Mastering Nylon

Everything about nylon that I've learned from experience and soaked up from my friends

By G. William Tyrrell Jr. Illustrations by Cathy Pasquale

The late Bill Tyrrell wrote this article for *KiteLines Magazine*'s Summer/Fall 1981 issue. Some parts of it are dated, but it's still an excellent primer on using nylon to build kites. Reprinted with permission from Valerie Govig. Visit *www.kitelife.com* for an online archive of back issues of *KiteLines*.

The rustle of nylon, particularly ripstop nylon, is the ubiquitous sound of kiteflying. Where did this stuff come from and what is it?

Originally developed as a cheap, strong, available synthetic replacement for scarce silk in parachutes during World War II, ripstop nylon soon became available for other uses. The boating industry adopted it for sails and before long it found its way into clothing, backpacks, tents, luggage, hot-air balloons and of course, kites!

Why is it called ripstop? It gets its name from its weave. Within the base weave (which is usually very close) there is a slightly larger-diameter thread that runs checkerboard-style throughout the cloth in 1/8, 3/16 or ½" squares. This is what gives it "rip-stopping" characteristics. Of course, the fabric will tear if punctured, but the second weave gives the cloth extra tear-resistance. That's important in parachutes, sails and kites.

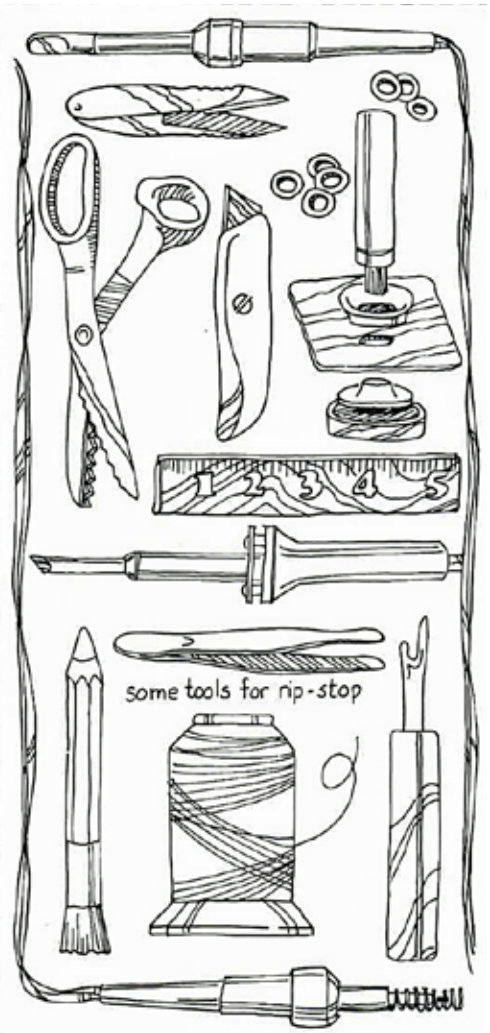
It's the combination of high strength and light weight that so often makes ripstop the kitemaker's fabric choice. When you're looking at a cloth that weighs as little as half an ounce to the square yard, the sail on a 6' delta kite, for example, could weigh under 1½ ounces. And the wide selection of brilliant, translucent colors helps boost ripstop's popularity.

The Coating Factor

One of the first things to notice about these nylons is that they are coated. Urethane or acrylic is rolled into the cloth's grain under high pressure and some heat. This gives the fabric slickness and low porosity which to various degrees make the cloth water- and windproof. Coatings also give enough body to the fabric that it can be sewn conventionally, on home or industrial machines.

Ripstop coatings vary almost as much as the base fabrics themselves. They run thick and thin and it's often difficult to tell the true weight of the cloth by touch. For example, a cloth designated as 1½ ounces per square yard can feel like a 2.0 oz., 1.0 oz. or even a ¾ oz., depending on the thickness of the coating and the texture of the fabric you're comparing it to. Heavier cloth with thin or no coating may weigh less than a thickly coated lightweight.

Most coatings penetrate fabric evenly and thoroughly, but sometimes there is more



coating – or the appearance of more – on one side than the other. For kites, you present the slicker side to the wind.

Wind, weather and wear-and-tear on a kite you fly a lot will eventually break down the crispness of the coating and soften the fabric. If you've sewn before but not with ripstop, you'll find it takes some getting used to, mainly because of its slipperiness – a trait of all nylons but especially ripstop. The slipperiness is a blessing and a curse –a curse because the stuff slides all over the place, and a blessing because it's easy to realign. (You can lessen slipperiness by dipping your fingers in Tacky Fingers from a stationery store – a tip from Kites of the Four Winds.)

Types of Yardage

You can find the following nylons on the market at $1 to $6 a yard *[ed. note: those are 1981 prices]*:

Parachute ripstop is, naturally, a lightweight fabric, weighing ½ - ¾ oz. per running yard. But it's very soft (little or no coating) yet very slippery, a trying combination to sew with. Further, it's extremely stretchy, highly porous and hard to obtain.

Recreational ripstop is used for backpacks, tents, sportswear, etc. Colors here are often subdued (except for hunters' international orange). If you need wide cloth (45-60"), it's a possibility. Weights tend to be heavier (1½-2½ oz.), coatings lighter. You might work with these for kites less sensitive to bias, such as deltas, taut boxes and big flat kites.

Balloon cloth is a group of nylons and polyesters that have the asset of very wide color choice, making them attractive to artists for use in special designs or applique work on ripstop. Widths are 45" or 60", but availability is limited to balloon manufacturers (if you can find one in your area).

Nylon, Polyester or Acetate Taffeta are close, plain-weave fabrics that are somewhat coarser than ripstop but still have wind-holding ability, as their use in windbreakers attests. (Acetates do not hold up and are not recommended for kites.) Taffetas are also used for hot-air balloon envelopes (as is ripstop), tents and luggage. "Aspen Cloth" is one of the names for nylon taffeta. These fabrics are not ripstops,so once a tear starts they tend to run. The color range is wide for design effects and beautiful cobra ("dragon") tails. Less expensive than ripstop, taffetas are about $2.50 per running yard by 45 inches wide, and about equivalent in weight to 1½ oz. ripstop sailcloth. A variation on nylon taffeta is nylon tire, satiny surfaced on one side, used for flight jackets, evening wear and such. The slick side can be good for slipping wind, but examine the bolt for stretch. These taffetas stretch on the bias, or diagonal,rather than the straight of the grain. They also have a soft drape that flows with the wind, ideal for dragon tails. Taffetas are also suitable for Eddys, Rokkakus, large flat kites and others that gain extended wind range from flex. In picking taffeta, observe its traits, adjust your sewing practices to it, keep your kite symmetrical and it can work very well for you. Do be careful to choose a low-porosity cloth.

Fabric shops offer lots of attractive stuff in an ever-growing selection of blends with high-tech names – not all of which will work well for kites. Don't depend on the clerk to know what you need. Test samples yourself by holding the fabric up to your face and blowing. If air passes, the cloth fails.

Sailcloth ripstop or spinnaker cloth – ah! The answer looking for our question. This fabric has pretty much all the qualities the kitemaker needs. First is its low-to-practically-no porosity. This is imparted by the coating we talked about. Available in 38" and 42" widths, sailcloth ripstop comes in up to 15 colors, but the real treat this stuff offers is its range of weights. *[Ed. note: today ripstop is available in more than four dozen colors, in widths of 54" and 60".]* Here they are, in weights per square yard, before coating (coating adds 1/8 to ½ oz. per yard):

Half ounce is the lightest available. Its tissue-paper-like feel belies its strength. To take advantage of it properly on your kites, you should reinforce the edges by using folded seams or edging tape. This ripstop is sold only in red, white and blue in 38" width.

