



Newbie

Among 120 or so boats at the ORC Worlds in Trieste this month will be at least one welcome 'new face' in the shape of the brand new Humphreys-designed Aquatich 40. In the past some have criticised the ORC rule for not inspiring new designs; the counter argument being that the rule works well enough that with careful tweaks many well-proven (and well-sailed) existing designs remain competitive.

There has certainly been some clever – and sometimes aggressive – playing around with ORC optimisations in the past few years, perhaps getting too clever at times as we saw with the Scugnizza episode last year. However, the new Aquatich 40 was drawn very much with ORC competition in mind and it will be interesting to watch her at this regatta (but keep in mind that in Trieste she is among a minority of Corinthian entries in the largely pro-crewed Class B).

This year's host venue at Porto San Rocco in Muggia, just south of Trieste, is expected to have conditions typical of many ORC championship events: light to moderate thermal breezes and flat water. As is normal at major ORC regattas the regatta will consist predominantly of windward/leeward races, plus a coastal race or two depending on weather conditions. As always with windward/leeward courses, particularly in light airs, getting and holding a lane off the start in clear air will be vitally important, so most recent designs and optimisations have focused on these parameters.

Lymington-based Humphreys Yacht Design were approached by Norway-based Bjørn Erik Bjørnsen for a new ORCi-optimised design of around 40ft that would be fun to sail but also comfortable enough to be suitable for the rather long commutes Bjørnsen must make from his base in Stavanger to other racing venues in the region. With this mandate Tom Humphreys was able to take a fresh look at ORCi and develop the design for the Aquatich 40 racer-cruiser starting from the office's good understanding of the wheels and levers that optimise performance and rating in IRC.

Humphreys reviewed all the principal parameters, focusing initially on beam, draft, displacement, VCG sensitivity, rig height and appendages, working with Roland Kleiter at KND-SailingPerformance who supplied DasBoot CFD and yaw-balanced VPP data. This process turned into a thorough analysis involving considerable background research on the ORC system itself and so Tom's comments in comparing IRC and ORC influence on design are interesting.

Having established the parameters for a base design, Humphreys graphed the base boat to demonstrate the effect of displacement variations from 600kg lighter to 400kg heavier. This displacement range of 1,000kg was what they identified as achievable for a design of this size, given the relatively production-oriented build materials and processes used – ie infused vinylester/foam/E-glass sandwich with a gelcoat finish (the intention is that Ocean Tech in Slovenia will produce the boat as a series-build).

'Graph 1 (*overleaf*) shows the time difference in going lighter or heavier than the base boat,' says Humphreys. 'For this example I've assumed we're looking at 12kt TWS so have used the ORC Medium (wind strength) Triple Number time-on-time scoring for windward/leeward racing [typical for an ORC championship]. The ratings are compared in terms of time differences (seconds per hour) to the base boat. Negative values represent a lower/slower rating.'

'As you can see, the ORC rating increases significantly for displacements lighter than the base boat compared to IRC, while going heavier shows a similar rating reduction under both systems.'

'Graph 2 displays corrected time deltas (sec/nm) compared to the base boat on a 12kt TWS windward/leeward course. Negative values represent a slower corrected time than for the base boat. As on Graph 1, the same ORC Medium Triple Number windward/leeward ToT scoring is used.'

'For the ORC studies we used the ORC VPP,' says Humphreys,



Although the new Humphreys-designed Aquatic 40 is likely to be the only new design racing the ORC Worlds in Trieste this month there will be plenty of super-optimised existing designs to measure her against; that said, the yacht went afloat late and good preparation is critical in the well-refined but predominantly cruiser-racer ORC fleet – more than half of which are entered in the professional division. The Aquatic's modest draft with a large area fin and bulb puts her in between the short, squat fins popular in ORC and the deep fin/long bulbs of larger IRC racers

'and for the IRC evaluation we ran two base trial ratings with gaps in parameters filled in using an "IRC calculator" that we have refined over the years from the many design trials our office has run.

'The IRC calculator is pretty accurate and reliable, but we also validated the rating deltas against existing IRC trials we already hold for similar displacement increments for a 39ft IRC design that we worked on last year. So I can't say I'm 100 per cent certain, but I'm confident they'd be within 1-2 points' accuracy'

The big points to note from the graphs (*overleaf*) are that IRC and ORC ratings for moderate (and heavier) displacement designs appear to be quite similar, which is reflected in the similar rating and corrected time deltas. However, beyond the base displacement used in this study, going lighter is currently penalised more heavily under ORC than under IRC.

