



Time to revisit

Cat or tri... designer Marc Lombard has teamed up with multihull expert Eric Bruneel in an informative new attempt to have it all

To reconcile 'boat sensitivity' and comfort

Eric Bruneel has more than 30 years of experience in the design and construction of multihulls, of which 26 (1983-2009) were devoted to the development of Fontaine-Pajot SA, a world leader in cruising catamarans whose 2,000th unit was delivered in August 2009, two years after the company was listed on the Euronext-New York Stock Exchange. Meanwhile, in 2003 Bruneel built his own 50ft Joubert Nivel-t-designed trimaran *Trilogic*, with which he won his class in the 2004 OSTAR solo transatlantic race as well as the 2005 Fastnet. He also placed second in the 2006 Route du Rhum.

When Eric came to us, soon after the death of my greatly mourned confrère Michel Joubert, we were very interested in taking on his ideas for the design and development of a new range of fast cruising trimarans under the umbrella of the recently created Neel Company.

Eric, Michel and Bernard (Nivelt) had already successfully taken steps with the concept of the cruising trimaran with the development and production of their 45, 65 and, most recently, 51-footer.

I had known Eric a long time, since the Little America's Cup in Melbourne in 1989; he was competing while we were involved in the design of his C-Class cat. By now I was also immersed in offshore trimaran design.

I started my career with Walter Greene in 1980 when I had the chance to meet all the other special figures of trimaran design and sailing of the time: Dick Newick, Mike Birch, Eric Tabarly and the Gougeon brothers – legendary creators of the West System of epoxy construction.

From then on I became addicted to

multihull design. I have now spent 25 years designing racing multihulls, mainly in the open classes and also the Formula 40, later on designing Orma 60 tris where we were among the earliest adopters of the retractable curved C-foil.

Over time we have evolved into a small design studio with particular competence in fluid dynamic analysis (numerical simulation), structural calculation (FEM/FEA) and of course naval architecture.

Our company is now a partnership with Eric Levet (longtime partner), HP Shipman (naval architect), Paul Cougnaud (structural engineer) and Lionnel Huetz (fluid dynamics). Today the Marc Lombard Design Group is involved with most of the major actors in the boat industry, among them Groupe Bénéteau, Bavaria Nautitech, the Hanse Group (Privilège-Marine) and many other builders in France (JFA in Concarneau, Fora Marine in La Rochelle, Alubat in Les Sables) designing both sail and powerboats.

However, racing design remains our passionate 'hobby', with successful IRC



Opposite: the Neel 47 marks the first full collaboration between Eric Neel and the Lombard office (though Neel's trimaran *Trilogic* had hulls 'borrowed' from an earlier Lombard racing design). Most of the work put into the modern multihull cruiser-racer focuses on two hulls, but given equal investment there is no reason why a modern tri cannot match most of the benefits of a cat while reliably delivering better upwind performance and an easier motion in a seaway. The Neel 47 follows the powerful Joubert-Nivelt designed Neel 65 (left) and the slippery Neel 45 (below)



of buoyancy in the floats of the modern designs together with the increasing size of the 'average cruiser'. Almost all of the latest big multihulls feature large and comfortable interiors, the result being that (other than for racing boats where displacement continues to reduce) – while overall weights have increased significantly and with modern high-buoyancy floats – the amount of the available stability that is actually used when sailing is in proportion much smaller than on earlier designs.

Typically, on a current generic 40ft cat, when reefed (or not) according to the suggested sail configuration (ie the 'manual'), you're still only using half the maximum righting moment. On a typical modern 60-footer the percentage becomes lower still, giving an increasing margin of safety before capsize. On today's biggest multihulls the available stability is so high that you can no longer capsize under the pressure of wind alone; you would first break the sails, and then probably the mast before ever reaching maximum righting moment.

Trimaran or catamaran

As with the cats, for a modern trimaran the bigger the size the greater the usable stability. However, with the trimaran's extra width the margin of heel before inversion is even bigger.

In Figure A (*overleaf*) I have plotted a comparison of stability between two multihulls of the same size, both designed by ourselves: the new Neel 47 trimaran and the Nautitech 46 catamaran. Both yachts are situated in the same performance range, with moderate overall weights (around 11 tonnes empty and 15 tonnes fully loaded) and similar sail plans.

When sailing reefed in 20kt AWS the stability margins of the two boats are equivalent, but the safety margin in terms of angle of heel is greater in the case of the trimaran. In other words, the trimaran will usually feel more secure when hit by a gust or a particularly steep sea.

