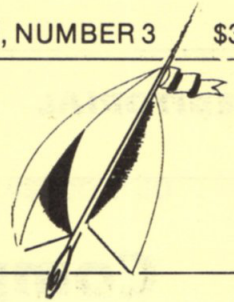


# FABRIC FOILS

## The Journal of Sailmaking



# Choosing the proper cloth finish...

by BOB BAINBRIDGE  
of Howe and Bainbridge

In the last issue we considered sail cloth design. As is so often the case in sailing, it is a matter of compromise. It is not possible to optimize cloth performance in one respect without degrading it in another. The primary tradeoff occurs with regard to stretch on the bias and on the fill — one cannot be improved without worsening the other. This tradeoff and others account for the five distinct types or "lines" of cloth now available from Howe and Bainbridge.

But cloth design is not the only determinant of performance. Each line can be finished in a number of different ways to optimize certain traits. Thus, even within each "line" there is a broad range of fabric characteristics possible. And, to a certain extent, these characteristics will overlap one another. It is, in this way, possible to make an unbalanced construction behave very much like a more balanced weave or to make a fabric with poor yarn quality behave like a much more expensive weave.

Unfortunately, these effects of the finishing process are likely to be rather temporary. As a result, it is best to consider the finishing process a fine-tuning mechanism. It allows specific characteristics of a weave to be highlighted. It should not be used as a crutch to bolster cloth weaknesses. For this reason, some types of finish are not appropriate for some cloth lines. Examine Table I which lists current combinations of cloth lines and finishes. It is necessary to develop a familiarity with the types of finishes available in order to understand this.

Sailcloth finishing is a complex, multi-step process which extensively alters the fabric. We alter the fabric in four ways. First, the material is chemically cleaned. Then it is treated with resin. Then it is heat treated. And, fourth and last, it is mechanically processed or "rolled." Note that although there are only four distinct effects there are many, many steps in each process. Each one

**TABLE I: AVAILABLE COMBINATIONS OF CLOTH LINE AND FINISH**

	CLOTH "LINE" OR DESIGN					
	High Aspect Main	High Aspect Genoa / Low Aspect Main	Genoa	General Purpose	Bermuda	Nylon
BSDS						
V.Firm, Firm	✓	✓	✓	✓		
M. Firm						
Carolyn	✓	✓	✓			
NYT	✓	✓	✓			
Temperkote		✓	✓			
Bermuda Software					✓	
Stabilkote III						✓
Dynac						✓

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## Computer-Aided Sail Design

Some sailmakers and many of their customers look upon computers as a *deus ex machina*, i.e. a mechanical solution for all the problems that beset us in sail design. Let me assert right now that this is not my belief. Indeed, just as the typewriter did not improve literature (some insist that it caused a deterioration in its quality), so computers will not improve sail design. But it is true that these machines can perform a great number of calculations quickly and store vast amounts of data efficiently. The question is whether these capabilities can improve sailmaking efficiency and quality.

The answer is, "Yes...but with qualifications!"

This piece is being "created" on a Wang 2200 LVPC minicomputer. I have invested nearly \$65,000.00 in the hardware that is being used here over a five-year period. And thousands of manhours and at least another \$10,000.00 have been invested in software development. We have found the computer extremely valuable in performing bookkeeping and mailing list maintenance functions. We have also compiled, with the aid of the computer, the most complete and useful list of sailplan data ever assembled. But we have not been able to use the machine to improve our lofting accuracy or efficiency. We have tried. And I believe that we will eventually succeed. But the gains will, at least in the near future, be only incremental.

But what has been done in other lofts? It is sometimes difficult to separate truth from the hyperbole that accompanies claims made with regard to computer use. What follows is my estimate of what has been accomplished.

Laser sails are cut with a numerically controlled machine. This makes each sail quite standard. At least one of the North lofts is using a similar procedure linked to a microcomputer to cut panels for a wide variety of sails. Three companies (Ted

Continued on page 5

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# FABRIC FOILS

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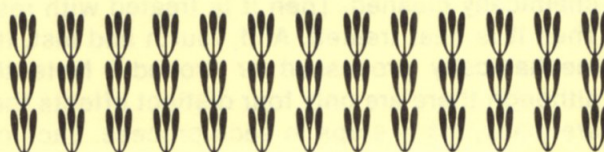
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### IN FUTURE ISSUES

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Selecting Sailcloth Weight, Type, and Finish  
Battens and Their Use  
The Relationship Between Round and Broadseaming  
The Function of Leech and Foot Lines  
Sailmaking Threads  
Two-Ply Sail Construction  
Sacrificial Roller Furling Covers  
Evaluating Sail Shape  
The Use of Draft Stripes  
Industrial Machines for Sailmaking  
Making Batten Pockets That Last  
Sail Insignia and Large Scale Designs  
Working with Nylon Spinnaker Cloth

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# Choosing the proper cloth finish...

Continued from page 1

permits a degree of adjustment and variability. Thus, finishing is a nearly infinitely variable process.

Even so, it is possible to categorize the types of finishing processes possible and analyze their effects. At Bainbridge we have established seven categories: "Carolyn," "Softwave," "BSDS" (Bainbridge Stabilized Dacron Sailcloth), "Yarn Tempered," "Dynac," "Stabilkote," and "Temperkote." There is no resin used in the finishing process for Carolyn cloth. Softwave and BSDS cloths are impregnated with a "melamine" resin. Yarn Tempered, Stabilkote, and Dynac cloth is coated with a polyurethane resin.

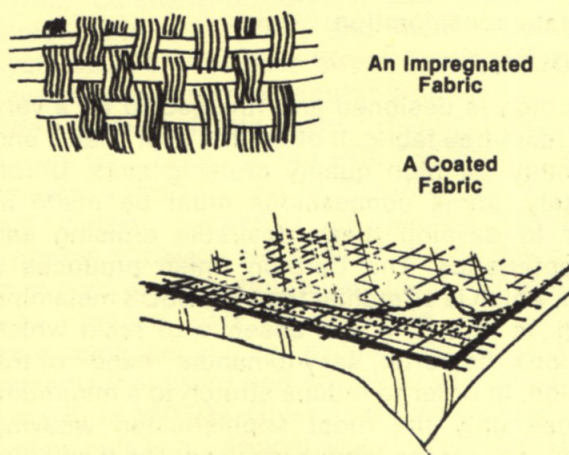
## Resin Impregnation vs. Resin Coating

The difference between resin impregnation and resin coating is very important. An impregnated fabric is dipped through an aqueous solution of resin prior to heat setting. This resin soaks into the fibers and then, during the heat setting, it chemically bonds those fibers together. The resin is largely invisible. It leaves no deposits and adds virtually no weight to the fabric. It does not plug the holes or interstices in the fabric or limit fabric porosity (the amount of air that can be blown through the fabric). An impregnation can be thought of as inhibiting the stretch of a fabric as opposed to trying to eliminate all stretch. With various concentrations of resin coupled with heat setting temperatures and other finishing techniques, it is possible to produce a very specific "spec" in a fabric.

While an impregnation seeps into the fibers of a fabric and chemically bonds them together, a coating is an actual film of resin which sits on one surface. The Yarn Temper, Dynac, and Stabilkote finishes are examples of coated finishes. A liquid polyurethane resin is actually squeegeed onto the fabric. In the case of Yarn Temper and Dynac, this is done in an attempt to eliminate stretch as much as possible. The Stabilkote finish is intended to reduce porosity.

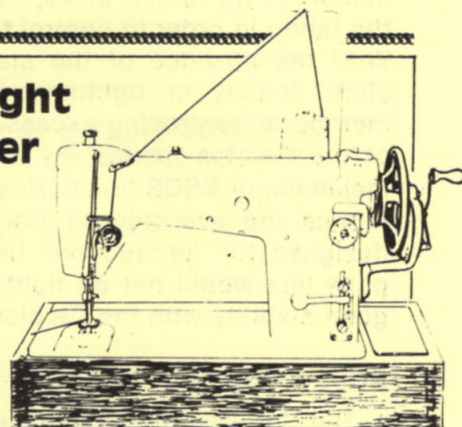
Mylar is also used to coat fabric — the result is the Bainbridge "Temperkote" finish. The Mylar film is attached to the fabric with a cohesive membrane that sits on the surface of the cloth.

FIGURE 1: IMPREGNATED VS. COATED



## The Sailwright Moneymaker

At last, the sewing machine for you! Until now sailmaking and sail repair have been carried out either with small, lightweight, and often underpowered sewing machines designed for home use or with heavy and ridiculously specialized machines intended for volume commercial work.



