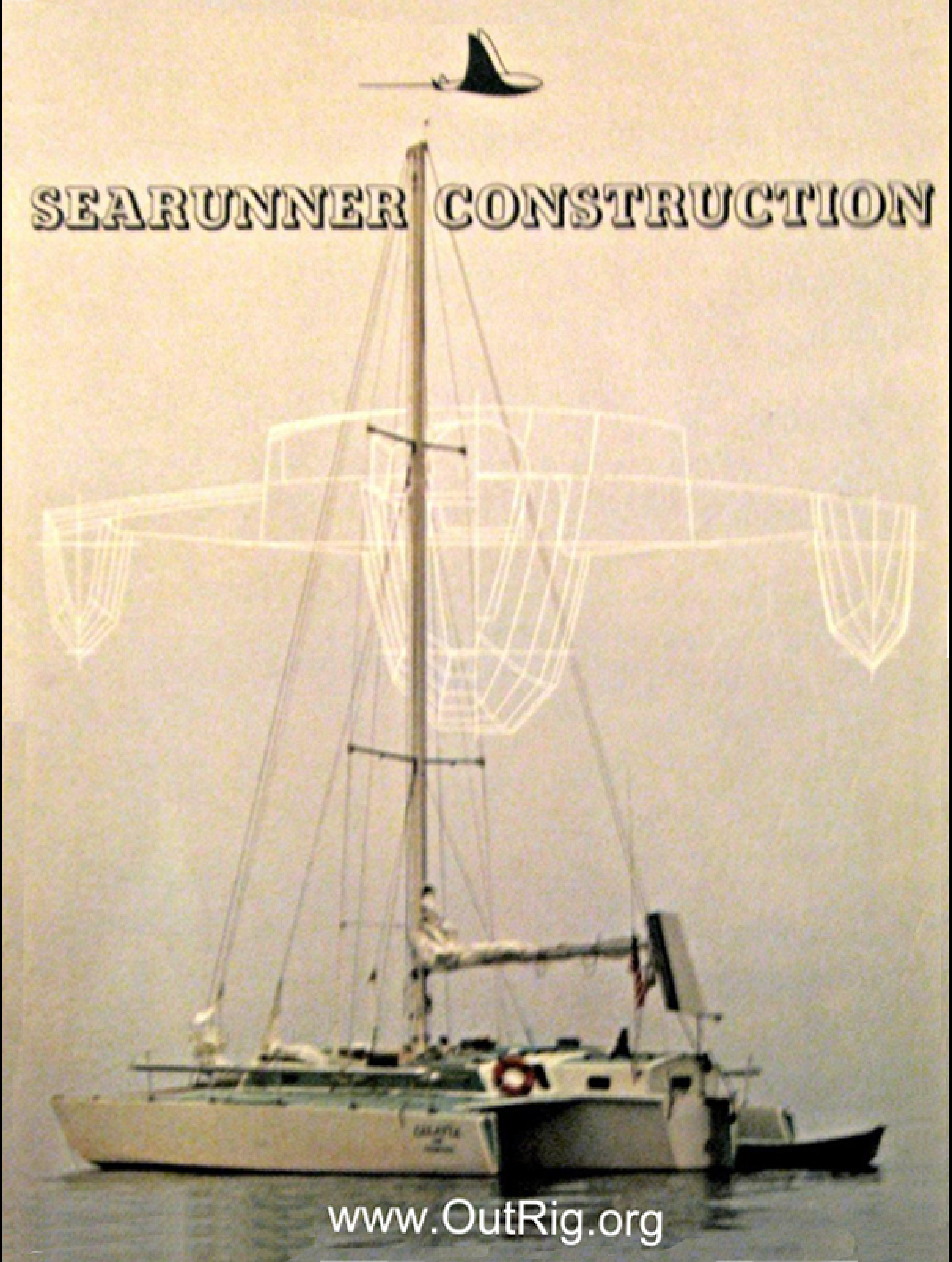
SEARUNNER CONSTRUCTION



www.OutRig.org

SEARUNNER CONSTRUCTION

FOREWORD

To the Digital Edition

This edition of **Searunner Construction** is published digitally as a feature of the ***OutRig! Project***, which collects, preserves and disseminates the history and lore of modern multihulls. We think this book contains a fair bit of that history, and a full share of the lore.

Originally published in print in 1971, this boatbuilder's companion was written to "answer all the questions" being asked the designer by the many builders of Searunner trimarans. However, the ulterior motive for writing it was to permit me and my family to take off on our long-planned cruise in our own Searunner, SCRIMSHAW.

The story of that cruise is told in my 2011 memoir "Among the Multihulls," where the primary challenge in extended cruising is revealed as just getting away. One of the many shoreside affairs from which we had to extricate ourselves was an obligation to hundreds of loyal clients who had bought our plans for constructing their own escape vehicles. We learned the hard way that the real cost of providing boat plans to such a clientele is in aftermarket consulting for the builders. Design drawings alone, no matter how expressive and comprehensive, are not enough for many amateur boat builders; they need some kind of access to the horse's mouth. Just because we had somehow managed to finish our own boat, had done some seafaring before, had saved up a cruising fund, and had no plans to return to California, did not, I believed, entitle us to abandon our Searunner patrons. So, before setting sail we arranged for friends Tom Freeman and John Marples to administer our business and share the earnings with us, but we knew that, before we could embark, somehow most of the builder's questions must be answered in advance. Investing most of our precious cruising fund in printing costs, we produced this book to that end, and in the summer of 1972, we sailed away.

It worked. Prospective plans buyers often acquired this book first, and were convinced by it that they could execute such a giant project as building a seagoing sailboat – so the book drove plans sales. There were a number of other successful multihull designers offering plans at the time, and some of their clients, too, were encouraged by this volume. Moreover, we learned that there were builders building our Searunners WHO DIDN'T REALLY WANT Searunners, instead preferring some other design, but they bought our plans because, with this book, they figured they could actually finish their projects. There has been a steady demand for used copies of the book (some selling for as much as $50), and perhaps because of all its classic Jo Hudson cartoons, the old manual has disappeared from many libraries. Hudson and I really shouldn't find this quite as flattering as we do, but with today's availability of digital distribution, re-publication as a download becomes feasible… Feasible, that is, if there is a kind man like Alex Rook willing to perform all the scanning and correcting at no charge! Optical Character Recognition is far from perfect, but this Manual is a faithful reproduction of the original. For that we all owe Alex a hearty "Hail!" of gratitude: alex.rook @ gmail.com

Nowadays, the frenzy in owner-built multihulls has subsided, and Searunner Trimarans, while still respected by multihull devotees, have been largely replaced by more contemporary designs built in factories. Forty years of accumulated know-how and the advent of new methods and materials have elevated multihull production into the realm of aero-space. This technology is often applied to very streamlined racers, or to opulent, floating domiciles, or to vessels trying to be both. Composed almost entirely of petro-based materials, the cost of such composites alone, for these manufactured multihulls, continues to escalate steeply. (In contrast, the relative cost of forest products is stable or decreasing.) Multihull manufacturing requires large tooling investments, and the modern cost of creating even one work place for a hired boatbuilder, plus the margins paid for distribution through dealerships… These and other factors now all combine to make the retail price of production multihulls astronomical.

Which is a great shame! A prime influence on the early advent of modern multihulls was their economy. Lightweight construction in wood by owner-builders made these upstart vessels truly accessible to the common man, and much of the design development was performed by individuals working alone, without regulation and with great freedom of expression. Of course, not everyone has the time or inclination to build their own boat, but for those who do, it can be very fulfilling.

What does all of that have to do with this book? Well, a primary reason that the Build-It Yourself phenomenon has declined in recent years is because wooden boats are classically perceived as being biodegradable. True enough, a particular fault in this original text is its lack of sufficient information on how to build for longevity. SCRIMSHAW, always well ventilated and kept bone dry inside, is now 40 years young and going strong, but many of the early home-built multihulls have long since turned to oatmeal. This, too, pleads for an updated edition. Such an update could reveal just how far the craft and science of low cost, light weight owner-building has advanced in forty years.

But has it really advanced that far? The question "Which Boat For Me, and in which material?" has many answers, but if low cost is a primary consideration, then the basic material in the most economically efficient multihulls – then and now – is still ***laminated wood**.* How come? Because the major difference in wooden boatbuilding today is that we have epoxy with which to do the laminating, the bonding, the coating, the sheathing, and the sculpting (this was not true when the Manual was written). And if this composite of plywood, lumber and epoxy is *done right* then the potential for a modern wooden boat to last for generations is now at least as great as with any other material, and at a fraction of the cost! Furthermore, when the engineering properties of wood are correctly employed, modern wooden structures can exhibit strength and lightness roughly equal to – or in some cases exceeding, those built with the synthetic composites. The operative words here are "*done right*" – which applies to any boatbuilding system – and this book, together with its updated appendix, is intended to help the amateur owner-builder achieve that operative.

To permit drawing valuable comparisons between the old methods and the new, the book's original text and graphics are preserved herein as a base line artifact, and all updates are presented in an extensive new Appendix to the book. Yes, the original manual is preserved intact. Added is Appendix IV, which is devoted to updating each of the four Phases of construction as arranged in the original text. Included are case-by-case updates of the many statements in the original which either are in error today or which no longer apply. In particular, there are several techniques in materials handling commonly used in the 60s through 80s which have since been deemed dangerous or unsafe. For example, the uses of certain wood preservatives, and using acetone for cleanup, are now strongly discouraged. Much new material is added to each Phase such that the Appendix can stand alone without the reader referring constantly back to the original. Furthermore, by adding the updates as stand-alone essays, the book – and especially the Appendix – can be made to apply to modern wooden vessels of any design.

This combination of old with new makes the book particularly applicable to the new series of trimaran designs called SEACLIPPERS, as designed by John Marples (viewable at www.searunner.com). Ranging from ten to over forty feet long in eight sizes, the Seaclippers are created to vastly simplify and reduce the costs of owner-building modern multihulls. When comparing Searunners with Seaclippers, and also comparing the old, pre-epoxy building method with the new, a huge, long-term, trial-and-error advancement is revealed.

It is this comparison that we hope will bring confidence to those builders and sailors who choose the sight, sound, touch and cost of wooden boats, and thereby make this old book valuable anew.

Jim Brown

Please note:

At this writing, Appendix IV is being released in increments as they are produced. Each installment is posted for free downloading at www.outrigmedia.com.

STRUCTURE OF CONTENTS

For The
SEARUNNER CONSTRUCTION Manual

PHASES HAVE ROMAN NUMERALS: “I” THROUGH “V”
APPENDICES HAVE REGULAR NUMBERS: “1” THROUGH “4”
APPENDIX 4 IS UPDATES

Updates are designated by the Phase Numeral to which they apply plus the suffix “UP” such as :“PHASE III-UP.”

Updates are produced in INSTALLMENTS, so are fully designated like, for example:
PHASE III-UP
INSTALLMENT 6

CONTENTS

PHASES

APPENDICES

UPDATES

CONTENTS

PHASE I

TO BUILD THE HULLS

DESIGN

Based on ten years of trimaran experience, the Searunner series of designs includes all of the features which the designer believes contemporary cruising trimarans should have. The series includes sizes in overall lengths of 25, 31, 37 and 40 feet. A complete discussion of Searunner design concepts and design philosophy is presented in our $4 catalog “Searunner Trimarans”
But briefly, here are the features you will be building:

Central Cockpit for maximum protection, central loading, and ease of handling; improved fore’n’aft motion.

Cutter Rig for best combination of performance and ease of handling. With the mast stepped in the cockpit, many sail handling operations can be performed from within the cockpit.

Self Steering by wind-actuated vane for reducing the fatigue of steering on passages.

Inboard Engines (in all but the 25'er) for maximum dependability, economy, and maneuverability under power.

Asymmetric Floats for improved windward performance in heavy conditions.

Wide Hull Spacing to minimize interplay wave system generated between hulls, and reduce pounding on the under-wing.

Increased Displacement gives greater load-carrying capacity with attendant safety.

Increased Sail Area to yield good performance crucial to cruising boats with cruising loads.

Molded Chine Construction. Easiest construction method for hulls with reduced wetted area and increased displacement at low cost and fine appearance.

Main Strength Bulkheads instead of cross-arms for great inherent platform strength, light weight, walk-through pass ways, and ease of construction.

Divided Cabin Layout for privacy and comfort in the accommodation. More features that are more usable, and seamanlike. A series of separate-use spaces with a “place for everything” instead of “everything in one place”, as with conventional layouts.

The conformation of these Searunner designs is based on experience gained in the 26' Caravel experimental trimaran, and the Brown 41' central cockpit trimaran and several earlier designs.

Note that the outriggers have very long bows with deep forefoot for maximum buoyancy to prevent diving, and that the main hull stern is very shallow, but wide, to resist being depressed and thereby dampen pitching motion. The bows have a rather high freeboard, and the deck has lateral camber, and reverse sheer. That is, it slopes down as it runs aft. The under-wing panels sweep up as they run outboard, but have a constant height, fore'n'aft, above the water, until they curve upwards at their ends to meet the edges of the wing-decks. Stems have a slight clipper curve near the prow, with limited flare, and are sharp near the cutwater.

The arrangement of the main hull chines gives a small "flat" in the bottom, with bottom-side panels, and topside panels. This configuration, when combined with "molded chine" construction is to yield the most nearly molded hull form possible using sheet plywood construction and still be consistent with easy fabrication. The molded chine bottom has a fine, deep entry to reduce pounding, and with a very small attack-angle in the forebody. The exit is very wide with a rather flat "outrun". The midsection is as nearly semi-circular as is possible with this construction. Topsides panels of the main hull and floats include a slight, but noticeable compound shape (as much as is easily bent into sheet plywood planking) to enhance the strength and beauty of the hulls.

The above description fits a very efficient, aesthetically pleasing, but easy to build multihull.

But the geometry of these trimarans, considering the three hulls, the wings, and the superstructure, is actually quite complicated. To insure correct execution of the plans, full-size patterns are provided; not just hull patterns, but patterns for all transverse parts including wing framing and superstructure. Many metal parts and other important pieces such as stems are given full size!

Patterns show center-lines, and a reference line to allow the builder to orient the parts in the boat.

This system greatly differs from the usual method of establishing the shape of parts using tabulated offset measurements. It allows <u>any</u> builder to produce hulls and platform in perfect shape and alignment. It also allows the designer to employ a rather sophisticated configuration for efficiency and beauty, with the assurance that the builder cannot go astray.

CONSTRUCTION

The construction of a Searunner trimaran differs from other trimarans in the following respects:

1) Full panel frames, wherein an entire float or main hull frame is made from a full panel of plywood, are used wherever possible. This differs from the usual method where the frame is built-up from lumber, with plywood gussets at the juncture of lumber components. The full panel frame's shape is drawn right on the plywood and cut out. More plywood is used, but less lumber and less labor, and less weight results, with greater strength. Wherever sound engineering allows, the sawn plywood frames are not doubled-up with lumber perimeters. But the connective bulkheads and other key framing is faced with lumber to provide an absolute bond of framing to planking. The major features of the boat's interior accommodation, as well as its exterior shape, are established by these full-panel, combination frames. After the hulls are built, the interiors are already established by the frames, which saves a lot of work, and weight.

2) A rather large framing interval is used. The distance between frames is typically 40", and

is constant, wherever possible, between main hull and floats so that wing framing can mate with hull framing in all hulls. Fewer frames are required, with cost, weight and work savings.

3) Longitudinal stringers are, wherever possible, placed “on edge” with the width dimension of the stringer perpendicular to the planking, for greater planking stiffness This makes the 40" module possible, and facilitates cutting notches to let-in the stringers.

4) “Chine logs”, the heavy stringers at the chines, are eliminated. Instead, “intermediate stringers” are placed close to each side of the chine. Planking is fastened to these, and then the open seam in the planking at the chine is taped inside and out with thick fiberglass, yielding “taped seam construction”.

5) Because there are no chine logs, and the lumber-faced frames are reduced to a minimum, fairing up is practically eliminated. The skills formerly required to shape the chine logs, with their compound, progressive bevels, are bypassed. This is a substantial saving in time and effort to the neophyte builder, or to the shipwright.

6) Chine seams are taped on the inside with fiberglass and then the chine is given a generous radius on the outside. The radius can be generous because there are no fasteners going through the planks into the chine logs. A lot of the planking material at the seam can be removed without cutting into fasteners. As the hull is fiberglassed outside, the seams are taped again, with multiple overlaps of the fiberglass, yielding the molded chine. This procedure has great inherent strength, dimensional stability, and longevity compared to the old method using chine logs. The fiberglass and plywood forms a more compatible composite at the chines than the fiberglass and lumber composite. The system is relatively easy, lighter in weight, and better looking. The resulting hull has a wetted surface area within 10% of a fully molded, equivalent hull, and is substantially less expensive and easier to build than a fully molded hull.

7) Main-strength bulkheads replace the earlier cross-arms. These full-width, full-height bulkheads are of sandwich construction. Plywood is cut to shape from full-size patterns describing the main hull section and superstructure, with “arms” extending outboard to form the wings and receive the floats. A lumber truss is then fastened to this plywood, and then the whole is covered again with another layer of plywood, forming the sandwich which has great inherent strength. Large cutouts are made to form passage-ways through the main hull without “ducking under” as in the earlier cross-arms. All mating surfaces of plywood to lumber are made with glue and frequent fasteners.

8) The 25' and 31' sizes have optional A-frame outrigger beams which allow the craft to be folded or disassembled for transport at 8' highway width. This allows the 25'er and 31'er to be built at an inland site, or in small backyards where the builder may take advantage of having the project close at hand.

9) Hulls are built one-at-a-time, each in turn on the same simple strongback jig. When all three are ready, the main-strength bulkheads are dropped in to the main hull and mated to waiting connective bulkheads. Then the floats are mounted on the ends of the main-strength bulkheads, and the multihull is now a unit. This approach is much simpler than the monolithic construction used in earlier Brown designs, which required that all three hulls be built at once with the cross arms installed for proper alignment A-Frame version boats can be built completely, with decks and cabin, before mounting the outriggers.

10) Wing bulkheads, sawn from plywood as shown in the patterns, are mated to hull and float framing. Because of the central cockpit layout, some of these wing bulkheads can span the hulls amidships in the cockpit area and add appreciably to the platform's integrity - formerly not possible with the central cabin layout.

11) Cabin side panels are important structural members. The cabin is not stuck on to the deck as in many trimarans. Cabin sides go through the deck to meet with the under-wing panels and thus add great support to these.

The cabin sides combine with the midships wing bulkheads and the main-strength bulkheads to accept the chainplates and rigging which supports the mast. With the cutter rig, central cockpit combination, the mast is stepped on the center board trunk. The trunk is securely fastened to hull frames which accept the wing bulkheads, and to the hull which accepts the main-strength bulkheads. Thus the platform is designed to accommodate the columnar load of the mast, and the rigging strains at the chainplates, in such a way that these opposing forces are evenly distributed throughout this extremely rugged labyrinth. Suitable chainplate locations are a big problem in many other trimaran rigs and structures.

This system provides for relatively simple installation of decks, cabins, and under-wings so that the whole vessel has a solid, unified construction.

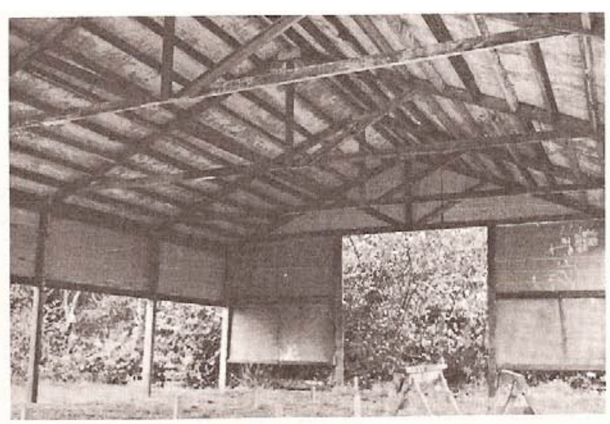
Searunner interiors and the cutter rig deck hardware layout are distinctly different than what is found in "normal" trimarans.

Except for the above differences, Searunner trimarans are structurally akin to other sheet plywood trimarans. They rely on the great diagonal integrity of the plywood panel for their strength, gaining most of this from the planking itself. Plywood is stronger, for its weight, than fiberglass, and stronger-lighter than many of the recent exotic materials for its cost. Technically and practically, it is the ideal material for owner-built trimarans, if properly considered in the design.

All joints are glue-fastened, using nails, staples, or screws primarily as a clamp for the glue joint. Workmanship can have an effect on structural strength, and of course, on appearance. But basically, the trimaran configuration is inherently right in both structure and dynamics. Searunner trimarans are offered as well developed examples of the type.

WORKSITE

No single aspect of the construction can have a greater effect on your project than the worksite. If you run a clean operation with good facilities, you'll build a good boat and be a good sailor. If you find yourself working in a big mess with poor light and no workbench, or if your only extension cord has the kind of plug that's always pulling out, you should examine again your interest in ocean sailing, for a messy boat is dangerous.



A shed of this construction, anchored to concrete piers, can often be legally built to neighborhood ordinances covering a "temporary structure". Time limit is one year, but if you don't annoy your neighbors they probably won't complain. Try to interest the local powers in your project.

Unless you can work many hours per week, it is expensive to rent space in a legitimate workshop. For the weekend builder, the best place to work is at home, in the backyard. And if you live in the temperate zone, you should have a good overhead shelter.

Transport to the launch site can virtually always be solved if you can get the boat built. And you'll get it built better and faster if you have a good place to work. For the larger boats, some builders find that it pays to move their residence to a place which satisfies their worksite requirements.

MATERIALS

PLYWOOD

Exterior Douglas fir plywood, grade A-B, may be used except where noted. Marine plywood is specified for some applications, and is desirable throughout, though it costs about twice as much as exterior Products of the United States Plywood Corp. are recommended, as they are consistently good.

The difference between exterior and marine grade is not in the glue, but in the quality of wood used in the laminates. Some voids are found in the inner plies of exterior material, and generally, more care is taken in the making of marine panels. These differences are considered in the design of the boat. Rest assured that exterior grade panels may be used safely, except where marine is specified. Three-eighths inch thick plywood is widely used in the Searunner Series. Exterior grade 3/8" panels usually have three plies, whereas marine has five. In some localities, "5-ply exterior" is available in this thickness, and is suggested as a good compromise in the larger boats.

The boats are designed for standard 4' x 8' plywood panels, with special wider or longer panels sometimes desired, as described in each design.

FRAMING LUMBER

Depending on locality, choose any lightweight boatbuilding wood such as Douglas fir, spruce or cedar. Select premium quality material, absolutely clear and straight. Kiln-dried, vertical grain fir is usually found to be the most realistic wood for trimarans with regard to cost and service rendered. All dimensions shown in the plans are NET except those in quotation marks, such as "2 x 4" and "5/4". This "five-quarter" stock is usually available in "blanks", surfaced two sides to about 1-5/32" thickness. If it is not locally available, have "2 by" material surfaced down. Some 1" net material is called for, which may be taken-down from "5/4" stock, but most of the framing lumber is standard "one-by", ¾" thick.

Exotic woods such as Philippine mahogany or teak are specified for some items. Other wood may be substituted for these in "economy" boats, though service rendered should be considered. For all unfiberglassed woodwork outside the cockpit (exposed to weathering) teak is best. An occasional light application of linseed oil will keep this material looking "bright", and minimize maintenance. Mahogany will serve the same purpose, though not as well, but is a good compromise. Above all, don't varnish anything that sees direct sunlight. Varnish is a nuisance when exposed to weather, and unless you have a maniacal fetish for maintaining your boat, this old-fashioned stuff will make your boat look "doggy" in about 3 months exposure. Oil all unglassed outside wood! It's cheaper, saltier, and in the long run, better looking. Choose teak or mahogany as you wish, or fir for economy. In the case of fir, paint well with a light color.

Lumber quantities and sizes are contained in the appendix for your design.

GLUE

Use all Weldwood "plastic resin" glue, or equivalent, the water-mix variety. Avoid use of expensive epoxy glues as they are unnecessary in these boats, and require carefully controlled working conditions. Be assured that your basic glue may be of the UREA type, which has been seen to render good service in trimaran construction.

NAILS

Hot-dipped galvanized nails will serve for all of your fasteners where they will be glass covered or used in the interior. Bronze fasteners are unnecessary in these applications, but the election of these is left to the builder. Galvanized staples are used in the larger boats. See the power tool section for staple gun information.

FASTENERS

Brass screws may be purchased in several sizes for miscellaneous fastening.

Considerable latitude is open to the builder in selecting fasteners for the metal parts. Stainless steel is recommended for most applications, with bronze and galvanized fasteners used at builder's election. Be sure that galvanized parts are not combined in direct contact with brass or bronze parts, and that none of these touches aluminum. Stainless steel is the only fastener which can be used in conjunction with aluminum, particularly in the presence of sea water. Make your own count for major fasteners, depending on the materials involved.

WOOD PRESERVATIVE

All inside surfaces are to be liberally coated with a clear sealer-preservative, with several coats going in the bilges and hard-to-ventilate areas. Weldwood "Woodlife", Zehrung's "Pentaseal" and "Cuprinol" are examples.

FIBERGLASSING MATERIALS

Two types of polyester resin (finish and bonding) are required. Avoid the all-purpose type. Resins with isophthalic acid added are suggested, and the finish resin should be selected for its sanding qualities. Some formulations are better than others. Avoid the procedure of adding your own wax to make finish resin out of bonding resin, unless you are thoroughly experienced.

Fiberglas cloth, usually the 4-oz. weight, 50" width, with volan finish, is specified. Some fiberglas matt is used, and some builders can obtain "Fab-Mat" for taping the chines. Accessories and a list of basic materials is in the appendix.

Detailed fiberglassing instructions appear later in this manual, with careful coverage given to the technique used in molded chine construction.

PURCHASING

Builders usually find that ordering materials from various sources yields various results, and prices. Perhaps the best policy is to select a good local source, approach the seller with a description of your needs, and indicate that, if the price is right, you will buy all of your material from him. This assures the seller of a captive customer, and the buyer of a quantity price. In the case of bulk materials such as lumber and plywood, the seller will usually store the material, and deliver to the buyer as needed.

Lumber is usually purchased in boards of the specified thicknesses, and ripped-down by the builder to the desired widths. Order in standard sizes to suit your supplier. Inquire if there is a width or length premium on certain sizes, and avoid these.

Ripping down requires a table-saw (see power tool section herein) and sometimes in the smaller boats, the exact sizes needed can be ordered, milled by the seller, to avoid most of the ripping. Still, it is a great convenience to have the table saw.

Glue, nails, fasteners, preservative, and a post of boatbuilding items are generally purchased from a marine supply store. Good relations with your local source should be maintained from the start. This will be to your advantage in the outfitting stages at the end of your project.

BULK METALS

All the boats have certain metal parts in the rigging, steering, etc., which cannot be store bought, and so must be fabricated. Owner-builders usually shy away from metal work, but the design of the parts is made as simple and direct as possible. Any fair sized town has a sheet metal shop or metal fabricator qualified to do this type of work. Shop time is expensive, however. Any sub-fabrication you can do, even the layout of the parts on the material, will save machinist's time, and save you money, probably lots. But first, you have to get the material. To call the nearest metals supply and order chunks of stainless steel or aluminum is also expensive. Some scrounging will save you money, certainly lots. But it takes time. Surplus metal outlets are found in most cities, but the builder should select the correct sizes and the correct alloys from the scrap stocks. The proprietor can help. So can a magnet, a micrometer, and a good book on the subject of sheet gauge sizes and alloys. With the material procured, you can do the layout work from the plans right on the metal. Then the shop can do the rough cutting, shearing, breaking, and welding. You can do the finishing and drilling, but some running back and forth may be necessary.

The smaller designs in the Searunner Series are optionally de-mountable, using metal parts and fasteners to allow disassembling the boat for transport. Full-size patterns for the A-frame metal work are given in the plans, and directions for fabrication and installation are extensively treated in the appendix for those designs and in the section on metal-work. This de-mountable feature is a great advantage for builders who wish to build far from the launch site, or wish to transport their boats to various ports without sailing all the way. Or, for the convenience of storing or maintaining the boat. Do not resist the demountable option simply because of the metalwork - it is a relatively simple portion of the job.

POWER TOOLS

A bewildering selection of power tools is available. Some are designed for production work in industry, others especially for the home craftsman. Many manufacturers make two lines, one for each intended purpose.

For the trimaran owner-builder, it is not necessary to buy all industrial grade tools, though some of the suggestions below are necessarily top quality so you can get the features you need.

The list is intended only as a guide, and does not represent a testimonial for any particular brand or tool. Items which are considered absolutely necessary are marked with an asterisk (*).

* ¼" drill motor (NOT to be used for sanding)

* 6" Electric handsaw

    This is a lightweight, very handy tool, but not capable of continuous ripping. The lighter saws are best for this work.

* Electric handsaw

    This saw, combined with a bench stand, makes a satisfactory table saw for ripping stringers, etc. Not necessary if you have a table saw.

* Table saw — Any 8" saw with adequate power for ripping ¾" fir rapidly.

* Saber saw

* Disc sander, 7", 3500 RPM

A light, very handy tool used for general sanding and with the foam pad for glass.

Disc sander, 8"

A medium-speed heavy duty sander for sanding fiberglas with the 8" foam pad. Advisable to rent equivalent when fiberglas sing smaller boats, and purchase for large boats. A 7" sander rated at 7 amps. will suffice for using the 8" foam pad on the 25'er. For the larger boats, select 8-amp. minimum.

* Foam pad, 8"

Sanders should have the standard ⅝" arbor to receive a variety of disc-back pads. A very stiff back pad is used for rapid shaping of wood. Also, a variety of abrasive wheels (designed for grinding-off welds) can be used in the metal-work stages of trimaran building. A belt sander is useful on metal work and finish woodwork, but <u>not</u> for fiberglassing.

Power plane

Very useful, especially in the larger boats. Other, cheaper models available with diminishing results.

Router

Any <u>small</u> router will serve for rounding-off edges of stringers, etc.

Extra plane cutters and 3 sizes of round-over router bitts.

Staple gun

Staples

½" crown, galvanized, 1-¼" length for ⅜" planking; 7/8" length for ¼" planking.

The staple gun, which requires an air compressor to operate, represents a sizable investment, though the tools are sometimes available used from other builders, and can be rented in large cities.

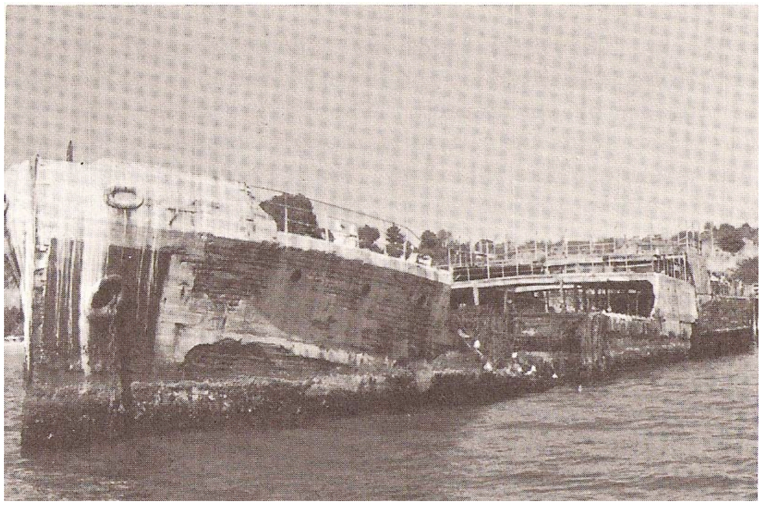
This, together with the power plane and a good shelter for your project can mean the difference between a hassle and a pleasure.

Investing in these tools, and shelter material, adequate light, power, and water on the building site, is the best way to get off to a good start. A big, strong workbench and well-organized tool storage are essential.

A good selection of hand tools is also necessary.

OTHER MATERIALS???

There must be other basic stuff from which to build a trimaran besides plywood and glue and fiberglass. Welded aluminum surely has its place in the future, and in larger sizes. Even welded steel, when the concept grows to commercial proportions. We receive lots of inquiries about other materials and the following is an attempt to answer these before they are asked.



Ferro-cement is enjoying a hot spurt of popularity among backyard builders of monohulls, but no foreseeable developments could make it a suitable material for multihulls. This is because of its inferior weight-to-strength properties in thin shear panels. While it may have strength equal to thick lumber planks (as in traditional plank-boat construction) at about the same weight, if the ferro-cement laminate is reduced in thickness to have similar weight to plywood planking for multihulls, it is paper thin and fragile. In fact, a square foot of ferro-cement of the same weight as a square foot of ⅜" plywood, with similar strength, is as yet unattainable.

Recent information on ferro-cement hulls makes much contemporary amateur construction suspect with regard to longevity and strength. Many intricacies in the handling and curing of the stuff are becoming known, but working with these is a lot to ask of backyard builders. Plywood and fiberglass asks a lot also, but the designers and builders are answering with excellent results. The intricacies of plywood are known quantities, and manuals like this one circumvent many pitfalls still unannounced to the builders of “stone boats”. Backyard experimenters are credited with the advances now evident in multihulls, and inevitably the same growth will come to those who work with masonry.

I see a clear comparison between today's rage in ferro-cement and early trimaran promotions. The one single factor which nearly killed the trimaran movement - low cost claims - is now working to torpedo ferro-cement. Much of the hoop-la over stone boats revolves around easy amateur construction and great cost savings. The construction aspect - for good hulls - is controvertible; and the cost saving on the hull alone is so misguiding that it borders on the unscrupulous. Unsuspecting landsmen are enticed into a cheap seafaring endeavor on the claim that ferro-cement costs half. It is hard for them to understand that the cost of the hull alone, relative to the cost of the entire sea-ready vessel, is so minor that when they're finished they have saved maybe 10%. And saved relative to what? Ten percent saved on a traditional planked boat (by going to concrete) isn't much of a saving if one considers building a similar design in all fiberglass or all plywood or a combination of the two. Ferro-cement boats are not inexpensive. Neither are trimarans.

But they are different. Maybe that's the attraction, perhaps for both types. A spidery outrigger and a stone boat are so different from each other that the philosophical motives of the two types of builders have got to be miles apart! One enthusiast chooses to defend, to insulate and to encapsulate himself from the forces of the ocean-sea. This, in a capsule of inorganic, inert material that is as distant from life as man can make it.

The other type elects to welcome ocean energies, and to make himself welcome also by simply getting along - going with the environment. His craft is as nearly alive as man can make it.

But both types of boats work. They both function. The proponents of each represent a single, growing sub-cult which can be identified by the unmistakable appearances of those who go to sea as travelers instead of tourists or sportsmen. They share many of the same problems and much of the same fulfillment. I hope that these two mini-cults can enjoy the opportunity to poke plenty of fun at each other, and nothing more than fun. Weill be needing each other in the farthest reaches of the oceans. Here's to you, stonies! May your vertical boats forever operate in the horizontal medium we share.

Ferro-cement forming

<u>Foam sandwich</u> construction is an interesting alternative to plywood for multihulls. Its development shares some of the same youth and hoop-la attending ferro-cement, but its weight to strength properties make it suitable for multihulls.

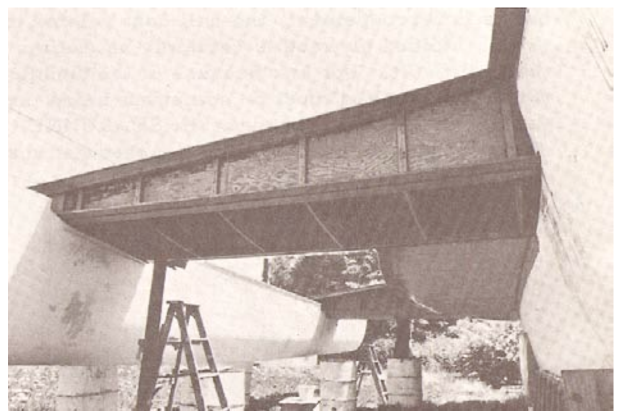
Some excellent seagoing, racing multihulls have been built with this method. Polyurethane foam panels are heat-formed over a simple lattice-like "plug" shaped like the hull. The outside of the foam is fiberglass covered and the one-piece shell then removed from the plug, and then fiberglassed on the inside. Thus you have a sandwich with a foam core and fiberglass covers. All interior framing and cabinetry is now "dropped in" and fiberglass taped to the sandwich shell.

Depending on a wide range of alternatives open to the builder's discretion, the hull - with interior can come out weighing somewhat less, or about the same, as a similar plywood hull.

There are several examples afloat today to indicate that there is no weight saving for cruising boats by using foam and fiberglass. It is the fiberglass, inside and out, that brings the weight up. But there are other advantages such as sound and heat insulation, molded form, and built-in floatation.

Two things have discouraged me from plunging headlong into foam boats for backyard building: cost and design. Foam and fiberglass (two sides) is somewhat more costly than plywood and fiberglass (one side). The foam is not readily available at the corner lumberyard. In fact the good stuff is currently imported from Switzerland! No clear cost comparison has emerged but a ballpark figure has the square-foot price for the base materials about twice as high. Some contend this cost disadvantage is offset by labor saving.

The design of foam boats is still quite developmental. Many attempts to convert existing plywood designs to foam construction present enormous engineering problems to the builder. The designer's role is clear here - he should design for foam to build in foam. And, speaking for myself, I'm not qualified. This same dilemma has been tantamount in the ferro-cement movement where most building is done to plans modified from anachronistic monohull designs. Good things will happen for both types when gifted designers can work with confidence in the new mediums.



This excellent fifty-footer was designed by the owner-builder for foam-sandwich construction, in the hulls only. All else is plywood.

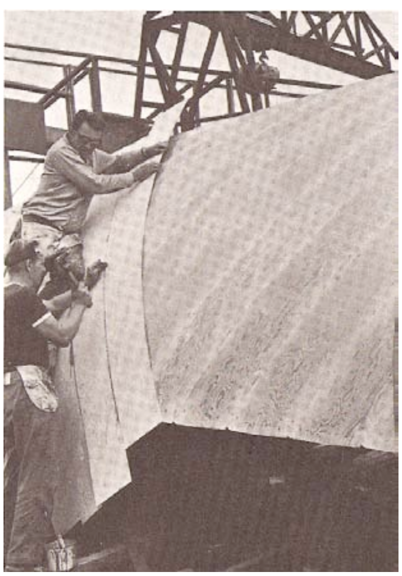
One of the primary attractions to using inert materials like foam and fiberglass and concrete for boat construction is that they offer reduced maintenance and increased longevity because of their non-biodegradable nature. A foam-and-fiberglass hull is not dependent on wood preservative and ventilation to keep it from returning to the dust from which it, and everything, is made. But current practice puts the lie to this claim of non-biodegradable trimarans. The art-craft of boatbuilding with foam has not yet advanced to the point where it is all-foam. Because of the superior stress and working properties of wood, most modern foam boatbuilders revert to using plywood and lumber in the platform, deck and superstructure of foam-sandwich hulls! The outrigger beams and under-wings - the most structurally critical components - are built of an amazingly light, strong, and workable cellulose-fiber material that grows in the forests of Earth. Called "wood", this natural material is also biodegradable. It remains stable only by the builder's, and the owner's, care.

"Care" is the word. A boat is nothing without a sailor. It is an inanimate amalgamation of hundreds of materials having no chance whatever for survival without all kinds of "care".

Wood has one attribute which is definitely unattainable by any inert material; it will be forever better in boats because it engenders care. We can love it. Until the human form evolves into an inertness which allows the love of plastic, there will be wood in boats. And that evolution seems very distant indeed when one looks around the harbors at the teak-bedecked Clorox jugs floating alone, so seldom cared for or loved, and so seldom used.

So, composites of materials prevail using any mixture of any material. Most trimarans, for the moment, are made essentially of wood, and their exteriors are protected from biodegrading by fiberglass and paint; anything to make them look like what they ain't. But the interiors of the most cared for, loved and used trimarans are made to look like what they're made of - wood. For those multihullers who are into sailing to develop the most efficient wind machine conceivable, any material is fair game. As is any competitor and any expense. But if you're building a boat to form your life around to use for "hanging out" around the ocean, consider wood. It works too.

Molded plywood is an excellent material for multihulls, and monohulls. By cross-laminating strips of sheet plywood over a skeleton that is shaped with compound (actually called "complex") curves - that is, with bends in both directions - you can have probably the strongest, lightest, most efficiently-shaped hulls. The only reason Searunners aren't built with this method is that I feel the "molded chine" method we use to be better suited for owner-building by most of my clients. There is a considerable cost difference per square foot of planking area (about 40%), but as in ferro-cement, the hull cost relates to all-up cost in a minor way. Mostly it's the work. Molded plywood is certainly no easier, and according to my analysis it is substantially more difficult. Not just because of the double planking steps, but because the hull framing over which it is applied must be somewhat more involved than with Searunner framing. The advantage in efficiency between the Searunner form and a truly molded form is apparently so slight that the fractional gains in speed get unattractive except to purely competitive sailors.



Molded plywood planking operation involves two or more layers of diagonally-laid strips of sheet plywood or veneer fastened very frequently into complex hull framing.

I sincerely believe that it will be a very long time before other exotic materials displace plywood and glue. Molded plywood, foam sandwich and even balsa core have earned their special places in the backyard. But for the motives that most owner-builders want a trimaran, I contend you're safe with Searunner construction in more and better ways than any of the contemporary alternatives.

START BUILDING

FRAMES

Use of the pattern sheets is simple, if awkward. The prints are so large (42"x 96") that they are cumbersome to handle without damaging. The best approach is to find a large cardboard tube and roll-up the pattern in use on the tube. Roll it out directly onto the plywood which will be cut for the frame. Mark through the pattern with an awl or nail all points which pertain to that frame you are making. Roll-up the pattern, and connect up your marks on the plywood to reveal the shape of the frame.

The pattern shows that some of these marks are connected with straight lines, some with curves. A template is given in the patterns for the "compound topsides" curves common to most frames. Make a plywood template from the pattern, and use the template to draw the curves on the frames themselves.

Some of the curves are not like the template, and are marked "special curve". To transfer these from pattern to plywood, punch several holes through the pattern along the curve. Remove the pattern and drive brads into the marks, and bend a limber batten over the brads. Draw the curve along the batten. Or, use a dressmaker's pattern wheel tool to mark through the pattern directly onto the wood.

In the larger frames, two or more panels of plywood will need to fit together to make an area large enough. Arrange the joints as shown in the "FRAMEPLANS" of the working drawings. The "frameplans" are small scale drawings of the frames themselves, and contain information which, when used with the pattern sheets, allow you to build the frames.

Wherever possible, joints in the panels for making large frames are located right on the center-line. The pattern sheets show only one half of the frames; that is, one side of the center-line. By placing the pattern over two layers of plywood, and marking and cutting both layers at once, you make both halves of the frame. Invert one layer and arrange with the other along the center-line to make the full frame. The 25'er and 31'er patterns show both port and starboard halves of the main hull frames by taping the two patterns together.

For making float frames, cut two layers at once to make both floats at once. There is one important thing to remember. Because of the asymmetric float design, the frames have a peculiar appearance. The "Asym" goes on the <u>inboard</u> side. Our minds are not accustomed to looking at unilateral shapes and the frames will appear cockeyed. Be sure you apply the framing lumber to the plywood on the correct side of the connective bulkheads. Each frame must face in the correct way for the correct float. Mark each frame as you cut it out; for instance, "S-4A" = <u>Sta</u>rboard float, Station <u>4</u>, <u>Aft</u>er side. And on the reverse side of that same frame, mark "S-4F" = Starboard, #4, Fwd.

When a man asks his wife, "Can I build a boat?" instead of, "Shall <u>we</u> build a boat?" it can mean the same to her as when she asks him, "Can I blow up a balloon?"

When you have applied the framing lumber to S-4F, then P(Port)-4F should appear as its mirror image. Be sure you get them right.

Some main hull frames do not have joints at the center line. To mark the second half, invert the pattern sheet and number the holes punched for the first half by shining a light through the pattern to read the printed number on the good side. In any case, arrange the joints in the frame plywood only as shown in the frameplans, for structural reasons. The surface grain in the frame plywood should follow that shown in the frameplans.

Be sure to mark center-line, Reference-line, wing-stringer level, and all other pertinent information on BOTH SIDES of all frames. To mark backsides and double layers, drill very small holes straight through the plywood, and connect up the holes with lines on the other side.

Cutting out the frame plywood is best done with a skilsaw. A large, low workbench, covered with plywood dunnage, makes the only suitable cutting table. Set the depth of cut on the skilsaw just deep enough to go through the frame plywood you are cutting. Cut along your lines. The blade will scratch the dunnage underneath.

The patterns show the outside shape of the frames, while the frame plans show the inside or interior cutouts. Lay these out on the plywood after cutting the outside shape, and again, cut with the skilsaw, finishing inside corners and radii with the saber saw. During all this cutting, the two layers of plywood may be held together in register by temporary small nails.

Some of the frames consist of sawn plywood only. These are easy to cut right along the lines even the curved lines - with the skilsaw. But other frames later receive lumber perimeter framing glued-on as shown in the frameplans. And some of these have curved edges per the “compound template” or “special curves”. When a curved frame is to receive a lumber perimeter later, follow this procedure:

When cutting out this plywood, cut about ½" outside the curve. When the side-frames are later installed, allow the lumber to protrude outboard a little beyond the plywood. Then after the glue has dried, the curve may be cut with a skilsaw, cutting both parts at once to the template-line. This requires that the template-line, or the special-curve line appear on the plywood on the opposite side from the lumber side-frame, or else the lumber will cover-up the line which you have to follow when cutting. It gets confusing, so it’s best to draw these curves on both sides of these frames, or make sure you don’t cover-up or cut off a line you need.

All the frames have temporary extensions above the deck to provide for fastening to the strongback. These are later cut off.

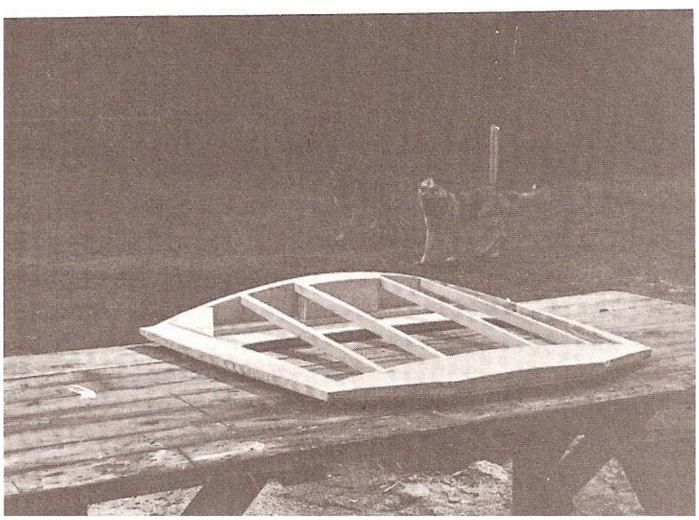
When installing the lumber side-frames to the plywood, use glue and nails. Position each piece with a nail or two, and then invert the frame and drive nails (or staples) through the plywood into the lumber. Nail on 2" to 3" centers, and keep your nails well back from the edges, or you may cut into them later. Install the interior glue-strips, as shown in the frameplans, in the same manner.

Note that some lumber side-framing is shown to “run wild"”at the deck. This will provide enough “meat” to cut a secure notch to receive the deck stringers later.

Most main hull frames have temporary lumber attached to provide for mounting the frame on the strong-back. This is shown in the frameplans as shaded material. It is all removed later. Use “duplex” double-headed nails to facilitate removal.

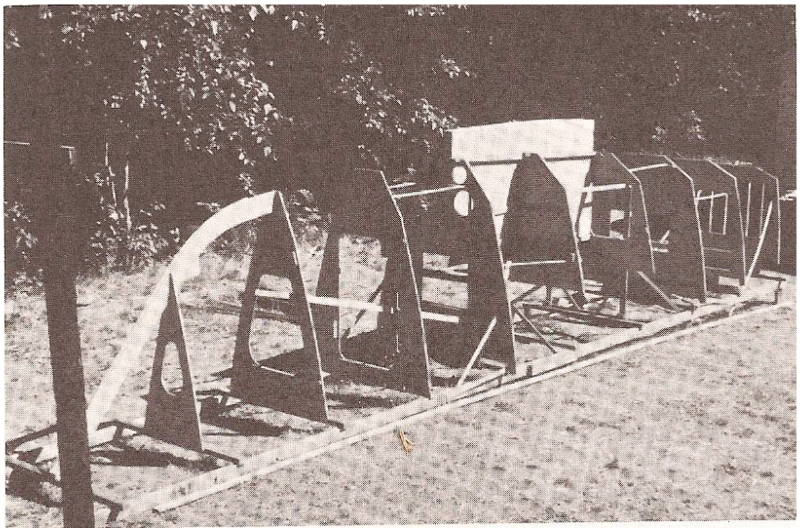
Some main hull frames are split to allow inserting the centerboard. Build these as shown in the frame plans.

Transoms are built-up with a rounded shape resulting, which relieves the otherwise square-ended appearance. The main hull transom in particular is a complicated frame. Plans show various layers of lumber arranged to provide enough material to be shaped down by power plane and sander later. To facilitate this shaping, avoid using nails in laminating-on the build-up lumber. Clamp wherever possible, so you won’t encounter the nails in shaping. All transoms may be built flat if the builder wishes to simplify the job.



31-footer transom

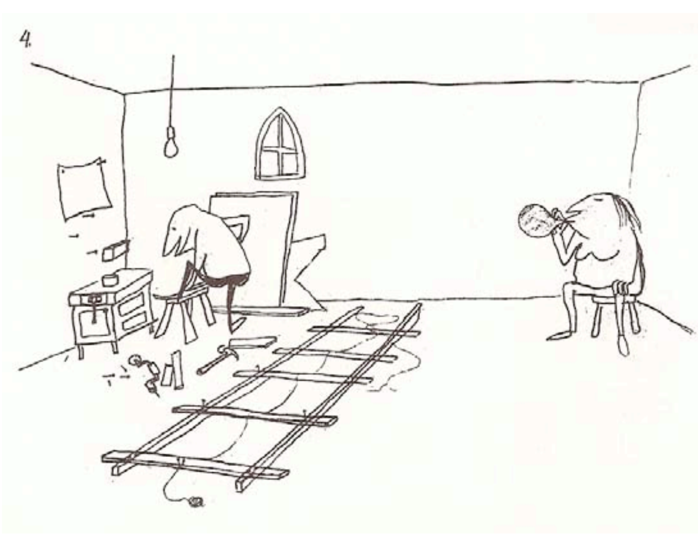
Stems are shown in the patterns. These long, curved pieces of plywood establish the profile of the bows. Cut them per pattern from the prescribed plywood (laminate to make thick enough if necessary).

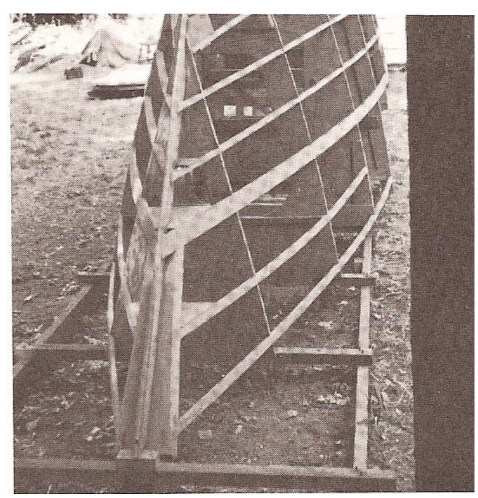


31-footer hull frames

Also make the stemhead timbers. These pieces form a mate between stem and planking at all three prows, allowing for the shape of the prows to be rounded and flared in an attractive way. Planking is applied forward to cover the stemhead timbers, but not beyond. The void forward of there is later filled with soft wood such as pine. The filler is shaped to give the rounded, flared prow, and heavily fiberglassed.

But the primary function of the stemhead timbers is to provide a mount for the stemhead fittings. These are straps of stainless steel which bolt to the forward face of the stemhead timbers, and protrude up through the deck to accept rigging. The main hull stemhead timber mounts the headstay fitting, and this head stay is the hardest working piece of rigging in the boat. Care should be taken in installing this main hull stemhead timber. Get good glue joints of timber to stem, and most important, planks to timber. Use frequent fasteners when planking at the prows, but avoid riddling the installation with big nails, which may actually weaken it. The main hull stemhead timber is made preferably from mahogany and is faced with plywood, laminated on. Leave a slot between the stemhead timber and the topmost part of the stem to allow a sliding fit for the stemhead fittings. The main hull stem also receives a simple pair of straps near the "knuckle" in the forefoot which serve to anchor the forestay. These must be installed <u>before planking</u>.





31-footer stemhead timber installed

When all your frames are built, spend the desired effort cleaning them up. Some sanding of plywood edges is suggested, and a router may be used to round off the edges of the glue strips etc. Do not round off any surface to be glued onto later by another part.

CENTERBOARD TRUNK

The sides of the trunk itself are marine plywood, butt joined where shown to give the desired size, and fastened together as a sandwich with spacers between. Spacers should be mahogany.

To build the trunk, make the sides to the measurements shown. Then fasten the glue strips on the outside of the sandwich which accepts the floor boards. These and the butt blocks and the trunk logs are all installed at this time to the separate side walls of the trunk. Fastenings for these should be on the husky side. Fasteners go from the inside of the trunk. through into the glue-strips outside.

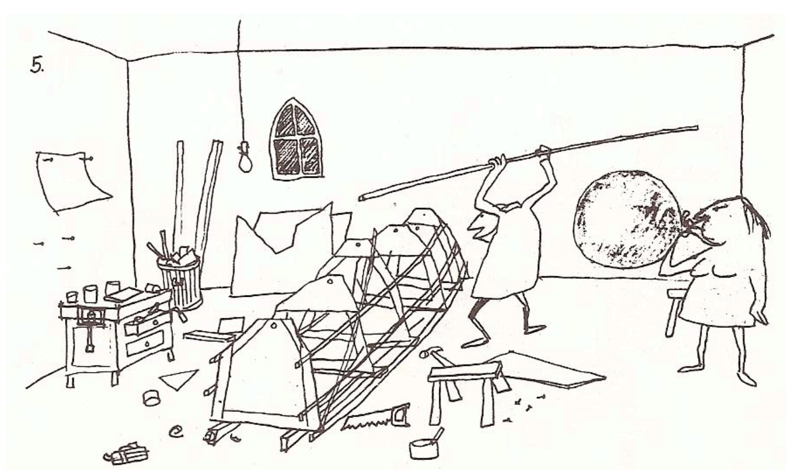
Now, before assembling the sandwich, fiberglass the insides of the trunk, and the inside edges of the spacers also. Current practice is to completely glass both inside trunk walls with two layers of 4 oz. cloth. And, glass the inside edges of the spacers, all separated. Then assemble the trunk using 1-¾" #12 bronze or stainless steel screws (1-½" for the 25'er) and a catalyzed rubber mastic in the joints, like "CALK-TEX". This stuff takes several days to set up, but it is a great, flexible adhesive.

Install the "Delrin" plastic thru-hull fittings as directed, bedding them in a flexible, waterproof mastic. These non-corrosive underwater parts later hold the pin which mounts the board. Get them exactly opposite each other. They may be installed later if you wish.

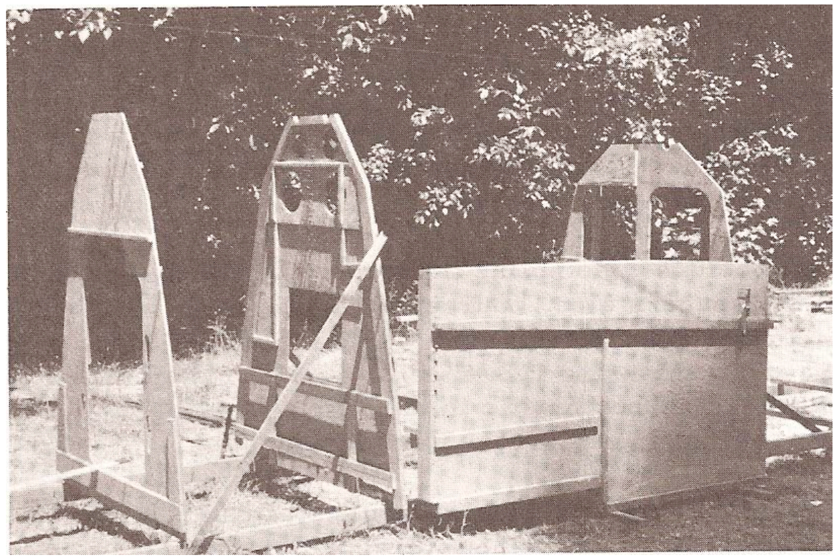
To be sure that the centerboard trunk fits where it belongs, its construction or final assembly can be postponed until the main hull frames are set up on the strongback. The trunk is installed in the boat before any stringers or planking go on, so building it with the frames is the right time to build it.

When assembling the trunk finally, use quantities of Calk-Tex, forming a bead of glue inside the trunk at these joints. Install the bronze or stainless bolts where shown, and reach up inside the trunk to smear-out the bead of Calk-Tex into a fillet in all corners.

But before assembling, make sure your glass job is good. Apply a coat of finish resin and sand the inside of the trunk, especially at the keel end, in preparation for receiving fiberglass wrapped up inside the trunk from outside the aperture, later in construction. When doing this glassing at the aperture slot later, use plenty of glass. The same material with which you are glassing the "shoe" on the deepest part of the bottom may be wrapped down inside the trunk, forming a lip of glass around the inside of the slot about ¼" thick, and going inside about 3".



Get the ends of the slot with circular patches of matt and cloth. It is intended that this fiberglass will constrict the size of the slot all around, and act as a bearing surface for the board. The boat will be upside down when you do this glass work, so to eliminate the problem of resin dripping inside the trunk, thus obstructing the board, you should fit a spacer to plug the trunk 4" inside from the keel. The plug, a 2x4 cut-down, should fit snugly so you can seal around it with wide masking tape. This plug can later be knocked out and the excess resin cleaned away. Remember that this trunk is 3" wide and you <u>can</u> get hands and tools in there to work.

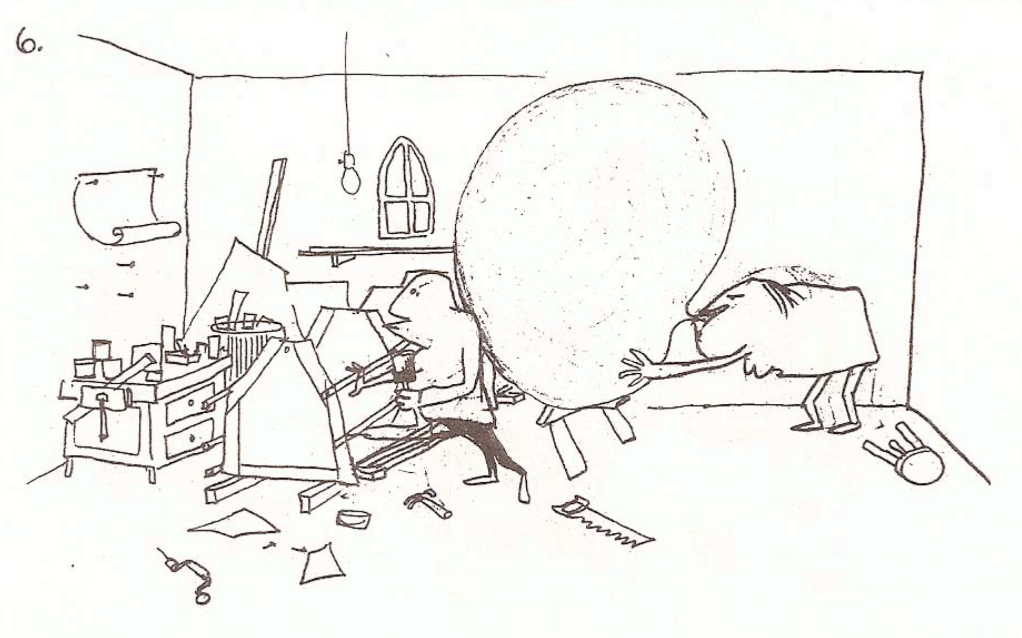


31-footer centerboard trunk ready to install. Small sticks clamped to trunk logs protrude to rest on frames during installation.

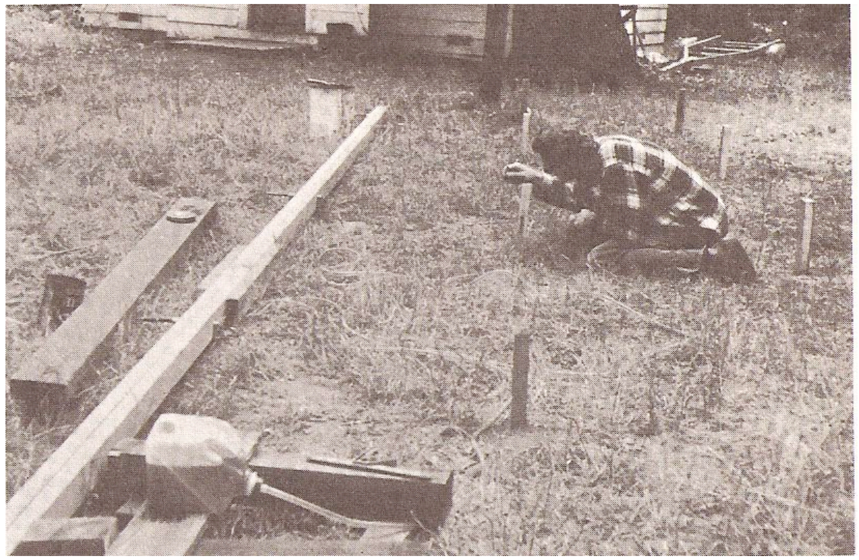
<u>STRONGBACK</u>

A ladder-like jig made of 2x4 rails with 2x4 rungs nailed across every 40" - this roughly describes the strongback. It’s as simple as it sounds, except the level part.