Three-quarter ounce is not all that much heavier than coated ½ oz., especially if the ¾ oz. has a light coating. The ¾ oz. is considerably stronger and more tear resistant than ½ oz., though, and comes in about 15 colors, pastel to intense, from various manufacturers. This weight is probably the most popular for kites because of its strength-to-weight ratio and its easy sewability.

One ounce to 1.2-oz. is next. What you've got here is an even stronger cloth with usually more color intensity – a more opaque, rich hue when the sun shines through it. It's still lightweight enough for making super fliers and it's generally available in about eight standard colors.

One-and-a-half oz. is about as heavy as I'd recommend for most kites in ripstop sailcloth, but it's very good for large and high-wind designs and big Parafoils. One-and-a-half has the most intensity of color, too. It can be useful cut down into narrow fabric strips for use as edge binding on lighterweight cloth. Also it is popular for kite carrying bags. It sews well because it has more body and less slipperiness than lighter-weight ripstops. About eight colors are available.

Two to four oz. is a heavy-duty cloth that has little use in kite sail construction. (The exceptions are 1.9, 2.0 or 2.4 oz. ripstops or taffetas with thin coatings and still light enough for large sails.) This stuff is excellent as reinforcing material, cut into strips for edging tape, tails, pockets and tabs, and again super for equipment bags. Not quite as many colors come here, but they are bright in reflected light. For great strength, you could make a high-wind, high-angle kite with the 2.0 oz. sailcloth and it would last halfway to forever.

If you're making a very large kite or one that will undergo exceptional stresses, you should ask your fabric supplier for more details, such as strength ratings on the different grades of ripstop. A strength rating is a composite derived from weight, tear-resistance, weave, coating and other manufacturing factors.

Can You Color It?

In spite of all the colors available in sailcloth, frustration with limited hues is quite common. You can order custom-dying with a minimum quantity of about 1000 yards! Otherwise, uncommon colors – or stripes rarely – can only be obtained as scraps from sailmakers' lofts or similar chancy sources. I have no personal experience with dye-bathing ripstop in a home tub – my wife would draw the line! – but I would like to hear from others who have tried it.

Here's something to consider: spirit-based markers. The 2"-wide ones are preferable but 1" ones will do. Simply lay out your cloth on a cardboard surface and draw. Marker inks will dry very fast and leave an intense color if you cover both sides of the cloth. You can also use marker refill inks, applying them with wide brushes for larger work. A caution with these inks: make sure you work in a well-ventilated area, because the fumes are toxic. Learn to work fast with brushes because refill inks evaporate quickly. I'm still in the experimental stages with these inks, myself, but my initial work with this technique has proven colorful. I would be happy to hear from explorers who are blazing parallel trails in this thicket.

Other than with marker inks, no one I've seen has really succeeded at painting ripstop. Paint usually flakes off, requiring touchups after each flight, and tends to be opaque, so that whatever color you see in reflected light on the ground will go to dead black in the sky as it blocks light transmission through your kite.

Opacity occurs with silk-screen printing, too, although some inks made for nylon seem to have the flaking problem cured. If you are already familiar with the process, you could try it, but otherwise silk-screening would be a lot of technical overlay to pile onto your kiting habit. And of course the point of printing is quantity production, of interest to the manufacturer but not the one-at-a-time kitemaker.

Can You Cut It?

Okay, so you've got this lovely ripstop or taffeta – what now?

In logical order of kite construction, you will: pattern and cut the fabric, sew the main seams, sew in reinforcements (hems or edging tapes), attach grommets, tabs, sticks and all the other fixtures and finally bridle your kite.

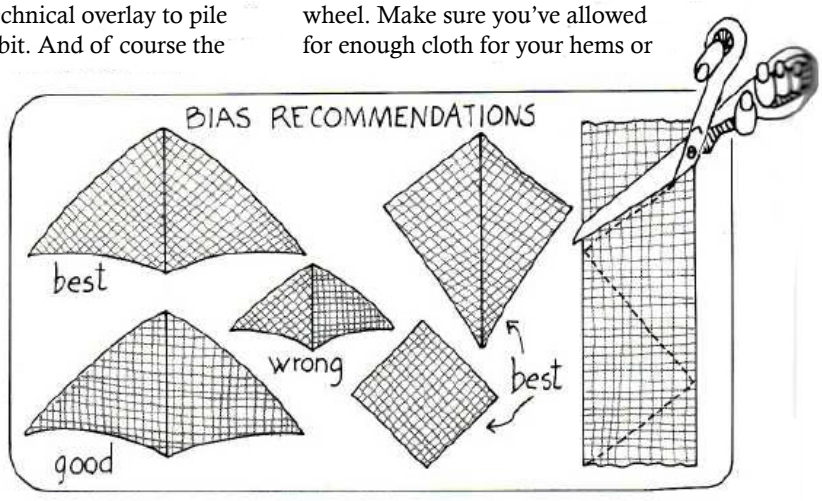
Suppose you've got one of those one-page kite plans. You need to lay out the kite parts on wide paper, enlarging them to full size. Large cardboard pieces or big rolls of brown wrapping paper can be used (or smaller pieces taped together if expedient). Margaret Greger, fabric kite mentor, suggests using "pattern-making paper," sold in fabric shops, four feet wide by any length, from a roll, with one-inch dots all over it. She says it's the best thing she's found for making big kite patterns.

In laying out your pattern, keep in mind the width of your cloth. If the kite has multiple parts (like a Parafoil), use these pattern pieces to plan your layout on the fabric. Move the parts around until you get maximum use out of the cloth.

(If you're making a large kite, it may be a challenge to find space to spread out all the fabric. We've heard of people thumb-tacking nylon to a carpeted floor to stretch it out and laying out their pattern on that. Just don't cut your fabric on the same surface!)

But here's the catch. You've got to observe bias. Even ripstop will usually have more stretch along the diagonal than along the straight of the weave. You want to maintain an even bias on both sides of the kite, that is, vertical or horizontal or symmetrically angled alignment. If your kite (for example, a delta) has bias running on one side differently than the other, the kite's going to favor one side. (Do you want a political kite?) Even with first-quality ripstop, the grain may not be dead straight. Lay out the parts by the grain rather than the yardage edges.

Now that you have the kite pattern pieces laid out, draw them onto the cloth. Use dressmaker's marking pencil, which makes a removable orange line, or tailor's (French) chalk on dark colors, or ordinary lead pencil on light hues. Margaret Greger uses dressmaker's tracing paper and wheel. Make sure you've allowed for enough cloth for your hems or



stick sleeves. (Hem allowances vary with size of kite, but typically are ¾" wide.)

Now for the moment of truth: cutting the fabric. You can use scissors, razor cutter or hot iron, as I'll explain. Starting with scissors (sharp, tight ones), here's a tip. Barely open the blades of the scissors and begin a cut, with the fabric held taut by tape or by hand. The blades will slice through the cloth. That sounds tricky, but it's not. You'll be an expert within five cuts. Try it on a few scraps before committing the good stuff.

To cut with a utility knife, Xacto-type knife or single-edge razor blade cutter, use a glass surface or table top, a piece of Formica that you don't care about, corrugated cardboard, a marble slab or the smooth side of a piece of Masonite (though Masonite will dull blades quickly). Glass is the fastest working surface. You can use a wood floor or table if you protect it with at least a half inch of newspaper – the more the better – and don't press too hard. Lay out your cloth on one of these surfaces and use a straight edge to guide your knife or single-edge razor blade. (Use only a blade that is new or very sharp, especially so at the tip.) The straight edge can be a yardstick (metal is best), piece of wood or even heavy cardboard if you're careful. Hold the straight edge or cardboard pattern down tightly, particularly when you're starting, and cut slowly but steadily, holding the knife flat against the rule edge. If you're cutting one layer of fabric at a time, you won't need much pressure; only with "mass production" do these details get critical. You can use scissors for one or a few kites, of course. The advantage of the knife/straight edge route is that you obtain straighter lines.