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  - Special wide feed dog and presser foot included with each machine—gives more consistent feeding even with slippery sailcloth
  - Hand crank and motor left on machine at all times—switch to handcrank by flipping the drive lever in place and slipping the belt off
  - Impressive two-speed drive with advantage of new low-speed (300 spm)—sew without touching the balance wheel, sew many layers without needle heat up or melted thread
  - Perfect control.

## Sailrite Enterprises

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Columbia City, Indiana 46725  
(219) 244-6715 or  
tollfree outside Indiana (800) 348-2769

The Sailwright Moneymaker ..... **\$995<sup>00</sup>**

Delivery (via UPS in two boxes) will run from \$10 to \$40 depending upon your distance from Indiana. We will add the appropriate amount to a charge card purchase or send the machine freight collect if a check or money order is received.

Continued on page 4



# Choosing the proper cloth finish...

Continued from page 3

## The Cloth Finish Categories

Each of the types of cloth finishes deserves separate consideration.

### CAROLON

Carolon is designed and finished to be a very soft, resin-free fabric. It offers the best "hand" and durability for high quality cruising sails. Unfortunately, some concessions must be made in order to develop these desirable cruising sail characteristics. The Carolon finish produces a fabric which is stretchier than the BSDS melamine finish. In fact, it is the absence of resin which develops the softer, easy-to-handle "hand" of the Carolon. In order to reduce stretch to a minimum, we use only the most sophisticated weaving technology for the fabrics involved. The maximum number of fill yarns, "picks," must be packed into the fabric in order to control the bias elongation. With the absence of the stabilizing melamine, cloth density or tightness becomes the only method of controlling excessive bias stretch. All of the Carolon fabrics are also available in the melamine or BSDS finish. However, not all BSDS fabrics are available as Carolon, and a fabric designed for "production" like our general purpose line would not be tight enough to provide good stability with the Carolon finish.

### SOFTWAVE

The Softwave finish is especially designed for our Bermuda sailcloth. That fabric design is intended to provide a good cloth at the lowest possible cost, and this finish is intended to blend with that end. The cloth is impregnated with melamine resin but in such a way as to keep the cloth very soft and supple — only slightly less so than Carolon. Under the very highest loading, the fill yarns of these Bermuda fabrics will stretch more than Bainbridge fabrics, but this can often be offset by using the next highest weight cloth in the Bermuda line.

### BSDS

Bainbridge Stabilized Dacron Sailcloth or "BSDS" is the standard melamine finish. By varying the way the resin is applied, a range of hands is possible. The medium firm finish on 4.4-ounce cloth, for example, would yield a stretch specification of roughly 3-19. The 3 and 19 represent the fill and bias stretch respectively at 10 pounds of pressure. A firm finish would change these figures to 3-15. A very firm finish would bring the stretch ratio to 2-10. These figures are intended

**TABLE II: COMMON SPECS FOR BAINBRIDGE DACRON SAILCLOTH**

Weight	BSDS			
	MF	F	VF	YT
<b>Genoa Fabrics</b>				
2.2 oz.	33-104			8-10(CYT)
3 oz.	17- 64 laser			4-6
3.3 oz.	13- 32			5-7(CYT)
4.5 oz.	9- 24	6-13		
4.75 oz.	8- 26	6-16	4-11	
5 oz.	7- 24	5-15		3-5
5.5 oz.	7- 25	5-15		
7.25 oz.	5- 18			On Request
<b>High Aspect Jib / Low Aspect Main</b>				
4.4 oz.	3-19	3-15	2-10	2-4
5.4 oz.	3-18	2½-12	2-10	2-4
6.5 oz.	3-24	2½-14	2-10	2-4
6.7 oz.	3-20	2½-14	2-12	
7.7 oz.	3-20	2½-12		
8.7 oz.	3-20	2½-15		
10.4 oz.	3-21	2½-15		
<b>Mainsail Fabrics</b>				
5.25 oz.	2½-25	2½-20		
6.3 oz.	2-22	2-12	2- 9	2-4
7.25 oz.	2½-24	2½-18		1-3
7.3 oz.	2-25	2-10		On Request
8.3 oz.	2-24	2-12	1- 8	
8.33 oz.	2-24	2-12		On Request
9.25 oz.	2-24	1½-16	1½-12	On Request
10.3 oz.	2-20			
<b>All Purpose</b>				
3.8 oz.	8-38	5-14	3-7	3-4½
3.9 oz.	8-38			
5.3 oz.	8-28			

for comparison only since they will change as the cloth is used, but they do indicate the relative stability of the cloth in its various finishes. Remember that the BSDS cloth makes use of a resin impregnation. That means that it is a relatively durable fabric. The finish will not crack or peel or flake off. The finish is not distinguishable from Carolon except that it has a harder or firmer hand.

### YARN-TEMPERED

Yarn Tempered cloth is extremely firm. It is intended strictly for racing. This fabric has a very hard, firm, durable coating which sits on the surface of the material and provides the lowest stretch characteristics available in a Dacron sailcloth. When the 4.4-ounce cloth mentioned above is finished in this manner, the stretch ratio drops to 2-4. The chart below indicates the normal stretch ratios for other BSDS and YT finished sailcloths.



## DYNAC

The Dynac finish is a coating especially designed for racing nylon sails. It greatly reduces the stretch ratio of any nylon to which it is applied. At the same time, it cuts porosity to zero. Unfortunately, the Dynac finish greatly decreases the tear strength of the fabric. Individual yarns are forced to take a much greater share of any local stress than when the cloth is uncoated.

## STABILKOTE III

The Stabilkote III finish is a more forgiving nylon coating. It gives low stretch, yet it is a dimensionally flexible coating. It has such a tremendous adhesion that it is almost impossible to see on the surface of the fabric even after the sail has been stuffed into a bag hundreds of times. The coating is so flexible and durable that the tear strength is consistently good, especially for a coated fabric. Stabilkote III Ripstop is the most popular spinnaker fabric in the world.

## TEMPERKOTE

Finally, the Temperkote mylar-coated fabrics are the latest in a series of polyester film (Mylar) and woven polyester fiber (Dacron) laminated composites. The latest designs utilize a larger denier yarn in the fill direction. This was done to deliver fill strength substantially greater than is possible with Mylar alone. This unbalanced construction concept, a result of years of weaving technology that Bainbridge has developed, is consistent with our BSDS fabric development, which has moved in recent years towards higher fill strength fabrics. Temperkote has been made possible as a result of a sophisticated adhesive system and laminating techniques which have been developed specifically for this product. The entire laminating system has achieved such amazing adhesion and durability that the fears of delamination that plagued the early development of this product are now virtually unheard of. Even so, it must be recognized that the composite structures are not so durable as other sailcloths. Temperkote is a racing fabric and must be given careful treatment.

The combined understanding of cloth designs and cloth finishing techniques will make possible cloth selection that allows for very specific end-use applications. The table at the head of this article summarizes all that has been said in these two articles. The columns represent the six lines of fabric available. The rows indicate the seven finishes in which those lines are available. We hope that this table and all that has been written here will make your next cloth choice more appropriate. ■

## Computer-Aided Sail Design

Continued from page 2

Adresen, P.O. Box 40053, St. Petersburg, FL 33743; Sailmaker's Service, 955 West Fourth Street, Erie, PA 16507; and Marine Computer Systems, 675 West Main Street, Tustin, CA 92680) have released microcomputer programs that provide a table of offsets useful in handcutting single panels on a table marked with "X" and "Y" coordinates. Tables III and IV illustrate the input re- and output generated by Marine Computer Systems software. No attempt will be made here to explain how the figures are used. These tables are intended only to illustrate the kind of assistance that you can expect. The cost of these systems (hardware and software) will range from \$12,000 to \$80,000. Given that they increase efficiency only in a marginal way, if at all, that expenditure may be difficult to justify for any but the largest lofts.

