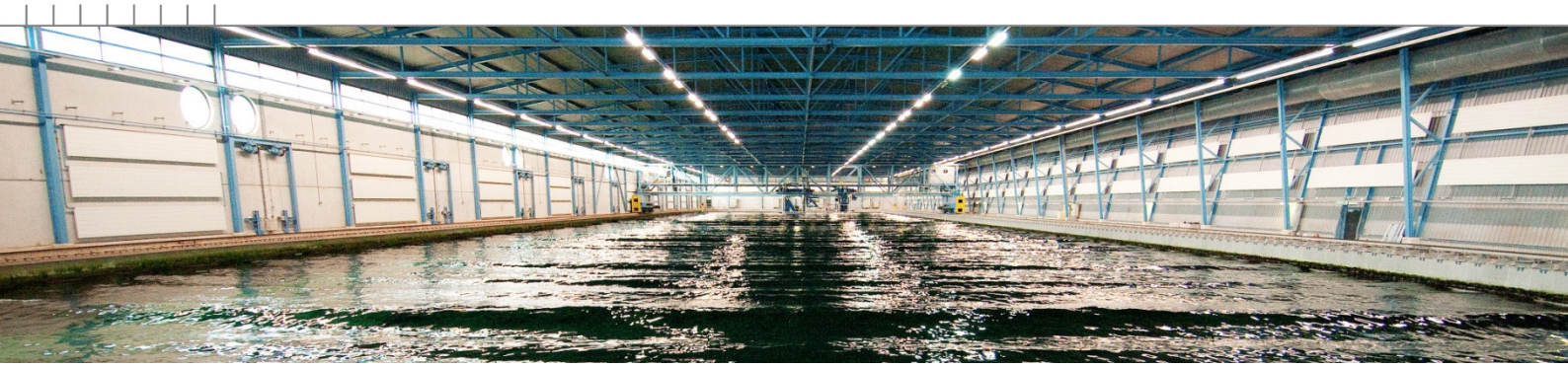


MARIN (MARITIME RESEARCH INSTITUTE NETHERLANDS)

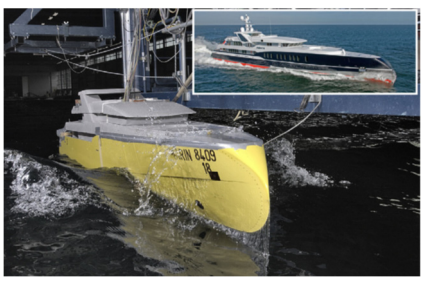
A brief introduction

For more than 80 years MARIN has been a reliable, independent and innovative service provider. We expand the boundaries of maritime understanding with hydrodynamic research. MARIN has a dual mission. Providing the industry with innovative design solutions and carrying out advanced research for the benefit of the maritime sector as a whole. This link between academic research and market needs is a unique interaction that benefits all parties concerned. Our customers include commercial ship builders, fleet owners, navies and offshore companies all over the world. Feeding back the result of advanced research programmes into commercial projects makes MARIN a proactive company, which is driven by a team of highly motivated and experienced people.

Providing nine exceptional facilities

Our exceptional range of facilities enables us to meet any challenge. We dispose of nine different model basins to solve specific design and research issues:

- Seakeeping and Manoeuvring Basin
- Offshore Basin
- Deep Water Basin
- Depressurised Wave Basin
- Concept Basin
- Shallow Water Basin
- Cavitation Tunnel
- Zero Emission Lab
- Multiphase Wave Lab



Extending boundaries

We extend boundaries by supporting the entire design process, from validating initial ideas to measuring the performance of finished products.

- Concept Development – ‘exploring possibilities’
  A concept of a ship, offshore structure or harbour design is evaluated on its limitations and possibilities. Computer simulation and elementary testing techniques are used to make recommendations for improvement.
- Design Support – ‘interacting to achieve perfection’
  A design is refined in close interaction with the customer. We work on solutions in the field of speed, manoeuvrability, motion, loads as well as safety and legal requirements. By simulating performances, considerable savings can be made in future operational and maintenance costs.
- Operations Support – ‘improving performance’
  Once a ship or offshore structure has been built the design is optimised in service with the utmost safety, efficiency and cost-effectiveness. Moreover, on-board measurements, full-scale investigations and analysis can be carried out and crew training is given in our state-of-the-art simulators.
- Tool Development – ‘making know-how accessible’
  We develop software and hardware tools to be used for design and operational verification. In this we draw heavily on our knowledge from both research and commercial projects.

Our services incorporate a unique combination of simulation, model testing, full-scale measurements and training programmes. We participate in JIPs, networks and fundamental research. Sharing experience and building knowledge is essential for growth and development. Being committed to high-quality technological innovation, MARIN will always be challenging wind and waves.

For more information contact MARIN
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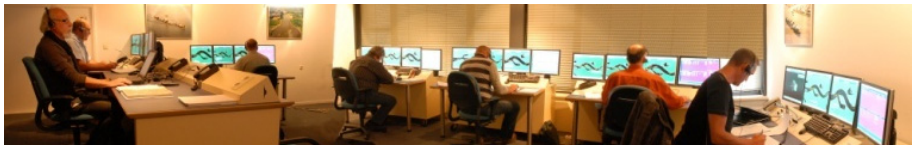
Simulating reality, measuring results

In combination with the model tank facilities MARIN uses simulation software, full-scale testing and training. This strong combination is used to achieve reliable prediction of the performance in the design phases but also to improve and ensure the optimal operational use of the ship or offshore structure.

- Full-mission Bridge Simulators – demonstrate personnel the feasibility of a port layout in terms of safety and viability. But also risk and downtime in (offshore) operations will be reduced by using these simulators.
- Fluid Dynamics Software – Computational Fluid Dynamics (CFD) tools provide a cost and time effective method for optimising the design in the early design phase or addressing scale effects.
- Ship Trial Investigations – different types of real time research takes place, where we examine for example, vibration and cavitation, flow patterns around the hull or the influence of slamming and whipping on the loading of the vessel.
- Dynamic Stability Simulation Software – simulate the behaviour of a steered ship subjected to wave and wind conditions and can predict large motion phenomena such as capsizing, broaching and parametric roll. It has also applications in forensic research.
- VTS Simulator – This vessel traffic management system trains and educates personnel to manage traffic flows in ports and busy shipping traffic lanes.
- Offshore monitoring systems – continuously record dynamic behaviour of offshore platforms and collects data of motion, hull strains, VIV motions, mooring and riser tensions.
- Offshore Multi-body Software – simulate operations at sea, including coupled mooring analysis, dynamic positioning and multiple body simulations during offshore lifting or offloading.



The synergy between these activities and model basin tests is the basis of our problem solving capacity. It is used to achieve a reliable prediction of the performance in the design phases but also to improve and ensure the optimal operational use of the ship or structure.

Sharing experience and building knowledge

By sharing experiences, the common knowledge base continues to grow. JIPs (Joint Industry Projects) form a significant part of MARIN's business. They are an important way to develop and share knowledge. It allows all parties to enjoy cost savings of shared investment and to benefit from research they cannot afford on their own. MARIN is participating in various networks for cooperative research, such as CRS, CRNAV, Vessel Operators Forum and the FPSO Research Forum. The interaction with customers and the market as a whole facilitates a broader translation of our fundamental and theoretical know-how into real-life applications. Fundamental scientific research is crucial to maintain a leading position in hydrodynamics and the maritime sector as a whole. Cooperation with universities and other organisations is necessary and desirable.