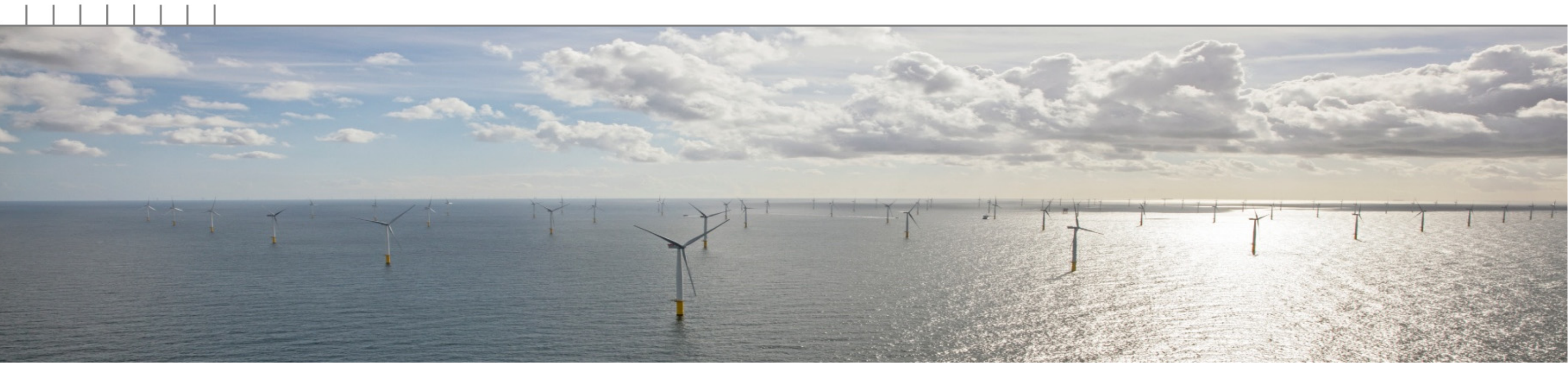


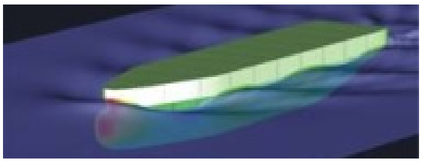
Offshore Support Vessels

Integrated design of Offshore Vessels and Operations

The Maritime Research Institute Netherlands was founded in 1932 as a hydrodynamic research institute. Our expertise ranges from powering performance of ships, seakeeping and manoeuvring behaviour, Dynamic Positioning (DP) capability to the training of offshore personnel in our full-mission bridge simulator. Next to our model testing expertise we develop and use hydrodynamic software tools to enhance the hydrodynamic quality of the ship design.

Our main objective is to assist owners, shipyards and operators in order to improve the quality of their vessels regarding all hydrodynamic aspects of ship design. Our services include:

- Hull & Propulsion optimisation
- Vessel motions/ Crew comfort
- DP capability studies (including the effect of thruster interaction)
- Advanced DP control relative to other ships
- Training of crews on full-mission bridge simulator
- Operability analysis
- Lifting and Side-by-Side studies



Hull for optimisation for ship resistance

Hull & Propulsion optimisation

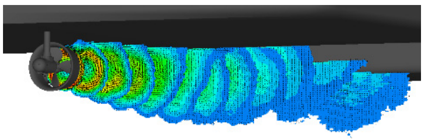
Our services are based on experience with more than 9,000 ships and 6,000 propellers. Our ship powering activities cover a wide range of services such as:

- Advice and assistance in an early stage of the design of ship hull forms, appendages and propulsors
- Computational predictions of resistance and propulsive performance for a wide range of ship types
- Computation of the flow around ship hulls, both non-viscous and viscous
- Testing of ship and propulsor models for resistance, propulsive performance, cavitation and hull pressure, vibration, radiated noise and erosion and alignment of appendages
- Propeller design
- Analysis of trial results

Our hull CFD programs (RAPID and PARNASSOS) are used to optimise the lines plan of the hull to reduce fuel consumption. For a speed power prediction on the initial main dimension of the vessel in an early stage, our DESP code based on the well-known Holtrop & Mennen method is used in combination with correlation on model test results of comparable vessels. Dedicated model tests are used to observe the cavitation behaviour and accurately predict the vessel speed in calm water.