Continued on next page

### TABLES III AND IV: MARINE COMPUTER SYSTEMS' GENOA DESIGN SHEETS

#### TABLE III: INPUT PARAMETERS

MARINE COMPUTER SYSTEMS  
GENOA PROGRAM

CAL 20

I, FEET	21.00
J, FEET	7.33
JC, FEET	7.33
MAST RAKE, INCHES	0.00
LUFF, FEET	20.50
LP, % OF JC	130.00
CLEW ABOVE TACK, INCHES	13.00

PANEL WIDTH, INCHES	36.00
SEAM ALLOWANCE, INCHES	0.50
LUFF TABLING, INCHES	0.00
LEECH TABLING, INCHES	0.00
DISTANCE TO 1ST SEAM	0.00

CAMBER	
BOTTOM:	8.50 %, MAX AT 42.00 %
1/3 LUFF:	12.00 %, MAX AT 42.00 %
2/3 LUFF:	12.50 %, MAX AT 42.00 %
TOP:	11.00 %, MAX AT 42.00 %

TWIST, DEGREES	3.00
----------------	------

LEECH HOLLOW, INCHES	1.00
FOOT ROUND, INCHES	9.00
HEAD RING, INCHES	1.25

STRETCH NUMBERS	4.00	5.00
-----------------	------	------

APPARENT WIND	15.00 KNOTS
HEADSTAY TENSION	850.00 POUNDS
MAX HEADSTAY SAG	2.63 INCHES

WINDSPEED	TENSION, SAG = 2.63	SAG, TENSION = 850.00
-----------	---------------------	-----------------------

4	60.44	0.19
6	136.00	0.42
8	241.78	0.75
10	377.78	1.17
12	544.00	1.69
14	740.44	2.29
16	967.11	3.00
18	1224.00	3.79
20	1511.11	4.68
22	1828.44	5.66



**TABLE IV: PARTIAL LISTING OF  
OUTPUT PARAMETERS**

GENOA PROGRAM  
CAL 20

PANEL NUMBER 1

TOP LEECH TOP LUFF  
X = 0.18 X = 126.91  
Y = 0.00 Y = 0.00

BOTTOM LEECH BOTTOM LUFF  
X = 0.00 X = 127.20  
Y = 10.91 Y = 0.50

FOOT OFFSETS AT 1/5 POINTS

X = 0.00 25.44 50.88 76.32 101.76 127.20  
Y = 10.92 14.63 15.39 13.31 8.39 0.51

PANEL NUMBER 2

TOP LEECH TOP LUFF  
X = 0.47 X = 104.96  
Y = 36.00 Y = 36.00

BOTTOM LEECH BOTTOM LUFF  
X = 0.00 X = 127.47  
Y = 0.00 Y = 0.00

BROADSEAM AT BOTTOM OF PANEL  
X (INCHES) SEAM (INCHES)

0.00	1.16
12.00	1.08
24.00	0.93
36.00	0.77
48.00	0.62
60.00	0.52
72.00	0.49
84.00	0.55
96.00	0.76
108.00	0.91
120.00	1.10
126.73	1.18

BROADSEAM AT 1/5 CHORD POINTS

0/5	1/5	2/5	3/5	4/5	5/5
1.16	0.91	0.59	0.50	0.78	1.18

**TABLE V: A SAIL PRICE SHEET PRODUCED BY  
MARINE COMPUTER SYSTEMS' SOFTWARE**

I = 30.00 J = 8.00 P = 25.00 E = 8.75

SAIL	AREA	CLOTH WT	PRICE
Mainsail	109	5.75 oz	\$457.
Reef points per row			\$35.
Mainsail Cover			\$79.
Storm Jib	36	6.5 oz	\$170.
Storm Trysail	33	6.5 oz	\$161.
Working Jib	87	7.25 oz	\$324.
Lapper	138	7.25 oz	\$471.
Genoa #1	150% 180	3.8 oz	\$445.
Genoa HVY #1	150% 180	4.5 oz	\$474.
Genoa BLADE	100% 120	6.6 oz	\$385.
Genoa #2	130% 156	6.6 oz	\$459.
Drifter DACRON	150% 180	2.2 oz	\$487.
Drifter NYLON	150% 180	0.75 oz	\$408.
Blooper	150% 180	0.75 oz	\$433.
Radial Head Spinnaker	432	0.75 oz	\$520.
Triradial Spinnaker	432	0.75 oz	\$598.
Cruising Spinnaker	347	1.5 oz	\$391.
Battenless Mainsails:	92% of standard price.		
Flattening Reef:	\$15.00		
Club Jibs:	Add 10% to Jib price.		
Roller Furling Headsails:	Add 6% to standard price.		
Sew on covers:	\$3.25 * (leech + foot)		
View Windows:	\$18.00 each.		
Telltale Windows:	\$12.00 each.		
Draft Stripes:	\$15.00 each		

**TABLE VI: A MAINSAIL PRICE USING  
SAILWRIGHT'S TI 59 PROGRAM**

SQUARE FT? 109.00  
AREA 109.00 MAIN  
HOURS 12.07 MAIN  
HDWRE 46.39 MAIN  
CLOTH YDS. 20.00 MAIN  
CLOTH COST?MAIN 4.35  
174.  
437.69

Continued from preceding page

This may seem to run counter to all that you have read about the use of computers by sailmakers and, indeed, even to what you have learned by talking to those sailmakers. They all seem to be enthusiastic beyond words. In every case, however, I think that you will find that their enthusiasm is more for the potential that they see than it is for what they are able to do today. Keep in mind, too, that they feel a (perhaps unconscious) need to justify the expenditure in time and money that they have made. And, finally, given the public image of the computer's power and accuracy, the loft's status can be bettered by joining in praising the machines and claiming to have mastered them.

I do **not** recommend computers for any loft doing less than \$500,000 gross volume each year UNLESS the owner or manager has a good deal of spare time that he is willing to commit totally to the machines. That time will be "wasted" in terms of short run gain. It may pay off in the long run by

Visit us at the Boat Barn in Columbia City...





## CONNIE'S CORNER



Some of you will remember a Sailrite Newsletter where Connie gathered together all the discontinued and shop-worn items and offered them for sale at very **low** prices. This section of the Fabric Foils is an outgrowth of that. We will use it to keep you informed of the miscellaneous items which we want to get off our shelves.

It is also a good way for you to do the same. Classified ads are **FREE** for current subscribers. The ads are subject to editorial selection and space availability. They are limited to one-of-a-kind opportunities and small lot sales. Standard commercial products are **NOT** eligible.

Free ads are limited to a maximum of 50 words. The only payment is your current **FABRIC FOILS** mailing label to verify your subscriber status. Photos of items for sale are also printed free — space permitting. Just submit a clear black and white photo along with your ad copy.

**Nylon Backpack Netting Seconds in Charcoal.** Great for "drying" bags and hammocks. Strong but not suitable for trampolines since nylon sags when damp. Flaws primarily in the color. \$2.49/yd. (44 inches wide). Sent postpaid in quantities of five yard or more. Sailrite Kits, Route 1, Columbia City, Indiana 46725. Phone (219) 244-6715.

**Adhesive-Backed Numbers.** Old stock in assorted colors, sizes (red, black, blue, 10" 12" 15" high). Outmoded by new Dacron insignia material but perfectly usable. Some numbers vinyl, some ripstop nylon, some even new Dacron fabric but in off shades. Give us color and size and number preferences; we'll fill order as necessary with stock on hand. \$2.00/12 numbers, sent prepaid if 12 or more numbers are ordered. Sailrite Kits, Route 1, Columbia City, Indiana 46725. Phone (219) 244-6715.

**Stablekote III Seconds.** Often called 3/4-oz. ripstop nylon spinnaker cloth. Lots on hand. Surprisingly good condition. Rolls often less than five yards; some flaws in color. Give color preferences but don't hold us to them since we cannot order in colors when supply is exhausted. 40 inches wide. \$2.45/yd., sent postpaid in quantities of five yards or more. Sailrite Kits, Route 1, Columbia City, Indiana 46725. Phone (219) 244-6715.

**Plastic Thimbles, Discontinued Stock.** Suitable for light-duty applications in rope eyes.

1/4-inch rope thimbles ..... \$ .45 ea.  
3/8-inch rope thimbles ..... .65 ea.

Sailrite Kits, Route 1, Columbia City, Indiana 46725. Phone (219) 244-6715.

**Olympic Slug Slides, Discontinued Stock.** Excellent slug slides for installation on sails for boats under 26 feet. These slugs can be attached with just a screwdriver. They clamp over the boltrope and do not require grommets. The hinge makes these slides work very smoothly.

Olympic Slug Slides ..... \$ .45 ea.

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**Brummel Hooks, Discontinued Stock.**

Brand new brummel hooks. There is no better way to secure sheets and halyards on small boats! These hooks are fast, strong, secure, and very light.

Size 00 — working strength of 500 lbs.  
Eye hooks ..... \$2.00 ea.  
Small bail swivel hooks ..... 5.00 ea.  
Large bail swivel hooks ..... 7.00 ea.