Incidentally, I've never had much luck using pinking shears to frayproof ripstop. But Ed Grauel swears by his and says, "The secret is shears large enough – I use 10½" size – and keeping them sharp." (I admit to never having tried to sharpen pinking shears.)

The Hot-Cutting Alternative

Ultimately, however, hot cutting is better for cutting single kite parts because it seals the edge of the cloth, making it frayproof. Cold cutting of edges (to different degrees, depending on weight and coating) leaves an edge that may fray. If you're hemming or tapebinding the edges anyway, coldcutting is OK, but anywhere that you have a raw-cut edge, hole or vent, you should hot-cut the edges.

How to hot-cut? Again, use a glass surface or Formica. Masonite works, too, but may adhere to the cloth at the edges. (This is usually cleanable but sometimes leaves a stain.)

Your hot cutting tool can be an ordinary pencil soldering iron. A wood-burning knife can also be used. The trick is to match proper heat with tip design and your hand speed. A 25- to 45-watt model is suitable for light cloth or slow cutting of heavier cloth. You should have a tip temperature of 500° minimum (preferably higher). Use 55- to 80-watt heaters with 700-to-1000° tip temperatures for heavy cloth or high production on light cloth. Some kitemakers get satisfactory results with a small 25- or 30-watt soldering iron with the tip cut to ½" to ¾" and filed to a rounded flat sharp blade (like a screwdriver).

Though a pencil point or ground flat spade will work, probably the best tool is a sailmaker's tip made for the purpose. Curtis Marshall's customized silver tip is said to be the best of all and it works very fast if you have that need.

Once the iron is up to heat and stable, simply cut along your Masonite pattern or straight edge (not metal, which seems to draw heat out of the tip). Move the cutter as fast as the cloth will separate. You can weight your pattern with lead diving weights, gallon cans of paint, books or whatever to free your other hand to lightly pull the cloth away as it is cut. If the iron isn't cutting smoothly, slow down your hand speed. For mass production, use a hotter iron. Also for repetitive work, a Teflon® wheel guide as made by Curtis Marshall and used with a cone-tip hot-cutter will save pattern wear and provide a uniform and automatic hem allowance to your needs. For one-at-at-time kites, you can work with more ephemeral equipment. Like Margaret Greger, you might find tagboard and paper (either lightweight kraft paper or white tissue paper) adequate for patterns, especially applique. Margaret says, "It's true that a little paper edge may remain on the fused edge of the fabric, but it's easily pulled away. When I am cutting fine detail, where weights are too big for holding the pattern in place, I use my fingers, and when that's too close for comfort, the eraser end of a pencil."

Some more "hot tips" for the cutter tip: Lightly file it sharp (not razor sharp or it will tend to wander). Also keep it clean with a wire brush. If it's dirty, heat transfer will slow. With a little practice and the right tools, you can cut nylon like a pro (or if you're a pro then like a dedicated perfectionist amateur).

Incidentally, you can achieve the sealed edge of the hot cutter without buying the tool by running the cut edge of your ripstop pieces carefully alongside a candle flame, allowing just the edge of the fabric to sidle into the flame. A little tricky, but some people claim success with it. (Be careful!)

A word to the wise: ventilate the area, or work outdoors, when hot-cutting ripstop, to minimize inhaling the fumes. And (in case it isn't obvious), make your entire kite workshop, with its hot-cutters, razors, fumes and sewing machine, off-limits to children .

Getting Set To Sew

If you don't yet have one, now is the time to make a work area for yourself with all your tools in one place and plenty of light. A large work table is an almost-necessary accompaniment. (Ed Grauel's model of a shop has a converted door table, outfitted with measuring tape along the sides and neatly labeled storage boxes underneath.)

I suggest you occasionally reread the booklet that comes with your machine. (I'm still learning from mine!) Make sure you oil your machine occasionally, following instructions in your manual. Keep the machine clean; vacuum or blow lint and dirt out regularly ("So important," says Harry Osborne, who ought to know). Wind bobbins slowly and evenly; fill several in advance for big kites.

Don't sew unless your mental and physical outlook is good. You will waste good fabric otherwise. Sew at a steady pace, not in spurts, to keep your stitching even.

Can you sew ripstop by hand? Yes! Louise Crowley's kites are wonderful examples. But most of this article pertains to the more usual machine sewing.

Which Comes First, Needle Or Thread?

For domestic sewing machines, there are two basic needle choices: the ballpoint needle (for knits and the like) and the regular sharp point, which is what you need to spear through the tightly woven, crisply coated ripstop. If yours is an industrial machine, get acquainted with its parts supplier. He or she will have oodles of needle types for every kind of fabric, machine model and use. You can really match the needle to your work. You'll be looking for a very long taper in what the industry calls a high-speed, antifriction, cool-running "coated" needle. A "government" needle (a long taper design) gives less puckering of seams in ripstop sewing.

As a general rule in needle selection, use a thinner (lower-number) needle for thinner materials and a thicker (higher-number) needle for thicker materials. Also adjust your selection to the total thickness, or plies (layers) of fabric you're sewing together. Below is a chart prepared for *Kite Lines* by Harry Osborne, director of the clothing and textile department, Edmonds Community College, Lynnwood, WA. Keep several needles on hand as you sew and change the needle often. A needle can grow dull after as few as eight hours of sewing.

Needle Selection Chart

A = nylon in ounces per square yard
B = needle for < 3 plies
C = needle for > 4 plies or reinforcements

A	B	C
½	11	11 or 14
¾	11 or 14	14-16
1½ - 2.0	14	14-16

Threading your way through this maze? Now about thread. As the needle selection is governed by the fabric you're using, thread choice is determined by your needle. Polyester or nylon thread is recommended. Polyester is more flexible and will hold thread tension better through the machine than nylon. However, nylon is generally stronger than polyester in the same size. Gutermann's is a strong polyester thread for machine sewing and comes in many colors.

A popular thread in fabric shops these days is "crystal" thread, in fact a domestic nylon monofilament. It has all the characteristics of mono line: strength, invisibility, economy and kink-proneness. Our friend Margaret Greger warns of the kinks and also of "bargain" thread at four for a dollar, which frays and isn't worth the savings. Margaret uses ordinary dressmaker's cotton-covered polyester thread for all her small to medium-size kites. Neither it nor the polyester thread in most fabric shops is sized. These threads appear to be the equivalent of old-fashioned 50, suitable for most needles and sewing conditions.

Guide to Needle and Thread Selection

Needle	Thread
11	60-80
14	40 or 50
16	30 or 40

Guide is based on polyester or nylon thread, not cotton. Note: needle size (thickness) increases as number increases, but thread thickness (denier) increases as number decreases.

When you get into the serious-sized kites, the Parafoils or other highly stressed kites, I recommend stronger polyester or nylon thread. If you're making multiple kites, small spools can be expensive, so consider buying bulk thread in half- to one-pound spools. (No waste here; you can always fly small kites off a large roll.) Tailors' or sailmakers' suppliers have 30-, 40- and 50-denier polyester or nylon thread for sewing sailcloths and taffetas. (Check your yellow pages for sources.) Parachute Grade B military nylon is another good choice, limited in color but cheap. I regularly use it with a number 14 needle on almost everything I sew. Whatever thread you use, cut it, never break it.

One of the ultimately-ultimate uses of thread I've ever heard about was by a young Parafoil maker named Rick Frederick whose kite won Grand Prize at the Maryland Kite Festival about four years ago. It was sewn in panels of striking color contrasts with thread to match. Yes, the color on the top stitch matched its panel and another color on the bobbin stitch matched the adjacent panel!

Stitching Basics

Stitch length is an important adjustment. Set your machine at eight stitches per inch for basic straight stitching on ripstop. A finer setting will weaken the cloth and may cause tearing at the seams.