If you are working on a dirt floor, dig small holes to receive two rows of 2x4 posts. The rows are 4' apart, and the posts about 8' apart (except in the 25'er - see plan, Sheet 4). Fasten the rails to the posts - so that they are straight, flat and LEVEL. To determine grade, shoot-in the rails with a transit (builder’s level). Or, a handy gadget which will be of use later in marking your water-lines is called a Hydro-Level. It is a long transparent plastic tube with a reservoir. Water level in the reservoir can be transferred to any point within reach of the tube by reading water level in the tube. The same thing can be done with a garden hose. At any rate, get the strongback rails to grade and keep them as low to the ground as possible.



Level of colored water in plastic jug reservoir is transferred to strongback posts through transparent tube. Be sure there are no bubbles in tube.



Working on a wood floor is easy. Just shim-up the rails with shingles and nail to the floor. A concrete floor presents special problems. Without drilling the concrete to anchor the strongback, weights can be used. We have had success with fiberglassing the strongback to the floor in patches.

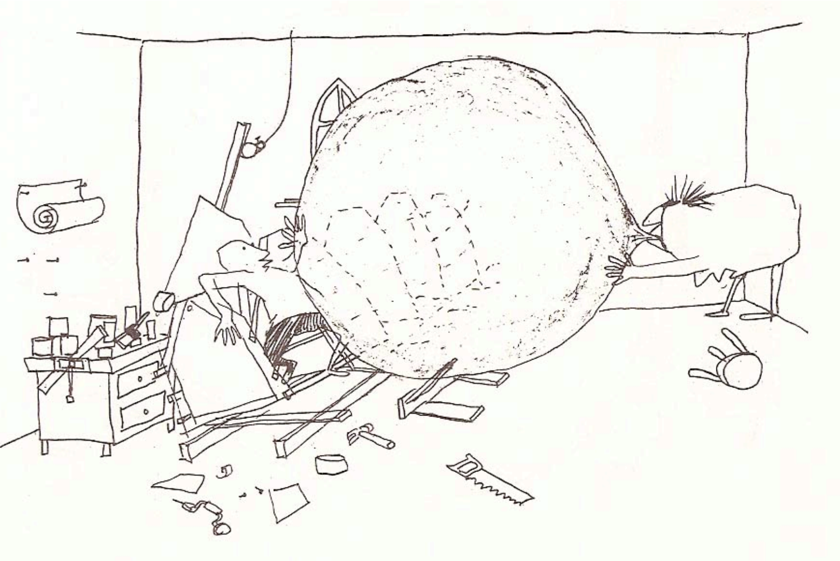
Nail the rungs or cleats (as they are called in the plans) across the rails at the specified module, making certain they are perpendicular to the center-line string. (All hulls can be built on the same strong back.)

Another center-line, above the strongback, is made from clothesline wire and stretched between two posts (high enough to clear the keel of your boat) and located to be exactly over the center-line string on the strongback. Posts which support this string should be firmly set and/or guyed with wire to stakes. Now, a plum-bob hung from this "overhead baseline" will drop directly onto the center-line string.

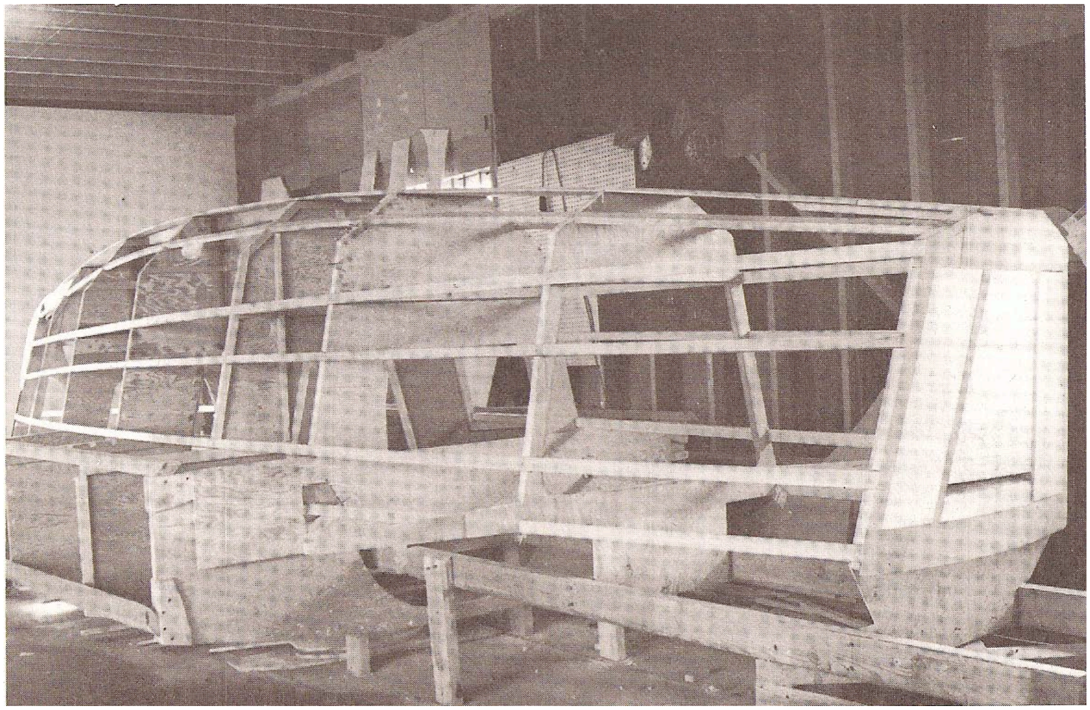
<u>SETTING UP</u>

To set up the frames on the strongback, the plum-bob is used to locate and mount the frames on the cleats so that their center-lines are vertical and plumb. Once you get it started, it's a simple system that is absolutely accurate. The plum-bob is also used to locate the centerboard, stems, and the float sternposts. If your strongback is level and the cleats at their proper intervals, the "overhead baseline" method assures good alignment of the frames (not necessary in the 25'er). But it is quite possible to get a frame in backwards. Make sure they all face the direction indicated in the frameplans.

7.



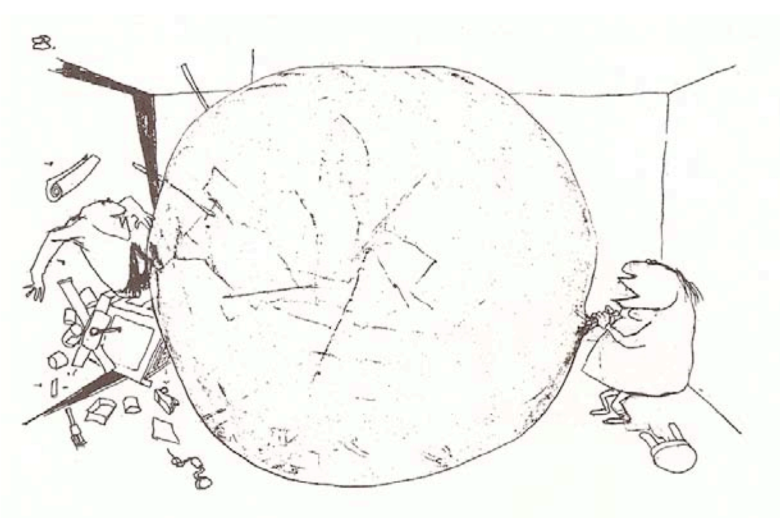
The asymmetric float again has its special illusion. Don't build two of a kind; they have to be a handed pair. (If you build two port floats, contact the designer. He may be able to help you locate a builder who has an extra starboard float.)



25-footer frames and stringers with main-strength bulkheads built-in.
25's transom is slightly raked aft at the keel; all other Searunners have aft face of transom set vertical, though edges are raked.

In the 25'er, the main strength bulkheads are placed on the strongback, and the main hull is built around them. But in all other sizes, there are "connective bulkheads" built into the hulls and the main strength bulkheads later dropped in and glued and bolted and nailed to these.

The connective bulkheads in the floats and the main hull must have their lumber side-frames facing the correct direction (forward for the forward bulkheads, aft for the after bulkheads) so that the main strength bulkheads will later mate to the "clean" side of the connective bulkheads. BE CERTAIN.



Temporary battens from frame to frame, and diagonal braces down to the strongback, will be needed to support the frames as you set them up. The stems, when installed in their notches, form a good diagonal brace. In the main hull, the centerboard trunk will form a rigid unit with its mating frames. Install the trunk and the stems temporarily at first, until alignment of all frames is checked. Then install them permanently with glue, using clamps for the stems, and plenty of fasteners for the trunk.

The transoms rake aft at the keel, with a specified overhang. Notice that the main hull transom is arranged so that the aft face is vertical at the center, even though the edges or sides of the transom are raked. This is accomplished by the progressive camber, deck to keel, of the outside of the transom. The purpose is to form a vertical mount for the outboard rudder, which simplifies the steering linkage and windvane installation. So be sure the aft face of the transom is plumb at the center. (Except in the 25'er where the whole surface is raked, see plan Sheet 4. Or, set the 25'er transom vertical, if you wish.)

STRINGERS

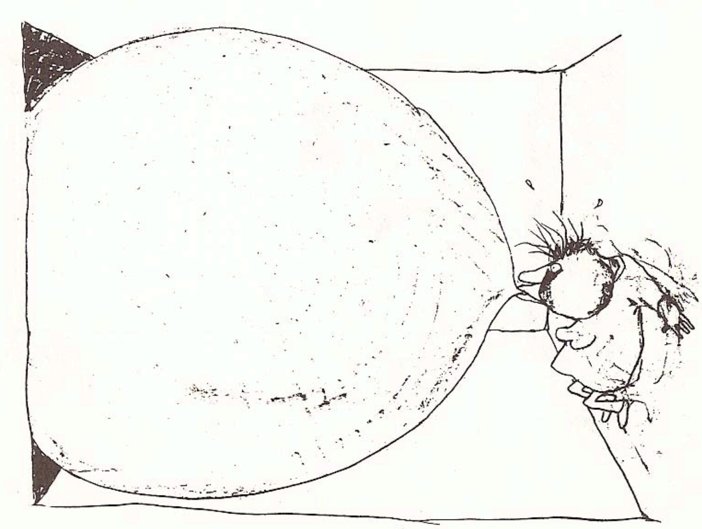
The working drawings show several different types of longitudinal framing, or “stringers”.

The deck stringers run along the frames at the final deck level, which is shown on the pattern sheets for each frame. These stringers later form the deck-to-hull joint by providing a member into which to nail down the deck. The only deck stringer which runs full length, bow to stern, is the float outboard deck stringer. All others are interrupted between the connective bulkheads forming a space which is later filled by the wing. In A-frame boats, the inboard deck level is recessed - see plans. The float outboard deck stringers are important: the curve they establish is the sheer line of the boat, so get them in with a nice fair curve.

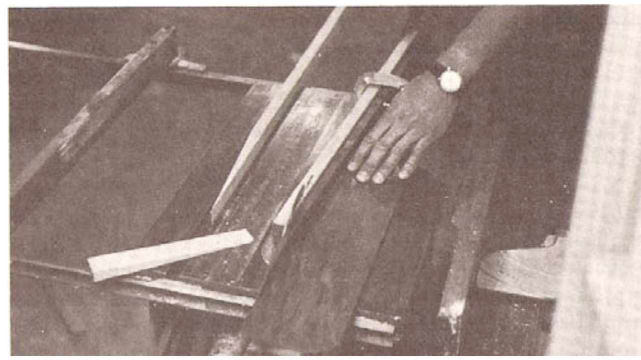
Wing stringers run along the hulls, full length, at the under-wing level. (There is no wing stringer on the float outboard side, except in the A-frame 31'er.) The wing stringer level is marked on the patterns, and a detail shows that the stringer is installed to allow for the thickness of the under-wing panel which mates to it later. In the larger boats, the main hull wing stringers serve another purpose: the distance from the chine to the deck is, in places, greater than 4'; a longitudinal splice in the planking is located to fall on the wing stringer in these cases. To provide for the splice, the stringer itself is made rather wide, and installed flat to give a surface for fastening the plywood planking.

The intermediate stringers are easy to install. They go in on edge. Some of these, however, near the float keels, lie flat so that the builder can better reach past them to tape the keel seam with fiberglass later. In places where the float keels have a very sharp apex, these stringers are omitted to allow taping. Stringer arrangement on the hulls is specified in the working drawings.

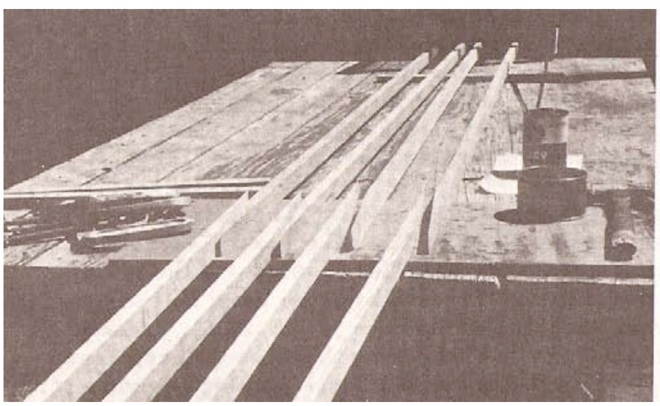
9.

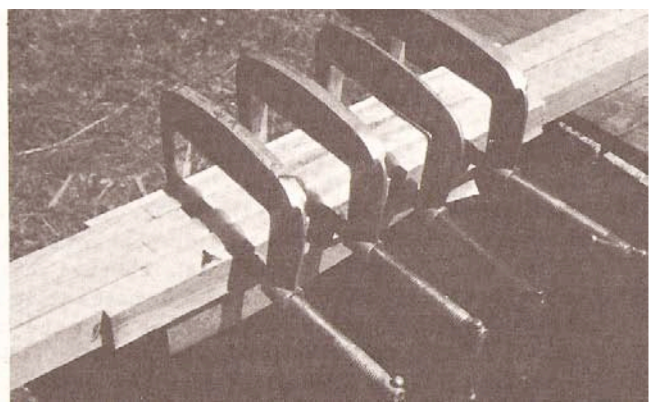


Scarf-cutting jig is simple plywood with 10:l angle cut on one edge. Glue-strip on straight edge slides in groove in table-saw top. Glue strip on angled edge serves to clamp on stringer. Keep clamp back - watch fingers!

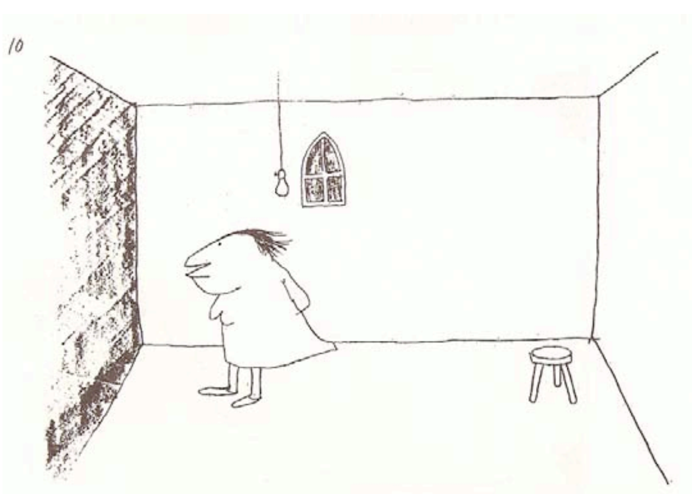


Prepare the necessary lengths of stringer material by scarfing end to end (overlapping wedge type joints). Cut scarfs roughly with a skilsaw and plane-down matching pairs together on a bench, or cut scarfs in a jig on a table saw. Glue and clamp securely, using no fasteners. Scarfs in ¾" material should be 8" long. In 1" material, 10" long, etc. To those who have had no experience with scarfing, it will seem that these long, tapered joints are unlikely to hold. Try to break one, and you will see that they make the strongest place along the stringer.





Arrange stringers for gluing scarfs in groups of about four. Apply glue and drive one very thin ¾" brad through each assembled scarf to hold register. Wrap each with wax paper to avoid gluing one stringer to the next. Then clamp.



When a woman tells her husband “You can build your boat if I can blow up my balloon”, it can mean that one vessel may displace the other, with destruction and deflation the result.

A SPECIAL BREED

by Edna Denholm

It takes a special kind of man to build a trimaran. First he has to have the dream, and then he has to have the determination and tenacity to carry through to its completion. It helps if he is a skilled carpenter, has a shop full of tools and a good friend or two to lend a hand when needed. But his most valuable asset may turn out to be his Wife.

The Builder needs a Wife with whom to share his dream, to discuss the next step, to celebrate the completion of each major phase, to plan color schemes and small comforts and, when the time comes, to shop for winches, stove, sails, anchors, sinks and all the rest. They have to talk about how it's going to be; where they will go; what they will do; not just once, but over and over again. It takes a long time to build a tri This good talk warms the spirit and revives the fading picture in the heart of the Builder when weariness and discouragement blur the vision.

Small things can be important. The Wife knows when to look at a tired, dust-covered Builder standing in the living room and urge him to sit down in a good chair - that's what chairs are for. She helps when she does't make a fuss about eating dinner with an unshaven, sweat-encrusted Noah, because she understands that he's just too tired to shower, or that he wants to do a little more before it gets dark. She is an even greater help when she has gotten slightly sweat-encrusted herself.

Some wives even give up the comforts of home to rough it in a leaky shack or the back room of a shed, because that's a good place to build a tri - and the rent is so low, or nil.

Cheers for the wife who, knowing how much all that fitting out is going to cost, suggests a slight reduction in her housekeeping allowance and doesn't expect any accolade when she not only continues to keep up her Builder's strength with tasty, tempting food, but manages to keep the cold beer flowing, as well. It takes a lot of beer to build a boat.

There should be a special mention for the mates who, seeing how much all that gear is going to cost, plunge into the ratrace and start bringing home a pay check. That is above and beyond the call of duty, but sometimes that's what it takes to build a trimaran. However, the award for meritorious service goes to the hardy girls who bring in the only pay check, thus freeing their Builders to spend all of their time in the boatyard. What a help!

The Wife not only can, but does: hold a board, mix-spread-and-wipe glue, sand-prime-and-paint, and fiberglass, too, because things go faster that way, and besides, it's more fun with two. And, wow, it takes a lot of glue, fiberglass and paint!

It even helps to have a Wife in the boatyard to swear at when exasperation and frustration overwhelm the novice shipwright - provided, of course, she swears back at him only once in a while.

Naturally, the Wife dreams her own dreams of life afloat, and since she has had a piece of the action, the realization of them will have an extra dram of satisfaction. And, since they've labored side by side in the boatyard, there is going to be a heck of a lot more empathy between her Captain and his Crew when there are just the two of them out there on a long cruise. Yea, verily, she shall have her reward.

Yes, the tri Builder is a special breed - he has to be to hold a Wife like that.

This excerpt from "Chapters from the Builder's Wife" (a book in preparation) is included with kind permission from the author.

"That's what it says, Luv. "DO NOT install centerboard Trunk until after..."

or "Sorry Luv. I Lost my place..."

But a "special breed" sometimes can accommodate themselves together in a boat they build themselves together. whether building or sailing, the man and wife team is the ideal solution to the crew problem.

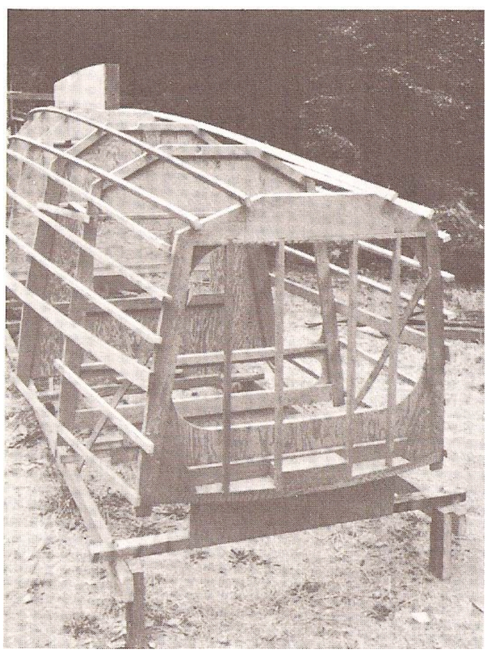
Before starting to install the stringers, stand at the bows of all hulls and sight down the keels. Are they in line? Do the same at the sterns.

Closely "eyeball" down the chines and along the topsides. Look closely for anything out of line. If there is obvious trouble, check the C/L [centerlines] and Ref. [reference] lines and finally, check to see that the frame in question is built right to the pattern sheet.

When you are satisfied that everything is close, begin to bevel the edges of the frames to receive the planking. Bending a batten along the sides of the hulls, and "eyeballing" will give the approximate angle for each frame. A power plane is the best tool for the job, but the disc sander and sharp hand tools will suffice.

Almost no beveling is needed on the midships frames, and very little on any which are sawn plywood only, without side-frames. Near the bows and sterns, and on the connective bulkheads, bevel carefully to allow the planking a good glue surface.

At this time, fair-up roughly, just to prepare for installing the stringers. Final fairing-up is made much easier by the presence of the stringers, which will show you the correct bevel-angle at each frame. For now, just "clean it up".



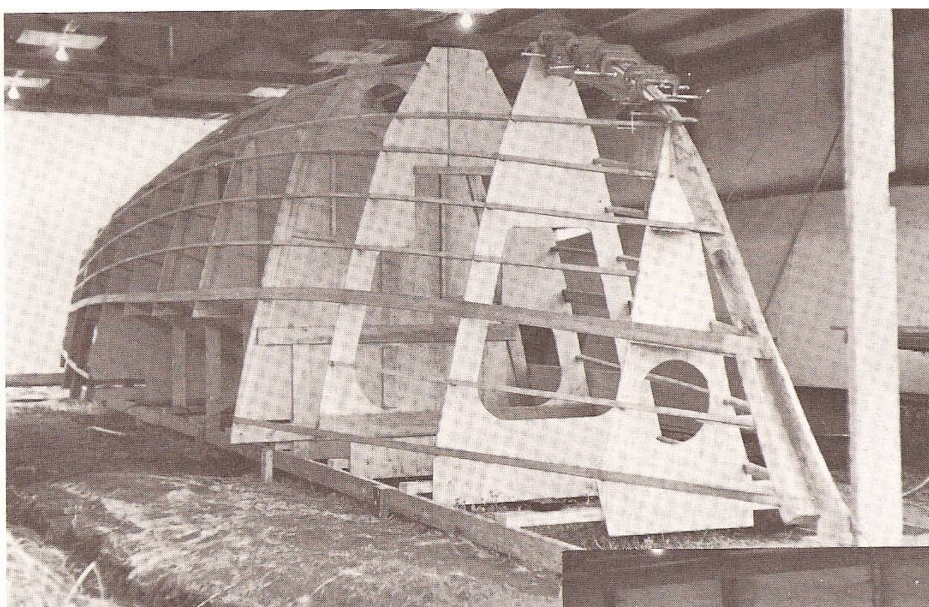
Left: tack all stringers over frames. Above: mark beveled cuts on stringers to fit stem by using a scrap of stringer material as a scribe. Cut with saber saw in place. Then mark all frames where stringers pass. Remove stringers to cut notches (below).

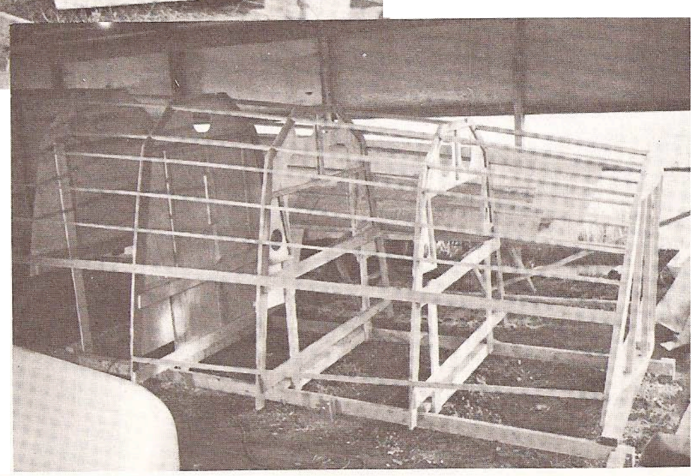
When ready, position the stringers on the frames as illustrated, making sure that the deck stringers run along at the deck-level marks, and that they scribe a fair curve. For now, just tack the stringers in place. Then, with a sharp pencil (a jackknife makes the best mark) mark clear, sharp lines <u>on the frames</u> EXACTLY where the stringers cross them; and, with pencil only, mark <u>on the stringer</u> where each frame crosses the stringer. Remove stringers and set the skilsaw to the depth of the notch. Pass the skilsaw between your marks, using it as a dado to cut out notches for the stringers. This sounds impossible, but is actually simple once you get the knack, and is the best way to cut these many notches; but you need a small, light skilsaw.

<u>WATCH OUT FOR NAILS</u>. Pull any nails which conflict with the notches. One trick is to cut the notch right up to the nail Then, knock the nail out into the notch you have cut by driving on it sideways with a nail set. Pull with pliers, and finish the notch. It is wise to examine all notch locations before cutting and mark them with a red “X” if nails fall in the area.

If you have a router, pass the quarter round bitt over the inside edges of all stringers, taking care to leave the edges square at the notches. These eased edges make a neat appearance, are easier to paint, and retard splintering. A handy router type tool called the Stanley Shaper will do this even after the stringers are installed.

A trial fitting may be helpful to see that you have properly beveled the stringers where they converge on the stems.

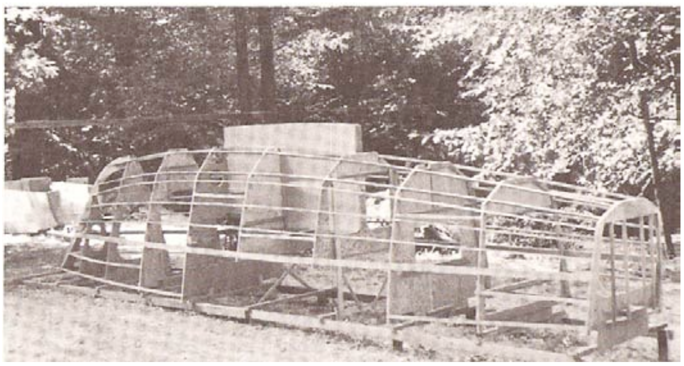




37 and 40-footer bow and stern stringer arrangements. Note breast hooks at bow.

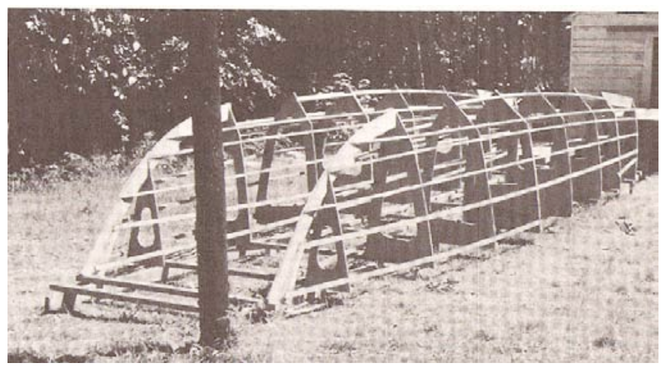
As the stringers run across those frames, see that they scribe fair curves as they converge on the stems and transoms. Cut the notches deeper and remove waste from the frames if necessary. If it is found that any frame is low, it may be easily built up by gluing on a fairing strip of the needed thickness. Nail these on through scraps which may later be split off around the nail heads for pulling the nails after the glue has dried.

Then coat the notches with fairly thick glue, and the stringers where they mate to the notches, and install. If your notches are carefully cut, very little nailing is required to hold the stringers until the glue dries. For sloppy notches (and there will be some) save the wedge shaped scraps when cutting stringer scarfs. Dip the points in glue and drive them gently between the stringer and the wall of a loose notch. Break off the excess after the glue dries.



3l-footer main hull framing

31-footer float framing



Note that there are some large breast hooks shown at the bows. These are simple pie-shaped panels of light plywood which are glued across the stringers where they converge on the stems. Bevel off the stringers a little with the sander and fit the breast hooks with glue and clamps or nails. See photos. The purpose of the breast hooks is primarily to hold one stringer to the other until the planking is on. Otherwise they tend to pop off of the stem. After planking they form a useful strength member in the bows, but cut holes through them or leave them short to allow ventilation in these tight places. No foam or plastic is used to fill voids or provide floatation. Experience shows it causes severe maintenance problems.

In certain places, solid wood blocks are indicated at the chine. Planking is fastened into these blocks at the chine seam where that seam is difficult to reach from inside to apply fiberglass tape.

PLANKING

Now begins the only critical joinery work in the hulls: fairing-up the frames to receive planking. Go over the entire boat, shaving down the high spots with plane and sander so that sheet plywood planking will run fairly across all the framework and mate everywhere.

This is especially important at the stemhead timbers. Trial fit a large scrap of plywood to simulate the planking.

The final judge in fairing-up is the eye! If you can perceive humps and hollows in the framework now, they will definitely show in the finished craft. If a batten placed over the framing reveals rough, uneven surfaces, the planking will not mate to the frames, and the structural strength of the hulls will be reduced. There is, however, a large margin of safety or “fudge factor” in the structure. Do the best you can.

When you are ready to apply the planking, examine the drawings to see where the butts in the panels will fall, and mark with crayon the approximate location of these on the framework. Note that in most cases, butts in the bottom panels and side panels are staggered. Also note that on the main hull, the topsides planking is, in the 37-footer for instance, ⅜" plywood. But the bottom-sides planking is ½" thick, and the very bottom plank is ¾" thick. These graduating thicknesses are a major advantage of this type of hull as opposed to molded plywood construction. We can put thickness and strength where it is needed - on the bottom to protect the boat in beaching or grounding.

Plank the sides first. Tack the individual panels along the framework and then, drawing from inside, mark where all framing will mate with the panels.

Molded chine construction has no chine stringers and so there is nothing in the boat for you to draw a line against to indicate where to cut the panels at the chine seam. At the deck, the deck stringer will give you that line on the panels, but you can determine the chine line on the panels by tacking a long batten along the OUTSIDE of the boat exactly where the corner of the frames meets the inside of the panels. You can mark the outside by drilling tiny holes through from inside at the corner· This batten (when tacked into the panels which are tacked up on the boat) will describe a fair curve from frame to frame. Draw a line along the batten on the planking.

When all other framing is marked on the inside of the panels, remove them one by one, numbering them in order, and mark exactly on the stringers where the butts fall.

Cut the panels to shape, getting as close as you can while still leaving the line on. Any margin you leave now will have to be planed-off later. Cut closely.

Now, lines must be drawn on the outside of the panels to show where to nail into the framing. To do this, drill tiny holes through from inside-out at all intersections of frame-to-stringer, as shown by the lines drawn previously on the inside of the panels. Invert the panel and connect-up the holes with lines. When nailing on the panel, drive nails in the holes.

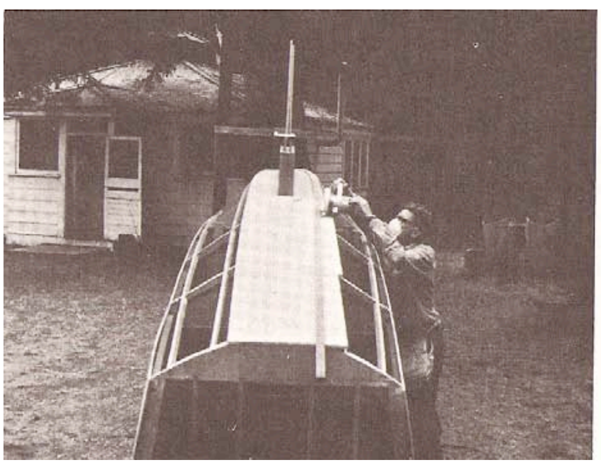
It is not necessary to mark the panels for nailing into the edge of the ½" plywood frames. Omit nailing here, but use plenty of fasteners at the connective bulkhead frames and all those which have lumber side-frames. And, of course, the stringers.

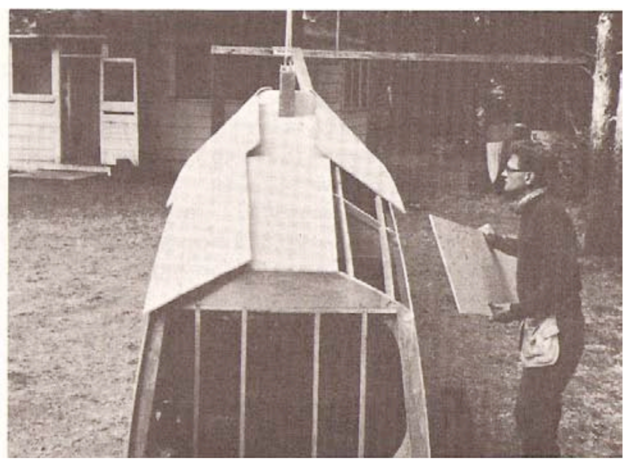
Before planking, make the butt blocks to cover the butt joints inside. They are easily made by ripping out strips of plywood of the specified width for the blocks, and long enough to reach, say, from chine to deck. Tack these onto the stringers over the lines which indicate the position of the butts. Mark from inside where the stringers mate with these strips and mark each strip with numbers for each block to be cut from it. Number consecutively each butt block, and mark the same number on the stringer adjacent to where that butt block will go later.

The above discussion of planking has been confined to, for instance, the side of one float. Up to this point, you would have the panels of planking for that side all cut to final shape, marked inside for gluing, outside for nailing, and set aside. Butt blocks for that side are several strips, marked for cutting later, after the planking is on, and numbered.

You can proceed to install the above planking and butt blocks now, or you can continue to cut and make ready all of the other planking. The advantage of cutting it all at once, and then installing it all at once is that you may be able to rent or borrow a pneumatic staple gun (see tool section) for the planking operation. If all your planking is ready to go on, you can plank the whole hull (or hulls) in a very short time, and avoid procuring the staple gun several times.

Rough cut panels tacked onto floats (left) are trimmed at chines using long batten to guide skilsaw. (Note that top stringer in float at left extends to frame 2 by dropping 4" below apex instead of 3" as at other frames. This avoids cutting off frame with notches). After curves are cut, adjacent panels may be scribed from existing curves, as shown below.





If you decide to pre-cut all the planking for the float, for instance, it is best to tack the pre-cut side panels back on the boat, and use the chine line that is established by them for cutting the bottom planks. Position the rough cut bottom planks on the boat, and scribe the chine line onto them from the side planks. Float keel lines can be drawn by the same procedure as the chine lines.

All of this conversation about drawing and cutting the chine lines on the planks is not intended to mean that you need a perfect fit. In fact, a small gap at the chine seams is desirable. Much of the plywood at the seam itself is later removed when you radius the chines.

When you are ready to plank, choose a cool day, or work in the early or late hours if it is warm. The nailing requires enough time so that the glue will set before you have the nails driven if it is warm. One trick is to wipe, with a barely damp rag, the areas to be glued this postpones the glue's set up time. A staple gun helps lots in any weather to get a good glue joint.

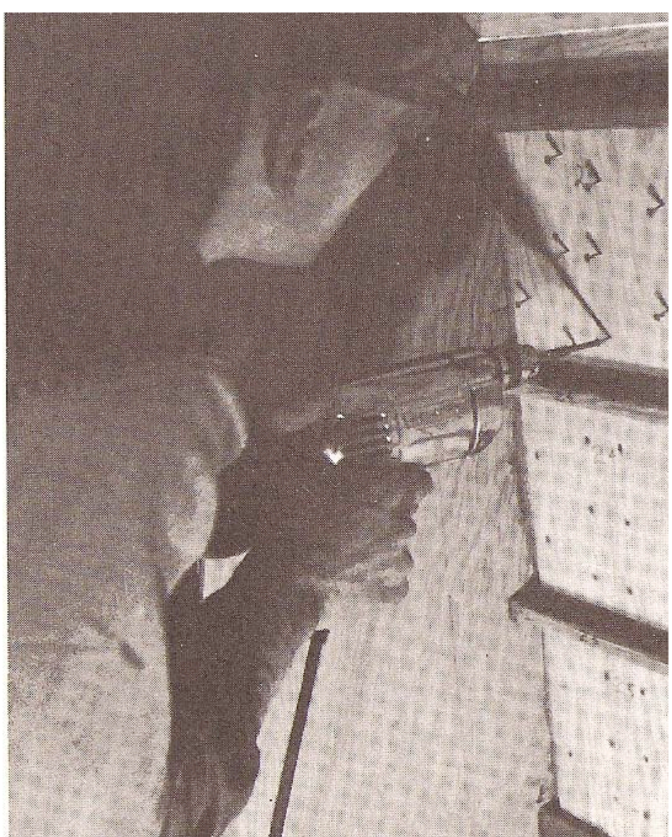
Mix the glue thin so you can spread it quickly with brushes. Get some help if possible. Spread glue on both plank and framing and position the plank carefully by finding the nail holes originally used when tacking it in place. These can be previously marked with a circle around them.

Then spot-nail the plank in place every foot or two. Begin nailing every 2" at the deck stringers, or wing stringers in the wing area. Finally nail to the frames and intermediate stringers every 3" or 4". You will need someone inside with a back-up weight for the stringers, and to wipe up excess glue with a damp rag. Don't bother with nailing into the edges of sawn plywood frames.

But careful fastening of the planks to the stemhead timber is critical. The stems themselves are "sharp-ened" in the fairing-up phase, and fairing the stemhead timber to allow the planks to flow from stern to timber is required. Large gaps in the glue-line here would weaken the boat. Also, take great care with the longitudinal butt which falls on the wing stringer, if your boat has this. Make the seam right on the center of the stringer.

On the main hull, plank the bottom last. This heavy planking may be rough-cut to shape, and then scribed for final cutting by tacking it in place and marking from the bottom sides already in place. The bottom overlaps the bottom sides - it goes on top of the other planks. Fasten the bottom planks securely into the centerboard trunk logs with bronze fasteners.

Butt blocks may be installed anytime after planking. There are many ways to install butt blocks, but here is the nicest way, though not the cheapest: screw them. You will need an electric screwdriver or one of the popular electric drills with a speed adjustment on the trigger for driving screws. And you will need lots of screws, preferably the phillips-head type which are easy to drive with the electric tool. And brass is the only metal for these screws, because they will come through on the outside. That's right, drive screws from inside-out and grind-off the points outside. In boats with ¼" planking and therefore ¼" butt blocks, use ¾" number six screws. This size is necessary for them to grab in the planking. Drill the butt-blocks to receive the screws (start them by hand) but don't drill the planking. Drive them through. Apply glue to the back of the butt-block and to the planking, and just drive away. Don't be tempted to over-tighten or riddle with screws. About 12 or 14 for each block will suffice. Use ¾" screws for ⅜" planking, and 1" for ½" planking. Grind off the points outside before 'glassing; they come right off easily if brass.



Screw the butt blocks.

Do not use regular lumber for butt-blocks because it will easily split; it must be plywood.

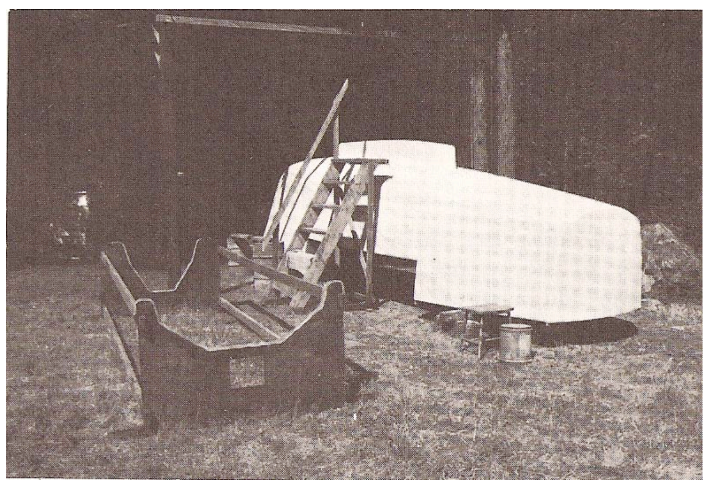
When the planking is all on, you may apply the curved, false transoms.

Optional cap strips are laminated on to the edges of the planking at the stems. Make the strips of thin layers of lumber bent and glued to the edges of the planking, which have been planed flat to receive these. Apply by nailing through the top strip, which is not glued on. When the glue in the other layers is dry, split off the top strip, revealing the nail heads, which can now be pulled. Then these strips can be planed down to conform with the bows and relieve the bluntness at the cutwater (edge of the stem near waterline). The cutwater should be about as sharp as the radius of a nickel. But beware of disturbing the profile shape of the stem with the cap strips. Taper the ends of the strips to meld with the curve of the stems. The cap strips are not structurally necessary, and may be eliminated if you will be satisfied with a slightly blunt cutwater. Shape it reasonably with the grinder and leave it at that.

HANDING THE HULLS

When the planking of a given hull is complete, the hull can be removed from the strongback. Cut off all temporary portions of frames above the final deck level EXCEPT the connective bulkheads. These extensions form ideal "stickers" to rest and roll the hulls on in handling. Regardless of the size of your boat, it seems that the best way to move a hull is to get enough help to muscle it around. The hulls are much lighter than their bulk indicates. But be sure that, when rolling a large hull, lines or braces are used which prohibit it from falling. Take the time to rig it up so that it CAN NOT FALL.

Build a cradle and a stage. This cradle has a notch in the after chock which can be cut out to allow the mini keel to pass through if launching the boat from a ramp in shallow water. The stage (stairway) is "two-by" lumber with dados for the steps and plenty of diagonal bracing. Wood preservative on this equipment will make it last you can keep it or sell to other builders. Fasten with duplex nails to allow disassembly for transport.



TAPING THE SEAMS

By eliminating the chine and keel stringers, a great deal of difficult joinery work is avoided displaced by taped seam construction for the molded chine.

Taping the seams is a somewhat unusual procedure for wooden boats; general taping is very common in fiberglass boat construction where the skin is built first in a mold, and everything else taped in later. So fiberglass boatbuilders are familiar with taping technique.

In the Searunner trimarans, the stringers proximate to the seams in the planking form an ideal taping situation wherein the builder has a sort of gutter defined by the stringers in which to lay the tape (except in the 25'er which has fewer stringers). But this tape is being applied to wood instead of fiberglass. There is absolutely no difference in the technique, but there may be a small difference in the bond strength. Isophthalic bonding resin, a polyester, is considered best for taping seams. Polyester to wood bonding is mechanical in nature, but correctly done on clean dry wood it is extremely strong.

The gutters formed by the stringers near the seams are of varying width, some four inches, some six inches, etc. Fiberglass tape used should be as wide as the gutter, and will, in practice, lap up onto the stringers a little. The tape is made from at least two layers of 2 oz. fiberglass matt, and one layer of any glass cloth. Cloth tape of various widths can be purchased in rolls, but it is less expensive to cut your own from a large roll of cloth. Matt and cloth can both be cut from rolls by making a plywood template the size of the tape desired. Press the template onto the fiberglass and trace around it with a very sharp knife. Keep it sharp.

In the bilge areas of the main hull, three layers of matt are used, and on the larger boats, three layers around the centerboard trunk.

Cut enough “tape” for the whole boat while you are at it, stacking the strips neatly.

A recent innovation in taping seams has been made possible by using “FabMat”, which is a thick, strong blanket of fiberglass consisting of woven roving and matt pressed together in one layer. It is an Owens -Corning product available through most fiberglass distributors. One roll is huge and more than you need for even the 40'er. But it is available only by the roll (order the roll cut into 4" wide tape) and costs about $100 wholesale. So you will hope to buy together with another builder. This material relieves using so many multiple layers of matt and cloth, and it is very strong. No cloth is necessary to cover it for working out the bubbles. It goes on faster.

Before taping inside, the hulls must be turned right-side-up. Only temporary bracing to hold the floats is needed, but a permanent, husky cradle for the main hull is recommended at this time. The rest of the construction will be done with the boat in this cradle. So it needs to be the transport cradle for the boat to the launch-site.

The cradle, and any temporary supports, should be located on the hulls at frames so as not to deform the planking at that place. In the taping operation, the hulls will be rolled from side-to-side to make the seam you are taping as nearly straight down as possible. Use gravity, don't fight it.

Before turning the hulls into their cradles, apply a firm seal of 2" wide masking tape to the outside of the seams. This will keep resin from running all over the boat. And, it pays to do some rough shaping at the chines before applying the masking tape.

When you are ready, the steps for the actual taping are as follows:

1) Arrange materials on a good workbench so you have resin, catalyst, acetone, brushes, roller and scissors all available. A 12"x 4' scrap of plywood will be used to pre-saturate the layers of tape on the bench. Make a trough on this as in the photos.

2) Tip one of the floats on its side so that the chine is nearly straight down. Hook up a good clamp-on, easily moved light, and an electric fan; and then go home.

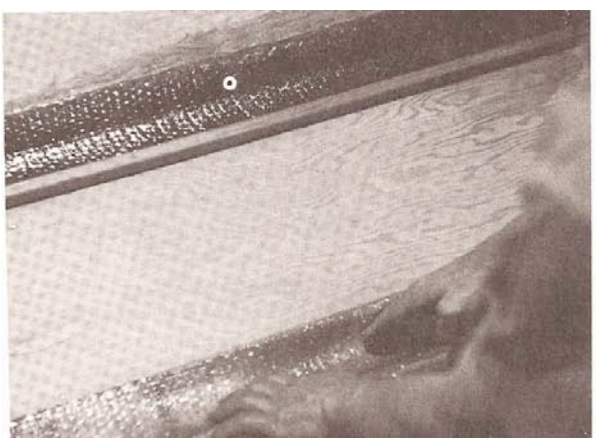
3) Come back when you have plenty of time, the temperature is right (60 - 70 degrees), and there is no direct sunlight on the bench.

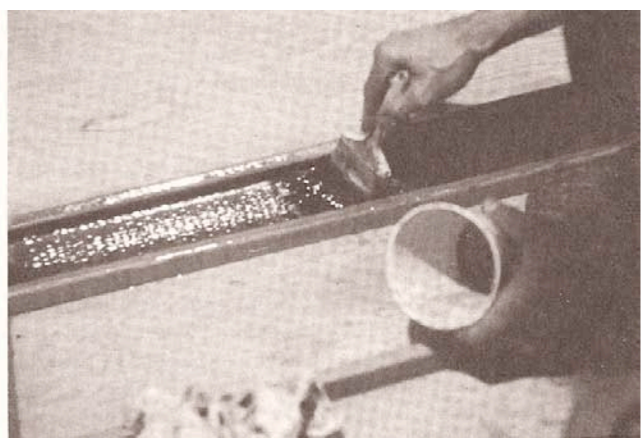
4) Catalyze a little resin, and dump it out onto a piece of tape (cloth on the bottom, matt on top). Spread it around briefly with a big brush - don’t dally or work for complete saturation. Wet-out one layer of matt, then apply another on top, and more resin. If you are using FabMat, two layers is the least you will need. Three with regular matt. It saves weight and money if you use one layer the full width of your gutter and the rest cut half as wide to straddle the seam only. For a 6" gutter, use two layers of 4" matt staggered to make 6" tape, double-thick in the center. This is enough for the 25, but the larger boats can have twice as many layers just in the deep areas of the bilges.

Use your own judgement about where to put extra layers, but avoid overdoing it. Resin is heavy. Pre-saturate your tape in the trough, on the bench. Not in the boat.

5) Pick up this sodden, stinking thing and, if necessary, fold it up accordion-style in one hand with as few folds as possible. Take it over to the boat and lay it over the joint, straddling evenly on both sides, cloth side up (roving side up for Fab-Mat). The trick is to get it in place the first time. If you get all wound up in the first piece, and there are a bunch of bubbles and wrinkles, pull it out and throw it at some inanimate object that needs the reinforcement, and start over. This time, don't fool around with it on the bench, and get it in straight the first time - cloth side up. Work it down smoothly with a wet brush and then leave it alone.

Pre-saturate tape in a special tray with trough as shown at left. Carry to boat and drop it in the "gutter" getting it started as on center as possible (below). Then work out the bubbles with a brush and wipe up your drips with a rag.





Newcomers to glassing may want to take the tape to the boat dry, and saturate it in place with a brush, one layer at a time. This works, if you avoid the temptation to brush out the matt. Just get the resin on there, and work out the layup after the cloth is placed on top. But saturating in place is a very slow process compared to pre-saturating on the bench. The trick is to learn to handle the pre-saturated tape without wrinkling it. You will be sailing lots sooner if you force yourself to learn this skill. You will work out a system. With just the right amount of resin on the tape, you won't have to add more in the boat, or run around chasing sags and puddles. The proper amount of catalyst in the correct quantity of resin for the prevailing temperature will let you work for about 40 minutes without cleaning up your tools or mixing more resin. Feel it out. If you don't like a particular piece, get it out of there while it's still wet. After it gels, it's hell to remove it.

Generally, catalyze the resin “cool”, because thick lay ups, like this get hot when setting up, which weakens the ‘glass. Wash hands frequently in acetone while working.

You will find that some areas of the float keel, and around the main hull stem are hard to reach because they are so narrow. Try folding the tape lengthwise on the bench, and dropping it into these fine areas, then separating out to each side.

The electric fan in the boat will keep the styrene vapor from giving you hallucinations. But a good cartridge-type filter respirator is greatly desired.

Bonding resin is used for all of this taping. Almost none of these taped seams are visible, and if your ‘glassing looks a little bushy, it will all be covered up.

With the hull upside down again now, proceed to radius the chines. Don’t hesitate to remove wood. This shaping is best done with an 8", high rpm grinder with 36 grit discs. Just grind the daylights out of her, but be aware of your radius. Make it round and fair. If you have planked with exterior grade plywood, you will encounter some voids. Fill these, and all other big imperfections with a catalyzed putty made with microballoons as discussed in the general fiberglassing instructions below.

A power plane will also be of great help when rounding the chines. It will do the rough shaping much faster than a sander, and give cleaner lines fore’n’aft. The curves can then be sculpted with the sander. On the float chines and keel, and the main hull shallow chine, remove plywood until you get right down to the fiberglass beneath. On the main hull deep chine - at the bottom - the bottom plank itself is thick enough to allow a generous radius in most places without cutting into the bottom-sides plank very much.

To clean up this shaping, an excellent molded appearance can be achieved by working-over the chines with a big sanding block. A 2x4 about two feet long, covered with the 50 grit paper used in floor sanding machines (available at large hardwares or tool rentals) will really rake off the high spots. It’s exercise, but this effort will produce very nice results by establishing a good base on which to apply the outside fiberglass.

These radiused areas may, if you wish, be taped with one layer of cloth outside, but it is not really necessary. Here’s why: in glassing the hulls, two layers are used on each panel below the waterline. Overlap these onto the adjacent panel just as far as the radius goes. Then, when glassing the adjacent panel, overlap again, giving 3 or 4 layers of 4 oz. cloth at all radii.

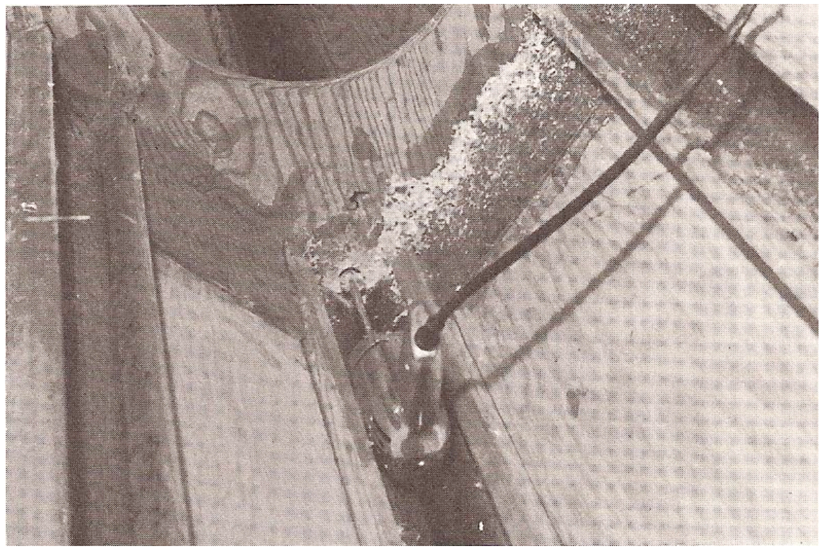
After fiberglassing the outside of the hulls, which is discussed in the next general section of the manual, it is best to paint them immediately, especially if one hull is to be stored outside while you are building another. Use a white primer which is intended for use over fiberglass. It should be a flat white paint especially intended for sanding and re-coating; especially if it is an epoxy-base paint. Gloss epoxies are very difficult to sand and re-coat. This painting will insure that the fiberglass is clean and freshly sanded when painted. The white color will reflect the sun’s heat. A sandable epoxy primer is best if you have access to spray equipment. It must be sprayed. Otherwise, brush or roll-on any easily sanded alkyd based white primer.

While you’re at it, now is the time to apply wood preservative, especially in the floats. Mask off all areas which will later be glued to something else, especially the connective bulkheads.

All the paint and preservative can be brush applied, but it is tedious work. Rented spray equipment is usually not good quality, but it will still be much faster than brushing, especially in the larger boats. The main hull has so many surfaces to be glued later that it may be wiser to preserve and paint inside by brush. The preserving should be done as soon as the boat is turned right side up if it is outside. The floats should be primed outside, and preserved and painted inside as soon as they are built.

Before preserving the floats (preferably before fiberglassing them outside) drill 1" diameter limber holes at the apex of all frames. A speed bore or butterfly bitt is best.

Drill limber holes in floats before 'glassing outside but after taping inside. This is because the drill may encounter a planking fastener and kick it out through the fiberglass.



So there you have Phase I - the hulls; that's the best I can explain it.

Making the frames from patterns, and setting them up on the strongback is a pretty straightforward operation, but making the stringers, notching for and installing them could be approached in several ways. For instance, some builders will cut scarfs with a power plane. Others will use a jig in the table saw. You may come upon a different way that is best for you.

Cutting and marking planks can be done in a dozen different ways, all with similar results. The method described above is fine for the guy who has never done it before, but after doing one hull, that same guy could write his own section on the subject. After you mess around with plywood for awhile, you see that these tangible materials are handled with an almost abstract approach by every individual builder. You will "psych-out" your own rapport with the stuff.

In fiberglass, we have a modern material which requires its fair share of good old fashioned workmanship. But more than with old fashioned materials, fiberglass has a mystique about its handling which each builder will interpret differently. Boatbuilding has never had a development which gives the shellback builder such a grand opportunity for controversy, confusion and individual expression. Boatbuilders seem to need opportunity for these.

So by writing instructions I don't mean to say that you've got to do it my way. Why, I'll be disappointed if you can't come up with something better; something that works better for you. I hope you pass along what you learn - which is the purpose of this book.

PHASE II

FIBERGLASS

Fiberglassing wouldn't be so bad if it weren't for the sanding. When you and Harvey get dressed-up in moonsuits and arm yourselves with whirling discs, try to stay your mind on a brighter scene. Visualize your boat from a detached vantage that your family and neighbors cannot see. Without the distant vision, fiberglassing is insufferable.

Taping the seams in the Searunner's molded chines has given you a good introduction to fiberglass, but covering the outside of the hulls is a totally different skill. The seams are structural, but mostly hidden from sight. The outside 'glassing is cosmetic. It shows!

Because of the strong influence that automobiles have on our impression of how things should look, and because of the cosmetic possibilities of fiberglass, there is a strong temptation for backyard builders to expect too much of themselves. A backyard boat is not necessarily a yacht. It doesn't have to look like it was made in a factory.

The fiberglassing method described below has been used by hundreds of owner-builders, and the results range from rough to beautiful. And I've noticed that many of the beautiful boats sit in harbors while the rough ones sail the oceans. In practically all of them, the fiberglass has not cracked or peeled and the boats are well protected. There are other, more exotic materials and methods, but the system below definitely meets the requirements.

REQUIREMENTS OF THE FIBERGLASS

<u>To seal the joints of the surface</u>. The simplified method of wood construction leaves exposed joints which require covering to keep water out of the wood <u>and</u> out of the boat.

<u>To provide permanent attractive finish</u>. Unprotected plywood is very vulnerable to breakdown and checking by sunlight and water. This is because of repeated changing of moisture content of wood. Fiberglass provides an inert seal with smooth surface which means minimum maintenance.

<u>To add structural strength</u> to vulnerable extremities of the hulls. The narrow shapes have sharp extremities which are vulnerable to everyday handling at dockside and on the beach. (These shapes protect the boat from moving water, but not solid objects.) These places - bows, keel, rudder, etc. - need protection from abrasion and impact. Thick layers of fiberglass in these small areas provide complete security from damage sustained in normal service.

As we use it, fiberglass does <u>not</u> contribute materially to the stiffness or rigidity of the hulls. It is primarily a water seal.

COMPONENTS OF THE FIBERGLASS

Fiberglass Reinforced Plastic (FRP), as the name implies, is a coal tar based plastic, reinforced with glass fibers. It is applied to boats as two components. The glass fibers are woven into cloth, laid on the boat, and saturated with liquid plastic, which then hardens, bonding the whole to the wood. Without the glass fibers, the plastic would crack and chip off the wood, like varnish.

<u>Cloth.</u> There are several types of glass cloth. We use the 4 oz. per yard weight for covering the large panels of area. Four ounce cloth is generally considered on the light side for boat work but we have found it to be completely satisfactory if used as described. With multiple layers in some places, it saves weight and work and money while giving good, long-lasting results. DO NOT use heavier cloth on Searunners. It is not necessary. Dynell and Vectra cloths are advertised as lighter and easier to work, but the truth is they use much more resin and are more difficult to handle for <u>this</u> application. And they are much more expensive. Stay away from that stuff.

<u>Matt</u> is glass fibers pressed into a blanket like felt. It is not woven. It has certain applications where we can use it to advantage, but DO NOT cover the hulls with this material, except where noted for certain structural applications.

<u>Fab Mat</u> is discussed in the previous section on taping seams. Great stuff.

Resin. We use the ordinary polyester resins, or the newer isophthalic resins of two types, bonding and finish. Bonding resin is for saturating the cloth, thus bonding it to the wood, and a second application fills and covers the weave of the cloth. Finish resin, used in the final application, cures to a smooth and tack-free surface for sanding. The isophthalic resins are better bonding, and more easily worked. For information on where to get the best local resin, contact a surf-board shop.

Bonding resin dries with a permanent tackiness, which, when recoated with more resin, fuses the two layers. Actually, the bonding resin is best described as air-inhibited resin. This means that where air can reach it, it never dries. Underneath the tacky surface, however, is a good hard core of plastic. The tacky surface also sets hard when deprived of air by recoating with resin.

Finish resin is the same stuff as bonding resin, but has a special wax added. While still in liquid form, but in the setting-up process, the wax rises to the surface, sealing off air, thus eliminating the tacky surface. Shake the can before using. Barrels should be rolled end over end each week during use. Avoid adding wax to bonding resin yourself unless you are thoroughly experienced. Buy good finish resin for best sanding qualities.

For our own purposes, the basic difference between these two resins is that bonding resin does not have to be sanded before recoating, and in fact, cannot be sanded because the tack clogs the sandpaper. Finish resin must be sanded before recoating with anything to remove the wax, or else nothing will stick to it. Its advantage is that it can be sanded. The finish resin is applied as a final thin coat.

Thixotropic resin is a formulation of finish resin which has a thickener added to reduce the resin's tendency to run downhill. It is useful in 'glassing vertical or overhead surfaces, and sharp corners. A plastics supply will have thickener you can mix with your own resin, sometimes called "stop-sag".

"GUNK" is the term for various putty formulations of resin with fillers. A number of autobody polyester fillers are available, but none I have found is more useful than the stuff you mix yourself with Microballoons. This is a fine powder wherein each granule is a tiny hollow sphere of phenolic glass. When mixed with catalyzed finish resin to a fudge-like consistency it does a great job of filling imperfections in the woodwork before fiberglas sing. Its superior feature is that it sands very easily. Unlike other catalyzed or air-drying putty compounds, microballoons sand faster than the wood. With hard-setting gunk, the sander chews away the wood and leaves a mound of gunk. With microballoons, the filled depressions sand off flush. It can be mixed with talc (art supply) to form a creamy mixture excellent for making fillets and repairs.

Trouble is, it's hard to get. And it is generally not available in small quantities. It comes in large paper bags like cement, which weigh only 17 pounds. It is a Union Carbide product called Phenolic; product #BJO-0930. Current price is $2.13 per pound [ed note: about $18.50 as of 2010], minimum order $25.00. This gives more than enough for a 40'er, so split with another builder. Avoid using asbestos powder to make gunk - it floats in the air when sanded, and is hazardous to your lungs. Asbestosis!

Solvents. Acetone is the cleaning solvent for removing resin from hands and tools. You will need about one gallon for each 5 gallons of resin used. Styrene is resin thinner, sometimes used to hasten resin's permeation of thick mat or heavy cloth.

PREPARE THE SURFACE

A clean, dry, freshly sanded surface of bare wood is best for 'glassing. All corners and points should be rounded to a radius of the approximate size of a nickel, with certainly no edges sharper than the side of a pencil. Sharp edges are hard to 'glass because the cloth is slightly springy and refuses to bend sharp corners.

All dents, depressions, gouges, cracks and holes should be filled with microballoons gunk. Mix by catalyzing a shot glass of finish resin with three drops of catalyst in the bottom of a soup can. Add microballoons to half fill the can and stir; add more powder to make like fudge. Spread rapidly on the boat, with a putty knife, over-filling the depressions. Larger batches need more workers to spread it on before it sets. Sand off excess as soon as it cures enough to not pull out. Rake off large overfills using just the blade of a Stanley Surf-Form file. Sanding can be done with the foam pad and 60 grit paper. Don't sand too much - you'll dig out the soft spots in the wood - and the plywood raised grain will show through the finish 'glass job.

