

Offshore Sailing Performance – Cat v Tri Debate

By Derek Kelsall

When it comes to performance, the catamaran configuration is at a major disadvantage - whether designers, builders or owners, those twin hulls possess a seemingly irresistible invitation to provide space and we seem to be quite unable to resist the temptation to fill that space. The typical 40 ft. trimaran is designed with two small cabins and a small area for seating, galley and charts and uses a small outboard motor. The typical 40 ft. cat gets a very large saloon, four separate cabins, separate galley, two heads, diesel engines etc.

The cat v tri debate has fascinated most involved with multihulls since the sixties. Any reviewer of the current range of multihulls on offer at boat shows, in the magazines or represented in the major races could not fail to gather the impression that there was a clear roll for each. The cat as the multihull cruiser and the tri as the offshore performance multihull.

After more than three decades of modern development one would expect there to be such a clear picture of the relative advantages of the two basic types. The facts are

1. The catamaran cruiser is taking an ever larger slice of the cruiser market.
2. All major offshore races are dominated by trimarans.
3. At the other end of the size scale, the 26 ft. micro class, in terms of numbers, is equally dominated by trimarans.

The cruising trimaran, which played such an important roll at the start of the modern multihull movement, has almost disappeared from new build and the new racing cat is almost equally rare.

My proposition in the debate is that the above picture is a false one, due more to historical factors than on the water performance differences. My case is that twin hulls are rightly the basis for the cruisers, the charter fleets and the commercial operations but are equally as effective, if not more so, for high speed sailing with the power rigs of today. The later qualification is fundamental to my argument.

As a race entrant, designer and builder of both catamarans and trimarans, who was in on the introduction of multihulls to the offshore yacht race scene and has been a part of, or followed the race activities ever since, I seriously believe that any newcomer to multihulls could easily be misled as to the true picture. Three hulls are not essential to performance and by my theory and experience, two hulls, when combined with the typical rig, is a better base than three.

Yes, as the first to race a tri across the Atlantic and the first to win a major open offshore race in a multihull, also a tri, I have changed my stance on this question. I believe it is fair to say that "Toria", my 1966 Round Britain Race winner set the style for the racing trimarans. She sailed on two hulls, minimum weight foam sandwich, long full buoyant floats with full transom, curved beam and with one hull flying even at rest. Toria's weakness was her rig, which we put right on sister ship "Trifle" - same hulls, 20% wider, full battened mainsail, rotating mast and 7/8ths genoa. I chose trimaran for the extra width, which seemed to make more sense than the narrow beam catamarans of the time.

The trimaran won in 1966 and in 1996 - the 96 Atlantic Race was dominated in most convincing fashion by the 60 foot trimarans. All these trimarans fit the above outline description. Some pretty convincing results there to contradict my argument! The following I believe to be the explanation.

A Basic change

The theory of the "Toria" arrangement, and the majority of race tris that followed was that the boats weight was taken on the main hull and the floats kept the mast upright against the wind forces on the rig. When the lee hull was lightly loaded, in light airs or running, the total wetted surface drag was much less than the equivalent catamaran.

In one way, we could see the current racing trimarans as a steady, 30 year development since, with each new design required to be either more powerful or less weight. The simple, basic "Toria" description does still apply - but what about the theory? We had not envisaged 60 footers, with near 60 foot beam and 100 ft. masts, sailing at 25 kts. That substantial extra power has changed the roll of the floats and hence, the basic theory of the arrangement - the floats must now be fully capable of supporting the full weight and to provide the balance, the reserve buoyancy and control to keep the boat on course, as she meets the waves at high speed. At this point we must question the roll of the main hull. With so much power, the times when the lee hull is lightly loaded will be seldom. In my view the answer is self evident - the main hull, in the water, is superfluous.

Watching the spectacular start of the 96 Atlantic race, as the five top trimarans departed at 25 kts, with main hulls flying but not sufficiently clear of the water to avoid wave impact, did nothing to change that view. That two of the five capsized came as no surprise. I have no doubt that two hulls would provide the more appropriate base for such speed machines, if only to avoid the varying forces introduced by wave impact on the main hull of the trimaran. You may ask - are all the current race designers blind to what is after all a very simple principle? Certainly not. Nothing I write here is likely to be news to them.

Sponsorship and fashion, are powerful forces in today's offshore race scene. How to "Sell" the project to the sponsor is crucial. Gone are the days when the sponsors could be tempted with promises of some 'new idea'. The tris have dominated for so long that cat could be seen as out of step. The truth is that the designer is never working alone and not free to include his ideas as he might like to be. To illustrate - when we were designing and building a sponsored racer some years ago, the man behind the project insisted that a cutter rig be designed rather than the 3/4 fully battened main sail and rotating rig we had used so successfully for Trifle and all previous racers. The reason - Dick Newick designs had had some recent success with cutter rig. This was something he could "sell" to his sponsors. It took some years to get back to the Trifle style rig, which has dominated ever since.

In addition, the designers are in the unenviable position of being expected to produce a fully functioning efficient vehicle from scratch, that can be put onto the race course and win. His best chance of success is to refine the last design. He may believe in switching to a cat but what chance of success first time?

This is not in any way a new idea. All of the above thinking has been incorporated in a number of catamarans including one I designed - the 63 ft., 4.5 tonnes catamaran called VSD for Nick Keig. She could be described as a trimaran with the main hull clear of the water. In other words two cross beams and central accommodation with all the fore and aft loads from the rig taken on the central unit. For various reasons, which is another story in itself, although she proved to be in the same performance league as the very best at the time (mostly trimarans), she did not get the race results and I have always felt that her true potential was never seen. For me she was one of the most interesting craft I have ever been involved with and one with that real light weight easy performance feel while sailing. Sailing VSD was to have to look at the log or at the water as it passed under to get a real feel for the speed.