For zigzag sewing, the stitch length can safely be set tighter, typically at 15- or 16-stitches per inch, which doesn't exceed (in its effect on the cloth) the eight per inch standard for straight stitching. Up to as fine as 20 per inch can be used for a satin stitch around an applique. Needle choice for applique work should be an 11 for ½ or ¾ oz. ripstop or taffeta and a 14 needle if you're working with a lot of thickness.

Be sure you're using the right foot and throat plate for either straight stitching or zigzag stitching, according to the requirements of your particular machine.

To get used to ripstop's slippery ways, try out some stitches on scraps. Make your machine settings and note the tension level on foot and thread settings. With practice, you'll develop a feel for ripstop work and how to overcome its slipperiness. (To get real control over the material, you might want to buy a "roller foot" for about $1.50 at your fabric store. It grips your fabric like a tiny snow tire.)

Now, for an exercise, line up two straight pieces of fabric and make an ordinary seam, holding the sewn end with your left hand while aligning the edges of the ripstop with your right as it goes under the foot. Nylon always needs your guiding (not pulling) left hand. Go slow and easy at first. Secure your seam ends by back-stitching or lock-stitching a few stitches in place.

Ripstop needs constant attention to the aligning process. Guide the cloth through; let the machine do the work. Don't apply drag with your right hand or pull with your left. Either of these can break needles or thread or jam the machine.

A clue that something is wrong is when your stitches are running much denser than usual for no apparent reason. This is caused by extra cloth drag or weight, or by too much vertical machine foot pressure tugging on the foot/feeder/needle operation. Let the machine, correctly set, control the speed of the cloth and consequently the stitch length.

An exception to the above practices is sewing very large panels or heavy fabrics. Just try a piece of cloth about ten feet square! The weight creates tremendous drag over the edge of your sewing surface. To correct this, work on or next to a larger table or persuade an accomplice to catch the flowing fabric and keep it off the floor. With practice you'll develop a feel for how much backward pull you can get away with to compensate slightly for extra cloth weight drag. It won't be much. Mel Govig and I discovered this phenomenon when we built a 3,200 square foot American flag of 1½ oz. ripstop on our home Singers.

You can sometimes save time by stitching several items in succession, feeding one after another through the needle without clipping threads until several sections are done, then clipping between sections.

When you're sewing over thick seams or reinforcement bumps, slow down. Turn the wheel by hand and/or lift the presser foot as you move till you get through the thick section.

Margaret Greger says that she follows the dressmaker's rule to stitch seams from the widest part to the narrowest. This means you will have less trouble with stretching on the wing stick casings of a delta, for example, if you stitch from the base of the kite toward the tip. She believes that symmetry in a fabric kite is safeguarded if all seams are stitched in the same direction (especially important with sled stick casings and Parafoil construction). If, for instance, you hem the edges of a sled, follow the wide-to-narrow rule on the wingtips. Don't start at one point and hem all the way around. Many materials will stretch and pucker and symmetry will be lost.

Trouble-Shooting

Let's check out some of the problems associated with needles, threads and stitching.

If you hear a popping sound coming from the crisp, coated ripstop as you are sewing, it indicates a needle problem. It can be that you're using a ballpoint instead of a sharp point, in which case simply replace it with the proper needle. Or you may be using a needle that's too thick for the cloth; if so, try one size thinner. Or it could be the result of using a dull or damaged needle, which you should simply replace.

Sewing with a damaged needle or an oversized or wrong point can also fray the cloth on the bobbin side of your sewing.

Needle breakage or bending can occur as the fabric deflects the needle during sewing. A bent needle must be replaced at once to prevent damaging the fabric or seam quality and slowing down your sewing.

A too-heavy needle used on thin material will cause cloth to pucker so you won't get a flat seam. Worse still, it will give you a loose stitch that will weaken the seam and lead to a tear. The hole being made by the needle is bigger than the thread.

If the needle is too thin for the thickness of the material you're sewing, the machine will indiscriminately skip stitches. The needle thread (as compared to the bobbin thread) may also break.

Sometimes the machine needs adjustment of the feeder plate. Some machines are owner-adjustable, others require a service technician, but you can check on it yourself. Turn the machine's wheel till the feeder is at its highest point of travel. The bottom groove of the feeder teeth should be even with the top surface of the throat plate. If your feeder is too high or too low, height adjustment will be needed. You may have to see your service

person, but don't be afraid to make adjustments yourself if your owner's manual tells how. The adjustments are surprisingly easy. If you have a diamond-toothed feeder, replace it with a more correct straight-toothed design for ripstop sewing.

Edge Binding Methods

A hot-cut edge on nylon seals the threads and prevents raveling well enough to satisfy many kiters as an edge finishing method. The usual hem or framing string may be dispensed with on smaller kites. But perfectionists will discover that fraying can start after extensive flying or heavy winds, especially on a kite that has flutter in its trailing edge. For this reason, or if you are cold-cutting your kite, you may want to bind or hem the edges.

There are various kinds of binding tape. Bias tape is a narrow cloth trim in a polyester-cotton blend, in nylon or occasionally in all-cotton. Nylon matches the sheen of our cloth best, but polyester is good, too. Cotton is not suited to kites because it fades and shrinks. The double-fold bias tape has a finished edge about ¼" wide and is ready to be slipped over the edge of the kite and stitched in place without the use of a binder attachment on your sewing machine. It is good for binding around sharp curves. Grosgrain and herringbone twill tapes will also bend in curves but not as tightly unless you use a sewing machine folder attachment.

You can cut your own strips of cloth to turn into edge binding. Use a weight of fabric about equal to ¾-2½ oz. ripstop. Heavier can be used but it will take more adjustments on your machine. Cut on the bias of the fabric for tape that is to go around curves; cut on the straight of the grain for stick sleeves or any strong, fixed hem.

If you hot-cut the ripstop, you only have to fold this ½"- ¾" binding once. Wider is easier to handle. Practice on scraps. Folding edging material by hand is slow going but can be done with practice. Using an iron helps. If you find yourself making lots of kites, you should consider a binder attachment for your machine. If you standardize on one kind of binding tape, you'll get your money's worth from the attachment, which costs about $5 to $10 for a home machine. This works well for occasional use if you can match the binding material to the attachment. If you are making multiple kites or manufacturing, then a professional binder attachment, custom-made for your machine and binding, is recommended.

Here are some tips on stitching techniques for applying binding tapes. You can use either a straight stitch, eight to the inch for strength, or a zigzag stitch for more width of coverage. If you're using the zigzag, make sure tension adjustments give you a stitch that's tightened down snugly. If you can't get enough adjustment before the thread breaks, use stronger thread. If using a home machine, you may need more thread tension range to get through thicker sewing with edge bindings. Here's a trick that works on my 10-year-old home Singer; it may work on yours, even if it's another brand (check with your serviceperson): you can take the outer thread tension knobs and dial off. This will give you a few more threads of adjustment range.

Also, when going around corners or binding more than one piece of cloth together with a narrow edging, you may have to inch your way along slowly, touching the switch lightly. A zigzag doesn't use quite as much thread tension and can cover a ¼" width or a curve better. Zigzag can be ripped out more easily, too, if you make a mistake! If your machine has lots of choices of stitches (with cams or switches), my favorite zigzag for ripstop is one that stitches three or four strokes for each zig and each zag. It's called a multistitch *[a.k.a. triple zig]*. If you like fine detail, you can use decorative stitches in thread of contrasting color.

Hemming Treatments & Taffeta Strategies

Instead of binding your kite's edges, you can choose simply to hem them. Fold the edges twice (we fanatics don't use just one fold), either by hand or augmented by iron (to press the first fold) or by a hemmer foot. Singer used to make an adjustable hemmer foot, but you may have to scavenge the service department of your local dealer to find one now. Caution: a hemmer foot isn't at its best with the slipperiness of ripstop, but will work better with the less shifty taffetas, which don't hold a crease as well as ripstop and thus require you to use more refined hand techniques. You can also accomplish a double fold hem with a professional folder attachment that leaves no raw edge to show even on the back of the kite.

