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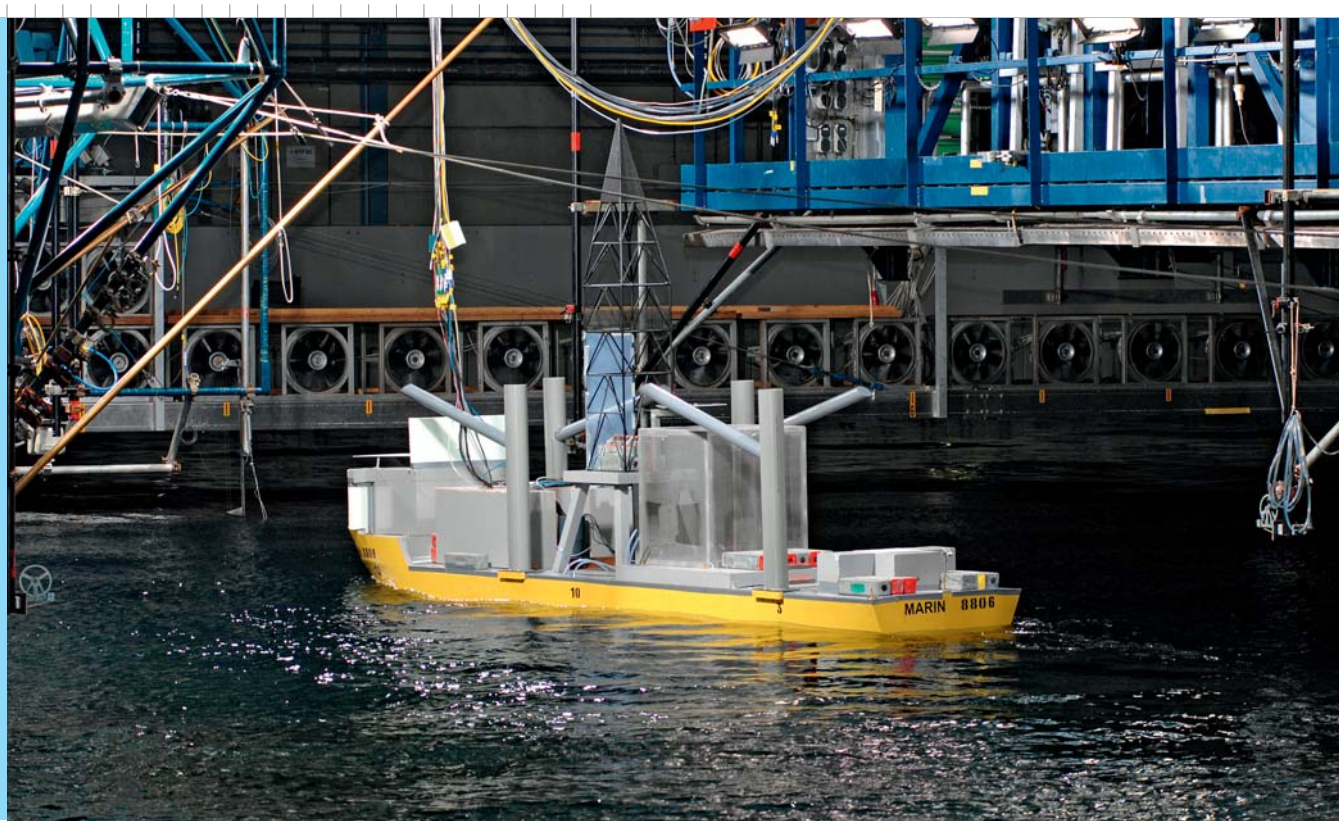

Drillship during DP model tests in wind, waves and current

DP simulations and model

MARIN has a long history in Dynamic Positioning (DP) model testing and computer simulations. In recent years there has been increasing interest in the application of DP systems. And in the past two decades the DP performance of numerous drilling vessels, semi-submersibles, installation vessels and shuttle tankers has been investigated in MARIN's basins. Two recent projects are highlighted.