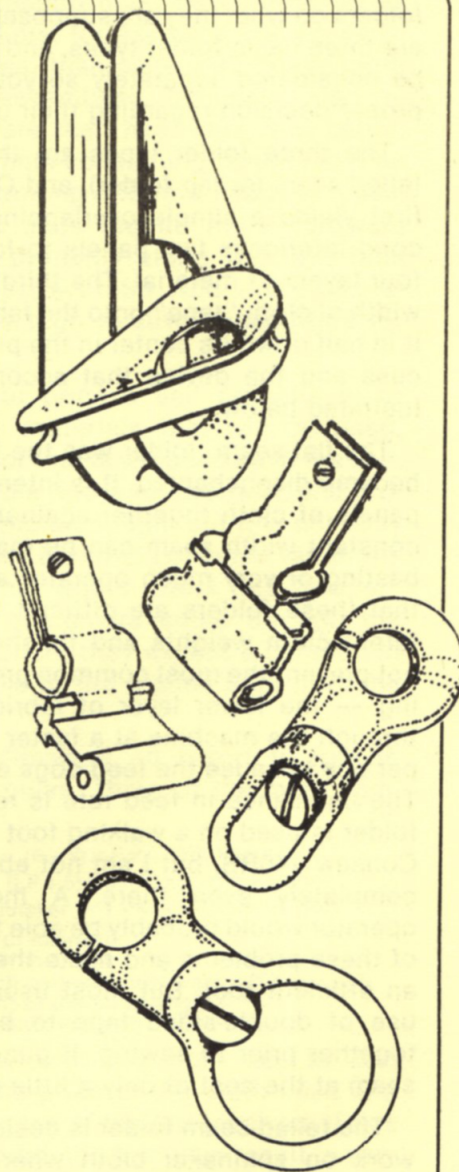
Size 0 — working strength of 1000 lbs.  
Eye hooks ..... \$3.00 ea.  
Small bail swivel hooks ..... 6.70 ea.  
Large bail swivel hooks ..... 7.50 ea.

Sailrite Kits, Route 1, Columbia City, Indiana 46725. Phone (219) 244-6715.

**EZ Splice Kits.** Tools and instructions for splicing 5/16-inch braid-on-braid or 1/4-inch hollow braid line. Discontinued item. \$1.45 each, sent postpaid. Sailrite Kits, Route 1, Columbia City, Indiana 46725. Phone (219) 244-6715.

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# Move'em out!



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46725.





# Ask Jim Grant

????????????????????! !

**Q.** John Hughes in Marion, Massachusetts, asks about the use of folders on sewing machines. Do they save time? Are they difficult to use? Are they worth their rather considerable price?

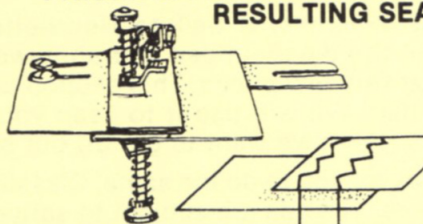
**A:** We are dropping all folders from our Sailmaker's Catalogue this year. Most of our customers have had a difficult time making the folders do what they are supposed to do. But there are three basic folder types, and each one should be considered separately so you can all make a proper decision regarding their usefulness.

The three folder types are the flat-seam, the felled-seam (or lap folder), and C-tape folder. The first yields a simple overlapping seam. The second interlocks two panels to form a seam with four layers of material. The third guides a narrow width of cloth "tape" onto the fabric edge, folding it in half down its center in the process. Each process and the device that accomplishes it is illustrated below.

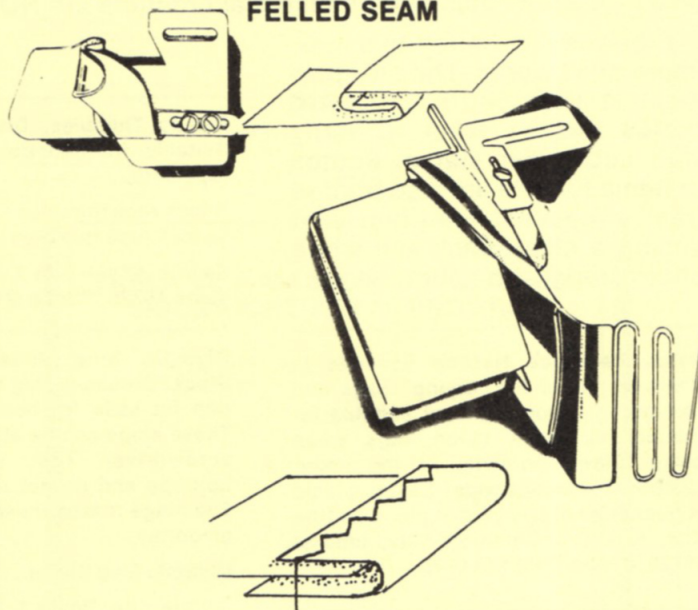
The flat-seam folder was the first with which I became disenchanted. It is intended to force two panels of cloth together against stops so that a constant width seam can be maintained without basting or very much operator attention. I found that these folders are difficult to adjust for different cloth weights and finishes. They also do not prevent the most common problem in sailmaking — the lower layer of fabric tends to move through the machine at a faster rate than the upper one because the feed dogs engage against it. The imbalance in feed rate is reduced when the folder is used on a walking foot machine like our Consew 146RB, but I am not able to eliminate it completely even there. A more experienced operator would probably be able to overcome both of these problems and make the flat-seam folder an efficient tool. But most users will prefer the use of double-sided tape to baste sail panels together prior to sewing. It guarantees a perfect seam at the cost of only a little extra time.

The felled-seam folder is designed primarily for work on spinnaker cloth where the extra bulk along the seam can help prevent puckers and where it can contribute to greater strength. Unfortunately, spinnaker cloth is very slippery and extremely flexible. The first characteristic results in the same feed imbalance that I described above with the flat-seam folder: the panel of cloth engaged by the feed dog tends to move through the

**FIGURE 2: FLAT SEAM ROLLER GUIDE AND RESULTING SEAM**



**FIGURE 3: LAP FOLDER AND RESULTING FELLED SEAM**



**FIGURE 4: C-TAPE FOLDER AND RESULTING FUNCTION**

machine faster than the panel that is dragged along under the presser foot. The second characteristic, the flexibility of the cloth, makes it difficult to maintain a consistent overlap along the seam. The cloth is so soft that it tends to roll over at the stops. Again, an experienced operator can overcome both of these problems. And then this particular folder becomes a real timesaver. It should also be noted that this folder, like the one above, is easier to use with a walking foot machine since the operator can tug on the fabric more firmly giving it increased rigidity.

The C-tape folder was designed initially for use in the garment industry where fabrics are much softer than those used for sails. The problems experienced with this folder stem from the stiffness of the cloth. It is difficult to keep the fold in the center of the material. It is also difficult to keep the edge of the sail pushed properly into the folded tape. Neither problem is serious — a little practice will generally overcome them. But, just because the cloth is so stiff, the increase in effi-



# How much should sails cost?

The Maine Bay Canvas Company published a survey of prices gathered from nearly 100 sailmakers all across the country in 1979. The result of that survey are summarized below:

Sail	Median	Mean	Std.Dev.
196 ft.sq. Main / 6 oz.	\$568.40	\$566.44	\$96.04
148 ft.sq. Jib / 6 oz.	358.16	344.84	62.16
403 ft.sq. Genoa / 5 oz.	757.64	741.52	128.96
700 ft.sq. Cruising Spinnaker	700.00	742.00	189.00

These figures are, of course, very much out of date. But I cite them not as a guide for current pricing but to indicate just how much deviation there is in the prices quoted by sailmakers. The standard deviation column demonstrates this most clearly. That amount must be added to and subtracted from the mean in order to encompass two-thirds of the sailmaker's quotes. In the case of the first three sails, this deviation is roughly one-third of their mean prices. For cruising spinnakers, it is over half of that mean price. I doubt if there are many industries where such wide-ranging price variations would be found.

What does this mean? Obviously there are some bargains to be had when it comes to buying sails. But these bargains can become "busts" if the poor sailmaker decides that he must cut corners after misquoting a job. And, even if he puts forth his best effort (he may not realize how low

ciency offered by these folders is marginal even when they are working properly. A tape can be easily creased down its center and applied to the sail edge neatly without the folder. Once again, the folder would no doubt improve efficiency enough to justify its cost if it were in continuous use by an experienced operator. But sailmaking requires tape applications only roughly 5% of the time. The time spent mounting it and adjusting it could be devoted to the actual work.

All of these folders "work," but they are obviously most effective when used continuously by experienced operators on machines that have special provisions for pulling fabric through with certainty. Of the three folders above, only the four-inch C-tape device is used with any regularity in our student loft, and its use is confined primarily to the 146RB Consew machines. ■

his price is), he must limit after-sale service — perhaps only because he finds himself bankrupt! So both sailmakers and sail buyers have an interest in paying the "right" price for sails.