There's a nice zigzag finish that Steve Edeiken (on his Rainbow stunt kites) and Mel Govig use. They run a narrow but elongated zigzag stitch right along the very edge of the raw (hot-cut) fabric. (Try it on a scrap and see what happens.) A light cord can be run right inside the stitch for more strength. It's quick and neat for an Eddy-type kite, for example.

Some more tips for taffeta users: save your scraps to use in patching or repairing later, since taffeta is more apt to tear. Hot-cutting an edge makes it easier to align and sew. Nylon edge binding (which doesn't stretch) is a good treatment for taffeta. A very slight exertion of tension on the seam, both ahead and behind the needle, while stitching taffeta, can sometimes help with control, but be careful, too much or too little will make the fabric pucker. Ripping out stitches is easier with taffeta than ripstop and the old seam will heal better.

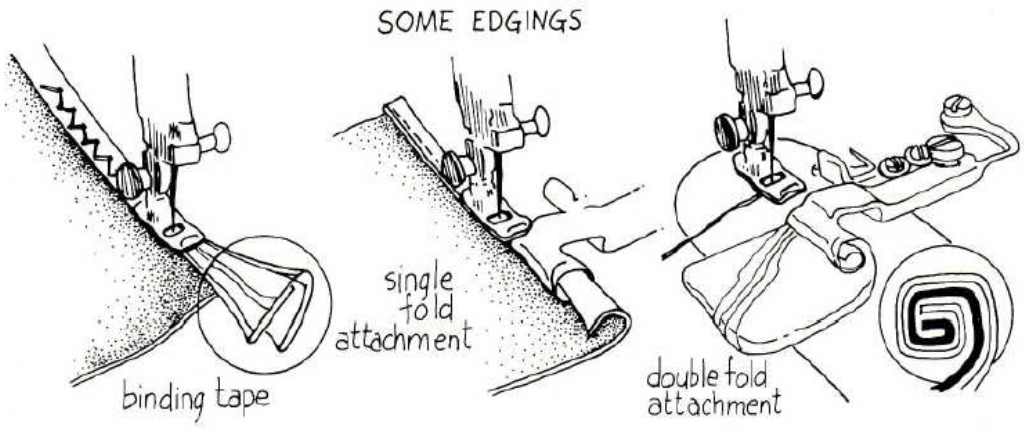
Pockets & Reinforcing

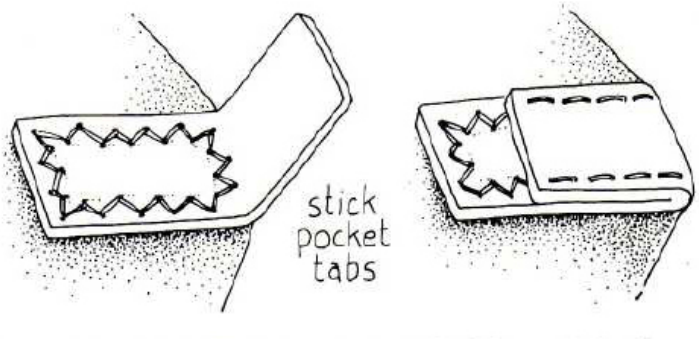
One way to make pockets for kite sticks is simply to use one of the tougher edge binding tapes, such as grosgrain, about 1"-2½" wide, depending on stick diameter. Ed Grauel suggests allowing additional sail area to fold over on itself for pocketing. This is appropriate, of course, only on heavier cloth. If you're using your own fabric strips, 2.0 - 4.0 oz. nylon ripstop or taffeta is very good. The final sewn pocket should be about two to three times as wide, and about four to five times as long, as the stick diameter. Hot-cutting helps keep the edges from fraying. Position the pocket on the kite and sew the two sides; the fold will form the bottom without sewing. If the pocket is large (over 1½" wide), sew the open pocket on four sides to the sail, then fold over the flap and sew on the two long sides to finish. Although a stick can wear through almost any pocket, nylon seems to wear the best.

Where you need extra-strong pockets, you may want to use tough nylon webbing material or even leather, as Cloud Pleasers does on its deltas. Leather requires a special needle to sew and scissors to cut, but might be worth the extra trouble in exceptional cases.

Nylon bindings, whether ready made or cut by yourself, work well as reinforcements for holes, grommet mounts, bridling points or load distribution tapes. You can also use the more flexible tapes to outline appliques or vents.

Another use for nylon edging tapes is in

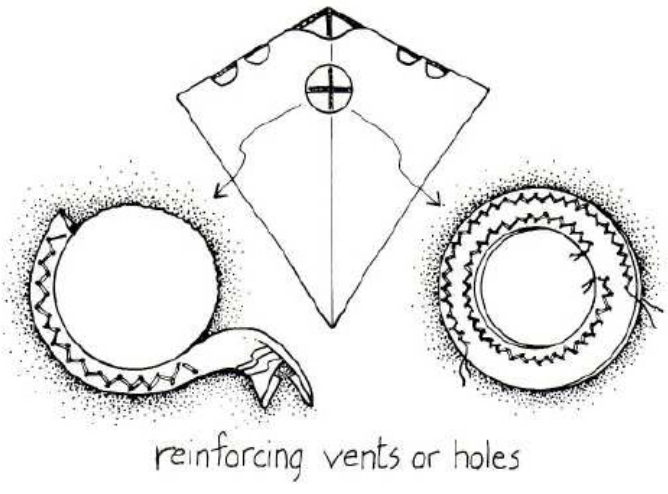




modular construction of large kite sails made of very lightweight (½-¾ oz. per sq. yd.) sailcloth. Parachute canopies and hot-air balloon envelopes are made this way. The technique applies especially to kites that are made from several bolt-widths of cloth. The panels of cloth are sandwiched between two load-carrying nylon tapes in such away that the panels are sewn only to the tape, not to each other. An advantage of the system is that damage is contained to the modules, which can be more easily replaced or repaired than a whole sail.

A strong way to reinforce a vent or hole is to tape (Scotch or masking tape) a patch of fabric over the area to be cut out. Hot-cut the patch and sail together. This will "weld" the two edges together. Sew up and remove the tape. (Try not to sew through the tape; it may gum up your needle.)

A similar technique calls for adhesive-back or crack-and-peel ripstop, a material that is used by sailmakers for repairs, quick lettering and applique work. You simply hot-cut the stuff, crack the backing off and stick it on. For maximum adhesion, keep surfaces clean and dry, and burnish the crack-and-peel with pressure using any hard, slippery tool (a screwdriver handle, bottom of a glass or cup, bottle cap, etc.) The idea is to get the maximum bond through pressure, especially at the edges. Done right, the patch will have a more transparent look than if you applied only thumb pressure. Adhesive-back ripstop needs no sewing and is especially good in a hurry. Like most adhesives, it works even better warmed up. The press of a warm (nylon setting) iron will make more permanent adhesion.

