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A PRIMER ON PANEL LAYOUTS

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We live in an age where an art as old as sailmaking collides head-on with new technologies and high-tech engineering. In fact, sometimes it's easy to forget that we are only dealing with a simple element like wind and the means to capture it. It really isn't that difficult to make sails that meet or exceed our performance expectations; yet for many sailors understanding what goes into these products remains confusing, intimidating, or even downright complicated. In the previous article of this series ("It All Starts With a Yarn"), we looked at the most basic component of every sail—the yarns that make up the fabric. In the present article, we will examine the fabrics themselves and how they are used by sailmakers to their best advantage.

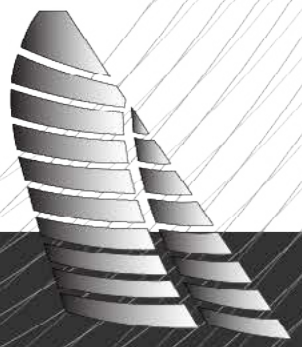
Before you consider a new sail you need to ask yourself two important questions: What kind of sailing do I plan to do, and what is my budget? Both answers will influence your purchasing decision. Let's take the last point first. Sails are no

different than most items you buy—you get what you pay for. If you invest in fabric and construction detailing up front, you will get a sail that looks better and holds its shape longer. It will not necessarily last longer, but if you measure the usefulness of a sail by how long it looks good and does a good job, then the investment will pay off.

The second point is equally important. Buying a sail that is over-built or over-engineered for your needs is just about as bad as buying one that is under-built. If you daysail out of the Florida Keys, you don't need a sail built to withstand the rigors of a Newfoundland gale. Likewise, you wouldn't want to cross the South Pacific with sails engineered for a summer afternoon off Sausalito. So give some thought to where and how you like to sail, and make sure that your sailmaker understands your plans. The difference in sail engineering is subtle, but the result will be sails that are just right for you.

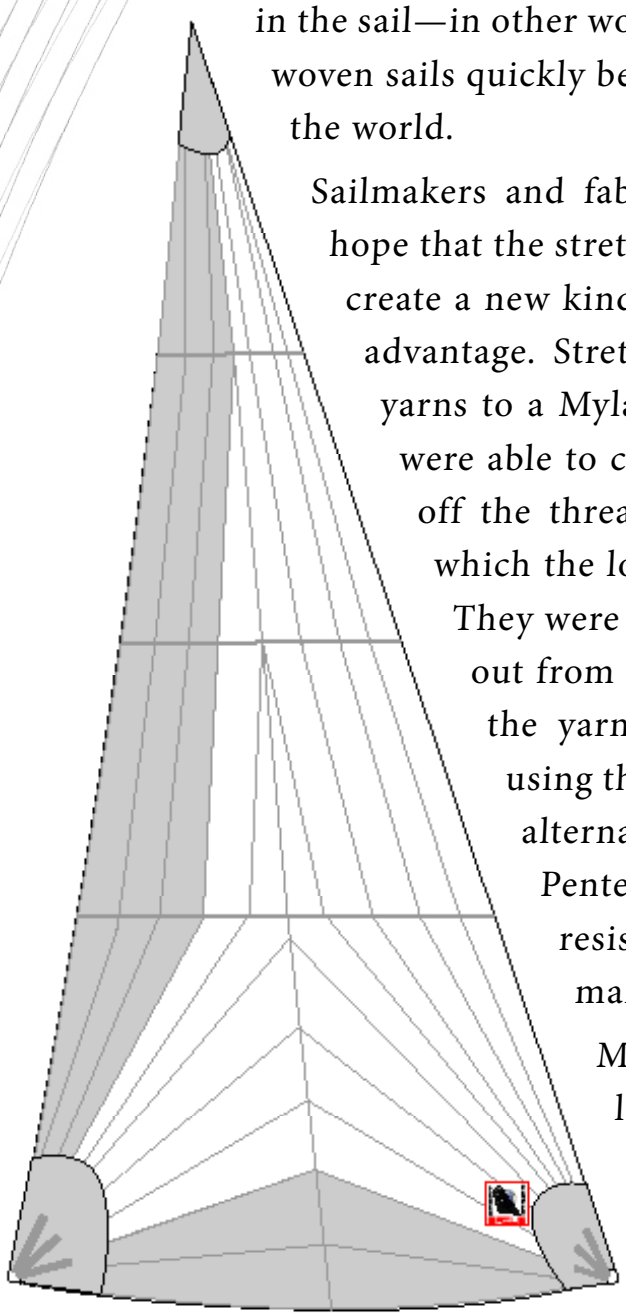
Your first decision will be choosing the fabric. This choice has an initial impact on the panel layout, and ultimately an impact on your budget. While there are a number of fabric options from which to choose, for most boats in the 30 to 50-foot range, your choice really comes down to only two, and they remain the same notwithstanding the kind of sailing you will be doing. There is durable Dacron for a woven, cross-cut option, and there are some laminates that can be used for radial construction. Both base fibers are polyester; however, the way the yarns are treated and the manner in which they are used make for very different fabrics. Let's look at each separately.