By contrast, in Figure B (*overleaf*) I've plotted the same variables but now substituting an old-generation trimaran... a light and narrower boat, with small buoyancy floats, still with the equivalent sail area. The reserve of stability is now a much smaller percentage of the total power used. In other words, those boats function more like racing machines and can become quite unsafe (small stability margin) if not well sailed by experienced sailors.

designs including the two MC34s *Courrier Vintage* and *Nutmeg*, the IRC46 *Pata Negra* and the successful and unusual Ofcet 32. Then there is the Class40 (our Lift 40 won the Route du Rhum 2018) and our latest flying Mini designs 945 and 950.

It is the combination of those experiences in yachting and racing that led us to the idea of a new fast and comfortable cruising trimaran. So it was logical for us all to regroup to look once again at the evolution of cruising trimaran design.

The company brief – Neel 47

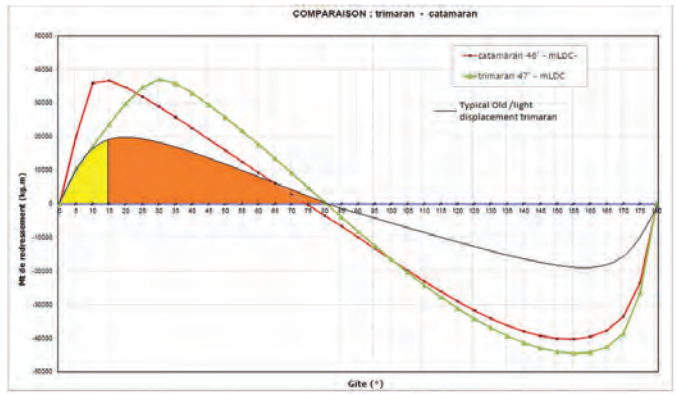
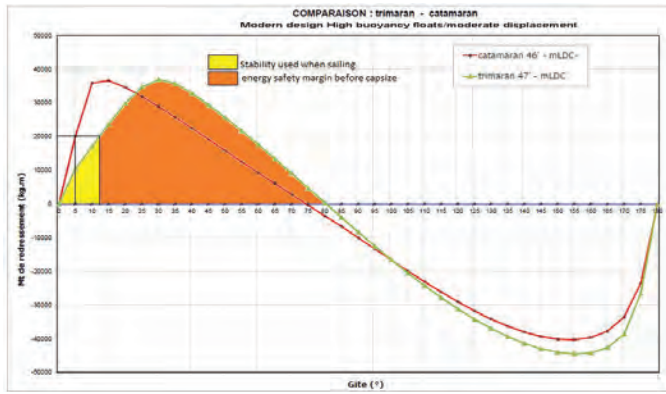
Modern trimarans first achieved notoriety in the 1970s with the singlehanded OSTAR transatlantic race with the victories of *Manureva* in 1972 (André Allegre design) and Phil Weld's *Moxie* (Dick Newick design) in 1980. But it was the Route du Rhum of 1978 when the three-hull form hit the headlines when Mike Birch's tiny Walter Greene Acapella design beat the giant monohull *Kriter 5* of Michel Malinovsky by just 78 seconds and stepped directly into the sailing history books.

Since then multihull development of all types has made dramatic progress and the latest giant Ultim tri perfectly encapsulates today's idea of the pinnacle racing boat.

But if the trimaran became popular as a racing machine it remained of micro interest for cruising purposes. The image of high-speed racing hindered most attempts at promoting cruising trimarans, the sportive association simply being too strong to reach a large audience. Also not helping was the fact that the traditional narrow and shallow trimaran main hull offered no accommodation at all. If Newick (and Derek Kelsall) did produce some designs that were cruising oriented they only proved of interest to sailors with previous great experience of ocean racing.

The stability of multihulls in general, with the ultimate risk of permanent inversion, was a huge drag on early ideas of promoting the breed as a 'safe offshore boat'. So what has changed, and why are multihulls no longer considered dangerous machines?

The main positive factor is the increase



Left: Figure A – stability/reserve stability (y-axis) plotted against heel angle (x-axis) for a current 46ft cat and the new Neel 47 tri.
Right: Figure B – stability (y-axis) versus heel angle (x-axis) for the same 46ft cat and an older-style light-displacement trimaran

So margins of safety have drastically improved on modern multihulls, making inversion very unlikely except in the most extreme circumstances.

Weight and performance

As is well known, besides waterline length, multihull performance is mainly a function of the ratio of power to carry sails versus overall weight. So are modern trimarans heavier than modern cruising cats?

