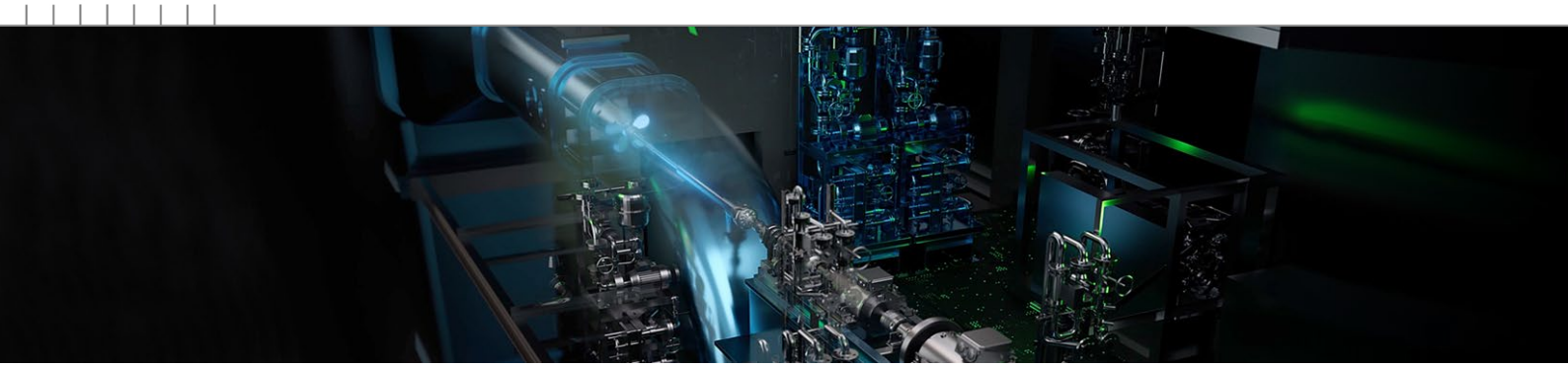
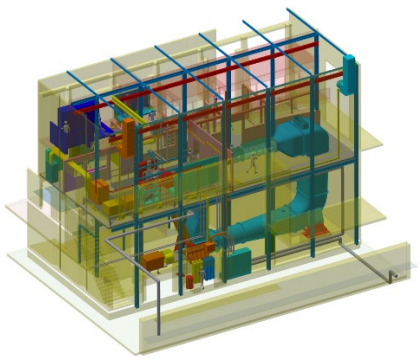


Zero Emissions Lab for pioneering research

MARIN has developed a research and configuration test environment: the Zero Emission Lab (ZEL). Our competences of hydrodynamics will be united with innovative future ships' propulsion and power systems.

The transition from conventional propulsion and power systems, based on burning fossil fuels, to future systems that have meaningful reductions of exhaust emissions requires a digital and physical research and test environment to be utilised by the whole maritime sector. Therefore MARIN is working on 'Marine Power Systems' to support the transition towards vessels that have no bad exhaust emissions.



A major initiative involves the extension of the existing cavitation tunnel facility to develop the new Zero Emission Lab. This engine room of the future integrates power and propulsion systems and enables the representative coupling of the propulsion hydrodynamics with the power supply. ZEL is a unique test facility worldwide for the research and testing of future marine propulsion and power systems, applying realistic, dynamic operating profiles.

On the one hand, ZEL will contain the physical hardware of the future engine room. Typical power components are fuels cells, batteries, super capacitors, electric machines, advanced internal combustion engines and a gearbox for hybrid solutions. Supporting components are storage for energy carriers, electrical infrastructure in DC and AC, advanced automation and control systems, and integrated cooling. Besides propulsion, several auxiliary and payload consumers can be configured as well. MARIN can support the selection of the test configuration and the tests to be performed by exploration of feasible technologies and setting up a concept design.
On the other hand, the engine room hardware connects to the hydrodynamics through a real propeller in the cavitation tunnel and an additional electric machine which is controlled by sophisticated hydrodynamic algorithms. These simulate the dynamical behaviour including acceleration and deceleration, cavitation and ventilation, behaviour in waves and manoeuvring, etc.
With simulation, monitoring and big data technology, a so-called digital twin of the ZEL will be developed as well. The digital building blocks enables building and operating ships in virtual reality. The digital twin accounts for scaling (effects) and effective system integration.

This concept fits perfectly in MARIN's focus on the complete lifecycle of ships and the ambition to make them smarter and cleaner. With the help of these facilities, risk and costs will be substantially reduced.

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