Dacron has been around since the '50s and has proven to be one of the most resilient fabrics for sailmaking. When it was introduced, the only way to make sailcloth was to weave it, and so woven Dacron became the benchmark product. It had its limitations and in spite of fabric makers' attempts to overcome them, they remained. The most obvious problem was stretch. Because of the way fabrics are woven, some yarns have to go over and under the other yarns. As soon as a load comes on the fabric, these "over and under" yarns (called crimp) straighten out, and the result is stretch. In the early days, sailcloth manufacturers saturated the woven fabric



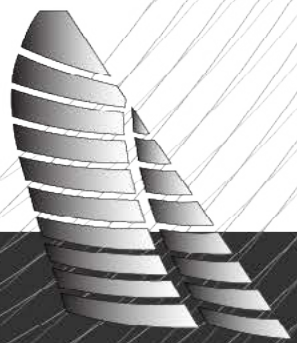
with resin, which impregnated the fabric and minimized the stretch, but over time the resin flaked out and the fabric reverted to its old problems. The good news, however, was that the yarns running across the fabric were straight and did not have crimp, and so the fabric was oriented so that those yarns ran parallel to the loads in the sail—in other words, perpendicular to the leech. So, cross-cut, woven sails quickly became a common sight on waterfronts around the world.

Sailmakers and fabric makers are not ones to sit around and hope that the stretch will go away. Instead, they went to work to create a new kind of fabric that used the yarns to their fullest advantage. Stretch ruined sail shape, but by laminating the yarns to a Mylar substrate (or film base), these technocrats were able to create a fabric that had less stretch, especially off the thread line (the Mylar saw to that), and one in which the load-bearing yarns were laid along the panels. They were then able to build a sail with panels radiating out from the corners with the load going directly onto the yarns. This was a much more efficient way of using the fibers, and radial sails soon became a viable alternative. To compound their advances, they used Pentex yarns in the laminate to offer better stretch resistance in the fiber, as well as in the overall makeup of the fabric.



Shaded areas show heavier fabric in the high load areas of the leech and foot

Many different yarns have been used in laminated fabrics, and they work well for different applications. The most obvious one of course is Twaron which you see often in racing sails. Spectra and Vectran have also been used with great success in cruising laminates.



However, it's only the bigger yachts that need the strength and stretch resistance of these fibers for their sails. For most cruisers Dacron is sufficiently reliable, and after all, that's the most important point if you are heading far offshore.

One of the greatest benefits of radial construction is that you are able to use varying weights of fabric in the same sail. With this technique, sailmakers generally build the sail with heavier fabric up the leech and along the foot and lighter fabric in the

body and along the luff. When you are sailing upwind, there is actually very little load on the luff of the sail, and therefore you can use comparatively light fabric. Once you bear off onto a reach, more load comes onto the front of the sail, but the overall load in the sail is decreased. With a woven sail, designers calculate the leech loads and engineer a sail accordingly. Because with the cross-cut configuration the same fabric runs all the way across the sail, you end up with the same weight fabric at the luff as you do at the leech, and the result is a heavier sail. What difference does that make, you ask? The lighter the sail, the easier it is to set and trim, especially in light winds, and if you have used fabric efficiently, your sail will hold its shape longer.

So why not just choose a radial sail every time? There are two major factors that go into the cost of a sail: the fabric and the labor required to build the sail. In both cases a radial sail is more expensive. The laminated fabric is more expensive to produce, and radial sails require more work to manufacture and there is more waste. It is worth remembering that an investment in fabric up front will pay dividends in the long run. It just depends upon your budget.

A lot of science and engineering go into building good quality sails. You start with a yarn and build from there, moving toward creating a product that will work well in a broad range of conditions. It is easy to get lost in the chemistry and the mystery, ending up confused by the jargon sailmakers have created to describe their products. But don't forget that just as yacht designers need a good eye for creating fine yachts—and find that the beautiful ones always sail the best—sailmakers that have an eye for aesthetics and beauty are the ones that build the better sails.

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