At the other extreme, the most active small multihull offshore racing is the Micro class, where Farriers and Dragonflies make up the majority of the fleets but where, more often than not, the one or two Firebird catamarans take line honours every time. The explanation here is very easy to find. The definition of a Micro is a trailer sailer. The two Companies producing the Dragonflies and the Farriers produce excellent products which are particularly popular due to their trailer/sailer convenience. Both designs are performance oriented in size and style of rig and equipment. The catamaran solution to trailer/sailing convenience was not previously available until now with the Kelsall Catamarans X-Kats.

What is obvious from the above is that the sailing speeds, in day to day sailing of similar cats and tris, are quite close. No rating rule distinguishes between cat and tri - which must be interpreted to mean that all round performance is directly related to length, sail area and weight and not to number of hulls. The differences is only seen in the more extreme conditions - which is important in crossing oceans but probably of little interest to the typical trailer sailer.

Other Factors

We could not leave the debate without mention of other factors such as seaworthiness, motion at sea, handling, weight and cost.

Seaworthiness

Some may claim the trimaran as the more seaworthy. I don't believe that either the theory or events on the water support that notion. The perhaps most surprising fact of the modern multihull development is the seaworthiness of the catamaran. The catamarans of the late fifties and the early sixties were just too narrow. The performance craft had too little stability to support their sailplans. Beam has steadily increased since. Today's catamaran is a very different animal, regularly undertaking major ocean crossings in every part of the world.

I believe the following to be true - the catamaran is probably more susceptible to overpowering under sail. Its very high initial stability and its low angle of heel can give a false sense of security. The typical trimaran on the other hand is more susceptible to wave capsize, due to low diagonal stability and tripping. The former can be avoided. Obviously we must promote caution. I take the view that anything that can float can capsize. If not self righting they stay capsized.

There is a video of a tank test, comparing mono and catamaran in high winds and breaking seas, which gives a slightly different picture to the usual one presented of the cat being pushed sideways by the breaking wave. The mono (commercial craft without deep keel) rolled with each wave. As the breaking wave hit the windward hull of the catamaran, it rose rapidly looking like an immediate capsize but due to the speed of the wave, the lee hull was lifted before a large angle of heel occurred, to flip the cat back onto an even keel. Three hulls would, I believe, respond less effectively in such conditions. A recent discussion with a skipper of 32 foot cat, with some severe gale experience described the falling back, after the wave had passed, as being as disturbing as the initial impact. Incidentally, his preference excluded the idea of the very large sea anchor and meeting waves head on - which is contrary to some reports that I have read.

Motion At Sea

Over the years I have been at the start of a number of ocean races. A few have been into strong head winds and seas. No one could fail to note the difference between the gyrations of the different rigs, which has to be the best indication of the motion on board. The tris heeling, rolling and pitching to a noticeably greater extent than the catamarans. The width between the two hulls supporting the craft is a more important factor affecting motion than overall width.

Weight and Cost

A simple basic fact - two similar hulls must be less cost than three, in both materials and time. Some years ago we built two 40 ft. extreme, carbon/kevlar/epoxy racers for Lake Geneva - one tri, one cat. The scantlings were basically identical. The rigs were very similar. The all up weight of the trimaran was 1,100 kg. The same for the cat was 860kg. Length for length the race cat should win out on weight alone.

Where Now?

Am I foretelling the demise of the trimaran configuration for both racing and cruising? I would be the first to say - that would be a pity. Variety is the spice etc. My second response has to be - As an innovator, the basic idea of one long slim hull, with some widely spaced, light weight side support still has enormous appeal. The concept is entirely at odds with the current multihull norm where the tall rig, on wide beam, imposes enormous loads on the structure. This is not a problem for the cruising catamaran (other than the high cost of the rig) which has plenty of structure between the hulls to take the loads.

During the late sixties and seventies, a number of designers experimented with long, light weight, wide, small floats, foils etc. They worked but they did not win. Eric Tabarly's foiler for instance, in the Transat en Double (France to Bermuda and back), was just pipped at the post by Eugene Riguidels standard Kelsall tri. Had the foiler concept been developed, had the weight saving potential been fully achieved etc, I have little doubt that the result would have been reversed. I am not at all convinced that any of these ideas were tested to any final conclusion. Proas were the outcome of similar thinking and similarly never fully tested or exploited.

Equally appealing are the possibilities promised by some rigs seen on experimental machines. "Go Fly a Kite" was my introduction to a talk on speed sailing many years ago - by which I meant a sail plan which acts in the same way as a kite and does not impose the capsizing forces or the enormous loads associated with the standard sail plan. To give an idea of what can be done when the sailing forces are taken out of the structure - at one time I had a 51 ft proa, with inclined rig, sailing at 3/4 ton (no conventional cat or tri could come within 3 times this wt.) - that also is another story. Neither was it an entirely crazy project - the main hull, 25 years on, is still afloat as the main hull of a trimaran.

I can imagine both racers and cruisers with configurations on these lines and I will be delighted to see a new rig come onto the multihull sailing scene in the near future. Could this be the next breakthrough in multihull sailing? For best performance it could then be trimaran or even proa.

Fastkat 50 represents the catamaran configuration that I believe fills the specification of the ideal multihull for long distance, short handed and fast passage making cruiser, with standard rig.