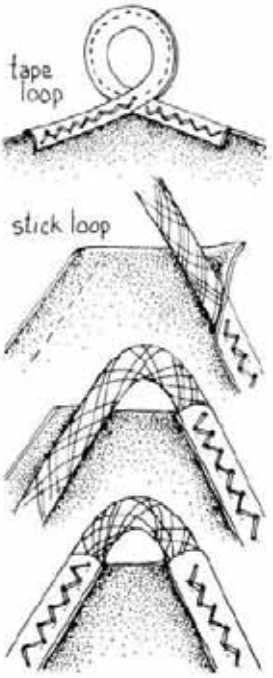


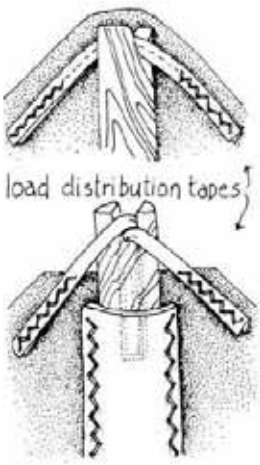
Anytime you attach or pass a line through your kite's sail, wear and tear sets in, even where you've put grommets. To relieve all those vulnerable points (keels, ribs, spar hook points, tail or drogue mounts or banner mounts, etc.) you need reinforcement. The easiest and fastest way I know to make a hole to accept a grommet is with your pencil soldering iron. Just melt a hole right through the sail with its reinforcing material folded over it. Grommets should never be set directly into fabric but should be cushioned by extra material (edge binding tape, doubled self-fabric or adhesive-back ripstop). Grommets and grommet-setting tools are a stock-in-trade of most kitemakers. My personal preference is for the ¼" hole grommets (3/8" for large kites) because the larger diameter spreads a load over cloth better than a tiny eyelet. Again, practice on scraps.

By the way, a quickie hole (not strong, just quick) can be melted through nylon if you need a pass-through for a bridle, for example. Light a match, blow it out and apply quickly to the cloth while the match is still white-hot. (You always have matches around to seal line ends, don't you?)

Tips For Tapes

Techniques for loop-making can help binding tapes do double duty on your kites. For example, on kites with fins or keels, you can insert a short length of tape (the width of the hem) inside the hem, making a loop of about one to two inches long (depending on size of kite) to extend out from the point before you reinsert the tape on the other side of the hemming. Lock stitch across the tape in the hem. A stronger way is to use edge binding folded in half over the full outline of the keel. I do this by sewing the binding over the trailing edge first, trimming it off flush with the leading edge. Then I sew tape over the leading edge, leaving a 3"-6" tag hanging off the lower end. I bend this back to form a sewn loop over itself about an inch or two long. It works as a good line attachment point. It helps to allow an extra inch of tape to extend into the kite structure at the base of the keel or fin to take wind pressure off the cloth. This method applied to large Parafoils, for example, has another advantage; in transferring sail loading to the edges, which won't stretch as much as the cloth, you help eliminate tipsy flight caused by fabric bias in the fins. Load distribution can be most important if you're building large stressed-skin kites such as flares, Codys or large boxes. To prevent torn out pockets and worn out fabric on your kite corners and to allow for easy stick replacement, Pete Ianuzzi and other proficient kitemakers use tape loops at the corners of their kites. The tapes can be made from folded-over twill tape or strong shoelaces. Sewn into the corners of the kite, a few inches along the hem, leaving enough of a loop unstitched to accommodate the slotted end of a kite stick, the tapes don't get frayed or cut even when they crash onto pavement. For large kites and others for which you want to control skin stretch, the tape can be stitched across the cover from the corners and then stitched to a stick loop to distribute stress more evenly. As an alternative to loops, the stress tapes can be sewn into the kite cover (as far as 10 to 20% of the sail width). At the edge, the tapes can wrap over a metal ring and the slotted stick inserted into the ring. It is probably obvious to the artists among us that these edging tapes can strengthen the kite not only physically but visually. Dark or black edge taping can separate the colors to give a stained-glass window effect. You can deliberately select a wider dark edging than you functionally need (up to 2" wide), just to really make the colors glow. (Be the first in your sky!)





The Piecing Route

Sewing sections of colored fabric together makes an attractive kite. Here are some of the mechanics:

Start with simple stripes. (They can be

extremely effective.) Run them across, up-and-down or obliquely slanted on your kite. Whatever the fabric grain, keep it symmetrical. Margaret Greger says that horizontal stripes seem to work better than vertical for lateral balance. Also you may safely mix fabric weights in horizontal stripes. Create your stripes by simply piecing together strips of fabric in colors you like. Almost any measure from 2"-24" works, in uniform or varying widths. In effect, you're making new bolts of cloth from which to cut out your kite or kites. This is also an easy way to make large panels from smaller-width yardage for super cloud-busters.

A simple plain seam is fairly adequate and the face of the kite is neat, with no stitches showing. Sew straight stitches, eight per inch. You can strengthen this seam by running a second row of stitches on the back to secure the open edges. A lapped seam, with ¼"-½" overlap, is neat if the flapping edges are sealed with a hot cut.

Now, the very finest and strongest seam of all, which every good sewing class teaches, is the flat fell seam. It is the strongest joiner as well as the most aerodynamic seam because there's no drag from loose edges fluttering around on your kite. Kites of the Four Winds and Cloud Pleasers make their delta kites using this seam. It is not so terribly hard to make. At the risk of repeating what you can find in any sewing book, we're describing it here:

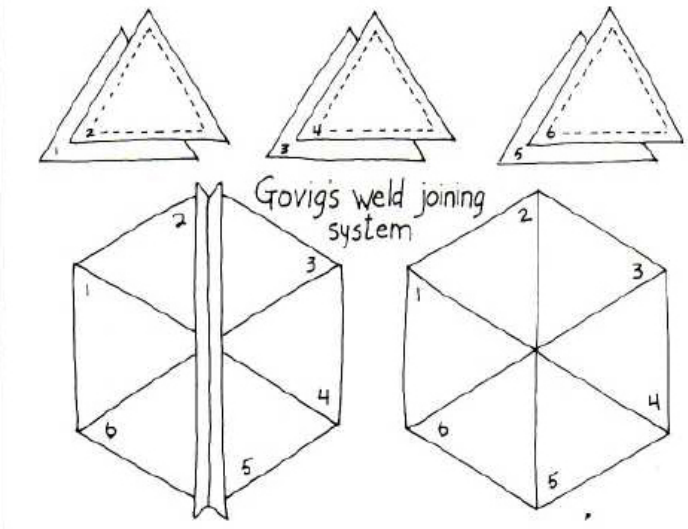
Lay two pieces of ripstop together (wrong sides together if your fabric has any front/back orientation). Offset the upper piece about ¾" from the edge of the bottom piece, which will project beyond. Fold the lower ¾" edge over the upper piece and sew with your basic eight stitches per inch. (Zigzag is easiest but straight stitch is stronger. That's always true, but especially here. However, zigzag's inherent stretchiness isn't much of a consideration unless you're building a really big kite.) Now, open the seam flat and fold the free edge over so the cut edges are

hidden. Now run a second line of stitching close to the outside edge. You now have a flat, clean and classy seam.

Now that you have made this striped stuff, you can play all kinds of layout games with it and different kite patterns. Keep your kites symmetrical, of course.

Stripe yardage can be the basis for chevrons, diamonds, Bermuda style pieced circles and more.

Mel Govig has a system for joining these that we can learn from. He takes two pieces of ripstop of the same size, say, a yard by a bolt width. He then takes a long straight edge and his soldering iron cutter and makes four stripes (two pieces of fabric) by cutting through two pieces at once. This creates a heat-sealed edge. The heat seal is not strong but will hold the pieces together until they are sewn. Mel sews these seams by running a wide zigzag stitch right over the welded seam after spreading the fabric flat. By using very light foot pressure and thread tension settings, he finds that the machine gathers the seam into a bead and "wraps" it into a very tight, strong, almost-flat abutted seam. (Try it on scraps.)



Mel is still discovering new applications for this heat-welding technique, which can be used on ripstop as a new way of basting, to temporarily and quickly join fabric prior to setting a permanent seam. As an example, for larger kites and extra strength, a seam can be stitched about ¼" from a heat-welded edge, while the pieces are still together, then the material folded flat and sewn again alongside for a very strong seam.

Again, the heat-welded seam conveniently holds two modules in perfect alignment for you when you sew on load-bearing tapes as described before. If a panel has to be replaced or repaired, you rip the seam from the tapes on the side next to the damaged section. The welded seam inside can be easily pulled apart and the new or repaired panel sewn back in place.