But what is the right price? Most sailmakers quote sails on the basis of their size and type. There is obviously a direct correlation between sail size and the hours required to build it. But the type of sail in question must be considered as well since spinnakers, for example, can be sewn faster, area for area, than sails with heavy cloth and large patch assemblies. Mainsails also require more hardware than headsails, and batten pockets are quite time consuming. There must be distinctions even among different headsail types. High aspect ratio sails require more hardware (since it is used primarily along the luff) than others with lower aspect ratio. And stormsails require an extremely high relative expenditure for hardware.

The only way to price a sail properly is to itemize all of the materials that will be used, tabulate all the labor that is wrapped up in the sail, and add a reasonable figure for overhead and profit. This sounds simple enough, but it is not easy in practice. There are hundreds of minor variations from sail to sail that would effect this "proper" price. And when customers come through the door or call for a price, they expect a competent sailmaker to be able to fire a price right from the shoulder.

As a result, sailmakers all resort to rule-of-thumb pricing formulas. Three of the most common are below:

$$\text{Main Cost} = (E + 9) \times P \times (\text{Cloth Factor})$$

$$\text{Jibsail Cost} = (LP + 5) \times (I - 6) \times (\text{Cloth Factor})$$

$$\text{Radial Head Spinnaker} = I \times MG \times (\text{Cloth Factor})$$

where:

E = Foot of mainsail

P = Luff of mainsail

LP = Length perpendicular from luff across jib

I = Height of the foretriangle

MG = Spinnaker midgirth

The cloth factor will vary from .85. to 2.45 depending upon the price of the cloth used and the overhead expenses of the loft involved. If this cloth factor is ignored, the formulas result in very nearly straight line increases. There is, however, some influence exerted by the aspect ratio: higher aspect ratio increases the price slightly. The graph below illustrates the curves for two mainsails.

Continued on page 12



# Centerfold Reveals All!

It was just 13 years ago that we first published the books that have guided so many people. They have been improved in minor details in three or four editions since their introduction, but they had not been a major revision.

During this past year we have been working on a completely new **Canvas Working** book, a new **Spinnakers: Their Design and Construction**, a new **Sail Repair Manual**, and a new **Jibsails** book. These books now feature far more drawings and more explicit text. In some instances instructions have been modified to reflect advances in the practice of sailing. This is especially the case with our **Sail Repair Manual**, which was almost entirely rewritten.

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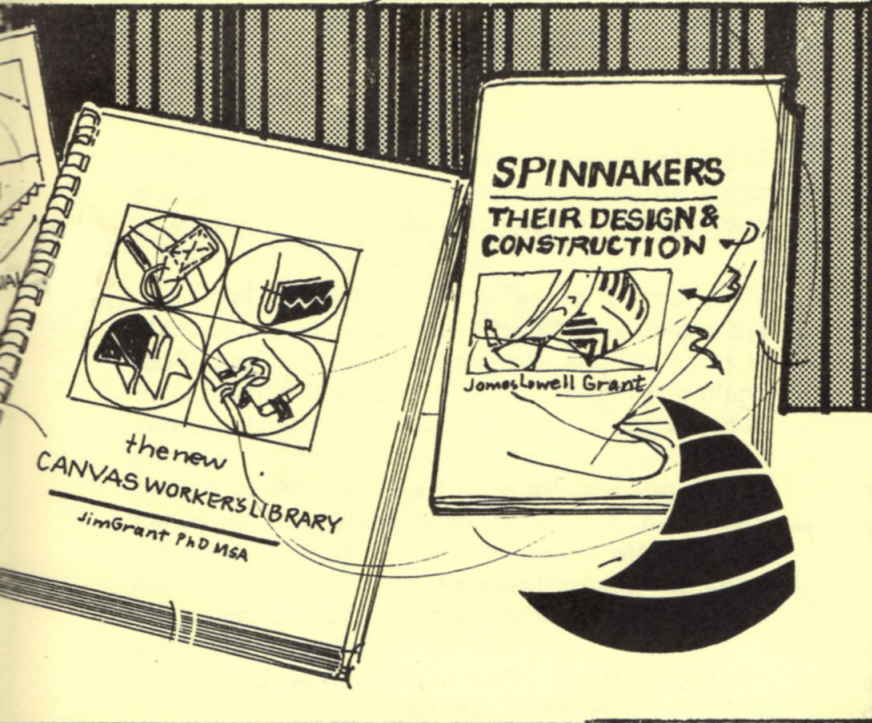
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Without doubt, these books are the definitive source of sailmaking expertise. They are used by professional and amateur alike. They are helpful not just for those who build sails, but also for those who want to understand how they should be used and modified.

Each book is written not just for entertainment (although they are entertaining) but for the sake of clarifying and explaining an old and treasured art form. The intent is to make it possible for everyone to understand and even participate in sailmaking as it is practiced today.

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The cloth factor is figured by dividing the cost per yard by 6.25 on the assumption that 6.25 square feet of sail can be made with one square yard of fabric. Then an amount equal to the cost of fabricating one square foot of sail is added to that figure. This cost is best calculated by dividing the square footage production figures for one month by direct labor and fixed overhead expenses for that same month.

Let's consider an example. We must price a mainsail that is 25 feet on the luff and 11 feet on its foot. Our cloth factor is derived as follows:

Cost of cloth (at wholesale—retail will be roughly twice this figure) = \$4.50	
Cost of cloth / 6.25 =	.72
Monthly production in sq ft. = 6000	
Monthly fixed exp./dir. labor = \$3,000.00	
Square footage overhead =	.50
Final factor for use in formula	1.22

Remember that these factors can be set down in a table for ready reference. Each cloth can be assigned its own factor. Indeed, it is best to keep separate production and expense figures for each cloth weight to allow for the greater production speed possible with lighter cloth. Then those factors can be quickly plugged into the simple formulas as follows:

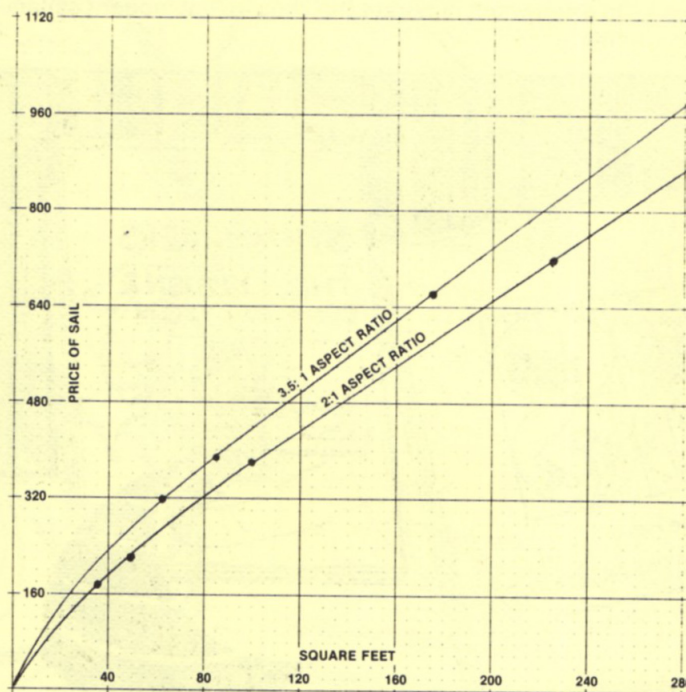
$$\text{Main Cost} = (11 \times 9) \times 24 \times 1.30 = \$650.00$$

There is room in the cloth factor calculation for differences in efficiency from sailmaker to sailmaker. But those differences should not be extreme.

There are other pricing systems in use. The advantage of this one is that it is very simple to use with just a desk calculator. It is a good way to begin to bring order to any quoting system.

In time a more sophisticated system like that sold by Sailrite for use with programmable calculators will be desired. This system actually calculates "normal" hourly requirements for each sail as well as normal cloth and hardware costs. It is more appropriate for those who want to implement a cost accounting system and keep track of actual profit (or loss) on each sail produced. ■

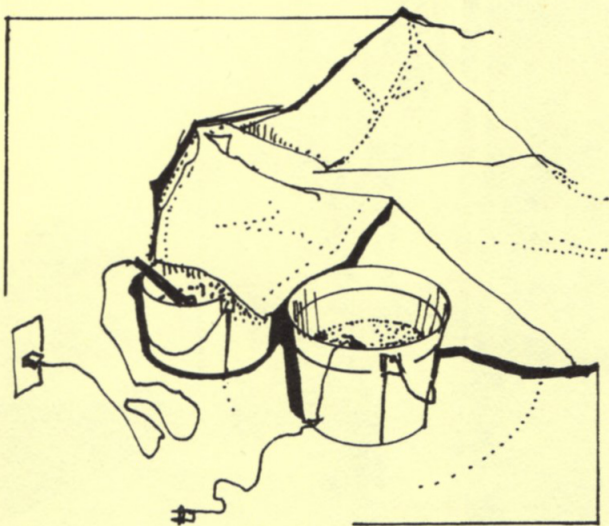
## How much should sails cost?