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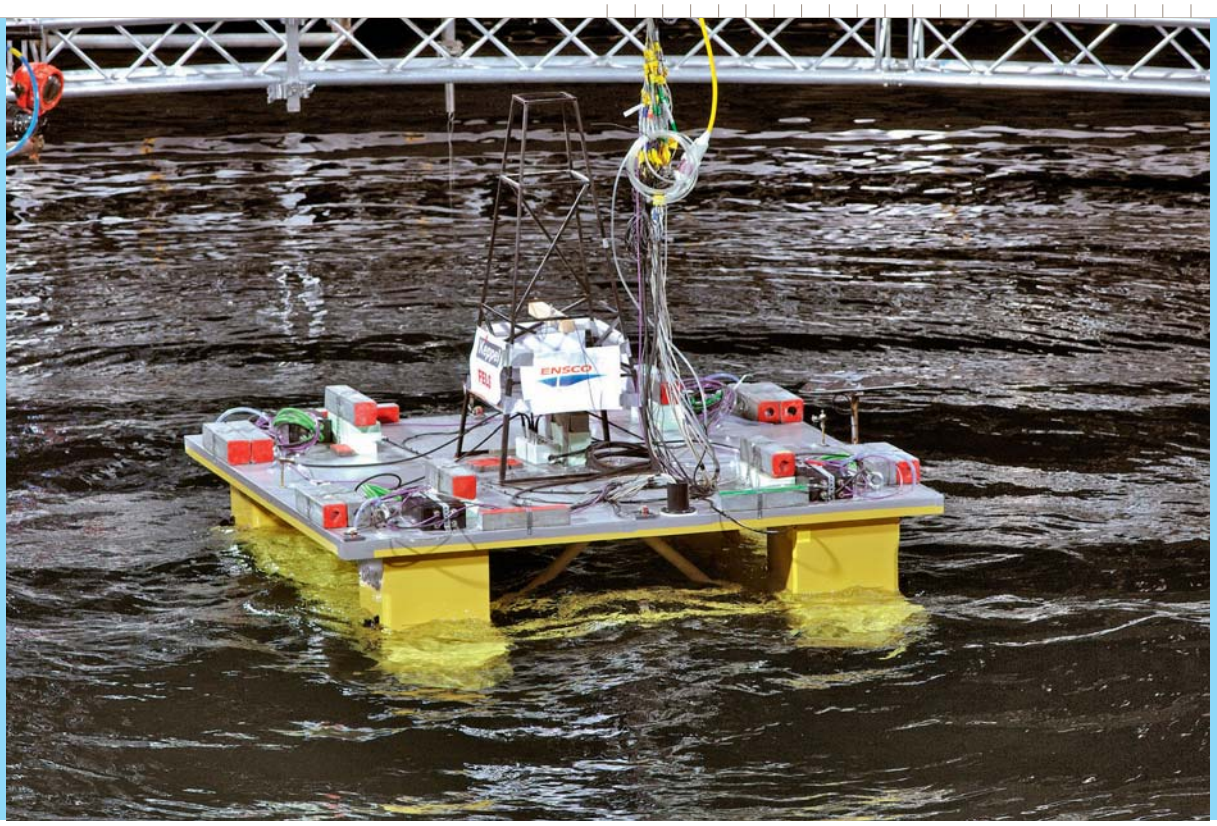
RUNSIM is the DP system used in model tests. This contains all the elements present in real-life DP systems, including a position measurement system, a Kalman filter, a controller and an allocation algorithm. For azimuthing thrusters forbidden zones are also taken into account and new options are regularly added to the model DP system. One recent improvement was the development of a new type of azimuthing thruster, with the possibility to measure not only the thruster RPMs during DP model tests but also the thrust and torque.

Time-domain simulations for DP vessels are carried out using MARIN's multi-body simulation tool aNySIM. Results of simulations can be used to optimise the test programme. For example, by selecting the most relevant environmental conditions to be considered in the model tests, or by optimising the DP system control settings before the vessel actually enters the water, valuable time is saved in the basin.

Deep Water Drilling Vessel Last year, DSME commissioned MARIN to perform



Dynamic positioning test of the Ensco-12000 semi-submersible

testing - on the spot!

model tests on a mono-hull drill ship with a central moon pool. Two operational profiles are of primary importance for a drill ship; it has to be able to move fast and safely from one location to another and it has to keep a stable position by means of DP. Additionally, the DP system has to be capable of keeping control over the vessel in survival and thruster failure conditions.

Three models of the drill ship were built focusing on different aspects. A large model was made to optimise the front and aft edge of the moon pool, during calm water resistance and propulsion tests in MARIN's Deep Water Towing Tank. Optimisation of the flow in and around the moon pool in transit conditions resulted in a significant decrease of resistance and fuel consumption.

A smaller model with six azimuthing thrusters was built for DP-controlled model tests, in operational as well as survival conditions. Intact and thruster failure scenarios were simulated. Tests were performed in MARIN's Offshore Basin, where wind, waves and current were applied. The vessel's motion behaviour in transit conditions and the effects of waves on the power consumption were analysed. Seakeeping tests were performed in the Seakeeping and Manoeuvring Basin.

A third model was built at BMT for wind tunnel tests on the topsides of the drill ship. The results were used for the DP tests in MARIN's Offshore Basin.

Prior to the DP model tests, numerical time domain aNySIM simulations were performed to select an optimised set of DP control coefficients. After the DP model tests the numerical model was optimised based on the results of the model tests. This strong combination between DP simulations and model tests saves valuable time in the basin and provides the possibility to perform numerical simulations for a wide variety of situations with an optimised numerical model.

Ensco-12000 Deep Water Drilling Semi-submersible The demand for ultra-deep, drilling semi-submersibles continues to grow. Standard solutions based on spread mooring systems are being offered. But beyond certain water depths, technical and economical constraints associated with this solution may favour a fully dynamic positioning system. Therefore, Ensco International and Keppel-FELS commissioned MARIN to carry out seakeeping and full DP tests for their newly developed ultra-deep, drilling rig. This new semi-submersible is designed to operate at water depths of up to 12,000 ft. An extensive set of model tests were completed at MARIN's Deep Water Offshore Basin. The semi-submersible was equipped with eight azimuthing thrusters. Tests were carried out for various heading set-points and environmental conditions. Wind, waves and current were part of these environmental conditions. Thruster failure cases were also considered, adjusting the DP system's allocation algorithm depending on the location of the failed thruster. The platform maintained its specified heading with minimal motions and power consumption.