Seakeeping and Manoeuvring Basin

To simulate and test the behaviour of ships at sea as closely as possible, we use free sailing models for most seakeeping and manoeuvring test campaigns. To ensure accurate test results by using adequately large models, a sufficiently wide and long basin is required. The Seakeeping and Manoeuvring Basin (SMB) with its 170 m x 40 m x 5 m is perfectly fit. The basin is fitted with flap-type wave makers on two adjacent sides and adjustable beaches on the opposite sides. This allows for free sailing ship models to sail in regular and irregular waves from any direction and for free sailing manoeuvring tests such as zig-zag and turning circles at the design speed of the ship.

Tests in the SMB:

- Seakeeping tests in regular and irregular waves.
- Free sailing manoeuvring tests in calm water and waves
- Captive (CPMC) manoeuvring tests
- Tests on (floating) offshore structures to determine the motions and load due to waves.
- Tests for wind assisted ships
- Wireless controlled models at high speeds.
- Underwater manoeuvring.
- Side by side operations.

Basin capabilities

Model size

Although ship models can vary between 0.3 and 11 metre of length, the typical length of free sailing models is between 4 and 6 metre. Scale depends on required speed, wave conditions, model outfitting and measurement requirements. For floating (offshore) structures the model size is also determined by water depth and required wave conditions.

Model instrumentation

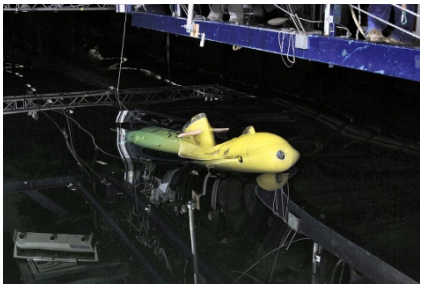
Ship models are fitted with all relevant appendages, including propulsion line, steering gear, stabilising fins, ESD's and anti-roll tanks. All appendages are fully functional, adapted to work at model scale and with a realistic control based on the ship motions. Model tests for side by side operations and launch and recovery tests with multiple models can be performed as well. DP systems and control is available using an in-house developed control system.

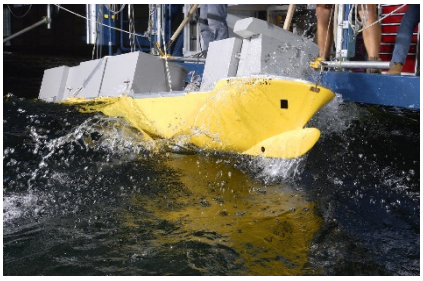
Carriage

The carriage runs over the total length of the basin with a maximum speed of 6 m/s and consists of a main frame and sub frame. The main frame spans the full width of the basin, the sub frame can move along this main frame over the entire width of the basin at a maximum speed of 4 m/s. The carriage can follow all movements of a model that is sailing freely by itself under auto pilot control or it can follow a prescribed track with a ship model mounted to the carriage. The latter case is used for Computerized Planar Motion Carriage (CPMC) tests.

For each specific need MARIN has test facilities available:

- Offshore Basin
- Concept Basin
- Shallow Water Basin
- Deep Water Basin
- Depressurised Wave Basin
- Cavitation Tunnel
- Multi Phase Wave Lab





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Waves

Waves can be generated with peak periods ranging from 0.8 to 4.2 seconds and, depending on the peak period, up to a significant wave height of 0.45 m. At two adjacent sides of the basin, segmented wave generators are installed, consisting of 320 hinged flaps of 60 cm wide. Each flap is controlled separately by a servo motor. The wave generator can be used to produce regular and irregular, long and short crested waves from arbitrary directions. Opposite the wave generator passive sinkable wave absorbers are installed. To further dampen the waves, the wave generators are equipped with an active reflection compensation.

Wind

Wind forces can be modelled using portable wind fans or by attaching lines with controlled tension winches.

Measurement and observations

Models are tracked by a 6 degree of freedom position measurement system. Instrumentation of propellers rudders and accelerations, pressured, loads are well possible. Typical registration is with 200 Hz, but for high frequent phenomena, higher measurements rates are being used. Default close-up video recordings are made for allowing registration of important phenomena. To measure captive forces and moments on the complete model, a turn table and force measurement frame can be fitted between the model and carriage to also force yaw motions and to determine the current or manoeuvring forces.

Expertise and experience

Over the years MARIN has gained a vast experience in performing a wide range of tests for all kind of ships and offshore structures, varying from small fast craft, 400 m container vessels to autonomous submarines.
Besides ship motions, seakeeping tests can focus on any behaviour in waves. This includes added resistance in waves, optimisation of anti-roll devices and non-linear behaviour such as parametric roll, broaching and slamming. In addition, we perform IMO tests on a regular basis, for weather criterion, safe return to port and ships with an open top notations. Manoeuvring tests are often carried out to verify and improve the performance as required by IMO manoeuvring regulations (zig-zag and turning circles tests). Many custom manoeuvres are performed to verify market-specific performance criteria, such as for naval ships, towed FPSO's, tugs and submarines. CPMC tests are performed to compose mathematical models to perform fast time or real time simulations.

Publications

- Dallinga, R.P.: 'The New Seakeeping and Manoeuvring Basin of MARIN, Japanese workshop on waves', 1999.
- Quadvlieg, H.H.A.: 'A New Combined Seakeeping and Manoeuvring Basin for the Third Millennium Maritime Research', MARSIM 2000.
- ITTC leaflet: https://ittc.info/media/7879/seakeeping-and-manoeuvring-basin.pdf.