TOOLS OF THE TRADE

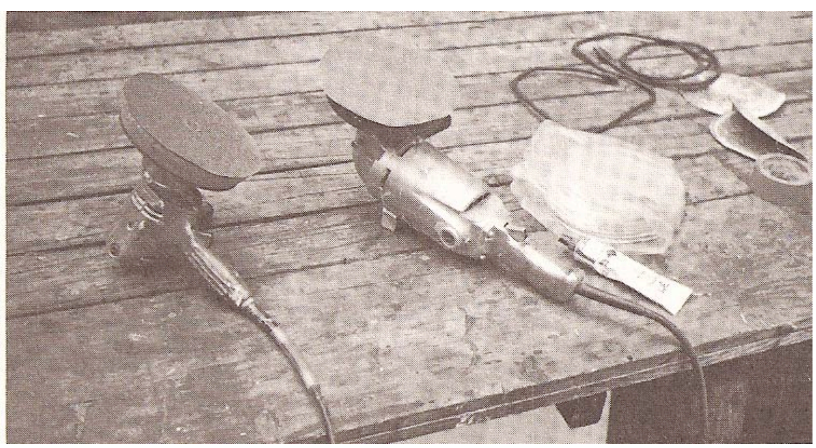
The paint roller is our most useful tool. A little practice will have you performing miracles with the silly thing. Roller cores with short mohair nap are best for applying cloth. By carefully cleaning rollers in acetone, they can be reused, though sometimes disposable rollers are cheaper than acetone.
Paint brushes are used in tight places, and small patches. Contemporary nylon brushes are best - some older nylon ones dissolved in acetone. 2 and 3 inch sizes, about 3 of each, will be used.

Also needed are:

1) large sharp scissors
2) sharp knife
3) two roller trays
4) two roller handles - nine inch
5) paper c. c. graduates [i.e. cubic centimeter or millileter] to measure catalyst (or shot glass)
6) large tin cans
7) small staple-gun
8) putty knife
9) surf-form file

<u>Disc sander</u>. For all but the 25'er, a real monster disc sander is imperative for swinging the foam pad. A 7" model which will run at about 2500 to 3000 rpm. under load, with the 8" foam pad attached, will draw 8 to 12 amps. A 7", 7 amp. sander will suit the 25'er, and be useful for small jobs on larger boats.

Hi there! Let's get acquainted.



The foam pad is a gimmick which makes fine finishes with fiberglass easy, to all appearances the ONLY gimmick. It is a simple disc pad backed with about ¾" of foam rubber to which sanding discs (with no center-hole) are fixed by means of a contact rubber-cement; 3M Feathering Disc Adhesive from auto supply. It is a must for sanding the finished job preparatory to painting. One won’t complete a large boat unless you carefully keep it away from sharp edges while in use. Keep the pad on the flat and sand edges and crevices by hand. Discs for the foam pad should be purchased by the full pack in 80 grit, usually from an auto supply.

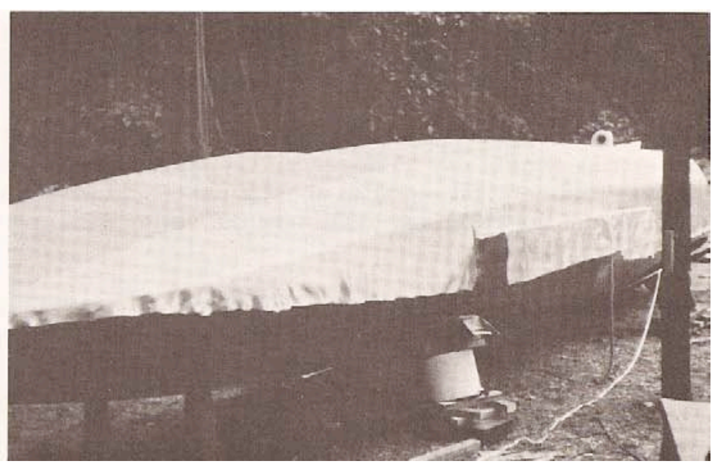
COVERING THE HULLS AND DECKS

Covering the large open panels is easy. The most important step is the first.

Roll the boat over so that the surface you are working on is as nearly horizontal as possible. This is quite a stunt with the larger boats, but whatever contrivance is necessary - blocks and tackle, sky hook, or what have you - please don't attempt to 'glass a vertical surface. It will cause you no end of trouble because the resin will sag, and you will spend weeks sanding that could be spent sailing.

Carefully brush off the dust - especially bits of sawdust as anything that protrudes above the surface, or holes below the surface, will cause air-bubbles in the 'glass. A tiny pit-hole before glassing may cause your boat to leak.

Lay down the cloth. On the main hull, begin with one side of the bottom, laying the selvage edge (straight-woven edge) along the chine, but lapping this joint about 2" up on the topside. Try to make it straight and even. Your cloth should be wide enough to reach over the *bottom* plank, where it is cut off long enough to lap over onto the other bottom-side, also 2". A pistol-type staple gun is very handy for holding the cloth in place, especially if there is any wind blowing. The stapler should be held quite cock-eyed, driving only one shank of the staple, allowing the other to protrude for easy removal with pliers as resin sets. Lay down two layers of dry cloth at once for all below the waterline areas. You can saturate two layers at once easily. Stagger the edges slightly to minimize sanding. Fiberglass manufacturers often recommend that a coat of resin be applied first to the bare wood, before applying the cloth. DON'T DO IT! The cloth is then very difficult to lay-out because of tackiness in the resin beneath. For hydroplanes and speed boats, the slight additional bond strength afforded by the "prime coat" may be desirable. But for sailboats it is NOT NECESSARY, and causes much extra work from wrinkles and sanding. Put the cloth on the boat dry.

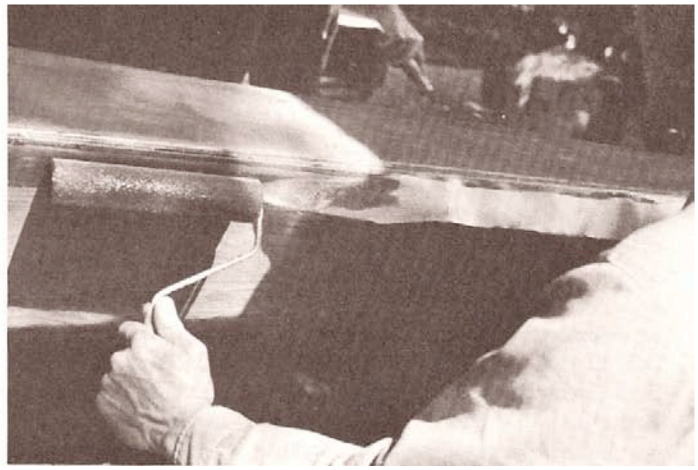


Roll the boat over and layout the cloth.

Catalyze the resin. Aside from working on a level surface, the most important feature of a good 'glass job is - USE ENOUGH CATALYST. Manufacturer's directions on the subject are usually inadequate. The object of adding catalyst to resin is to make it get hard; that is, change it from liquid to solid. The sooner it hardens after being applied, the better. If it takes too long, it will leech out of the cloth into soft spots in the wood, leaving the cloth dry; it will run off over the chine, dripping down the side or the transom, making a terrible mess. You will have to suffer endless tedium of sanding unless you use enough catalyst. We seem to use about twice as much as that which is prescribed for the resin, i.e., instead of 2 oz. per gallon, we generally need 4 oz. But a lot depends on temperature and your particular resin. Never walk away from a wet hunk of 'glass; stay there until it gels to clean up drips with a putty knife, or you will have to sand them off later.

Now, if there is anything worse than getting too little catalyst in the mix, it is getting too much. If the job sets up while you are still doing it, you've got a real mess - on your hands - and worse, on your boat.

It is possible to avoid both of these pitfalls by working with what we call "small, hot batches". By adding plenty of catalyst to the resin, it still will not gel before about 10 minutes after mixing. So, we simply do not mix more than we can apply in that time. You mix a batch, spread it on the cloth, mix another, and so on. Ideally, by the time you are applying the third batch, the first is beginning to gel. Fresh batches, if well worked around in the roller pan, will rinse the old stuff out of the roller, and you can keep on going forever if you like. Especially if you run the roller dry on the boat when the first batch is used up.



Leave a clean line when finishing the first batch. Run the roller dry. Start the second batch by soaking the raw plywood edges first - then get them again later. Wrap the keel with the roller - it is faster than the brush. Hit the raw edges again at the last.

If you are a beginner, working in the shade (sunlight is a catalyst) on a warm day (heat hastens the setting time), say 65 degrees, try starting with a one-pound coffee can about ⅔ full of resin. Add catalyst equal to about a pencil thickness worth in the bottom of a shot glass, and GO. Dump the catalized resin into the roller pan, push the roller around in it, and roll it on the cloth.

If the temperature is 50 degrees, add half a shot (small shot glass) of catalyst to the same amount of resin. If it's really hot, and you're working in sunlight, hang on brother! Use a few drops and go like mad. It is better to wait until dusk, or get going at dawn if you can't otherwise get out of the sun in a hot climate. We <u>never</u> apply finish resin in direct sunlight because it disturbs the sanding qualities of the final coat.

A good man with a big roller (some are 12" wide) can handle a two-pound coffee can ⅔ full or more. We have fiberglassed in 40 degree weather, cloudy, and threatening rain, by adding one and a half shots of catalyst to a brimming 2 lb. coffee can. One man mixing and another rolling with a big roller can really mop out a big boat in a hurry; but start small, as above, to get the feel of this catalyst business. It is best to avoid 'glassing in less-than-60 degree weather, as too much catalyst has been found to cause the job to age poorly. All the variables of temperature, humidity, wind and sun will affect set-up time. Avoid extreme conditions until you get the feeling for how much you can get away with.

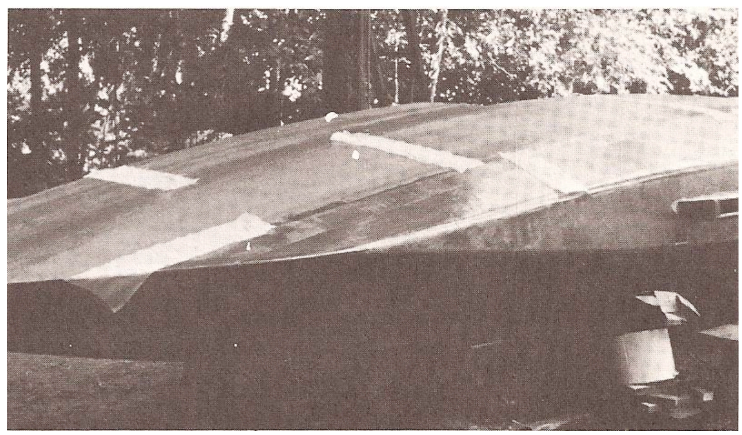
On boats the size of the 25'er one whole panel, i.e., one side of the bottom, can be done with one batch. For larger surfaces, we feel that a series of "small, hot batches" is imperative. Enough catalyst for a quick, clean set-up is thereby insured.

The builder is protected from a threat of having a large batch of catalized resin set up before the job is finished; also from using too little catalyst, causing a prolonged liquid state resulting in runs and lean spots in the cloth.

How much resin to apply? It is important that the right amount of resin be applied to the dry cloth. The object of this first coat is to saturate the cloth, and permeate the wood, thus bonding cloth to wood. Too little resin causes "lean" cloth, scarcely stuck to the wood. Too much resin is usually the problem. If you attempt to load up the cloth with the first coat, the result will be that the cloth will float to the top of puddles of resin, causing "rich", weak, bumpy areas where the cloth is actually separated from the wood by an uneven layer of resin. The roller will deposit an even amount of resin if you just move it around, rolling and re-rolling the area. When you are finished with a given spot, the cloth should look wet, not soaking. So should the roller.

When covering joints in the plywood, for instance at the chine where end grain wood is exposed, return a few minutes after the first rolling to add a little more resin. This will compensate for increased permeation of the wood here, which would otherwise leave the cloth lean. When wrinkles develop, step down to the end of the cloth and give it a slow, steady pull. They will come out.

Have 8" or 10" wide strips ready to apply over butts in the plywood while the bonding coat is still wet.

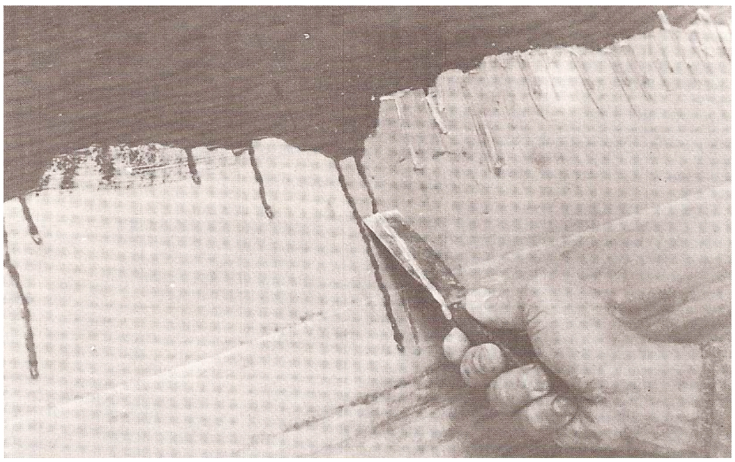


On the big boats it will be necessary for the builder to climb right up on the boat in stocking feet and work himself backwards off the end. This requires a roller handle extended about 3 feet long, a stepladder or scaffolding, and a helper to mix the resin and move the ladder. <u>Be sure the tilted boat is secured before you climb around on it</u>, as the hull is vulnerable to damage from falling before the deck and wings, which complete the box structure, are installed.

Ye Olde Scrap Bucket is an important tool. Drain cans for re-use by resting them on cross sticks. Don't litter your work area with this messy scrap.

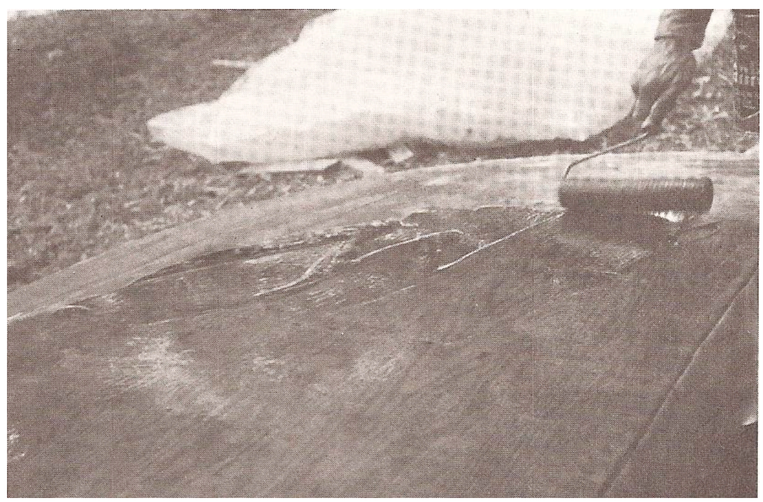
Some light sanding of rough spots on the bonding resin may be possible, depending on your resin. Keep the sander away from bonding resin which has dripped down over the bare wood, as it will clog the sander.

Trim off cloth which protrudes at the deck, transom, etc., with a sharp knife after resin has thoroughly hardened. Try to trim heavy cloth and matt while resin is still "green". It is easier to trim off scraps later than to try to cut the dry cloth to fit exactly before applying resin to it. It always slides around a little. Try to pull out staples before resin sets up. Drips and splashes around the work area are easily cleaned off after they have gelled, by scraping them up gently with a putty knife. If you leave them overnight, you'll have to grind them off.



Scrape-up drips while they're in a "gel".

The second bond-coat (-step process) or finish coat (two-step process).



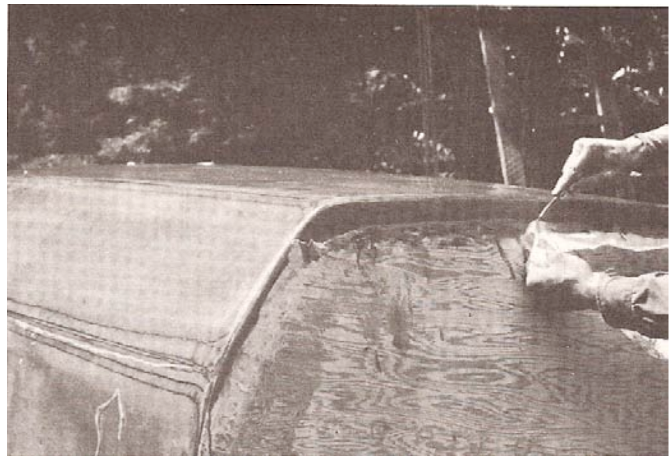
A second coat of bonding resin may be applied. The object of the second coat is to establish a perfectly smooth surface. With the first coat, the trick is not to use too much resin. With the second coat, use plenty - as much as you can apply without sags or puddles appearing. The first application of the bond-coat leaves the weave of the cloth showing on the surface, like honey soaked-into hot toast. If you don't cover it with enough resin, it will still appear, causing what is called the "waffle effect" or "orange peel". With this result, considerable sanding is required to smooth it off, and part of the cloth itself is removed. This can all be avoided if you roll the boat horizontal, and get plenty of resin on there the second coat.

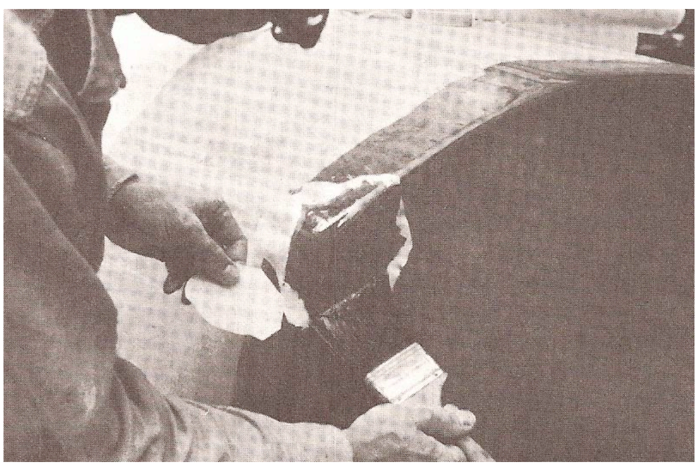
Applying the second coat is very simple. Catalyze a little hotter than suggested for the first bond coat, and just dump it on the boat right out of the mixing can. Proceed to push it around with the roller like spreading gravel with an iron-rake. Use lots, but watch out for sags.

It takes a minute to flow out to a perfect glassy surface. Like honey on cold toast. But just barely bury the cloth. Extra rich coats crack, and are heavy.

If, while working with any resin, the batch you are using begins to thicken, STOP! Leave as clean a joint as possible, clean off your tools and begin anew. Do not try to work with resin in a gel.

Trim with a sharp knife.





Reinforce corners with plenty of round patches.

The finish coat. After you have completed two applications of bonding resin as above, apply a very thin layer of finish resin with the roller, using lots of catalyst. This will serve to seal off the tackiness left by bonding resin, and afford a good sanding surface. Use as little as you can, running the roller practically dry.

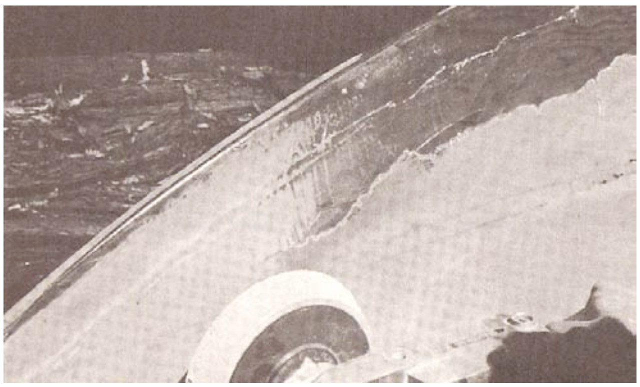
NOTE: It is possible to reduce the above described 3-step process of applying resin (two coats of bonding resin and one coat of finish resin) to a two-step process of one bonding coat and one finish coat. For this system, the builder simply substitutes finish resin for the second coat above, using lots of it as described. The two-step process is possible only if you ROLL THE BOAT.

SANDING THE FINISH COAT

The finish resin must be sanded before applying anything over it (more resin or paint) to remove the wax and any imperfections. If you have followed directions to date this sanding will be minimal and easy, instead of prolonged drudgery, and the result can be perfect. Sand the open panels with the foam pad until almost all traces of glossiness are removed.

To date, we have been working on, let's say, one side of the bottom of the main hull. Before doing the other sides, the edges of what we have done must be "feathered" or they will leave unsightly ridges, and cause air-bubbles in the proximate panels which overlap them. With the disc-sander and the foam pad sand the edges, feathering them down to the wood. This will be an easy job if done as soon as the resin is hard enough to sand. If you postpone the feathering until the resin has cured hard, you will need a 50-grit disc on the hard-rubber pad.

In doing other feathering, for instance at the cabin to deck joint, always lap the deck 'glass up onto the cabin sides about 2", and feather while green. Then apply 'glass to the cabin sides and lap it down onto the deck about 2". Then feather again, making sure you get to it while the resin is still green. The difference in hardness between the under layer and the one you are sanding will make it easy to do a fine job of feathering the joint with the foam pad, especially if the corner has a gunk fillet, as described below.



Feathering. The new resin surface (at top) is still green and the old surface (below) is cured hard. The difference in hardness makes feathering easy. Keep the sander away from the sharp edges, such as the stem, as shown.

For the above operations, the builder should protect himself from the dust produced, which can cause real discomfort and irritation upon contact with the skin. We wear a hooded sweatshirt, and full length raincoat. Secure the sleeves of the sweatshirt about the wrists by binding with masking tape, and wrap a soft rag around your neck like a scarf. Avoid breathing the dust by wearing one of the special filter respirators, or a bandanna over nose and mouth (a diaper is good). We use the paper disposable respirators available at auto supplies, because they are light and comfortable. If you don't wear glasses, use goggles of some sort to protect the eyes. Dressing up like this is annoying and hot, but well worth while. Clothing thus used should be laundered separately, as the dust will otherwise contaminate everything, particularly the unmentionables. The coarser the sanding disc, the more irritant the dust.

We have found that the feathering can be done with a foam rubber pad IF it is done right away. The most valuable thing these instructions could do would be to impress upon the builder the matter of timing. The three above mentioned applications of resin should, ideally, go on in quick succession, with enough catalyst in each batch to make it possible for the builder to work continuously without waiting for a set up. Sanding should begin the moment the finish resin is hard enough NOT to clog the disc. Keep after it!

After the edges are feathered, the rest of the sanding is easy, because you are not actually grinding off I 'glass, IF you have put enough resin on to bury the cloth. This is particularly true with 4 oz. cloth. Fit your sander with the foam-rubber pad (some adaptor may be necessary) and stick on a 60 or 80 grit disc. Holding the disc flat against the work, just pull the switch and move it around. Don't be tempted to use the discs too long, and don't bear down on the sander. Dull discs will polish the surface. Bearing down dulls discs quickly, but may be necessary for feathering in some areas. This sanding can be absolutely minimized by doing it right away, as soon as the resin is hard enough - certainly the same day it is put on. The longer it sets, the harder it gets, the longer you work, and the less you sail. Don't put off the finish sanding.

The sanded surface at left has no glossy spots remaining. The area under the sander is a butt-block covered with two layers of 4 oz. cloth. Feathering of the edges is complete. The glossy surface at right is unsanded. Don't put off the finish sanding!

You should now be ready to 'glass the proximate surfaces in the same way. By putting two layers on the bottom-sides and bottom when you do the opposite side, overlapping its two layers on the bottom only will make a total of four layers on the bottom plank and the deep chines. When you put a single layer on the topsides, and overlap the shallow chine, you get three layers on the shallow chine. That's plenty, even with 4 oz. cloth. Except for the butt-block areas in the topsides. We put a strip of 'glass about 10" wide over all the butts where there would otherwise be only one layer; i.e., the topsides, deck etc. This extra layer at the butts gives a little something extra to sand on if you have rough joinery there - to help avoid sanding through the 'glass. We also tape the longitudinal butt seams in the main hull with 2 or 3 wide tape layers near the bow. Stagger the edges for easy sanding. Roll the boat so that each surface you 'glass is as nearly horizontal as possible.

If it is impossible for you to roll your boat around so that your working surface is nearly horizontal, then fiberglassing the vertical surfaces can be managed as follows, but you are headed for lots of sanding, and a finish surface of questionable appearance.

> Get the dry cloth up there in place as straight as you can (working against gravity) and secure it with staples as above.
>
> Apply several light coats of bonding resin, trying, against gravity, to fill up the weave of the cloth without producing sags and runs; then a coat of Thixotropic resin.
>
> Sand the finish with your foam disc-pad, and 60 grit paper. You will need lots of discs to grind off the bumps.
>
> If necessary, apply another coat of Thixotropic resin, and repeat until an acceptable surface is produced.
>
> You will save yourself a lot of work if you somehow manage to roll the boat, but the above system is necessary in 'glassing the cabin-sides and other vertical surfaces which are unavoidable.
>
> NOTE: By using the 4 oz. cloth, a decent 'glass job may be made to vertical surfaces, because the cloth is smoother, requiring less resin to fill.

STRUCTURAL FIBERGLASSING

By working with alternate layers of 2 oz. matt, and regular cloth, it is possible to add structural strength to vulnerable spots by building up thick patches of fiberglass which conform perfectly to the hulls.

These patches are to be preferred instead of metal reinforcement - i.e. stem-caps, keel runners, etc - because they are light, easy to make, inexpensive, and most of all they FIT what they reinforce, and are therefore stronger. Matt is almost impossible to use by itself, but when combined with a covering layer of cloth it can be handled without coming all apart or balling up in a mess. Bonding resin is used for these lay ups.

Keels. A “shoe” of fiberglass should be added to the deepest part of the main hull or minikeel to take abrasion when beaching.

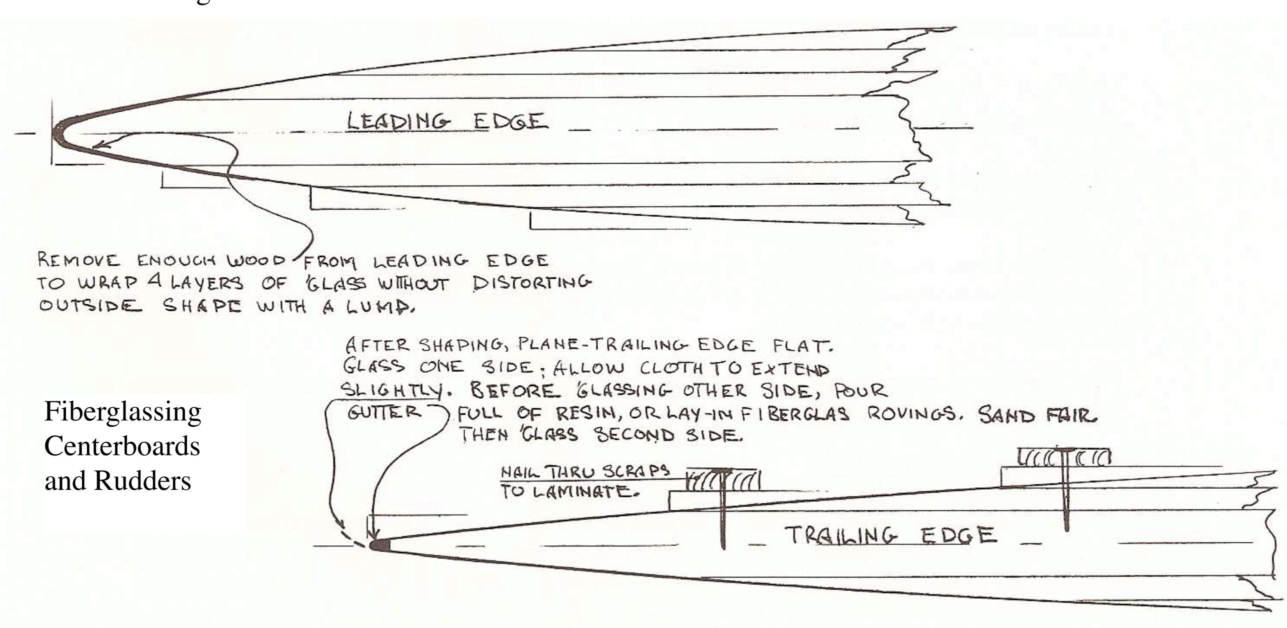
Cut alternate layers of 2 oz. matt and cloth to fit the shape. These layers are worked down together in pairs - one pair for the smaller boats, up to five or six pairs for the larger boats. Stagger the edges of the layers, each a little larger, with the cloth being a little larger than the matt it covers. Arrange the dry pieces in order on the bench, and mix up some resin.

Take it easy on the catalyst because thick hunks of ‘glass set up faster than thin layers (heat develops as in concrete) and it may take you some time to get all the layers down. Using a paint brush or roller, wet out the layers one at a time, right on the boat, covering each piece of matt with its cloth cover, and working out air-bubbles with your fingers, finishing with the largest piece of cloth on top. Fragments of matt will get into your resin can via the paint brush, giving the impression that resin in the can is thickening. Test it by holding up the brush to look for fine drips to fall, indicating that the resin is still workable. If globs appear instead of drops, STOP where you are, leaving as neat a surface as you can, and begin with fresh resin. When the lay-up is complete, add a coat of finish resin, and sand the lay up as soon as it is hard enough.

Work the shoe material up into the centerboard trunk (bonding it to the ‘glass which was put inside the trunk before assembling). Beware, however, of constricting the slot to the point where the board will not fit. We advise rasping out a little extra wood around the slot to allow room for the ‘glass. BE CERTAIN TO TEST THE CENTERBOARD IN THE TRUNK FOR A FREE FIT BEFORE LAUNCHING.

Stems can be reinforced in a similar way, but multiple layers of cloth only, each a little wider than the first, can be worked-down the stem; 5 or 6 layers being enough for the larger boats. Matt is hard to feather and shows lots of bubbles.

Centerboards, fins and rudders are best ‘glassed with two layers of regular cloth in Searunners; more for other designs. Do one side at a time while the piece is lying flat, and later tape the edges with cloth. The latter is a little difficult if the edges are sharp, and the builder may have to stand by, working the stuff down until it gels.



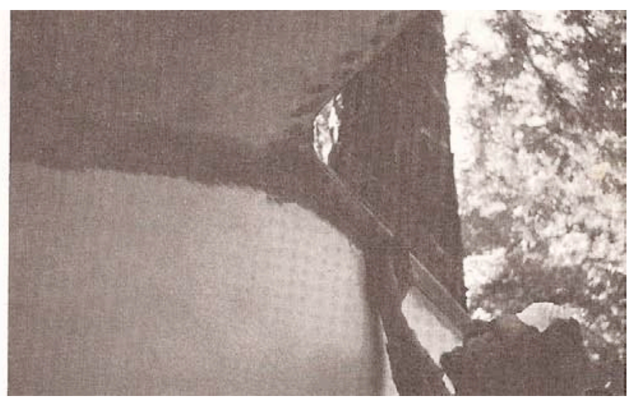
Fiberglassing Centerboards and Rudders

Under-wing seams in Searunners, that seam that falls beneath the cabin-side panel in the fixed-wing boats, need a husky reinforcement. Cut tapes of 2 layers matt, one 2" wide and one 4", with a 6" wide cloth cover, all about 4' long. Stack them in readiness. Pre-saturate on a 4'x8" strip of ¼" ply. Carry this sodden tray over to the under-wing. While one person holds the tray up near the underwing, another person works the tape up into its overhead position. Sand while green.

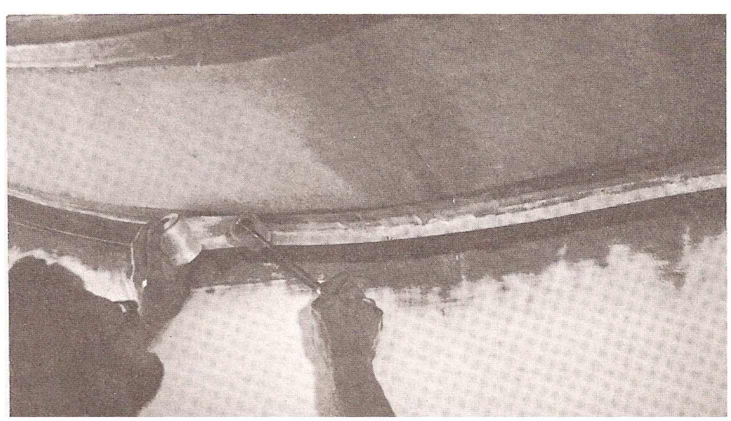
Extremities such as bows, and cavities such as cockpit floor corners, can be reinforced with round patches. Cut circles of cloth, and tear out smaller circles of matt (tearing matt, instead of cutting, makes for self feathering edges), and pre-saturate them on the bench. When pressing them into place, they will be found to contort around to fit almost any shape, like an "elastoplast" bandage. It may take several, staggered patches to cover. Trim and sand while the lay up is still green. Such patches are also used to reinforce critical fastenings. Thru-bolts on the mast, rudder and other fittings, may be protected from the bolts enlarging their holes by applying a band-aid, and later drilling the hole. Two or three circles of matt may be used under one larger circle of cloth, the band-aid being a little larger than the base of the fitting.

GUNK FILLETS

All inside corners, such as at the cabin to deck joint, and under the wing at the wing to hull joint, can be given small radius fillets made of gunk. They are applied easily with tools like a spatula cut from thin plywood or metal or formica. Simply scoop up some gunk with the triangle shaped tool, choose the angle which best fits the place you are filling so that the tool slopes well forward in the corner, and spread out the gunk with a single, long stroke, holding the sides of the triangle against the walls of the corner. Make up this gunk from finish resin, and sand when set with the foam pad and 60 grit. The fillets make it much easier to 'glass the corners and give the boat a molded, organic appearance.



Overhead gunk fillets are made (above, left) with catalized microballoons in a calking gun. After rounding the fillet with the triangle (above, right) and allowing it to set, the seam is taped with two layers of 3" wide cloth tape using a little roller.

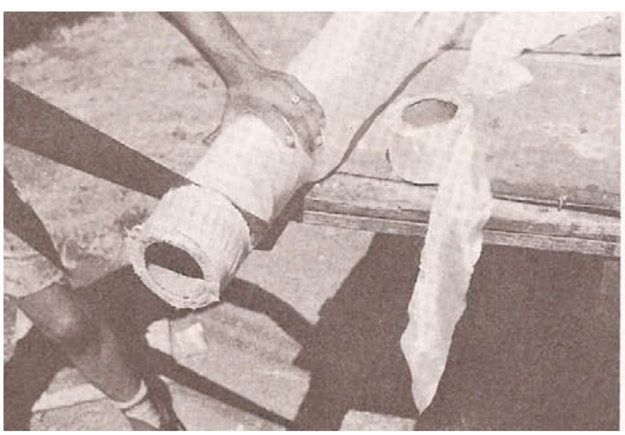


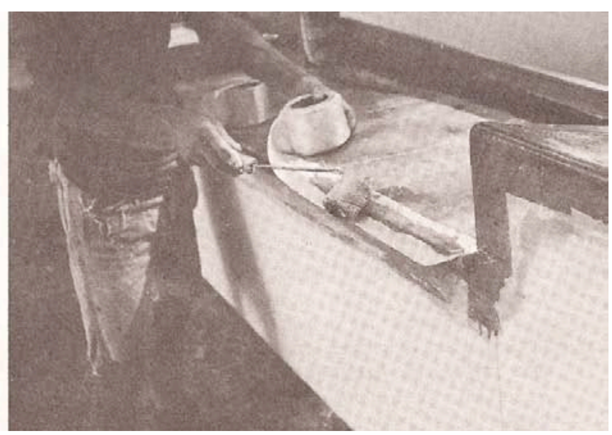
Overhead fillets are easy to apply if you squirt the gunk up there with a calking gun. Large paint stores or boat supplies have empty calking tubes you can fill yourself with catalized material. Apply a generous bead to the overhead corners and run along with the spatula to achieve the desired radius. Some experiment is necessary to learn just how thick to mix the gunk and how large a bead to apply so there is enough when making one stroke with the spatula. Very little sanding of the fillet is necessary if the technique of applying it can be learned. But it's still a sticky job.

Cut 'glass tape is available in various widths made from about 8 oz. cloth. This is the best stuff for fiberglassing fillets and convex radii. All of the points where plywood comes together at corners and ledges should be taped with a minimum of two layers of 8 oz. tape. We buy 3" wide rolls and stagger them slightly to end up with a strip 4" wide and double-thick in the middle, over the seam. Run this tape around all the gunwales, cabin brows and chins, in the cockpit, under the wings; everywhere there is a corner. If you shirk the taping you'll have maintenance troubles later. A 2" wide roller makes quick work of it. And, as always, sand while green. But keep the sander on the flat - don't sand through the tape. Do the outside radii by hand - it's fast work. Slight pits will be revealed when sanding this 8 oz. tape, caused by sanding into tiny bubbles.

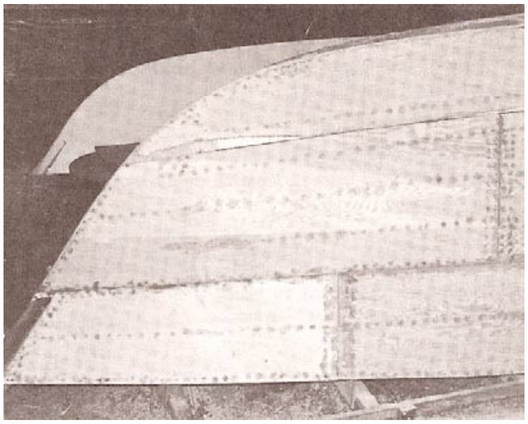
Four-ounce tape, incidentally, is easier to use than the usual 6 oz or 8 oz cloth tape that comes in the gauze-like rolls. But rolls of 4 oz. tape are unavailable - unless you make your own. When you have a wide roll of cloth that gets down to about 30 yards remaining, set it aside and make tape out of it. Bind the roll tightly with masking tape where you wish to cut through the whole roll; 3" wide tapes are about right. Brace the roll against a block of wood nailed to the bench, and cut with a 10 pt hand saw! It will dull the saw, but it will give you tape with nice sharp edges and surprisingly few strings. The light cloth makes better tape because it entraps fewer air bubbles and is easier to feather. Applied with a 2" roller with the alternate layers of tape staggered slightly (minimum 3 layers including overlap from adjacent panels), you'll get a nice taping job. We call this "De Rush Method" of taping because it goes pretty fast.

By the time you get to the outside taping you'll be a fiberglass expert, and you may wish you weren't. 'Glassing is hard, messy work. But it moves along. If it doesn't, you're being too fussy. Push yourself - it's the only way to develop the skills. Your own system, different from mine, will evolve. There's something tempting about mummifying your creation in inert plastic, and one gets to asking a lot of himself. Too much, unless you're going to try selling the product in an automobile showroom. Knock it out. Once it's in the water all those imperfections won't be noticed.

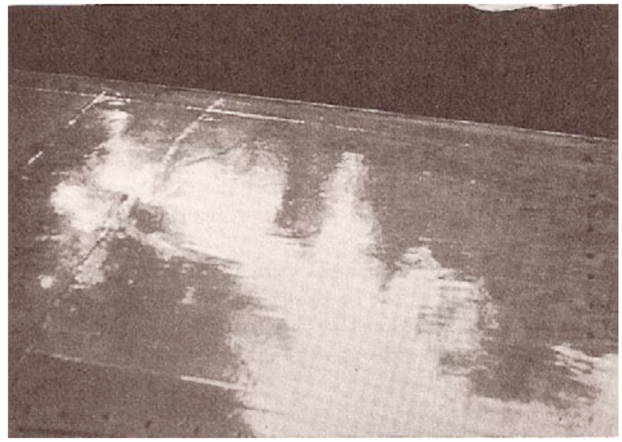




Cut 4 oz 'glass tape by cutting off small rolls from a large roll with handsaw. Apply two layers at once, wetting out both with the same batch of resin, to avoid feathering between layers. Stagger the edges slightly to reduce feathering. There are miles of this work to do, so learn to do it fast; two or three layers at a time.

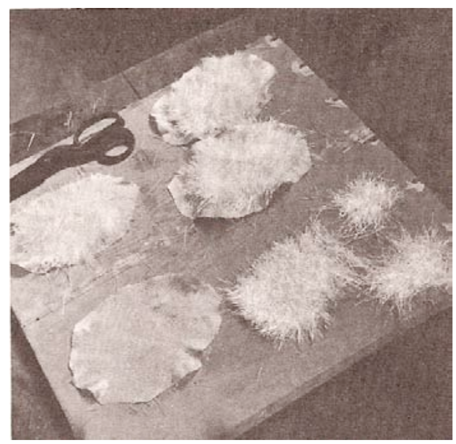


Ready to ‘glass, after microballoons.

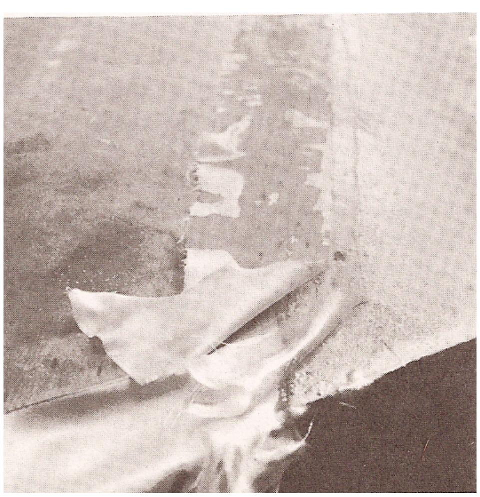


The finish coat, unsanded.

Narrow strips of matt or Fab-Mat, when combined with wide strips, give added thickness at seam, with reduced weight.



Round patches cut from cloth, torn from matt.



Two extra tapes at longitudinal seams.

Ready int he evening,cover at night, GO in the morning.

MINIKEEL

Minikeel construction can be scheduled either before or after fiberglass sing the hulls. If you're working outside, go ahead with 'glasssing and then deal with the minikeel.

This feature is optional; it can be omitted or included for reasons discussed under Ruddersss and Self-Steering. If you omit it you'll save yourself a lot of work but it could cost you hull damage and reduced steering control later.

Material for the minikeel can be lumber or plywood or a combination of both, all laminated together. But it's got to be dry. If you build this part with green boards it will warp and crack the fiberglass, especially if they are "two-by" boards as suggested in the plans. And if two-by lumber is used, select straight, un-twisted pieces because it is too stiff to straighten with clamps when gluing.

Glue joints between the laminates are not too critical because there is so much glue surface. Clamp and nail the parts together as shown in the drawings and photos.

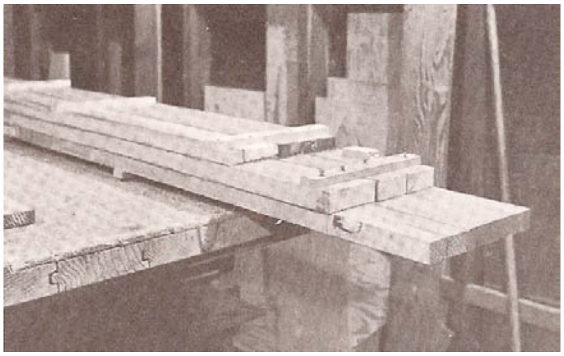
Photos show that the minikeel can be built in four sections, each roughly shaped, and then located on the boat, around the protruding trunk, and pinned together with large nails. Remove the parts and register them together with these pins when gluing up the four sections.

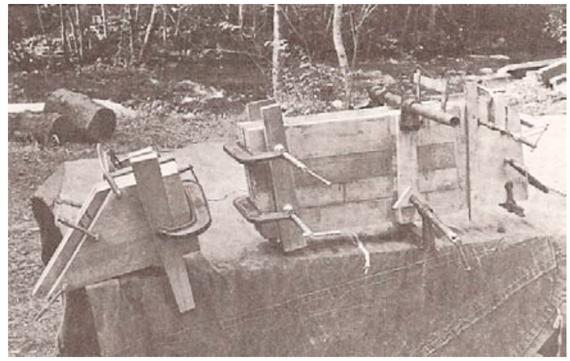
Shaping is done by making saw cuts of varying depths, cutting down to a curve drawn to a bent batten, as in the photos. Chip-off the excess material and fair-up with a power plane or grinder. Fiberglass heavily. Use matt and cloth or at least four layers of 4 oz. cloth on the sides and about eight on the bottom. Do as much of the fiberglassing and sanding as you can while your minikeel is on the bench because it is much less accessible on the boat. Install the finished part on the boat using lots of very thick glue or resin mixed with microballoons so that it can barely be spread with a stiff brush. Catalyze cold to give yourself plenty of time to smear up the trunk and the minikeel with your adhesive. Get some help in lifting it up on the boat. Work from a sturdy scaffold on both sides of the hull.

Fiberglass with heavy cloth tape where the minikeel meets the hull, and tape around the slot going into the trunk - with matt and cloth cut about 6" wide, applying a lay up nearly ¼" thick and wrapping it down into the trunk. This 'glass forms the bearing surface for the board to the trunk. Don't leave lumps or overlaps in the trunk which would restrict the board.

Put a plug inside the trunk, with a cut-down 2x4 and masking tape, to keep resin from running down in-side the trunk beyond reach of your tools, as discussed in Fiberglassing, Phase II. Sand off the very bot-tom of the minikeel as flat as possible to aid in fitting the wormshoe.

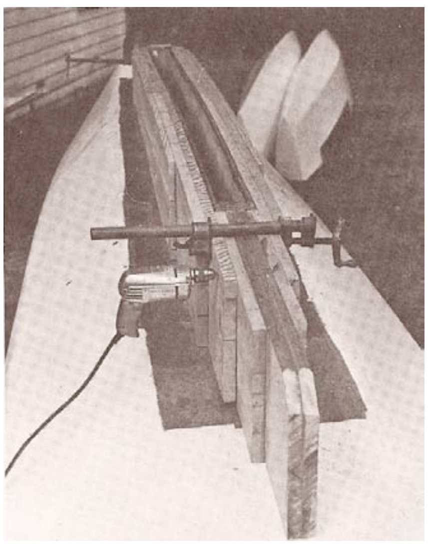
A Wormshoe is a classic term referring to a sacrificial timber on the deepest part of the vessel which can be bumped and battered and easily replaced at haul out time. They are traditionally made of very hard wood, like ironbark, but we use good 'ole plywood. Cut the shape to fit the bottom of the minikeel and soak it in green cuprinol before installing with bronze nails. Drill through the fiberglass on the minikeel to admit the nails and put a patch of mastic around each nail hole before installing the shoe. If properly protected with preservative and bottom-paint, such a wormshoe will last for years. Note that the aperture in the wormshoe can have a shape to restrict the travel of the centerboard; to keep the board from going to the full-down position (desirable in Searunners) the aperture in the wormshoe can begin 6" aft of the slot in the trunk, and be shaped parabolically like the leading edge of the board. The aft end of the aperture can be similarly shaped, and be located 1" from the aft edge of the trunk opening. Make a paper pattern of your wormshoe and wrap it in a stiff tube and a double plastic bag so you can pull out the pattern to make a new wormshoe when you haul out at Rabaul or Gibraltar.

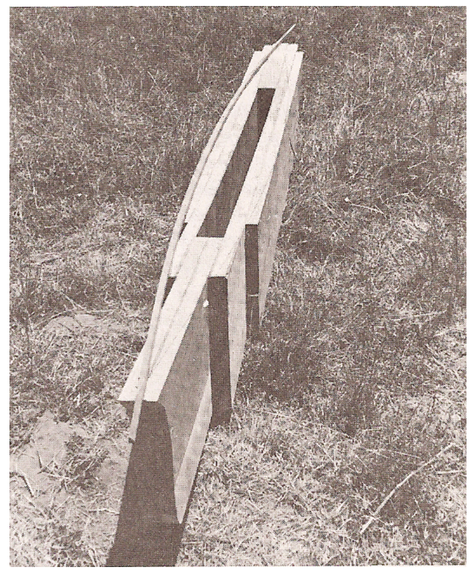




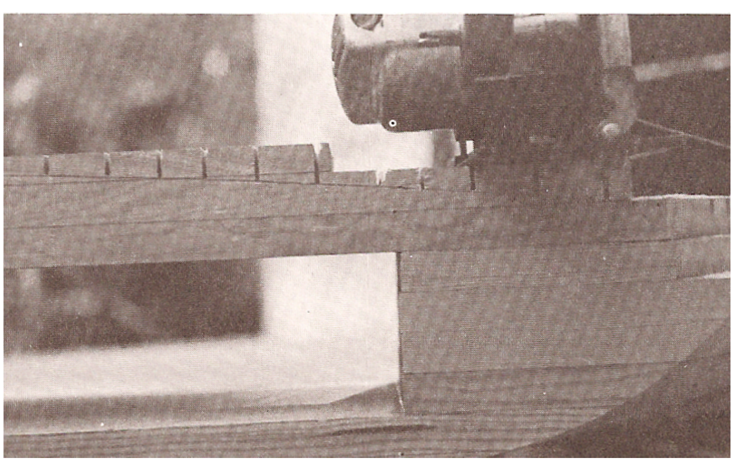
Glue-up side pieces.

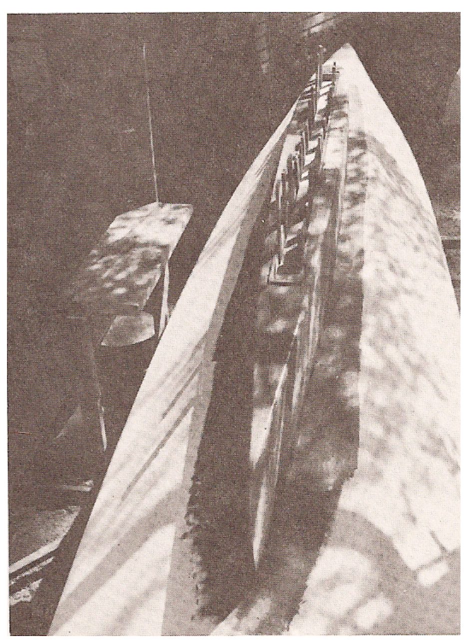
Glue-up end pieces.

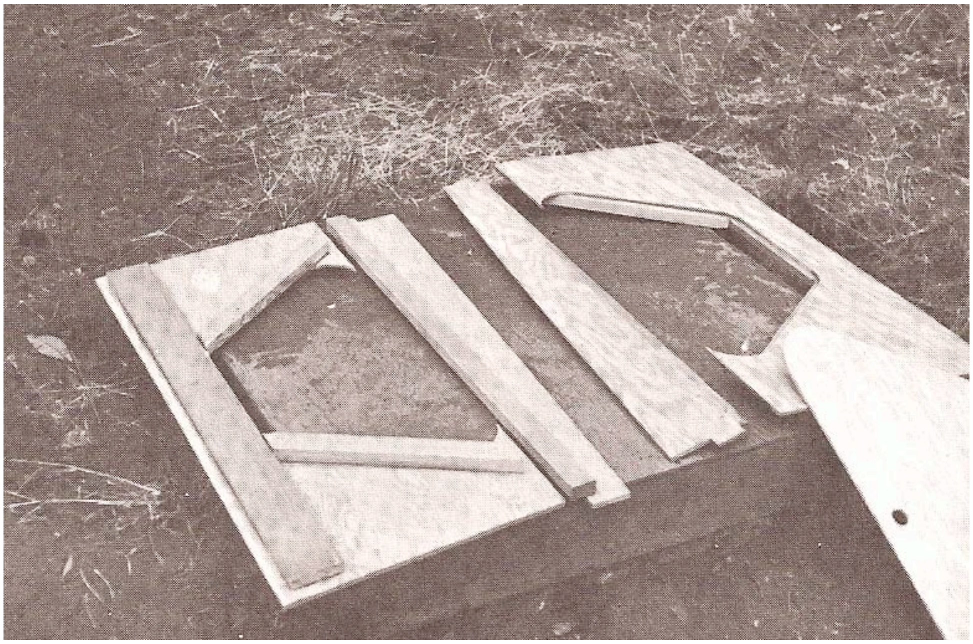




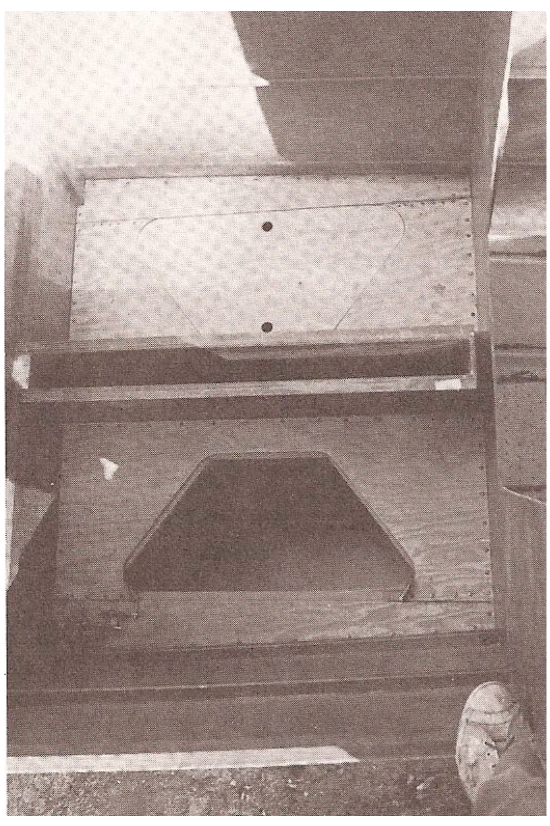
Locate sides and ends in place on boat and pin together for register. Remove and glue-up minikeel. Bend curve with batten. Shape with varying-depth cuts. Fiberglas and install on boat using wedges to force trunk walls out against minikeel.







Before going on to Phase III, there is a structural job that should be done first. All of the larger Searunners have a "permanent sole" adjacent to the centerboard trunk and just above the bilge. The purpose of this panel is to support the walls of the centerboard trunk. Fierce strains are exerted here by lateral strain on the centerboard - as it cantilevers out the bottom. The "permanent sole" panels are to accept this strain and deliver it into the frames. Space below the soles is useful stowage and so access holes can be cut in the panels to allow entering the bilges from above. Photos show these sale panels before and after installation in the 31-footer. The shape shown for access holes is to give maximum support to the trunk. In larger boats it is sometimes not necessary to install them in two pieces, but it is in the 31. Be sure they are attached securely, <u>with glue</u>, to the <u>frames</u>. The joint at the planking may be made wi the fiberglass tape.



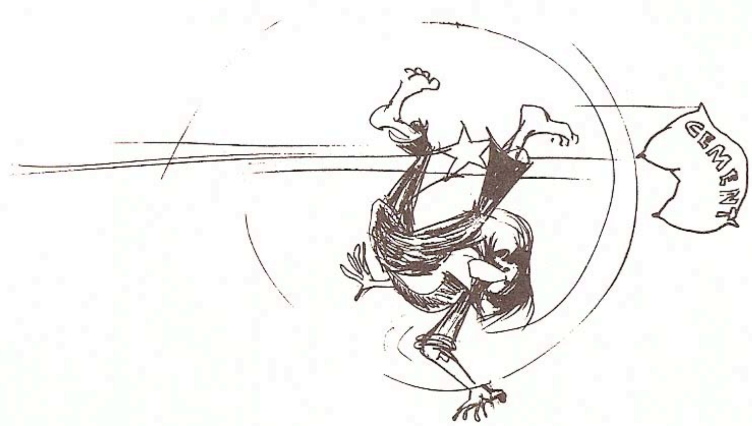
When taping your chines with fiberglass, if you get all wound up in the first piece, and there are a bunch of bubbles and wrinkles, pull it out and throw it at some inanimate object that needs reinforcement, and start over.

1.

2.

3.

4.

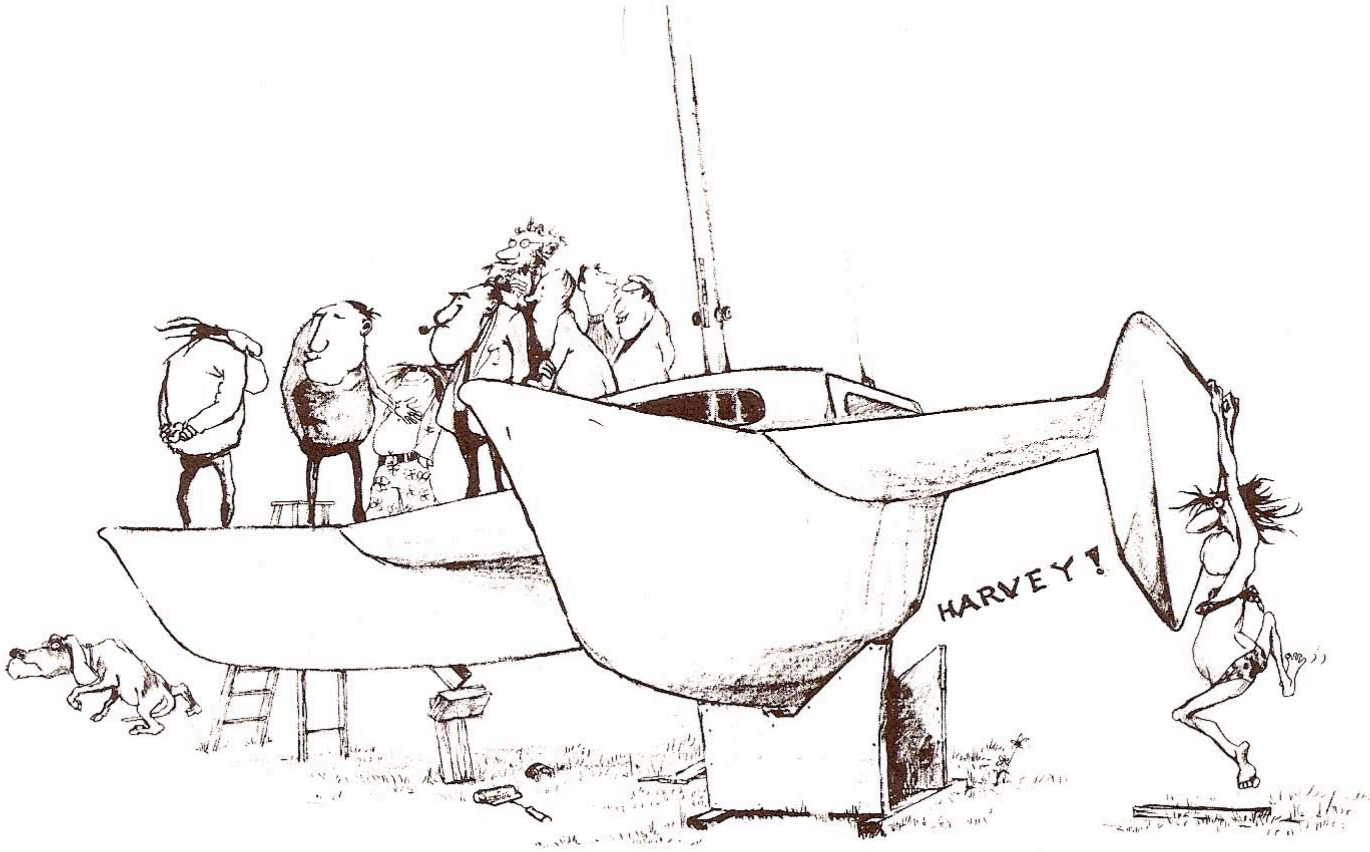


You and your wing-ed craft have taken on a trampling herd of neighbors for a formal interview. Or perhaps you have dived overboard with your waterproof camera to catch a snap of a deckload of natives. You and your <u>super structure</u> are the centers of attention now.

Mark Hassall took the picture

PHASE III

WINGS, DECKS & SUPERSTRUCTURE



Fabrication of the hulls in Searunners has been substantially simplified for the builder in the design stage, and joining the hulls into a unit is also easier in Searunners than in many other types of trimaran construction. But brother builder, be forewarned! Whether you're constructing a ferrocement unimaran or a spidery wooden outrigger, once you've got the hull(s), you're just beginning.

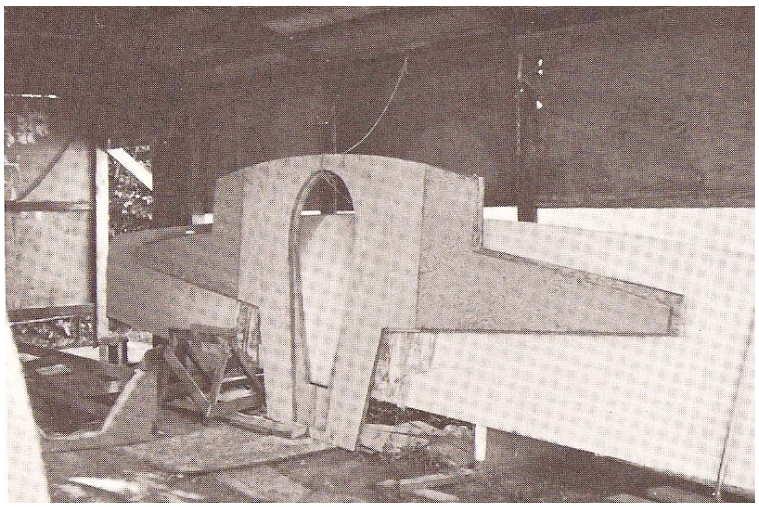
It's a good beginning, maybe twenty percent of the project. But resist the temptation to set your launch date. It's like predicting the election from the count of only 5 precincts out of a hundred - without a computer. Looking from astern, if you've put in what it takes to get those fish-like hulls constructed, and enjoyed it, now you've really got something coming up off the bow. It looks like a bird and it's super.

Joining the hulls. In A-frame boats the craft receives its wings at the end of Phase III, when it is even more impressive a change. But in fixed-wing boats it happens now. You've got to hook 'em up before going on with wings, decks, and superstructure.

Main-strength bulkheads can be built in Phase I with the frames. But you don't need them until now, for joining the hulls. Build them from the full-size patterns, laying them out just like you did the frames. Here it is necessary to tape two patterns together to gain the full size. After cutting to shape both sides of the sandwich out of plywood, cut the lumber truss filling and glue it to one of the pieces of bread. Paint with glue all the voids that will be left inside, and close up the sandwich. The glue acts as a preservative in these voids. It has a formaldehyde base and renders the atmosphere in there so toxic that no beasties can grow.

Glue is preferred to preservative or paint in such places because both of the latter are extremely difficult to apply, in this case, without interfering with the final glue joint. Preservative is so splashy and penetrating that it is fairly impossible to apply it only where you want it in the trusswork. If it gets on a surface to be glued, it inhibits the joint.

