



Luxury Yachts

Model tests

Consultancy

Guidance

Expertise

Analysis

Services for the Luxury Yacht Industry

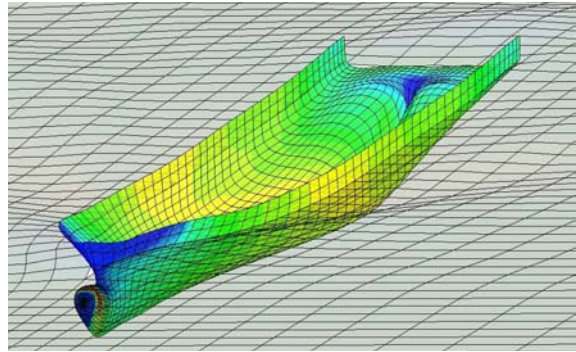


Introduction

FORCE Technology, Division for Maritime Industry, (DMI) offers complete hydrodynamic and aerodynamic consultancy and model testing for luxury yachts.

DMI continues to strengthen its position in the testing of luxury motor yachts, and have secured several new prestigious orders in this sector. Recent orders include yachts from 35 to 120 metres, with speeds ranging from 15 to 60 knots.

These projects involve all of the disciplines that DMI is offering for the world yacht market, including resistance, propulsion, manoeuvring, seakeeping and wind engineering analysis.



CFD analysis for large luxury yacht



Yachts in their right element

Full Speed Ahead

As for all vessels the speed performance of a yacht is important. Designers and shipyards need to ensure that the vessel can meet the specification with a reasonable margin, in terms of power requirements.

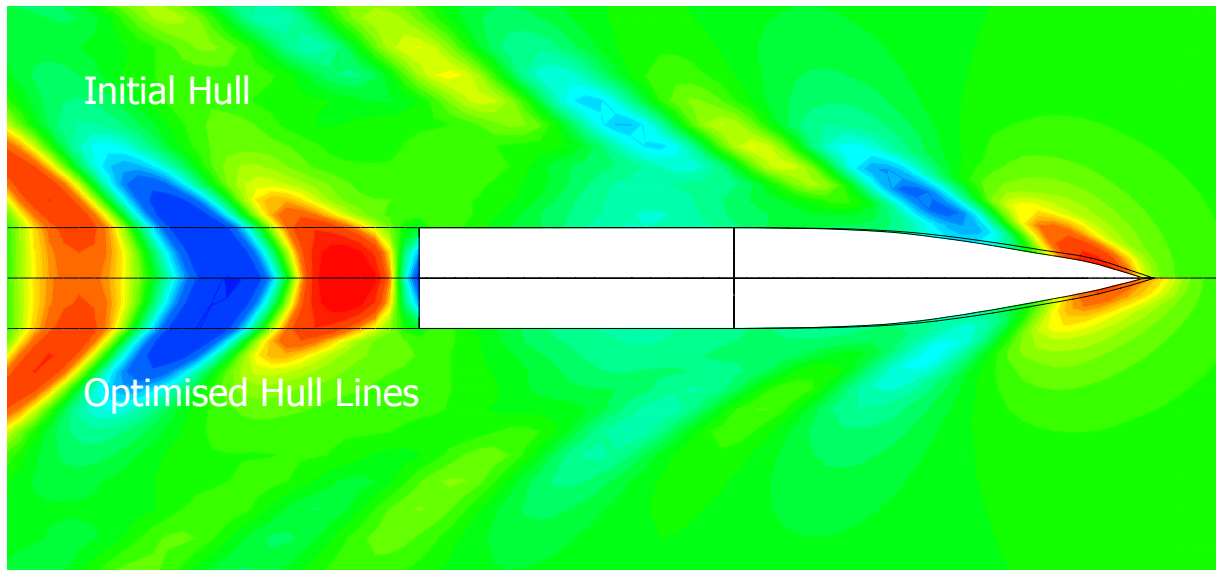
To assist designers and shipyards in their pursuit of the best possible solutions for their clients, DMI can provide speed and power prognoses based upon DMI's large database of hull forms and CFD calculations, in which the hull form can be optimised. CFD studies have been carried out on, e.g. the effects of bulbous bows and variations in hull form aft (wedges, tunnels, etc.). Combined with subsequent model tests, CFD is a very efficient and cost effective tool for the designer. DMI always provides a CFD study free of charge with each model test, in order to optimise the hull form before model construction.