**FIGURE 5: MAIN COST FORMULA AND ASPECT RATIO**  
(CLOTH FACTOR IS NOT USED HERE)



FIGURE 6: SAFE HOTKNIFE HOLDER



John Hughes, who supervises the use of one of our Sailwright Sailmaker machines at the Tabor Academy in Marion, Massachusetts, passes along a tip on cutting circles:

An awl is used to pin the center of the fabric blank to the work surface. A hotknife is held at the radius limit of the desired circle, and the blank is turned while the knife is held in place. The blank can be cut from this initial slit to its edge with a scissors so that the waste cloth can simply be peeled away much like a potato peeling at the hands of an experienced cook. The cloth will rotate, and a perfect circle will be cut with no trouble at all. By the time you are through, the knife will have burned a bit of a hole in the table so use a surface that you don't mind damaging.



## TIPS

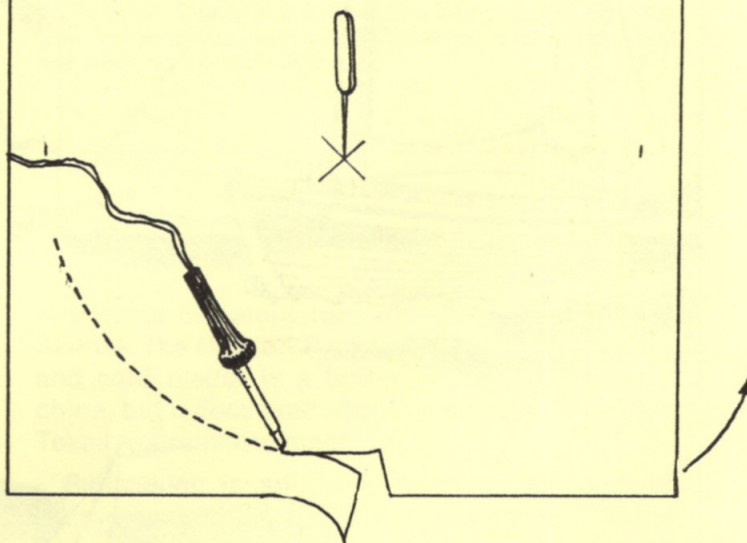
worth passing on...



Dick and Barb Orpin, who contributed an article on their new sailmaking business to the last issue of **Fabric Folds**, make the following suggestion regarding hotknife storage:

Fill a metal paint pot with five or six inches of cement. The hotknife can then be placed point down in this pot for safekeeping. The pot should have a handle so the knife can be easily carried from place to place in the loft. The weight of the pot makes it very unlikely that it will be overturned. And, if cloth accidentally falls onto the pot, it will not make contact with the hot tip of the knife. If you forget to unplug the knife, it will not burn the place down. Dick reports that he committed this sin "just once" and came in the next morning to find the wood floor barely warm under the pot.

FIGURE 7: AWL AND HOTKNIFE USED TO CUT CIRCLE IN FABRIC BLANK



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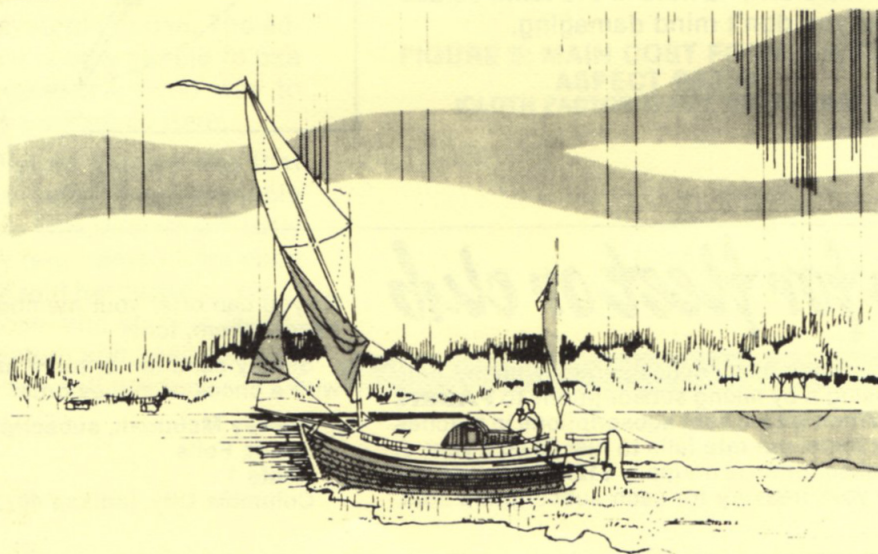
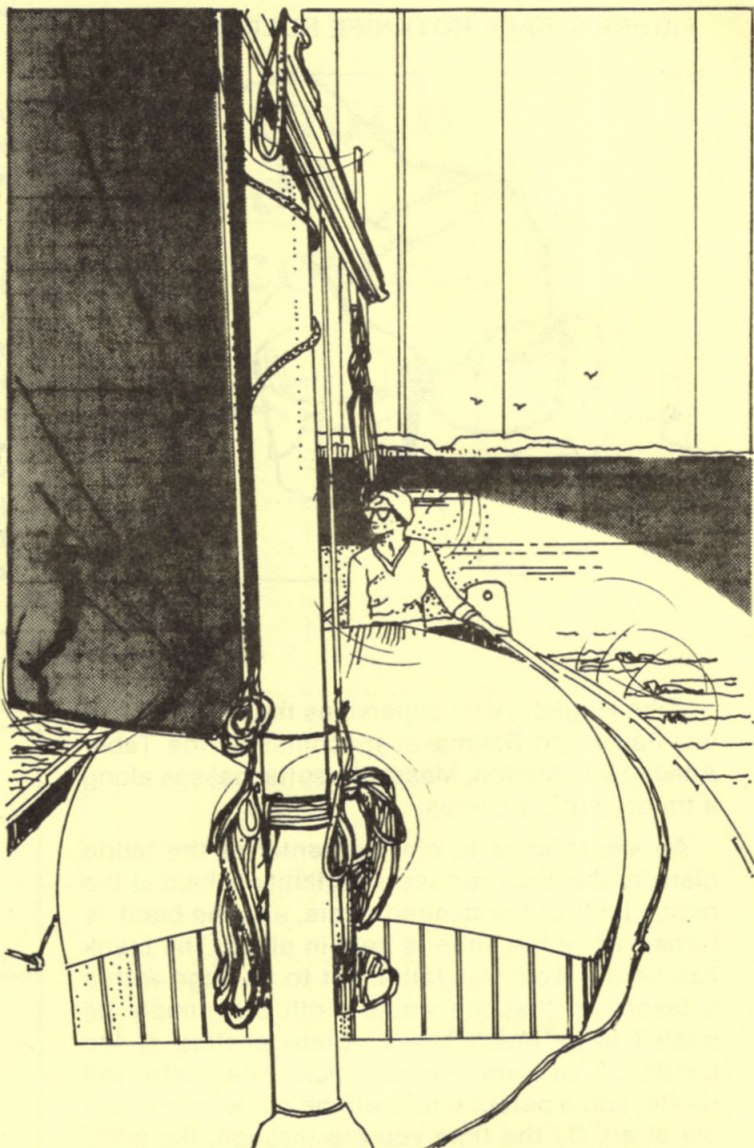
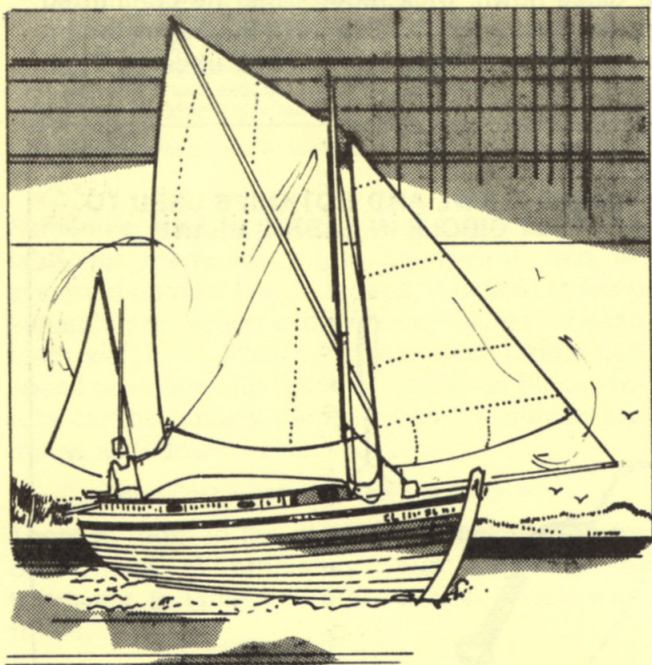
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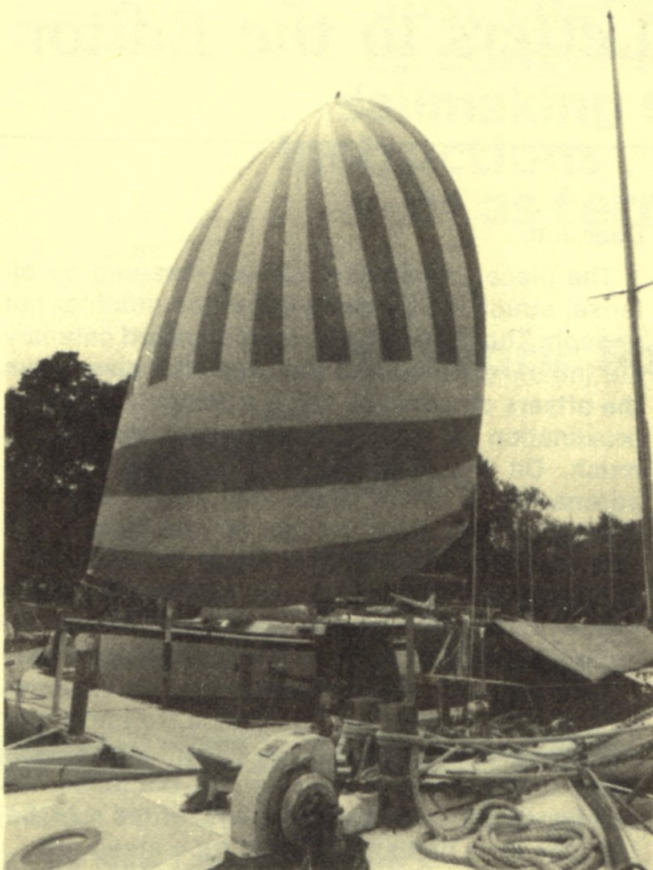
# on-the-waterfront