While constructing these sandwich bulkheads you will be impressed with the apparent flimsiness of the materials, and by the number of pieces. Be relieved to hear that, as of this writing, none have broken in thousands of miles of ocean sailing. And don't get fussy with all those interior pieces. Their joints to one another are made entirely by the plywood skins, which will span the gaps of crude carpentry. Use good lumber; get good ply to lumber joints (a staple gun helps - see Power Tools) and hold the outside shape to within about ⅛" of the pattern. If you're a half inch out anywhere it will still work. And the strength of those bulkheads - once the wing and superstructure are built around them - is known to be sufficient even if very badly built. I had my doubts too, at first. But we've given them a grand opportunity to fail by exposing them to unreasonable abuse from driving hard to windward against conditions where any reasonable sailor would have turned around. So don't get traumatized into overbuilding the main-strength bulkheads. Just get them done.



Main-strength bulkheads for the 37-footer

When completed, they are flexible in a fore'n'aft direction (but not up-and-down); flexible enough so that you need to clamp a 2x4 across their cut-out passways (in the big boats only) to stiffen them while moving them around, or they might break at the "archway". And flexible enough so that their mounting bolts can easily pull them up to a snug fit and a good glue-joint against your (maybe imperfectly aligned) connective frames in the hulls. This flexibility is a key factor in facilitating the joining of the hulls in Searunners. Other designs with crossarms instead of main-strength bulkheads contain beastly alignment problems for the builders.

Wing bulkheads are those that fall between the main-strengths to establish the lines of the cockpit, etc. They are also built from full-size patterns in the plans, but they are not of sandwich construction. Make them look about like the frameplan drawings.

Wing frames are portions of some of the wing bulkheads; those wing bulkheads which do not protrude through the cabin-sides to the floats. The wing frames go in after the cabin sides, as shown in the plans.

Cabin side panels are those cumbersome longitudinal members that complete the wing framing, mount the chainplates, and plank the sides of the superstructure. These are structurally important components. The cabin-sides should be made of marine plywood in the vicinity of the chainplates (which support the mast).

A flat place is needed to build them. If no such floor is available at your site, build them on the strong-back. Layout the dimensions on panels of ply, according to the drawings, and install the indicated lumber portions to them with glue. The things have to go together with the other wing framing like a house of cards. But because of the size of this card, cut the appropriate notches, etc. a little sloppy, for clearance during the assembling.

Basic instructions for building the main-strength bulkheads, wing bulkheads, wing frames and cabin sides are on the drawings. Try not to belabor the jobs, and finish by applying one layer of fiberglass cloth to the areas of the cabin sides and wing bulkheads that will be exposed to weather, on deck and in the cockpit. Sand this 'glass as soon as it is set.

All these wing components can be pre-fabbed even before setting up the hulls on the strongback, in Phase I. It's nice to have them already done when you get the hulls ready to receive them. And if you begin the project in winter, it is wise to pre-fab as much as you can before spring - if you're building outside. These pre-fabrications are made possible (without the hulls to fit them to) by the full-size patterns in the plans. No other plans we know of offer patterns for these parts.

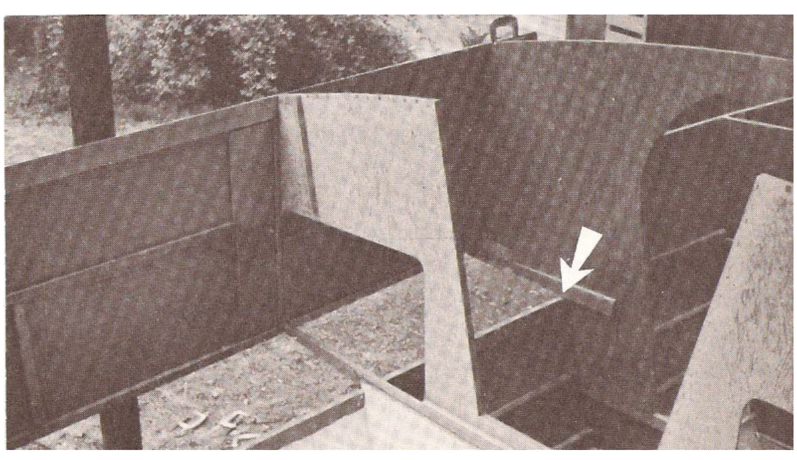
And after you have finished the hulls, you can move them to a more convenient site for fitting them together with wings. By pre-fabbing all wing framing, including cabin-sides, and maybe even procuring all the outfitting materials discussed in Phase V (and listed in the appendix for your design) you could have all the pieces ready to throw together at the new site.

JOINING THE HULLS

Joining the hulls isn't exactly throwing pieces together, because these pieces just aren't thrown. Muscling them around is a job for all your friends and neighbors, and some rudimentary equipment. But with multihulls, more than any other type of boat, the builder is released from the weighty task of fitting a massive monohull with a chunk of metal ballast that weighs (size for size) more than your whole boat. Without special skills or equipment, you can get your bird together.

In the 25'er, the main-strength bulkheads are already in - the hull was built over them - but in the larger boats it would be hell to turn them over with those arms sticking out. So, with the main hull resting firmly in its cradle (see cradle photos) and located so that you can complete the project (hopefully without moving her around), drop-in the main-strength bulkheads.

Install the main-strength bulkheads. These are mated to the connective frames of the same number (#4 and #7 in the 31, #4 and #8 in the 37, and #4 and #9 in the 40) with bolts, glue and nails per the drawings. But before locating the bulkheads, bevel-off the top of the underwing stringers with a grinder to receive the underwing panels. And before drilling the bulkheads and frames for the bolts, carefully locate the bulkheads with clamps so that centerlines, reference lines and eyeball lines agree. Stand at the bow and eyeball down the under-wing surfaces from one bulkhead to another.



3l'er bulkheads and cabin-sides show how wing bulkhead #5 mates to hull frame 5 and to cabin side. Arrow points at gap which admits underwing panel over wing stringer.

They should be exactly parallel. Your eye will tell you better than an instrument. Be certain that the under-wing surface of the bulkheads is above the top beveled surface of the under-wing stringers - above by at least the thickness of the under wing panels for your boat (¼" in the 25 and 31, ⅜" in the 37 and 40) because these panels have to later fit in to the gap you leave now. Drill for the bolts, then remove the bulkheads and apply the glue for final installation. Don't over tighten the bolts; they are to form a glue joint clamp only, and may be removed after drying, if you know your joint is good. Spot in nails as shown to bond the ply portion of the connective frames to the bulkheads. That's it.

Mount the outriggers. In the A-frame 31, the exact same procedure applies to mounting the bulkheads, but not to mounting the floats - that comes later. In all fixed wing boats, however, now is the time to mount the outriggers on the ends of the protruding arms of the main-strength bulkheads. The easiest way is to call upon your friends and neighbors. But if you're a loner or don't trust your friends and neighbors to manhandle your outriggers, you can use chain hoists or come alongs from overhead, or lever up a cradle from beneath. Mostly we just get a case of beer and put out the word. You may even make some new friends and neighbors.

You'll need some C-clamps to hold the float in its position, and a sturdy table or barrel to place under the float keel to prevent the one-floated craft from tipping over in its cradle when the gang lets go. Make a trial fit. Get the deck levels lined-up; check the center-lines and do the same thing for that gap between the under wing stringer and the bulkhead that you did on the main hull. When it's right, drill for the bolts; drop her down to apply the glue; raise her back up to find the holes with the bolts, and squeeze 'em up just snug. Spot in a few nails in the ply portions of the connective frames, and repeat on the other float. The whole job of joining up can be done on a Saturday afternoon if you've really got things ready. But if your bolts are too short and you haven't got a step ladder and the beer gets warm in the sun while your helpers wait for you to run down to the hardware for a glue brush, then chances are you may be in for fits of exasperation once you put to sea.

Install the wing bulkheads to the waiting extensions of the main hull frames using glue and nails. Screws are handy when working alone, when you can't back up with a maul for nailing. But before joining with glue, eyeball the location of the wing bulkheads in a trial fitting. Make sure the cabin side surfaces are aligned for a straight cabin side later. Check the centerlines, eyeball the under wing surfaces and get that gap for the under-wing panel. Then glue the wing bulkheads in. In the 37 and 40, note that wing bulkhead #6 goes full width into the float, like the main strength bulkheads. With such large components you will encounter some minor alignment problems even if built right to the pattern. But a little shaving here and a tapered shim there should be all that is necessary. The worst thing that could happen is that you get a wing bulkhead in backwards (port for starboard), or you find that, after the glue is dry, one of them is fastened to the wrong side of its mating frame in the hull or float. None of these troubles is really serious, but they could cost you lots of time. So get them right. Check the trial fitting, and check the final fitting before the glue is dry.

Wing beams are scabbed in supports for the deck and under wing near the edges of the wings. They are needed in a place where there is no framing in the hull or floats to fasten them to, and so must be "scabbed-in". They'll come out stronger than you imagine, but how to get them there isn't obvious. It's like fiddling something out in mid air. Start by notching the cabin side, and the outside wing stringers (curved plywood). The latter can be done with the tip of a saber-saw and chisel. Install the transverse stringers - they describe the shape. Now scribe ply panels to fit these stringers, and install. That's it.

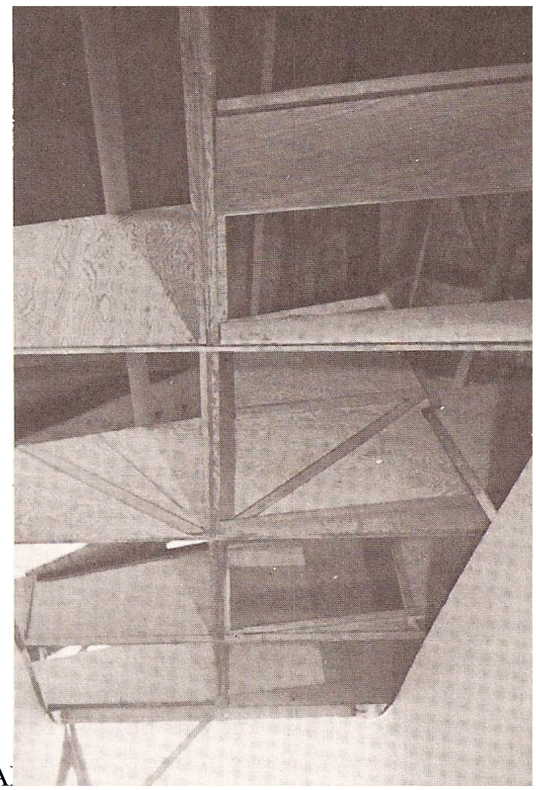
Install the cabin sides. In the 25, and 31 A-frame, the cabin sides go on easily because no wing framing protrudes through them. Nonetheless, some builders with a fetish for accuracy may wish to wait until the main-strength bulkheads and wing bulkheads are installed before building the cabin sides. They can take measurements from the boat and build the cabin sides to fit. But mostly, we just go by the patterns and clean-up discrepancies with the plane or the grinder.

See the 3l'er appendix for directions on pre-installing the A-frames before the cabin side panels.

In fixed-wing boats there is bound to be some adjustment of the cabin side notches, etc. to get the whole to fit. A saw cut there, a chisel cut here, and some patient helpers lifting up and down so you can watch for the restriction, is all that should be needed. Make a trial fit, then glue and fasten. Get good glue joints at the forward main strength bulkhead. Install the simple wing frames from cabin side to float. Tack a batten across the cantilevered, curved up ends of the cabin sides to protect them in the rest of the construction, and to visually describe the edges of the wings.

See, it really is bird-like. From the ache in your neck and the glue in your hair from working overhead, you know how it got to be a bird. You built it!

Cabin side panel for the 37 and 40 is so long and floppy that some support from a clamped on 2x4 is desirable while handling. After installation it mates with the wing bulkheads to form a very rigid structure.

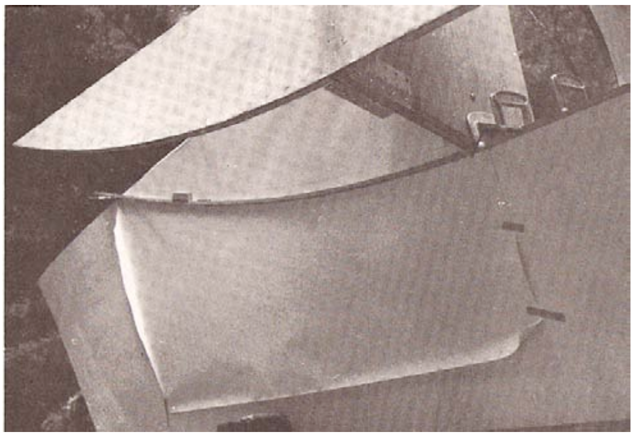


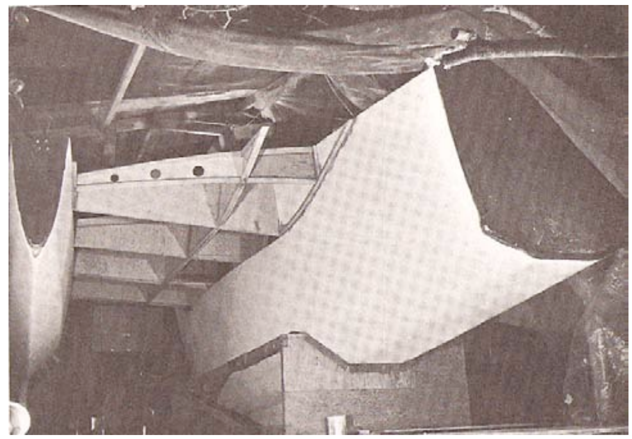
UNDERWING PA

Underwing panels are bitchy. There's no better word. They are hard to cut, fit, install and fiberglass. Fortunately, most of the surface is fiberglassed before the panel is installed, but the edges, seams and fasteners have to be taped - overhead - to complete the job. We've worked out a few tricks which we'll pass along here, and hope that you endure this operation because, by consensus, once this is done the rest is downhill. Cutting the panels to shape is done by a technique of scribing. You tack the rough cut panel as nearly in place as it will go, and mark the curved edge (next to the hull) with a scribe. Let's say that a given panel will fit to within 2" of the hull at the widest gap. Take a scrap block of wood 2" wide; place it against the hull so it bears on the panel to be marked. Slide the block - and the pencil - down along the hull, duplicating the curve of the hull with your line on the panel. Now remove the panel; cut to your line, and replace the panel again. This time it fits rather closely, right? Except, to get it to fit into the hull, over the under wing stringer in that gap you have left, you've got to cut some notches in the panel to admit the wing frames, etc. With the panel tacked right where it is, mark those notches by extending straight lines out from the frames. Now remove the panel again and cut the notches. This time when you put it back, it's got to fit - or does it? Probably you'll have to chisel out a little from a tight "gap" or a tight notch somewhere to get it to go.

Now it fits at the hull. You've had to cut-off at least 2" from its original rough cut shape, and let's hope that the original shape was left large enough so that you still have some extra wood at the other edge; the edge along the bottom of the first cabin side. Arrange it that way with your first rough cutting.

With the panel fitting firmly in place at the hull, mark a line where the cabin side mates with your panel - mark both the inboard and outboard edges of the cabin side. Remove the panel again (again?!?) and cut exactly between the two cabin side marks. That's it. That's one panel anyway, and that's the basic method.





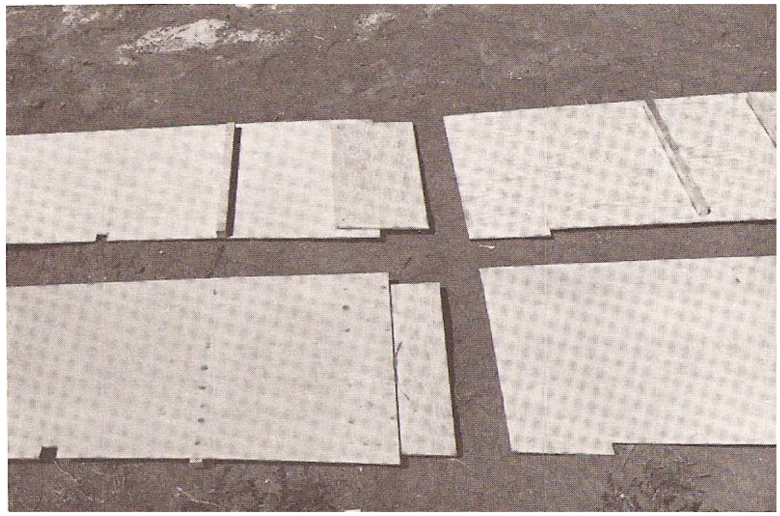
Pattern for curved portions of wing stringers is made by scribing along a batten (left). To install, sand paint off of hull (right) and fasten with epoxy glue with ¾" screws from inside.

For the curved portions of the under-wing, where the panels bend up to meet the edges of the wings, it is pretty hard to bend the ⅜" thick panels for the 37 and 40 footers. It's easy after they are cut to shape, but rough cut, they are pretty stiff. We usually make a pattern out of scraps of ¼" ply, scribing-in the curves as described above. It is much simpler to bend to shape the strips of the pattern (see plans) than the full panels. Tack a diagonal brace across the pattern - while on the boat - to hold its shape when the pattern is removed. Mark around the pattern onto a ply panel, cut to your marks, and it should fit exactly. But it doesn't have to fit exactly; it can be a quarter-inch out anywhere and still serve, if you do a good 'glass job later.

In the 25 and 31 footers, the under-wings are ¼" ply (do not increase) and so can be easily bent to fit while marking, without using a pattern.

The 37 and 40 footers are prone to take a hell of a beating under the wings if they are overloaded or over-driven in some conditions. Some builders suspect the central seam (the one at the cabin side) to be weakly designed and elect to locate it 8" outboard of the cabin side and cover inside (or outside) with a 6" wide butt block, full length. In the designer's opinion this is unnecessary, IF the usual seam is well fastened, and covered with a husky tape of fiberglass as described in Phase II.

But there are butts. Cut and fit butt blocks per plan for the transverse seams in your underwing. They are thicker than the planking butt blocks and so are installed by fastening from outside-in. A nice trick is to install them to one panel (one side of the butt seam) allowing half of the block to extend, ready for fastening the adjacent panel to it. The adjacent panel can best be fastened to the blocks with screws, driven from beneath.



Underwing panels ready to install with butt-blocks half attached to one panel, ready for other panel. Fasten second panel with screws from beneath after both panels are on boat. Top pair of panels are shown as seen from above, inside boat; bottom pair as seen from beneath, in the tunnel. Note glue strips and notches. Fiberglassing is done.

But we're getting ahead of ourselves. After all the panels are cut and marked for gluing and fastening, and the butt blocks installed half way as above, fiberglass them on the bench. One layer of 4 oz. is plenty. Note however that where the panels enter the hull to fasten to the under wing, they should not be glassed. A 1¼" wide strip of bare wood should be exposed for a good glue joint at this critical juncture between under wing and hull or float. To keep that strip of wood clean we cover it with two layers of masking tape. One layer is not enough because the resin will soak through, attack the mastic and leave stickum on the wood where you need glue instead. Fiberglass right over the tape. After sanding make a knife cut along the edge of the buried masking tape. If the glass is still "green" you can pull off tape and glass together.

It is really nice to have a staple gun for installing the under wings because overhead nailing is a special skill. If you have to nail, drill the panels for the nails before applying glue - it'll go much faster. And speed matters, as in planking, because an extended "open-assembly time" on a hot day can damage the glue joint. Nail or staple first from inside, along the wing-to-hull joint. This is the critical joint. The bent portions of the panels can be easily forced into shape by using shores (like stilts) from beneath. No steaming is required and the fiberglass has little or no effect on the bendability of a panel.

The beveled strips at the leading and trailing edges of the wings can be best installed with screws from beneath because the overhead hammering is difficult. They can be nailed - or stapled - if you have a helper to hold the back up sledge. Prop up with shores to establish a slight camber while these strips dry - to make decking easier later.

When all the panels are installed, fiberglass the central seams heavily, and apply gunk fillets to the wing-to-hull joints and tape with a minimum of 2 layers of 8 oz. tape. Run a strip of 4 oz. tape over the rows of fasteners you have driven through the fiberglass in the open parts of the panels, and also in the cabin-sides.

In the A-frame 31, slap on an extra strip of 4 oz. cloth about 8" wide to the under wing areas which will be later drilled to receive the A-frames. Sanding the overhead tape is really heavy work, so catch it while still "green"or you'll never get it done right. But honestly, most of this under-wing 'glassing can be pretty rough with no cosmetic detraction to the boat as a whole. Nobody sees it after launching.

More heavy fiberglass is applied inside to the wing-to-hull joint. Use Fab-Mat if you've got some left. Alternately, this joint can be strengthened greatly by fastening 2" wide strips of ½" ply over the top of the under-wing panel, between the wing framing (leave ½" gaps at ends for drainage). Use 2½" nails (1¾" in the 25'er) going down into the under-wing stringer. The object is to hold the panel DOWN onto the stringer in the face of pounding from beneath by wavetops (especially if the boat is overloaded).

Further reinforcement can be added to the bent portions of the wings (forward end only) by taping with matt or Fab-Mat inside, where the wing joins the hull and the float and the cabin-side. All this reinforcement is largely obscured and needn't be too neat.

INTERIOR PAINTING

Now the fun starts - almost. Laying down the deck is especially satisfying because you feel like you're putting on the lid of the pot after filling it with your own home-grown ingredients. But there's one more thing to add: paint.

The subject of painting is involved and controversial, especially on the exterior. But we're talking about interior paint and now's the time to do it. There'll be plenty of light and fresh air with no deck in the way. So unless you're working outside, rushing to beat the seasons, do the initial interior painting now.

You've probably already got preservative in the hulls. It might be wise to spray another coat up around the stems forward of frame 1. You can spray with a "flit-gun" or Black Flag insect sprayer. A good coat of preservative in the wings is important, but it is also wise to apply a special epoxy sealer called "Gluvit" (Travco Labs) in crannies where water will inevitably seek the low points. Just a narrow brush stroke of this stuff is enough to keep small puddles of condensation and leakage from sitting in the low points of the wing. This is especially advisable in the A-frame 31 after the angles are installed on the main strength bulkheads. Gluvit is fantastic stuff, but should be applied before preservative.

It is not strictly necessary to paint in the wings. They may be left with just preservative if you will not be disturbed by a deep darkening of the wood in time. Dark wood does not necessarily mean rot, but it does mean that it's hard to see in wing stowage areas and hard to keep them clean. Paint just in some places if you wish, where the compartments will be occasionally seen. The wet hatch and life-raft hatch areas should be given fillets in the lowest corners with Life-Calk and then coated with Gluvit; two coats where the anchors will be stowed. Paint is compatible over Gluvit and Life-Calk. For interior paint, there is probably little argument against using any "marine" alkyd primer, covered with a "marine" alkyd enamel. Exterior house paint is sometimes formulated to never dry completely - for flexibility. Avoid that stuff. One brand of "just plain paint" should be chosen so colors and thinners and availability are constant.

In the main hull, you can avoid painting surfaces which will be glued-to later, or mask them off. But for the purpose of interior cabinetry etc., glue will usually stick to paint all right if it is roughed-up or scraped a little with a sharp hook scraper. Avoid painting or preserving in the area where the rudder skeg will later be glassed into the bilge at the transom, or you'll have to grind it off to bare wood for glassing later.

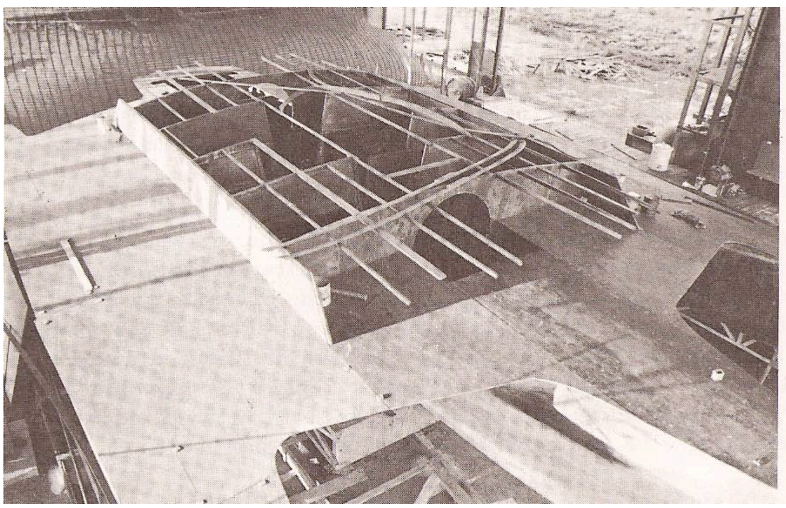
If you do all the coating you want to do in the wings now, before fooling with deck stringers, you won't have to reach around them later. Except to spread on some preservative to the deck stringers themselves. This should be done before "fairing up" the deck in preparation for planking so that any stuff that gets on top of the stringers will be planed off in the fairing-up. It gets involved, doesn't it? But try to keep up with the Gluvit and preservative and paint as you go along because it's hell to reach through those holes into wing compartments later with a paintbrush. In case I forget to mention it later, the underside of the deck itself can be coated with glue wherever it will be difficult or impossible to reach in later with preservative or paint. Try to minimize the painting to be done after decking because the vapor gets stiff and the light is bad and the contortions are real exercise. On the other hand, avoid slapping on layers of paint where it'll never be seen because the weight and the cost add up in a hurry.

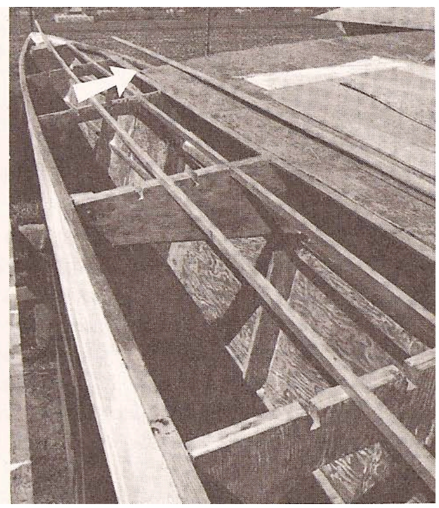
Some experienced builders prefer an all varnished interior because varnish is easy to apply and it is the lightest of all coatings. This requires skilled woodworking and great care in wiping up glue, filling nail-heads with Duratite, and keeping the wood clean. Don't try it unless you know what you're doing. Microballoon gunk with talc can be used for interior filling if you're going to paint over.

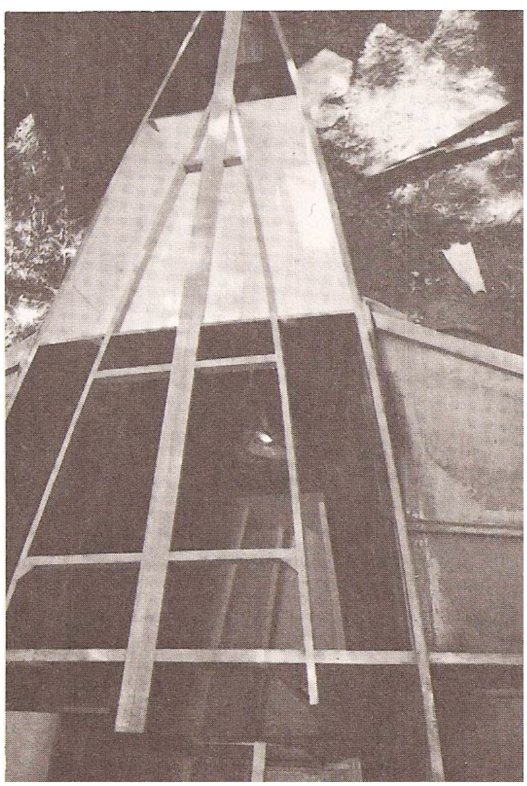
In any case, don't varnish the bilges. Get at least one coat of primer and one enamel in the bilges (up to the shallow chine, including the taped seam) and use some Gluvit and/or lots of preservative in the wings.

DECKING

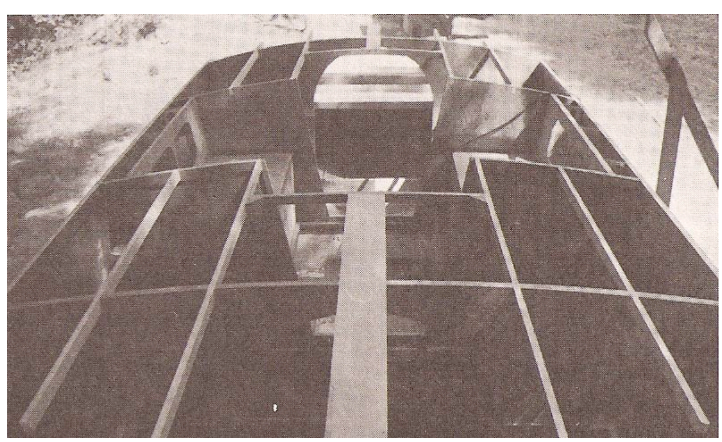
<u>Deck stringers</u> are a pretty straightforward proposition. Go by the drawings. Most of them go in on edge like with the hulls, but some are flat to form longitudinal butt blocks in the decking.







Deck and cabin-top stringers. Top left: 37-footer deck panels tacked in place; cabin-top stringers going in. Top right: 40 footer float deck stringers going in; note wide, flat stringer receives longitudinal seam in deck panels. Below left: alternative method of foredeck framing gives tapered hatches; note fiberglas tape reinforcement inside wing at wing-to-hull joint. "Beveled strip" at wing's edge shows at right. Bottom right: 31-footer cabin-top stringers.



In fixed wing boats there is a flat stringer on the side decks which must be centered exactly 4 feet out from the cabin side. The best way to mark for this is to take a sheet of 4 foot wide plywood and lay it against the cabin side out across the deck. Mark the deck frames along the edge of the plywood and center your stringer on that mark.

The deck stringers which extend to the edges of the wings at the beveled strips need not fasten to the strips themselves. They can float loosely until decking; the deck will hold them in place. A screw through from the bottom of the wing will keep them from flopping (before decking) if they bother you.

The wide center line stringers in the deck and cabin top serve the same purpose: to let seams in the decking fall on them so longitudinal butt blocks will not be necessary. They are extra wide to help avoid a hump at the seam caused by bending down the cambered cabin top decking.

Don't be disturbed by notching through frames and the main-strength bulkheads to admit the deck stringers. The wood you remove is replaced by the stringer, and the whole joint later spanned by the decking, which is the important part of the strength. Just watch out for nails.

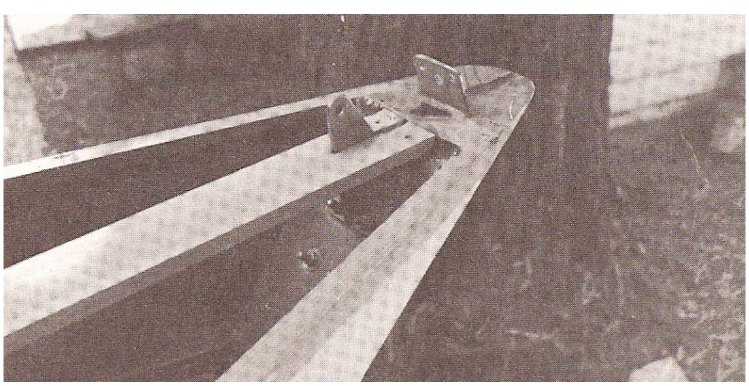
Some of the cabin top stringers "run wild" beyond the main strength bulkheads, their ends to be later secured to the cabin top itself. Their lengths can be roughly scaled from the drawings, but leave them about 6" longer for final trimming later.

Some skepticism has been expressed by builders who feel that the deck stringers, as designed, leave the deck a little springy underfoot. That's right. The deck is a little springy, and there's nothing against it except tradition (men are accustomed to walking on earth or concrete). You'll never put your foot through these decks, and your foot applies the greatest concentrated loading the deck will see; the weight of a breaking wave will be distributed more than the weight of the crew. If you insist on stiffening the deck, try using 5-ply ⅜" plywood for decking, or locate the stringers on 9" centers instead of 12" as drawn. But it's not necessary. The added weight means there is something else you can't afford to take along.

Framing the hatches is facilitated by using mahogany for the little corner blocks, and installing them with screws. But if you drill for nails and use a back up weight when hammering, fir and nails will work fine.

Installing the stemhead fittings and the float transom fittings is done before decking. Be sure enough of these stainless parts will protrude above the <u>finished</u> deck to allow attaching hardware through the top holes; one hole diameter of clearance, above the bottom of the hole itself, is minimum - two if you're going to use chainplate covers.

Carefully notch the back of the main hull stemhead timber to receive the forward butt end of the kingplank. The vertical cut of the notch can be made with the skilsaw if done before the stemhead fitting is installed. Otherwise you'll have to chisel it out, carefully.

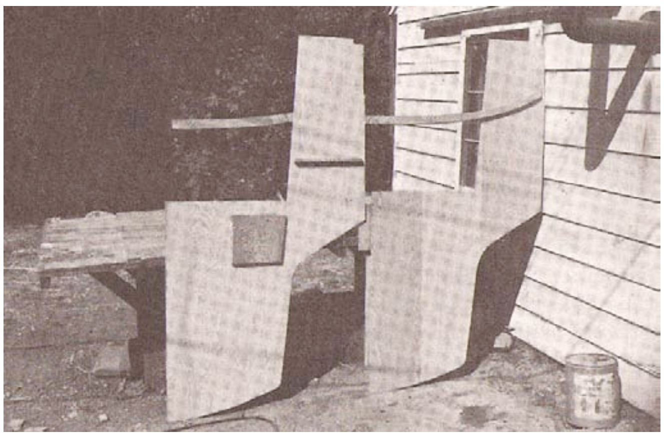


Main hull stemhead fitting, with optional roller-furling headsail tang, and kingplank carefully notched into stemhead timber. Just before applying the deck, squirt heavy beads of Life-Calk around these fittings to form a seal <u>beneath the deck</u> to keep water out.

Before installing the main stemhead fitting, squirt a little wood preservative into the bolt holes and let it dry.

The float transom chainplates can be installed outside the transom by glassing the nuts in place inside for the bolts - to be inserted later; because you can't crawl in that far to hold them with a wrench after the deck is on. Better, I think, to put the float transom fittings inside. Notch away some of the deck glue strip to let the chainplate lie flat against the plywood in the transom. Bore for the holes, but counter-bore first from outside to let the nuts and washers be sunk into the aft face of the transom. Fill over them with gunk and fiberglass later when 'glassing the deck.

Deck panel. Some transverse butt blocks are required, and should be installed half at a time as with the underwings. You can get all the panels ready to go and then rent a staple-gun, or else get the gang in again for a traditional "Raising of the Roof". But beer spilt on deck inhibits the bonding of the fiberglass, so sand off any stickiness before 'glassing.

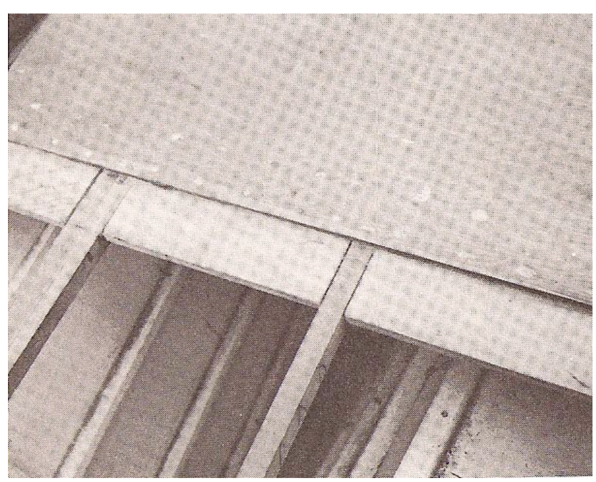


These 31-footer sterndeck panels have cabin "chin", glue-strips, and doubler for stern anchor cleats installed on them before the deck goes down.

If you're working outside in damp weather or fog, roll on a coat of bonding resin to each panel as it goes down (assuming it is good and dry). If your bonding resin has a lot of tackiness to it, you'll have a time keeping the new deck clean until you get the 'glass on. But the goop can be scrubbed with an acetone rag. This coat of resin will exclude moisture which may otherwise enter the deck plywood before you get around to 'glassing.

Now it's really happening. You're putting on the lid and you deserve some sincere congratulations. If you're working alone and nobody seems to notice what's going on, believe me that there are lots of us who know what this is like for you. Congratulations! There's a good way to go yet, but it's getting done and you're doing it.

Deck panels have transverse butt blocks installed half at a time. The adjacent panel can be nailed into the butt blocks if a helper backs up from beneath with a sledge. If you're working alone, it is easier to use screws.



Those overhanging lips at the bow and stern of the main hull are not strictly necessary, but they're not hard to do; choose a suitable scrap for the doubler and mark its curved fit to the hull <u>before decking</u>. Cut to the mark and save aside. After the deck is on, hold the scrap under the overhang and scribe the outside curve. Glue in place with clamps, or drive bronze ring-nails through. The points will break off and grind flush easily.

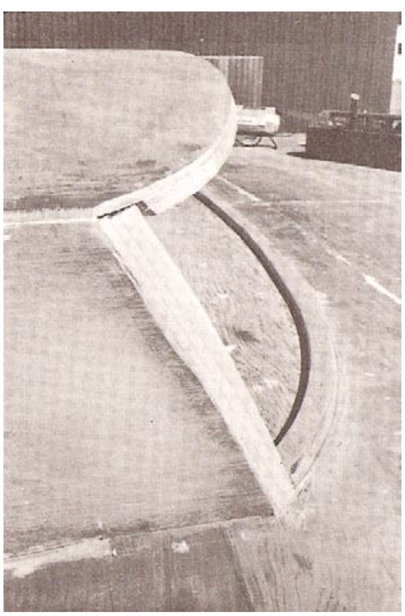
The appearance of the boat can be seriously diminished if the leading and trailing edges of the wings do not flow from hull-to-float with a fair camber. To assure a good curve, it is wise to clamp a husky, long plank across the wing's edge while you are decking. Force the under-wing up to this plank with shores; then fasten the deck. If it still looks crooked instead of curved, use C-clamps to pull the wing up to the plank, while the glue dries.

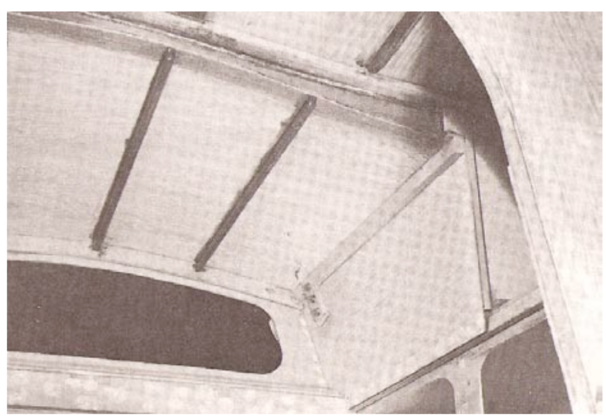
The cockpit seats, seat backs, etc., should go in before decking the cabin top. These panels can be fiber-glassed before they are installed for a substantial timesaving. The covers for the winch handle stowage bins can be fitted with partitions for the compartment, but it gets involved; suit yourself.

One method of building the cockpit is to fiberglass the panels first, install with glue and set the nails; and then - avoid the nasty job of taping all those concave corners by making fillets out of Life-Calk. Squirt it into the corners with the calking gun and then smear it out into a fillet with your fingers, filling the nail holes with the same stuff. Push it into the cracks with care and let it set-up for a few days without getting covered with sawdust. It's a lot easier than 'glassing and just as waterproof. Coat the fillets with Gluvit for good measure.

Cabin-top decking can run wild fore'n'aft to the ends of the stringers, then be trimmed to the curve for the brow later using the appropriate pattern. But the cabin chin stringer should be applied to the deck panels before that deck panel is nailed down on the boat. The brow stringers can be applied to the lower surface of the cabin top panels after those panels are in place. BUT, watch out for the tendency to develop a hump in the cabin-top at the center-line. Clamp a scrap of 1x3 crosswise over the joint to hold it down.

The cabin fronts and backs require some special fitting techniques. First, fair up by eye with the grinder. Then make a pattern out of butcher paper right on the boat. Crease the paper with your fingernail to show the shape, and transfer to the plywood with a dressmaker's wheel. The bending of these panels is fairly easy to accomplish if you begin with a close fitting shape.



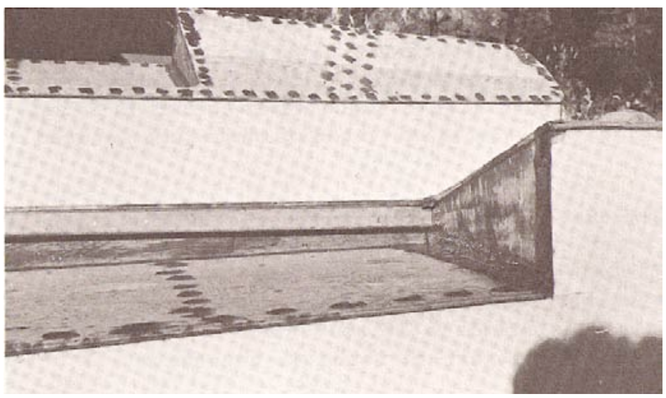


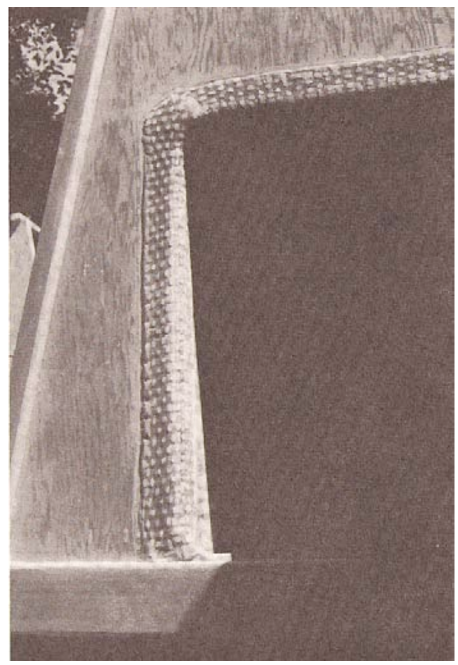
Left: Cabin "brow" and "chin" faired to receive front panels. Above: Sterncastle joinery as seen from inside. Note fiberglass tape on brow seam at top.

The sterncastle is kind of a bear to build because there is no framing for it. You fiddle it up as you go. Make the back wall first, to give sides that are no higher at their after end than at their forward end. And the top panel, for all its camber, should be horizontal at the centerline - don't get the sterncastle looking up as it looks aft. In the 37 and 40 it seems best to double plank the sterncastle top with two layers of ¼" ply cross laminated; first layer running transverse. Same for the 31 if you wish, but one layer of ¼" is enough. Shore up the sterncastle deck stringers from the bilge, to keep them from sagging, until the glue is dry.

To prepare the deck for glassing, use the grinder, the power plane, and the router to give the radii you desire to the outside corners. Too much radius sometimes makes the boat look puffy. Sharp corners make her look boxy. Satisfy your own eye. You're the one who's got to believe she's beautiful.

The longitudinal seams in the deck should receive at least 4 layers of 4 oz. glass; two tapes and two overlaps. Because of this build up it is wise to run down these seams with the grinder, digging out about 1/16" of wood to make room for the glass - or it will leave a lump. So, leave a lump if you wish. The ocean won't care.





In the 31 A-frame float deck (above) it pays to coat the lower edge of the deck stringer with Gluvit before decking because it is hard to reach later. At right, 3l-footer cockpit seats fasten to wing bulkhead #5 with fiberglass tape to avoid a glue strip protruding in the bunk. Or, line the opening with glues trips and allow the seats to come through, fastening to the inside edge of the strips with screws.

After glassing the deck and the radii, run around all the outside corners with two layers of 8 oz. tape 3" wide, staggered as described in Fiberglassing, Phase II. One neat trick is to paint on a coat of bonding resin to the areas to be taped. Let it gel; then apply the tape. The tackiness of the bonding resin will form an adhesive for the glass tape, which would otherwise float around. Stick on all the tape, then saturate with a roller, or saturate as you roll out the tape; either way that works with your resin. Some are tackier than others. Feathering this tape is a job, so get on it while it's green.

Get a coat of primer on the underwings, decks and cabins just as soon as you're finished sanding the glass, especially if you're working outside. Fiberglass doesn't like sunlight and a coat of white will give it time to cure without cooking.

There she is. Nothing I can say will add to how you feel about her now.

HATCHES

Just about the time you think you've got the real work done and are ready to begin on the interior fun, you're faced with hatches. They may as well be built now so you can close up the boat and lock it. Deck hatch openings are dangerous if uncovered (or covered with loose boards and tarps), so let's really finish up the exterior before we go below.

The design of Searunner hatches is not the fanciest or the best you'll find. Their construction is kept to a rock bottom minimum because, otherwise, covering all those holes in the boat becomes an enormous task. The Thirty Seven, for instance, can have some fifteen openings in the deck and wings! Also, the joinery and metal work can become depressingly complicated; the builder spending weeks of time with no apparent results. So, our hatches are not the most advanced, but they work. They do a reasonable job of keeping the water out and still operate without sticking and breaking. You can get them built with a normal supply of patience, especially if you build them all at once: get set up for hatches and don't stop until they're done and done right - right through to the locks.

<u>Wet hatches</u> are those that can be built to leak. They're in the wing or over wells in the deck, both of which can be arranged to bail themselves overboard through scuppers in the underwing or the topsides. These scuppers should be 1" diameter holes drilled in the lowest point, coated around with Gluvit and covered outside with a flap of inner-tube secured by small screws with washers. In some conditions, you'll have as much water coming in as going out, unless the scuppers are covered with a one way valve made of inner tube secured on the forward edge of the hole.

To cut hatches in the deck, you can locate the exact position over the under-deck framing by first cutting a rough hole within the space; reach in with the drill and make small holes up through the deck in the very corners of the framing. Connect up these holes on the deck surface and cut to your marks. In the case of wet hatches, cut the opening with soup can sized radii at the corners. A warped cover can cause its corner to lift above deck; if the corner is square and sharp, it will catch your foot or your spinnaker. So round the corners of wet hatches.

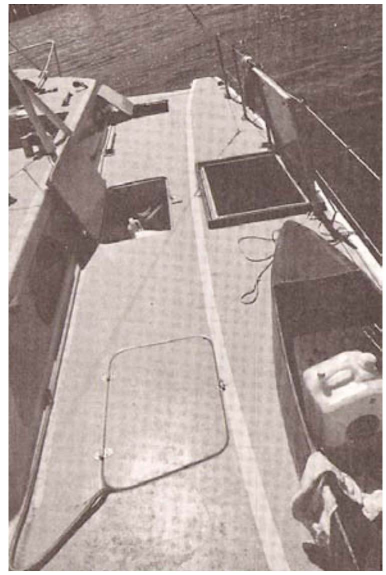
Peer inside the opening and imagine water splashing around in there; really sloshing as though you had lost the hatch cover in a hurricane! Can it get into the hulls from this hatch? Any openings which could possibly deliver deck water to the bilges should be sealed. Since wet hatches are sometimes used as ventilators, the cutout into the hull or float through the planking must be fitted with a sealing cover so the ventilator can be closed from inside. The simplest are ply panels lined with strips of wetsuit rubber latched in place with turnpegs.

Any other leaks in this wet hatch? Can water seep under the bulkheads into other wing compartments which are not self-bailing? Fix them watertight now with a bead of Life-Calk or a stroke of Gluvit in the corners (if this was not done before decking).

The edges of the opening are now lined with thin strips of wood which have rounded corners; these being glued in at the under-deck level so that the cover rests on them flush with the deck. The cover is five-ply, ⅜" plywood not fiberglassed, but carefully double-coated both sides with Gluvit and painted white, with non-skid. White will contrast with the deck's color so you can find the hatch at night. The edges of the opening are also double coated with Gluvit (thin with lacquer thinner to make brushing easier) and painted the deck's color. If you use teak for the lining strips, they can be screwed on after painting and oiled or left raw. Install the cover with stout hinges and latch with turnpegs or barrel bolts. If you must lock your wet hatches, try to arrange barrel bolts beneath that can be reached from inside, as an alternative to padlocks dangling all over the deck. Wet hatches used for anchors and chain can receive a carpet of something like wetsuit rubber, to minimize the noise during use and protect the bottom.

Most important, fit the covers with a positive latch (turnpeg or barrel-bolt) to keep them securely closed in heavy weather.

“Wet hatch” in foreground has rounded corners with deep notch in one corner to allow anchor line to pass while still closing hatch.
Center wet hatch is for life raft on, say, the starboard side and for emergency supplies on the port side; this one opens under the wing also. Float hatch has cleats all around to receive hinges and latches; this one secures in the up position by engaging the barrel bolts under the life-line. Distant wet hatch is for anchors, like the one in the foreground.

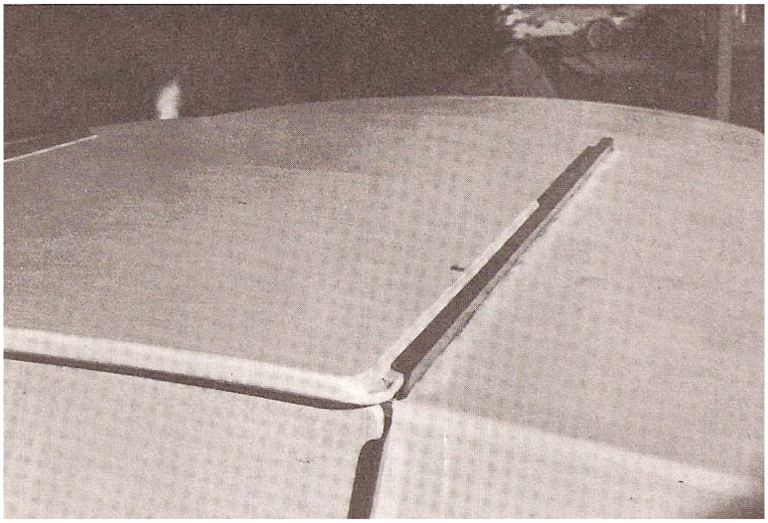


Companion hatches are the most difficult to build of the dry, non-leaking type. They have two opening surfaces, one vertical and one horizontal. To allow easy traffic for the crew between the cockpit and the cabins, these hatches should be large, easy to open, and reasonably non-leaking. I’ve never seen one that didn’t leak at all when really inundated, but horizontally driven rain and spray should not be granted general admission to the cabins. The most leakproof hatches are often the worst because they swell and stick and cannot be opened without a lot of cussing, and a sticking hatch is dangerous if it traps the crew.

In our design, the overhead or vertical component of the companion hatch slides in channels made of stainless. These can be ordered from most sheet-metal shops. Wooden channels warp, crack and leak more readily than metal; and metal-to-wood slides better than wood-to-wood. The companionways in Searunners are lined with plywood entry webs which strengthen the opening and project above the deck to form a water stop. When installing the cabintop stringers (before decking) locate them to serve as hatch framing by installing them exactly parallel. The hatch channels can then be installed against the entry web projections and be parallel also, for easy sliding of the cover.

The overhead companion hatch cover, in our system, is made of a simple, flat plywood panel with nothing fancy around the edges. It fits loosely in the channels and that’s that. Except if you wish for the hatch cover to be cambered like the cabin-top. To make the hatch covers match the camber in your cabin-top, you can cross-laminate three layers of ¼" plywood on a jig. The jig can be about five strips of wood cut to various thicknesses and tacked down on the bench, with the hatch plywood bent down over the strips. To determine the correct thickness for the strips to get the correct camber to the hatch, make the hatch header. Scraps cut from the header will show the exact camber of the cabin-top at the hatch. Use these scraps to check the camber of your jig. A large scrap of ½"ply bent down over the strips makes the best cover for the jig. Cut the three layers of the hatch extra large so that they can be trimmed later. A ¾" thick hatch will not fit in the channels as drawn; so you can get larger channels or else build the edges of the hatch to be only ½" thick, but ¾"thick elsewhere. Nail the three layers, glued together, down over the jig to clamp.

Nail through scrap strips to allow pulling nails later. When the glue is dry, remove the nails, fill the holes and trim to fit loosely in the channels. Ease edges and round the corners carefully. Double coat with Gluvit and nonskid.



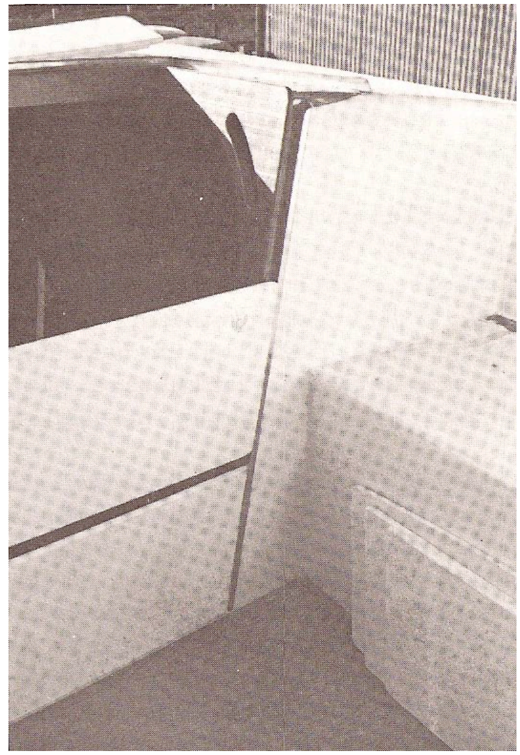
Cambered overhead hatch is ½" thick at edges to fit in channels. Higher channels would allow full ¾" thickness. Note rounded corners and eased edges.

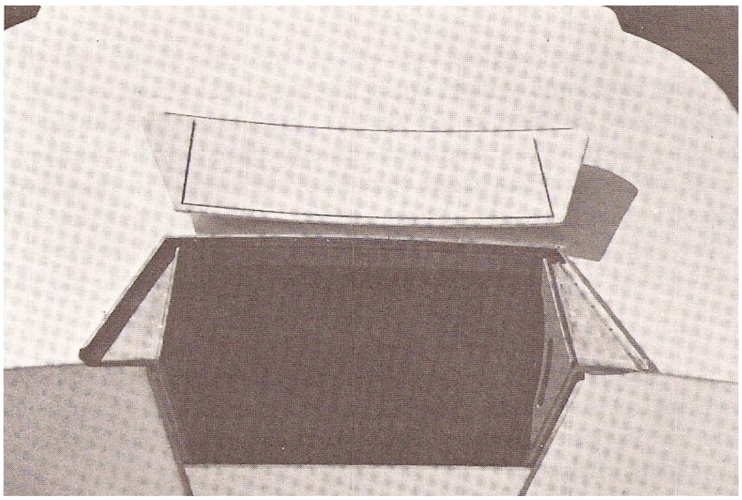
If you don't wish to deal with cambered hatch covers, make them flat but be sure to extend the entry webs above the cabintop to allow a flat cover to clear the cambered cabintop at the center, plus the height of the header. In this case the channels are fastened to wooden battens beside the entry webs to raise the channels up sufficiently. The entry webs, headers and battens (if used) should be installed with very thick glue or Life Calk to keep these seams from leaking. And the hatch cover is cut to extend about 2" over the vertical portion of the hatch when the cover is closed. A stiffener is added to this protruding edge to make the cover strong enough to jump on even if the vertical portion is open. And a strip is screwed to the underside of the opposite edge to engage weather stripping on the header when the cover is closed. Rubber weather stripping or a rubber bumper is necessary to keep from damaging the hatch when it is slammed closed, and a similar stop for open is desirable. The padlock can be closed through a simple hole in the channel.

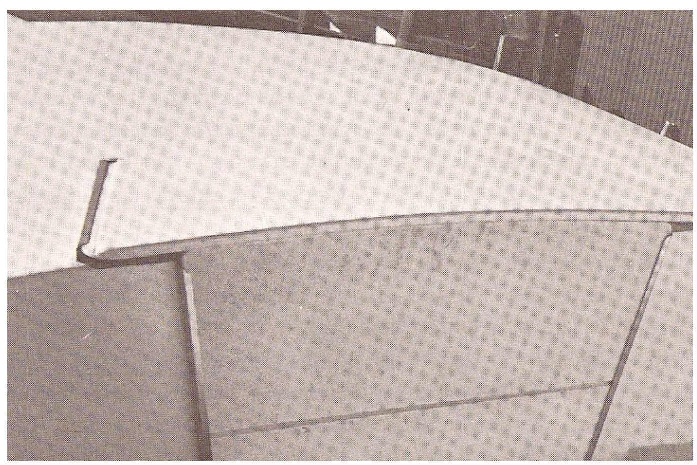
The vertical portion of a companion hatch has two obscure requirements: it should be partly closable and completely removable. We use drop-in boards which are held by stainless channels just like the overhead portion. These channels should not be made of wood, or if they are, should be positioned outside the opening (instead of a dado in the entry web) to facilitate dropping in the boards; fitting a hatchboard into two sides of a dado simultaneously is impossible in a seaway; but if the channel is outboard of the opening, a sailor simply slaps the board against the cabin bulkhead and lets it slide down into place, automatically. Removing and replacing these hatchboards is further facilitated by the tapered or Keystone shape of the vertical opening, which makes it necessary to lift or drop the boards only an inch or two to engage to disengage from the channels.

The drop-ins are usually arranged in three sections so that the bottom door can be left in place in heavy weather to keep any water in the cockpit footwell from cascading down the hatch. With one, or even two boards in place, it is passible for the crew to climb in and out without exposing the boat to this danger. When on anchor in the rain, the middle door can be left open for ventilation, but when the weather's fine, the whole maw can be made wide open. In contrast, hinge type doors (when open) extend their sharp edges to impale the crew. Another trouble with doors is that, being usually the saloon type which open at the center and swing to both sides, they are weak. If closed against the overhead cover, they are strong enough; but if the top cover is open and the front doors are closed, the crew can fall through them, pushing them in with possible damage to the crew as well as the doors.

Vertical drop-in boards will disengage from channels by lifting up only as much as the gap shown. Stow removed boards against seat as shown, secured with shock cord.







3l-footer's forward hatch top cannot slide because mast will step just forward of hatch. So build to remove like this (above).

The drop-in, completely removable ones (as in Searunners) are quite a pain for other, though lesser, reasons. Removing and replacing three boards every time you go below gets tiresome, and noisy. In practice, any crew member with average agility will climb over the bottom door or two, or even three if he's in a hurry. But they're still a pain. There's the problem of where to put them when they're removed. Never lay them on the cabin-top if the vessel is under way because they can be lost, with possible serious consequences. Stack them in the cockpit or stow them below. And most important, make them <u>light</u>. They must be light enough to flip around with one hand. ¼" plywood with a doubler laminated around the perimeter is plenty of thickness while still being light. Solid ⅜" 5-ply is also suitable, but solid ½" ply gets too heavy to handle easily. Round the edges and corners. Gluvit optional, paint is enough. Do not fiberglass - it won't stick.

Incidentally, we have given up on fiberglassing any and all hatches. Unless you use epoxy and flexible cloth, it just will not stick more than one or two seasons. Fiberglass, like masking tape, is fantastically tenacious to anything it can be wrapped all the way around, but hatches have too many edges to wrap, and anyway Gluvit, both sides, painted a light color, really lasts. The same number of coats both sides reduces warping.

A possible option is to make one of the three hatchboards out of plexiglas. Plexi isn't light, but it admits a lot of light to the cabin. In the 25 and 31 which have ⅜" thick hatchboards, laminate 2" wide strips of ⅛" plexi to the edges of a ¼" plexi hatchboard, using special plexiglas laminating solvent. This gets the plexi thick enough to match the channels. In the larger boats, which have ½" hatchboards, laminate ¼" strips to the ¼" plexi hatchboard. Regular plywood replacements for the plexi boards are desirable when locking up the boat, and give some extra plywood on board for emergencies.

<u>Deck hatches</u> are those that swing up from the deck, hinged on one edge, like the float hatches, forward hatch, etc. They are the most difficult to make water-tight because they are sometimes assaulted by <u>moving</u>, solid water. The speed of this solid water generates hydraulic pressure sufficient to blast through tight joinery even when pressed firmly onto good weather stripping. The most vulnerable to leaks or damage are the float hatches because the leeward float deck is commonly swept by solid water a couple-inches deep, that is moving as fast as the boat; this particularly when the boat is driving hard to windward in a seaway. If you're building a Searunner, you're building a boat that <u>will</u> drive to windward in a seaway, so the float hatches will be rigorously tested.

To fail the test can lead to capsize! There are many recorded incidents of leaking, or damaged, or lost float hatches causing an accumulation of float bilge water that seriously jeopardized the boat's stability. Two such incidents in my recollection caused the float to fill <u>full</u> with water <u>without</u> capsizing the boat; but that's getting close!

With this degree of importance assigned to these hatches, it is unreasonable to depend on the hatches alone. No float hatch, no matter how super, is a substitute for a <u>float</u> bilge pump that is operated from the main hull. Lacking such a permanent pumping system, the sailor should occasionally change tack while driving to windward, and check the float bilge which was previously to leeward. If your only bucket is stowed in that float, it may now be washed to the stern, inaccessible without diving. So keep a good bucket (with strong "ears" for the handle) in <u>each</u> of three hulls. <u>Three buckets and three pump intakes minimum</u> (see <u>Interior Safety</u>).

The above seems far afield from the subject of float hatches, but the truth is that holes in the deck (hatches) cause more trouble than holes in the bottom; so we may as well get ready. In monohulls, water in the bilge is easy to detect when it floats the floorboards, but a leaking float can go undetected, and affect stability. However, this effect on the boat's motion and speed should be easily detected by the man who knows his boat and listens to what she has to tell him. When a slosh and a stumble says, "I've got water on the port knee", the first thing he says to the crew is, "Ready about" to take the weight off by changing tacks. Then he inspects for water, and cause, suspecting first the kneecap: the float deck hatch.

The plans show a rather simple design for deck hatches. Some tend to make these high and massive, but that means they only stop more water and generate more hydraulic pressure. Do not attempt to build flush deck hatches unless you've done it before and understand the problems from experience. The trick in building our hatches watertight is in the deflectors, and the pressure on the weather stripping.

Cut the opening as with wet hatches and install the coamings with thick glue. Nice coamings are made with raw or oiled teak screwed in with Life Calk and left unpainted. Coamings need protrude above the deck only about one inch. Build the covers out of ⅜" five-ply, or ½" ply for the larger hatches, with inch deep framing on the edges to fit loosely over the coaming, and Gluvit inside and out.