Another important issue for most motor yachts is the optimisation of the appendages. Appendages are essential for propulsion, manoeuvring and comfort in

a seaway, but it is important that they are optimised to avoid excessive added resistance, noise and vibration on board the yacht.

DMI combines CFD calculations with streamline tests for shaft brackets, bilge keels, fin stabilisers, etc., in order to optimise the position and orientation of these appendages.

Sailing yachts have a similar range of performance issues to motor yachts, and the full scope of DMI's numerical and experimental expertise can be used to optimise sailing yacht performance. Rigs and appendages can be tested in the wind tunnels, and the performance of the hull and appendages can be evaluated in the towing tank. In conjunction with model tests, CFD provides a powerful tool for optimisation studies, and DMI's in-house sailing yacht VPP can be used to predict the performance of the yacht in specified environmental and operational conditions.



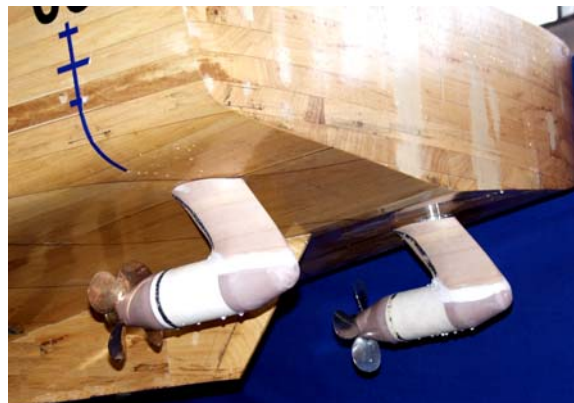
CFD analysis for large luxury motor yacht

DMI has experience in all types of propulsion for motor yachts, including single screw propulsion, twinscrew open shaft propulsion, water jets, and POD propulsion on large modern yachts. DMI provides expertise in the selection and optimisation of propeller characteristics.

In order to evaluate propeller performance, DMI can also carry out cavitation tunnel tests to analyse propeller performance, assess the likelihood of cavitation and measure pressure pulses induced on the hull, in order to ensure low noise and vibration levels on board the yacht at sea.



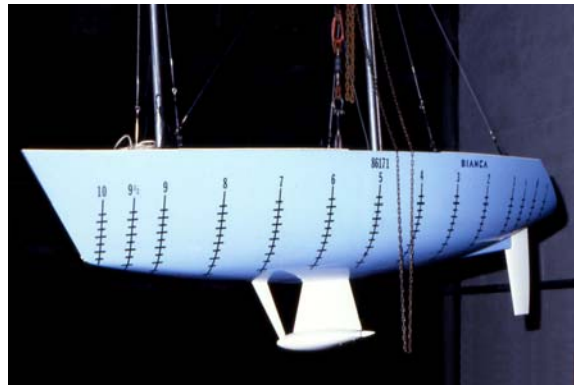
Model prepared for wedge tests



Twin POD propulsion arrangement



Sailing yacht in the towing tank



Advanced keel design

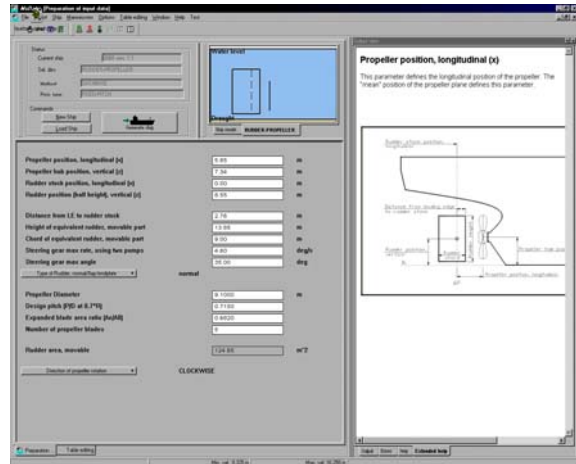
Stay on Course

Equally important to the performance of the yacht is its manoeuvrability and course stability. DMI has carried out several studies of manoeuvring characteristics on motor yachts.

