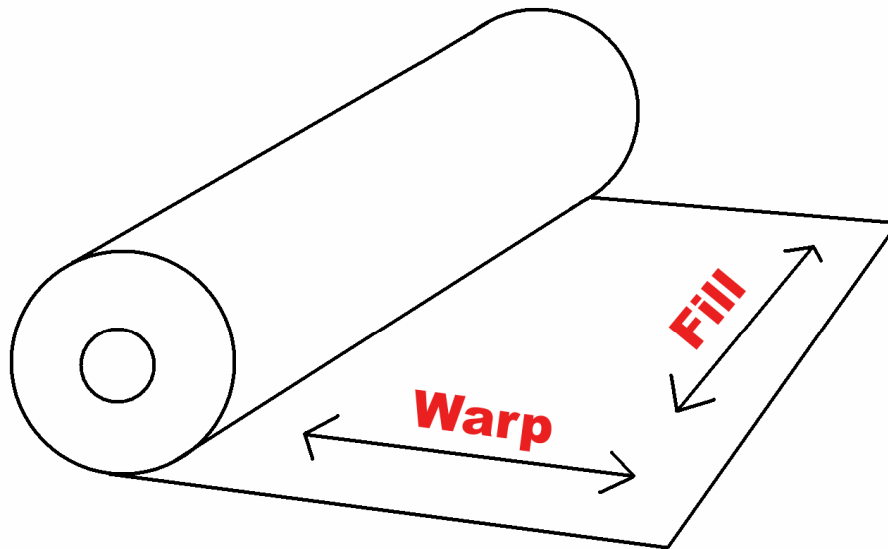


## **Warp-Drive** Warp-Oriented Dacron:

### *Innovation for the Rest of Us*

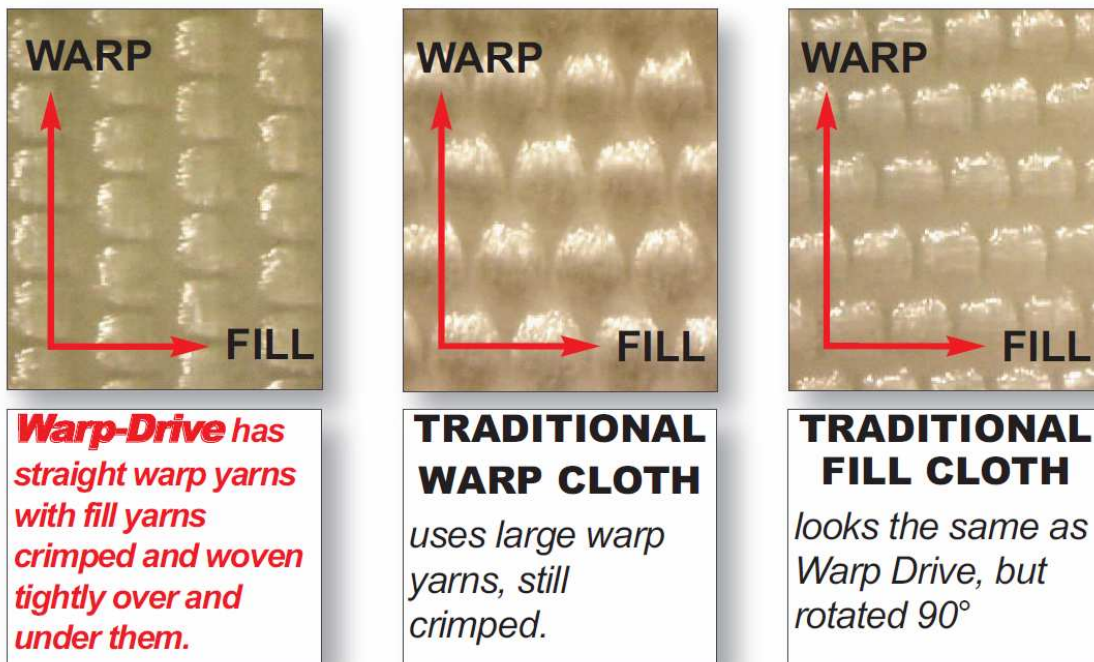
Recent innovations in the very competitive sailmaking industry have centered on exotic and expensive fibers, new lamination techniques and various methods of constructing 'load-path' structures. Magazine articles, blogs and online message boards are filled with endless talk about the newest fibers available to the racing sailor with deep pockets. The vast majority of sailors, however, have little need for sailcloth that lasts only a few seasons at the very best, despite having incredible performance characteristics. These sailors most often are using sails constructed in the same cross-cut technique that has been in use for better than a century. They use cloth that has been woven using the same technique and from the same fibers for decades. *Warp-Drive* from Challenge Sailcloth aims to change this lack of innovation for the common sailor and provide performance cruising sailors with reasonably-priced, durable and high-performance sailcloth for bi or tri-radial construction.