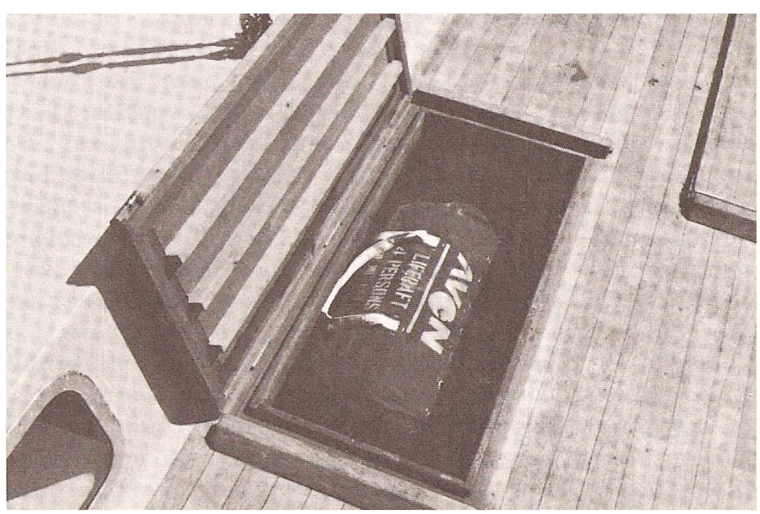
Paint white, with nonskid. Carefully install weather stripping to the inside of the cover. The automotive stick on type is OK for awhile, but the best stuff is made for magnetic latching refrigerator doors. Apply with contact cement and/or copper tacks.

Now, the deflectors, or “cleats”, are installed to the deck with screws from beneath. Teak or mahogany is best for these, left unpainted. The important purpose of these cleats is to keep moving water from slamming into the hatches. Don’t try to fiberglass the cleats or coamings; it won’t stick. Arrange the hatch hardware, the hinges and the latches (barrel bolts or turnpegs) to distribute pressure on the weather stripping all around, particularly the forward and inboard edges. Either the hinges or the latches can be mounted on the cleats; in which case the height of the cleat, above deck, should be carefully determined to be equal to the height of the hatch cover above deck, when you are standing, full weight, on the hatch cover - depressing the weather stripping firmly. This means that after the hatch is completed, to get it open one stands on it (or kneels in a seaway) to take the tension off the latches. If you arrange for this kind of pressure all around the weather stripping, together with cleats to deflect moving water, you’ll have leakless deck hatches.

The float hatches can be hinged outboard to rest against the lifelines with a snap-lanyard to hold them open. In this case the hinges go on the outboard edge between the deck and the edge of the cover. Locate the screws in the cover to depress the weather stripping. Barrel bolts don’t make good latches because, if left in the closed position, they can be broken if the cover is slammed by the wind. Home made turnpegs, as in the plans, seem best. They don’t work open because of tension caused by the weather stripping; and, if made from ⅜" micarta plastic or 3/16" aluminum, they won’t break when the hatch is dropped on them, as brass barrel bolts will.

The 31' A-frame has its float deck hatches so well protected by the recessed deck that cleat deflectors are not strictly necessary, but a cleat on the inboard edge is needed to mount the turnpegs. Two turnpegs near the corners (or other latches) are always better than one in the middle because they will give better pressure on the weather stripping. The covers are flexible and so need two hinges and two turnpegs to get even pressure all around.

The forward deck hatch (on the main hull foredeck) should open aft to lean against the cabinfront or the sub-forestay, with a snap-lanyard like the float deck hatches to keep it from slamming closed. Ideally, there will be cleats on all four sides of this one, with gaps at the corners for draining; though one cleat on each end (forward and aft) is sufficient if the weather stripping has good pressure on the sides. Because the forward hatch might be used for escape during fire or capsize, it must be unlatched from inside. One or two handles on the bottom surface are needed to pull down on the cover to release the pressure on the hook type latches.



Typical deck hatch joinery.
Note weatherstripping under lid.

If exterior latches are included, make them so they will <u>break</u>, like ⅜" plywood turnpegs, to allow escape. Or, special made turnpegs that can be turned with inside handles would be best. Keep in mind that hatch hardware should not protrude into the opening and thereby form a hazard to crew or sails. Especially if you plan to use a spinnaker; when handing the chute in a squall you may wish to stuff it down a hatch, so ease all edges of coamings and covers. The forward deck hatch cover may be made of ½" plexiglass if you are willing to sand the top surface and cover with Gluvit and non-skid; it will still admit lots of light and the non-skid is a must on this hatch. Skylights made like this, though much smaller, can be built over the galley, affording some escape for cooking and stove odors.

<u>Life-raft hatches</u> are just like deck hatches, and are shown in the plans. It is absolutely imperative that these be included in fixed-wing boats unless you prefer to lash the raft in the bow nets - where it can be lost. The raft must be accessible if the boat turns turtle. If the underwing hatch is built just exactly like the deck hatch, it can be opened even if underwater. Simplified, quickie underwing hatches can lead to the loss of the raft; it has happened. A rugged eyebolt connection should be provided inside the hatch compartment for attaching the raft's painter (tether). Two underwing hatches, port and starboard, are desirable, so that the extra one can contain emergency rations and equipment, accessible without diving. The very best way to prevent capsize worry - and thus prevent capsize - is to prepare for it as you would prepare for sinking in a monohull.

<u>Butane lockers</u> are feasible in the 37 and 40, but smaller boats are better able to carry the weight of alcohol - or preferably kerosene - cooking arrangements. But the big boats can carry the weight of ten gallons of butane - a reasonable supply - and include stoves with ovens. But the butane bottles must, by law, be carried on deck in ventilated boxes. A suitable void in the wing or cabin can be prepared for the tanks by building it isolated, vapor-tight, from any other compartment (use Life-Calk and Gluvit) and mounting the tanks so securely that they <u>cannot</u> dislodge even in a wicked collision. The gas line leads up to the top of the void before piercing the wall via a vapor-tight seal) on its way to the stove. And the void is given generous ventilation out the bottom of the wing; fit such scuppers with rubber flaps outside which hang open.

<u>Ventilators</u> have so many shapes and sizes, and prices, that little of a specific nature can be said, except to lean on the old axiom about ventilation: No boat ever had too much. Ventilation has two requirements: to give the boat's occupants fresh air, and to exchange the atmosphere in all the restricted crannies of the structure to prevent dry rot when the boat is left closed up and idle. The subject of dry rot deserves brief treatment here - it's not dry. It requires the correct amounts of moisture and oxygen and a certain temperature range for wood to start growing rot. In spite of good ventilation, we have seen trimarans develop rot in areas that were not treated with preservative. And, we have seen that preservative can prevent rot for many years in unventilated, dank areas. So first, slosh that toxic stuff everywhere you can reach - and squirt it where you can't reach. Then, keep the boat dry - particularly of fresh water. The worst rot spots are near the deck where rainwater leaks in around chainplates, fittings, windows, etc. Finally, ventilate. Horn type vents that can be removed, with the opening then closed, are best - but expensive. For the floats, one in the bow and stern, turned to face opposite each other, are recommended. Lacking these, leave the float hatches propped ajar when the boat is idle (which makes them hard to lock). In the main hull, horn vents are also useful in the forepeak and in the wing vents. New deck ventilators are available that protrude very little and look like an upside-down bowl with holes; they are quite watershedding and afford a good exhaust for hot air near the deck. But with hot air going out the top, fresh air must enter somewhere to replace it. Try to arrange for one small opening port hole in each end of the boat, ruggedly installed within about two feet of the water-line. This can be left open in quiet harbors to provide a circulating system. But don't leave these open when conditions may develop which would cause the boat to swamp via the port holes - it has happened. A safe place for an opening port is in the transom. The forward cabin might more safely be pressurized by a big horn vent in the forepeak. Louvers in the top companion hatchboards also provide escape for hot air near the top.

Don’t put any vents directly over bunks or the chart area; nothing is worse than a wet bunk.

A large capacity exhaust vent or opening skylight over the stove is important. Flame type heaters, of which the small kerosene Aladdin is preferred to any other, must have a one foot square opening directly above them; they put out much more heat than can be used, so let it out the cabintop along with foul air. The thermo-siphon caused by a big heater - which discharges most of its heat in the interest of ventilation - is the only simple way of avoiding interior condensation in cold climates. Heating and ventilation go together, just as much as cooling and ventilation.

The foregoing discussion of hatches gives a good example of how inter-relative the various design features of a boat can be. It has been impossible to talk about just hatches! The subject deserves to brush with such matters as bilge pumping, capsize, spinnaker handling and ventilation. These explain why the hatches are designed like they are. And so it goes with boats; everything you do affects everything else you do - and therein lies the fascination.

WINDOWS

Except for the sterncastle windows of Searunners, all trimaran windows should be dead, unopenable, unsliding, water-tight and strong. All of the opening type windows that we know of have leaked, and because there is almost always a window over a bunk, make them absolutely tight, and depend on ventilators for ventilation.

There is a long record of trimaran windows being pushed in by waves because of the early tendency to make them much too large and install them poorly. One type of installation that has commonly failed has used sash made with a rubber molding called “Lockstrip Channel” or “H-Rubber”. But we still use it!

Lockstrip Channel makes a completely satisfactory, leak-proof installation if it is done correctly with the proper material. It has these eminent advantages: low cost; light weight; the builder can cut his own shapes and cut plexiglas to match with his saber-saw. Because the shape of the windows has a dramatic effect on the total aesthetics of the boat, we consider the freedom of window shape to be an important advantage of Lockstrip Channel windows. The windows are the expression on the boat’s face. Also a broken pane can be replaced with the existing molding; and these windows will fit curved cabinfronts, etc. For these advantages, one pays by having to develop the skills of working with Lockstrip Channel - which I will attempt to describe:

Get "Griffith" brand molding from Griffith Rubber Mills, P. O. Box 10127, Portland, Oregon. *[ed note: Griffith Rubber Mills 2625 NW Industrial St. Portland, OR 97210 503.226.6971 or 800.321.9677 http://www.griffithrubber.com is the current address; the following specs are no longer valid]* Don’t use any other (the automotive stuff is unacceptable). This rubber molding comes in sizes to match your cabinside and plexiglas thickness. Use ¼" plexi, clear or smoked (like Polaroid), for all Searunners. The 25' and 31' Searunners have ¼" cabin-sides and fronts, so order Griffith Lockstrip Channel #GCH-3, size ¼" to ¼". The larger boats have ⅜" cabin-sides and fronts so order Griffith Lockstrip Channel #GCH-4, ¼"-to-⅜" (50' minimum order should do for all boats). These are the H-moldings.

The "Lockstrip" itself is a small bead of specially shaped rubber which, after the window is installed, is pushed into a groove in the side of the "H" section with a special tool, thereby locking the "H" section closed around the opening and the pane. Order the tool from Griffith also and keep it on board. The Lockstrip number for both sizes of H-molding is GSX-17. Specify black or white; you can mix white channel with black locks trip, etc.

Now the secret of a strong installation is accuracy; the pane must be cut smaller than the opening all around by exactly the thickness of the cross-bar in the H-rubber (usually 5/16"). It develops that the thickness of the cross-bar in the "H" can vary with different rolls of rubber, but the emphasis on accuracy is not misplaced. Measure your "H" rubber.

Begin by cutting the opening to the shape desired. Do not exceed sizes shown in plans and don't make the corner radii too tight. We use a 3¼" diameter tin can to draw the minimum corners for the small size channel; 4¼" can for the large size. These are minimums. Unless you fancy yourself an artist worthy of designing special window shapes, use the oval ended patterns shown in the plans. Locate the windows carefully to avoid interior framing and to fit the window within the outside painting pattern. Draw the window and carefully cut the opening. The hole will look bigger than your pencil marks, so don't draw them too big. A drum sander helps to fair up any irregularities in the opening you have cut. Rough cut the plexiglas (leave protective paper on) and have a helper hold the pane over the inside of the opening while you scribe outside. Make a special scriber from a pointed knife with a spacer taped to the tip so that your clean, sharp scribe line is smaller than the opening by exactly the thickness of your "H" bar. Cut the final shape and clean up right to the line with a sanding block or belt sander. Ease the edges of the panes and the openings very slightly with sandpaper. Apply wood preservative to the edges of the openings with a roller, taking care to drip a little of it down into voids in the plywood. An eyedropper helps with this; don't fill them full.

When the preservative is dry, cut the channels for all the windows to length. Measuring isn't good enough; you'll have to fit the channel into the opening - all around tightly - and cut long: ¾" long for small windows, up to 2" long for the large front window. Cut the ends square with a long, sharp carving knife; one pas s in one direction on a cutting board with a strip nailed on to hold the rubber.

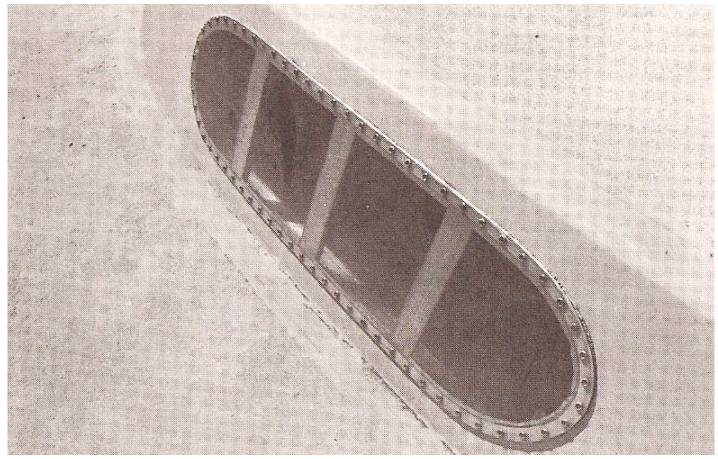
Now comes the lubricant. To cut the ends as above, wipe the knife with a smear of some creamy mechanic's hand soap, any of the very slippery water soluble grease solvents without abrasive. Use this stuff throughout installation to get the plexiglas to slip into its groove in the channel, and to get the lockstrip to slide into its slot in the channel.

After cutting all the panes to exact size and all the channels to over-length, arrange for a patient helper and a relaxed beginning because installing the panes has a special skill that will give you fits the first time around. You need a couple of little hardwood sticks about the size of one of those big flat lumberman's pencils sharpened like a chisel on one end; one such stick for the helper - inside the boat - and one for you outside.

Settle back and ponder the job. You've got to get the cabin wall and the window pane both into the grooves of the "H" rubber, and at some time or other the window and the molding are going to tell you that, together, they are bigger than the opening! So start by fitting the molding to the opening first. Put the splice at the top, securing the ends in place with masking tape; stuff the end in to accommodate the extra length. Now remove the paper from the pane, wipe the edge of the pane liberally with lubricant and just stuff it in the hole! The stuffing is the skill; start at one end and use that little hardwood stick to peel the outside lip of the "H" around onto the outside edge of the pane while the helper does the same thing inside. It goes along okay at first but as you reach the point where you've almost got the first one in you will suddenly realize that it's impossible. It can't go. The whole thing is a gag. You've been hoodwinked and you're furious; all that money and all that work. What a joke on you.

Nuts-and-bolts-windows are the only alternative now. You'll have to cut new plexiglas with larger panes to overlap the openings about 1¼" all around. Buy enough #10 machine screws (non-ferrous), with nuts and washers, to put one every 2" all around all windows. That's a lot of screws to buy. While drilling all the holes you'll discover that plexiglas sometimes cracks when drilled and you'll have to junk a piece or two. Then you smear up the works with something like Life-Calk and bolt the windows on - outside the opening. It's a good enough system. Some builders prefer it and you can always see their boats coming because those nuts and bolts look like rivet heads in the armor plate of a Sherman Tank.

You would probably prefer Lockstrip Channel on your boat if those last few inches of that pane would "get in the groove". There is a way! The helper carefully rotates the remaining unfinished portion of the molding outwards until it has almost dislodged from the cabin wall.



Nuts'n'bolts windows

Now you can get your stick under the lip of the groove and peel it over the edge of the plexi. Now push. Push firmly inwards on the pane. Harder. And the next thing you know, you have pushed the whole business right on through into the cabin, smacking your helper in the face with a piece of greasy plexiglas. On the next try, your patient helper will be ready to push back, back against your push at the very instant that the pane pops into final position.

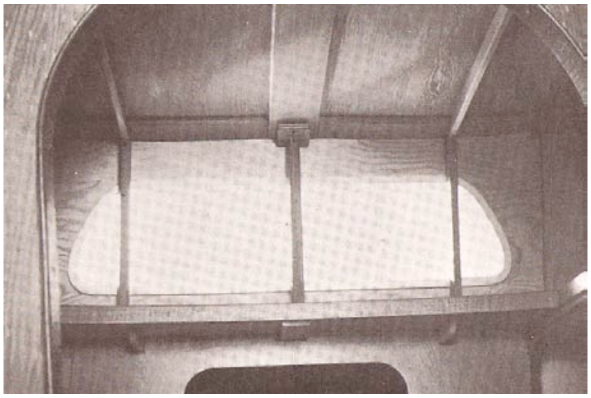
So you've got it in. It looks like it will fall out in a breeze, but after you insert the lockstrip it will stand a hurricane. The lockstrip is easy; don't cut it to length - use it right off the roll. Insert one end into the special tool so that it protrudes through the loop about half an inch. Grease up a few feet, poke the tool, and the end of the lockstrip, into the slot and just pull it along. Lubricant in the slot helps. Start at the bottom of the window; go around and cut long at the end, stuffing in the extra length with your hardwood stick.

An optional step before installing the lockstrip is to seal around the outside of the H-rubber with mastic. Using Life-Calk in a tube or calking gun, squirt a very small bead under the outside lip of the H-rubber to seal it against the cabin. When you then install the lockstrip, the pressure will squeeze a little Life-Calk out all around. Let it harden overnight before cleaning it off. Clean off the lubricant with a sponge and a little water. (If you slobber lubricant on the cabin all around the window it may later inhibit the bond of your paint, so sand around the edges by hand before painting.) That's it. Beat on it to convince yourself it is strong.

The front window is the hardest because of the bend, so practice on the small ones. Before installing the front window, regardless of whether you use lockstrip channel or nuts-and-bolts, we recommend installing at least two vertical bars behind the pane. These should be carefully cut to fit from 1"x2" hardwood (like teak) with notches in the forward edges to let the lockstrip past the bars. Fasten with plywood "saddles" at the top - against the brow stringer and drive large screws up through the chin stringer into the lower end of the bars. If you ever encounter terrible conditions these will keep the front window from being pushed in. Or, if the window is destroyed the bars will help support your storm cover. The bars are not strictly necessary because the lockstrip channel makes a very strong installation if done accurately, but they are good security and we recommend they be included.

Aluminum sash is available in stock sizes or custom shapes. Custom aluminum windows with safety glass, ordered to your shapes or made from your cut outs, make the nicest, heaviest, most expensive windows; but don't try sliding aluminum sash windows over bunks. And don't try safety glass panes with lockstrip channel unless the glass cutter will guarantee he can hold the accuracy of his panes to ¼" smaller than your cut-outs (allowing 1/16" for the sawcut).

Regardless of which window system you select, carry storm covers. These can be roughly cut, two inches larger than the openings, from scrap plywood; ¼" for the side windows ⅜" for the front and sterncastle windows. Don't bother with fasteners; they can be nailed on in an emergency - if you have the nails in your toolbox. A sail makes a good storm cover or quick patch for a hole in the hull.



Front window with hardwood bars for reinforcement, and Lockstrip Channel.

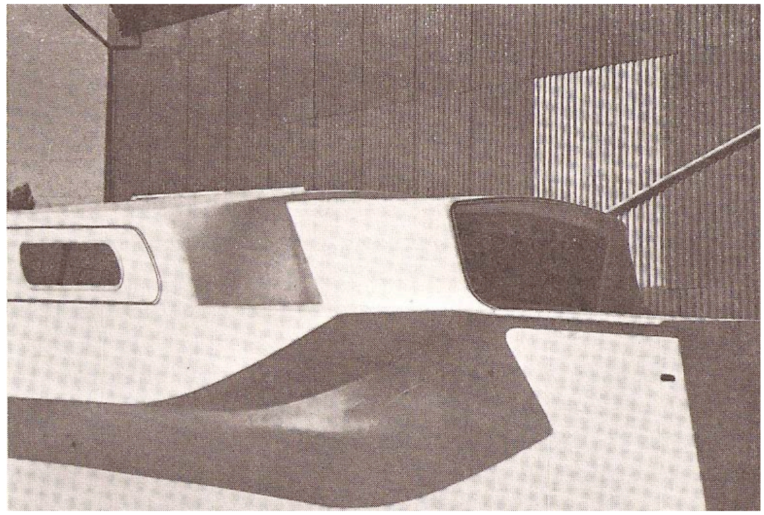
Opening ports or ("port lights" can be substituted for windows if you are content with the shape given. Whether round or rectangular they make the boat look like an armored truck. They cost about fifty dollars each and I don't recommend them over bunks. Even though they have O-rings and thumbscrews they can still leak. A reasonable substitute for ventilation over bunks would be 4" diameter inspection plates. One of the many plastic jobs now available will suffice. Make sure they are the screw-in type; I hear they don't leak. You can make a scoop out of a cut plastic cup to stick out of the hole into the breeze and it will deliver a lot of fresh air to the sleeper.

Some builders prefer no windows at all but then the boat has no expression on its face - just a dumb blank. look and a dark cave inside. So, unless you're willing to spend lots of loot on custom aluminum sash windows, go with lockstrip channel. In spite of its tendency to scratch, plexiglas makes good windows because one rarely looks out the window to see what's outside. Windows are primarily to let in light and relieve the visual confinement of the interior. In spite of the fact that the curtains are pulled much of the time, windows can't be done without by most crews.

Sterncastle windows are a specialty to Searunners, and are of great value because they can be opened. Some have been built as "dead lights" but when the boat reaches the Tropics, out comes the window. Because of the top overhang of the sterncastle roof, and the outward-leaning angle of the window, it can be left open in rain and spray and offers ventilation at a time when the hatches must be closed. Only the experience of suffocating below in a tropical drizzle will impress the value of this window on the crew.

The most useful sterncastle window I have seen has its top edge cut straight across (instead of arched) with hinges at the top so that the bottom swings outward. This arrangement can be left ajar in a downpour. (Incidentally, so can the forward deck hatch, providing the head compartment is arranged as a shower - see Interiors.) Other sterncastle windows tilt out at the top with hinges at the bottom; but this is not so good because the pane is vulnerable to breaking when walked-on. Some windows lift out all together. The latter is the simplest. A handle is attached to the inside of the pane and the opening lined with doublers to form a slot at the top and bottom; the top slot being deep enough to allow the pane to be inserted high enough to enter the bottom slot. You can lift it out and lay it flat on the sterndeck or stow it inside. A simple pin at the top, to prevent lifting up the pane, makes the lock. And shock cord can hook onto the handle - pulling inward - to allow different prop-open positions. If you're going to lay it down outside on deck, better have a snap-on lanyard to keep it on board.

A-frame 3l-footer has Lockstrip Channel sash for side window. Custom sterncastle has side walls that start up from deck at the same point where wings start outboard. Aft window is well protected when window is tilted out at bottom.



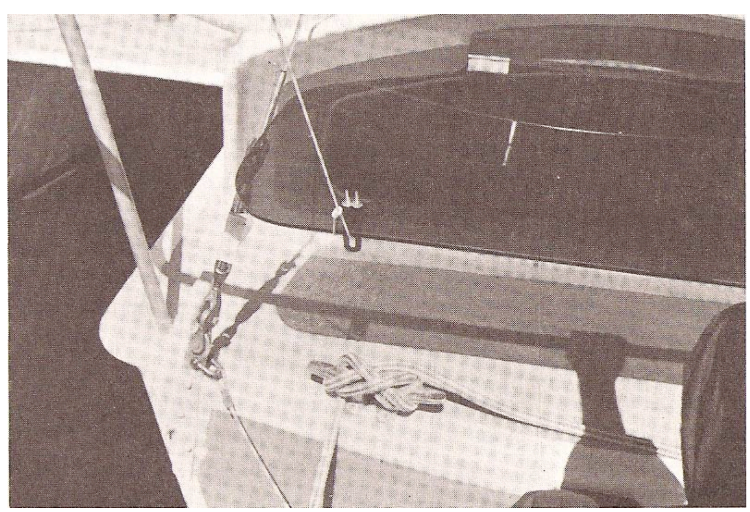
The 31 can have a ¼" plexi pane but the larger boats seem to need ⅜". A ridge in the opening can hold weather stripping, and shock cord or turnpegs will squeeze the pane against it probably well enough. If the window drips there is a trough inside to catch the water.

Don't forget the storm cover. This one can have fasteners and a lock if you wish.

An aluminum sliding window - one that slides open half at a time - will work nicely for the sterncastle; except that now this opening is too small to use for a fire escape. In case of capsize, the sterncastle window can allow access to and from the after cabin - if it is large enough - without a lot of diving. This is a grim but possibly important point.

Now that you know a little bit about how to put the panes in place the window project really is fun. It is perhaps easier to do the job after painting, particularly if you're going to spray, because then you won't have to mask them off. So do your windows after final painting unless your construction schedule has you working inside before finishing the outside. In this case (the usual case) you'll need the light and ventilation of windows, and cutting the holes will open up a whole new vantage on the project.

Sterncastle window has curved top line but hinges are arranged on a straight line to allow hinging at top instead of bottom. Shape of window sides is to allow sides to clear backstay bridle turnbuckles.



EXTERIOR PAINTING

There are many builders who will have a greater knowledge of painting systems than the author. These individuals can decide for themselves among the myriad painting systems. This section is written for those who don't know where to begin.

Such a variety of paints is available that the backyard builder can be easily bewildered by the selection. There is a strong temptation to be snowed with the manufacturer's propaganda about the lasting qualities of his particular formulation, the gloss retention and resistance to chalking; all this without mention of application method and ease of re-coating.

There is also a temptation for backyard builders to expect their boats to paint-out looking like a freshly finished Lincoln Continental just emerging from the drying booth. Our intense indoctrination to the automobile paint job cannot be duplicated in a homemade boat without a whole lot of automotive technology, skill - and yes - automotive paints and primers. If you are a skilled auto painter and wish for your boat to look like a good car, use automotive paint, painting equipment and your best technique.

<u>Types of paint</u> usually selected by owner-builders include the synthetic or alkyd primers and enamels, and the catalized two-part mixtures of epoxy or polyester or polyurethane plastic paints. Or, many brands are "adulterated" plastics which are one-part "air-drying" enamels that have some "plastic" content. Each has its own application quirks, its own thinner, its own willingness to get along with other paints, and its own longevity, with peculiar aging and re-coating features. Basically, the "synthetic enamels" are easiest to apply by brush or roller, have the best color selections and are the most universally available in brands of marine paint. These brands offer primers that spread easily over bare wood or fiberglass, and the usual method of application is to use the primer first, sand lightly, and follow with the color enameL The primers are formulated for easy sanding and good filling qualities for burying imperfections. For a fine, smooth job, prime once or twice, and sand between coats to take off the high spots and fill the low spots, follow with one or two coats of enamel sprayed, brushed or rollered.

From long experience with these paints I can recommend them completely for interior use, but have reservations about exposing them to direct sunlight and abrasion. They dry slowly and permanently retain some degree of softness for flexibility - which means they will always gouge. They don't hold particles of non-skid very well, and amazingly the enamels don't adhere very well to the primers. And, where one coat of enamel overlaps another coat, one doesn't adhere well to the other. This is particularly true if painting outside and makes for very troublesome problems with masking tape peeling-up the paint to which it is stuck while attempting to paint another color up to the tape. And, anti-fouling bottom paints will sometimes lift the primers or the enamels where the anti-fouling is asked to cover a dry - but recent - layer of primer or enamel. And the lasting quality of the anti-fouling seems to be profoundly affected by its underlayer and neither a chemist nor crystal ball will predict the outcome of your combination of paints, time between coats, application methods and the weather on the day you did the painting. Some of the biggest and best boatyards use "synthetic enamels" exclusively and that says a lot. But their aim is to get her covered with something pretty with the least effort and expense, and to hell with what happens later - it's up to a boatyard to repaint it. So, we use these paints on the interior with satisfaction, and on the exterior with reservation.

So what else? Epoxy? Not for me. Except perhaps for primer. A few brands offer a flat white epoxy primer which - like all epoxies - must be sprayed. So if you want a primer that will stick to your exterior fiberglass job with a chemical bond and <u>can</u> be sanded to remove highs and fill lows, and if you've got really good spray equipment with a big compressor and if you know how to handle a gun and if the high cost and toxicity of epoxies doesn't scare you and if you can arrange for laboratory conditions during painting and if you can jump right on it and sand the primer before it cures so hard that nothing will cut it - okay. Use epoxy primer.

But an epoxy finish coat usually chalks and yellows before other paints and it cures glass-hard so that re-coating is rather difficult. In areas of the boat which are not exposed to sunlight it retains its gloss and hardness so well that re-coating with anything, even epoxy, has doubtful results. Make no mistake: an epoxy paint job over a good, well-sanded ‘glass job will last indefinitely - it won’t crack, chip or peel and, except for chalking and yellowing, it offers permanent protection. My own opinion is that it is inconsistent with backyard application facilities and its toxicity alone rules it out for me. If you spray indoors or without a respirator or let it cure on large areas of your skin, it will make you sick, and some individuals suffer a permanent reaction. Spraying the stuff has a special skill: it is heavy paint and requires a light “fog coat” first to provide a sticky base for the buildup. Even then it often sags (like resin on a vertical surface) and the results can be disappointing. So, if you insist on epoxy and are not yourself expert in handling the stuff, get the help of someone who is - and get expert quality spray equipment.

Where next? Whitewash? Poster paint? Well it gets that bad when you’re looking for a good paint for a homemade trimaran. Other "plastic" paints claim the toughness of epoxy and the workability of synthetic enamel. The author’s experience with these is limited but doubts remain regarding compatibility with other paints (especially vinyl-base anti-fouling), ease of application and overlap bonding of one gloss coat to another.

Flat versus gloss is a subject only recently discussed in the trimaran field. Coming as we have from the glossy womb of American culture, it seems improbable that anyone would wish to paint his yacht with a dull, non-reflective paint. Why, with all those shiny cocktail buckets lined-up in the marinas, each competing with the other for flashing highlights caused by sunshine bouncing off the oil covered surface of harbor water, then to ricochet from glossy painted topsides into the dazzled eyes of the beholder; why, with all that action in the weekend fleet, would anyone coat his boat with something flat? Don McGregor would, and it is absolutely stunning. Using white semi-gloss synthetic enamel and adding “flatting agent” and a touch of olive green, Don recently painted his wholesome Cross 42 - and the result, to most viewers, is something splendid. Whereas the cosmetic imperfections in all hand-made boats are emphasized by a glossy finish, Don’s “flat” boat looks flawless, unified and strong. The surface is not at all rough like flat primer; it is smooth enough to shed stains like enamel but it just doesn’t shine. One assumes that the problem of overlap bonding is reduced by the absence of gloss, and patching or re-painting local areas shows no lap-marks. This, it seems to me, is a fine way to paint a cruising trimaran. It’s not a new idea - the fishermen and some seasoned yachtsmen have used it for years because they’ve learned it is a good way to keep their boats looking the best for the longest for the least in time and effort. I hope to see a lot of flat-painted Searunners around because it could indicate that their owners have made one more of the many adjustments away from yachting and toward cruising. A cruising boat that shines like an automobile might just as well be one, and this fierce desire for cosmetic perfection in a homemade boat is simply inconsistent with the other motives of cruising. Don’t get stuck in the perfection bag!

Colors. This is one area where the designer really ought to keep his opinions to himself, hut I am reminded of Henry Ford whose early products were offered to the public in any color, so long as it was black. In trimarans, take your choice - so long as it is white. Let me explain: inside the boat, the choice is naturally yours but be forewarned that if everything is dark it is hard to see and if everything is light, the hospital-like interior will offer no respite from the tropic sun - an important consideration.

Outside, it has GOT TO BE A LIGHT COLOR. Sunlight and heat can do more to age your boat, and your crew, than rot and rocks. These boats are made of organic material - wood and the moisture content of wood will come and go with temperature. And as the moisture comes and goes, so do the dimensions: shrinking and swelling. Cycles of wetting and drying of the wood fibers will cause gradual deconstitution of the cellulose. Especially if these cycles go from extreme hydration (condensation at night) to extreme dehydration (tropic sun on a dark deck). Conversely, we have seen that plywood trimarans, when properly treated with preservative inside and well glassed with a LIGHT paint job will sustain many years of heavy service - even in the tropics - with no discernible decomposition. Also, a white boat is easiest to see, day or night. A white deck would be best for heat reflection but intolerable for reasons of dirt and glare. A mixture of any color with white for a light pastel can be used for hull and decks. Some builders like the one-color scheme for simplicity and a feeling of unity. Others prefer a slightly darker deck for contrast even though this means lots of masking. For reasons of longevity I personally prefer white or near white everywhere - except the horizontal deck surfaces that receive non-skid, and the cockpit and the cabin sides.

The white should come up over the topsides onto the deck (and cabin-top) to about 2" inboard of all corner seams like the sheer, cabin edges, brows, chins etc. The purpose is to keep the lumber underneath - to which the plywood is attached thereby making the seam - as cool as possible. Keep the corner seams cool to avoid cracks in the fiberglass caused by expansion and contraction of the lumber under the seam - due to changes in its moisture content. To convince yourself of the effect of color on heat, make a few samples of white paint mixed with any dark color in graduating shades, and put it in the sun. Feel!

Blue is the weakest color - it fades; red is a close second-worst and is said to promote seasickness. Earth colors like tan and orange and green are really colorfast. Generally, these boats are far-out enough to not require a zany color scheme, and too many colors makes them look hodgepodge. One place where a darker band of color is used successfully is the cabin sides.

Avoid attempting to fiberglass over mahogany plywood and leave that area unpainted for a natural look. Mahogany fades to a urine-yellow under 'glass and maintenance problems are invited.

Some builders paint the under-wings "international orange" to make a capsized vessel more visible from the air. But actually, in this situation, the under wings would be slightly submerged. Nonskid on the underwings is a very good idea - especially around the life-raft hatches. A very sharp and sensible place for international orange is the boot-top stripe (around the water-line).

This combined with orange on a foot or two of the masthead, and the spreaders, makes a very noticeable boat. (When choosing colors, remember that collision is the second greatest hazard at sea; falling overboard is first.) My own feeling is that the exterior color scheme should consider orange. Select something basic for the cabin side band. Use a pastel of that same color for the decks and cockpit, and white or near-white everywhere else except the orange; and the "basic" should tolerate the orange (which I hope will exclude blue).

<u>Nonskid</u> is usually some form of grit mixed in the paint. It is a critical part of the paint job. Only a sailor knows what it is like to work on a slippery deck - literally murder. There are many approaches to applying the grit and many grit materials. Some use sand, washed and dried and sifted through screen about half the weave-size of window-screen (unless you live near Carmel, California where all the sand grains are perfect size). But the deck is the area that will be re-painted most often and this will eventually bury the non-skid. If anyone ever has to grind-off your sand for a new deck job he'll wish you had used something like ground walnut shells. But the walnut shells I have seen are much too coarse for boat decks. They're all right for public gangways and fire escapes, but on a boat they'll tear out the knees of your foul weather gear or give you what motorcyclists call road rash.

Perhaps the best approach to nonskid for your first time around is to buy the chemical compound grit. It is offered by the marine paint companies to be mixed with the deck paint and applied by brush or roller (special inert sand is available from aquarium shops, and is said to be the best). Roller gives by far the more even distribution of the grit. Stir the paint well each time before filling the roller tray and stir the stuff in the tray with the roller each time you dip. To get even distribution, don't paint in direct sunlight or a warm wind (a good <u>general painting rule</u>). The trick is to roll and re-roll - really move the roller, like you are killing ants. When dry, re-coat with straight paint to anchor the grit, and if you're using synthetic enamel, let the job cure as long as possible to avoid scuffing-off the grit. Put duckboards or carpet over traveled areas until the paint is hard (but the trouble is, synthetic enamel doesn't really get hard).

Another method is to sprinkle the grit into fresh paint, holding the pepper shaker high and rolling down only a little paint between sprinklings to as sure it is wet enough to grab the grit. And another is to apply a very thin, <u>even</u> coat of paint or Gluvit and inundate the surface with sand. When the bonding layer is set, sweep off all excess sand leaving a close cover one granule thick; now paint again. This method is the best looking and most nonskid - but heaviest and trickiest to do right.

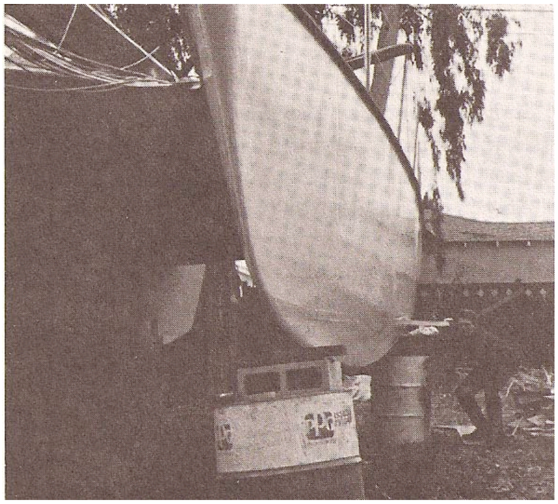
<u>Boot top</u>. [aka, boot stripe] The waterline stripe around the hulls is not a necessary part of the paint job, but it has a dramatic effect on the visual countenance of the vessel. A doggy looking boat can be revived with a good boot top, and a yachtsie one made to look plain by its omission. The boot top and the rub rails and the steering vane all help to accentuate the boat's lines. I regard the boot top as a big, fiddling unnecessary job well worth the trouble and the price of the masking tape.

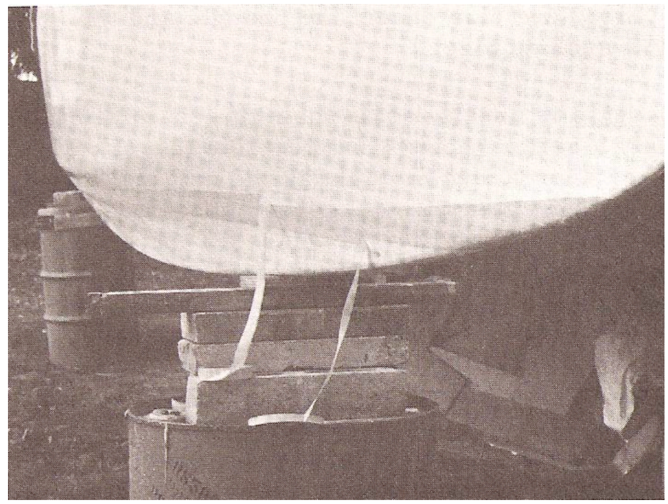
It takes lots. First, level up the boat by blocking the cradle. Use a hydrolevel (see "strongback") to determine its level, and also to make a series of pencil marks all around the boat (about 4' apart) to designate the top of the antifouling paint. We'll assume in this discussion that you've got the boat painted except for the boot top and the antifouling, both of which can be done at the same time as launching day approaches.

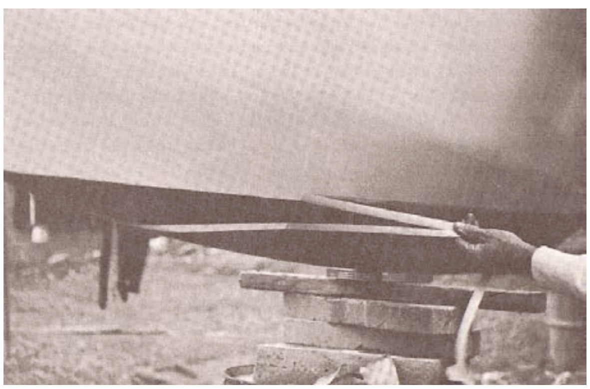
These pencil lines, determined by the hydrolevel, should be located to describe the waterline plane on all three hulls according to the following table:

25'er - 2" above the bottom of the transom
31'er - 4" above the bottom of the transom
37'er - 5" above the bottom of the transom
40'er - 5" above the bottom of the transom

These levels do not agree with the datum waterline on the plans but are intended to give plenty of bottom-paint sticking up above the surface. This helps keep harbor muck from washing up along the topsides and gives the boat a lower visual profile. I prefer to make the float waterlines 1" above the main hull's for the same above reasons.







Top left: Position wide tape along waterline marks by stretching out long lengths; note rub-rails. Above: Apply narrow tape above and below wide tape. Proceed with painting as described. Then (left) remove tape.

The masking method for the boot top is best understood by examining the photographs. The idea is to apply three strips of tape of different widths, all right together, edge against edge. The lower strip is ½" wide, the next up is 1½" wide (or 2" if you prefer a wide boot top), and the next is ¾" wide. Go all around all three hulls with the tape. You'll be walking on your knees a lot so make knee pads out of rags and masking tape. Now, sand or rub with steel wool the topside paint that extends below the tape. This will help the bottom paint stick to the hull when you later lift the tape. Now paint the bottom anti-fouling paint up to and on to the tape. Now remove the wide strip of tape, revealing a band of the topside's color underneath. Sand or scrub this with steel wool to help the boot top stick to the boat. Now paint the boot top between the remaining strips of tape, two coats. Remove the rest of the tape. See, the boot top stripe is separated from the anti-fouling by a ½" wide stripe of topside color - very effective!

<u>Anti-fouling</u> paint is that expensive, unattractive, copper-laden stuff that you put below the waterline. The copper particles in the paint react with seawater to form copper sulphate: poison. The paint's job is to release its toxin slowly to create an envelope of uninhabitable water around the boat - uninhabitable by the marine organisms who are, like the boll weevil, always "lookin' for a home."

In the short years since the re-invention of the trimaran there have been hundreds of examples of lubberly seamanship caused largely - and insidiously - by foul bottoms. A green beard can make a multihull most unmanageable; do not attempt to maneuver under sail any trimaran whose bottom is not clean! Because of shallow draft, these boats can be easily scraped and scrubbed, so even if your bottom paint has long since spent itself, it is dangerous and lubberly to move a foul trimaran - even if just to the beach for a bottom-job - without first scraping off the bushy stuff.

And bottom jobs on the beach aren't as easy as they sound. Beaching between tides gives scarcely enough time to scrub, rinse with fresh water (requires a beach with a hose), and repaint before the tide interrupts your work. Two tides of four or five foot range are usually required, and only boats with mini-keels can be maintained without hauling or blocking-up; otherwise a large percentage of the bottom is inaccessible.

The point of this mention of later bottom maintenance is to emphasize the importance of the first bottom-job, before the first launching. Buy the best bottom paint you can get, regardless of cost, and apply it in strict accordance with the manufacturer's instructions. Experiment with the special thinner for your bottom paint to determine if it will attack and lift the primer on your hull. Generally, the undercoat on the hull must be well cured for several weeks or months. Some bottom paints won't stick to bare fiberglass or epoxy primers. This esoteric issue of compatibility apparently affects the life of the anti-fouling. The marriage of your paint to your bottom and the drying time before launching can cause the toxicity to be released in a burst, or not released at all. It's tricky business and nobody seems to know all the answers, but things to avoid are: inexpensive bottom paints, colors other than "red" (copper color), painting over incompatible or uncured primers and repainting over unscrubbed, unrinsed, salty, damp bottoms in damp weather. If you avoid all these, still the most you can expect from a good job in salt water, without an occasional underwater scrub, is about one year's protection. With a scrub or two, some paints will go eighteen months - or two years in brackish water. Some paints seem to have vitamins in them: a beard will grow around the waterline (where sunlight is available) in a few weeks after launching. This can easily be knocked off from the dinghy. But it's time to repaint, preferably by haul-out, when the first barnacles appear down deep. That's the sure sign of spent paint and to sail a trimaran with barnacles is dangerous. High speed steering and close-quarter maneuvering are profoundly affected by fouling. Tying up in marinas with lots of electrical wires on the docks and on the boats will, unless everything is first class, dramatically affect the life of copper bottom paint. This is due to a faint electric field in the water causing electrolysis in the paint.

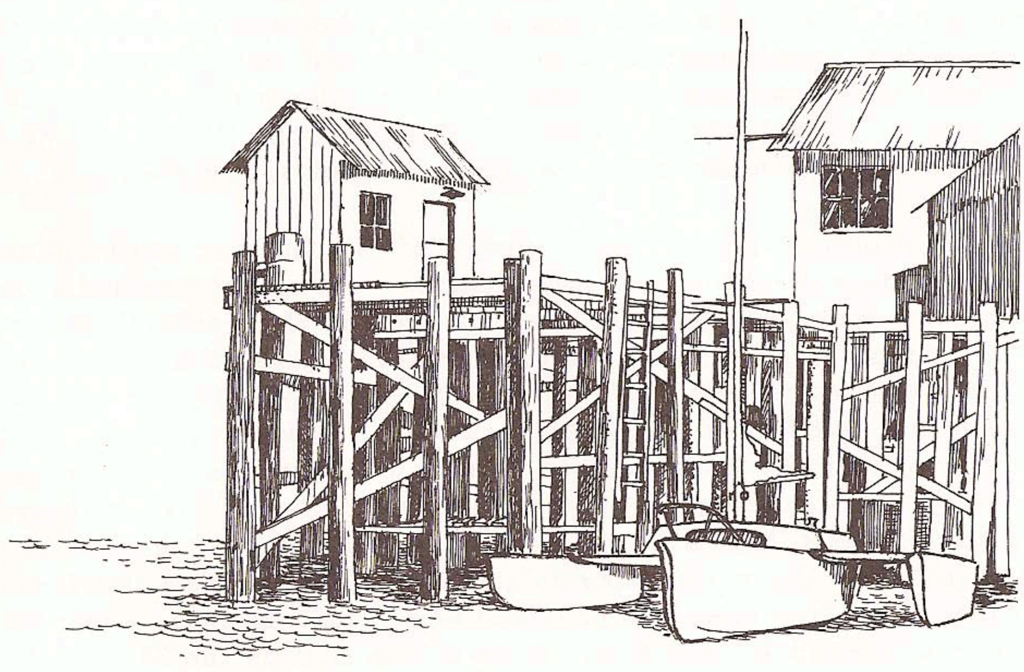
There are two basic types of bottom paint: hard and soft. The soft stuff sloughs off with use and makes the surface ungrabable by marine beasties. It is not generally used on multihulls because a real burst of speed might rinse most of it off in the wake (!) and it is thought to increase resistance. No firm evidence is on hand to confirm either of these disadvantages as applied to trimarans. But the hard stuff is generally used for yachts - it can be rubbed down after drying for smoothness. But for cruising trimarans this is seldom done. The smoothness obtained by brushing on two light coats and wet sanding is an insufferable job in the pre-launch excitement. For competition machines it is a must, but cruising folks usually smear on the paint with a roller and call it done. Most hard paints have a vinyl base and require a special thinner. Add this thinner to the roller tray as you work to keep the paint from getting pasty - it dries very fast. Give her one light coat and keep right on going around a second time, so long as the second doesn't lift the first. One gallon will do the 37 and 40. Some say that a "base coat" applied a few weeks or months before launching, with two more coats the day before launching gives best results. Avoid bottom painting in a warm wind, in damp weather, and at night. Do not spray. Do not sand except by wet-sanding. The dust is lethal! Get it off your skin and don't eat in the vicinity of sanding dust or with paint on your hands. This stuff is poison! Paint fumes and booze combine to heighten the effect of both, including the hangover.

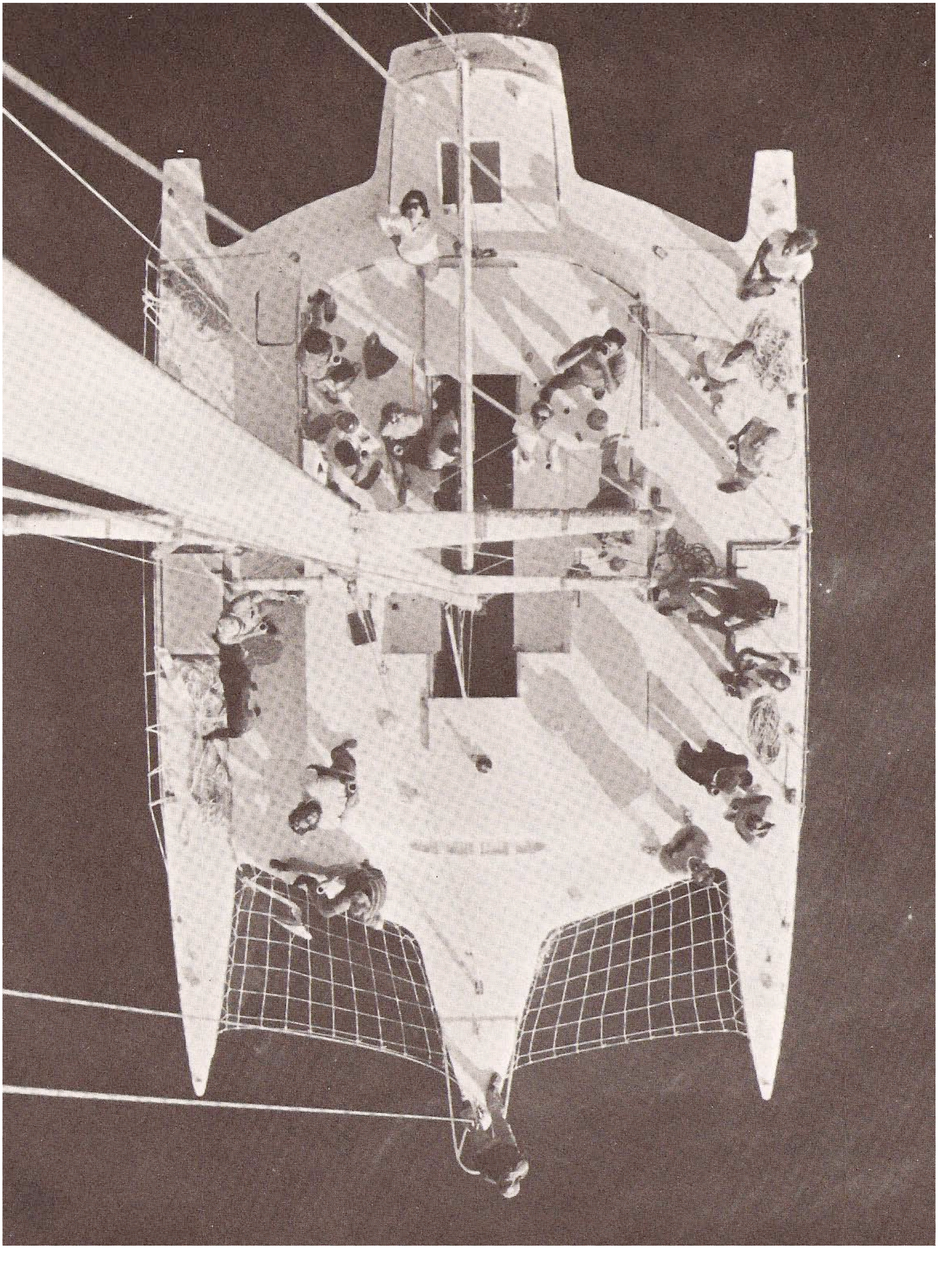
After shooting off for several pages on the subject of paint, I'd better close by admitting that I do like cosmetics. A skin-deep film of beauty doesn't change her dynamics and so would seem unnecessary. But then, resorting to the wisdom of an old friend and early tri-mariner, "It's amazing what a little paint will do for a boat - or a woman!"

Rub rails are really part of the paint job because the finish is incomplete without the protection of rub rails. These strips of mahogany or teak are screw-fastened outboard of the float planking, almost full-length, and located just down over the radius of the sheer. Locate them high like this so that screws, every foot, can be driven through the planking and into the deck stringer with no doublers or screw-blocks inside. The rub rails will cover the fiberglass tape ridge caused by fiberglassing the sheer seam, so this ridge need not be feathered so carefully where it will be covered by the rub rails. This matters because the sheer is the most visually obvious line in the boat. Without the rub rails, the fiberglass feathering along the sheer is critical. With the rub rails, an otherwise lumpy, unfair sheer line can be visually straightened by careful installation of the rub rails.

On the 25'er, the wood strips can be ⅝" x ⅞" with the outer edges rounded slightly by plane or router. On all other Searunners we use ¾" x 1" strips, no heavier please, installed in 2 or 3 lengths without scarfing. Make simple butt joints, unglued, by locating the screws next to the joints so as to align the two pieces carefully. If you damage one spot, you can replace that length only. Make one extra length to store in the float for replacements.

Damage occurs in chafing against other boats or pilings - anything vertical that passes above your deck height. This kind of damage is uncommon in marinas because the floating padded docks meet the hull down low. But once you leave the cloister of yachting areas and get out into the real world of commercial harbors, you'll definitely need rub rails. They improve the profile of your boat and when you moor in the lee of a power plant, or in any sooty harbor, the crud that collects on your deck will run off with the nightly dew and severely stain your topsides - unless you have rub rails to form a drip lip. So they do pertain to the paint job. Don't leave them off.





PHASE IV

Interiors

Up to now you've been pretty much involved with building parts for a machine - a wind machine. It has been the hulls and the wings and the decks; the structure of the machine. If the design is right and the operator is skilled, that wind machine will function. During this construction, the builder's fantasies can range from water flowing smoothly around the hulls to waves crashing down on deck and through it all the machine functions. Like all machines it seems relatively mindless and impersonal; anonymous.

But now comes the insides. Now that machine develops a mind and a personality and an identity because now you will begin to see yourself in it. The visions run from reclining in the sterncastle with a cup of bouillon to a glorious collapse in your bunk after the dogwatch. While installing the head you may imagine squatting there for an hour with a book while "sitting out a calm". Or, if you've done some cruising you may recollect the mayhem of bandying about the head compartment like a die in a shaker, struggling to get down through four layers of clothing.

Or building the galley. Imagine the flames from a runaway stove charring your paintwork, or spilling the salad oil on the floor boards in a steep roll to starboard. Imagine also the aroma of that boiling lobster you picked this morning from the reef, and turning out tea and brandy for a sterncastle full of wet sailors from another boat who just came romping into your lonely anchorage after a hard run down from the next island. You build a place to navigate while contemplating the dividers stretched out to measure a long day's run in the trades - there, we've broken 200 miles for 3 days in a row! Or you're desperately twisting the knobs of your radio trying to figure how you got us lost as a dog in the fog. So, there's lots of rich stuff in store for the builder of his own interior; lots of identifying with the boat. And now his mate can really get involved, with the color scheme and the fabrics and the arrangement of stowage.

But there is also lots of compromise in store because the interior of a boat is really not at all like the interior of a house or car. A house is not a vehicle and a car is not a habitation. But a boat is both. The interior features must allow the inhabitants to "vehiculate" in the otherworldly environment of the very variable ocean-sea. It is this double duty requirement of <u>inhabiting a vehicle</u> that must be kept in mind while building the interior. The way you build things must satisfy such a wide envelope of requirements that there are bound to be some stiff compromises.

ENGINE INSTALLATION

Especially the engine. It may seem strange that the engine is considered here as part of the interior but it is. More than any other engine, a boat's engine is <u>lived with</u>. The weight of its presence subtracts directly from the things you would like to take along but can't because of overloading. Every pound of engine and fuel you live with is a pound of something else you have to live without. The space it occupies is space that nothing else may dare to share and the smells and sounds and dangers which permeate your habitation are really there, no doubt about it. So is the safety factor, the convenience and the sense of security. But the quality of the installation itself can render all of these - safety, convenience and security - false.

If I could, I would describe now a quality installation for each Searunner and that would be that. But I can't. I don't know much about engines or their installations. If I were putting one in a boat of my own lid select and buy the machine on the basis of the best trusted, most recent information and in keeping with my basic economic policy for the whole boat. I'd follow the plans for mounts and shafting but consider the dimensions of my own engine and my type of rudder to determine the position of my propeller and mounts. l'd layout these dimensions to scale on the lines drawing and transfer them to the full-size pattern sheet (in plans). I'd have to account for propeller rotation: most marine engines turn the prop in right hand rotation, and so in Searunners the engine is placed on the port side of the centerboard trunk. If, because of gearing or manufacture your engine turns the prop in left hand rotation then mount the engine on the starboard side. I would try to avoid an engine which has its exhaust port on the side next to the centerboard trunk because this seems to be the primary space restriction in Searunner installations - clearance for the hot exhaust pipe if next to the trunk. John Marples at Almar Enterprise has designed a successful on-center shaft for an off-center engine with belt transmission for adjustable gearing. In any case, I'd have to arrange for the prop shaft to just clear the rudder, to allow pulling the shaft without dismounting the rudder.

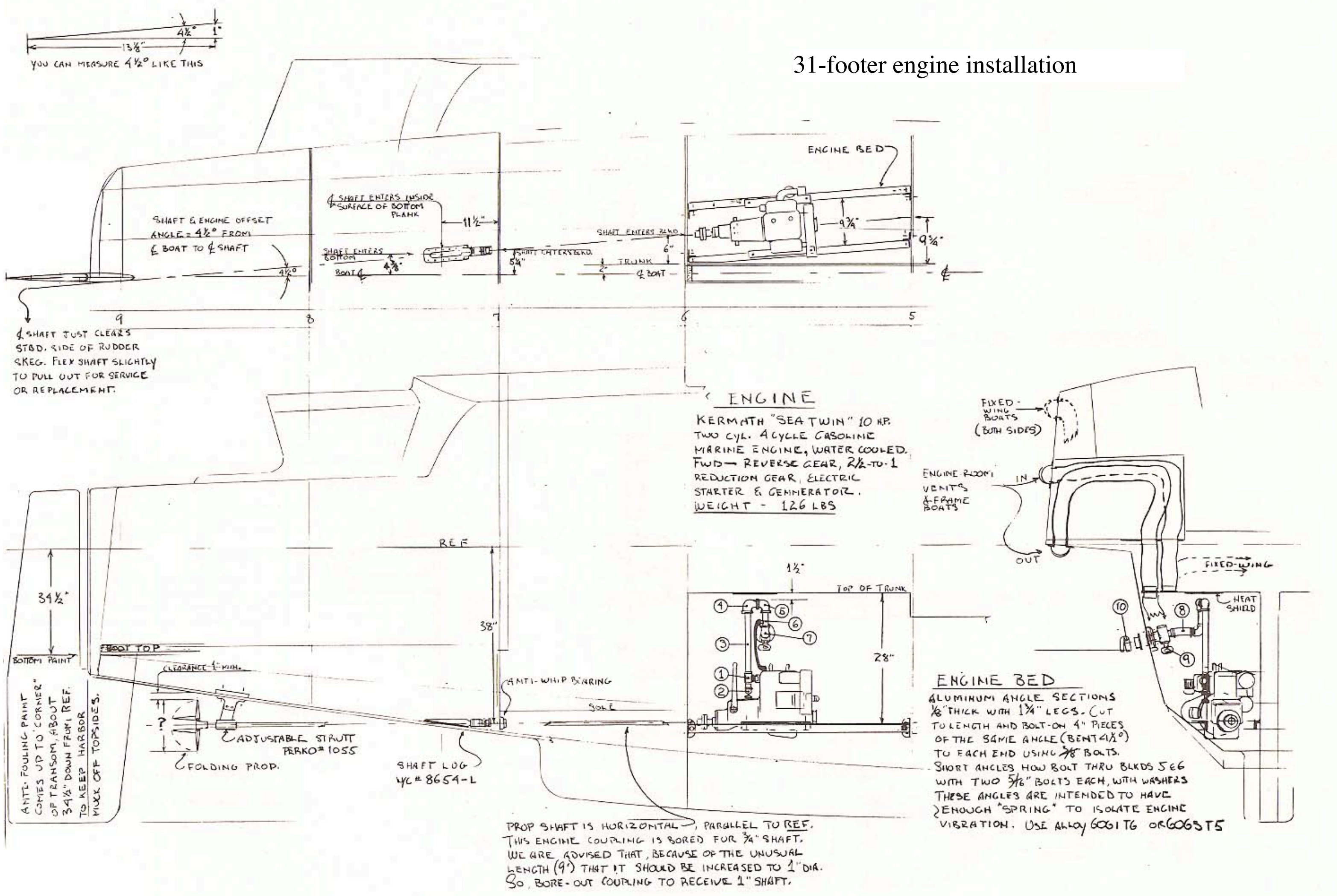
In boats with skeg rudders it appears possible to locate the engine on either side, port or starboard. The rudder skeg seems to cancel the effect of propeller torque on the helm, so locate your engine to consider other features like the exhaust port, if you wish.

To facilitate installing or removing the engine, some builders have built the cockpit seat and seat front, and the cockpit sole - in the area directly over the engine - to be removable. This is not like a hatch. The seams in the plywood are not glue fastened but instead attached with mastic and screws. The fiberglassing can be done as usual over these seams, but years later the 'glass can be sliced only enough to allow easy removal of the panels, and the engine.

I'd get the engine on the mounts (preferably before installing the cockpit seats and sole) and line it up with the shaft. Then I'd holler for help.

The myriad intricacies of plumbing, wiring, exhausting, tankage, controls and instruments are so involved and interlapping that, without the help of a <u>genuine marine mechanic</u>, I'd be snowed. Even though I've been in on the installation of dozens of engines in trimarans I wouldn't trust myself to do my own. Or, if I did, at the very least I would pay to have an expert examine the works and tell me what was wrong. This is particularly crucial in the case of the fuel system for gasoline engines. It has to be first class. You just don't pick the sore tooth of a tiger with a dime-store pen knife.

What I'm trying to say here is that I profess ignorance. I know enough about it to admit that I don't know enough about it. I'll tell you what I know (or what I think I know), and unless you think you know more, get help! We'll start with the selection.



