Article written by
BRIAN HANCOCK
brian@greatcirclesails.com

HIGH TECH SAILS FOR CRUISERS

Originally published in Ocean Navigator Magazine
Copyright Great Circle Sails

Increasingly cruising sailors are looking for performance from their boats and sails and over the last few years there has been a trend toward high-tech disguised, in some cases, as low-tech. Take for example carbon fiber masts. There are now numerous traditional looking yachts that have a carbon mast and boom covered in a wood veneer so that to the unsuspecting eye it looks as if they have wooden spars. The same is true with hull construction. The boats are built out of carbon and then painted to look traditional. Sailmakers are doing the same thing. Call any sailmaker and they will tell you that around 80% of their cruising customers are still buying Dacron cross-cut sails, but it's the other 20% that are pushing the edges with high performance fabrics and sophisticated engineering and that percentage, while still relatively small, is growing every year. Often it's barely noticeable. A quick glance

at a suit of sails and you might think that they are just plain old Dacron sails, but hidden between layers of laminate is some very sophisticated engineering.

Membrane sails on this Alerion 41

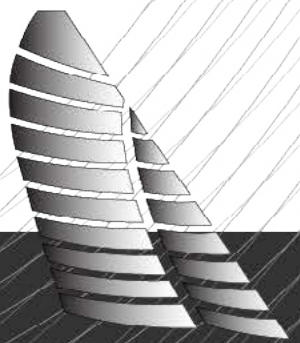
There is a very real advantage to having high tech sails even if you are only cruising. If you measure the life of a sail by how long it holds its aerodynamic shape as opposed to how long it holds together, then you are going to get a longer life out of a sail that is highly engineered and built using high performing fibers. The additional upfront costs may indeed save you money in the long run, but that's not the only reason for considering something more exotic for your sails. For all boats there is a need to reduce heeling and pitching as much as possible and they way to do this is to reduce weight aloft. A membrane sail built from a blend of carbon and Vectran will be about 30% lighter than a sail built out of Dacron. A hundred feet up that weight difference translates noticeably into how the boat sails. With the lighter sail there is less heeling and more importantly, there is less pitching. Constant pitching over the duration of a long passage is very fatiguing on

the crew, so any way to limit the amount of pitching is good for your crew and an overall performance gain.

The other advantage of a high tech sails, other than the obvious increase in boat speed which in turn reduces the amount of time spent at sea, is that because they are much lighter than conventional Dacron sails they are easier to handle. It's easier to furl and unfurl a headsail as well as to take in and shake out a reef. The sails are easily to manage when hoisting them for the first time and take up much less room when stowed below. Another noticeable advantage is that high tech sails are able to hold their shape through a much broader wind range meaning that you will end up reefing less and also being able to carry a headsail through a wider range of wind conditions.

There are four distinct parts to a high tech cruising sail. Fabric engineering is a key component, the overall sail engineering and construction is also important, the size and configuration of the sail can be a key factor and the individual fibers used in the fabric are at the heart of a high tech sail. Let's look at some of the exotic fibers currently being used in sailmaking, and then take a closer look at overall sail engineering.

Some of the exotic fibers that are used in sailmaking are Kevlar, Vectran, Spectra or by its other name Dyneema, Tetraneema, Twaron, Technora and Carbon. Each of these fibers have their own strengths and weaknesses, but the key attributes that fabric makers, and by extension sailmakers are looking for in a fiber are all the same. Low stretch is very important, good flex, meaning that the sail can be folded and flogged a lot without the fibers breaking is also important. The last attribute is it's resistance to UV degradation. A fiber like Vectran is extremely low stretch and can be flexed a lot without degradation, but show it some sunshine and it immediately starts to break down. When a sailmaker uses Vectran in a sail, the UV sensitive yarns are encapsulated between UV treated taffetas. This way the full benefit of Vectran's properties as a fiber for sailmaking can be exploited, and it's one weakness - UV degradation - is mitigated by the taffetas.



Most cruisers know Dacron and know that it's used to make a woven fabric usually with the strength in the warp (across the fabric) meaning that the sail is engineered to be cross cut. Dacron is very durable and when treated properly can withstand UV degradation for many years. It's drawback is that it's relatively stretchy. Some fabric makers will add an exotic fiber to the weave to lend a hand to the overall strength and stretch resistance of the fabric, and while this helps the result is nowhere near as good as when fibers are used in fabric that is laminated and not woven. Dacron is still the standard bearer for most cruising sails and it has earned it's place by years of performing well in all conditions.

Tri-radial laminate sails

The next step up from a woven Dacron is a woven laminate. The basic engineering of this fabric is a central layer of mylar encapsulated between two woven taffetas. The thickness of the mylar can vary, as can the weight of the fibers, as well as the fibers themselves. The fibers can vary from polyester to spectra or dyneema or Tetraneema depending on the size of the boat. When the sail is engineered the designer decides what weight mylar to spec, what fibers to use and what weight of fiber all in an effort to create a fabric that is perfectly engineered for it purpose.

Laminated sails can be used to build tri-radial sails which have a distinct advantage over cross-cut sails. The principal loads in a sail run up the leech and sail designers engineer the sail to handle the leech loads. On a cross cut sail the same weight fabric is carried from the leech to the luff, but the loads along the luff are half that of the loads at the leech meaning that the sail is way over engineered through the body of the sail and along the luff. The result is a sail that is heavier than it needs to be. With tri-radial construction you can use a heavier fabric on the high load leech, and a lighter fabric along the low load luff resulting in an overall much lighter sail.

Square head membrane on this boat

A step up from cross-cut and radial sails are membrane sails where each individual yarn is laid along the load path of the sail. This is a much more efficient use of each individual fiber and again results in an even lighter, stronger sail. It's also a lot more labor intensive hence the higher price. There are two different kinds of membrane sails. At the top end are sails that are built on a mold with continuous fibers running from the bottom of the sail to the top. The other way is to engineer panels of fibers that are then sewn together. The result are discontinuous fibers running from the bottom of the sail to the top, but the fibers are at least running along the load paths and the seams make sure that the loads are transferred between panels without losing any strength.

There are so many variables in sail cloth and sail engineering that it often becomes confusing for sailors. One sailmaker may tout the benefits of a particular fiber or construction method over another and they probably do so because they have some experience and a comfort level with what they are recommending. That does not mean that what another sailmaker is recommending is wrong. They are probably both right. You need to choose a sailmaker you are comfortable with and trust that you will get a great sail. While a high-tech sail is undoubtedly more expensive than a basic cross-cut dacron sail, the cost over the useful life of the sail can often be justified. If you are considering a new sail made from an exotic fabric remember that it's how long the sail has a decent shape that counts, not just how long it holds together.

I hope that you enjoyed this article. There are many more at my website www.greatcirclesails.com. If you need new sails for your boat just click this box and I will send you a no obligation quote.

BRIAN HANCOCK
Owner Great Circle Sails