

## The new – “Kelsall Cat Rig” The twin wing rig with a difference.

*A rig for catamarans, which just makes sense.*

*Safer, excellent all round performance, lowest loading on all parts of the rig and structure, easy to handle, takes the hard work out of down wind steering, reef down wind, dump at least half the sail area on any tack and you can either build it or buy it. No need for lots of carbon either.*

Goal posts and cross bar - The rugby world cup in NZ might be claimed as the inspiration, but not so.

This is one of those rare occasions when we have worked on several different aspects of the same design challenge and suddenly everything falls nicely into place. It is the combination of stays, runners, the cross bar and twin wings which works so well.

When it comes to supporting a rig, the catamaran (and trimaran) has a massive advantage. The width allows an increased support angle between the mast and any side stay, which then decreases the loads on the mast and the stays. The Kelsall Cat Rig (KCR), uses the full width of the cat rather than half the width on which the conventional single cat mast is based. Double the angle and halve the load is the starting point, but only a small part of the merits of this unique but very simple rig development.

### HISTORY.

Twin rigs on cats are nothing new. The first I sailed alongside was Prout's Ebb and Flow, in the 1960's and I have sailed a few since. Jazz, a French cat in France for example, won the Breste Speed Week just pipping us on 93ft., tri, William Saurin by half a knot. Goal post rigs are not new either. Yves Parlier's was featured in many race reports and a 46ft. Kelsall in S. Africa has one. Then there is the Freewing Twins which Richard Glanville and I devised a few years back, with the mast head strut, allowing the wings and sails to rotate freely under the stays. Freestanding twins is probably the most common. Flying carpet is well documented and sails nicely on my one evening around the harbour. Our design, “Cool Change” and its demonstration of the performance and handling advantages of twin sails and the freedom from sheeting restrictions, has provided a very strong incentive to pursue this development.



**KSS Kittiwake 42** – will be equipped with Kelsall Cat Rig.

### FREESTANDING OR STAYS.

Stays are the most weight efficient way to support any post or mast. Freestanding masts are heavier (usually of carbon), with bury (extra length) and does depend on very well engineered bearings. For me, having an asset and not using it does not sit well.

Hence, a stay system which interferes least with the sheeting of the sails and imposes least loading on the whole, was the objective when we started down this route. Sails which do not depend on stay tension impose least loading onto the rig.

## COMPROMISE.

The stays/strut arrangement here introduces one sheeting compromise only. The windward sail cannot pass between the masts. As the lee sail can swing 180 degrees forward and be dumped in any sailing direction, I see this as a huge advance on the currently popular, but highly restricting mainsail sheeting on a cat. This compromise, compared to Freewing Twins, is justified by the reduction in all rig loads by 25-30%, by moving the strut down and the increase in roach. When adding the 2.5 – 3.5 safety factor, that is a huge difference in the sizing of all items.

## HOW DOES IT SAIL?

To illustrate just one sailing condition - directly down wind, in the typical conditions found in Trade Wind ocean crossing, the KC rig will come into its own. The sails can be wing and wing, forward of athwartships, removing the tendency to broach or the unintentional gybe and can be feathered in the squalls which are often a feature of trade wind conditions. Downwind steering will be fun rather than the hard work of the conventional rig. A light weather down wind square sail, set between the masts is an interesting option, to further add to the performance. Lifting sails perhaps.

## THE STAYS.

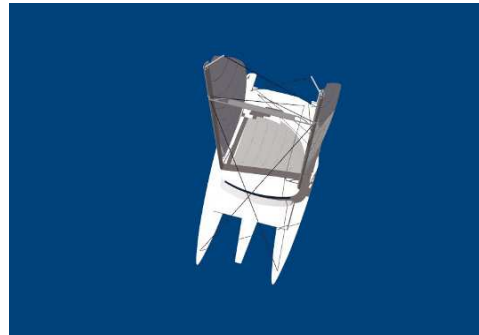
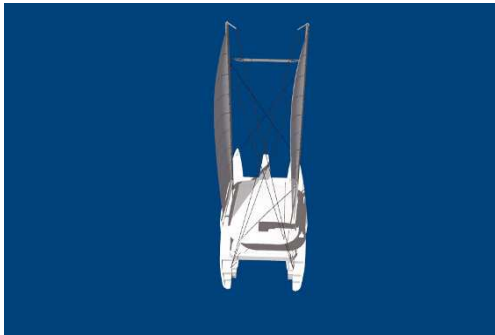
The stays we have are – forestays from each strut position, crossing to the bow on the opposite side.; two mast head back stays also crossing to the opposite side; and two aft runners from the strut position, which also cross over, going back to the backstay chainplate positions. The mast-head backstays are taken from a swinging arm which cantilevers the attachment to clear the roach of the sail.

