# The Catamaran Rig

By Derek Kelsall, 2008

Having sailed boats with junk rigs on monos and cats, free-standing on monos, Freewing rigs, Airorigs, freestanding twin wing rigs on cats, fixed freestanding twin rigs on cats, I love the freedom of sails where the sail control is not restricted by stays. It adds a new dimension to sailing but is also a safety factor.

I have particularly enjoyed sailing on the Free-standing twin wings rig on *Cool Change*. On this catamaran, it has everything in its favour, except it's cost. All carbon weight means dollars. We are working on projects which we hope will make this facility more available and more competitive for cats – Freewing Twins, where light stays replace a lot of the carbon of freestanding is one such project.

***Cool Change***

That is the background to my experience, but I am not suggesting that we will see huge numbers of catamarans changing to twin rigs in the immediate future. The objective of this article is to consider the options for the typical catamaran sail plan.

**With or Without Runners for the Standard Cat Rig?**

The full roach main and small jib has become standard for catamarans. We used it on 42 ft. trimaran Trifle in 1966 and for most of our racing and cruising cats and tris that followed, though with a short period when we toyed with cutter rigs, but soon returned to full roach main and small jib.

All of our sail plans are drawn with runners and fixed shrouds, where the shrouds are well forward. Almost all other designers position the shrouds further aft, without runners. Shrouds further aft mean a further restricted boom angle. To me this is a step backwards from the use of runners, (which allows the main to be released as the cat is turning to beam on) and a long way from the ideal I describe in the first paragraph.

No cruising owner wants extra lines to control, but there is more to this question than 'with or without runners' or of 'restricted boom angle'.

**Our justification for the runners is as follows:**

Looking at the catamaran sail plan in profile, the typical angle between the fore-stay and the mast is 18 degrees. The shrouds, in conjunction with runners if fitted, keep the fore-stay tight. Without runners the angle between the shrouds and the mast will be 8 – 9 – 10 degrees. The angle between the runners and the mast will be 18-20-22 degrees. Fore-stay tension, essential to reasonable performance, is achieved by the tension in the shrouds or in the runners. In the shrouds only situation, there is more than twice the tension in the shrouds than in the runners for the same fore-stay tension. This immediately gives a 25% increase in the mast compression attributed to the fore-stay tension.

Without runners the fixed shrouds are pre-tensioned, with no provision to adjust while sailing. Wind in the sail puts more pressure on the stay, the mast and shrouds have added load, the mast compresses (shortened in length), the shrouds stretch and the boat deforms, all three adding to the sag in the fore-stay.

The runners are adjusted while sailing, to give the tension needed and compensate for any strain in the system.

A factor perhaps not so obvious is the effect of any mast bend out of alignment. If the supporting stay is at 20 degrees and the mast bends to reduce that angle to 17 or 18, there is no major change in the loading. With the support angle at 8 degrees and the bend reduces the angle to 5 or 6 degrees, the change in load is a lot. The stay will stretch, the mast compress etc., and the mast will fall off to leeward, to further reduce the angle. With the three stay system, it is no surprise to me that the trend has been to ever heavier 'tree trunk' like spars which stand absolutely straight rather than the masts which respond to wind pressure by bending. Slack rigging has always felt the best to me while sailing. Pre-tensioned shrouds give the opposite feeling. The runner can also have a check stay on the same control, giving excellent mid mast support, from a light stay and even less bending moment in the mast. The wind-surfers, perhaps the most efficient sailing craft, get max power from masts and booms which bend to compensate in the gusts.

**Summary**
Eliminating the runners –

Adds weight and cost.
Seriously limits sheeting options off wind.
Makes very difficult down wind steering.
Increases the chance of an unintentional gybe.
Can make it difficult to reduce sail down wind.
Reduces the control available to the sailor.
Introduces high pre-stressing into all parts of the rig and into the boat.
Reduces the safety factor in the rig.
Loses the ability to have an effective tight fore-stay.

To illustrate the later, we regularly race our catamarans in local races in UK. We could always get a really tight forestay without over tightening the runners. This would often result in the windward shroud going slack as all the pressure went onto the runner from the windward side.

As designers, we have to work with the Spar makers and accept their section recommendations. We find the section and rigging sizes have gone up by at least 2 sizes from the early cats we designed. However, those early rigs are still sailing. Naturally, the costs have gone up accordingly. The structures under the mast need to be carefully designed to resist permanent stresses. The inescapable fact is that the three stay rig is an inefficient use of the spar and rigging options available to the designer.

Is having two less lines to handle worth all the negatives involved here? I think not. I find agreement from those who have the down wind experience, particularly trade wind sailing. I have never had a client complain about having runners to operate.

Most owners initially see the runners as applicable to racing, ask for no runners, but are unaware of the real compromise. We do not insist and some do take the recommendations of the Spar Maker. All I have talked to in the industry, on this subject, prefer to stay with the industry standard, but none have contradicted my reasoning. I can understand anyone who takes the line – surely all these people in the industry cannot be wrong. Well, I can point to a few other incidents where the whole industry has been wrong.

My advice when a designer or a spar maker is selling the standard cat rig, is to ask, how many trade wind ocean crossings he has made on a catamaran. Is he talking from real experience or from the fashion of the industry. In some circumstances, catamarans do tack down wind for extra speed. This is not generally true of trade wind sailing. The cats go with the wind and waves, directly down wind.

**Rotating Masts and Wings**
I am also a fan of rotating masts. I mention here as it does also have an impact of the stays. It just does not look right to me to have a roughly round section as the leading edge of the main driving foil. It would still be possible to get some rotation with three fixed stays but certainly not with the same ease with which rotation is normally achieved with slack rigging and the runners to tighten the forestay. I am amazed to see pure racing cats with the same three stay rig, which does not allow the wing mast to rotate sufficiently on any tack. The rotating systems that we use are no more complicated than scaling up those used on a Hobiecat dinghy.