

# Newsletter 1.26



Dear readers,

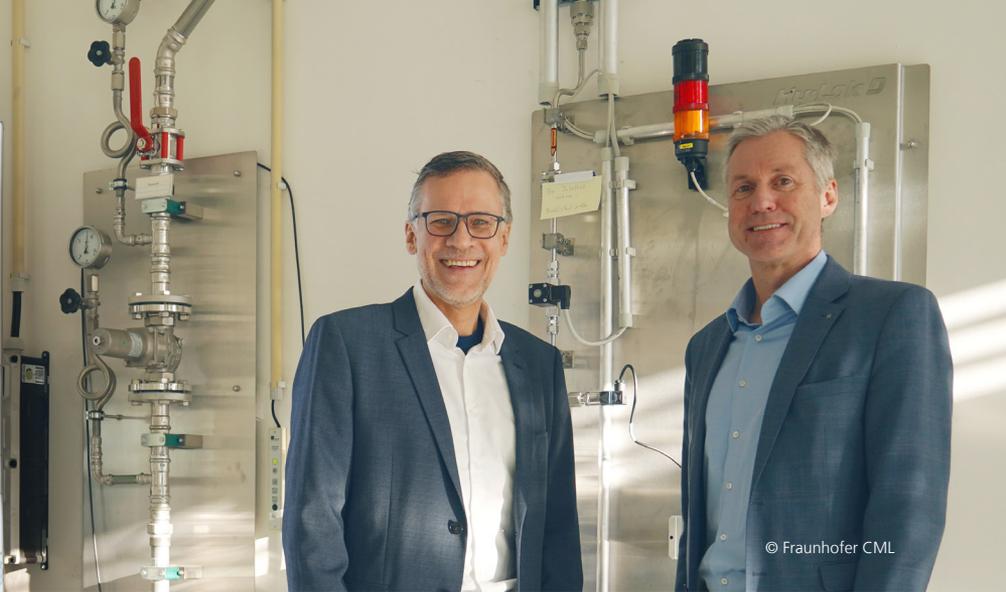


In our first newsletter of the year, you can find out how Hamburg is sending a strong signal for the hydrogen transition by setting up a Fraunhofer CML laboratory at the Center for Applied Aviation Research (ZAL).

Our projects also continue to develop: EyeCaptain supports navigation on the ship's bridge by continuously analyzing traffic situations and automatically calculating important parameters in order to provide early warning of collisions or groundings. The DIEB project strengthens the security of critical maritime infrastructure through innovative data integration and risk assessment. This is done with the help of our mobile sensor platforms Cells on Wheels and our research vessel VEKTOR. And: The VEKTOR is participating in this year's Hamburg Port Anniversary.

Enjoy reading!

Kind regards, **Prof. Dr.-Ing. Carlos Jahn**  
Head of Fraunhofer CML



*Roland Gerhards, Managing Director of ZAL (left in the picture), and Prof. Carlos Jahn, Head of Fraunhofer CML, at the handover of the laboratory space at the Fuel Cell Integration Center in the ZAL TechCenter.*

# Hamburg drives forward the hydrogen transition: cooperation between aviation and shipping

The transfer of the Fuel Cell Integration Center (FCIC) laboratory space at the ZAL TechCenter to Fraunhofer CML will create a unique research infrastructure in Hamburg. As part of the [Hanseatic Hydrogen Center for Aviation and Maritime \(H2AM\) project](#), Fraunhofer CML and the ZAL Center for Applied Aviation Research are pooling their expertise to further develop hydrogen and fuel cell technologies under realistic conditions.

The new laboratory offers state-of-the-art test benches and test environments, including altitude and cryogenic chambers, which enable investigations into material behavior and system reliability. The aim is to test and optimize fuel cell systems and their supporting components for use on board. The modern infrastructure and proximity to aviation partners offer considerable advantages. Both industries face similar challenges – from safety requirements and refueling infrastructure to extreme environmental conditions. In view of the goals of the International Maritime Organization (IMO), which is aiming for climate neutrality in maritime shipping by 2050, hydro-

gen research is becoming increasingly important for shipping. Alternative energy sources such as hydrogen and its derivatives, ammonia, or methanol, as well as highly efficient propulsion systems, are indispensable. Fuel cells offer great potential in this regard: they operate locally emission-free, quietly, and with high efficiency. Especially in hybrid propulsion concepts, they can significantly increase efficiency on board.

