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MAXIMUM SAIL POWER

CHAPTER 2
IT STARTS WITH A YARN
A Look at all the Fibers used to Make Sails - Part 2

Cross cut Dacron sails on this little cruiser

FROM FLAX TO COTTON

It may seem foolish for any modern look at sails and sailmaking to be discussing cotton and flax sails. On the other hand it would also be foolish not to look back to the very beginnings of sailcloth, if only to illustrate how and why progress and change takes place, since it is sometimes for the most unusual reasons. In the early 1800s, for example, American warships had sails made from flax, at least until

the Navy decided it needed to find something new. It did so not because it was concerned about the strength and usability of flax sails, but rather because the fabric was imported from Europe and the powers that be were afraid that if the supply of flax were ever cut off by the enemy the effectiveness of the American Navy would be compromised. There was at the time a small domestic sailcloth industry using cotton to build sails, but while it showed promise as a fiber for making fabric, there was still some debate among the ship captains of the day. Some felt that cotton absorbed too much water and was difficult to handle. Others said that flax was stronger and easier to use. Still others claimed that cotton sails did not stretch as much and the sails looked better than the flax ones. In the end it came down not to any decree from the Secretary of the Navy, but rather to a now historic boat race.

Yacht America

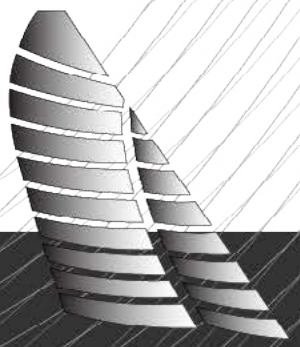
In 1851 the yacht America raced around the Isle of Wight off the south coast of England and handily beat the competition to win the Hundred Guineas Cup. That cup came to be known as the America's

Cup, and while new fibers and fabric have been at the cutting edge of America's Cup competition since, few of them have had the impact that the sails on America had back then. While many observers were impressed by the schooner's hull shape, others noted that the cut of her sails was "as flat as a sheet of paper," which allowed the boat to be sailed closer to the wind, a huge advantage on any race course where the boats have to sail to windward. America's secret weapon then was not just below the waterline, but also in the cotton sails flying from the masts. Flax might be stronger in terms of breaking strength, but cotton did not stretch as much, and minimizing stretch became the name of the game. Soon the use of flax on warships was replaced by cotton. The rest, as they say, is history.

BENCHMARK FIBERS - DACRON & POLYESTER

Polyester, more commonly known by the name Dacron, is short for polyethelene terephthalate. Dacron is actually a trade name that was given to polyester by the Du Pont company, and thanks to some pretty effective marketing, it has become the most common name used to describe the fiber, and by extension, the fabric that results from weaving it. From a chemical standpoint, Dacron is a type of long organic molecule called a polymer manufactured from ethylene glycol — the same stuff used as automobile antifreeze — and terephthalic acid. In England polyester is called Terylene, and in other parts of the world it goes by various other names including Tetoron, Trevira and Diolen. The bottom line is that the name Dacron caught on, and for simplicity's sake in this book we will use only the terms Dacron or polyester to describe the fiber.

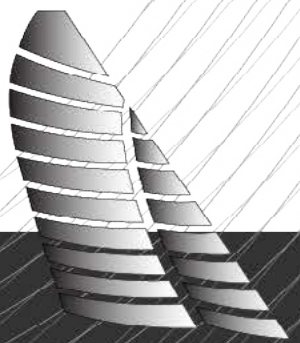
Polyester was initially developed in 1949 at the Du Pont plant in Seaford, Delaware, to create fabric for furniture upholstery and later for the much larger fashion industry. One of its initial attributes was that it did not mildew like cotton, and that alone set it apart. Soon word of its other qualities filtered down to the sailmaking industry: properties like high tensile strength and high modulus, both when the fabric was wet or dry, which meant that sails made from this material would not distort in high winds.



There were other encouraging properties like high flex resistance, which meant that unlike many plastics it would not become weakened over time by flapping or folding; good UV resistance, which meant it would not become weak or brittle in the sun; and most importantly, good resistance to degradation by chemical bleaches and abrasion, which meant it could stand up to the rigors of the actual weaving process. Later it was discovered that polyester shrank when exposed to water and heat, which made it possible to create fabrics with an even tighter weave, one to which resins and finishes could then be added, thereby creating very stable sailcloth. Despite having pretty much the same basic strength and stretch characteristics as cotton, polyester's other attributes soon had it displacing earlier fibers. Thanks to this combination of properties, polyester has been a benchmark fiber in the sailmaking business for almost five decades.

These days Dacron is available in a number of different types that are differentiated by their tenacity. Type 52, for example, is the highest tenacity fabric and offers a premium balance of high strength, low stretch and maximum shrinkage when compared to other Dacron types. Type 56 Dacron has "regular tenacity" and offers most of the desirable attributes of Type 52 Dacron, but at a more reasonable price. There is also a fiber called 1W70 polyester, originally made by Allied Signal (now Honeywell), that has a higher tenacity than Type 52 Dacron, although it costs more. The two yarns are sometimes blended to gain performance without a dramatic increase in price.

Although in recent years Dacron has been replaced in many racing and mega-yacht applications by exotic high-tenacity and high-modulus fibers like Kevlar or Spectra, its proven durability still makes it a very popular yarn for cruising fabrics. It is also used for small racing boats and many one-design classes. In fact, in 2002 Dacron sails made up around 70 percent of the new sails being built around the world with laminates and molded sails making up the balance, and it's not likely that that number will decrease anytime soon. It really is a benchmark fabric that has stood the test of time. Part of Dacron's success can be attributed to its remarkable properties and affordability. But it



also has an advantage in that woven Dacron can be used to make cross-cut sails, which are cheaper to build than radial sail because there is less labor involved. This combination of a well-proven fabric and an efficient construction technique will undoubtedly result in Dacron remaining a major part of the sailmaking industry in the foreseeable future. In fact, it's likely some of those early polyester sails are still being used around the world. My Dad has retired from sailing. Otherwise his boat would be a good place to look.

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