

Maritime Training Simulations - Fast Rescue Boat Case Study

With the advancing technology in recent years, the use of efficient VR and AR applications has gained momentum. VR enables the representation of a virtual world using a head-mounted display (VR glasses). The user can freely move around and interact with this virtual world. There are many advantages to using VR training. The central point is that seafarers can train close to reality, independent of time and location. This can also reduce the amount of training required on board. The game character of the application, the „gamification“, also makes it intuitive and increases the learning success. Once completed, the training scenarios can be repeated as often as required. Theoretical basics can thus be consolidated before practical implementation. The fact that the training is not tied to a specific person or location means that it can also be carried out outside the training facility. All that is required is a powerful computer and VR goggles. Instructions are given during the training session by voice, text or image. In times of contact restrictions and in an increasingly flexible working world, the use of VR training units offers great opportunities.

Through the individual conception and integra-

Autonomous Operations under Water - Challenge of Locating and Positioning

Autonomous technologies have become an indispensable part of many everyday processes, such as mobility, and help to make them safer, more efficient and more resource-saving. In the EU-funded research project [SeaClear](#), the CML develops solutions for autonomous operations under water together with eight partners. SeaClear is a system of autonomous vehicles that identify and collect maritime debris from the air and underwater. Underwater, environmental parameters place high demands on people and equipment. Great water depths, high pressures, fundamentally poor visibility, and darkness after a few meters present limitations or hazards for divers, which is why remotely operated vehicles have long been used in areas of research, exploration, and exploitation. The turbidity of the water, deflection or attenuation of signals, and the aggressiveness of (salt) water require new approaches.

Operations use a lot of electronics and IT. Camera systems and other sensors record envi-

ronmental data, IT systems process them and develop appropriate responses for dynamic situations. In the SeaClear project, the CML ensures the smooth interaction of hardware and software. The CML is also developing the collection basket for maritime litter and the special interfaces for the gripper, which is to reliably place collected litter in the basket. This requires some intelligence so that the gripper can safely control the basket. Pressure sensors and underwater GPS enable three-dimensional localization to within a few meters. The use of further electronic filters and measuring systems limits this radius to one meter. And to actually dock the waste gripper, both optical tools such as light and markers and a mechanical guide rail are used. Successful tests at the Port of Hamburg in May confirmed the functionality of the developments. So the CML is now successfully driving the automation of processes underwater as well.

tion of VR applications, the training of seafarers can be raised to a new level in terms of practical relevance.

In this context, the CML has developed a complete VR training unit in cooperation with the Fraunhofer innovation platform FIP-S2@Novia in Finland. The „Fast Rescue Boat“ application maps the deployment of a rescue boat in a simulation environment. This enables virtual maneuver training of, for example, nautical personnel on board and rescue workers. The focus of the application is on the observation and execution of the different work steps during the deployment of the (virtual) boat. These are in particular the preparation of the training equipment, the lowering of the lifeboat, the rescue of a POB (person-over-board) as well as the docking of the lifeboat to the ship after completion of the mission. The project was presented at Nor-Shipping 2022 in Oslo and received great interest from trade visitors.

Further virtual training sessions are possible and especially planned around processes for the future, e.g. for safety exercises on board.

Foreword



Dear Readers,

Normality is returning. Different than before, but finally with personal reunions and more intensive, spontaneous exchanges than all meeting tools allow. As much as we have come to appreciate them, we were happy to welcome the many guests on site at our lecture event Maritime Innovation Insights in early May.

We are already looking forward to many more visitors at our booth no. 327 in hall B6 at the world's leading maritime trade fair SMM in September. In the meantime, we are finally allowed to move into our new building in Harburg's inland port - we have been waiting for this for a long time and are full of anticipation. Our autonomous research boat SeaML will soon be able to moor directly at the building, for example, for tests with our collection basket for maritime waste.

Our virtual Fast Rescue Boat, on the other hand, will remain in our new simulation environment in the new building. We report on these projects and on „Quantum Computing in Maritime Economics“ in this newsletter and hope you enjoy reading!

Prof. Carlos Jahn
Head of Fraunhofer CML



Das autonome Forschungsboot SeaML im Hamburger Hafen. © Fraunhofer CML

The Quantum Leap for the Maritime Economy

The use and possibilities of quantum computing have been a topic of research for decades. However, we are currently experiencing a particularly exciting phase, as practical application is paving its way and moving closer step by step. A wide range of potentials are being created and exploited at the same time. Quantum computers can be used to optimize processes on a completely new scale and to find solutions that were previously unattainable.

