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Major research programme for the sailing yacht market

Over the last few years, MARIN has become increasingly involved in delivering hydrodynamic services to the sailing yacht market. In a bid to keep up with demand, MARIN is about to start a large research programme focused on this special market.

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The 2005 Volvo Ocean Race and the America's Cup of 2007 are two examples where MARIN played a key role. In addition, MARIN is involved in hydrodynamic projects for the growing private yacht market. Technical demands are becoming more complex due to fierce competition and because of the increasing size of private yachts.

Computational optimisation

Testing techniques and computational programs are being constantly improved, with MARIN drawing on its large knowledge-base.

For computational optimisation, use is being made of the "Free-surface potential flow" program RAPID, which has been extended with a sailing yacht module and improved for more extreme geometries and conditions. This program provides an adequate flow model to predict values like the wave pattern and wave-making resistance, side forces on keel and rudder and its induced resistance.

Compared to model testing, the performance of a new design can be calculated relatively quickly and simply. Another significant advantage is the possibility to predict the effect of very small and local design changes.

An effort has also been made to reproduce sea trial measurements in Valencia wave conditions in 2005 for one of the 32nd America's Cup challengers. MARIN's in-house program Panship was used which contains a time domain panel method for the seakeeping of ships with lifting surfaces. A very good correlation was obtained with the measured data, however more detailed correlation should be made in the future. The main advantage of using a numerical approach was being able to get an insight on the local flow variations at the bulb and winglets. This also led to thinking for future developments including prospects for optimisation in dynamic non-steady conditions.

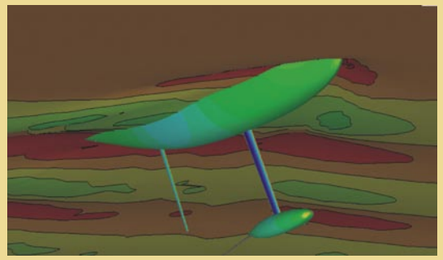
Experimental optimisation

In 2004, MARIN conducted model tests for the ABN AMRO Volvo Ocean race team. Extensive research was needed since the yachts had to comply with the Volvo Open 70 Rule restricting the yachts' length, draught, displacement and sail area, and due to strong competition. Tests were performed at a 1:3 scale, resulting in models of around 7 m tested up to 8m/s model speed for more than 200 different test points, for each design and appendage configuration.

MARIN's newly-developed yacht dynamometer was deployed and the appendages forces and moments were measured separately. Towing tank results were used for comparison between tested models and for validation of the computational optimisation tools used by the designer.

Recently, several new designs have been tested for well-known design offices like Hoek Design, Dijkstra & Partners and Perini Navi. In this market, yachts are certainly increasing in length but not in draught, due to the restricted depth in the harbours. This results in very low aspect keels with extreme design where only a third of the total draught is made up by the keel.

Designers' tools are not sufficient to calculate performance so model tests are needed. Test results are used to improve keel design and the balance of the yacht. Self-propulsion tests are also performed in order to have an accurate prediction for the engine size and propeller geometry.



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On the competition side, America's Cup and Volvo Ocean races are very interesting opportunities for investigating seakeeping. It is still a relatively open and new field, with a lot of potential. Little or no testing techniques are available on the market to study these yachts in realistic wave conditions with free running models in oblique seas. Using the full capability of its large seakeeping and manoeuvring basin, MARIN aims to produce a fully operational set-up in the second half of 2006 to carry out these tests.

Meanwhile, in the leisure market, comfort at anchor is a major concern in a similar way to the motor yacht industry beforehand. A wide variety of existing products and constant innovations help answer the owner's needs in terms of roll stabilisation: retractable or non-retractable fins, anti-roll tanks combined with fuel or ballast tanks, active tanks, moveable keels and propulsion systems. Many more are being developed, bearing in mind that they should not interfere with sailing conditions. The slender and round hull forms of sailing yachts yield inherently less damping than for motor yachts, meaning a higher roll angle while at anchor. Requirements for comfort levels are however, the same, which stimulates the need for further innovation and adapted solutions.

MARIN consistently aims to provide the right tools for designers and to support them in choosing the most suitable products and technical solutions available. The same tools are also a great opportunity for companies to develop new solutions and check their efficiency before launching them.