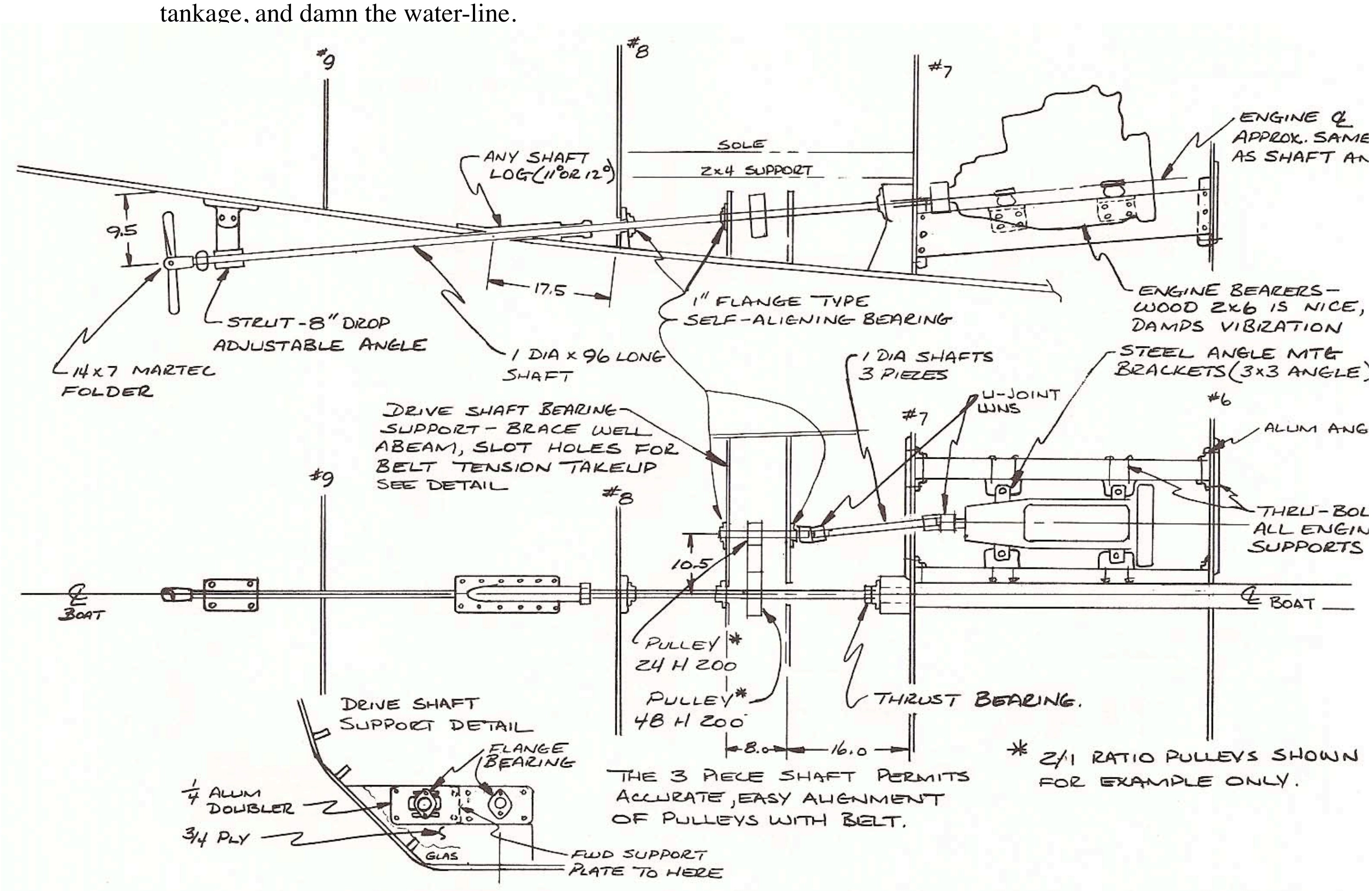
31-footer engine installation

Diesel vs gas

Use gas. With the possible exception of the 40 footer, none of the Searunners really fit any of the currently available bread-and-butter diesels. Perhaps the little Volvo MD2 diesel is the right choice for the 37, though at 14 hp, it is just enough power to move her around. If you want more power, go gas. The Perkins 4-cylinder 107 is too much power for the 40, but not a bad selection if you want a tug boat engine in your trimaran. A certain mistake is to select a big two-cylinder diesel like the Albin or Osco because they are so damn rough they'll shake your feet off of the foredeck at an idle, and conversing down below at cruising throttle requires ear-horns. They are much too powerful, too heavy, too costly, rough and noisy for trimarans. Those engines are designed for fishing boats. Sails are our real engine. What we want is an <u>auxiliary</u>.

If you go on an auto trip you take a spare tire and some tools. Not a spare engine. If you go sailing in a dinghy you don't fit her out with bronze rowlocks and ash oars. You take a spruce paddle. A cruising trimaran is really a seagoing dinghy with outriggers. The larger ones are too big to paddle so we need a spruce engine. When it comes to engines, gasoline is to diesel as spruce is to ash.

I know, you're getting - or giving - all those arguments about the safety of diesel fuel, the good "mileage" and the low maintenance. There's no arguing these points of diesel superiority, but I believe the reasoning is misdirected. A good gasoline installation combined with a vigilant operator is safe enough. Safer than a diesel whose operator thinks it does not require vigilance. Safe enough to be way down the list of seafaring hazards, a list headed by things like falling overboard and collision and navigation errors. The diesel's fuel consumption is less, per hp/hr, than the gas engine's. But in a diesel, to get equal power to a gas engine you have to pack around a lot of iron whether the tanks are full or empty. This is because the weight (and cost) of a diesel machine is somewhat greater than that of a gasoline machine. The old bit about carrying less fuel for the diesel for equal cruising range to gasoline just doesn't apply in practice because anyone with a diesel philosophy is going to pour in all the fuel he can accommodate with his tankage, and damn the water-line.



ALMAR ENGINE INSTALLATION, with belt transmission.

It is this <u>diesel philosophy</u> which is inconsistent with trimarans. In a workboat where the engine is running all day, every day, where it is the primary motive power and there is no <u>auxiliary</u>, the diesel is superior for low operating costs and maintenance. But in a trimaran the engine depreciates not from use but from disuse! Unless the "diesel philosophy" has resulted in a burdensome design being overburdened some with all the accouterments that go more with a habitation than with a vehicle; unless the concept of a seagoing dinghy with outriggers has been bastardized to be more like an overloaded lifeboat with

The above “unlesses” can go either way in the construction of your interiors, beginning with your choice of engine.

If you’ve followed the plans up to now and refrained from doubling the planking thickness and dumping-on an extra barrel of resin, then why not stay with the program all the way? If you hear any wild-ass sea stories about these boats taking tons of green water on deck or pounding out the underwing you should ask, “Did it have a diesel engine?” or, “Did the builder have the diesel philosophy?”. When I ask it, I use “diesel mentality”, a more appropriate term applying to the broad subject of cumulative unnecessary weight which has done more to hinder multihull development than any other factor. And most of it occurs on the interior. Are you the type that will have a hard time resisting stoneware in the galley and a generous sandbox for the cat? If your philosophy dictates the selection of machinery and tankage that exceeds those given in the table below, better get yourself something besides a Searunner because you’re starting an insidious accumulation that can be killing.

	Engine Weight	Tankage
Searunner 25	40	6
Searunner 31	200	20
Searunner 37	300	30
Searunner 40	400	40

No specific engine is named for each design because each builder will have his choice depending on availability and cost. I personally don’t care if rubber bands are used if they don’t appreciably exceed the weight. Some engines that I feel have been successful are:

Searunner 25	Johnson or Evinrude 4 hp with 15" shaft extension
Searunner 31	Kermath 10 hp. Sea Twin with reduction
	Lloyd 20 hp. two-cycle with reduction
Searunner 37	Universal 28 hp. Atomic 4 with reduction
	Volvo MD2 14 hp. diesel with reduction
Searunner 40	Universal 28 hp. Atomic 4 with reduction
	Graymarine Model 412 direct drive
	Volvo MD2B 25 hp. diesel direct drive

Gear reduction vs direct drive

A wise old marine mechanic once told me “It ain’t the engine what pushes the boat, kid, it’s the prop. A little prop spinnin’ fast’ll push a little boat. A big boat gets a big prop spinnin’ slow.” This is the line of wisdom you’ll get from wise old marine mechanics, none of whom - at least those I have met - have ever been sailing in a trimaran. An impudent young trimaran designer says it this way: “It ain’t the prop what pushes the boat, Dad, it’s the sails - unless you drag a big prop which now you need because the sails don’t work. When the wind dies, a little prop spinnin’ fast’ll do fine if you keep her light.”

You can see that the subject of gear reduction has led straightaway into propellers. If your propeller shaft turns at engine speed (direct drive), it’ll be “spinning fast” and so it will use a small propeller. If the shaft turns at about half engine speed (gear reduction) then you’ll need a bigger screw. Which one to choose depends on two things: is your engine on the small side for your boat or is it suited to a locomotive? And, is your engine a high rpm or a slow turning type? Most marine engines turn slowly. A small engine in a big boat needs gear reduction to allow use of an adequately large prop. A high speed engine usually requires gearing to allow use of an adequately large prop. None of this would be argued by the wise old marine mechanic, or the impudent young trimaran designer. But one last combination will cause conflict. In trimarans, a powerful engine designed for efficient running at a moderate rpm does not need gearing! Diesels may run slowly but contrary to popular impression, they are powerful (for their weight, compared to gasoline).

So, taken all together I believe the ideal choice of engine for the 37 and 40 foot Searunners to be a throaty gasoline machine - light for its power - with direct drive and a moderate propeller. For instance, take that 30 hp. Graymarine #412. It cruises at 1650 rpm. which is very slow and smooth.

Swing a 14" two blade prop at engine speed and you'll cruise at about 7 knots. You'll get good maneuverability, better than average "lug" against headwinds, and sneak it in for 400 lbs. Just right for the 40.

For a larger engine, like a four-cylinder diesel, you'd use a larger prop <u>without</u> reduction. For a smaller engine, like the Atomic 4, you'd use a similar prop <u>with</u> reduction. Just right for the 37. If you consider the Atomic 4 to be inadequate for the 37, then use the Graymarine 412, but you're overdoing it. That big engine is 100 lbs. overweight and gives power you can seldom use, but must always carry.

In the 31' Searunner, that little Kermath 10 hp needs reduction to be capable of swinging a 12" two-blade. The 20 hp Lloyd two-cycle runs fast and so also needs reduction.

The 25' Searunner cannot, under any circumstances, accommodate an inboard. Outboards are treated in the next section.

Continuing with propellers - as matched to inboard powered Searunners - you need two: a fixed wheel and a folding wheel. If you can only afford one, get the folding. This advice will likely meet with more disagreement than any of the statements above, so I'd better explain; folding propellers are designed so the blades close up, like a poppy at night, to reduce drag under sail. They are less efficient than a fixed prop and as such meet with widespread controversy. Those who favor the fixed wheel are generally unaware of this fact: fixed propellers not only slow any boat's progress under sail, in trimarans they also <u>drastically reduce high-speed steering control</u>! In heavy weather when the trimaran may exercise its <u>prime virtue</u> of being able to <u>run away</u> from dangerously breaking seas, a big fixed propeller running ahead of the rudder will profoundly affect the helmsman's ability to control the direction of the boat's travel. The possibility of broaching (sliding sideways down waves) is <u>substantially increased</u> by the existence of the fixed propeller! This is because the turbulence created by dragging the prop causes the rudder to run in wildly turbulated water. The effect is not obvious at normal speeds in smooth water, but when surfing headlong in tumultuous conditions this turbulence causes the rudder to STALL: lose its effectiveness as a guiding foil. Many accounts of trimaran broaches can be directly traced to this combination of design features: no centerboard, shallow spade-type rudder and a big fixed three-blade propeller. Rudder stalls are insidious - they happen <u>suddenly</u>. Good control can go to no control at all as the rudder reaches a certain speed at a certain angle of helm. Bango! - you're riding a runaway. Few sailors in the world today have enjoyed the confident sensation of crisp steering control while surfriding in open ocean. This aspect of the trimaran's safety potential is seldom realized. Centerboards and skeg-type rudders are a sure way to realize this marvelous safety potential. This gives the trimaran a huge umbrella of ultimate safety in zero-hour conditions as well as a great gain in the aesthetic experience of ocean sailing. If you wish to deprive yourself of this potential and trade it for "improved performance under power" then go ahead and drag your bucket-sized prop across the ocean. Whomever decides for the big fixed prop should be made to do the steering.

If you've got a fixed two-blade, and you carry it in the horizontal position while sailing (to reduce the zone of turbulence seen by the rudder) then it will be nice for a river trip or sailing in water protected from surfing-sized waves. Some propeller merchants will loan you reconditioned props for experimenting to match your engine. When you find the right wheel, buy it and take it off and replace with the equivalent folding prop. Current manufacturers are Martec and Federal.

The simplest (though incomplete) way to describe a good propeller match for your boat and engine is to say: an oversize prop won't let your engine achieve its specified top rpm - the speed at which the engine's rated horsepower is measured. An undersize prop lets your engine race above that rpm. The right prop will "hold the engine down" and also "let it rev up". A tachometer is essential for choosing a prop. The other part of the description is that, at the correct cruising rpm, the right prop will push the boat the farthest for the least fuel consumed; a delicate match which is seldom achieved and has small importance for an auxiliary trimaran.

The usual propeller match for trimarans is one that is too big - it won't let the engine rev up to its rated rpm. This is because the usual trimaran propeller installation offers more "water space" around the prop which gives it better "bite" in the water than with most sailboat installations. Propeller merchants tend to recommend - on the basis of their monohull experience - a prop that is too large. Follow this important rule in determining your cruising rpm with your propeller: run it up full throttle and note the maximum rpm your engine will achieve while the vessel is under way. Now, reduce throttle to 75% of the maximum. This is your cruising rpm. Higher sustained rpm will damage your engine.

There's more that needs to be said. Let's throw it all together and get it over with:

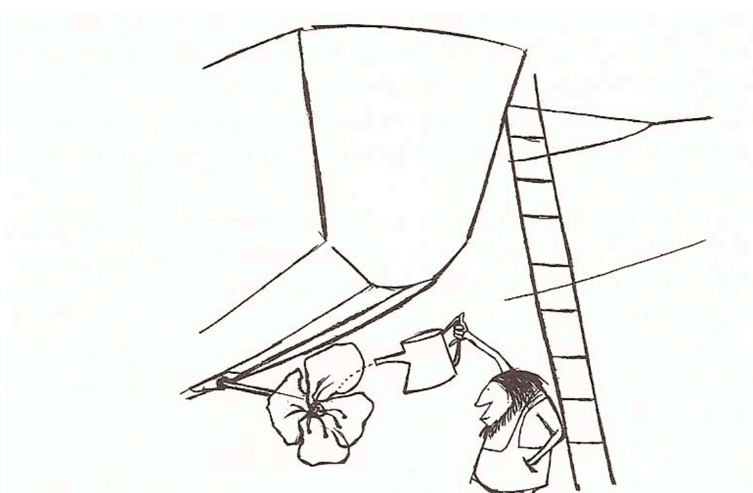
- Gear reduction on a big engine is heavy and costly and further increases the size of the shaft required, the size of the accompanying bearing, strut, shaft log and prop. The accumulated weight can be hideous so don't use gear reduction on a big engine.
- Automotive engines with marine conversions are OK if the right size, but most are too large and the cost of the marine conversion is substantial - look into the subject thoroughly. Marine engines really are much different.
- Volkswagen engines are absolutely out but a reasonable air cooled installation will surely be developed by some resourceful builder. There are many attendant problems and if you're not really hep on boats and air cooled engines, don't try.
- Use best quality heat-resistant hose with all stainless hose clamps for your cooling water plumbing. A plugged hose can overheat the engine to destruction and it can also burn up the boat. If the "wet" portion of the exhaust is deprived of its water it can catch fire quickly.
- Engine room wiring must be first class. Use a separate battery for starting and secure batteries to stay put in a capsize or collision and still make them accessible for filling.
- Morse cable controls for shifting and throttle are easiest to install but a handy guy can frog-up good mechanical controls.
- Engine instruments for temperature, charge and rpm should be visible from the helm.
- Resist the advice of the expert who says you should have rigid engine mounts and shaft coupling - these boats absolutely require that engine vibration be isolated. Despite peels of laughter caused by our weird angle-iron engine beds (see plan), none has failed at this writing.
- Flex mounts and angle iron beds require flex couplings as well. Where the shaft passes through the hull use a self-aligning type stuffing box and make the walls of the hole in the hull clear the shaft by ¼" all around (⅜" for big engines) or else shaft whip will cause the shaft to encounter the walls of the hole - which should be sealed with several coats of Gluvit.
- Inboard exhaust systems are heavy and expensive and deserve the attention of an expert. The mufflers which are supposed to keep seawater from entering the cylinders via the exhaust port don't work on trimarans in rough conditions and so the exhaust thru-hull fitting absolutely must be fitted with a seacock so you can close it positively in surfing conditions.
- We also recommend a petcock in the lowest point in the exhaust system to drain condensation and ventilate the exhaust pipe.
- Do a careful job of insulating the dry, hot portion of the exhaust pipe. Wrap with asbestos, then wrap with fiberglass tape and soft stainless wire. Then paint with several coats of "Arabol", a product available at plumbing and heating outfits. Be sure no asbestos fibers can slough off and plug the air intake.
- Put at least two jumbo sized, cleanable (not disposable) fuel filters in the fuel line and a valve at the tank to shut off fuel, as well as at the carburetor. Two tanks with separate lines and filters and valves are best.
- I can't imagine putting gasoline in a plastic tank.
- Follow Coast Guard ventilation requirements but don't put engine room vents under the wings.
- For a gasoline engine, to make it absolutely safe, put the starter button inside the engine room. To start, stick your head in there, open the exhaust port valve, the fuel-line valve at the carburetor, and close the exhaust petcock. Do you smell gas? If so, don't push the starter button! The reverse procedure when shutting off the engine will force the sailor into regular, intimate contact with his engine. Gasoline odors and other irregularities will be quickly noticed. Because of the inordinate heat and vibration of diesels, this above procedure is valid for both fuels.

Oh, brother! It goes on and on. Let's talk about outboards and then try to bring it all together at the end.

Outboard vs. inboard

All Searunners except the 25 are designed to accommodate inboard engines. The 25 is too small for any kind of inboard. Because the boat is so easily maneuvered, paddled and sailed in vagrant zephyrs, most owners use no motor at all most of the time. But because beginning sailors are reluctant to allow themselves this freedom, and because the specified 4 hp motor sounds impotent to them, some grossly oversize motors have been fitted to the 25. These are commonly mounted to Gargantuan brackets attached to the side of the hull, down low, and the combined effect deprives the owner of ever gaining full appreciation of his boat. Outboards are designed for transom-mounting on motorboats with transoms which are 15 inches or 20 inches above the planing water-line - above the cavitation plate on the lower end of the motor. In a motorboat this waterline is relatively constant but in a sailboat it varies considerably - especially if the motor is side mounted. To gain sufficient propeller immersion, the bracket must be located so low to the water that the power-head of the motor is little more than a foot above the water. Even if your motor is a "long shaft" model (for 20" transom motorboats) the propeller must be immersed much deeper than the cavitation plate, or else it will keep jumping out even when motoring in the lightest chop. If you mount the motor low enough to avoid this, you'll be dunking the powerhead regularly, even in the lightest chop. That's like putting cigarette butts in the urinal - it makes them hard to light. To avoid the dunkings, some builders have built a massive cowling around the engine as part of the bracket. Now, let's try to go from motoring in a light chop to sailing in big waves! It's like flying with your flaps down all the time. The motor - tipped up on its gargantuan, cowled bracket - is absolutely inundated at every crest and the drag of the side-mounted cowl turns the boat into an unmanageable slug. If you hang a hunky outboard over the side of a little trimaran you will irreparably modify its prime virtue: its ability to SAIL. And it won't even motor worth a damn. If you keep it pure it will sail like nothing else the ocean has ever known.

There is a place for an outboard motor - a special outboard motor - on the 25, and maybe even the 31. That place is on the transom and that motor is the 4 hp. Johnson or Evinrude with the extreme long shaft extension - 15" longer than normal. To my knowledge this is the only motor made with such a feature. Other OMC products can be extended 5" with a ready-made part, and sometimes catamarans are equipped with motors with 5 or more extension units of 5" each; a special job at a special price because the drive shaft for such a motor is a custom fabrication.



Flower Power

But in our case the 4 hp is maximum anyway because, in my opinion, an outboard motor should be light enough to carry in one hand. How else can you ambulate about the deck to remove or mount the motor while the boat is leaping around like a gazelle. This 4 hp job combines a weight of about 35 lbs with the extreme long shaft feature absolutely mandatory for successful transom mounting. That little outboard bracket in the 25'er plans is something you can make yourself, it is unobtrusive and strong, and it is well suited to this motor and this motor is well suited to this boat. It is enough power for an auxiliary on a 25' boat. It'll push you along at about 5 knots in a calm, and maintain steerage against a 15 knot wind. The bracket, located beside the rudder on the transom behind the boat places the motor in the shelter of the boat itself. Waves sluicing out of the tunnel run past the motor and not directly into it. The shaft is long enough to give good propeller immersion even in a chop while holding the powerhead high; high enough in fact so that when you tip the motor up for sailing the power head comes inboard, forward of the transom onto the deck! Shorter motors require brackets that cantilever aft of the transom by some considerable, precarious distance of trusswork in order to allow tipping-up the motor without the power head colliding with the transom.

True enough, the central cockpit doesn't go together well with a transom mounted outboard. That's not enough reason to put the cockpit at the transom or the motor in the tunnel. Managing the starting, stopping and throttle is a job for a second crew while you keep the helm, though one man can operate the boat alone from the stern in calm weather by steering the motor or turning the rudder itself. A simple link between the rudder and motor, causing both to turn together, will offer good maneuvering from the helm. Optionally, a throttle cable can be led to the cockpit but this can be more nuisance than convenience.

Attempts at accommodating outboards in special wells in the hull have been largely unsuccessful. The well occupies much needed space in the boat, the hole in the bottom is hard to plug when sailing and motoring, and the exhaust fumes of the engine come up in the well and are re-breathed by the motor which radically shortens its life. The motor must retract clear of the water to avoid electrolysis and, usually, must then tip up and lay down to stow below deck with a locked hatch. If all these requirements are overcome the space consumed is usually unacceptable.

The 37 and 40-footers are certainly too big for any sort of outboard installation because the motor required would be too large to manhandle. But several builders have concluded that the 31 is suited to an outboard. That's OK so long as all the aspects of fitting an outboard to the 25 are observed, INCLUDING the 4 hp motor. Don't ask yourself to hang a fifty-pounder on that bracket in a seaway! If 4 hp sounds too small (it's really all right for calms) then get two. The 31 has so much greater freeboard than the 25 that even that lanky shaft wont reach the water if the bracket is mounted at deck level. So, for the 31, you need a sliding bracket of some kind made of tracks or pipes. Arrange for the power head to come inboard when tipping-up. For starting when the motor is in the down position, a small hook-fairlead or snatch-pulley on the transom or on the motor will allow you to pull upwards on the starter cord. I am personally not opposed to this type of motor installation on the 31. It'll give you just enough umph to move around in a calm and otherwise you'll quickly learn to manage her with the sails. You will gain as much in sailing performance, weight and cost saving, interior space saving and safety as you will lose in the boat's capability to steam around like a tugboat. And you'll really learn to sail!

Our experience with British Seagull motors in trimarans has been disappointing. Absence of cowling over the power head makes them too vulnerable to spray. The open carburetor intake will gulp up a passing dollop and you're dead. The magneto is relatively unprotected from moisture and, despite claims of great thrust for heavy loads, we have seen that they are impotent, pound for pound, compared to domestic makes. Most conclusively, their long shaft model is much shorter than the Johnson or Evinrude 4 hp with 15" extension.

Engine vs no engine

The above longwinded discussion of engines is not intended to encourage the builder of a Searunners to eliminate the whole thing. The larger Searunners are designed to accommodate inboard engines with standard thru-hull shaft, folding prop and strut. Exotic, developmental installations are discouraged for the average builder. If the recommendations above are followed, the existence of the engine will not destroy the boat's seakeeping qualities and will add greatly to its versatility.

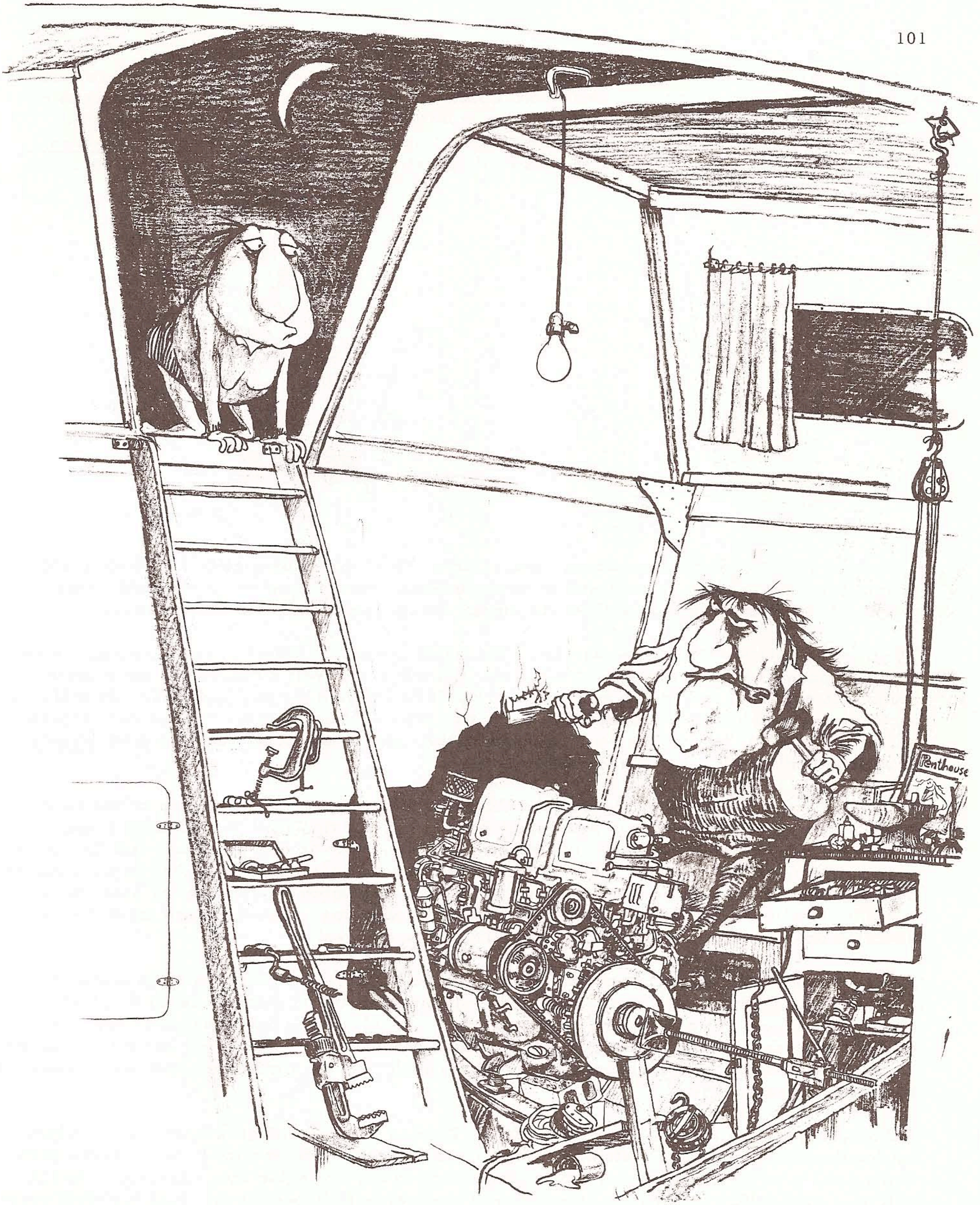
Some trimaran designs are not meant for inboard engines. The above discussion is not intended to encourage the builder of a boat whose designer specifies an outboard to fit an inboard. Matters of displacement, trim, structure, rigging and steering must all be considered when specifying an engine's location and its weight. If my comments about outboard wells or propellers or fuels seem to disagree with the design you are building, go by <u>your</u> plans. My comments apply to Searunners and can be justifiably limited to Searunners without conflicting with design features of other boats. That's just how <u>integrated</u> a boat design is.

However, if the builder wishes to be discriminating or prejudiced against any single faction in the Searunner community of design features, let it be the engine. If there is anything substantial you wish to add to the boat, like a cockpit doghouse and an extra, large dinghy, an extensive workshop or a growing specimen collection of something like coral or shells, please believe that for this addition you MUST leave something else out; let it be the engine.

I'm not going to offend you with a list of all the ancient - and modern - circumnavigators whose achievements were made without engines. There is no parallel between Magellan or Hiscock and me or you. The feats of seamanship involved in an engineless sailboat are certainly more demanding, and more satisfying when achieved. And certainly more embarrassing when not achieved.

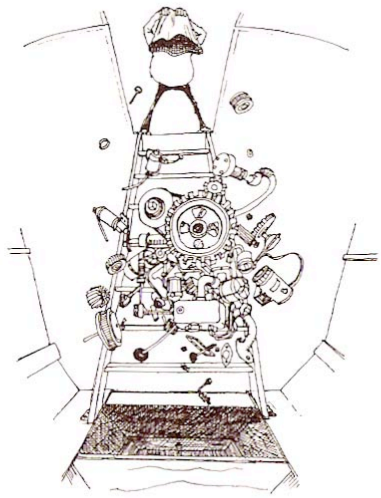
But NOT more dangerous! Certainly not. Anyone who argues for an engine on the basis of safety is missing the mark. Except in one instance - man overboard. Retrieving a sailor who has left the boat before arriving in port is the best single excuse for having an engine on the grounds of safety. Even then, the crew on board may have a better chance to return for the castaway if they can <u>hear</u> him - hear the whistle he should have sewn into the pocket of his lifejacket or tied onto the lanyard of his knife, always at hand. Lacking the convenience of the engine, the crew is perhaps better prepared to maneuver the vessel for pickup - because of man overboard drills that might not have been practiced had they an engine to rely on. And the possibility of falling overboard will be perhaps more omni-present in the minds of a sailing crew and so it may be thereby prevented. Still, an engine will be useful in such times of emergency, if it works.

Engine failure, in an insidious way, often causes danger of greater consequence than no engine at all. Boat engines are more prone to failure than any other type - especially these "amateur" installations. The marine environment is hard enough on deck hardware, made of bronze and stainless, but the engine is all ferrous metal. Whether fresh-water cooled via heat exchanger, or seawater cooled, a marine engine has an electrolytic contact with the ocean which causes corrosion as fast as granite dust eats up a tractor motor. Add to this the notoriously dirty fuels available at dockside and the difficulty in maintaining boat motors because of space limitations, the long periods of disuse interrupted by spurts of "lugging all the time" (a marine engine never lets up or runs downhill) and you have a brief explanation of why boat motors have lots of problems. Just like with automobiles, gasoline boat engines suffer most from electrical problems: battery charge and ignition. Here the diesel is singularly different because it has - theoretically - no ignition system. But diesels are often equipped with glow plugs for starting and are even more dependent on the battery for starting because their hellish compression ratios make even the small ones almost impossible to hand crank. And, while the diesel has no spark plugs, wait 'til you try adjusting fuel injectors or bleeding air from lines at sea! If you run a diesel out of fuel or cause the tank to deliver air to the fuel line - perhaps from the churning of heavy weather - better get the oars warmed up unless you really know how to <u>sail</u>.



What the hell do you think I'm doing ?
... I'm putting in the engine !

Now, here is where I really get in my licks - Engines don't make sailors. Sails make sailors and if it's a sailor you want to learn to be, chuck the engine. If you are just beginning at this seafaring business, you owe yourself the opportunity to learn to sail in a motorless boat. Whether it's a dinghy you buy while building your trimaran or the trimaran itself, give yourself a chance. At least for the first season of operation, the engine will restrict your basic aim - to learn to sail.



I can hear the moans of disagreement now. "He's crazy" you'll be saying. "Nobody could sail in and out of my harbor. I can't sail to work on Monday morning after an all-night Sunday calm and so I'll force myself to do without the engine except when there is no alternative."

Very well. That's what engines are for. But watch yourself. Watch yourself putting the cover on the mainsail while motoring past the jetty, and watch yourself struggling to get it off when the engine quits. If you end up on the rocks will it be because the engine failed? Or will it be because you wouldn't have attempted to enter past that jetty under those conditions without an engine? Or will it be because your reliance on the engine insidiously kept you from learning to sail past that jetty under those conditions?

And watch yourself when you secure the halyards - to keep them from flapping on the mast while anchored in a tight cove with a rubble bottom and a rising wind and a falling glass. If the anchor drags you'll just motor up and drop it again. Except that somebody left the refrigerator door open and it drained the "accessories" battery so someone switched to the starting battery and still the refrigerator door is open because the latch is faulty or the beer shifted so it won't close or any of a thousand things that could leave you engineless and halyardless and dragging onto the rocks. Great safety feature, those engines.

Silence is golden and sails are quiet. Watch yourself motoring right up onto the beach in a fog because you couldn't hear the surf. Picture you, at the helm, blinded by cabin lights which the crew burns freely while the motor is charging. You couldn't see the tiny lantern and you couldn't hear the shouts. It was a quiet Bahama night and you drove smack into a quiet Bahama smack, its crew enjoying their repose and their conch chowder while you came deafly upon them borne by a gasoline breeze.

Calms can be tiring though. Arduous in fact. Waiting for the wind gets downright revolting. Anchoring out or heaving-to offshore to wait for a favorable tide or wind to enter port - especially after a tiring passage - will make one decide to buy an engine then and there. And it will be a good decision if it isn't overdone and the boat is designed for it. Just don't kid yourself that the engine is for safety. It is for convenience, and sometimes safety, and sometimes danger. The tight spots it gets you into, when it fails, will be just as tight and just as numerous as the spots it gets you out of when it functions. Simply having one can cause you to blithely enter precarious predicaments which, if it fails, leave you no alternative but catastrophe.

Not having one simply means you will be inconvenienced by lack of versatility. The potential danger of being without it, in rescues and the like, is surely no greater than the potential danger of having a bomb or a bonfire always waiting to happen in your bilge. The convenience of having it can sometimes be cancelled by the inconvenience of maintaining it; a lot depends on the installation. The engine, more than any other single feature of your interior, is as good as it is bad; as wrong as it is right. No matter what you decide about engine versus no engine, you're going to curse it, and love it, either way.

I'm not saying you should leave it out. I'm saying it's a big job to put it in and if you go with an engine you do not necessarily go safely. If you choose to get yourself some bronze rowlocks and some big ash oars (seriously) and forget about the engine, it's OK with me. I'm leaving it up to you.

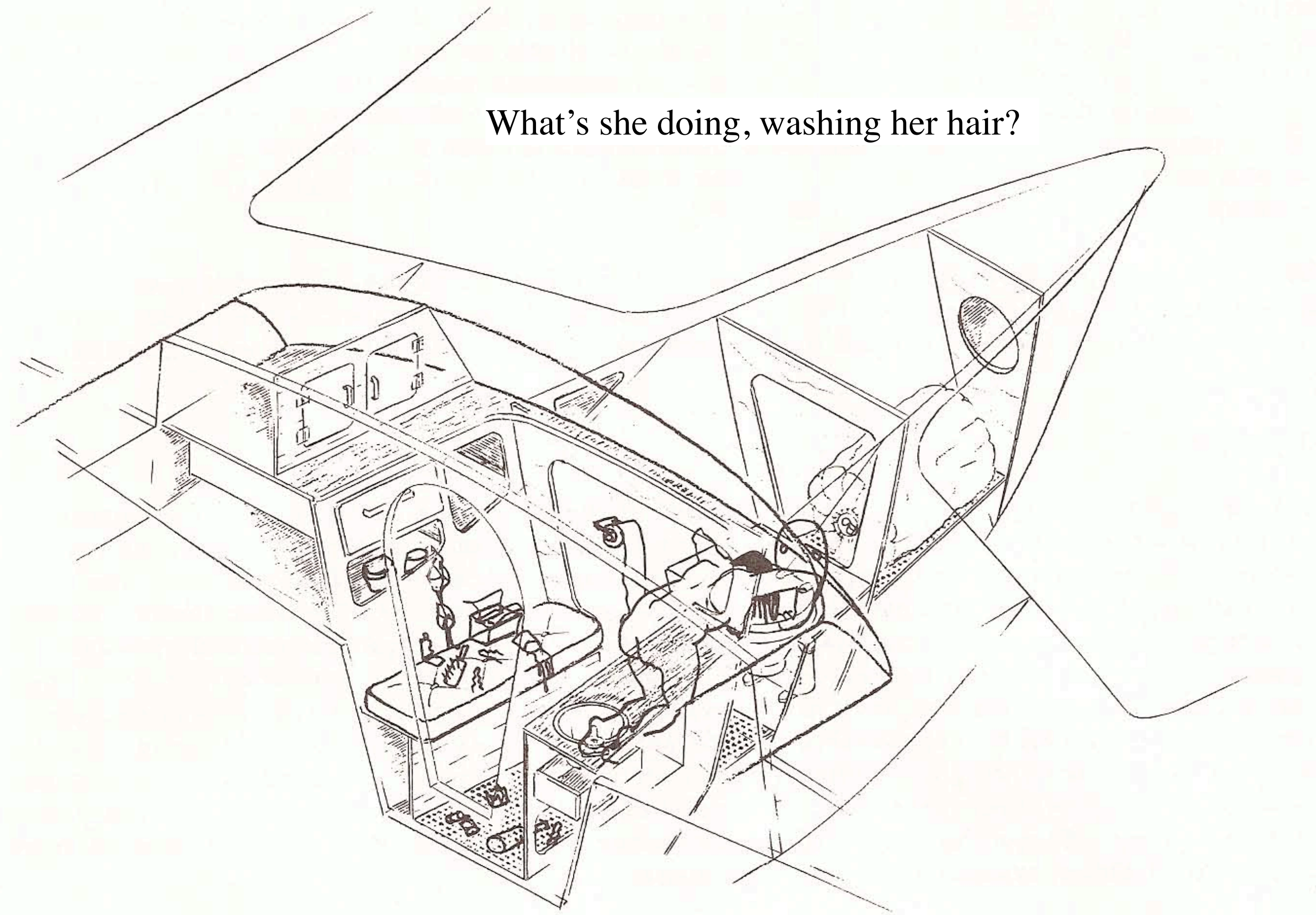
FURNISHINGS

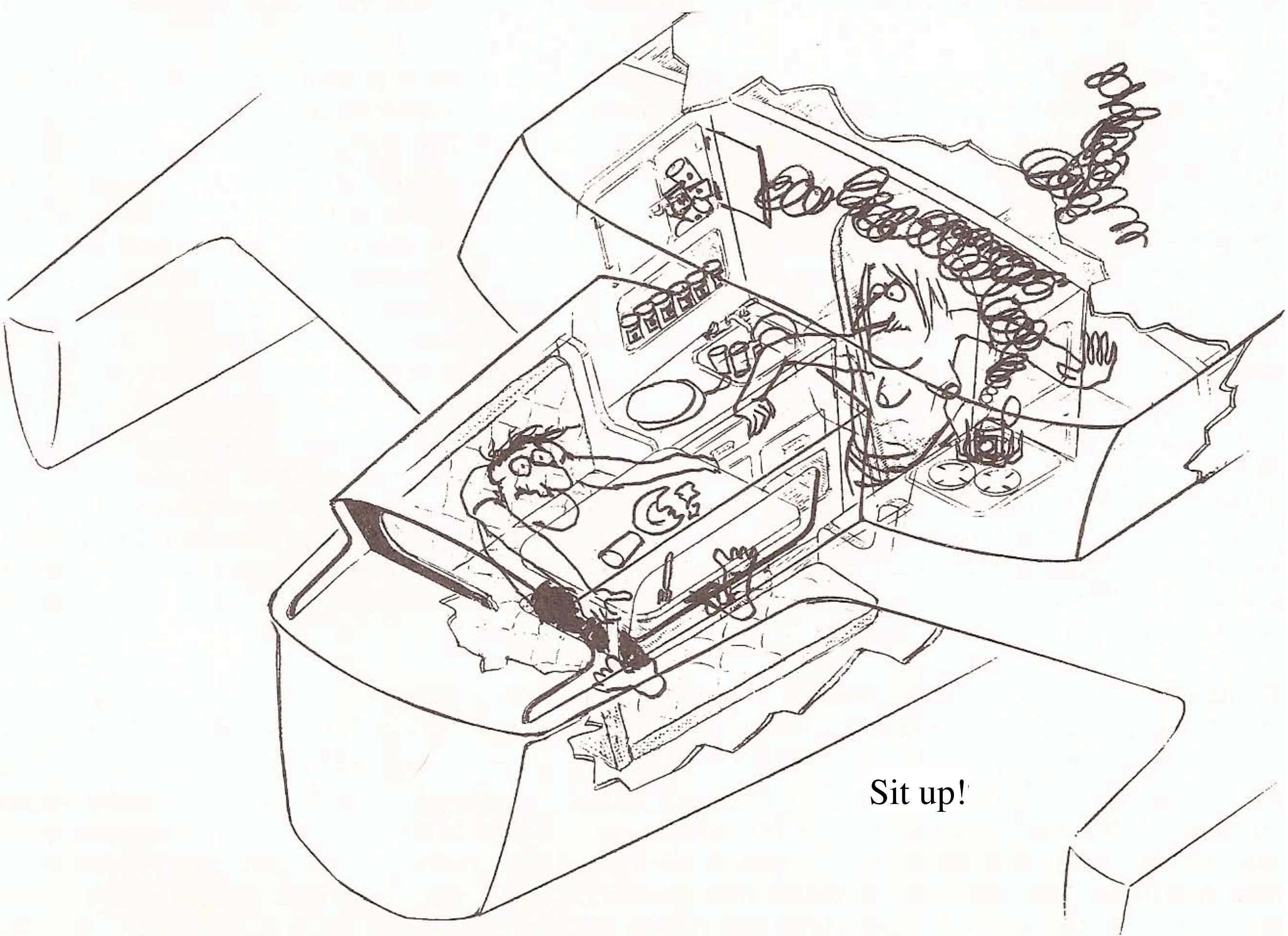
Within the restrictions of the design, your interior furnishings can be built to suit yourself. The restrictions are that you can't very well move frames around, widen the cabin, or cut larger holes for the windows or through the main-strength bulkheads. You can lower the floor level sole if you're extremely tall; or raise the counter tops - because these changes won't affect the structure. You can leave out bunks to make space for specialized stowage like a photo lab or a workshop; but watch out for adding weight! Don't put more weight in that bunk space than the crewman you have displaced. A bent for elegant joinerwork and opulent interior appointments can be responsible for the same weight as the diesel philosophy. Design your interior details with weight saving in mind; stick to the dinghy philosophy by learning to do nice work with lightweight materials. Plywood edges can be made attractive in most places without doubling up. Shape them carefully with router and drum sander and then sand by hand for the easiest, lightest treatment of plywood edges.

You can express yourself in a thousand ways with the interiors and still keep the weight down.

Galleys. Plan your counter tops and cabinets around your choice of stove and sink. The 25 and 31 are too small for bottled gas cooking. Kerosene is the best fuel for long distance cruisers of any size because of its universal availability and low cost. Alcohol is too expensive for full-time use and produces less heat per gallon than any of the fuels; not enough heat to bake in a Coleman type folding stovetop oven. My own opinion is that a good Primus or Optimus two burner kerosene stove, countertop type, with stovetop oven, is the real solution for all cruising cookery. These ovens really work and you'll probably not be baking much while under way with any stove. Bottled gas is not the wrong solution in the 37 and 40 where a stove with an oven can be accommodated, especially for full time living aboard. I personally consider these ovens to be dangerous because it is hard to tell when they are lighted - or blown out. Be sure your tanks are small enough to carry ashore in the dinghy for refilling. The primary advantage to bottled gas is that it is easy to light the stove. Kerosene burners must be preheated with a primer to light but we have found that preheating can be neatly accomplished with a Bernz-O-Matic type propane handtorch equipped with a wide tip to fan out the flame. A permanent storage nook can be built in the galley (far from the stove) to mount this hand torch. The torch will light with a flint spark lighter eliminating the need for matches, and has many other uses on board like burning ends of synthetic line, etc. The crew must be cautioned to turn off the torch firmly.

But if bottled gas is chosen for cooking, the bottles are very heavy when full, and dangerous if stowed inboard. The safest place to mount them is on deck, though they become unsightly from rust. Bottled gas wells can be built in the 37 and 40 just outboard of the galley cabinets, with hatches through the cabinside aft of the main-strength bulkhead. These wells must be vapor tight except for the hatch and a large overboard vent through the underwing. Gas leaks in the plumbing at the bottle are common. Vents must face downwards because the gas is heavy. An absolute seal from the cabin is essential and the line should penetrate this sealed panel at the top, on its way to the stove. Life-Calk and Gluvit should be used in sealing the well. Turning off the valve on the bottle after each use is the only way to surely prevent accidental gas accumulation in the bilges.


What’s she doing, washing her hair?


Sit up!

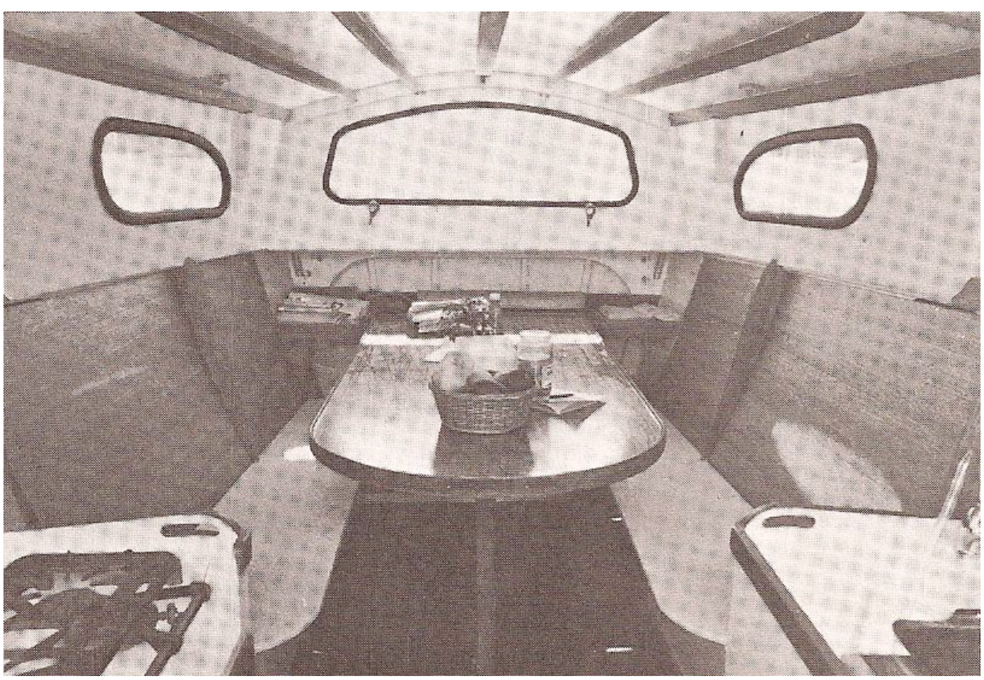
This degree of vigilance is so troublesome that I personally prefer to just fire up a kerosene stove.

37

37 Footer Galley
& Lounge

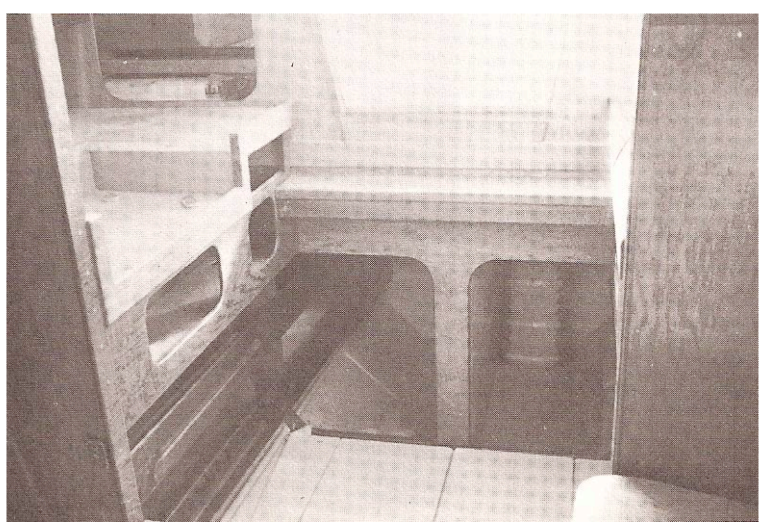
This very seamanlike galley features double sinks made by the builder out of plywood - then fiberglassed along with the countertop and epoxy painted. Cutting board fits over small, very deep sink. But reports are that for West Coast cruising an abalone pounding block is desired. Stove is super functional, un-yachtsie triple butane gallery with custom made fiddles (not shown) and cleaning space beneath. A folding stovetop oven is used for baking. Semicircular holes at bottom of counters form steps for reaching into locker spaces behind counters.

The dinette area is starkly functional with aft window that tilts out from the bottom and seats that raise for stowage access without struggling with cushions. Runners of carpet or thin foam can be added for comfort. This very appropriate table is made from a piece of the workbench on which the boat was built.



Sinks in boats are most useful if they are deep. This is not just to keep the dishwater from slopping out, but also to make the sink useful as a catch-all. If it's too rough to wash dishes, stow them in the sink. If the wind comes up and the galley has been left untidy, it helps to have a deep sink to corral the stuff while you're putting it away. An inexpensive sink can be made from a large stainless bowl or pan. But it's hard to get such a sink to drain completely without a boss around the drainhole to recess the drain fixture. Double sinks are found in many Searunners but they tend to drastically reduce the counter space. A cutting board can be made to cover one of the sinks, or the single sink. It is difficult, but possible, to make the cutting board fit flush with the counter top by mounting the sink flange to the bottom of the counter instead of the top. A doubler must be glued beneath to make the counter thick enough to drive screws up from below to mount the sink. Now the counter becomes thick enough to accept a cutting board of reasonable thickness and still have it flush with the counter top when it covers the sink. The edges of the hole through the counter - revealing the sink - can be coated with two coats of Gluvit. Sink drain plumbing should be large in diameter and lead directly to the thru-hull fitting; as short and open as possible. The basket-type of sink drain will catch silverware etc, but below the basket cut out any screening to allow a dispose-all going overboard. In harbor, use the basket to collect waste for taking ashore with garbage, but out at sea a big, open sink drain is a nice convenience. However, some sea conditions may tend to blast water up into the sink; so the thru-hull fitting can be covered with a rubber flap outside.

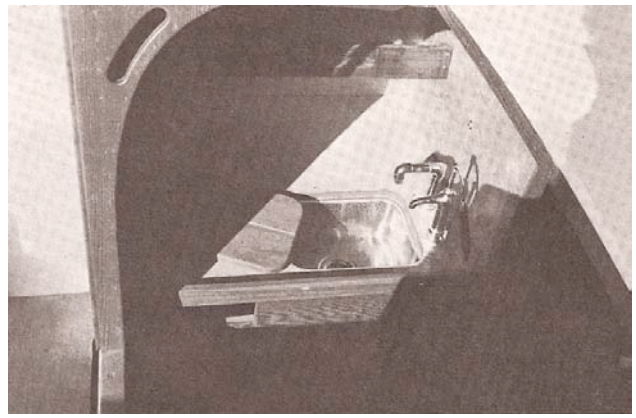
Pumps to supply water to the galley sink(s) come in a great variety. The basic requirement is volume - the fewer strokes per quart, the better. And the pump should hold its prime fairly well so that while washing dishes you don't have to pump like crazy each time you rinse a dish to get water from the tank - it is already in the line. The really cheap house-trailer pumps are not suitable for seawater. For fresh water, a pump rated at 15 strokes per quart is just satisfactory in the galley if plumbing from the tank is no less than ½" tube. For seawater supply a much larger pump is desirable so you can get some real volume in a hurry. One solution is to use a diaphragm-type bilge pump like the Guzzler or Gusher plastic jobs. Mount the pump below the counter so that one reaches through a hole in the counter-front to work the pump. A custom made spigot can be made from 1" size copper or plastic pipe fittings. A 1" hose leads from the pump to a thru-hull fitting below the waterline and on the <u>opposite side</u> of the vessel from the head discharge. This pump can be used as an emergency bilge pump by removing the hose from the thru-hull (after closing the valve on the thru-hull fitting) and leading the hose to a deep bilge for pumping bilge water - into the sink from where it drains via the large sink drain. This system is a great convenience in the galley because it makes a large supply of seawater easily available and discourages unnecessary use of fresh water. But the plastic pumps are unfortunately not designed to be absolutely watertight. To keep your pump from leaking seawater under your sink counter, disassemble it and pack all joints with a non-hardening joint compound like automotive "dum-dum" and reassemble. Do this before the first installation.



3l-footer galley has stove recess and turnpegs for mounting - and removing - stove. Long shelves below have high fiddles, extend under cockpit (no engine). Water tank is visible right of trunk.

The most common shortcoming in boat galleys is lack of counter space. It gets to be a matter of no place to set things you are using right now. Using the dining table - if it is next to the galley - helps a lot. But design your galley with as much countertop as possible. Cupboards with doors can sometimes have the doors open downwards to hang from a line or chain for added flat space when open. Countertop stoves are nicest when recessed into the counter so that a large object like a tray can straddle the stove and the counter when you're not cooking. Sinks with cutting boards - especially if flush - extend counter area, and stowage nooks going off into the wing or through a bulkhead, at counter level, also help. Determine your countertop height and width to allow for your sink and a recess for your stove. For instance, in the 31'er, raising the counter height about 3" above bunk level and bringing the counter-front inboard almost to the main-strength bulkhead cut-out will allow space for installing a standard Perko 10" x 14" sink 7½" deep and a Primus two burner stove in a recess.

31-footer sink is recessed to allow flush-fitting cutting board. Fresh water pump has handle. Seawater spigot connects to diaphragm pump beneath counter. Pump handle access is through hole in the counter front.

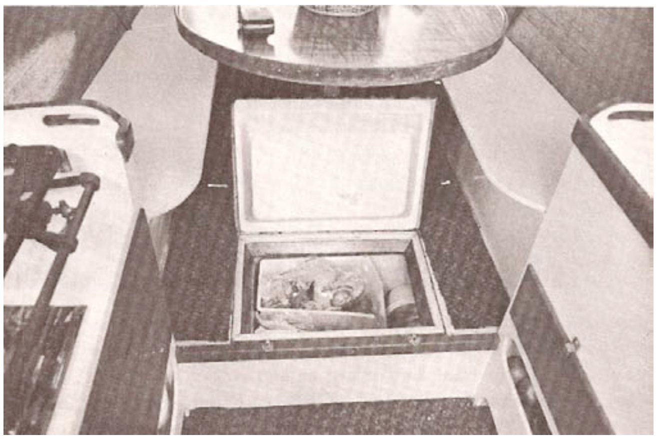


The best countertop covering is still Formica type laminate. But they pose some special problems in boats. It seems wise to not glue the countertops and fronts in place permanently. Maintenance of plumbing or repairs to the hull and wing are more feasible if the basic interior components are screw fastened, perhaps with Life-Calk in the joints, so that they can be removed without destroying anything. For Formica faced countertops, this means cutting the ⅜" ply panel, installing the sink or the recess joinery to this panel, then gluing on the Formica with contact cement and then screwing the panel into place. That means you have screw heads showing in the Formica! An unacceptable compromise in a habitation but OK in a vehicle. Especially if you use 1¼" oval-head chromed bras s screws because the heads are not unattractive. Resist the temptation to use too many; one every 6" or 8" is alright. Seal the edges of the counter with trim or Life-Calk and it will look first class. Countertops, fronts, etc should be treated with preservative before installing. The areas which they make inaccessible must be also preserved. Gluvit in the crannies, painting and other "finishing" in these areas will be rewarded by the confidence that your underwings etc, aren't going to hell where you can't see them. Arrange for all potential water pockets to drain into the bilge. In A-frame boats, carefully treat the tangs and plates which mount to the bulkheads with preservative, or preferably Gluvit. In the 31 cracks beneath the internal aluminum angles should be filled with Gluvit; and build your galley cabinets to allow access to the interior A-frame bolts.

Other details worth considering in your galley are:

- A cup rack to hold large mugs upright so they can be filled with hot soup or drinks while still in the rack.
- Angled dishracks that stow the plates in such a manner that they are usually quiet and cannot come out without lifting up.
- Open bin stowage with the floor in the bin on a 15 degree angle or so (perpendicular to topsides) to keep the contents usually quiet. This can be combined with attaching the floors in these bins to the hull stringers and designing the cupboard fronts with bin openings which agree and <u>coincide with the hull stringers</u> and these angled bin floors.

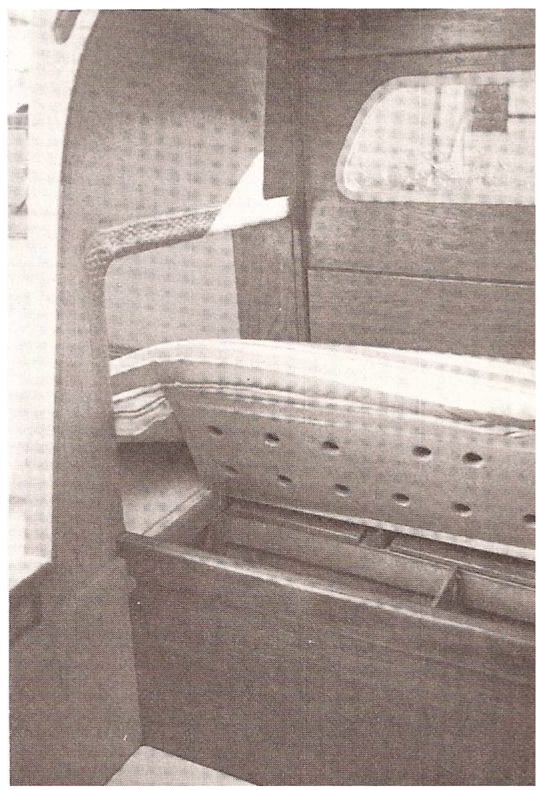
- Closed bin stowage for some items which must not fall out because of their weight or fragility.
- Cupboard doors and drawers with positive, mechanical latches which cannot open in a steep roll. Drawers should lift up before pulling out, and can slide on single, overhead tracks with little plastic sliders which fasten to the back of the drawer - a hardware item.
- Cupboard doors can be ⅜" ply mounted outside the opening with offset hinges and spring catches or homemade turnpegs to lock positively.
- Shelving for tall bottles can be arranged with a hole in the shelf overhead to receive the neck of the bottle, which must now be tilted in to stow positively.
- A large bin for pots can receive them on helter-skelter angles, crammed in to keep them quiet.
- Stowage with the opening in an athwartships panel is extremely valuable because this type is less likely to spill its contents than fore'n'aft stowage - use 'thwartships stowage for fragile, valuable items.



Best ice box yet! Built into bilge with 2" foam insulation. Top opening door saves cold air. Large size; this box extends full width of hull. Access to icebox, and to the dinette itself, is greatly improved by this <u>sliding table</u>. Runners on shelf under aft window let table slide aft, over shelf, about 18". Leg mounts rigidly into bilge. Best table yet!

- Panels adjacent to the stove should be Formica or metal faced to reduce fire danger - a large fry pan can deflect heat around its edges and scorch a bulkhead 3" away.
- Do not put fabric headliners in the galley unless covered with something fire-resistant over the stove - a kerosene or alcohol stove can run wild, and a grease fire can happen on <u>any</u> stove. These can cause tongues of flame three feet high so <u>build the galley overhead to resist heat</u>! And to be easy to wash.
- A foot-square opening skylight directly over the stove is very useful for discharging steam and cooking odors and will help keep your interior clean and greatly reduce condensation.
- Mount the galley's fire extinguisher just inside - or just outside - the galley so you can reach it while retreating from flames. It is wise to have an extinguisher on each end of the galley so you can retreat either way - even out the sterncastle window if necessary to avoid burning yourself. Galley fires are common and <u>should be expected in your boat</u>. Prepare for them as you build the galley.

- The most common cause of burns is spilling hot fat or water so put 1" high hardwood or metal trim on the counter fronts and have husky fiddles on your stove. Carry plenty of first aid for <u>burns,</u> the most common shipboard injury (including sunburn).
- Perhaps the best way to prevent burns is to provide good footing and bracing for the cook. Some seamen prefer the galley to have just less than standing headroom for the usual cook so he can brace his head in the corner of the deck beams and work with both hands. A seat belt around the cook's seat is useful and the floorboard should have rough nonskid under the carpet. The carpet won't slide and when it is soaked with seawater, or soapy dishwater, it can be removed and the cook will still have footing.
- The safest galleys for ultimate rough weather - if you've got a cook who never gets seasick and a crew who always likes to eat - are those in which the cook can <u>sit down</u> for a more favorable center of gravity.
- Good lighting, both artificial and natural, is most important in the galley. Some boats with bottled gas use gas lights with mantles, which are hot and blinding and offer increased possibility of gas leaks but also offer good illumination for the cook. Indirect fluorescent lighting and overhead skylight ventilators are preferred.
- Nonskid rubber matting is a great convenience in the galley and on the dining table. This stuff is an open mesh net, with about ¼" spaces, covered with soft rubber. It holds galley objects from sliding around in lockers, on counter-tops and on the table. Fishermen use it, and throw it in the dishpan after a rough meal. Available from restaurant supplies or through the West Catalog.

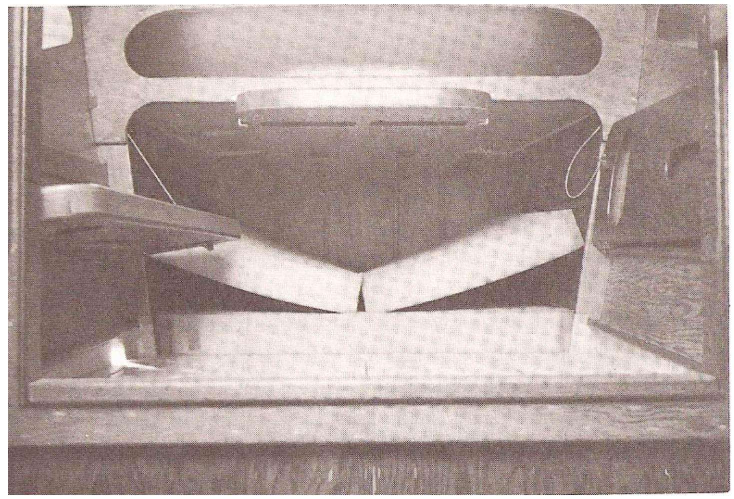


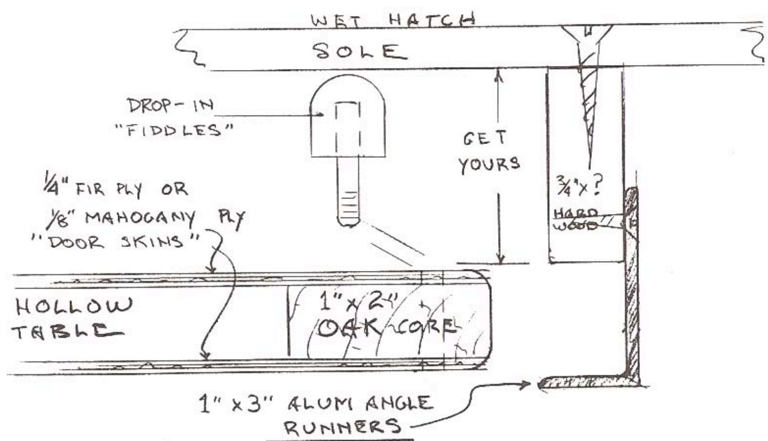
Stowage under 37-footer bunks (above) can be full cabinets, or arranged to handle a variety of clutter as shown here. Accommodation ladder swings up to fasten overhead for engine-room access at left. Stowage under 31-footer bunks (right) can have tilt bins as in plans, or part of bunk bottom panel removes as shown here. Note divider; compartments in bins help organize stowage.