'This exercise was based purely around a light to moderate displacement mid-tech racer-cruiser design of 40ft,' Humphreys added. 'TP52s have obviously been successful in ORC Class A for a number of seasons, so there is clearly a bit of a grey area in between, as is also the case under IRC currently.'

'We did also look at a lightweight IRC/HPR-style 40-footer based on hydro data we had from a previous project using the same CFD code. This also highlighted to us that at this smaller size, the lighter you go under ORC beyond a certain point the increasingly punitive the rating becomes compared to IRC.'

'However, this is a simplified comparison as once we start building reaching performance into the equation the lighter designs begin to show marked improvements in terms of performance against rating. This is true under both systems; however, under ORC, depending a little on the scoring option used, the relative performance gains are not as significant as under IRC, with its single number scoring, as ORC obviously tries to account for the improved reaching performance due to a lighter displacement.'

Humphreys then frames the design trends in the context of the typical ORC racing format: 'I suppose one contributing factor as to why ORC still seems to favour moderate to heavy designs in the smaller size range is that all major ORC championships are windward/leeward inshore biased with only a small offshore component, whereas most IRC events typically comprise more varied courses with offshore races quite commonplace.'

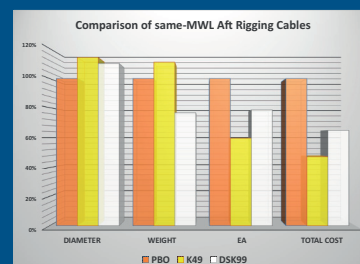
Draft for the Aquatic is 2.55m. Humphreys says that, due to the moderate displacement, a longer fin with less bulb weight for the same righting moment was not necessary. The draft was ultimately driven to provide sufficient span and aspect ratio for efficient upwind performance but with an easy groove; a shallower draft was also studied but the loss in upwind performance was enough to result in a poorer corrected time over the course types considered.

On sail areas Humphreys had these observations: 'When isolating sail area we found that increasing upwind sail area appeared to be

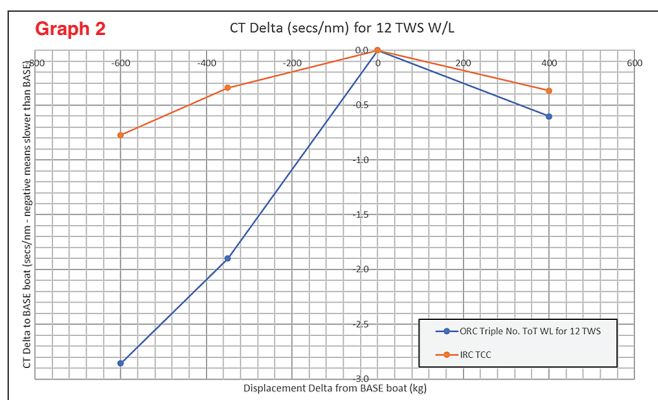
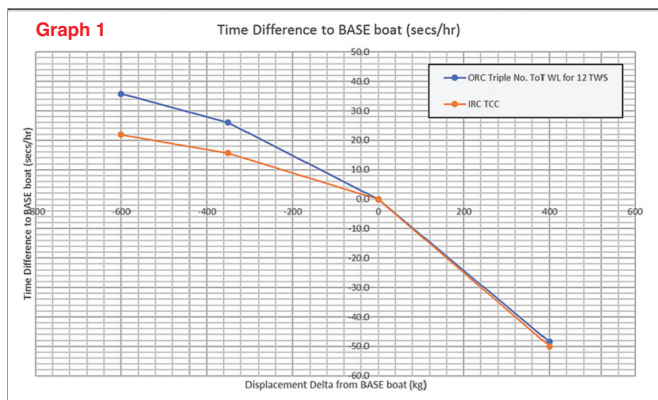
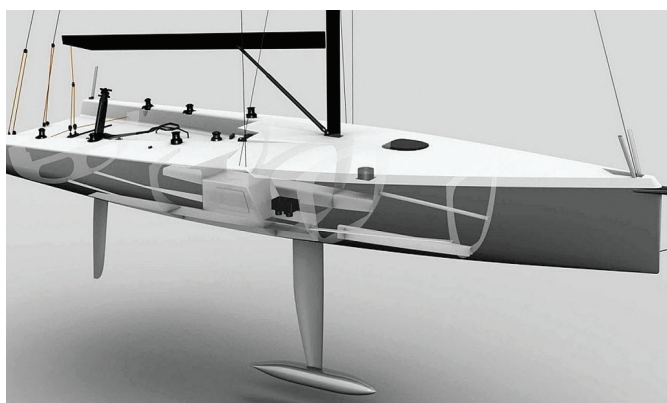