The combination of the forestays and the mast head backstays and the cantilever, induce a bending moment into the tops of the masts. This is where the runners are so effective. The lee runner takes the highest load and conveniently operates on the mast which is less able to resist bending due to its angle of rotation to the backstay. Also very conveniently, the lee runner is entirely clear of the windward sail. The backstays will not have a lot to do for most of the time. Both of the runners can be left on while sailing to windward.

The crossed stays come from our work with Freewing Twins. The arrangement of the runners in combination with the lower strut is the novelty here.

Headssail halyards will be fitted at the strut position on the masts. When the rig is carrying a high wind load, the stays to the windward mast will tend to go slack. The opposite to the lee shrouds on a single mast. The halyards will then be taken to the forestay chain plate and tightened to take out any F and A swinging movement of the mast and snap loads on the stays.

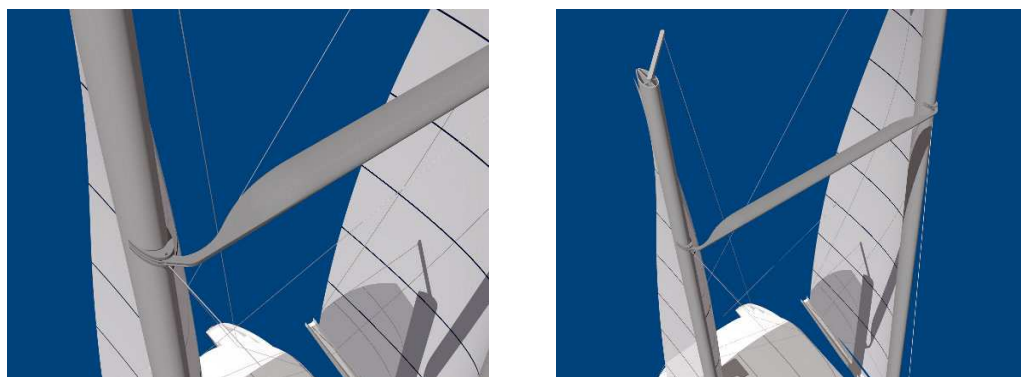
The stays will go to the leading edge of the wing masts. Being fibre, wrapping against the mast will not damage the mast. An extra wear pad will be added to the mast structure where needed. This we have done on rotating race rigs in the past.



KSS Kittiwake 42 – stays arrangement for a Kelsall Cat Rig.

## THE STRUT CONNECTIONS TO THE WINGS.

This is the one area which needs to be carefully dimensioned to allow the wing masts to rotate as far as possible in each direction. The fitting we have designed allows the mast to rotate inwards by 75 degrees and outwards by 165 degrees. The boom and sails can rotate further. The connection is a custom designed fork and fork style fitting. This is 240 degrees of rotation compared to about 80 degree for the regular cat rig's main sail, today. While sailing 70ft. My Way, where the owners had chosen to eliminate the runners (the spar makers advise) I had designed, I asked the skipper how far the boom could be let out before the battens hit the shrouds. We checked. It was less than 40 degrees each way.



KSS Kittiwake 42 – strut arrangement for a Kelsall Cat Rig.

## BOOMS and VANG OR WISHBOOM.

As the end of the boom of the lee sail is outside the boat, there has to be a vang of some kind or a wishboom. The conventional wishboom does not work well with a wing mast. A wishboom will need to be attached to the mast, just forward of the sail luff track. Cool Change uses a simple rope vang and topping lift, which has proven to be entirely satisfactory. We are starting with a fixed vang/boom arrangement. Some arrangements may favour wishbooms. Others may favour a reverse vang above the boom. Where we have a boom and vang hinged from the trailing edge of the wing mast, we move the mast support back on the mast foot, in order to reduce the turning moment on the wing from the load on the sail, boom and vang. Sheeting will be to a block on the centre line of the mast.

## COSTS.

We have yet to complete any detailed costing. Obviously, the time involved in custom building spars will be a major factor, though some suitable rotating sections are available. On the other hand, the fittings and stays will be reduced in number and much lighter and less cost. Rigging screws can be replaced by lashings. Stays can be fibre. The chainplates are very simple indeed. The mast pots for rotation are also simple. Halyard winches and runner winches are the only winches needed on under 12m. Two part tackles will handle the sheeting loads up to this size. ie four small winches in place of 6 or 7 larger on a conventional rig.