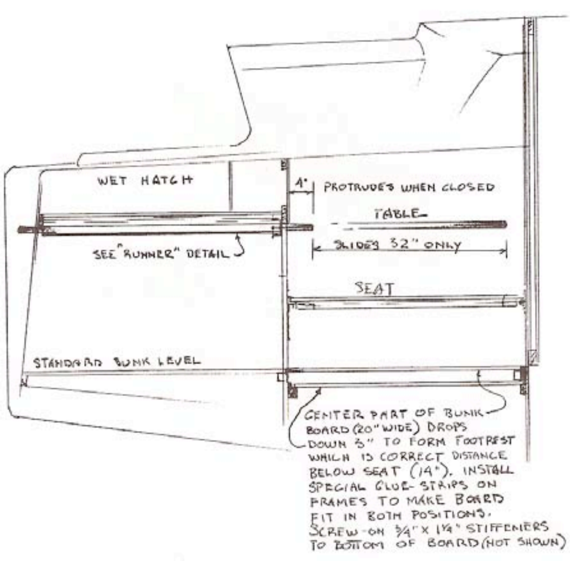
Refrigerators are a pain in the neck. If you insist on fulltime electric refrigeration or - God forbid - kerosene or gas refrigeration (because the pilot light goes while you are gone) or some sort of fancy pump on the engine to freeze a hold-plate then I'll let you work out the details yourself. Ice is the only alternative. A good portable camping chest is right for the 25 and 31. A built-in box with 2" foam insulation and <u>top opening</u> lid is right for the 37 and 40. Build it into the bilge just under the dinette table and lay on some dry ice before a passage. I think this is the best compromise.

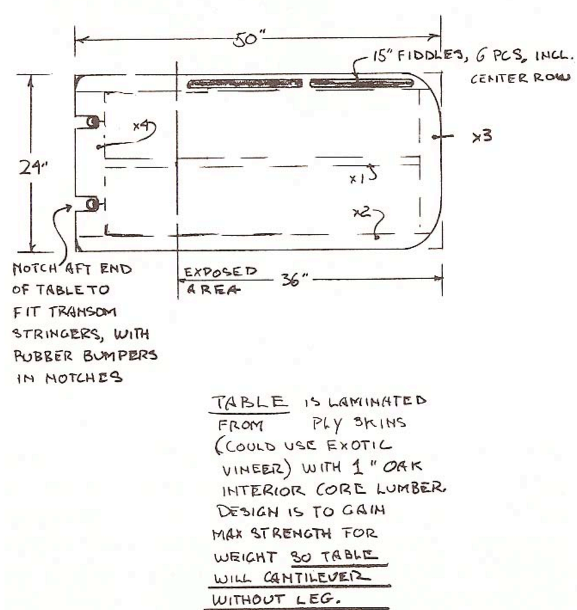
31-Footer DINETTE OPTION

When originally designed, the 31-footer was considered too small for a full dinette in the sterncastle; so plans show a converti-ble table with one side seating only. But several builders worked out an excellent modification which involves a huge sliding "bread board" table that emerges from be-neath the anchor well at the transom, and slides away when unwanted. The photo shows a sandwich-construction bible with a 1" thick oak core to make it very stiff so that it will cantilever without a leg.
Slides are 1" x 1" x 3/16" aluminum angle with a "toe" cut at their forward ends for bolting through frame 8; very strong. The table must be strong enough to withstand the full weight of a person falling on it when it is in the open position. Slots under the table are for chart storage. Seats fold up against the hull to avoid restricting the bunk's width. Seat hinges are large barrel bolts which en-gage the frames. In the down position the seats are supported by a ⅛" cable at their aft end, and by a barrel bolt into frame 7 at their forward end. Slots in seats are for maga-zines, etc. The 4" foam mattress panels for the forward half of the bunk are divided on center to facilitate storage in the aft half of the bunk, on top of the bedding which is rolled back to convert the bunk to a dinette. This modification offers comfortable seating for four persons <u>without</u> extending the length of the sterncastle.









It takes a great lot of energy to make cold, especially in a hot place, and I'd prefer not to have Searunners - and their sailors - burdened with the complication of producing that energy and the responsibility of maintaining the mechanical and electrical machinery needed to produce that energy. Anyway, most boat refrigerators or iceboxes are inadequately cold and inadequately large to give the crew of the vehicle the cold storage expected of a habitation. So whether you go electric or ice, you're going to have to reduce your expectations and modify your eating - and drinking - habits if you really go voyaging. Besides, going ashore for ice is one of the best ways to find out what the place is like. It can force you into some great adventures and some new acquaintances. If this line of logic doesn't appeal to you, then go ahead and install a house like refrigerator; but expect to be in for disappointing results if you use the boat for travel.

To summarize the galley construction, build it like the kitchen in a <u>moving</u> vehicle will have to be built. Make it <u>safe</u> and consider that somebody hungry will probably be in there digging for food most of the time. Don't worry with regular, multi-course meals but provide for a steady flow of substantial snacks and heavy one pot dinners. Make lots of tin can stowage readily accessible under seats and floorboards. These seat tops should tilt up easily without binding and the floorboards should be split down the center to allow the cook to stand on half while raising the other half. And don't fill your galley with that "chrome and leatherette" stuff. Put some real <u>wood</u> in it, hang some appetizing trappings on the bulkheads, write your own recipes and pin them up with fishhooks. This is a galley you're building, not a hotdog stand.

Heads

<u>Heads</u> are a pain in the … not the neck. The more experienced a crew becomes the less use the marine toilet will receive. So repulsive is the john that is stuck away up in the eyes of the boat that using it while underway is avoided whenever possible. The favored alternative is a bucket in the cabin (caution - don't turn it over) or relief over the side. Caution here too because there is a rumored Coast Guard statistic that says 90% of all male bodies recovered from falling overboard have the fly on their trousers open! Nonetheless, even a salty lady may come to prefer hanging her tail over the lifelines - surfing along - compared to suffering the confines of the "vomitorium", The most businesslike substitute I have seen in a Searunner is to locate a one-holer [aka, spronk head] right through the wing in the cockpit so the crew, including the helmsman, can use it without subjecting themselves to flying spray or falling overboard. And perhaps the greatest advantage of "direct plumbing" is that it can't plug up!

The clogged head is such a common occurrence on boats that it should be considered in selecting your fixture. The lightest, cheapest porcelain head is slightly more inclined to clog than the biggest, fanciest job you could install - but only slightly. They all plug up if used for anything but what the crew's alimentary canal produces naturally, plus very sparse amounts of paper; sometimes two or three flushings in the duration of one elimination are needed. And when the head does clog, which it will, dismantling the pump and valves is profoundly disagreeable because the whole works is packed with extruded, compressed, decomposing crap. If you're the type who is "never ever sick at sea", try a head repair while the vessel drives to windward, and you'll change your rating to "Well, hardly ever."

Another thing about those blasted pump toilets is that they sometimes backfire, spraying the bowl's contents on the one who is pumping. And they're impossible to keep clean. The installation, with hoses and pipes and stringers in the way, prevents reaching around the parts and into the crannies of the boat to wipe with cleanser. One seldom finds a head in a well-used boat that doesn't smell like an outhouse. And if, in the installation, the top of the bowl is anywhere near the waterline of the boat, a siphon can be formed which has sunk many monohulls and can flood the bilges of your trimaran. The top-bowl height should be 3 or 4 inches above the bottom-paint level (see Painting) to keep water accumulated in the bowl from sloshing out. The more that sloshes into the bilges, the deeper the boat settles and the faster the ocean enters through the crapper. This can float the floorboards pretty fast in a small boat. All this negative talk about the head is intended to serve as a positive guide in its installation.

Oh God!

You've got to have some kind of head. If you select a permanent thru-hull model, keep it high and provide clearance for reaching around to clean. For any type of head, prepare the area for easy cleaning by coating the woodwork with two applications of Gluvit. Make Life-Calk fillets in the tightest, deepest crannies and Gluvit over, then paint. Mount the head solidly to a ¾" ply shelf which fastens to stringers or glue strips so that the whole business can be removed for maintenance. Seal the fastener holes before installing, or reinstalling, to prohibit fresh water from permeating structural members and causing rot. Locate the seawater intake in a position where it can be easily reached to turn off the seacock, but beware of placing it where it can be stepped on, which might fracture the planking or the thru-hull fitting. This is true of all thru-hulls; locate to protect them from damage. The head discharge is a huge hose leading to a huge thru-hull fitting which, contrary to tradition, we always locate above the waterline. So what if somebody sees your head discharge. Locate it just at the upper edge of the bootstripe and on the <u>opposite</u> side of the vessel from the seawater intake(s) for the sink(s). We don't use a seacock on the head discharge because it is (1) above the water-line and (2) because the thing is huge and expensive and heavy and unnecessary if the thru-hull is above the <u>load</u> waterline.

Another useful gimmick in the head installation is to elevate it about 10" above the sole in that compartment so the shelf on which it is mounted will serve as a place to kneel for the men. It gets the man's center of gravity down lower and locates his mid-region closer to bowl height for better aim when the boat is jumping. This step should be neatly rounded or padded for the purpose, and it serves as a stepping place, along with the closed seat top, in leaving and entering the forward hatch.

By standing either on the step or on the seat cover the working crew should emerge through the forward hatch to a point about at his waist so that he can work the foredeck in rough conditions while well protected from falling overboard. The previous Searunner practice of enclosing the toilet itself in an opening cabinet - to hide it from view and form a step without walking on the seat cover - has been abandoned by all but the most genteel builders because the cabinet restricts cleaning.

"Chemical" heads offer a reasonable alternative to the overboard type. The subject of macerators versus holding tanks and impending regulations regarding the discharge of sewage from yachts all gets so involved that you can forget the whole business except for the following considerations: holding tanks of greater than about 7 gallons should be rejected for even the large Searunners on account of weight, and I would reject macerators also because of their electrical requirement.

This limits the selection to the house-trailer type of portable toilet which stows the waste in a tank - usually located in the base of the toilet itself - mixed with water and an odor control chemical which is mostly formaldehyde and cheap perfume.

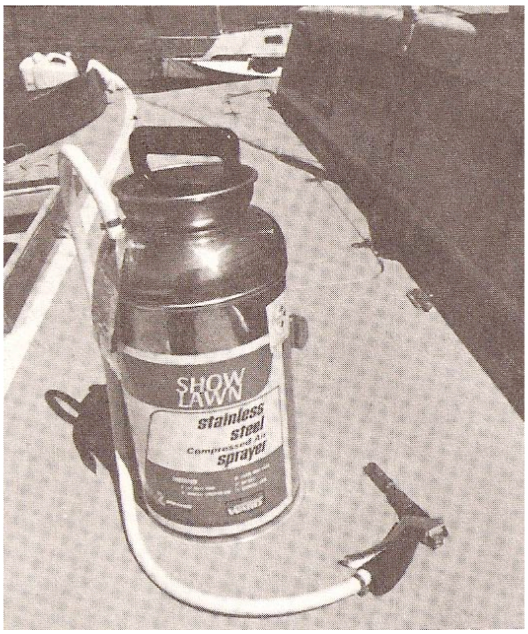
There are two basic types of chemical john. One has a separate tank for flushing solution which transfers to the waste tank during use. This is the heavy type. The other has only one tank. The flushing solution becomes diluted with waste during use which means that the bowl is rinsed with the stuff that has been contaminated. It isn't as bad as it sounds. The odor control and internal filter are remarkably effective and for the extent most heads are used, I prefer the latter type. It is light and simple to install and no harbor officials can hassle you if your head has no overboard plumbing at all. The task of emptying both types is disagreeable - but sufferable considering the other complications avoided. You have to separate the waste tank from the seat in the first type. In the second type the seat is integral with the tank, so you remove the whole head up through the forward hatch; or some of them will empty into a bucket through a plug in the bottom. If you're in a marina or crowded harbor you have to somehow transport your unit to Illegitimate sewage facilities for emptying. The joker is that most municipalities run the stuff right into the harbor anyway - sometimes via inadequate "treatment" facilities and rarely via the advanced "secondary" treatment facilities which discharge sewage of about the same bio-activity as that which you have pickled with formaldehyde in your portable head. Nonetheless, emptying the accumulation is a pretty crude reminder of the whole pollution process and the volume of your own contribution. The portable head offers the individual some chance to treat and select a dumping site for his own waste but the dumping itself is more disagreeable than with the pump-it-out raw approach of the traditional head. Considering the common availability of shoreside facilities, use of the open bucket at times and discharging directly into the ocean at other times, I favor the simplest chemical john installation for all Searunners. If you procrastinate in emptying the unit after long periods of use, the odor will become objectionable. But perhaps no more objectionable than the stink of a porcelain-and-pipe contraption that is impossible to keep clean or is sometimes clogged up. One thing about portable heads - they just don't plug up. Neither do those incredible Ball-Red gadgets which are a reasonable compromise if mounted high enough above the water-line and if you don't mind that gawd-awful big hole in the hull, below water level, slowing down the vessel all the time. It's like the engine; any way you go there are hard compromises. Considering all the requirements of Searunners I prefer the simplest portable head used as seldom as possible by an understanding crew who take turns emptying the thing.

The head compartment in Searunners can be made to double for a shower by the following steps:

Gluvit all the crannies including around the butt blocks. Pour in puddles of Gluvit in all places where water will collect; glob in enough to simply displace the water which would otherwise collect there (this is a good idea wherever fresh water may accumulate like under sinks and hatches). Then paint the compartment carefully. Rig shower curtains over both pass ways (frames 2 and 3 in the larger Searunners) to keep spray out of the dressing room and the sail bin. These curtains should be mounted onto substantial slides - like sail track - and be of sufficient quality to take lots of kicking around. Waterproof fabric with rugged grommets seems best because it bunches up better than plastic when the curtain is open, and affords a feeling of greater privacy when closed. Another curtain over the main strength bulkhead cutout (#4) provides two curtain separation in the head compartment and is considered sufficient barrier to sounds and odors while being much lighter and simpler than a door - which has no place to go when opened.

So, with the shower head compartment thus prepared, one needs a source of shower water and a means of discharging it overboard. Here's the idea: select a quality one-or-two gallon garden sprayer from Sears or your local green-thumb merchant, the type used to backpack liquid insecticides and fertilizers pressurized for spraying.

Some models come in stainless steel. Remove the spray nozzle and replace with a telephone type shower head available at a mobile home supply. Provide a rigid mounting position in the head compartment for this agrarian device. Heat your water - if you wish - in a large teakettle on the stove. Pour into the sprayer tank. Add extra cold water as needed and pressurize the tank with air by means of the pump on the unit. To shower, rinse off, soap down, rinse off, etc. This method was developed by Mick Putney, a longtime trimaran man with years of liveaboard experience. He sails a well developed [Piver] Victress - one of the first. His shower idea works for getting clean on a limited water supply and is especially useful for rinsing off after seawater swimming or a thorough drenching in heavy weather.



This "Show Lawn" shower from Wards has been adapted by shortening the nozzle provided instead of adding a "telephone" head.

What happens to the soapy water? It goes into the bilge. Because it is fresh water (which is far more conducive to producing rot than seawater) I contend that shower water should be confined to the bilge bay directly beneath the shower itself. So, the limber hole in frame 3 should be drilled ¼" above the bottom-plank, have its edges rounded and be fitted with a plug. Consider using the 1" expandable drainplugs made for trailer boat transoms or thermos bottles although a good cork will suffice. So, shower water accumulates in the bilge of the head compartment, beneath a small perforated, non-skidded floorboard which rests on the deepest stringers. The water is pumped overboard with the bilge pump.

The main bilge pumping system can be located in the head. A good diaphragm pump (like the one in the galley) can be mounted on the port side of frame 3 so as to be easily operated by a crewman sitting on the head. Large diameter suction hoses (try top quality 1" garden hose - a special order item from the green-thumb shop) lead from the pump to the shower bilge, the deepest main hull bilge and to each float bilge. All of these plumbing leads can be connected to the pump one at a time either by connecting up the line desired individually or by using plastic Y-valves. The garden hose screw couplings work; or simply plug and unplug hoses to the pump as needed with a clamp and screwdriver kept handy.

With the above described system the head compartment serves not only as a "vomitorium" and seldom used toilet, but also as a protected station from which to manhandle flogging sails on the foredeck; a shower; a wetroom in which to dump soaked clothing and sails or piles of mooring line; and the forward hatch makes a nice place to stick your head out of while talking with the neighbors on the dock and - unbeknownst to them - taking a leak at the same time.

One more consideration for the head compartment is its couple with the adjacent dressing room (in Searunners) with regard to stowing - and using - the bower (biggest) anchor.

DRESSING ROOM

The bilge area beneath the dressing room is the ideal place for stowing this largest, seldom used ground tackle. It gets the weight down deep and as near amidships as possible while still providing access from the foredeck.

Begin by installing a rugged eyebolt through frame 3 near the bottom. To this attach the bitter end of the bower anchor's rode. Lay the rode in a large figure-of-eight coil directly into the bilge following with a boatlength of chain which can be laced neatly into the next bilge aft, through a 6" hole in frame 4. This puts the weight of the chain as near amidships as possible. Finish with the anchor itself stowed on top of the rode. Current opinion favors the plow or the Northill type for this anchor, weighing in pounds about 60% or 75% of the boat's length in feet.

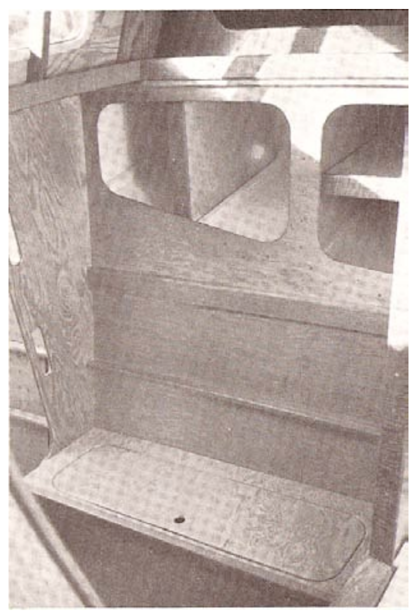
While smaller anchors are stowed on deck in wet hatches both forward and aft for quick access, it may sometimes be necessary to drop the bower anchor in a big hurry. So, the floorboard in the dressing room should be one piece and easily raised, tipping up and aft against frame 4 by a crewman standing in the head compartment. <u>Keep this floorboard clear at all times</u> from anything which would delay access to the bower anchor. Now the crewman may grab the anchor and, in one sweeping motion, raise it overhead and pass it out the forward hatch - and even overside - in a jiffy. The chain will come rattling out, dragging over the shower threshold and the hatch coaming with the probability of dinging up the woodwork, but the anchor may save the boat at this moment! Keep the chain, the rode, and the floorboard clear for action, especially when you're depending on your engine to get you through a predicament - one which you would likely not have entered without an engine - because if the motor quits and you can't sail out of there - perhaps because of the motor's effect on your <u>ability</u> to sail out of there - then you may need all your anchors at once. If the water is deep, the bower anchor has the longest rode - about eight boatlengths. The dressing room and head may be features of habitation but build them to provide also for stopping the <u>vehicle</u> with the bower anchor, pumping the bilges, and access to the foredeck.

Other considerations for the dressing room are collected as follows:

- Divide the large stowage bins in the wing into compartments to allow organizing the stowage - mostly bedding and linens.
- Leave 1" or 2" lips of plywood around the bin cut-outs to hold these softgoods in position without doors.
- Provide some closed stowage for the medical kit and toiletries to keep them from falling out, possibly restricting access to the bower anchor.
- The large stowage voids above deck in the corners of the cabin-front can be faced with opening partitions (which strengthen the cabin-front) or be left open for receiving duffel bags, sail bags, or baskets of organized stowage held in place with shock cord.
- If navigation facilities are located in the dressing room, consider the conflict with the lavatory purpose and its effect on charts and books. Navigating in the sterncastle is recommended for those who, like the author, get seasick when confined to spaces which lack visual contact with the horizon and have limited ventilation in rough weather.
- A large front window is an asset to the dressing room's habitability, if curtained, but current opinion indicates that vertical hardwood braces behind the pane should be installed to prevent the sea from punching in the window. These braces can be made to serve as handholds. They divide the curtain into small sections each of which can be attached with velcro and removed individually. Smoked plexiglas acts like a one-way mirror in daylight and reduces the need for curtains. This front window is very useful in the 25 and 31 when the helmsman sits on the cockpit sole out of the wind to steer. He can see where he is going through this window.
- The dressing room seat top need not be upholstered because sitting there is not a sustained practice (unless navigating there) and the seat top should lift easily to allow access to the useful stowage beneath. The geometry of this seat-top favors a panel fixed all around the perimeter with a smaller cutout to lift without binding against the frames.
- The dressing room countertop can be like the galley's but with a smaller sink (laundry will be done in the galley or on deck) and one pump, for fresh water only, is required though one for salt also is sometimes desired.

31-footer head installation features “portable toilet” with swing-up bar behind to support lid when open (also holds sails in sail bin).

Dressing room (below) features mostly open-bin stowage with dividers. Those at far left and far right can be closed with doors.



- The counter front can be equipped with open bins to agree in location with the hull stringers - as in the galley - with at least one drawer desirable.
- An opening skylight vent or other ventilator in the overhead is useful, especially for allowing the eye burning smoke of a kerosene lamp to escape. Locate the vent to agree with the lantern position. To co-operate with this overhead vent it is well to install a small opening port through the hull in the head compartment down low - just below the underwing stringer to admit cool air to replace heated air which escapes via the overhead vent thereby creating a thermosiphon even in no wind. But this port should be a legitimate marine fixture with dogs to close tightly while under way and be ruggedly installed through a doubler in the planking.

Bunks

Unlike the head, everything about the bunks is pleasant. More than any other part of the boat, building the bunks gives images of that deep seated satisfaction felt by a nomad who settles into his tent or a youngster who revels in the seclusion of his treehouse. Trimarans can have great bunks, many of them doubles. The larger Searunners have bunk spaces that are entirely separate from the rest of the accommodation. Bunks which convert to other forms of accommodation, like the sterncastle bunk/dinette combination in the 31' Searunner, are less desirable than permanent sleeping cabins, like in the 25', 37' and 40' Searunners. But conversions greatly increase versatility if the joinery is strong and easily operated. Among the several considerations in building your bunks are: sit-up headroom, lighting, ventilation, mattress material and covering, leeboards and stowage.

Sit-up headroom is not only for sitting up, but for getting in and out - especially in double bunks where the outboard sleeper may have to enter or leave the bunk by passing over the inboard sleeper. And even rolling over. Many trimaran wing-bunks have barely enough room over the sleeper for him to scratch his nose; an unacceptable arrangement for cruising boats. And ah! there's nothing like propping up in bed with a book or a drink - or a companion - while the vessel swings at anchor or schoons along under the guidance of the deck watch. It is like going back to the womb, and your boat is the great mother. But the fetal position alone is no good. Other positions appear to be restricted in Searunner wing-bunks because of their limited hip-clearance. In practice, however, the bunk's unique configuration is reported to encourage inventiveness. Sit up headroom combined with generous width and length (standard double mattresses fit the 37' and 40' wing-bunks) give bunks which are described by one Searunner first mate as "Su-u-u-u-perior!"

Lighting in the bunks should be suitable for night reading but electrical drain indicates a minimum of this unless you are connected to dockside current. A dual 12v-110v system is desired, with interchangeable bulbs. But this gets complicated and one soon realizes that reading at night, while under way, is required only at the chart table. A dim, local light - even a flashlight - is desired here so as to avoid flooding the boat with light which blinds the helmsman and awakens the sleeping members of the crew. But in the bunks, some kind of electric light - even a flashlight - is needed to assist in dressing, etc. It is used for short durations while under way. A fluorescent fixture (fluorescents have the lowest drain) of compact shape powered by the ship's accessory battery is probably the best - but not necessarily for reading. Reading in harbor, but without 110v. hook-up, is often accomplished with an "Aladdin" mantle type kerosene lamp. These give a beautiful 100 watt light at zero current drain but produce considerable heat at the top of the chimney so fireproofing over the lamp is mandatory. Two or three electric reading lights burning all evening will necessitate charging the battery with your engine or a separate generator running for a disagreeable period of time. So if you read a lot at night, without shoreside electric hookup, get an Aladdin Lamp (with spare chimney, wick and a supply of mantles) and arrange for fireproofed hanging positions near your bunk and also in the galley or dinette, and the cockpit. To expect unlimited, self-contained electric light aboard is also to expect long periods of battery charging with machinery and fuel weights inconsistent with trimarans as well as maintenance problems of large nuisance proportions, on any boat. In the long run it is probably easier to adjust to reading in your bunk by daylight - which is why all Searunner bunks have curtained windows.

Ventilation is considered in another section but with regard to bunks, try to arrange for a closeable vent (like a sliding panel or a screw in inspection plate) at the foot of the wing-bunks. This will afford some circulation to an otherwise dead space for hot weather or when the boat is left idle.

There is another bunk ventilation problem, especially in cold weather: condensation. Moisture collecting on the overhead can be reduced by exchanging - and heating - the cabin air as described under Ventilation. But what can you do when the mattresses sweat? It is a feature of the human that he releases large amounts of water vapor through his skin. Almost a quart during an eight hour nap, depending on the individual. Much of this is passed into the air but some is driven through the mattress. In the case of many trimaran bunks, the underwing panel is also the bunk bottom panel. In Searunners the two panels are separated by an airspace but still, a quantity of this water vapor will condense on the bunk bottom panel. In cases where the mattress and the great outdoors share both sides of the same panel, there's nothing you can do. But when design allows, perforate the bunk bottom panels with 1" holes on a 4" grid pattern. This helps the moisture escape, but some mildew can still be expected in time. Using all synthetic fabric for the mattress cover reduces mildew, especially if the bunk bottom is painted with a mildew retardant (available at paint stores) added to the paint. Use this only on bunk bottom because it is toxic. Paint with good ventilation and allow to dry completely before occupying the cabin. Foam mattresses are best. Sears sells covered foam mattresses that will fit right into the double bunks of the larger Searunners and are lightweight. But the cover is not all synthetic and the foam collapses in about 2 years of use, though the price makes them replaceable. Premium foam with removable handmade synthetic covers with rustproof zippers or snaps, or simple string ties, make a permanent installation. 3" foam is thick enough, 4" is luxurious. Closed cell foam is unsuitable for mattresses except if only ½" thick or so. Covering mattresses with naugahyde or other expensive, impervious upholstery gives the feeling of sleeping on a rubber sheet - but partly eliminates condensation under the mattress.

One brand of mattress foam known to serve for many years without collapsing or decomposing is called Nimbus foam, sometimes available at quality auto upholstery shops.

Leeboards are those planks that keep you from being pitched out on the deck - an absolute necessity in monohulls, and most seagoing trimarans as well. But Searunner wing bunks are partly guarded by the lower half being enclosed with the cockpit seat. Still, some form of guard is desired. A regular leeboard can be installed but it needs to be only half-length. It can be stowed by sliding into the lower half of the bunk. In the 31'er, tilt bins are shown for stowage under the forward bunks, but in practice the space is better used if access is gained from the top. By lifting up the edge of the mattress, an 8" wide door in the bunk bottom is made available, leading to the stowage. Now, a prop to hold this door partly open will also hold up the edge of the mattress at an angle: a padded leeboard. The door and the prop must be strong enough to sit on. This propped-up-mattress-edge approach to leeboards would serve in all trimaran wing bunks.

Canvas covered pipe berths are still a good approach to boat bunks for their light weight, comfort, adjustability for heel, and lack of sweating. But they will seldom fit in trimarans because their tendency to sag (which keeps the sleeper in the bunk) usually conflicts with framing or panels under the bunk. Double bunks are uncomfortable in some conditions if occupied by only one sleeper. He rolls around uncontainedly. Usually the extra space can be filled with a bag of sail or duffel - or extra pillows or a bunch of something stuffed under part of the mattress. Otherwise, nice big double bunks are a great addition to the cruising life.

Stowage around the bunks is important. Some builders have forgone the convertible double/single feature of Searunner wing bunks to make permanent doubles instead with large lockers below - against the hull. Others elect permanent singles for the added wing stowage which results. Some cubby hole stowage is important for all those little personal effects, and it's great to have a special shelf near the bunk - and the hatch - where you always keep your glasses, watch and knife. And nothing else. Don't stow anything heavy over bunks which can fall on the sleeper. A small telltale compass in the skipper's bunk - and the navigator's - is very useful especially in crews with green helmsmen and/or self-steering. It'll save you getting up to check the course. You can tell a lot by the telltale.

If you're awakened by what you think is a change in the ship's sound or motion, watch the telltale for awhile. If the helmsman, or the self-steering, is able to hold the course with about the same wandering as when you went to sleep, chances are everything is all right up there. So long as you can hear that the man on watch is still awake, you can go back to sleep. In this bunk you are going to build.

Carpets

Carpets are unnecessary but offer a degree of coziness even in a trimaran where the floor area is limited by the narrow hull. They also afford noise dampening. The all synthetic outdoor carpet fabrics available should be selected for stiffness - to avoid curling and sliding - and should have non raveling edges to avoid clogging the bilge pumps with fuzz. Arrange the carpet pieces to interfere as little as possible with access to bilge stowage areas.

For instance, the galley sale floorboard may be divided into two pieces so the cook may stand on one half while lifting the other half - while digging for a can of truffles in the bilge. What happens to the carpet? Well, assuming that the floor board will tilt up-and-outboard against the counter front, the carpet would like to divide like the floorboard - right down the middle so that the piece of carpet over the tilted board tilts with the board. But in practice, carpets which divide in the middle of the sale soon shift and get crossed over each other and trip the crew. So, the galley carpet, for instance, had better be one piece. Then, the cook stands on one half of the sole, rolls the opposite edge of carpet towards his feet and tilts the other half of the sole board away from his feet, digs for the truffles and, when he doesn't find them on that side of the bilge, he reverses the procedure to replace the opened portion of the sole. Then he turns around and stands on that side and opens the other side. Still no truffles. So he digs under the dinette sale in a similar manner and finally settles for those piquant jalapeño peppers they picked up by mistake in Mexico. This while promising to inventory the stores and list - by compartment - the contents of each bilge bay to minimize messing with all those carpets.

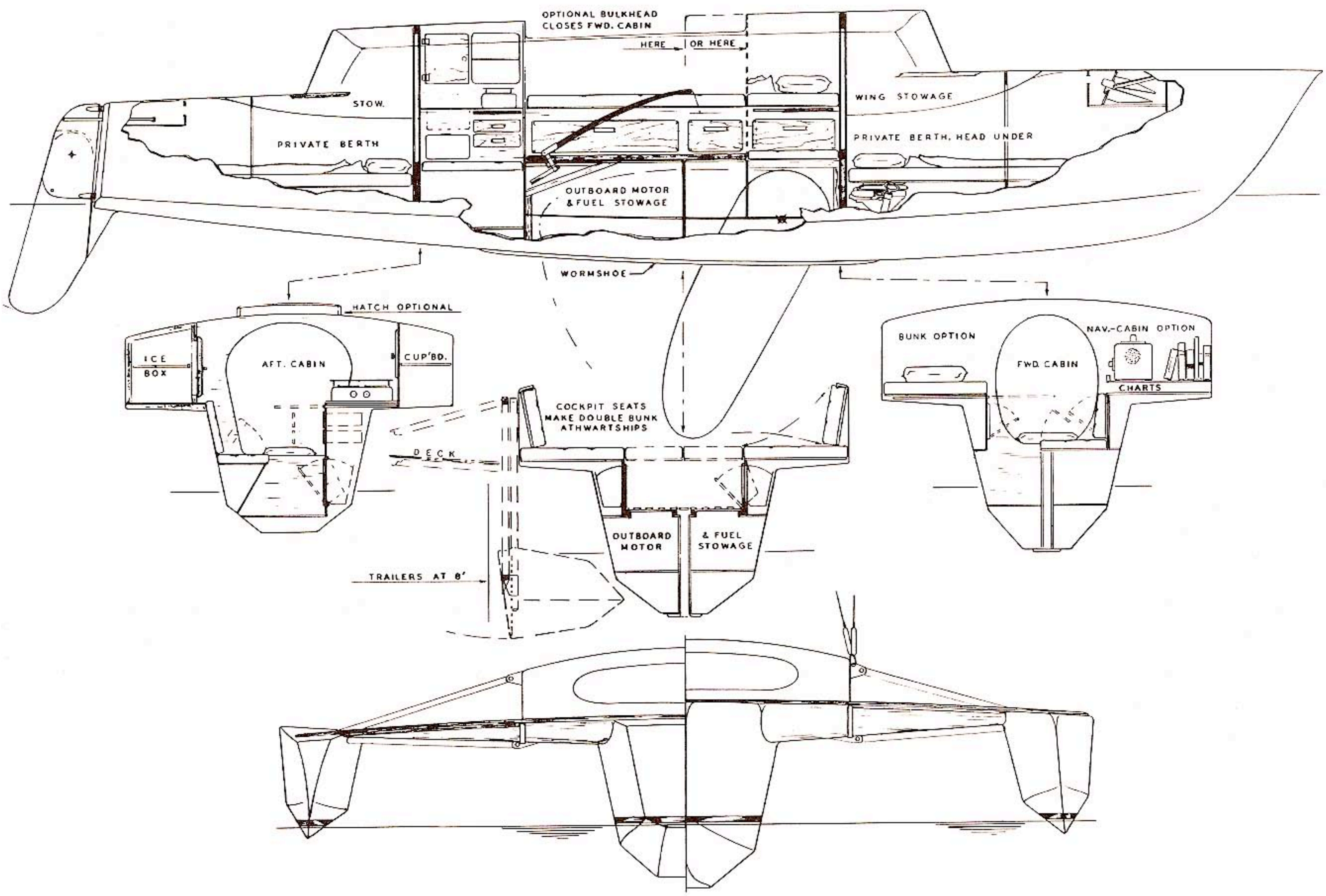
And for this reason, the carpets are sometimes removed while the vessel is in passage. May as well roll them up and stow them before they get soaked from heavy weather jumping down the hatch or a dripping crew coming off watch. There's nothing worse than pulling off your sea boots to reveal your, amazingly, dry feet and then stepping barefoot onto a squishing carpet before kicking your wet feet into the bottom of a dry sleeping bag. Or the reverse - hopping out of a warm dry sack onto the squishing carpet and then trying to pull on dry socks over wet feet while they're hollering for your assistance on the foredeck. You can't tell them you're delayed because you can't get your socks on! So roll up the carpets if you wish, but be sure now that the sole boards are painted with a raspy nonskid.

Cleaning house is easy with carpets. You just roll up the dirt and shake it out on deck. But, go to the rail. Don't dump the sand and fuzz from the carpets right into the workings of the back stay levers.

A few extra scraps of carpet are nice for "scullyrunners" on the dock and around the deck. A nice hunk of carpet makes a good substitute for cockpit cushions and seat covers for the dinette or the dressing room. Get enough, but put it away before it gets wet.

Headliners

Headliners have two functions: to cover up the usually rough workmanship in the visible ceiling, and to insulate. Their need can be reduced by doing clean work when building the overhead, and by painting the deck a light color to reflect heat. Condensation on the overhead is reduced by a headliner, but is better reduced by ventilation which also relieves the insulation requirement. So, I generally tend toward no headliner, for the work and weight and cost savings which result. If you consider a headliner necessary, use fabric instead of wood. Even ⅛" plywood adds too much weight to be acceptable and poses incredible fitting problems. Fabric headliners are usually made of automotive trunk liner material, which comes in a wide variety of patterns and weaves. One of the best fabrics seems to be Volkswagen headliner fabric, which is off white in color and perforated with lots of little holes. Foam or fiberglass batting insulation can be stapled up between the deck stringers and the fabric then applied.



25' Searunner Interiors

It helps to have the cabin heated to over 100 degrees while installing the stuff; this gives a tight job when it cools off. Wood battens can be fastened under the headliner to hold it up, and wood or rope trim all around the perimeter will hide the edges. But when you're done you have no easy access to all the thru-deck fastenings of deck hardware, and leaks can go unnoticed - soaked up by the insulation - until rot in the structure develops. A headliner over the galley is far from fireproof unless a non-flammable fabric is used. And how do you wash off the soot and grease? I'm generally against headliners but realize that some builders will consider them a necessity. For myself I'd go for a light color on deck and good ventilation.

It is the occasional wish by some builders to completely seal the inside of the structure with a thick layer of sprayed on foam with a cover of panel or fabric. Of course this would offer sound dampening and insulating properties, and floatation. But beware. These boats are built of wood and lack ballast so they will not sink if flooded and so do not require floatation material. Sound deadening would appear desirable but in Searunners the hull is covered with furnishings and stowage spaces almost everywhere. Where the hull is exposed it can be sealed with carpet - stuck on with tabs of Velcro - wherever water noise would disturb a sleeping crew because of a bunk's proximity to the waterline. Other attempts to completely seal the interior are unacceptably heavy and painfully complicated because of the mouse-castle nature of the structure. Let's face it: we just cannot have every feature we want in these - or any - boats. No matter what we put in, or leave out, we're going to have to deal with it, for its presence or for its absence. Because the fabrication of your interior can be an extremely complex undertaking, remember that the basic requirement is to get it <u>finished</u>. Make your decisions consistent with the "dinghy philosophy"; the multihull way is to <u>eliminate as much as possible - if not everything</u>.

Upholstery

Upholstery. I don't have much to say about what you cover your seats, and seat backs, with. Some interiors are so heavily upholstered that they look like the inside of a posh bistro where businessmen drink their lunch. Others are bare hulls with an air mattress thrown in here and there. Neither satisfies the cruising requirement. Nor does any upholstery scheme that makes the interior look like something it is not.

Fabrics can range from awning material and oilcloth to opulent multicolored tweedy stuff and naugahyde. Of these, awning material and tweed are preferred because they will pass air. Sitting on impervious upholstery makes your fanny itch, especially in the tropics. Synthetic or mildew proofed canvas textured fabrics will shed water but pass air and take heavy service.

The simplest means of upholstering seats is to wrap the fabric around the foam pad and staple it to the underside of the plywood seat top. Cut the plywood panel very slack, with rounded corners, to allow space for the fabric to bunch and still have the seat fit into its position. Drill several 1" holes in the panel to ventilate the pad and allow air to escape without hissing when you sit on the cushion. Apply wood preservative to the panel and use non-rusting staples.

Formed upholstery, with sidewalls and ticking and zippers, is usually a job for the pro, but make your own for economy if you feel qualified. It's not really difficult if someone can show you the tricks, and you have an adequate sewing machine.

Bolsters or cushions with a winter color on one side and a summer pattern on the other are very nice indeed for the variety they offer to the interior. Seats which commonly get walked on by the crew, while entering or leaving the hatchways, can be reinforced with a leather patch at the place where one's foot is customarily placed. The patch encourages stepping there, and nowhere else.

Full cockpit cushions are nice at times, but generally constitute a nuisance while under way. Some positive means of attachment to the boat, like Velcro patches or string ties, is necessary to keep them from blowing overboard. These cushions are always getting wet and saving up a reservoir of seawater for a dry day when you sit down in shore clothes and get sponged from beneath.

I prefer carpets in the cockpit, which dry quickly, plus several small scatter cushions or "life-savers" for serious loafing. Another idea for lounging or sleeping in the cockpit is to get some of that foam sheet that the backpackers carry for mattresses and cut it to fit. It is closed cell foam and as such will not absorb water. Its unusual density makes even thin sheets comfortable. Now there's an analogy - multihull sailors are like seagoing backpackers. They don't burden themselves with anything they don't need.

Plumbing and Wiring

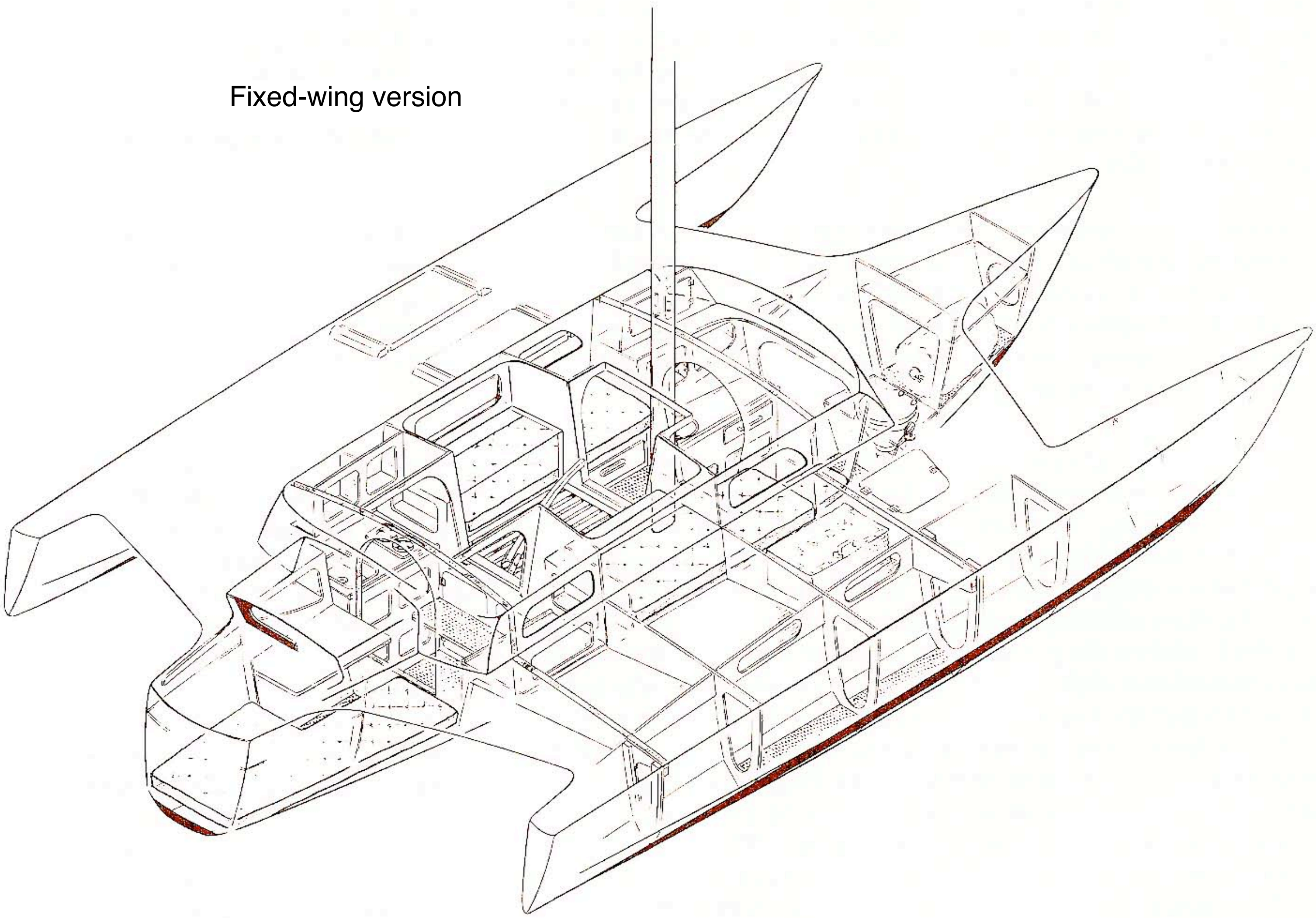
Plumbing and wiring has been touched upon earlier in this section. Short of including plumbing and wiring diagrams in the plans, I haven't got much to add. Not even diagrams. I don't know how to draw or read them and neither do most of my clients. They are seldom followed and, I believe, offer encouragement for excessive complication.

Plumbing, for sink and head drains, is done with large rubber tubing and hose clamps with plastic Delrin thru-hull fittings located above the water-line. Fresh water and sea water lines to the sink pumps are usually ½" diameter clear vinyl tubing attached to pumps and tanks with hardware store paraphernalia made of plastic or brass. Seawater intakes must be below the waterline and so need a valve for shut off. Although I know of some cases where the builder avoids the weight and cost and bulk of valves by attaching, with ⅛" nylon line, rubber plugs or motorboat drain plugs to the thru-hull fittings. The plug is always available if the hose must be removed from the thru-hull. Some water enters before the plug can be driven into the open thru-hull fitting, but these boats are so shallow draft that the hydrostatic pressure on underwater plumbing is slight; quite manageable with a plug instead of a valve - IF the plug is always there. A selection of wine corks is a good item for your spare parts list.

Wiring is an undertaking that requires some knowledge of <u>marine</u> electrics or professional help. The safest approach is to reduce wiring needs to a bare minimum by eliminating as many fixtures as possible. Even the most legitimate marine electric system is vulnerable to unimagined maintenance problems. Increased reliance on electrics afloat is increased vulnerability to the danger of electrical failure. I have sailed in modern yachts loaded with electrical aids of top quality, professionally installed, when <u>every single unit</u> had some symptom of malfunction, or complete blackout, even in a short 4 or 5 day passage! The smaller the boat the greater the problem. What's the reason? Seawater is a good conductor. A small boat operates in a boundary layer between air and water. That boundary mixes air into the water and water into the air because each fluid slides across the interface with the other to cause this mixing. In a blow, particles of conductive seawater are lifted from the interface and caused to circulate through into the farthest reaches of a boat's interior, <u>including the battery terminals and the electrical panel and the fixtures and all the surfaces in between</u>. Your electrical system is designed to connect the power source with the outlets using insulated conductors - wire. But the ocean comes along and blows through your cabins and connects the outlets back to the source with conductive, uninsulated seawater - a film of it everywhere! A sailor says seawater never dries and he's almost right. On a hot dry day after the blow, the only sign of what has happened will be a smear of minute salt crystals on your paintwork. You get your batteries charged up and your bedding dried out and sail on into a calm, misty night. Suddenly everything is clammy again! You stick to your bedding and the bulkhead drips and the batteries go flat. Those sophisticated black boxes on which you rely for navigation and communication all start to malfunction. The depth sounder says you're in 20 feet of water but your anchor finds no bottom at 200'. The running lights flicker and die and you dig for the only flashlight to find some disorder in the engine room because the starter seems dead. The crew complains that they can't see the compass and there's a freighter blowing off to starboard in the mist and a whistle buoy moaning on the port but they can't distinguish from which direction they can hear the sound of surf, and the navigator says the battery radio is getting two bearings, 90 degrees apart, from the same beacon.

At times like this you'll curse your civilized reliance on electricity. You get up on deck and open your eyes and ears wider than ever before and drive that boat out of trouble with your own

Fixed-wing version



kind of energy while promising yourself that if you ever get out of this one you'll put on a good lead line for taking soundings, put in a small engine that can be hand cranked, put off the navigator who relies on black boxes instead of keeping up his dead reckoning, buy a dozen flashlights and a case of batteries, install kerosene running lights for standby and SIMPLIFY THE ELECTRICAL SYSTEM.

In small boats that can mean brutal simplification: no switches but instead direct contact of running light wires to battery terminals. One dry cell powered light in each cabin and as few splices in the wires as possible. In the larger vessels, locate the switch panel away from the hatch in the driest cranny you can find. No switches on deck, all connections soldered or made with crimp connectors and taped and then coated with Life-Calk or some exotic sealant. Bayonet terminals for mast wiring etc., should be similarly sealed. Wiring that is exposed in the cabins is not unattractive if neatly done and frequently anchored with plastic clips. A main switch of the vapor tight variety close to the battery is used to cut off the entire system while the boat is idle.

I prefer the compass light (the most important electric light on board) to have its own circuit direct to the battery with the lead carefully shielded from damage. We put the masthead light on a separate switch so that it can be used alone for illuminating the masthead wind vane. Likewise the compass light - often used alone. Port and starboard lights (red and green) are also often used alone, separate from the stern light and the bow light. The purpose of all this separation is to minimize the current drain.

The best current saving navigation lights I have seen are fluorescent units made in England by Sea-Wife but available in the United States from The Navigator's Center, 15907 Redington Dr., St. Petersburg, Florida 33708 [does not appear to be in business as of 2010]. Their combination navigation light is a single 12" fluorescent tube that illuminates port (red), starboard (green) and stern (white) segments all with one bulb that draws only 9 amps! It is mounted at the masthead, above all sails and above the wave tops and its size makes it shockingly visible compared to the peanut-sized fixtures usually mounted on deck where they are often concealed and draw at least four times the power. This combination masthead light is illegal by international rules but I'd like to see them on all Searunners. You can get by the Coast Guard inspection with your kerosene running lights and/or an alternate, standby peanut set on deck. Of the kerosene running lights we know, the Perko size 0 series is consistent with trimaran requirements. For emergency use, and to discourage boarding by thieves in some ports, you could use a bright burning pressurized mantle lantern burning gasoline or kerosene. These are troublesome to operate and the mantles are fragile so a special storage place is suggested. Such a lamp can be a lifesaver when used as a flare when the electric system fails, which it probably will and so should be anticipated.

Recent information indicates that fluorescent fixtures are unsuitable for navigation lights. It seems that the real thing that makes a light visible at a distance is the size of the source; it should be as small and intense as possible. A fluorescent type spreads it out too much. Nonetheless, I favor the masthead position because the light is not down behind sails or waves. The size of the fluorescent fixture, when noticed, seems to indicate a vessel's presence with a degree of "shock factor" not possible with down low peanut lights. Whatever your choice of lights, get serious about it. But don't expect to be seen - you should be looking yourself. A powerful flashlight shone on the sails is the best way to announce your presence to merchant vessels in the area. Don't delay taking evasive action because those steamers really move! There's nothing wrong with firing a flare as soon as a collision situation is suspected. With our little boats and our little navigation lights, the burden of evasion is on us. Avoid shipping lanes and keep a lookout. Don't expect to be granted right of way because most of the time those monster ships don't even know you're there!

Ventilation

Ventilation has been discussed above but deserves emphasis here at the close of this section on Furnishings. Build everything with an eye to how the air is going to circulate through it. Storage lockers, bilge bays, cabinets and seats all define spaces which should be as open as possible. It is said that, using a principle known as "dispersion of gasses", an Eskimo can survive a blizzard by building a snow block igloo only large enough for him to crouch within.

For ventilation all he needs is a hole as large as his thumb! Yet your boat, and its crew, can suffocate on a hot day even with the hatches open. So, every 1" hole you drill to ventilate your interior will help another Eskimo.

Interior Safety

Many aspects of safety in the interior are discussed previously in this section, but additional remarks are necessary.

One tends to think of seafaring hazards as being things like storms and rocks and fog. But the truth is that an accident, like a plane crash or a shipwreck, is almost always the result of a combination of circumstances, anyone of which, alone, would not have caused the accident. Going up on the rocks is not often the fault of the storm alone. It might begin with the cook putting his hand in the frying pan while slipping on the non-nonskidded floorboard in rough weather and he takes to his bunk. The bosun gets hungry and so ventures into the galley and argues with the navigator over the last of the peanut butter, causing the navigator to work his last available sun sight by entering the tables with the wrong date, as the weather worsens. Finally, the skipper gets a hot meal together for his crew, who are about whipped. They crowd into the dinette for an important one pot stew, but the last gob to be seated gets pitched full -weight onto the table, which collapses because it wasn't built with this inevitability in mind, and the stew goes into the bilge. All except for the cupful which was passed to the helmsman, which was siphoned out by the wind before he had a chance to drink it. Cold-tired-hungry-wet-seasickness takes over. Everybody gets punchy and nobody cares what becomes of them and they end up on the rocks. Do you blame it on the sea? (Incidentally, ending up on the rocks in a trimaran, we have seen, can be salvation instead of destruction. You stay with the boat, and step off when the waves have tossed the boat clear of the surfline - not possible in a deep draft, ballasted monohull.)

The primary dangers of falling overboard and collision relate to interiors only in that both are perhaps more likely to happen if the interior is not designed and built to be livable while the boat is under way.

Fire is caused mostly by carelessness - the kind of carelessness that is hard to overcome for us shore dwellers because we're not accustomed to kerosene lamps, which sometimes grow brighter as they get hotter until finally there's a column of orange flame reaching out the top of the chimney. This is particularly true of "Aladdin" lamps, which have great usefulness on boats but must not be left burning at full brightness while unattended. Or the carelessness of trying to fill the tank on the stove while one burner is still on low, under the kettle and invisible. Conveniences like hot water heaters and refrigerators, which have automatic controls, are responsible for burning up boats when the controls malfunction at unsuspected times. Engine room fires and explosions occur when the operator assumes everything in there is OK and he starts it up - or lets it run for hours - or lets it sit for months - without any intimate contact between the machine and his brain. Smoking on board is more dangerous than ashore because ashtrays become forgotten when the wind comes up and bilges concentrate vapors which would otherwise disperse. The answer to all these fire possibilities is vigilance. Somebody on board must be responsible for training everyone else on board to be vigilant with fires.

Capsize relates to interiors, as described above, by the builder's responsibility at consider exits for the crew from each cabin, should capsize occur. At the minimum, there should be a hatchet mounted in each end of the boat and one in the life raft compartment. One should be accessible from the helm where it can be reached for clearing snarls on deck in an emergency. Heavy objects, particularly storage batteries, and tanks, should be secured to withstand capsize and the life raft must be stowed so it is accessible in the event of capsize, and secured to the boat with a 50 foot painter of ½" nylon line. So tethered to the mothership, the occupants of the raft can survive for perhaps months by returning to the cabins for sustenance. This preparation makes capsize eminently preferred to sinking (as in ballasted boats) and I consider one to be just as likely as the other. Both can, and must, be anticipated and prepared for by inclusion of a canopied, inflatable life raft.

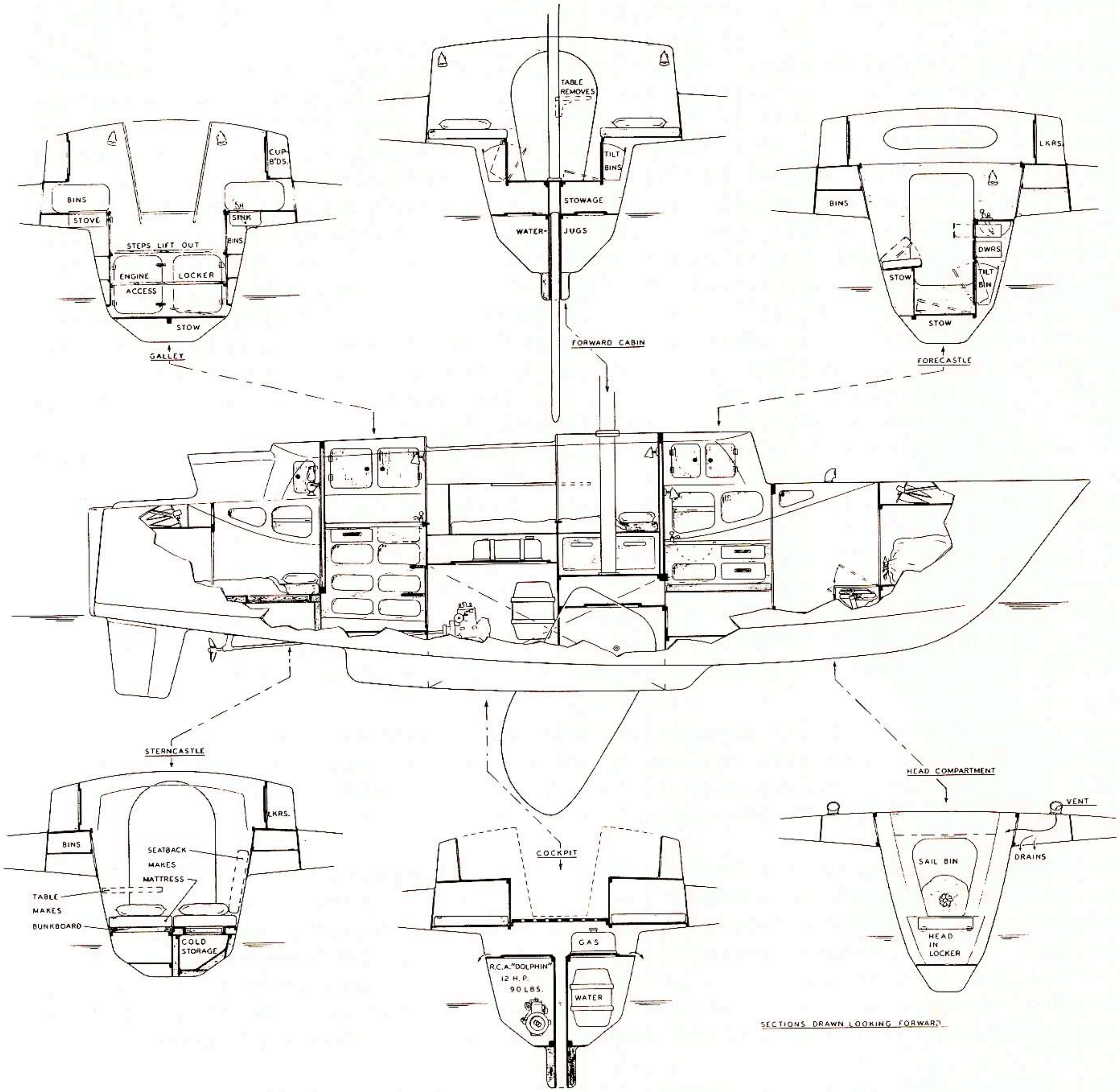
Stowage of stores and equipment should be carefully considered in the construction of your interiors. Heavy stuff - anything you can barely manage to handle with one hand - should be secured to anticipate a severe shaking, because that's what it is going to get if you really head offshore. A wise sea traveler keeps everything secure at all times, like a wise air traveler keeps his seatbelt on for the whole flight. Heavy objects are hard to stow because of their inertia: a can of half used cleanser may sit on a shelf through the same storm that pitches you out of your bunk!

Limber holes - those drains through the frames to allow bilge water to reach the pump intake in the deepest bilge - can be arranged in several ways. If you develop a bad leak fast it will probably be caused by striking a floating obstacle, and so the hole would probably be in the bow. Or, if you go surfing pell-mell right over a reef top, bouncing over coral into the lagoon, it might hole your bottom or tear out your rudder (unless you have a minikeel or a kick-up rudder). In the case of tearing out the rudder, the leak would be in the stern. Searunners are designed with thresholds in the accommodation near the bow and stern which offer watertight bulkheading that comes above the waterline. Limber holes in these threshold frames can be drilled slightly above the bottom plank and equipped with a plug. If you can confine a bad leak to a local area, where it can be pumped or bailed after repairing the damage, it is better than flooding the entire bilge. Also, one frame under the cockpit can be made watertight right to the deck and given the stopper treatment at its limber hole to confine a worse leak to one half, or the other, of the main hull. This 'midships watertight bulkhead in Searunners (not available in most designs) is sometimes opened by the builder to form a crawlway under the cockpit. This practice is discouraged because of the loss of watertight integrity. The engine room bay has no limber holes, to confine oil and vapors to that bay. In the floats, the cut-outs through the connective frames can be covered with ¼" ply hatches, screwed on for passages using automotive sponge weatherstripping for gasket. These frames so closed, and equipped with stoppers in their limber holes, will give three separate watertight cells in each float. Combined with two absolute cells in the main hull and four more threshold divisions described above, you've got a possible total of ten compartments which would have to be individually flooded in order to completely swamp the vessel! And even then she will float with her decks out!! A non-ballasted wooden boat needs no floatation material. Yet some still contend that monohulls are safer because about half of their displacement is used up by lead.

Pumps are discussed above, but for review, consider two manual diaphragm pumps with one inch plumbing. The after pump can double as a seawater supply to the galley sink, but its intake can be disconnected from the seawater thru-hull and led to the deepest bilge aft of amidships, assuming that the 'midships watertight bulkhead has its limber hole plugged. The forward pump, mounted in the head perhaps, is used to pump the shower and the deepest bilge forward of amidships. When the 'midships bulkhead has its limber-plug removed, this forward pump drains the entire main hull bilge of accumulated bilge water, most of which will enter through the hatches in the form of spray. Or, both pumps can be operated to clear the bilge, with open limbers. Otherwise, our real problem seems to be dust in the bilges rather than water because these are dry boats, meaning they are not built to depend on leaks to keep them from leaking - got that? Well, planked monohulls require that the planks be permeated with water to make them swell and fit tightly against the other planks. Some leaking is assumed and some bilge water is expected. But in "ply-'glass" trimaran construction, a steady, persistent leak means something is wrong, and should be investigated, not just pumped out and accepted.

The forward bilge pump will easily handle the entire bilge unless you are fighting a leak and have the 'midships limber hole plugged. Lines leading from each float should also be connected to this pump, when needed. If you have the float bilges divided by three watertight bulkheads as described above, locate the float pump intake in the center cell.

All this reasoning sounds involved, but you will rest easy under way if you know you have built your interior to offer alternative means of dealing with problems like fire and capsize and leaks. But this does not mean that an automatic CO_2 fire system or a big automatic electric bilge pump or automatic sheet-release cleats and a self inflating buoyancy bag at the masthead will offer the alternatives you need.



31' Searunner Interiors

All devices which increase the boat's automatic character are potential hazards because they tend to psychologically relieve the crew of its responsibility to vigilance. There is no relief from this responsibility.