THIS SECTION OF FABRIC FOILS will be devoted to news from Sailrite students and customers. It is a way for us to pass on all the success stories that are such a satisfying part of our business.

We have sent out quite a number of kits for the "Elvir," designed by Steve Redmond for home construction. Jim Bristol sent us photos of his finished boat and sails. Photos were not good enough to reproduce here, but Allan White was able to get all the detail in the sketches below. Jim has since sold the boat to a naval architect and has begun work on another, larger boat. Once again, he intends to make his own sails!







This beautiful shot of symmetrical R/D/S comes from Ed Luthy, Arlington, Virginia.



Bruce and Carole Bates have begun business as BONNY LEE SAILS in Thornton, Colorado. This photo was taken at a local boat show. Business is reported to be quite brisk. Carole and Bruce have been awarded the Apprentice and Journeyman Sailmaking certificates and are working on their M.S.A.'s.

## Computer-Aided Sail Design

Continued from page 6

making the assimilation of new machines with more power and better software more painless — but I have serious doubts about even this. I look upon my own investment as the IOR speedster that I should have purchased. Were it not for the fact that I really enjoyed all the frustrating hours spent in front of my CRT's, I would have to mark the purchase of my system up as a business mistake.

What **do** I recommend? We have found that pricing and radial clew spinnaker calculations are the two best current applications for computers on the loft floor. Fortunately, these tasks can easily be performed by inexpensive and easy-to-use programmable calculators. Microcomputers can certainly perform the tasks, but they are not so handy to use and easy to learn., We use two Texas In-

struments 59 calculators with PC 100 printers at Sailrite. The Hewlett Packard 41CV with its printer and card reader is a better, more powerful machine, but it does cost about twice as much as the Texas Instruments machine.

Sailmaking is still very much an art, and all claims concerning the use of computer science must be taken with a grain of salt. To this point, at least, there is little evidence that computer-designed sails are faster either in construction or in use than those built in the time-honored fashion. Even if some construction time can be saved, it will be done only at significant and perhaps unjustifiable cost. This does not mean that you should ignore computers, but don't expect too much of them either. ■



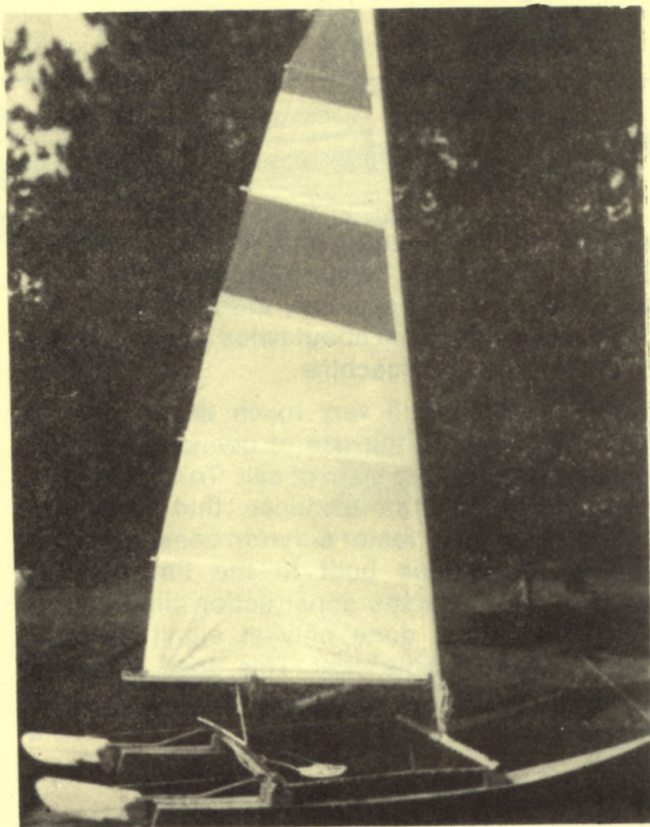
Thanks  
for a  
great  
project!

The following letter with the accompanying photo came to us from Dr. Malcolm Hawley of Winter Park, Florida:

"I am very pleased with my first effort on both home made sailboat and the sail. The only difference is: I would **never** build another boat even tho it performs well, etc. — But, I would build another sail without hesitation.

"Under sail with light to moderate air all the wrinkles smooth out of the tack area and most of the clew. Shape is good!

"If I were to make another sail for this boat I might make the roach a little fuller on the upper four panels with a smoother curve. I kept a time log — from moving the furniture and laying out the pattern to finishing details (end pocket protectors, etc.) took 28 hrs. I think I could make the next one in  $\frac{1}{2}$  to  $\frac{2}{3}$  that time easily. Thanks for a great project! You will be hearing from me again."



## Letters to the Editor

Dear Jim:

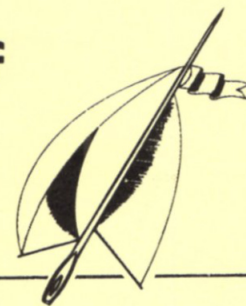
The piece on catenary curves, meaning no offense, struck me as being either too much or not enough. The offsets given for a standard catenary are indistinguishable at the precision given from the offsets obtained by using a parabola as an approximation so all the mathematics seems too much. On the other hand, if you get to deep catenaries I think that the form changes somewhat with depth so that no one table of offsets will do. I tried to go through the math from scratch to see how you got your formula and came to the conclusion that you are making a simplifying approximation somewhere, though I confess I haven't nailed it down completely. The sketches with the text seem, at first glance, to imply that the allowance for catenary is, for an awning, the same as the depth of the catenary, but in fact the allowance depends on the "pitch" of the roof, being less for a flattish roof than for a steep one.

Enjoy **Fabric Foils** very much,  
John H. Hughes  
Marion, Massachusetts

The mathematics are defensible, John, but note that we did not catch a typesetting error — the  $\text{CosH} = [\text{Exp}(x) + \text{Exp}(-x)]/2$ . Even so, you have some right to question their necessity. I doubt that very many sailmakers have ever contemplated the mathematics behind catenary curves. The fact is that a parabola approximation or even a seat-of-the-pants guess at a proper curve will generally do quite nicely when working with a stretchy material that is suspended in a rather haphazard fashion. But I still feel a little effort to understand the mathematics of the shapes with which we work is justified. It may be worthwhile to attempt to introduce a factor for roof pitch in awning structures as you suggest. Your point there is quite valid. ■



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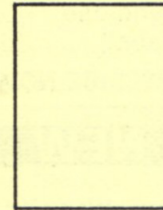
Indicate clearly your name, address, and all necessary information concerning the order. Check and money orders can be enclosed without fear. If a charge card is used, enter card information as request. Then fold the form and seal as directed.

