

Newsletter 3.26



Dear readers,



maritime transformation is gaining momentum – and Fraunhofer CML actively shapes this change through applied research and innovative technologies. At the SMM and All About Ports trade fairs in early September, at Hamburg Messe and the Congress Center, we will show, among other things, how artificial intelligence, autonomous systems and quantum-optimized solutions can help make shipping and ports safer, more sustainable and more efficient. The focus is on innovative technologies for maritime practice: from AI-based voice control on the ship's bridge to mobile robotics for ports and real-time situational awareness for resilient maritime infrastructures.

Visit us at our exhibition booths and discover how current research projects pave the way to application.

We look forward to your visit!

Kind regards,

Prof. Dr.-Ing. Carlos Jahn

Head of Fraunhofer CML



SMM

**Hall B
Booth 230**

Members of the Fraunhofer Transport Alliance's "Waterborne" research group present themselves at SMM 2026.

Fraunhofer CML at SMM 2026: AI for Shipping

When the international maritime industry meets at SMM in Hamburg from September 1–4, 2026, the "Waterborne" research group of the [Fraunhofer Transport Alliance](#) will present application-oriented research for the transformation of shipping. Together, five Fraunhofer institutes showcase solutions for more sustainability, digitalization and competitiveness along the maritime value chain. The focus is on technologies that accelerate the transfer of scientific findings into maritime practice.

Fraunhofer CML demonstrates how artificial intelligence, sensor technology and data-based methods can make ship operations safer, more efficient and more resilient. Visitors gain insights into current developments for the bridge of the future: [EyeCaptain](#) combines camera images, thermal imaging and navigation and sensor data into an enhanced situational picture, supporting the bridge team in the early detection of critical traffic situations.

The speech recognition system [Voice-to-Report](#) transcribes spoken maintenance logs, enabling efficient and fast service report generation. With [NEMO](#), Fraunhofer CML also presents a voice-based operating system that enables natural human-machine interaction on the ship's bridge and supports watchkeeping through reliable off-

line speech recognition. Furthermore, Fraunhofer CML shows forward-looking approaches for navigation and operational planning. A GNSS-independent positioning method uses an array of eight cameras to enable reliable navigation even without satellite signals.

In addition, the [MIRP project](#) illustrates how quantum computing can be applied to complex route and deployment planning for bulk carriers. By intelligently linking transport orders, ship availability and storage capacities, operations can be optimized, downtime reduced and resources used more efficiently.

The technologies presented support shipping companies, ports, shipyards, logistics companies and authorities in increasing safety, efficiency and sustainability. Visit us at [SMM 2026](#) at the Fraunhofer joint booth in Hall B, Booth 230. We look forward to exchanging ideas with you!

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Hall H
Booth 202

At All About Ports, Fraunhofer CML shows how research shapes the port processes of tomorrow.

AI and Robotics: Fraunhofer CML at All About Ports

Parallel to SMM, Fraunhofer CML presents innovative solutions for the digitalization, automation and sustainability of port processes at [All About Ports](#) on September 2–3, 2026. The trade fair offers the ideal setting to engage with representatives from the port industry, logistics, manufacturing and public administration on current challenges and future-ready technologies.

The exhibition focuses on three thematic areas that illustrate the transformation of modern port infrastructure. With the research [project GRIP](#), Fraunhofer CML demonstrates how artificial intelligence supports the condition monitoring of crane ropes. Through automated image data analysis, signs of wear can be detected early, maintenance measures planned more precisely, and unplanned downtime reduced. This helps increase the availability of critical port infrastructure and makes maintenance processes more efficient.

Another highlight is the hydrogen research [project H2AM](#) (Hanseatic Hydrogen Center for Aviation and Maritime). Together with partners, Fraunhofer CML develops research infrastructures and methods to test hydrogen and fuel cell technologies for maritime applications under realistic conditions. The aim is to scientifically support the market rollout of climate-friendly propulsion techno-

logies and to help companies transition to low-emission processes.

In addition, [robotics solutions for port environments](#) will be presented. Using mobile robotic systems, intelligent sensor technology and state-of-the-art test infrastructure, Fraunhofer CML shows how transport, inspection and handling processes can be made safer. The systems learn to autonomously optimize and coordinate complex transport tasks. They help port operators relieve staff and design processes that are both resilient and economically viable.