The manoeuvring characteristics can be determined by means of DMI's inhouse ManPredict software tool, free-sailing tests in manoeuvring basins or captive tests on DMI's Planar Motion Mechanism (PMM).

In free-sailing tests the yacht can be tested in waves in order to assess the manoeuvring characteristics, including the broaching tendency in following seas.

PMM tests also enable subsequent definition of simulator modules for training of crews in the full mission simulator. With the increasing size of modern motor yachts, crew training has become an even more important issue.



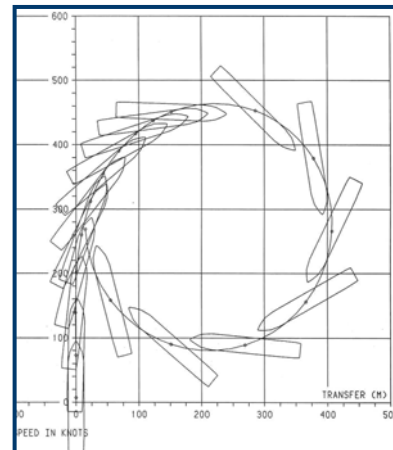
Prediction of manoeuvrability of the yacht



Manoeuvring tests in PMM setup with waterjet powered vessel



Yacht manoeuvring during sea trials



Turning circle based upon PMM tests

Avoid Seasickness

As on all passenger vessels, passenger comfort is of utmost importance on a luxury yacht, both at sea and at anchor in a harbour. DMI offers a range of numerical and experimental tools for evaluating the seakeeping performance of yachts.

Good seakeeping characteristics should be incorporated into the design from the earliest stages. DMI's SEAPEP software is ideal for this purpose, enabling the rapid evaluation of a range of hulls and environmental conditions, with regard to vessel motions and operability constraints. In this software, ship motions are computed by a linear or non-linear strip theory program.

For a more detailed analysis of a specific hull form the linear 3D code *S-OMEGA* code is used.

Model tests provide a comprehensive evaluation of the seakeeping performance of a yacht, including the effects of appendages, viscous flow and non-linear wave forces. DMI offers tests in head and following seas, or alternatively in oblique seas to investigate the vessel's behaviour in bow quartering, stern quartering seas, etc. Other special tests, such as zero speed beam sea rolling, forced rolling, roll decay and combined wind and wave forcing, can also be included in the test programme.

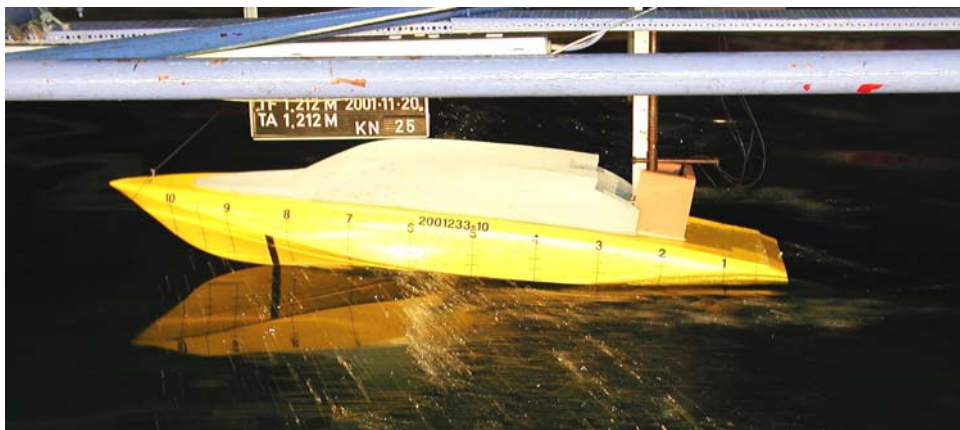


Yacht steaming at sea



Seakeeping test in large waves

Based upon the results of numerical or experimental data, operability analyses are carried out, with respect to variables such as motion and acceleration limits, motion sickness incidence, green seas on deck and slamming.