A first milestone has already been reached: the New Energies Solutions team at Fraunhofer CML has successfully commissioned a 60 kW Nuvera E60 fuel cell. Together with ZAL, a test bench was set up that includes all the necessary components such as hydrogen supply, power electronics, and cooling circuit.

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*EyeCaptain in action: 360° situational awareness, AI analysis, and early warning for maximum safety on the bridge.*

# 360° safety: How EyeCaptain is redefining navigation

With EyeCaptain, Fraunhofer CML and the shipping company Bernhard Schulte have developed a camera-based assistance system that takes nautical watchkeeping to a new level. The aim is to significantly improve situational awareness on the ship's bridge – especially in complex traffic situations, narrow fairways, or poor visibility.

At the heart of EyeCaptain is the intelligent linking of 360° panoramic cameras, thermal imaging technology, and real-time data from AIS, GPS, radar, and electronic nautical charts. Modular software components bring this information together and present it clearly on an intuitive touch display. This not only gives the bridge team an enhanced visual overview of the situation, but also active support in making safety-critical decisions. The system continuously analyzes the traffic situation and automatically calculates the closest point of approach (CPA) and the time to CPA (TCPA). EyeCaptain thus provides early warning of potential collisions, risky encounters, or groundings. Relevant events are automatically recorded and can be evaluated later on land – a valuable component for training, quality assurance, and safety management. Since the start of the project, EyeCaptain has undergone fundamental technical development: The software is no longer exclusively for use on board, but can also be used on the move and on land in the office.

Thanks to the further development of the AI model for object detection, EyeCaptain will be usable for different camera configurations in the future. This means that existing surveillance cameras can be used, keeping installation costs and initial expenses low. Depending on the camera quality, the Pelican system developed at Fraunhofer CML can be used, which, thanks to continuously trained object recognition and horizon stabilization, achieves a new level of detection of other objects on the water, even in poor visibility conditions.

EyeCaptain demonstrates how applied research can be transformed into a production-ready system that provides situation-specific support to personnel performing demanding tasks on the ship's bridge, thereby enhancing safety, efficiency, and data intelligence in ship operations in the long term.

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*Fraunhofer CML supports NPorts in field tests with Cells-on-Wheels and its research vessel VEKTOR.*

# Security for critical maritime infrastructure: The DIEB project

Maritime critical infrastructure (KRITIS) such as LNG (liquefied natural gas) terminals, offshore wind farms, and submarine cables are increasingly the target of cyberattacks, sabotage, and espionage. These threats endanger not only operators, but also security of supply and global shipping.

The [DIEB research project](#) – initiated by Niedersachsen Ports (NPorts) and Fraunhofer CML – aims to significantly increase the resilience and security of maritime critical infrastructure. Operators should be able to detect threats early, automatically, and based on data, assess their potential risk, and inform the relevant authorities in a timely manner. In particular, faster situation assessment and thus improved decision-making quality, as well as reduced response times and greater overall transparency, will enable effective countermeasures to be taken more quickly than before.

At the heart of the project is a modular security situation picture that flexibly integrates heterogeneous sensor data and enables real-time threat assessment through AI-supported big data analysis. This is supplemented by a real-time decision support and alerting system (EEAS) that automatically forwards information to authorities in a traceable manner. To this end, potential threats are identified, assessed, and then addressed. The primary aim is to strengthen the capabilities of KRITIS operators in the context of threats. The actual threat prevention is then carried out by downstream authorities. The scala-

ble system architecture allows for transferability to other maritime KRITIS such as offshore wind farms or pipelines.

Fraunhofer CML is responsible for technical management and develops innovative methods for hazard identification and assessment. This involves the use of novel data integration, pattern recognition, and risk assessment methods, which are validated in realistic scenarios. Fraunhofer CML is also responsible for technical evaluation and supports NPorts in field tests with so-called Cells-on-Wheels (CoWs) and its research vessel VEKTOR. The aim is not only to improve the monitoring of maritime KRITIS, but also to systematically increase their resilience.