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**FROM**

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City \_\_\_\_\_  
State \_\_\_\_\_ Zip \_\_\_\_\_

TAPE THIS EDGE DOWN



## Leech-cut Genoas

Judging from the two-page spread by North Sails in the February 1983 issue of **Sail**, "LeechCut" (a North trademark) genoas are the most recent breakthrough in sail design. The advantages for the cut are listed as follows:

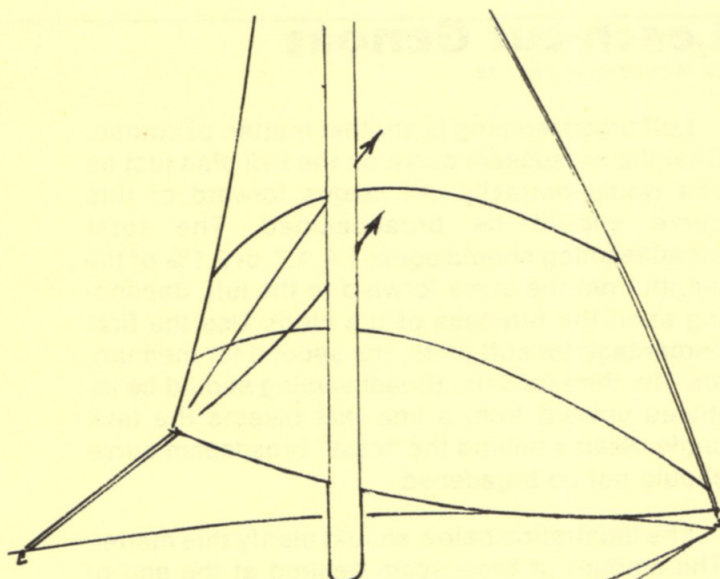
1. Fuller light air shape that does not distort as the wind increases.
2. No more hook in the leech to backwind the main.
3. Higher pointing and faster footing.

These claims should not be taken lightly. Is there a breakthrough here? And, if so, how can the rest of us take advantage of it?

This ad is particularly interesting since it claims to "prove [that] LeechCut #1 genoas are faster." This proof turns on the fact that the cut is utilized with a special "NorLam" (also a North trademark) cloth that is very strongly warp oriented. Indeed, it is claimed that the warp yarns are "crimpless." A Mylar laminate is added to control bias stretch.

It must be admitted that a strong warp oriented fabric placed along the leech of a genoa will cut leech stretch. But will this achieve the advantages claimed for the cut? One can be permitted some doubt. In the first place, leech stretch is not a serious problem in #1 genoas. By far the most serious stress and most harmful stretch will radiate out from the clew. Only a small portion of this stress and stretch will be controlled by the leech oriented cloth. Indeed, it is the bias stretch that will make a full sail grow fuller as the wind increases. And it is the same bias stretch that will cause the hooked leech that the LeechCut is said to eliminate. Indeed, a little stretch in the leech will actually help overcome some of the harmful effect of bias stretch — the leech panel orientation, if it does reduce stretch along that edge, should actually increase the tendency toward a hooked leech. And there is no evidence at all offered for the claim that higher pointing or faster footing will be possible. That claim appears to be thrown in just for good measure.

Now perhaps NorLam cloth is also a highly stable cloth on the bias. But no evidence to that effect is offered. The ad suggests that for smaller genoas which should be "stronger in the cross-panel direction" a regular Dacron fabric should be used. I see no reason why strength in this direction should be a characteristic of smaller genoas and not #1 sails. Be that as it may, however, this is an admission that NorLam is not so stable on the bias as regular Dacron — at least in cloth weights



**FIGURE 8: STRETCH RADIATING FROM CLEW IN LEECH-ORIENTED CLOTH**

that would be appropriate for moderate to heavy winds.

I don't for a moment want to suggest that the North LeechCut is completely unjustified. The cut is probably useful for very large, high aspect ratio boats in sails made of super-lightweight material. These materials tend to be very weak at their seams — stitching tears out with alarming frequency. And stress in the leech is greater than that along the foot, if only because the former edge is longer than the latter. Only the most dedicated racer, however, would be inclined to consider the minor gain in cloth weight savings made possible by this technique appealing. An ad setting forth this advantage would sell very few sails.

Even so, you may conclude that the LeechCut is best for your particular needs. If so, how do you allow for proper broadseaming? The ad declares that "North's computer couldn't care less whether it creates the panels offsets for a crosscut #3 or a LeechCut #1. Our 'Tin Sail' program," it continues, "electronically 'drapes' the cloth over the designer's shape in either direction." I have yet to see such a sophisticated program in use by any sailmaker, but it is certainly theoretically possible. The question is, can we duplicate the work performed in the North loft?

Yes, with surprising ease. Foot broadseaming can be carried out in the normal fashion at two or more natural seams intersecting the foot edge of the sail.



# Leech-cut Genoas

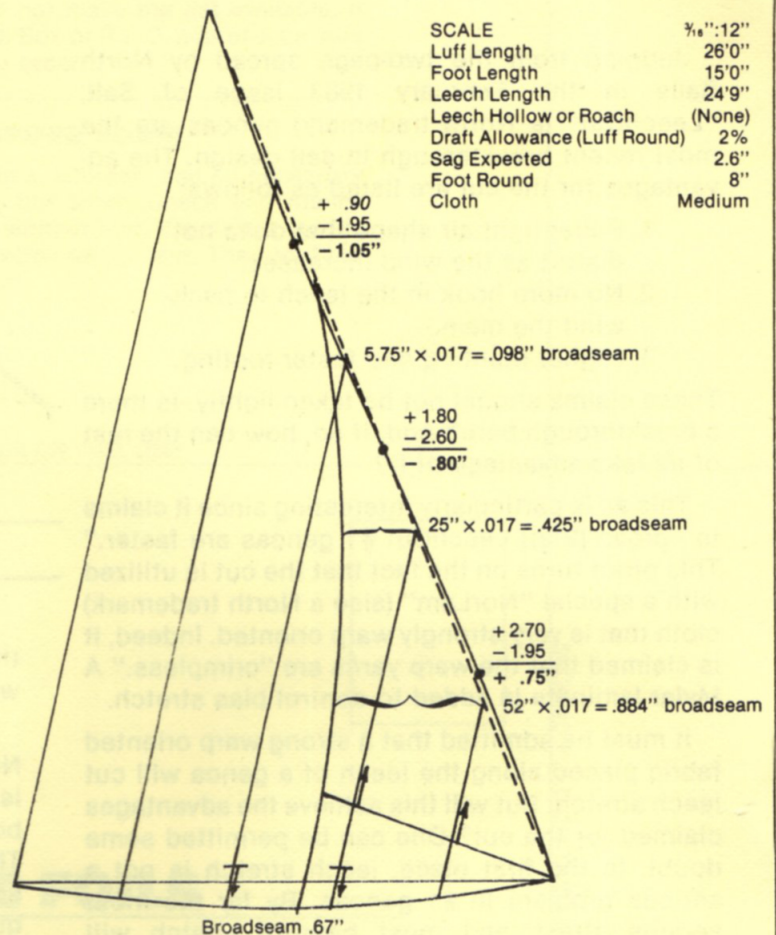
Continued from page 19

Luff broadseaming is another matter, of course. Cast the broadseam curve on the sail plan just as you would normally. All seams forward of this curve should be broadseamed. The total broadseaming should equal 1.4, 1.7, or 2.1% of the length from the curve forward to the luff, depending upon the firmness of the cloth. Use the first percentage for soft cloth, the second for medium, and the third for firm. Broadseaming should be initiated upward from a line that bisects the tack angle. Seams behind the "cast" broadseam curve should not be broadened.

The illustration below should clarify this matter. The amount of broadseam desired at the end of each seam intersecting the luff below the broadseam curve is then calculated by multiplying the chord at that station by a percentage figure in the range given above. This is the total amount of extra width that should exist in seam at that station in the sail. Keep in mind that the broadseaming should constantly increase as the luff is neared.

This technique leaves very much to a "seat-of-the-pants" feel for the shape that broadseaming will impart to the sail. But it does provide a touchstone or a beginning point for your work. Sailrite does not intend to develop any more complete guide for leech cut sails since we do not consider them a legitimate advance in sail design.

FIGURE 9: A LEECHCUT GENOA



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