Gone is the need for tracks and travellers and the expensive hardware usually associated. Gone is the need for headsails, where most yachts carry several. Light weather headsails are optional on the KC rig. Cool Change has proven that headsails are not essential for good windward sailing and CC is so effective off the wind that the planned headsails have never been bought. Two main sails will add cost. We suspect, the overall cost will give an advantage to KC rigs. We will be consulting Spar makers interested in supplying.

## COOL CHANGE.

I cannot over stress the extent to which CC influenced our thinking. At that time, it was stepping into the unknown to an extent and I do doff my hat to Don and Marilyn for their courage in taking this route for their liveaboard/charter future and for the quality of their work in making it themselves. 25,000 trouble free sea miles, easy performance sailing is testimony to their efforts and to the concept. We discussed the Freewing Twins option, but the freestanding won the argument at the time. After their last trip back

from Vanuatu, regularly recording 18kts., and a max of 22, the comment was “What an Awesome boat we have” and on KSS – “we could not have done it any other way”.

Sailing Cool Change very quickly dismisses the idea that the windward sail blanking the lee sail is a problem. In that situation it only needs a minor change of direction to bring both sails into play. In fact, this feature can be useful in some circumstances. Amazing windward ability demonstrates that headsails are superfluous when the sail/wing shape is right. Anyone wishing to check this out for themselves, contact D or M on <coolchange@xtra.co.nz> for a charter for a day or longer. A charter we can highly recommend.

Once again, we are fortunate in having a client prepared to take on the rig. The first is for a 42 foot modular design nearing completion; KSS 42ma. Two more clients who have seen the rig, will also go this route.

## WING MASTS AT ANCHOR.

There is now considerable experience of this situation. Richard Glanville learnt that the single wing, as Freewing, is best with the wing set athwartships, whether at anchor or marina. Examples of Freewing, including one on a 54 ft. Kelsall mono in South Africa, have been on the water for nearly 3 decades. At anchor, the twin wing masts are best set with the wings toed inwards. Feathering could be achieved by fitting a tail fin. The Walker Wingsail had this feature. There was no enough wind to test this during the one time I sailed on his first trimaran.



KSS Kittiwake 42 – strut detail for a Kelsall Cat Rig.

## THE MODEL.

The crude model I put together from the bits and pieces lying around in my workshop has proven to be a great asset. It gives a real feel of stability when loading any part of the rig. There is no sense that mast movement would be detrimental. I have always favoured stays which are relatively slack and then tightened with runners or wind loads. There is no need here for highly pretensioned stays.

## FASHION.

As a designer, features and shapes which reduce the loads have always been attractive to me. Boats and simplicity go together in my book, whether it is in the structure or the gear. I have never understood how the currently fashionable three stay cat rig could have become such an all encompassing fashion, when it has such obvious down sides. It is heavy, highly stressed, severely restricting of main sheeting angle, a very poor rig for trade wind sailing and it needs expensive controls and it ramps up the loads. The runners which we have always designed for this sail plan have the opposite effect.

This situation is a bit like strip foam becoming the fashion for so many decades when the way we built Toria (46 years ago), some ten years before strip came into common use, gave all the shapes we ever needed in a lot less time, starting with the basic full size foam sheets. Let's hope it does not take more decades to change the cat rig fashion, make full use of the catamarans potential and put more fun into sailing.

## **SUMMARY.**

Comparing the standard cat rig to the Kelsall Cat Rig:

- We have removed the high load of the forestay and the need for multiple headsails.
- We have replaced six heavy, pretensioned stays with six light weight all fibre stays.
- We have two masts and the cross strut replacing a single mast. However, being foils the drag is less and the angle of lift is higher.
- All up weight is similar and probably better when all factors are counted.
- The deck gear needed is a fraction of the weight and cost of that needed for a conventional cat rig.
- The final cost is still to be determined but KCR could well win on this score as well.
- All the evidence is that performance will be improved, but with only two sheets to tend while sailing.

The freedom from the typical sheeting restrictions alone would swing it for me. The total package just makes sense.

## **TAKE THE LOAD OFF YOUR WINGS.**

PS – with a minor mod, the Kelsall Cat Rig makes a very neat rig for a proa.

**Derek Kelsall**  
06.12.11