Blog written by
BRIAN HANCOCK
brian@greatcirclesails.com

MAXIMUM SAIL POWER

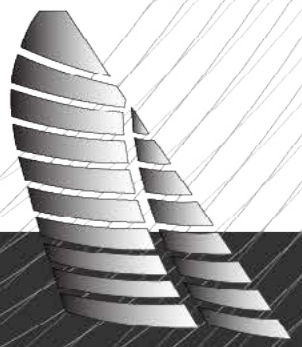
CHAPTER 2
IT STARTS WITH A YARN
A Look at all the Fibers used to Make Sails - Part 1

Polyester yarns on a loom being woven in Dacron sailcloth

In your mind's eye, try to imagine the wind flowing across your sails. If you have telltales, those small, light pieces of yarn or fabric attached to the surface of the sail, they will flutter in the air stream, dancing to their own rhythm dictated by the set of the sail and the aspect of the boat to the breeze. When these telltales stream in unison your sails are working efficiently; when they move haphazardly you know it's time to change the trim. It's a delicate dance dictated by many forces

and variables, one of the most important of which is the amount of stretch in the sail. If the fabric distorts, the shape of the sail changes and its efficiency is compromised. This balance between wind speed and sail shape is at the very core of sailmaking. It starts with a yarn, or more to the point, thousands of tiny yarns that form the basis of all sails. These fibers dictate the performance of the sail. So before we can explore the wonderful world of sailmaking, we first need to know and understand the different raw fibers that are used to make sails. It has been a fascinating evolution since cotton replaced flax, and polyester replaced cotton. Now the same fibers that are being used to build spacecraft are being used to make sails, bringing with them a wide variety of performance characteristics. Before you can decide which of them is right for your application, you need to know more about their relative strengths and weaknesses.

First though, some background. I grew up sailing on a small inland lake in South Africa in the 1960s. The lake was called Midmar Dam and we raced a local dinghy design called a Dabchick. I remember my father, a good seat-of-the-pants sailor, always had excellent speed when sailing to windward, even though he was the only one in the fleet who still had sails made from Egyptian cotton by some long-forgotten sailmaker. Then again, it may have been that his sails had stretched to a point where the shape was perfect for the conditions. Whatever the case, like many old-time sailors, he was competitive until a new wonder fiber called polyester really took hold, at which point he had to relegate his cotton sails to the dump heap. The new poly- ester sails were able to maintain their shape through a variety of wind conditions to the point where he simply could no longer be competitive, and a whole new generation of sails was created. Since that time, increasingly sophisticated materials and methods have been both a bane and boon to sailors and the sailmaking industry. It's a bit like the computer business. As soon as you decide on a new computer somebody brings out an even newer one that is both cheaper and faster. Sailmaking is the same. As soon as you decide on new sails, along comes a new fabric or sailmaking technology that is better, or at least is perceived to be



better. As a sailor and consumer it's important that you understand this evolution. While it's hard to predict the future, you can be better informed by understanding how we got to where we are today. Again, this comes from an understanding and knowledge of the very basics of sailmaking, and nothing is more basic than the fibers from which sails are created.

Before we look at the fibers that are currently being used to make sailcloth, let's run through some of the terminology that is used when discussing their properties. These terms are described in the glossary, but it is good to learn about them now to get a general overview of how they relate to fibers, and by extension, to finished fabric. They are all equally important to a good roll of sailcloth. The first three terms relate to a fiber or fabric's initial resistance to stretching and breaking. The second three terms relate to how a fiber or fabric holds up after use.

Bolts of Dacron fabric ready to be shipped to the sailmaker

- **Tensile strength — The measure of the ability of a fiber, yarn, or fabric to withstand pulling stresses exerted upon it.**
- **Modulus — The measure of a material's ability to resist stretching; usually its initial resistance to stretch.**
- **Tenacity — The breaking strength of fibers.**

To clarify these terms, tensile strength is a measure of a fabric's ability to withstand pulling stresses exerted upon it, while modulus measures a fabric's resistance to stretching. Tenacity is the point at which a fabric breaks. Obviously it's important when engineering fabric to bear in mind how much the fabric will change once a load comes on it, and when it will break.

- **Creep — The permanent elongation of a fabric under a continual load.**
- **Flex — The ability of a fiber or fabric to retain its strength after being fold- ed back and forth.**
- **UV resistance — The ability of a fiber or fabric to resist the harmful degradation caused by constant exposure to sunlight.**

A fabric engineer must understand what will happen to the fibers in sailcloth once they have been used. Creep, flex, and UV resistance are all properties to consider when choosing fibers because they will have an overall bearing on the product over time. So let's start at the very beginning and work our way through each fiber with a look at their benefits and drawbacks. We will start at the beginning of modern fabrics. Palm fronds for sails is going back a bit too far, so we will begin with flax and cotton.

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BRIAN HANCOCK
Owner Great Circle Sails