DIEB is funded by the Federal Ministry of Research, Technology, and Space as part of the “Research for Civil Security” program. As associated partners, the Lower Saxony State Criminal Police Office, UAV DACH e.V., the German Navy, Deutsche Energy Terminal GmbH, the Lower Saxony State Authority for Road Construction and Transport (Port Security Authority), and the Federal Waterways and Shipping Administration (WSV) confirm the relevance of the topic.

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## New addition to the 837th Hamburg Port Anniversary: VEKTOR – the Fraunhofer CML research vessel

VEKTOR is Fraunhofer CML's research vessel. Christened by Hamburg Senator Dr. Melanie Leonhard, the former police patrol boat was converted into a state-of-the-art maritime research platform by Fraunhofer CML employees over the course of last year.

The VEKTOR's equipment includes highly sensitive sensors and cameras that can record detailed information from both the immediate and more distant surroundings. Passive and active sensors enable real-time maritime surveillance—both on the water surface and underwater. In conjunction with radio beacons from other mobile sensor platforms and a drone, the VEKTOR is also used for airspace surveillance. Another special feature of the system is that the components used for silent reconnaissance do not emit any active signals themselves and are therefore difficult or impossible to locate. Drones and other technical components used for underwater reconnaissance can be deployed via the working platform at the rear. Equipped in this way, the VEKTOR can be used to test autonomous technologies, create maritime situation pictures, deploy AR and VR technologies on the bridge, or carry out inspection and surveillance missions.

The VEKTOR 2026 will take part in the arrival and departure parade for the first time at Hamburg Harbor Birthday celebrations. In addition, scientists from Fraunhofer CML will be on board at the berth in Niederhafen to provide information about current research projects and new developments.



## Fraunhofer CML@Logistics meets Science

The Fraunhofer CML was at the center of the “Logistics Meets Science” forum organized by the Hamburg Logistics Initiative (LIHH) and the Hamburg Logistics Professors (HHLOP) as a driving force for the transformation of logistics. Fraunhofer CML combines research and practice to advance the maritime supply chain through digitalization, automation, and AI-supported analytics. In the sessions on “Quantum Awareness” and “Agentic AI,” the researchers gave presentations showing how concrete challenges give rise to tailor-made solutions for ports, shipping, and autonomous systems. In quantum computing in particular—for example, in route and lock optimization as part of the QCI research project, which is being pursued jointly with the German Aerospace Center—the approach is evolving from a niche topic to a practical field of innovation with direct industrial benefits.

## Singapore Maritime Week, April 20–24, 2026

At the German Maritime Center (DMZ) booth, Fraunhofer CML will be showcasing solutions and developments in the field of autonomous maritime technologies, as well as ways to improve cybersecurity on the ship's bridge.



## Maritime Innovation Insights on May 7, 2026

[Maritime Innovation Insights \(MII\) at Fraunhofer CML](#) – a highlight for the maritime industry. Industry professionals can look forward to exciting presentations, live demonstrations, and personal exchanges – now in its eighth year!



## TOC Europe in Hamburg, May 19–21, 2026

At this year's [TOC Europe](#), which will take place in Hamburg from May 19 to 21, 2026, Fraunhofer CML will be showcasing mobile robotics solutions for ports and terminals at booth G16. We will also be demonstrating how computer vision can be used to support crane rope inspection. We look forward to seeing you there!



## Hamburg Innovation Summit on June 18, 2026

Four Fraunhofer institutions in Hamburg will once again be exhibiting together at the [Hamburg Innovation Summit \(HHIS\)](#). Fraunhofer CML, IAP, IAPT, and ITMP will be showcasing exciting solutions from the HHIS's key areas of focus, including AI & data science, climate & energy, advanced materials, and health. A joint lecture program entitled "Living sustainability: Fraunhofer Institutes deliver practical success stories" will present innovative developments for Hamburg's economy. We look forward to seeing you there! As in the previous year, participation in HHIS 2026 is free of charge for visitors.



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