Some terms are thrown around in this article that not all sailors are familiar with. Firstly, warp yarns of any textile run in the length direction down the roll of cloth. Fill yarns run perpendicular to the warp yarns, across the width of cloth (see graphic). The panels in a bi or tri-radial constructed sail need to be quite long, longer than the width of a typical roll of sailcloth, and hence need to be cut in the warp or long direction of the cloth. Bi or tri-radial sails are the closest construction method for woven sails to 'load-path' custom-laminated sails that many sailmakers now offer. The long panels cut in the warp direction follow the predicted loads that the sail will experience.



Traditional polyester crosscut sails use sailcloth with relatively straight fill yarns and highly-crimped warp yarns. Cloth is oriented in the sail such that the fill yarns align parallel to the leech of the sail. When the leech is loaded during upwind sailing, the already-straight fill yarns are able to withstand stretch using the inherent high-modulus characteristic that high-tenacity polyester fibers provide. Using this same cloth for a bi or tri-radial construction where the highly-crimped warp yarns of the cloth are parallel to the leech requires that the warp yarns straighten out before they are nearly as effective at resisting stretch using the natural characteristics of the fiber.

Early attempts at warp-oriented sailcloth were made using much larger, but still crimped warp yarns with fill yarns that were still relatively straight. Because there was still crimp, tri-radial sails from this type of cloth did not resist stretch very well along the highly loaded leech section of the sail, causing deformation of the designed sail shape.



In the late 1990's, Challenge Sailcloth began testing a 6 ounce, warp-oriented sailcloth that was woven such that the warp yarns stayed almost perfectly straight while the fill yarns took all of the crimp. The new, patent pending loom / technique worked, and *Warp-Drive* was born. This is the first time that a cloth heavier than 5.5 ounces was woven with truly straight warp yarns. In recent comparison testing, *Warp-Drive* rivaled or beat the warp 1% number of polyester cruising laminates. *Warp-Drive*, in some cases, has twice or more the resistance to stretch in the warp direction than other warp oriented wovens. In other words, it takes more pounds of force to stretch a given sample of *Warp-Drive* in the warp direction to 1% longer than original length than a cruising laminate of similar weight. Woven sailcloth that can outperform a laminate in the warp direction ounce-for-ounce is a true breakthrough.

*Warp-Drive* is now available in three weights, 6, 8 and 10 ounces, allowing Sailmakers to design durable bi or tri-radial sails for sailboats from 20 feet up to 70 feet long. These sails will be easier to handle than laminate sailcloth and will not mildew as a laminate will, yet will have similar performance to a laminate sail all while having the durability of standard woven sailcloth.

The actual construction of *Warp-Drive* is very similar to that of a high-aspect fill-oriented cloth turned 90 degrees. The warp yarns are of very large denier compared to relatively small denier fill yarns. These fill yarns are woven extremely tightly to give the best possible bias stability. Further stabilizing the bias with a firm resin gives *Warp-Drive* the strength to carry smaller loads placed on sailcloth in directions other than what the main panel orientation carries. While holding a sample of *Warp-Drive*, one is actually touching the fill yarns of sailcloth for the first time. In no previous woven heavy sailcloth were the fill yarns exposed on the surface. Normally, the fill yarns are ‘tunneled’ between the warp yarns and hidden from exposure. *Warp-Drive*’s fill yarns do exactly the opposite; they form the ‘tunnels’ that weave around the warp yarns and hide them from exposure to the surface.

Similar to our tightly woven, super-high count and fine-denier yarn high aspect fill-oriented cloth, the fine denier fill yarns of *Warp-Drive* do not have the same resilience to UV exposure that a well-balanced cloth with large warp yarns does. Because of this, it is not recommended to use *Warp-Drive* on sailboats headed for full-time use in the Caribbean or anywhere else with very high UV exposure. For boats used in these areas, we have a High Mass Fiber Weaves line that will last much longer under high UV exposure.

Despite this one drawback, the benefits of *Warp-Drive* still far outweigh the drawbacks of radial laminate cloth and fill-oriented sailcloth in a cross-cut sail. Fill oriented cross-cut sails will still rule for ease of construction and low expense. For extreme performance over only a few seasons, laminates are still a good way to go. With a third choice that offers excellent performance and durability over many seasons, the rest of the sailing community can now rejoice; the innovation stand-still they have been experiencing for several decades is ended.