Combine your visit to SMM with a short trip to the nearby All About Ports. We look forward to presenting our latest developments and discussing new perspectives for the port of the future with you at Booth H 202!

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Maritime Situational Awareness Creates Security

The research projects [DIEB](#) and [KIRMES](#) develop intelligent solutions for a comprehensive maritime situational picture that detects movements of objects on water and in the air around critical infrastructure. Different data sources are linked to capture, analyze and provide security-relevant information in real time for well-founded decisions. The focus is on a combination of state-of-the-art sensor technology, data fusion and AI-based analysis methods. Digital sensor data is merged, evaluated and used to detect anomalies such as unusual traffic patterns, GNSS disruptions or potential threats. Within the projects, Fraunhofer CML is responsible for designing system architectures, integrating various data sources, and developing and validating AI-based methods for pattern recognition and risk assessment. [Mobile sensor platforms](#) such as Cells on Wheels and the [research vessel VEKTOR](#) enable testing under realistic conditions.

The technologies developed provide a robust decision-making basis for port operators, authorities and operators of critical infrastructure. Through greater transparency, faster situational assessments and shorter response times, DIEB and KIRMES help sustainably strengthen the resilience of maritime systems. At the same time, the modular approaches allow flexible adaptation to different deployment scenarios, laying the foundation for a future-ready, data-driven security architecture in the maritime domain.

◀ *A Cell on Wheels (CoW) in action.*



Learn more about DIEB and KIRMES in the special newsletter edition on maritime security!



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With SeaDragon, Fraunhofer CML tests intelligent navigation and safe autonomy in a real-world environment.

iPORTUS: Autonomous Systems for the Port of the Future

Among the developments for the maritime transformation that Fraunhofer CML presents at SMM 2026 is the [research project iPORTUS](#). Conducted together with Kongsberg Defence & Aerospace under the project leadership of the Hamburg Port Authority (HPA), the project safely integrates autonomous and low-emission watercraft into complex port environments, opening up new perspectives for efficient, resilient and sustainable port operations.

The maritime industry faces manifold challenges: growing pressure for efficiency, the decarbonization of processes and increasing digitalization all call for new technological approaches. iPORTUS develops solutions for the deployment of semi-autonomous and remotely monitored Autonomous Surface Vessels (ASVs) in port operations. The focus lies not only on the technical performance of the systems but also on their safe integration into existing workflows and regulatory frameworks.

A key part of the project is the development of intelligent navigation and safety functions. These include AI-based obstacle detection, collision avoidance, and robust navigation via sensor fusion that also functions independently of classic satellite-based systems. In addition, a Remote Operation Center is being developed to enable the safe

monitoring and control of multiple autonomous vehicles. This links technological capabilities with requirements for operational safety and approvability. Within the project, CML is responsible for key developments concerning the autonomy and nautical safety of the deployed systems. Furthermore, the researchers design concepts for the safe operation of autonomous vehicles as well as analysis and evaluation approaches that support the transfer of these technologies into practical applications.

For companies, port operators and authorities, iPORTUS provides a basis for assessing and helping shape the deployment options of autonomous systems. Tests in the Port of Hamburg deliver insights for scalable solutions – ranging from automated inspection tasks to new operating models for autonomous fleets. In this way, Fraunhofer CML contributes to the safe and sustainable advancement of maritime logistics, demonstrating how research and practice together pave the way toward safe, automated port operations of the future.

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Smart glasses convert spoken observations directly into structured maintenance reports. (Symbolic image)

AI-Assisted Systems for Maintenance Documentation

Service reports in industrial maintenance must be precise, comprehensive and completed without delay – a task service engineers often have to handle alongside their technical work. The [project „Voice-to-Report“](#), carried out in cooperation with Wärtsilä Deutschland and Adtance GmbH & Co. KG, addresses exactly this challenge and decisively advances the digitalization of maintenance processes.

At its core is a pair of smart glasses with an integrated camera and microphone that converts spoken explanations directly on site into structured text – even under difficult acoustic conditions, such as heavy machine noise. New in the course of the project is the consistent further development of multimodal processing: voice data and automatically captured photos are intelligently linked by AI models. This results in consistent reports ranging, depending on the job, from ten to more than one hundred pages, automatically tailored to the respective requirements.

