A (definite) change for the better

It is usual in the first ORC column of the year to report about how the ITC has made improvements to the aero and hydro models of the VPP, making for racing that is 'closer than ever before'.

Well, there is some of that attention to detail, but this time it is wholly drowned out by one standout exception: the ORC VPP has just undergone a complete rebuild, rather than a winter refit, with a completely new hydrodynamic heart to the VPP, the so-called but all-powerful residuary resistance (Rr) formulation.

Since 1993 this formulation progressed from being a simple exponential representation to a polynomial set of curves whose patterns depended on test model data established using an automatic regression performed on the ORC's available database. These previous attempts tried to measure the effect of hull parameters such as Prismatic Coefficient (Cp), longitudinal centre of buoyancy (LCB) and waterplane area coefficient, which inevitably led to some pretty undesirable typeformed hull shapes (squared-off IMS floating coffins, anybody).

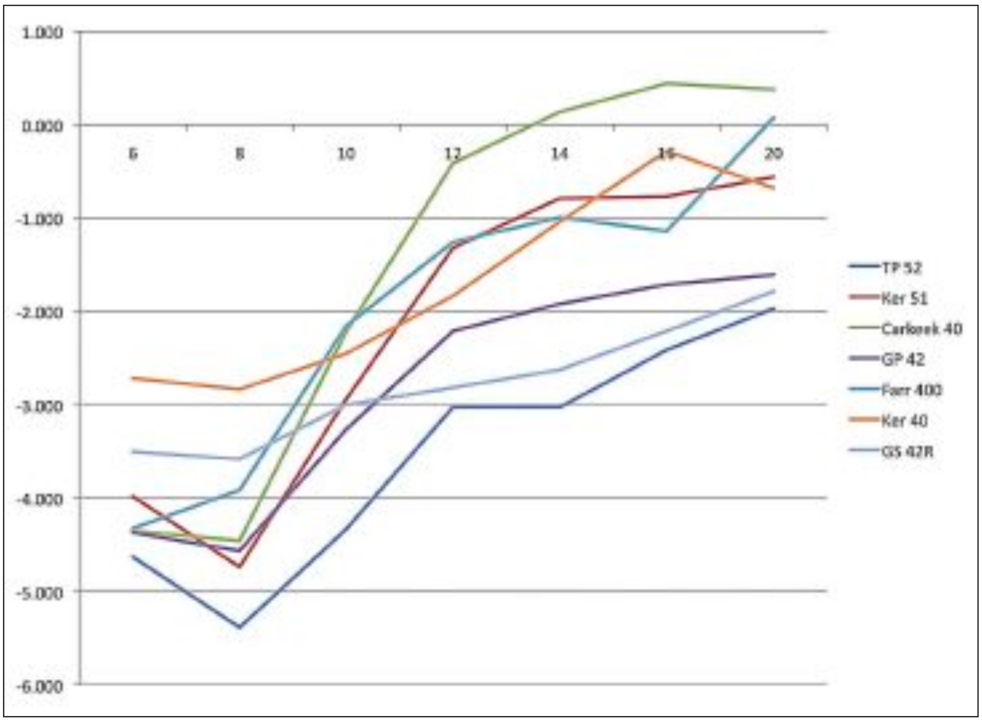
Nonetheless, 'correctors' were introduced over the years to keep up with design development while attempting to keep older designs competitive. But things were moving ahead too fast with the arrival of today's lightweight racers and the existing model was beginning to struggle; so in 2010 a working group was set up to perform an 'Rr overhaul', led by Andy Claughton from Southampton and supported by Kay Enno Brink from Germany, Philippe Pallu de la Barrière from France, designer Jason Ker and ORC programmer Davide Battistin.

The preparatory work was rather long and hard, but once the data was there it became possible to search out some measurement, dimensional and parametric inconsistencies in the data sets. An attempt was made to clean this data through CFD analysis by Philippe Pallu using Crain Icare software; however, in the end the focus was shifted towards creating additional data from a new 43-model series computed by Jason Ker using Numeca Fine-Marine RANS. The parent hull of the new series was a recent design for which high-quality tank data was already available.

Rather than including the evaluation of Cp, LCB and waterplane area, to avoid typeforming it was decided to narrow down the input to two main parameters only: Dynamic Length-Volume Ratio (LVR), and Beam to Canoe-body-draft Ratio (BTR).

Using this approach it has been possible to create and validate a base boat Rr curve on a model for which good tank and CFD data are available, then set up a method able to deliver a Rr value for each boat and each speed considered. The resistance data is extended to different hull designs depending on their variation from the base boat in its fundamental length/volume and beam/depth ratios.

When tested, the new Residuary Drag formulation proved to be robust and also very effective in assessing the resistance of the boat, so the working group went on to apply it also to heeled drag, using the same formulation based on heeled parameters entered for each heel angle.



This plot of typical Class A racing designs shows the percentage change in sec/mi rating from 2012 as a function of windspeed on a windward-leeward course. All the designs have been sped up, particularly in light air, although the 40-footers see less change as planing speeds approach

Another new formulation takes into account the axis of the boat when heeled, and then considers appendage sizes (and special configurations like canards and trim tabs) so that leeway angle can be calculated and used to compute the induced drag arising from the hull asymmetry.

Improvements were also made to the aero model to correct a situation for moderate and heavy boats with asymmetric spinnakers on the centreline, for which the old VPP gave downwind VMGs that were higher than observed, with a deeper predicted true wind angle than was possible in practice. The ITC has therefore completely revised the three aero functions known as 'power', 'shape' and 'blanketing' to yield better results.

These aero and hydro model changes were validated through test-runs comparing the various handicaps of 1,600 boats in the ORC test fleet, and also by rescoring several major championships.

The rankings changed little, and any changes also varied little across boat sizes and types. However, within each class the corrected time spreads across the top 8-10 boats, and even between adjacent boats in the same class, have been reduced by about 30 per cent using the new VPP.

The overall effects of the changes are that rated speeds of all boats are faster by an average amount of 5 sec/mi GPH, or about 1 per cent. Light boats are sped up downwind in particular but much less upwind, while yachts that had been heavily optimised to the coefficients used in the previous VPP no longer receive any special credits. Conversely, the yachts that were previously penalised for having a low prismatic and moderate LCB positions no longer find themselves in the wrong corner of the VPP space.

The rating changes can be conspicuous in some cases, as should be expected from such a significant overhaul, but the idea that there are individual winners and losers with this change must be avoided. The real winners being the racing community who have been delivered a new handicapping VPP that is much better able to evaluate the potential performance of a yacht's design relative to its competitors, considering only primary measured values. Not surprisingly, VPP-predicted speeds are also now much closer to actual speeds recorded onboard.

Jason Ker ❑