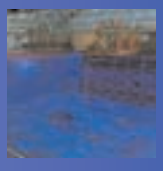

In decreasing water depths, resistance and propulsion characteristics change significantly, as do a ship's steering and manoeuvring characteristics. The general rule is that in shallow water, vessels tend to have much more difficulty in turning. MARIN's FRANS QUADVLIEG and SERGE TOXOPEUS chart a course through the shallows.

Offshore Basin well equipped for shallow water tests

Challenge of the shallows

Shallow waters can lead to turning difficulties and long reaction times, and when ships are regularly called to operate in shallow water, design requirements are needed. The aft ship design should be optimised as the flow towards propeller and rudder may be completely different from the same vessel sailing in deep water. The situation can be dangerous if, in shallow water, a dead water area occurs, causing the rudder to operate in zero water speed. A complete loss of steering force can result, with devastating con-sequences. Squat can also come into play, creating a bow down trim leading to increased course instability.

Zero speed manoeuvrability

Besides achieving sufficient course checking and turning ability, zero speed manoeuvrability is an issue. Traversing is typically a subject that needs to be properly understood for operations in confined harbours and the influence of the water depth on a ship's crabbing ability is considerable. Recently developed ships will sail faster on shallower water, increasing therefore traffic density and the risk of collision on inland waterways. Other developments such as very deep draft Malaccamax container vessels and maximum size ferries and cruise ships must also sail in confined harbours.

New Offshore Basin

The new Offshore Basin is well positioned for this kind of work and while model tests can be performed for deep water conditions, the basin's movable floor provides shallow water capability. Both free sailing tests and captive model tests (CPMC-tests) are possible and for all water depths, static drift tests, rotating arm tests and oscillation tests can be conducted to derive the hydrodynamic characteristics to set up a mathematical model for the manoeuvring behaviour of the ship. With this mathematical model, simulations can be carried out to investigate the controllability. This can be done using fast-time simulations, but the mathematical model can also be used in MSCN's full-mission bridge simulators. MARIN already has substantial experience in shallow water manoeuvring tests in its Wave and Current Basin and Shallow Water Basin where free sailing tests and PMM tests are carried out. And with the extended hydrodynamic possibilities of the new facilities, MARIN is ready to tackle all shallow water manoeuvring issues.