Access for maritime operators
The developed maritime service platform "PaSimU" of Wiegershaus GmbH serves as a marketing platform for the developed products and services. The aim of the platform is to "proactively" shape the maritime industry. Customers, OEM's or other interested parties receive proactive service offers via the platform, can inform themselves about them and, if interested, make the purchase via the platform

Potentials for the maritime industry

In the future, companies in the maritime sector, such as suppliers or shipping companies, will be able to realize their digital services for ship operation via a maritime service platform. Using concrete use cases, the interdisciplinary MARIA project consortium has investigated how the key technologies of augmented reality, intelligent assistance systems and machine learning or artificial intelligence can be used in the operational phase of maritime systems with the help of a platform. The future potential lies in the further development of the maritime service platform, which supports companies in the maritime industry in using or being able to offer digital services for ship operation.

Fraunhofer CML

The Fraunhofer Center for Maritime Logistics and Services CML develops innovative solutions for the maritime sector and the maritime supply chain.

We support companies and institutions from shipping, port management and logistics in initiating and implementing future-oriented technologies and processes.

Starting from everyday challenges, our interdisciplinary teams develop customer-specific solutions for private and public clients. In four research fields our employees transfer the latest scientific findings from the diverse research activities into practice-oriented applications.The focus is on solutions for end-to-end digitization and process automation, service concepts and AI-supported data analysis, as well as autonomous maritime systems and sustainable shipping.

The innovative concepts are tested and improved at the CML through modelling, simulation and real-time application.

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