Modern quantum computers are not bound to the algorithms of conventional computers and are therefore real game changers. Industry benefits from great efficiency and flexibility, because quantum computers can consider several possible solutions simultaneously. In doing so, they require fewer computational steps than ordinary computers, which often face search problems in the face of too many options. Quantum computers are thus the crucial tool for mathematical optimizations that can be used to further develop and completely reinvent systems in the maritime industry.

The Fraunhofer Competence Network Quantum Computing

To promote application-oriented research, the Fraunhofer-Gesellschaft established the central competence network Quantum Computing in 2021. Since then, the Fraunhofer-Gesellschaft has had access to powerful hardware in the form of the IBM Q System One quantum computer. It is also the heart of the Fraunhofer competence network for quantum computing.

Divided into eight competence centers, each with its own focus, the network ensures close cooperation with partners and customers from research and industry, also at regional level. In this way, it forms a contact point for companies and research institutions that want to advance the use of quantum computers. This applies both to first-time users and to experts involved in the development of new algorithms. Customers of the Fraunhofer Institutes can familiarize themselves here with the industrial applications of the topic. In addition to offering training and consulting services for the use of quantum computers, the competence network also provides a research infrastructure for commercially relevant applications and demanding requirements to which quantum computing is geared. Participating companies and research institutions thus gain a competitive edge in the economic

and innovation landscape.

Quantum computing for the maritime sector - roadmap to practical implementation

Fraunhofer CML combines knowledge and experience in maritime logistics, mathematical optimization and quantum computing, making it the ideal candidate to support companies in the implementation of this new technology. Fraunhofer CML bundles its expertise in the research field „Ship and Fleet Management“. To accompany customers in corresponding projects, the CML has developed a roadmap for quantum computing projects for application in the maritime industry. The roadmap provides a basic structure to efficiently approach individual issues. In a first step, challenges with optimization potential are identified, for which a mathematical model is set up and developed in the following. The design of this model is very complex. A front end is provided to translate real-world planning into corresponding solution options for the quantum computer. The experts at the CML also select a computing platform whose mode of operation adequately matches the requirements of the task at hand. In this way, an individual approach can be generated for the respective tasks and projects. Through our selection of bridging technologies, the CML actively drives the development of the use case while at the same time elaborating specific quantum algorithms. With this support, maritime companies can bridge the gap between development on the one hand, and operational deployment of leading-edge technologies on the other.

Due to the flexibility in platform selection at Fraunhofer CML, services and solutions can be developed according to the needs of industrial customers to solve modern optimization projects, such as the automation of logistics planning tasks. Whether network optimization, congestion planning or deployment & resource planning - mathematical optimizations are not only made future-proof at Fraunhofer CML through the use of quantum computing, but are also raised to a whole new level. Read more about the topic in our [new brochure](#), which you can find on the website www.cml.fraunhofer.de/en. Or get in touch directly with your contact at the CML, Dr.-Ing. Anisa Rizvanolli (anisa.rizvanolli@cml.fraunhofer.de).

Briefly Noted

On June 2, 2022, four Fraunhofer institutes, besides the CML the ITMP, IAPT and IAP, exhibited together at the **Hamburg Innovation Summit HHIS** and showed the broad spectrum of Fraunhofer research in Hamburg. Our demonstrator for damage detection on empty containers inspired the visitors as well as exhibits of new solutions for sustainable construction and intelligent energy use. The new Quantum Computing Application Center of the Hamburg Fraunhofer Institutes was presented and explained to Science Senator Katharina Fegebank during her visit to the booth.

A nice success was our first hybrid lecture event of **Maritime Innovation Insights** on May 5. Around 50 participants followed the presentations on optimizing fleet operations, real-time systems for smart ships, hydrogen logistics and water cargo barge, and robotics and AI in port operations. More than 120 additional audience members participated in the live broadcast. The sessions can now be viewed (in German) on our YouTube channel „Fraunhofer CML“.

Events

Maritime Innovation Update

Our digital lecture series, each Friday at 12 pm

III. International MARISSA Symposium - „Safe, Secure and Sustainable“

June 21-22, 2022, Bremerhaven

SMM 2022

The leading international maritime trade fair, September 6-9, 2022, Hamburg

Imprint

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