## The speedy discovery of a ship's wave making

# RAPID Explorer

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**After almost 15 years of intensive use, the RAPID code is still in wide-scale use for practical hull form design but increasingly, also in a systematic hull form variation framework. Introducing RAPID Explorer - a new step forward in the effectiveness of hydrodynamic design.**

The nonlinear, free-surface potential flow code RAPID quickly predicts a ship's wave making. It provides excellent directions for hull form improvement and thus could be, and has been, included in an automatic optimisation loop. However, simply searching for lowest wave resistance may unintentionally increase the viscous resistance, or cause poor performance at a different draught or speed. As long as all such other aspects are not taken into account, automatic optimisation would not give the right answer. This is why a ship hydrodynamics expert should still play a role in the design process. RAPID Explorer ensures exactly that.

The designer first selects the hull form variations to be investigated. Deformation modes are selected specifically, keeping in mind hard points, restrictions, the operational profile and insight into the hydrodynamics. MARIN's CAD system GMS, makes it possible to interactively and visually apply deformations to part of the hull, while keeping its fairness and surface quality.

### Results in an hour

A family of hull forms defined by all combinations and magnitudes of three parametric deformations is created. This design space is typically scanned in 5 x 5 x 5 steps. A user interface serves to create all 125 hull forms and their panellings and pre-process and run the computations in parallel on a PC cluster, thus producing the whole set of results within an hour or so.

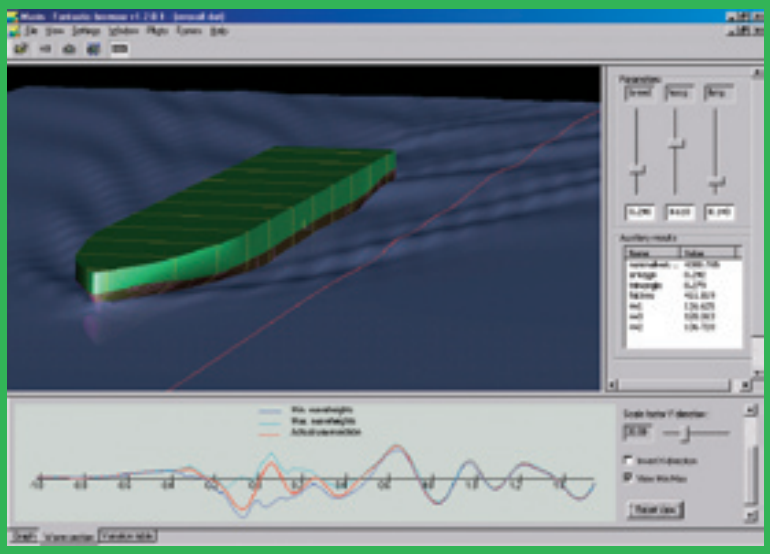
Analysis is crucial. Just selecting the shape with the lowest predicted wave resistance would be simplistic and a skilled designer can often do better, provided he gets insight into the predicted variations of the flow and wave pattern. To enable this, a fascinating visualisation tool was conceived by ICT-specialists at MARIN based on their SURFVIS visualiser.

By moving three sliders that set the three design parameters, it instantly displays the variation of the hull form, wave pattern, hull pressure distribution and streamline pattern. The visualiser clearly displays how the flow is affected by hull form changes, indicating what the best choice is and how further improvements can be achieved. This offers a convincing demonstration of design trends and even of the physics of ship wave making in general.

The whole process of designing the variations, running the computations and deciding on the best choice may take just hours and can provide a significant improvement in the design.

RAPID Explorer already has produced some remarkably good hull forms and provides a 'new dimension' to RAPID, which is now widely used in MARIN's practical hull form design projects.

MARIN



Visualisation of hull form and wave making variation. The sliders top right select the parameter settings defining the hull form (here, 3 deformations applied to the bulbous bow), and all graphs change smoothly when the sliders are moved. Top left: wave pattern, hull pressure distribution. Bottom: wave cut for the hull form considered (red line), and envelopes of wave cuts for all variations (dark and light blue lines).The middle right window shows the resistance predictions for the variation displayed.