Actually, as safety margins have increased, so the weight difference between the two types has declined dramatically. The reason for this, despite the slightly higher shell area of a trimaran, is that rig loads are easier to support with a trimaran's central hull, compared with a big cat where all the longitudinal loads are resolved via the floats and beams. The structural weight of today's best trimarans is only marginally higher than a cat of similar length.

And there are other benefits to the trimaran platform for our purposes, aside from the greater margins of safety:

- A simpler steering system with only a single rudder and so lighter and less complex controls.
- A single engine that is lighter than the twin engine installation necessary on cats.
- The generator and all of the tanks are situated in the main hull, saving weight and with better mass concentration.

In terms of accommodation, the total living area is generally rather bigger on trimarans, but expect the guest cabins in the floats to be smaller than the equivalent cabins in the larger hulls of a catamaran. In terms of weight, with the new Neel 47 the choice of a simple contemporary treatment of the accommodation led to a total interior weight rather smaller than on an equivalent catamaran.

At the end of all this, compared to a cat of similar size the trimaran ends up with a slightly lower displacement yet slightly greater sail-carrying power primarily because of the greater width of the platform.

Ultimately the 'real world' loaded displacements will end up similar, but there are other benefits of three hulls... In light airs, as soon as there is any pressure the tri's windward float lifts out of the water and the combined wetted surface of main hull plus float becomes smaller than the cat with both hulls still immersed. In turn,

the total friction drag with the single daggerboard and rudder is substantially lower than on a cat at small heel angles.

The result is that the tri will demonstrate better performance in winds under 12kt. This is an important consideration when looking at a cruising boat that will typically spend much of its life sailing in light conditions.

At the same time the air flow across the sail plan is more stable with the small amount of heel of a tri, which tends to settle the sails. The result is more stable laminar flow over the sails, increasing efficiency and performance.

With a single rudder and a deeper fin (even with a fixed fin) the trimaran configuration also has all the characteristics needed to deliver a nice feel to the helm, especially upwind where steering these boats can feel closer to a monohull in light to medium conditions at least.

On other points of sail, and in higher winds, the performance is just as good as on cats, the only real difference being a slightly higher downwind VMG because the tri is able to sail deeper angles on account of its lower wetted area.

So overall a rather good sailing pattern for the trimarans.

Comfort

The modern idea is to provide accommodation not only in the main hull but also in the floats and across the large nacelle. Of course, to allow this, the boat needs to be quite high on the water with generous freeboards, but in combination with high-volume floats it becomes possible to maintain an acceptable aerodynamic form along with some nice aesthetics.

The trimaran configuration offers a more private layout with the totally independent guest cabins in the floats. And with the master suite situated in the middle of the boat, at cockpit level, it really offers a different configuration than on cats. After the Neel 45 and the 65, Neel's innovative 51-footer introduced the 'Cockloot' concept, where the interior and exterior living space blend into a single volume. This also eliminated an issue we had with the 45 where forward vision from the outside cockpit space was obscured by the saloon bulkhead.

Following the first steps taken with the 51, with the new Neel 47 we have moved

the galley and navigation areas forward, giving a panoramic view in the kitchen and at the 'watch station'. In fact, on the Neel 47 you can (almost!) stand your watch from your bed in the master cabin because the front of the cabin is mostly made up of large plexiglass windows. With additional beds in the floats the Neel 47 offers no fewer than five totally independent cabins.

So our new trimaran has as much living space as an equivalent cat but with several distinctive characteristics: a master suite up at the deck level, more independent areas for guests, two further small cabins, one large shared bathroom plus two smaller bathrooms in the floats.

Structure and construction

A complete finite element model of the Neel 47 was built to allow us to engineer for minimum platform distortion along with high longitudinal rigidity of the main hull to withstand rig loads and ensure a tight forestay for good performance. Detailed modelling also helped us optimise the boat's scantlings and address the structurally difficult forward areas of the floats. This led to the addition of extra unidirectionals in the deck and floats to improve rigidity and strength in the critical areas.

The construction process is efficient with a one-shot infusion using quadraxial glass lay-up, UD's and various grades of PVC foam. The main infusion incorporates the inner sides of the floats, the main hull and the accommodation nacelle.

Only three primary moulds are employed with secondary bonding confined to the installation of the composite structural bulkheads plus the later internal inner mouldings for cabin floors and so on.

Conclusion

The first trials of the Neel 47 have confirmed a new era in cruising trimaran design, a yacht delivering a large interior, outstanding sailing performance that is a pleasure to steer and easy to manoeuvre.

On the water our latest design has been behaving just as expected and the commercial success is already a reality with more than 25 boats sold and five boats already sailing... meaning an expansion in our build facility. The future is bright.

The trimaran is back.

Marc Lombard, ML Yacht Design