Ideas? Did You Say You Need Ideas?

Please indulge me while I go off on a tangent about color. Here's what I like: smashing, brassy, brilliant, electric, vibrant, sky-bustin' patterns of artistic genius you never knew you could do! But you can.

Some suggestions: use high contrast hot colors next to cools, bright ones next to black or white.

Consider the medium we're flying in: light to deep blue sky and white to gray clouds. Contrasting colors will show the kite vividly against that natural background. Consider unconventional combinations: green and red, purple and orange. Sound garish? You'd be surprised. In the sky they can look super! Don't always let your favorite colors prevail. Experiment! For impact, cut out the backs of your kites behind appliqued pieces to let the hues glow by themselves.

Black or a dark color surrounding a lighter color makes the kite look bigger and livelier. Even light blue or white are more brilliant this way. Concentric circles (like archery targets), or rainbow arrangements, composed of separate bands of color, will blend together in the sky. You can alternate these bands with black for a contrasting effect instead.

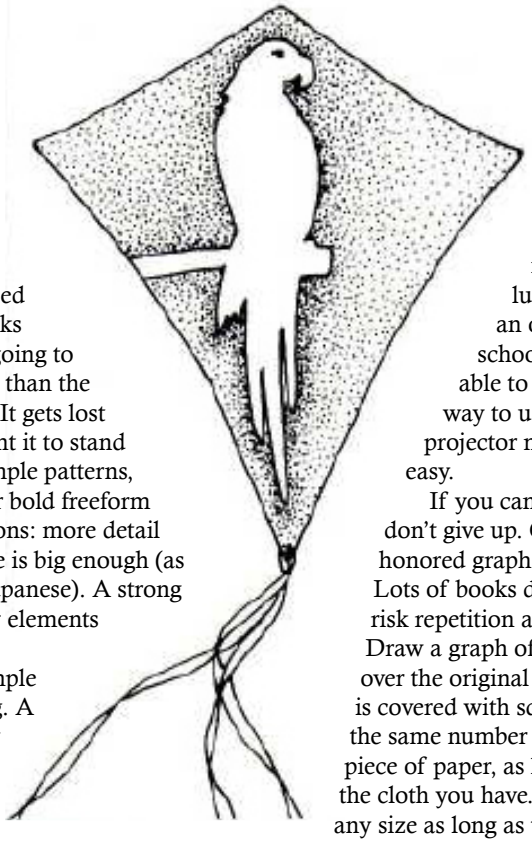
Socko colors may not be to your taste. You can go the opposite, quiet direction with ripstop, too. Use white with pastels or subtle strokes of color for dreamy effects.

Here's something that hasn't been done yet, as far as I know: layering of colors in kite sails. You can work with loose pieces of cloth in various shapes and colors, moving them about and taping them in place temporarily to find combinations that please you. Some will look good in reflected light as well as the more intended transmitted light. And you can put a white or light blue cover over the entire outside with the colors inside the sandwich. With ½ or ¾ oz. cloth, there's very little weight penalty on this new pastel blending game.

To make the effect even more translucent, like a frosted windowpane, wipe petroleum jelly on a rag and rub it all over the cloth until the sail becomes translucent. With a little care, you'll get it even. Then rub off the excess. The result will be something you haven't seen before. And you can continue to experiment with color spots, cut-outs, silhouettes. (Think of a witch on a broomstick, completely concealed on the ground in

reflected light but visible in the sky's transmitted light. Nobody's done it yet.)

Let me over-generalize about kite decoration. Much as I admire finely detailed applique work, it looks great only if you're going to fly the kite no higher than the family room ceiling. It gets lost in the sky. If you want it to stand out in the air, use simple patterns, stripes, geometries or bold freeform designs. The exceptions: more detail is dramatic if the kite is big enough (as we know from the Japanese). A strong design can hold busy elements together.



I have found simple borders to be striking. A single color will only look as good as its shape or contrast against the color of the sky at any particular moment. While this may in fact be quite beautiful, the mere addition of a black or contrasting edge can be very effective.

You can try out your ideas in advance without wasting expensive ripstop by using coloring markers and plain white paper. Draw your kite in pencil, then make photocopies. Fill in colors and designs until you like what you see when you hold the paper up to the light.

Out of imagination? Look around you. Walk through a wallpaper or tile store, a linen department, a craft shop, a gift-wrap department, an art museum (check Mondrian, Matisse, Magritte), a fabric store. Study advertising graphics. There's design every place you look. Let examples get you started, then modify to your taste.

Think you can't draw what you see? You know someone who can. Ask. Get friends involved. (I always say kites are people-magnets. And this goes for building them as well as flying them.)

One of the best ideas is to pirate designs from stained-glass pattern books. I just recently toured a book rack in a craft store and produced a King Tut, a toucan, an American eagle, sailing ships, antique cars, cherubs, airplanes and art deco abstract designs that are screaming to be colored in with ripstop! Stained-glass designs correlate to kite possibilities because they are simplified yet exotic. You want the minimum number of parts to make the maximum recognizable design at your favorite flying altitude.

Transferring A Design

If you now have a pattern you like (say, a stained glass window design), don't be timid. You can enlarge it onto a kite. Those of you artists with access to graphics equipment are in luck. Others may find an opaque projector at a school or library. If you're able to beg or barter your way to using it, an opaque projector makes enlarging quite easy.

If you can't find a projector, don't give up. Go to the time-honored graph squares technique. Lots of books describe this, but we'll risk repetition and summarize it here. Draw a graph of evenly spaced lines over the original until the entire page is covered with squares. Then draw the same number of squares on a large piece of paper, as large as practical for the cloth you have. The squares can be any size as long as the quantity matches your original. Simply draw in, on your large paper, box by box, the design that's in each of the original's boxes. When you have roughly sketched your lines, use a wider felt-tip marker to blend the lines together smoothly. Then cut out the pieces and use them to make fabric parts.

The kite background can be either dark or light. Dark hues will give you an outlining effect around the design parts, like leaded glass, after you cut away the backing to let the light shine through. On the other hand, light values, particularly white, will let the color through without your needing to cut away the back. Using a solid white background is a good approach for a design with many colors or intricate shapes. Making the basic kite shape of one solid piece of fabric avoids the problems of seam weakness and stretch differential of a pieced-together kite. (Ripstop is such a lightweight cloth you rarely sacrifice much in weight.) In addition, the white background does not weaken or change the colors; often it intensifies hues, like ground-glass backgrounds do for transparencies or slides.

In laying out the pattern pieces for your kite, be sure to allow for hems on the pieces, if you plan to have them. (Zigzag stitching alone over appliques makes a flatter kite, but hemmed edges are slightly tidier. To hem appliques or not is your option.) Also make allowance for interrupting elements in the kite, such as keels, sticks, pockets, binding, etc. (You don't want your beautiful toucan, for example, to be suddenly narrowed visually by a sleeve stitched down its middle.) Where you have this kind of break, just split your pattern in a straight line over both sides of the hurdle.

Once you have the parts laid out, stick them down temporarily with tape (doubled-sided is easy). Then step back. Does the design look right from 10'-20' away? If not, move the pieces like a jigsaw puzzle till it does.