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In developing the Aquatich the Humphreys office ran an unusually specific dual-system analysis of relative and rated performance, varying design parameters and then scoring their candidate designs under both IRC and ORC. The results (above) are interesting and bear out what is seen on the water: IRC (red line) does not particularly like small, light boats but ORC (blue line) evidently likes them a whole lot less. Once DSPL increases above the base boat (above) the treatment by both systems does even up though IRC is always kinder to the lighter design. And then there's the other big effect of boat size... for smaller IRC designs the French school led the way with conservative fin keels, as seen here (top left) on the hugely successful JPK 10.80. Go up in size and this IRC-based Fast40+ (left) from Shaun Carkeek is all deep fin and slender bulb. But 40-foot is still a grey area in IRC... however, by TP52 size the full-on racer is away over the horizon. It is often a similar story in ORC where TP52s have proved equally successful when well sailed

costlier under ORC than IRC. We did have two IRC trials to confirm this and the rating delta for an increase in upwind sail area through a taller, higher aspect ratio rig was distinctly more under ORC compared to IRC. The work we did, in terms of performance against rating, seemed to encourage a lower aspect ratio rig in ORC with longer J and E than the relatively high aspect ratio rigs with tall P and short E which have become typical under IRC. Consequently we ended up pushing the girths to increase area, with what is a relatively large headboard for a fixed backstay arrangement.'

However, the study Humphreys did on downwind sail area did challenge a common assumption that ORC penalises large spinnakers more severely than IRC. This may have become apparent at the last meeting of ORC's International Technical Committee in Southampton in March, where Humphreys and other observers attended to exchange ideas.

'Based on what I'd noticed over the years in ORC, I was expecting large spinnaker areas to be heavily penalised. However, this didn't appear to be the case, and the penalty in spinnaker area, at the sizes we looked at, was less under ORC than under IRC. I think this is partly because of a shape function introduced by the ITC a few years ago to encourage larger spinnakers – with the ORC VPP now trying to account for a loss of efficiency for a big spinnaker below 12kt TWS.' The Aquatich will have a carbon rig from Pauer, and bucking the ORC norm will fly spinnakers from a fixed bowsprit.

In summary, Humphreys said, 'We started this process assuming we would have a narrow, heavy, boxy design with a small rig so it has been a pleasure to see we ended with a nice, well-rounded design.'

Besides the Aquatich, there is one other 'new' ORC design that was supposed to debut in Trieste but builder delays mean that it will now first race at the ORC Europeans in Gdansk. In fact, the successful 2015 Maurizio Cossutti design *Katariina* has been in Estonia having a new hull fitted under the existing deck. Cossutti promises this boat will be 'rather different' in hull shape from the old design when it does reappear.

An experienced master at ORC design optimisation, Cossutti has numerous clients competing at Trieste, particularly in the small-boat Class C where a great deal of work has been done on optimising designs to hit the top of the class limit.

Among the Cossutti designs in Trieste are a racier version of the production Salona 380, built lighter and with a deeper keel, an older Vrolijk 37 now armed with a dramatic appendage update and, perhaps most interesting, the heavily reworked Melges 32 *Airis*: here a shorter steel keel blade has replaced the original carbon foil, plus a still undecided array of out-of-class sailplan options that are being considered to boost light-air performance.

And if the wind does pipe up watch out for the Cossutti-optimised First 40.7 *Mareus*: this big boat is hundreds of kilos lighter than any other 40.7 yet with less draft rates just under the Class C limit...

Finally, in Class C Cossutti also has his repeatedly modified Next 37 design *Mercedes AMG*, revised yet again this time with a long bowsprit and large masthead gennakers.

Cossutti's former protégé Matteo Polli has also been active, working on many of his pretty Italia 9.98 designs, of which there are no fewer than five in the Trieste fleet including the 2015 Class C champion *Low Noise II*. Polli says that he has advocated increasing horsepower on all his designs to be competitive in the light air and, like Humphreys, he reckons there are no rating disadvantages in reverting to big masthead symmetric spinnakers hung on long conventional poles to maximise VMG in crowded tactical situations.

Another trend Polli is chasing is in designing keels that are even lower aspect in shape with shallower draft. He believes that these can be more efficient because 'they have more effective draft presented to the fluid flow, and allow for less constraint in support structures' than typical high-aspect keels.

Dobbs Davis