Fast luxury yacht during tests



Seakeeping tests for a large luxury yacht in DMI's large towing tank

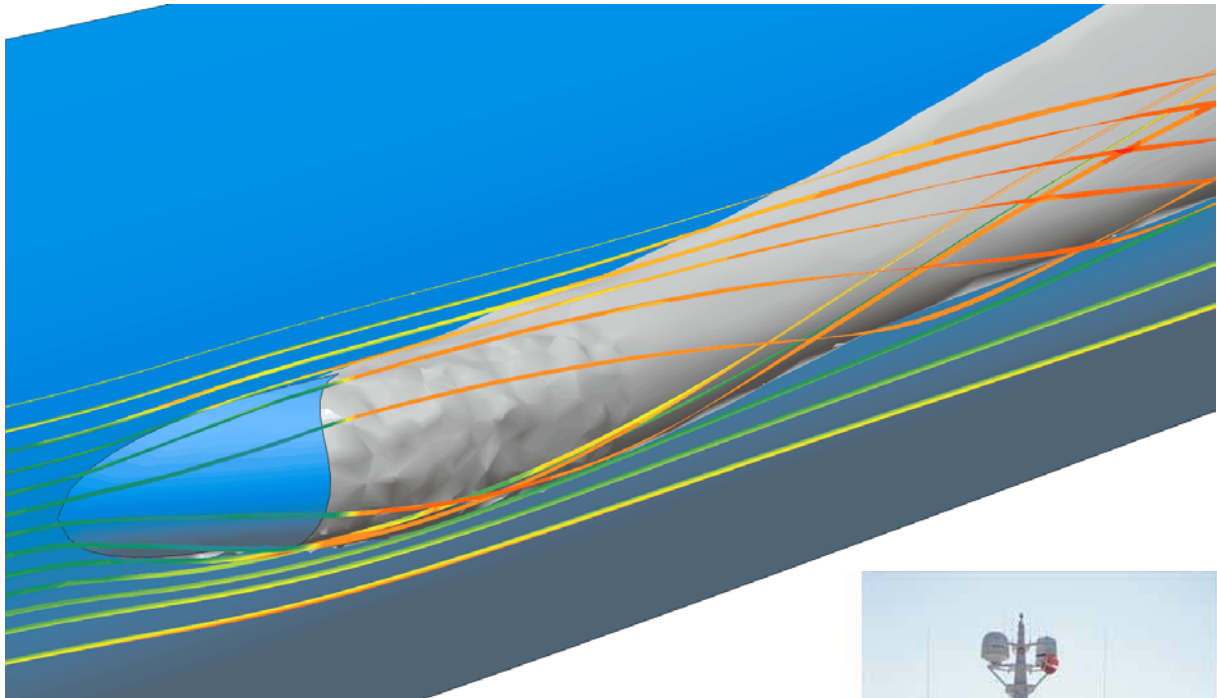
No Smoking

Whether the yacht exhaust has smoke outlets below the waterline or in funnels, DMI has the expertise to help the shipyard with the appropriate design. If the vessel has underwater outlets it is important to place them properly in relation to the hull wave system, throughout the speed range, in order to ensure that the dynamic waterline does not create higher back pressure than allowed by the engine manufacturer.

Furthermore, underwater outlets can also create smoke nuisance problems, in which the smoke rises from the stern wave, resulting in problems similar to problems from normal funnels. DMI has investigated these aspects on several projects, helping designers to find the optimum configurations.



Smoke tests for funnel design



CFD analysis of scoop outlet

For larger yachts, funnels are standard, and in these cases smoke nuisance problems can be resolved by smoke tests in the wind tunnel. In these tests smoke visualisation and concentration measurements are carried out in DMI's boundary layer wind tunnel. These tests allow designers to test various funnel design alternatives in order to find the optimum configuration.

DMI strives to add extra value to the client's yacht. All results are carefully evaluated and compared to similar vessels from our files. Based upon the model test results, DMI will advise the designer and shipyard on how to improve the yacht's performance, ensuring that the buyer gets the best possible yacht for the design / building budget.



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