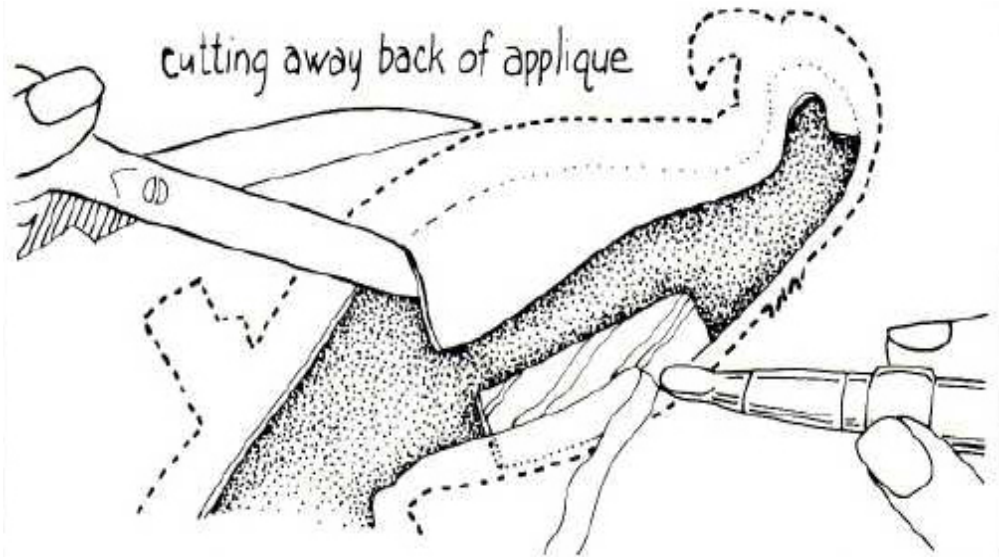
Attaching Design Pieces

There are various ways to "baste" or prepare pieces of fabric for stitching to your sail. You can glue-stick it, tape it or hot-tack it. (Some traditionalists use pinning but I don't recommend it when there are better ways.)

To explain: Margaret Greger says that glue-stick is the easiest method.

Lots of people use sticky tape, either the standard kind or double-sided. Standard tape works well if you tear it off as you go through the needle. You can use double-sided tape under the edges of your kite pieces, making sure the wrinkles are out and not in the way of the stitching path before you sew around the edges. To help prevent gumming up your machine's needle, take a tip from sailmakers, who use ¼"-wide tape.

Another sticking method uses artist's spray mounting adhesive, which seems like a wonderful idea because it gives a nonpermanent tack and you can pick up and reposition your pieces all you want. These sprays come from several makers (3M Photo Mount is the recommendation of Sky Zoo Kites) and are available in artists' supply stores. However, I



have to be fair and warn you that they emit fumes, are flammable and tend to gum up needles. You may not find these drawbacks overriding. All adhesives (sticky tape, spray mount, crack-and-peel) share the gumminess characteristic.

Or, you can use a hot tacker (or spot tacker). It's a lot like a pencil soldering iron but has a finer point. The sailmaker's version has a built-in spring that releases the cloth neatly. The tool is, of course, designed for the purpose, but you could, with a light touch, use the sharp tip of a 25-watt pencil soldering iron.

To make an appliqued kite using a white background, draw your pattern directly on the white ripstop, using a marking or lead pencil or (better) a marker in the same color as the fabric piece. Next, place colored ripstop pattern pieces under the white base. The colored pieces will show through, with the advantage that you don't have to cut out the pattern pieces first. You hot-tack them in place by lightly touching around them, at ½" intervals, with the sharp tip of a hot tacker. The hot-tacked points seal the fabric pieces together smoothly for easy handling when you (next) stitch right over the tack points.

Some suggestions for stitching applique pieces on a kite: sew your parts down to the base fabric, preferably with a zigzag stitch, all around the edges, one piece at a time. Keep the base fabric flat as you go. Take it slowly and carefully. With a little practice, you'll soon be a pro.

If you want to cut away the back of an appliqued kite, you can do it cold (with scissors) or hot (with a hot-cutter). Leave the least amount of raw edge you can, 1/8" or less. How do you hot-cut without going through the applique? Roughly scissor out the back, leaving a 1" edge. Then put a steel rule and/or curved metal edge under the fabric for backup as you hot-cut carefully! (The Dritz EZY Hem Gauge at about $2.75 in fabric shops is a neat and useful aluminum rule, straight on one side and curved on the other. It can serve as a heat-resistant shield for hot cutting work.)

Wash & Wear Kites

Ripstop nylon is fairly easy to care for. You can wash it in warm water and hang it on a clothesline to dry. (Don't put it in a dryer.) Light surface dirt will come out, but deep soil and stains may not. Ripstop will hold suds a long time so that in rinsing you may never get a clear rinse and spills or rain on the kite later will produce foam. Don't be alarmed; most kites don't seem to mind.

Can you iron the stuff? Yes, it's safe to use an iron set on the low, nylon setting. Don't use a wet cloth or steam as they will tend to stretch the fabric. Margaret Greger uses a tissue paper press cloth. Be careful ironing and test on a corner when increasing ironing heat because if it's too hot it will cause puckers that are well-nigh impossible to get out afterwards. Puckering is more apt to happen with lighter weight ripstops than with heavier ones. The best way to straighten ripstop (for instance, when it comes mashed off a bolt) is to give it a bath in warm clear water and hang it to dry over a straight rod. (Thanks to Cloud Pleasers for this helpful tip.) Of course, no matter how sleek the kite looks brand new from your workshop, it will soon get wrinkled when you roll it up and bag or rubber-band it. (Margaret Greger makes flat bags about ten inches wide, muumuu-like for kite comfort.) Most of the wrinkling will straighten out with flying.

Sometimes you will find bargain nylons that are soiled or wrinkled on a balloon- or sailmaker's cutting room floor. You can salvage them and pay perhaps no more than your washing or ironing labor.

There are other forms of wear on nylon, such as degradation of colors and cracking caused by sunlight after many hours of flight. An old, much-flown Parafoil will look all cracked, like a dried-out apple, but will usually fly just as well as ever. Sand is abrasive on kite covers that frequent the beach. Ripstop is not forever, but it's relatively more enduring than, say, washi, the Japanese rice paper used on kites which are rarely flown a second time. I've yet to see ripstop ritually burned at the beach after flight.

The Rewards

None of these techniques are easy the first time, but they are a lot simpler than they sound. (They are easier to do than write about, let me tell you!) With practice, though, they become easier. You grow facile in the art of translating from kite-seen-on-paper to living fabric kite. We've all learned there's nothing like answering a thrilled spectator's compliment with, "Thanks, I made it myself."

Acknowledgements

My heartfelt thanks go to the super people who helped (in lots of ways) to bring this learning-for-fun tool to print. I simply couldn't have written it alone. First, I thank Mel Govig for his constant flow of technical input. Others who lent me important knowledge support are Louise Crowley, Tony Cyphert, the Edmonds Community College of Lynnwood, WA (in the persons of Harry Osborne and Paul Doherty), Judith Faecher, Doris Fithian, Fran and Mary Gramkowski (High Fly Kite Co.), Ed Grauel, Pete lanuzzi, Jeannette Kehl, Bruce and Carolyn Kennington (Cloud Pleasers), Marty Lowell (Sky Zoo Kites), Curtis and Gray Marshall, Cathy Pasquale, Robert Sessions (Hood Sails), Tal Streeter, Sallie and Nick Van Sant (Kites of the Four Winds) and especially Rita Siravo, who first encouraged me to sew ("Every man should know how to sew"). Special thanks go to Annie for sharing her machine and her spirit and to Babs for typing and caring. Finally, I suspect that more than a few spouses will know what I mean when I save my greatest appreciation for my wife Mary for enduring a lot of disruption while helping me keep my feet on the ground when I have my head in the clouds. Last I thank Val Govig for two things. First for her added vitamins of information and tough editing work to make this whole article usable. Second (and I insisted she include this) for her dedication to *Kite Lines* as a communicative tool that helps us all know each other. Though it's a big collective article, all of us feel strongly that it is just a start on the subject of kitemaking with nylon. Do you have sewing, materials, procedures and design tips you'd like to share? Just write to *Kite Lines* or to me in the shipping and communications department at The Fabric Lady. There's more to come.

Bill Tyrrell