Propulsion with azimuth thrusters (left) or Voith propeller (right)

Model test of an offshore support vessel rolling in beam waves



Wakefield development behind an azimuth thruster (PIV measurement)

Vessel motions

Roll motions are often an important limiting factor in the operation of offshore vessels. This is for example the case in cross seas, where it is difficult to choose the heading of the vessel with the bow into the waves. The amount of roll largely depends on the heading and the amount of roll damping. In the early design stages a realistic damping value can be estimated based on experience from previous model tests. In later design stages a specific model can be tested for its roll behaviour in calm water and for different wave heights. In this way, the non-linear roll behaviour can be quantified.

The motion behaviour of a sailing vessel in waves can be computed to optimise the crew comfort for a specific ship design. The acceleration levels on board the ship can be derived for various locations. In addition to this the added resistance in waves is generally assessed in a model test for different sea states to determine the sustained speed in waves. Practical design aspects for a ship in waves that are much harder to quantify, are the effects of bow flare and stern slamming in waves from forward directions and the risk of excessive manoeuvring behaviour in waves from the stern-quarter.

DP Capability & thruster interaction

MARIN has a long history in research into the performance of thrusters during Dynamic Positioning (DP) operations. Research on ducted propellers started in the late 1960s (Oosterveld) but a lot of today's knowledge on thruster interaction effects was developed in the late 1980s and early 1990s (Nienhuis). As a result of the application of DP systems on many different vessels, there is continued interest in this subject. Today, newly developed tools enable more detailed measurements and computer simulations of the thrusters on DP vessels. This has lead to new research initiatives to improve the understanding of thruster interaction effects. Computational Fluid Dynamics (CFD) and new measurement techniques such as Particle Image Velocimetry (PIV) play an important role in determining thrust losses.

During DP operations the effective force generated by thrusters can be significantly smaller than would be expected based on the thrusters' open water characteristics. This is a result of thruster interaction with the hull, current and the wake of neighbouring thrusters. The understanding and quantification of thruster interaction (or thrust degradation) effects is essential for an accurate evaluation of the station-keeping capabilities of DP vessels.

Simulator view during anchor handling operation

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Training of crews on full-mission bridge simulator

In our full-mission bridge simulator we provide interactive trainings for complex offshore operations. Downtime of these operations is to be minimised. In open seas more effective supply operation will enable lower downtimes. This all puts a larger demand on offshore support vessels and personnel as they have to assist offshore platforms in exposed areas. Equally important is the persistent operation of offshore support vessels in offshore circumstances during side-by-side or tandem offloading operations.

MARIN has the capability and experience to create accurate models of specific vessels. It has done so over the last ten years through frequent contact with major propulsion manufacturers and by building a large experience record for training crews in offshore operations.

aNySIM: Multi-body time domain simulation tool

MARIN has been developing, using and selling hydrodynamic simulation software for many years. Specialised tools were developed for specific areas: coupled mooring analysis, Dynamic Positioning, multiple-body lifting operations, riser dynamics, offloading operations, etc.
Developments in the offshore industry in recent years showed the need for a more integrated and flexible tool. Therefore, MARIN decided to develop the new modular 'aNySIM' code. It brings together the capabilities of the different software packages and has become MARIN's main in-house hydrodynamic toolbox. Various modules can be coupled to the central N-body time domain simulation module. As an example, this makes possible studying a DP offshore support vessel next to an offshore platform, including all the hydrodynamic and mechanical interactions. Instead of buying or leasing the general program, a project-specific version of the program can now be shared. This allows clients to use the latest version for their own operability analysis, together with dedicated MARIN support and advice.

Operability analysis

To define the operational circumstances for a ship a thorough understanding of the ship's business targets and related values is required, and an adequate description of day-to-day operations, which are qualities of ship owners, ship managers and traders. The ability to quantify the relevant aspects of ship behaviour in all hydrodynamic related circumstances is a quality MARIN has acquired in last decade using the experience that was obtained in its more than 75 years of history.