Within the project, Fraunhofer CML is developing robust AI methods designed for the specific demands of maritime and industrial operating environments. A particular focus currently lies on improving speech recognition under real operating conditions as well as on methods

that make maintenance histories and wear patterns of identical components systematically comparable. This allows potential damage to be identified at an early stage, downtimes to be reduced and operational safety to be sustainably increased. For partners from industry and public authorities, this offers a twofold benefit: on the one hand, the documentation workload for service teams drops considerably, since manual report writing is eliminated and specialists can concentrate on their core expertise. On the other hand, a reliable, searchable data basis emerges that supports well-founded decisions on maintenance strategies and spare parts planning in the long term.

With this development, the project positions itself as a forward-looking building block of a digitalized, AI-assisted service landscape. Interested companies and institutions are invited to learn about current project progress and to enter into dialogue with our team. We look forward to hearing from you!

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The complex deployment of tugboats is set to be optimized by hybrid quantum algorithms in future. (Symbolic image)

Quantum Computing Orchestrates Tugboats in the Port of Hamburg

Anyone watching tugboats at work from the banks of the Elbe hardly suspects the complex logistics behind it. Short-notice berth changes, unplanned additional jobs, crew rest periods, maintenance windows, weather and tides – all this turns tug scheduling into a highly complex optimization problem at which conventional software quickly fails.

This is precisely where the [project „Quantum Tug Scheduling QTs“](#) comes in. soft-park GmbH, the FAIRPLAY Towage Group and Fraunhofer CML are jointly developing a hybrid optimization method that combines classical computing approaches with quantum computing. The idea: continuous subproblems are solved by classical solvers, discrete subproblems are handled by quantum algorithms – depending on where each approach can play to its strengths.

Fraunhofer CML is responsible for the application-oriented requirements analysis, models the scheduling task as a mathematical optimization problem and develops the appropriate decomposition and quantum algorithms. To ensure that the research does not remain in an ivory

tower, the team went directly on board the tugboats and into the FAIRPLAY control center to capture real-life operating procedures. The results are to be incorporated into a user-friendly interface for operations management that can be integrated into existing systems – and will be tested in everyday port operations. The expected benefits are more precise deployment plans, fewer empty runs as well as lower fuel consumption and CO2 emissions, while reliable tug availability is maintained.

The two-year project, which started in July 2025 and is coordinated by soft-park as consortium leader, receives financial support from IFB Hamburg under the PROFI Transfer program. The aim of the funding is to enable Hamburg-based companies to gain practical experience with quantum computing at an early stage – thereby securing technological leadership in a forward-looking field of innovation.

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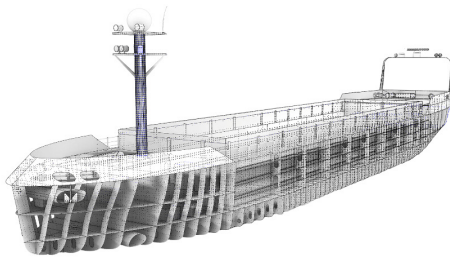
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Small Ships, Great Prospects: AUTOFLEX at SMM

With [AUTOFLEX](#), Fraunhofer CML is developing a new transport system for small, autonomous and zero-emission inland vessels together with European partners. This project, too, will be presented at SMM, showing how innovative concepts can shape the maritime logistics of tomorrow.

At the heart of AUTOFLEX are vessels capable of reliably transporting goods even on small waterways, in narrow channels and at low water levels. The concept is complemented by new cargo handling and energy supply structures that allow flexible integration into existing logistics chains. Fraunhofer CML actively shapes the development of the new transport system, drawing on its expertise in autonomous shipping, logistics planning and maritime technologies. Among other things, this includes approaches for assessing the safety of autonomous navigation systems as well as for analyzing the operational status of autonomous vessels.

Find out at SMM how AUTOFLEX helps to unlock new potential for lower-emission and resilient maritime logistics.



Watch Now: Collaborative Robotics in Ports

How can autonomous systems jointly master complex tasks in port logistics? The [new episode of the „Maritime Innovation Update“](#) series is now available on YouTube, providing insights into the research project RoboLab 2.0. The video shows how autonomous systems will safely and reliably take over transport tasks in dynamic terminal environments in future, and which technical challenges need to be solved in collaborative robotics.

Watch the new episode of the „Maritime Innovation Update“ now and find out what potential collaborative port robotics holds for terminal operators, vehicle manufacturers and technology providers.