Children on board really do belong. They sense the urgency of real situations and will even do what they're told. They will also do what they're not told like twist valves and pull plugs and borrow tools and play with medicine. I consider toddlers to be dangerous if the parents are unaware of the critical nature of the thousand details on a sailing vessel; how everything has its place and purpose - except the helpless little kid. But as the child reaches the age of understanding, an explanation of why the anchor line must be left neatly coiled, and how the screws on the compass magnets cause the instrument to lie if tampered with, and where they will be if they sail straight West for an hour at 5 knots … such explanations will impress the child with the true nature of reality better than any hypothesized schoolroom problems about "Dick has three apples …" And some children are as much a part of the crew as the cook or the sailing master. They are "Johnny on the spot" when it comes to retrieving things and putting them where they belong. Any fear they know they learn from their elders and some of this they reject. So, take the kids, but give them the same opportunity for indoctrination you would require yourself. Visiting kids who are uninitiated to seafaring reality should be carefully observed, as should toddlers. Running backstay levers should be opened to the slack position when visiting children are aboard. These things can kick like a horse if released by an unsuspecting child. For this reason it is urged that handles of rubber hose be fitted to the end of the levers, and be allowed to extend ⅜" beyond the metal portion, to provide a pad to prevent cutting the operator, should the lever be released and uncontrolled. Elaborate "cyclone-fence" lifelines and railings do more to comfort the parents than restrain a kid whose parents are leaving it up to the fence, and as such are considered unnecessary encumbrances. The child must learn safety afloat either from you, or from hard experience. Given that, get set to learn from them some neat tricks on how to enjoy yourself on board.

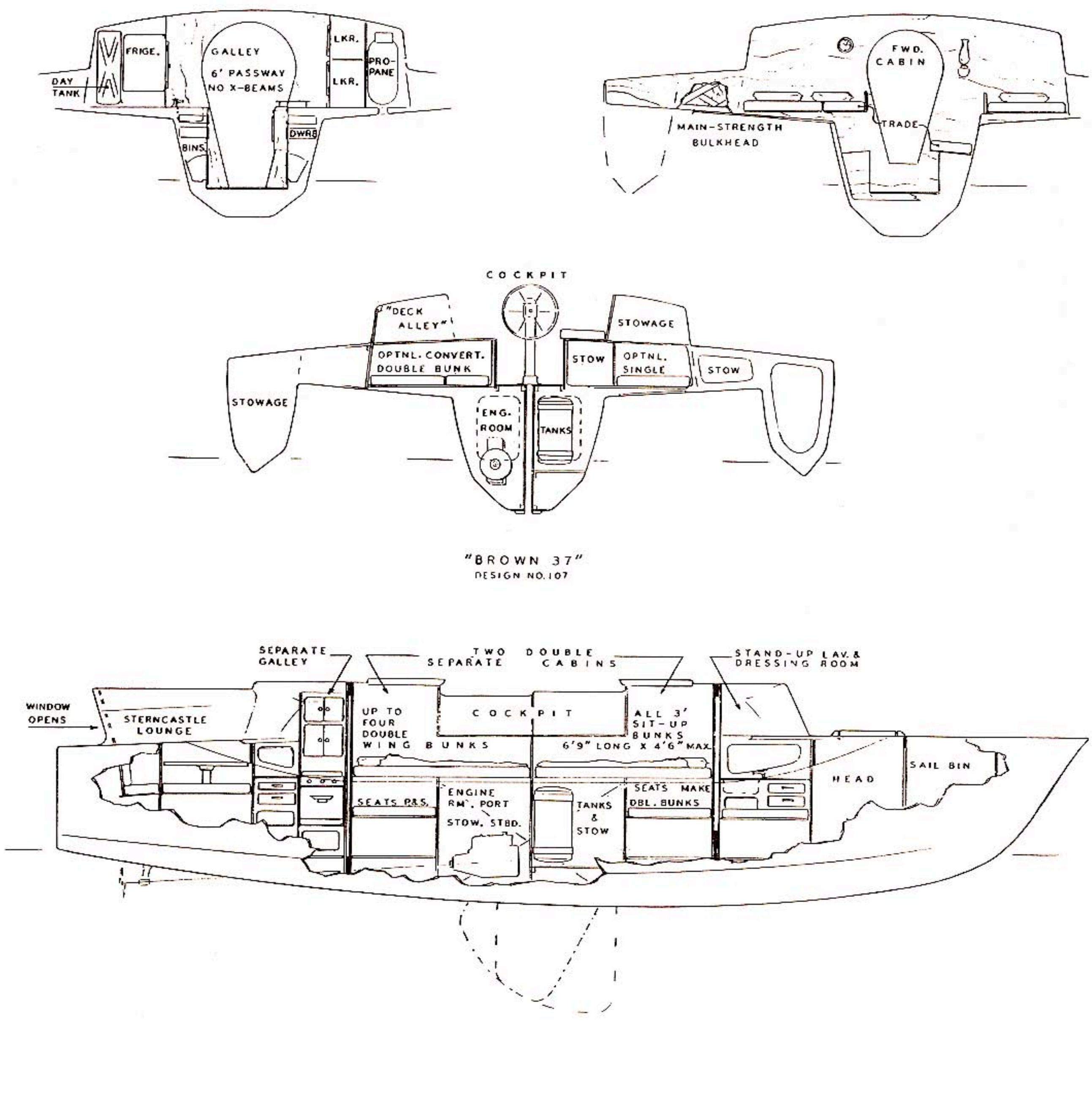
This section on interiors, by its chronological sequence in the manual, suggests that the interiors are built after the exterior structural work is complete, including hatches, windows, painting, etc. In practice the interiors can be built at any time after the structure is closed in, or some of the work can be done even before decking.

Builders working outside, or with minimum shelter, should organize the project to make fiberglassing occur in a fair dry season. Because hatches and windows are cut after fiberglassing, they can be left un-cut and weatherproof while working on the interior during winter weather. This will limit natural light and ventilation inside, but it seems better to work with drop lights and heaters if you can avoid building or renting some all weather shelter for the duration. A tent-like structure over the cockpit will keep rain out of the entry hatches so you can come and go without opening and closing them while working on the interior.

Another chronological option is to complete the boat all except for interiors, launch it, and finish the inside at the dock. But don't do it! Of the many attempts I have seen to complete a vessel which is lying afloat, none has succeeded in bringing the builder satisfaction proportionate to his labor investment. That investment becomes unreasonably high when dealing with the inconveniences and limitations of working without adequate shop facilities right at the site. Running up and down the dock with materials, trying to drill a straight hole with the boat tugging at her lines, and lying on your back in the dinghy, in the tunnel, bouncing in a chop, trying to turn a bolt-head that comes through the underwing … all gets pretty ridiculous when compared to working in your own backyard. The boats live seen launched before their completion never are completed - at least not to the owner's satisfaction.

Not that any boat is ever really finished. You'll be developing details of her interior - and her exterior - as long as she owns you. Or, as long as she satisfies you, and launching before a satisfactory completion, up to that point, makes it hard to ever achieve fulfillment. You may contend that you are unable to decide about details of the interior without "living with it for a while" but this is often a cop out to avoid the work of completing the interior.

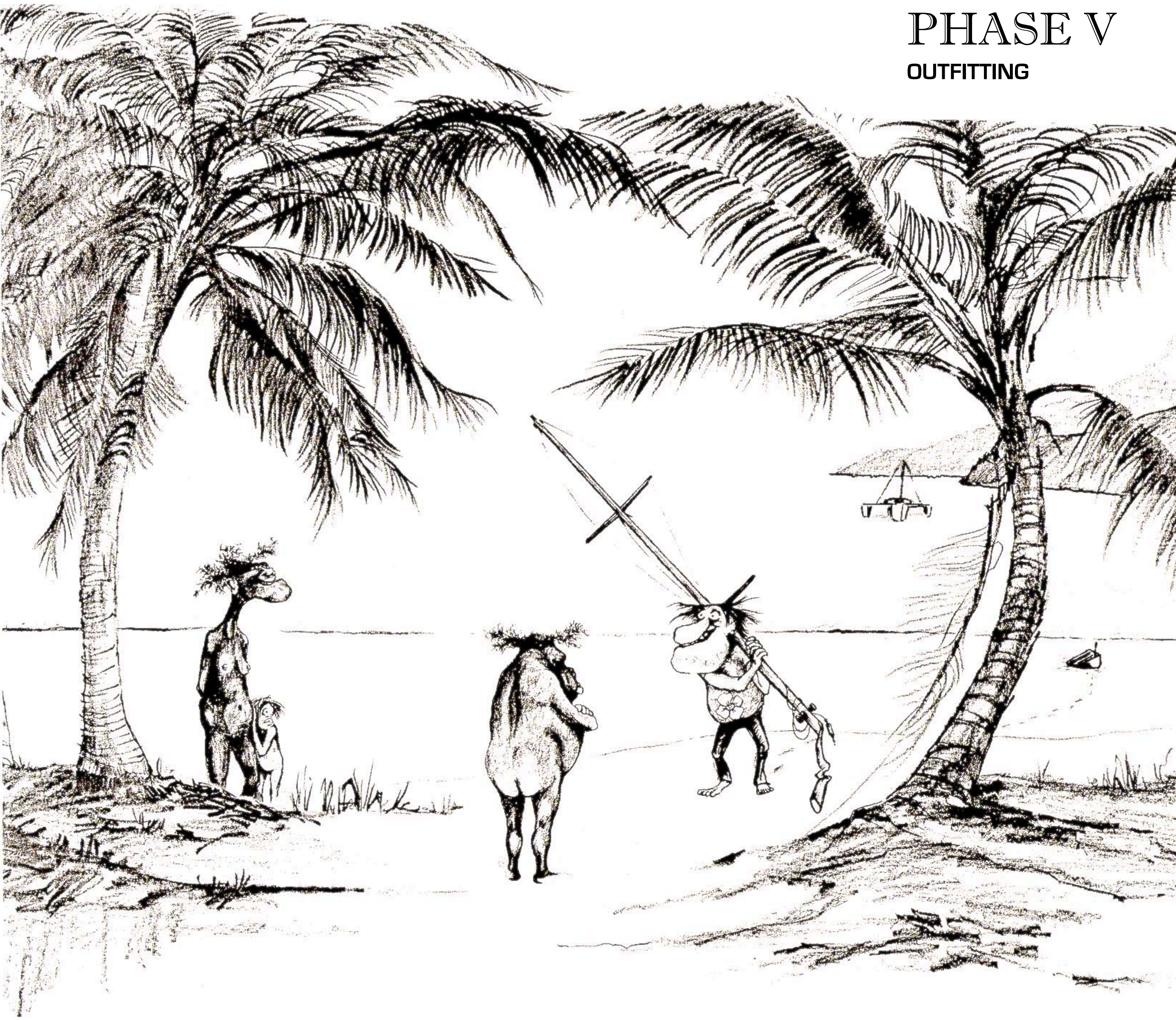
Either that, or you are making sure that you won't be able to live with it because that might lead to really going places with the boat - which can be quite threatening on a subconscious level. So, if you just want to stick her in the water without being ready to live with, ask yourself privately if you really want to go places. Even if the answer is no, better finish the interior, or she won't even be very satisfying at the dock and it will make her hard to sell. And once she's livable, maybe your answer will change.



37' SEARUNNER INTERIORS

Everybody gets a chance to play with something.
Until it breaks!

PHASE V
OUTFITTING



Hi there. You weld-um aluminum?

The last mile! This portion of the project has the aspect of climbing up a mountain - for years - and being tantalizingly close to the summit. You (and your pocketbook) are nearly exhausted but achievement is so close that now you'll do <u>anything</u> to make it. If you've been able to pace your funds with the boat's progress so that you've got a bundle saved up for outfitting - maybe forty percent of the total - you'll be a rare boatbuilder indeed. Most of us have to borrow money at the end. Remember, you'll do <u>anything</u>, so watch out for the kind of desperation that requires a good gun and a lotta nerve.

It is better to buy the outfitting materials with honest dough - earned before or after - because otherwise you'll spoil the feeling of Christmas; these purchases bring more pleasure than you'll remember since childhood at the Holidays. A youngster gains great glee at having somehow received a little motorized airplane that doesn't fly but instead turns somersaults on the carpet, and a boatbuilder gleans real euphoria from the cruddiest little chunk of polished brass - if it is going in his boat. Imagine the fascination you will feel when unwrapping your own hand bearing compass, or spinning the drum and listening to the pawls of your genoa winches.

Buying this stuff is a diverse study of procurement because it comes from a hundred different manufacturers. The usual approach is to deal with a distributor who has access to as many of these sources as possible. A local yachtie shoppe will often grant substantial discounts to a builder who agrees to buy all - or as much as possible - of his outfitting materials from that one supplier. The supplier now has a captive customer. And much of the merchandise for this customer - you - will not have to be carried in inventory. Take this book to him. Show him the part that applies to your design and let him price the parts he can supply for you.

It would be reasonable for him to request a working deposit and it would be reasonable for you to request a meaningful discount. The dealer discount on marine hardware varies greatly from item-to-item so don't be dismayed if some materials carry no discount for you and others run surprisingly high.

In twelve years experience with marine merchandise I have concluded that the markup earned by the dealer is <u>not</u> unreasonable and prices charged by manufacturers are - compared to other types of merchandise - very fair. The premium materials and costly workmanship in most marine items places such cost burdens on the manufacturers that few companies survive and none are known for high earnings. For the retailer, the problems of inventory in such a diverse line of merchandise, and the broad knowledge required to offer the sailor what he needs, the task of buying from so many sources and the losses caused by obsolescence in these lines - together with shelf life in things like paints - all add up to making marine hardware a very precarious business. The one thing that you, the backyard builder, have to offer your chosen retailer is <u>time</u>. If you give him time to order and receive for you the kind of merchandise he usually cannot afford to sell from his own shelf - because of the horrendous investment in inventory required to satisfy all his customers from his own stocks - then he should be willing to sell to you at a "less-than-list" price. The big outfits are not necessarily the most willing to discount. Working from the information in this book, any boating retailer with a decent credit rating can get you any marine item, whether he usually stocks sailing merchandise or not. Don't expect any price consideration at all unless you buy in hatches of greater than $200 at a time. Oh, maybe he'll give you 10% off on a can of blue paint - if he knows he's got you for the anchors and line also. But if you buy all the paint on a special order, and most of it doesn't come from his shelf, you should expect 30% off. He's still doing OK if you pay your bills promptly. Because he has no guarantee that you will pay, and because paint is non-returnable, he deserves a deposit - at least until you get to know each other.

Another good way of buying outfitting is to join one of the multihull clubs (Appendix #6) which offer procurement services. Some special "multihull services" firms offer group buying; you place your order and wait for other orders from other builders to accumulate buying power.

The single most important aspect of buying outfitting is to tell the seller <u>exactly what you want</u>! Make a clearly legible itemized list. Give him two copies and you keep one. The purpose of this section, and appendixes #1 through #4, is to make these specific orders possible, even for the man who has never been around boats. It is a monumental task of education to teach the neophyte boatbuilder all he needs to know in building - and outfitting - a seagoing sailboat.

Knowing that this attempt cannot be wholly successful, the writer expects the reader to <u>educate himself</u> in this subject. Read the magazines and catalogs. Talk with the guys who are doing the sailing, and walk (or better, row) around the harbors. Take your camera. Know your problem and look for your solution.

You'll find it to be completely absorbing of all your attention and probably all your money. There are cheaper ways of outfitting a boat than what's described herein, but you've got to know more about what you're doing. The materials prescribed for Searunners are consistent with these highly developed sail-boats and everything is done with an eye to keeping the neophyte out of trouble. Some builders will wish to make parts which are usually store bought, and vice versa. Where the choice is 50-50 I'll try to describe the two alternatives. Like the mast.

SPARS

Making a mast is a super-sensual and satiating exercise. The conformation of a stick that's 28 feet long, or 35 or 45, is extreme and unidirectional. But for all their sensuality, the mast and other spars have a weighty overtone of functionality. They are the bones - the hollow bones - of the boat's wings. The backbone of its motive power. Their functionality bears on the builder's (and sailor's) mind heavily, but ideally their design and construction leave room for not one ounce of fat. In theory, they should be just strong enough to withstand the hardest hammer of wind and the quickest snap of pitch and roll they will ever receive both at once. And these strains should be accepted without failure after long years of service and long years of idleness regardless of weathering and fatigue and corrosion. These spars, the boat's most tightly designed components and those which, in the event of failure, leave her most completely disabled, are the upmost extension of the fish like underbody towards the freedom of sky flight; the aero part of these hydro creature boats that makes them self propelled dwellers of the convoluted boundary region between air and water.

With these lofty parameters in mind, Searunner spars are designed to contend with multihull stability and sometimes quick motion, the resultant vicious strains and (here's the hard one) owner building.

In other words, these Searunners are sparred and rigged like <u>trucks</u>. The cutter rig is cantilevered skyward for large sail area in light airs, but the rigging is arranged for <u>ultimate</u> support - the strongest rig thus far conceived for its height and weight - and the spars themselves are husky- don't be tempted to increase the dimensions specified. The problem has been the reverse. Builders who are buying aluminum extrusions sometimes inquire if they can use smaller sections than specified; don't be tempted this way either. Often, the exact extrusion called for in the plans is not locally available. For substitutions, compare the "moments of inertia" (the IXX and IYY figures) given for the specified extrusion with those given for the substitution. And, compare the weight - per foot - for the two. Get something within 10% of these three vital statistics for your substitution. This brings up the most valid reason for building your own spars out of wood: you can get what you want.

WOOD VS ALUMINUM

If you can get good wood. There is only one good wood for building your mast: spar stock grade sitka spruce. Other woods like fir or cedar can be used for the boom, but use of anything other than good spruce for the mast is discouraged. At this writing there are still good sources for spruce on the West Coast. One supplier who is, at this writing, still willing to ship direct in small, one boat lots is:

Fred Tebb & Sons Tacoma, Washington
[ed note: Still in business as of 2010]

They accept orders for whatever is currently drying in their kiln. Other orders are returned. You've got to catch them when they're taking orders, and specify "spar stock", Other sources of good spruce can occasionally be found in principal cities. Be sure your wood is thoroughly air dried (one year minimum) or kiln dried.

So, the primary consideration in deciding between wood spars and aluminum spars is availability. Cost is a secondary factor because the cost of a bare aluminum extrusion is usually about equal to the cost of spruce and other wood spar building materials like glue and paint and, especially, clamps.

Spar clamps are discussed later. Find out what they will cost you - even if you make your own - before you decide on wood spars for reasons of cost.

Another factor is weight. Searunner wood spars as shown in the plans are designed to have the same inertia moments - the same strength - as the aluminum sections specified. So, one is as strong as the other (if properly built) but the aluminum is lighter - possibly as much as 30% lighter than wood if you happen to get a heavy batch of spruce! Weight - added weight aloft is the surest way to spoil your whole boating venture. An extra hundred pounds in your hulls is bad enough but an extra hundred pounds aloft is hideous. The two combined (both are likely to happen if you'll let one of them happen) will shoot down your bird, and your dreams. Because a multihull has such great stability, added weight aloft means little to our heeling angle - compared to monohulls. But because multihulls must conform to the surface of the sea, their spars are subject to greater flailing around. (You can spot a multihull on the horizon with your binoculars by the jig-a-jig motion at its masthead; going aloft at sea for repairs can be a shaking experience especially in a multihull; multihulls with overweight spars have an amplified motion which shakes the wind out of the sails and makes them poor performers; all these negative factors are substantially reduced in trimarans with deep centerboards.)

Frankly, we couldn't get away with our high and husky rigs in Searunners, and still have a comfortable riding motion without our deep centerboards and wide hull spacing to dampen lateral motion (roll) and our fine bows and buxom sterns to reduce fore'n'aft motion (pitch). That's another example of just how integrated a boat design can be. If you want a high and husky cutter rig you'd better have something like a Searunner underneath it. That statement isn't just to try and sell plans, but also to discourage builders of other designs from using this book to include features in their boats which were not intended by the designer. Follow your plans, whether they're mine or someone else's.

There are many misconceptions about aluminum spars. They are said to be more difficult to repair; to attach fittings or equipment; to keep from weathering; and more vulnerable to damage. My opinion challenges all of these contentions and I personally prefer aluminum spars for cruising boats. I have seen one aluminum spar crumple like a beer can and be permanently repaired by inserting a large wooden plug into the open ends of the break - this at a harbor where a new extrusion or a pile of good spruce were simply unavailable. Attaching fittings and equipment is, in most cases, just as simple but more permanent with aluminum. It requires the right fasteners - like Monel pop rivets for the sail track, and stainless machine screws, tapped into the mast, for other fittings. One exception is winch mounting in the larger spars, where an aluminum doubler is commonly welded on to thicken the mast wall for tapping in threads. Even this can be circumvented by fabricated winchpads attached with mechanical fastenings. In the 25 and 31-foot Searunners, where the mast is usually stepped on deck, the builder can reach up inside the mast to install nuts and washers on the winch fasteners. In the 37 and 40-footers, welded winchpads are used by the professional sparmaker because for him - with his heliarc welder handy - they are cheaper than fabricated winchpads. But fabrications are simpler, and quite satisfactory, for the backyard. And the ocean. I have never seen corrosion seriously weaken an aluminum spar even if not anodized or painted. But there are countless cases of wood spars collapsing because of weathering or rot in the wood, especially around the fasteners.

Searunner plans contain drawings for wood spars and specifications for aluminum spars. The spar hardware drawings can be used to fabricate hardware for both types, perhaps with the exception of the masthead fitting (called the "truck" by old salts) for aluminum masts. This is usually a store bought casting with all fittings incorporated in the casting. It plugs the end of the extrusion. Wood masts have a fabricated masthead fitting, shown in the plans. The builder can buy a bare extrusion and the cast masthead fitting, and make his other spar hardware and install it from the plans much the same as with wood spars. Or, he can buy the bare extrusion plus all the recommended hardware offered by the sparmaker who sells the extrusion. He assembles it himself, sometimes at a substantial saving. Sometimes not.

Whether you build your own sticks from spruce or fit your own homemade hardware, or buy the completed birds wing backbone ready to plug in, is up to you. One is as good as the other except that aluminum is lighter and that decides it for me. You've got a better chance for a pleasant beautiful voyage if the boat - especially the mast - is LIGHT.

<u>To buy completed spars</u> use the spec sheet in the appropriate appendix as a guide and talk it over with the sparmaker of your choice. You will note that there are some optional items like spreader lights, internal sail track, etc. Decide what you want for yourself by relying on your own experience, or the consultation of others, and what you can afford. Avoid internal halyards for cruising boats. Spinnaker gear is optional also. See the discussion of spinnakers in the section on sails and decide to go for the "chute" now, or never. Or, for inclusion of spinnaker hardware later without unstepping the mast, provide for mounting the spinnaker halyard block and the pole track now. The rest can be added easily. Except the spinnaker halyard winch. It may be that you will want to include a winchpad for this now. In the 37 and 40 footers we usually use the staysail halyard winch for hoisting the spinnaker. In the 25 and 31, a stays ail halyard winch is not strictly necessary, but a spinnaker halyard winch is, so if you anticipate adding the spinnaker later, better put a winchpad now that will serve for both spinnaker and staysail. You don't absolutely need the winch itself until you get the spinnaker, but the winch will be a nice convenience for hoisting the stays ail tightly anyway.

If you live in Maine and wish to patronize a California sparmaker, and your mast is longer than forty feet, the sparmaker will have to fabricate a mechanical butt splice in the spar because most states disallow shipments longer than 40 feet. The butt splice is commonly accepted as being all right but bears the disadvantages of added cost and weight. It may be worth it, to get what you want otherwise. You assemble the ready-made splice with mechanical fasteners at the boat. It's simple and strong.

<u>Building from extrusions</u>. You buy the tube and add everything else. The main consideration here is: are you really going to save money? If you have free access to metalworking facilities and plenty of time, probably you will save. Find out how much before deciding. Can you get the special fasteners and tools required? If so, go ahead but remember these things: stainless steel self tapping sheet metal screws are good for only light service parts like quickfurl hooks on the boom, etc. For sail track and most other parts, use machine screws and tap threads in the mast wall or use Monel pop rivets. For heavy service parts like winches, weld on doublers to increase mast thickness or reach inside with nuts and washers. Drill all holes for all hardware before installing internal wiring. Wires for mast lights, instruments and antenna (if any) should be bound in a harness and pulled through carefully with sound deadening attached. This is in the form of chunks of foam rubber (mattress foam scraps) which are tied to the wiring with nylon cord and electrical tape. The chunks should be three feet apart near the top graduating to six feet near the bottom. Each chunk is shaped like a fat salami with its lashing at the middle and just large enough to give a snug fit inside the mast. Without this sound deadening, an aluminum mast will constantly clang with the raucous sound of wires flapping inside, even in a calm. It will drive you absolutely looney. Caution the sparmaker of finished spars to use more frequent sound deadening for multihulls than monohulls - because of their jig-a-jig motion. The presence of the foam, now, takes the edge off the only important aesthetic drawback of aluminum spars - the noise. Halyards flapping and sail slides rattling are annoying, mechanistic sounds on a sailboat. Foam chunks inside help a lot to limit these outside noises, but other steps can also be taken in the interest of quiet.

One is to use extruded aluminum internal sail track. This track employs nylon cars on the sail which interact with the track more quietly than the usual metal slides on standard external track. But this approach, again, is more costly and heavier, and has the further disadvantage that the sail does not "fall down" the track as quickly when lowering sail, and may in fact have to be pulled down the track. This - in the interest of quiet. You decide.

The other cause of aluminum spar noise is the halyards clanking on the mast in the wind. It is particularly annoying to crews of neighboring yachts when there is no one aboard the "clanker". So be a good absent neighbor and secure your halyards away from the mast whenever she is not underway - whether wood mast or metal. This is done by tying them out to the shrouds, and by securing the halyard shackles to the extra holes in your chainplates; or, the forward side of the lower spreaders can be fitted with "thumb cleats", little wooden hooks you can make, so the falls of the halyards can be flipped into the hooks, out away from the mast, and secured snugly at the foot when not in use.

Still another factor with aluminum masts, which you can consider when building your own or before stepping one you have bought complete, is their ability to sink. I hesitate to mention this for fear its negativism will discourage some would be voyager, but metal masts, if torn from the vessel, or if the vessel be capsized, will fill with water unless sealed.

I had the privilege to correspond with Mr. Hunter Nicol, father of the famous trimaran designer Hedley Nicol, after the latter was lost at sea in his trimaran Privateer in 1966. The elder Mr. Nicol described how his son's boat had been overcome by a typhoon while outward bound from Sydney for California. The fact that Hedley chose to sail in that season is the only mark of discredit to his otherwise sterling contribution to the trimaran movement. It was a zeal for competition; a wish to challenge US designers in their own waters, that apparently led to his decision to sail in the teeth of the storm period.

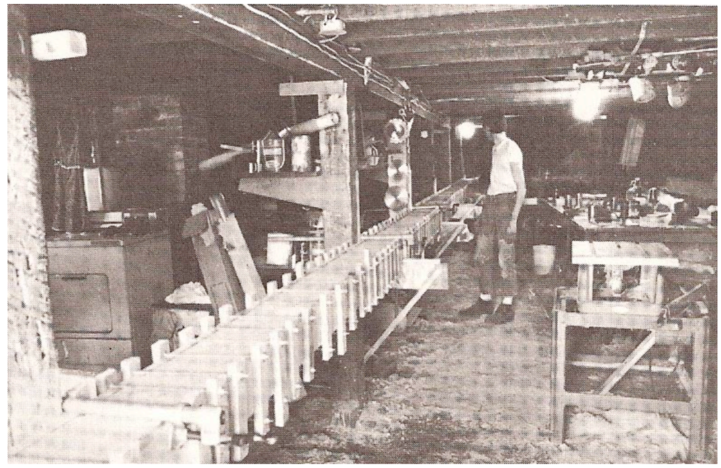
Only one outrigger was ever found. It had apparently been amputated from the boat by the crew with a saw in their attempt to right the capsized trimaran - thence to handle it as a single outrigger. Nothing is known of their success, or failure, at this attempt (there was no life raft aboard). However, the outrigger found had messages scratched upon it which were largely obliterated by marine growth. But from what was legible, it seems the boat was <u>dismasted prior to capsize</u>. Another phrase read "the sails would fill with water… " From there, conjecture takes over. Could it be that the mast, with sails, became suspended beneath the boat by some remaining rigging - dangling overside like a huge sea anchor - straight down. "The sails would fill with water … " could mean that the boat was held down on one side and not allowed to rise to seas. How else could the capsize be caused with no mast or sails up?

So, if you want to go by conjecture, or by any reasoning, then you'll fix your aluminum mast and boom so they won't sink. Pour-in-place polyurethane foam will do it, but don't pour it full. Too heavy! Just a foot or two at the head and foot will keep it from sinking. Choose a hot day in direct sun to make the foam expand a lot. Remove the step plate and the masthead; stuff in a wad of plastic bags down as far as your elbow and pour in foam on top. For good measure you can remove the thru-bolts at the spreaders and pour some more - just enough to plug the tube. You'll now have three cells essentially sealed. If you ever wish to float your mast ashore for work, or if you lose it overboard, or if you capsize with it still rigged on the boat, it won't fill with water, adding to the problem of righting the boat.

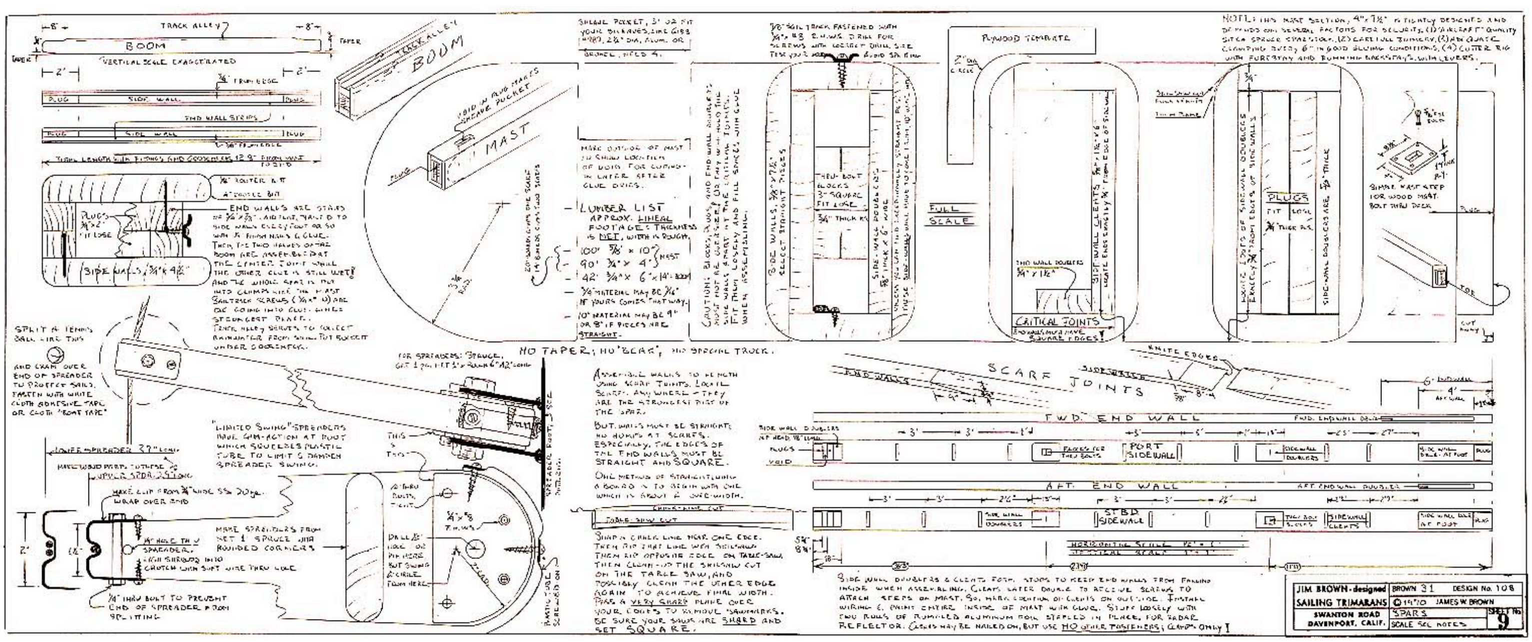
One more comment: in the event of dismasting, the spars and sails can - if in the water cause great damage to the hull by bashing at the topsides. But in a severe storm, if you can't get it all back on board, they can also serve as a sea anchor and wave breaker if trailed to windward of the boat on a LONG line. Get them out there at least half a wavelength away, with a long line on each end to hold them crossways to the wind. The two lines can lead through snatchblocks on the main hull bow (or stern) and back to the winches. They will make a good drogue until the storm is over - IF the mast floats. Either that or get everything on deck and lash it very securely.

Building wood spars is one of the most exciting and pleasing forms of woodwork devised by man. It is also a lot of trouble and work. Searunner wood spars are designed for owner building to reduce the critical joiner work by eliminating tapering and rabbeting. But there is no way to eliminate scarfing and joining (square edges on the walls) and frequent glue clamping.

This builder's basement has a row of columns providing mounts for a perfect "spar bench". The spar itself is built with the traditional method where the end walls cover the side walls (contrary to the drawing). Bolts on spar clamps must go across the wide dimension with this system and so need be somewhat longer than in the "Searunner Method".



A hollow wood mast is essentially a long rectangular box with two side walls and two end walls with plugs in the ends and doublers inside in the way of mast hardware. By tradition, the end walls are usually rabbeted with a groove about ⅛" deep to receive the square edges of the side walls. When assembling the box this rabbet keeps the sides from falling into the box. But cutting the rabbets requires special skills and tools; and, the mast clamps need much longer bolts to squeeze across the wide side of the box. So, in Searunner plans the end walls fit in between the side walls and are kept from falling in by small "cleats" of wood glued to the inward side of the side walls. The length of the cleats is cut to allow the end walls to rest against them and thus align all walls during assembly. The cleats also reinforce the side walls across the grain to discourage splitting, and offer double thickness for screw fastening of mast steps for climbing the mast - recommended for cruising boats.



This photo reduction from the 3l-footer plans reveals (to anyone with a magnifying glass) basic Searunner wood spar construction. Wood spars for smaller boats are described in Appendix 1, for the 25-footer.

But, this unorthodox design has the disadvantage that the side wall planks must be wider than usual - wide enough to cover the end walls. Wider spruce is harder to get. If it is unobtainable you can use the traditional system if you can cut the rabbets. Just hold the same outside dimensions.

Order the lumber to sizes that are nominally about two inches wider than their finished dimension, and remember that at least one foot of length is used for each scarf joint. Buy extra in case you goof or you get a bad board.

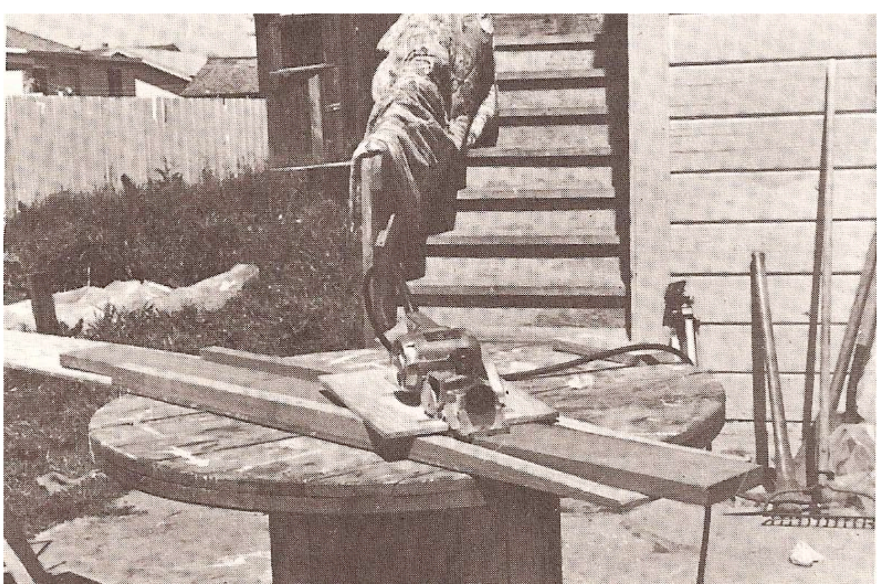
The first step is to join the edges; make them straight and square. Almost never will a board be straight, so snap a chalkline near one edge and cut off the crookedness with a skilsaw or by passing the board over the table saw freehand: no fence. It's not as hard as it sounds if you've got good support on both sides of the saw. These can be sawhorses on the feed side and a long table on the delivery side. Wax all surfaces for easy ripping. With one edge reasonably straight, pass the board through the saw with that edge against the fence to get the other edge parallel. Now turn the board over and clean the first edge again. Turn again and rip off a little more from the second edge. You're getting a pretty straight board.

Is the saw blade set exactly square? Check for square before making the final cuts on each edge, and trim all boards of the same width with a final cut at one setting of the fence - so they'll all be identical. So, you trim both edges of the board alternately, reducing it to its final, finished width.

Note that the end walls are thicker than the side walls. Do not substitute different widths unless your lumber is bad or you can't get clamps, in which case you'd better go for aluminum spars anyway.

A "spar bench" is certainly unnecessary. Any firm floor - even ground - will serve to set up saw horses every six feet. The tops of the horses can be adjustable, using wedges and spikes, or the legs can be shored-up until all the horses are in a straight plane as determined by eye. Check the horses for straight periodically during the project.

Scarf joints are not as difficult to make as they appear. Try one on a scrap for practice. Draw lines to indicate the long beveled joint. Cut outside the line with a sharp hand ripsaw or just chew off the waste with a sharp power plane. Plane down to the marks with a very sharp, long, hand plane by clamping the board so the knife edge of the scarf will fall exactly at the edge of a firm, flat surface like a good, clean, strong workbench. The ends of the two boards which will mate at the scarf can be planed together, side-by-side, to insure that their scarf angles are identical. This gives a straight board when scarfing is complete.



Here's one method of cutting spar scarfs. A power plane mounted to a wide plywood shoe is passed over a jig to taper the spruce board for scarfing.

Gluing-up the scarfs - and the entire mast - should be done only with Weldwood water-mix “red can” glue. Do not use Resorcinol or other exotic glues in sparwork. Locate the ends to be glued by driving a small brad through the joint when correctly registered. This will keep them from sliding around in the clamping stage. Align the two pieces straight by eyeball and clamp with ¾" pads under the clamps using wax paper to keep from gluing the pads to the scarfs. Get plenty of pressure using at least six “C” clamps at each scarf. In cold weather, drape the clamped-up scarfs with canvas and put lightbulbs inside to keep the joint warm - at least overnight. Test a sample scarf when the glue has dried two days at 70 degrees and you’ll see that the board will break anywhere but at the scarf. For this reason, any number of scarfs can be used, without regard to staggering them wall-to-wall to gain the necessary length. But scarfs are work, so get lumber as long as is practical but don’t worry about your scarfs. Even if you do rough work, the strength of these joints is unbelievable.

The hardest part of building the mast is joining the edges after scarfing (full-length wall) to get them straight and square. The best system I know is to use a power plane. Make a special wooden fence to clamp onto the shoe of the plane with small “C” clamps. This fence can be made exactly square with the shoe, extending downwards about two inches. By guiding your fence against the side of the board, the plane will automatically cut the edge square; 90 degrees to the side. Check with a T-square and try to make just one pass, full length, on each board with the plane set to about 1/32" depth of cut.

Cut and assemble all doublers, cleats and plugs shown in the plans, and get the walls ready for gluing. Nails - of the proper length to not come through outside - can be used for gluing on the doublers to the inside of the walls. Staple the wiring harness to the forward wall. Leaving two feet of slack inside, run the wires out the necessary holes in the walls and wrap the wires heavily with tape where they emerge, pulling some tape back inside the mast. This protects them at their most likely point of damage. Use great care to avoid damaging the wires.

Make a trial fitting of everything. Check to see that none of the doublers and plugs and cleats are too big - or they will hold the mast walls apart where joinery is critical. If anything, cut them small and fill the gaps with glue during assembly.

Get the spar clamps. You can buy or borrow them from another builder, or make them yourself. Each consists of two pieces of ¾" x 2" hardwood (fir will work if you don’t drill the bolt holes too close to the ends) and two 5/16" or ⅜" bolts (carriage heads are best) each with washer and nut. Drill one piece of wood to accept the bolts and hold them fast by the carriage head. Drill the other to accept the threads loosely. Determine sizes to fit your mast and make enough to put a clamp every eight inches (six inches between). The bolts are the expensive part, and can sometimes be borrowed from a cooperative hardware dealer on the promise that they will be returned clean. Black steel is fine - no plating needed. If you have to buy bolts, or clamps, you can probably sell them to another builder later. Strips of rubber and banding machines make unsatisfactory clamps.

Get everything ready for “The Great Gluing” and go home.

Come back on a cool day with some cool friends and slap it together. Check the horses for straight. Mix the glue thin like cream and have cans and brushes for everyone.

Paint the entire inside of the mast with glue using a paint roller to speed the operation. Quickly string-out two rolls of aluminum foil and crumple it lightly, then staple it every two feet inside the box before putting on the lid. This is a very effective radar reflector - it will make your outrigger canoe look like a battleship on any radar screen.

Time is critical. The open assembly time, if extended or if the day is warm, will cause the glue to stiffen and give rich joints. Go! Get clamps on near the doublers and plugs and check alignment. Have someone wiping glue while the others put on clamps. A speed wrench is a great assistance in tightening the bolts. Check the horses to see that she is straight - as you go. Do not use nails or screws in gluing up the mast walls.

Now a cool day is required for gluing, but by the following day - at the latest - you've got to get her warm. Seventy degrees for a few hours is enough, if she'll get warm again the next day. If you are working in winter, you'll have to drape the clamped up mast with plastic or tarps and get heat inside. Beware of fire! Leave her in the clamps at least 48 hours.

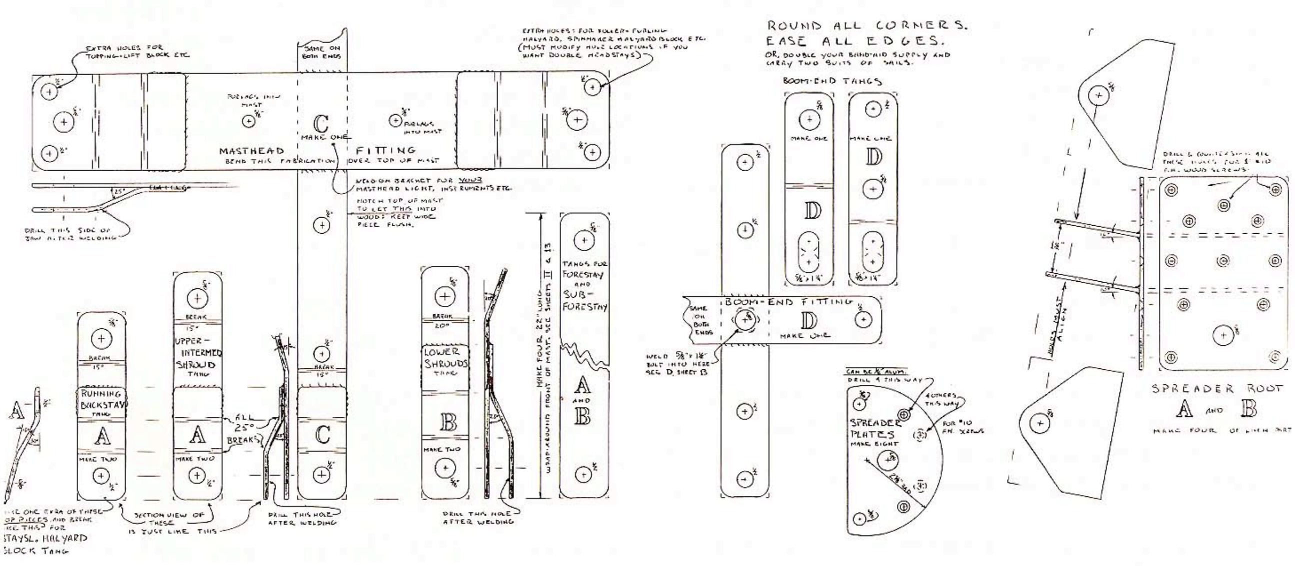
Shaping the mast is best done with a power plane and a big powerful router with a ½" bullnose bitt. Or, you can round the edges with a plane making full length passes. Clean it up nicely. Apply one coat of wood preservative and let dry three days. Prime with white primer, sand, prime again, and paint with one coat of good white gloss enamel. Do not varnish. If you go to the Tropics the sun's heat will cook your mast into looking like an old barn - unless you paint it with white or aluminum paint. I can hear the groans now, but beauty be damned - don't varnish your spars!

Booms are built like masts and if the clamps are too big you can put a thick plank alongside the boom, and drill extra holes in the wood part of the clamps.

Spinnaker poles can be made of tapered spruce but the common approach is aluminum pipe. You can make your own pole ends by plugging the pipe ends with wood and bolting on your hardware.

So, that's what it's like to build wood spars. It's a long trip but a good one and you shouldn't hesitate if you can't get aluminum and you can get spruce. Or if you like to work with wood, build your own spars just for the fun of it - there's nothing else like it in all of carpentry.

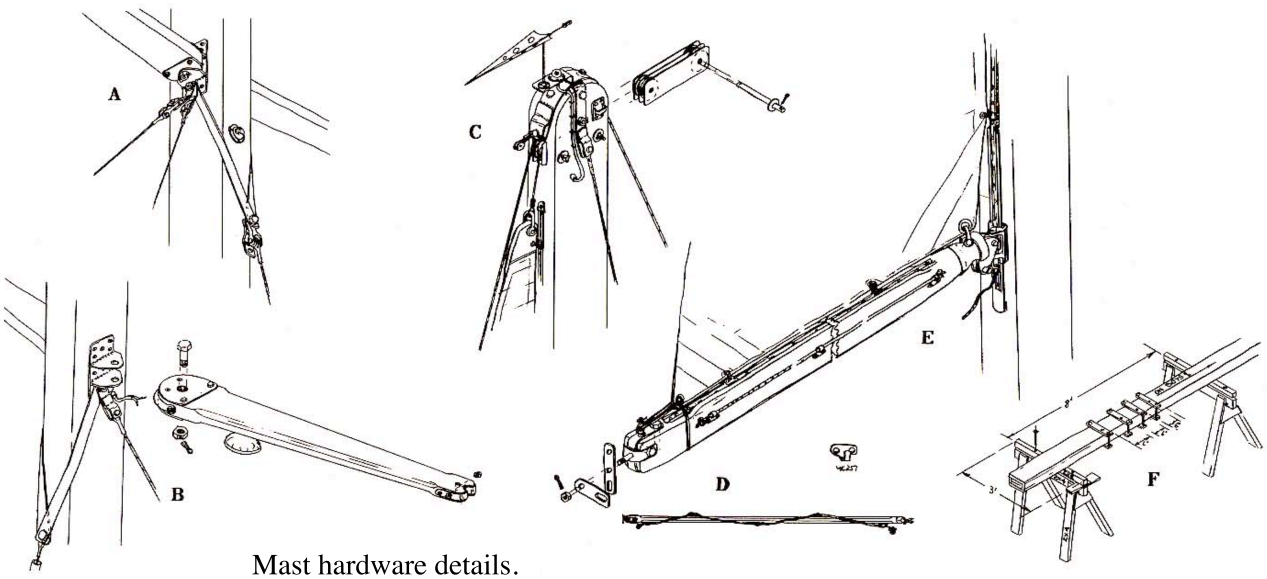
<u>Fabricating spar hardware</u> for Searunners is done by using full-size patterns for all critical parts. Photo-reductions of some of these parts are included here to illustrate the approach. Most of the parts are needed in duplicates - up to eight identical pieces. The full size print in your plans shows such parts only once. You can cut the drawing with scissors and have the cuttings Xeroxed as many times as necessary. Now, using white glue or library paste or rubber cement, glue the prints onto the required metal stock. The metal stock can usually be bought surplus but be sure of your alloy; all stainless parts should be alloy 304 or 316. Aluminum can be 6061 or 6063 or 5086, with a temper of T-5 or T-6. Get enough sheet stock of the correct thickness specified for the boat you are building.



The purpose of gluing the drawings to the metal is to get the layout work done - on the metal before taking it to a sheet-metal fabricator. Using a huge machine called a “shear”, they can cut out the parts in short order at reasonable cost. Ask them to nibble-off the corners to make it easy for you to round them off with a grinder later.

Then they can often take the parts to their “punch” and punch out all the holes; especially if you take the trouble to previously mark - with a center-punch and hammer - the centers for all holes as shown in the drawings. A little dent like this allows the punch operator to quickly locate the part under his amazing tool. The above approach is by far simpler than attempting to cut the parts out with saber-saw or band-saw, and then drilling the holes yourself. However, you may wish to touch the punched holes with a counter-sink to ease their edges slightly.

Some parts are to be bent or, to use the jargon of the trade, “broken” at certain places at certain angles. This can also be done by a fabricator, using his big “break” tool, but you can also do it in a husky vise with a hammer - much cheaper.



Mast hardware details.

All parts are to have all their edges and corners generously eased and rounded. It often happens on a sailboat that after a frantic scene of sail handling, the crew will assemble in the cockpit and compare their cuts and bruises. Such physical damage can lead to infections and a weakened crew but they are barely noticed during the height of men-against-sail encounters. They are caused by the minutely sharp edges of deck hardware, chainplates and spar hardware. The bleeding gets profuse when a crewman goes aloft unless the builder has experienced such carnage or takes the advice of those who have: “ROUND all corners, EASE all edges”. Damage to sails and lines are also caused by rough metal work by the builder. Make all parts so you can drag your palms and rake your knuckles hard across the edges without breaking the skin. Use a grinder, belt sander, file and emery cloth, or whatever will do the job. If you want to get fancy, all parts can then be passivated and polished (or electro-polished) by a plating shop. This makes them look like jewelry but is inconsistent with most backyard building.

Welding is required on some parts. Match the parts together with tape or screws and take them to the welder with plans or instructions to simplify and shorten the welder’s task and guard against mistakes. Welding is expensive.

Stainless can be welded by the “straight stick” electric arc method if the welder knows what he’s doing. So can aluminum.

But it is much safer for the welder you select to have “heliarc” or “wirefeed” equipment. All hardware and welds are, however, way over designed so that even bad welds should hold. The design of all metal parts is made uncommonly simple and straightforward with as little sophistication as possible. This is blacksmithing more than “marine” metalwork, so don’t be buffaloed by it just because you’ve never done any. But, some metal parts kits for Searunners may be purchased from special multihull service firms listed in Appendix #6.

As this book goes to the printer we have learned of a dismasting in a 37-foot Searunner caused by a failure in the mast tang for the lower shroud, part B. The tang broke off at the weld where the top jaw is welded to the longer piece - the weld going across the longer piece and apparently burning the metal sufficiently to cause the tang to fail.

Because of this incident, it is now suggested that the mast tangs and chainplates be welded everywhere except <u>across</u> the stock. Weld all around the upper edges of the chainplate doublers, leaving the bottom seam open. Weld only the edges of mast tangs.

To qualify this tang failure incident, it is fair to mention that all the fabrications on the mast involved were made of metal stock somewhat lighter than specified; instead of the ⅛" plate indicated the builder used what he could get - about 3/32" sheet stainless of an unknown alloy. The tang that failed had been welded <u>twice</u> on the same point; the second weld being made as a repair to the tang, which the builder had noticed was tearing. The episode occurred between Port Vila in the New Hebrides and Fiji -while beating against the trades and after 15,000 miles of sailing the in Pacific. The crew motored 250 miles to Fiji but admitted it would have been easier to jury-rig and sail downwind back to Port Vila. The above illustrates the degree of safety factor designed into Searunner components, and the degree to which the builder can reduce that factor and face the consequences. Anyway, let’s not weld <u>across</u> the spar hardware and chainplates.

Parts assemblies for the spar hardware are sketched in the “Mast Hardware Details” drawings. These sketches show Searunner spar hardware installed on a wood mast. They are similarly installed on an aluminum mast (except for the masthead fitting, sketch “C”), and are described as follows:

A. Upper spreader assembly includes spreader roots with spreaders installed and the various shrouds and stays. Special long tangs for the forestay hang on the thru-bolt and wrap around the forward side of the mast to converge.

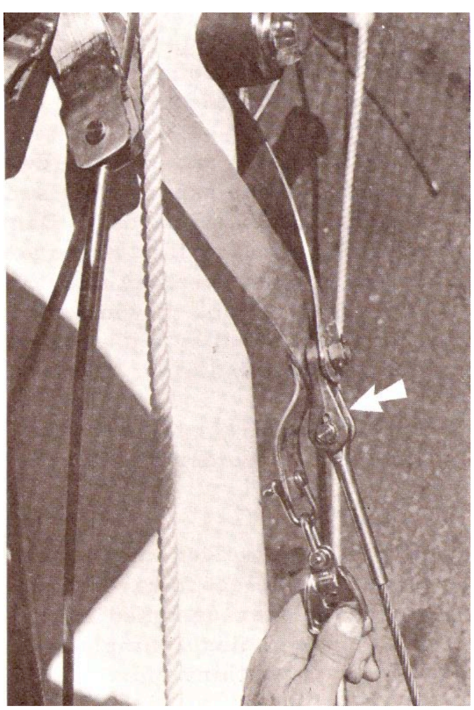


Photo of detail A in “Mast Hardware Details”. Note toggle at top of forestay (arrow). The nut on the bolt which secures these parts should not be tightened hard; allow toggle to swing. Note that nut and bolt are drilled for cotter pin to prohibit nut coming off. Also note that if the bent tang (shown at lower left in “Mast Hardware Patterns” drawing) which mounts the staysai1 halyard block (held by hand in photo) were to have an oval hole to admit the big end of a shackle, then only one shackle would be required to attach the block.

Between them hangs the forestay toggle (to give universal movement to the fore stay thus avoiding fatigue on this "running" stay) with the forestay itself attached to the toggle. Behind the long tangs hangs a short tang, with special angle breaks, which serves to mount the staysail halyard block (to a sailor, a block is a pulley not shown in sketch). The bolt which joins all these parts should be double-nutted or drilled for a cotter pin or somehow made to positively not come off. But you must still be able to remove it for maintenance while hanging in a bosun's chair, so don't just bugger-up the threads! This juncture should be heavily wrapped with tape to protect the sails. The next tangs to hang on the big thru-bolt are the intermediate shroud tangs. And on top of those hang the running back stay tangs which, like the running forestay tangs, have a toggle between to avoid fatiguing the wire. On aluminum masts, these running back stay tangs are sometimes mounted on a separate thru-bolt located 9" below the main thru-bolt to avoid crowding on the thru-bolt. This is not recommended for wood masts. Make welded, forked end tangs as in the plans to avoid crowding on this bolt. The bow light, if any, should be mounted on the mast just below the upper spreaders. You're supposed to have one for running under power.

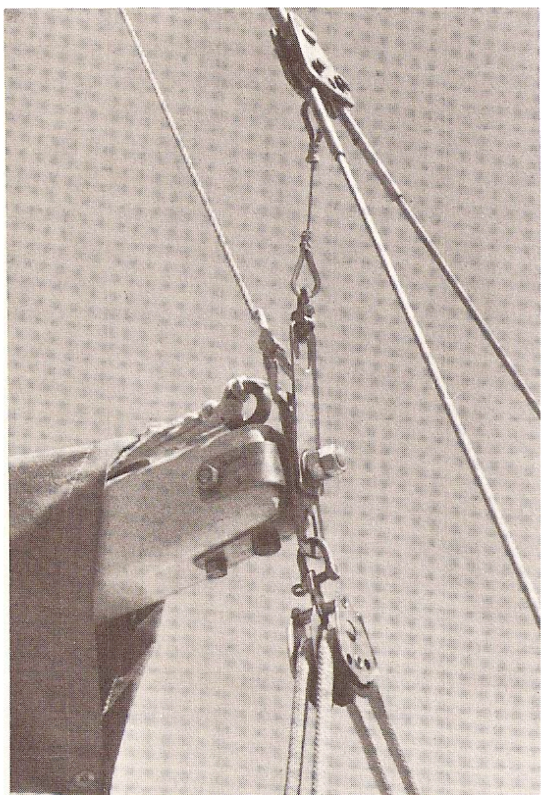
B. Shows the lower spreaders assembly. The sub-forestay hangs on long tangs like the forestay, but needs no toggle. It gets a full length roller of plastic pipe instead. The lower shroud tangs are shown, with the shroud attached. Wires for the spreader lights - if any - emerge here, clear of the spreader root plate. The spreader itself is shown unattached. The logic for this spreader's design is to make it so that it cannot be ripped off of the mast in a forward or aft direction. Spreader failures are very common on cruising boats. These spreaders have limited swing. They are hinged to swing fore'n'aft, and are kept from swinging too far by the shrouds themselves and by the design of the spreader. The rounded inboard end of the spreader can rotate between the jaws of the root on the large pin. But the pin passes through the spreader at a point off-center from the rounded end of the spreader (see spreader plates in pattern) so that a cam-action is formed which will gradually bind in the spreader root as the spreader swings. Wrapped around the end of the spreader is a short piece of plastic tube which, as the spreader swings and the cam binds, is squeezed by the cam against the spreader root plate. As the spreader swings (perhaps being pulled upon by a sail which is being pulled upon by a winch which is being cranked by a crewman who is unaware of the tangle aloft), the swing is gradually limited as the cam tightens against the plastic tube. A squeaking noise is created which warns of the situation aloft, but the spreaders can swing - without breaking - far beyond the point where the shrouds will stop them. The pin is nutted on the bottom and drilled for a cotter, but not over-tightened to squeeze the spreader in the jaws of the root. The outboard end of the spreader has a clip of light stainless wrapped around it and a notch to hold the shrouds. This clip must be thru-bolted to avoid the shroud splitting the spreader. A ¼" hole is drilled near the tip to allow lashing the shroud into the notch so it cannot come out. Begin by wrapping the shroud with electricians tape up and down from the spreader about 2" each way. Then, using seizing wire (soft stainless or Monel or copper) wrap over the tape tightly with the wire to squeeze the tape into the weave of the shroud. Then seize the shroud into the notch and through the hole. The object is to prevent the tip of the spreader from sliding up or down the shroud. You can go aloft and sit on the spreader and have quite a beautiful ride. Finally, add a tennis ball, sliced halfway through in a cross, over the end of the spreader and wrap the whole business with white <u>cloth</u> adhesive tape. This will protect the sails at a common point of chafe.

C. The masthead provides for lots of features. The masthead fitting mounts the head stay, back stay, upper shrouds, topping lift block, spinnaker halyard block, masthead light, wind direction vane and even a lightning rod. All these features are pretty straightforward - you just hook them on in the holes provided - except for the following: a special bracket should be welded to the masthead fitting to attach any masthead instrument senders you desire such as a wind speed and/or direction device, a whip antenna, etc. The wind vane or tell tale should be located as far aft as possible to make it visible from the helm, and the masthead light must be arranged to illuminate the vane. This will be a great help to the helmsman at times - especially if he is experiencing vertigo in rough conditions; the wind direction vane is one steady thing for him to stay his mind on.

A special bracket for mounting this hardware can be made and welded to the masthead fitting. The bracket could be a small pipe which would extend above the light to mount the wind vane and a quarter-inch brass rod would continue a few inches above to terminate in a very sharp point giving a lightning rod. This sharp point is said to dissipate the charge which would attract lightning. The ground for this lightning rod could be two-thirds of a boatlength of fat, bare, flexible copper wire attached to the head stay turnbuckle on deck or wrapped around the stay with several turns. The wire is coiled for storage and thrown into the water in electrical storms. It should be short enough so that if you forget about it, it won't get caught in the prop. If you plan to use a whip antenna for a radio telephone, mount the wind vane so as not to conflict with the whip.

Note in sketch "C" that the halyard sheaves are mounted in the sheave pocket by axles which go clear through. These axles also hold light aluminum plates which extend beyond the limits of the sheaves and fill the pocket to insure that the halyards absolutely cannot jump the sheaves. Clearance between the sheaves and plates should be close to prevent the halyards jamming between.

On aluminum masts the masthead casting has features to accept all these parts with the possible exception of our light-rod-vane gizwankus, which can be added by the builder.



Boom-end fitting for wood boom with eye-bolt for outhauling the sail. Sail cover hides lashings down around the boom. Notice wire strap hanging on backstay bridle junction; this is used to secure the boom when the boat is idle.

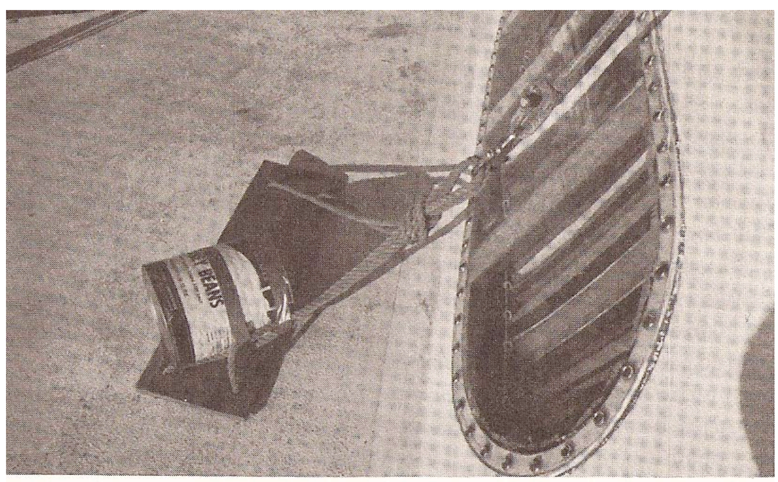
D. Referring to the boom, note that the spar hardware patterns contain pieces for making your own boom-end fitting for wood booms. It is a cross of stainless strap welded at the juncture, with a large stainless bolt drilled through and the head welded to the back of the straps and protruding aft to form a lug. The boom end has a counter bore to let the head of the lugbolt recess into the wood. The straps wrap around the boom end and bolt through. Hanging on the lug are two tangs to receive the main sheet blocks, the topping lift, and an extra tang for a boomvang or jibe preventer. The oval holes in these tangs (and in some chainplates) are to· allow a shackle to pass through and hang upside down if required. One of the bolts which fastens the boom end fitting is a large eye-bolt which serves as an outhaul terminus for the sail. Some outhauls are designed to give varying tension on the sail while under way, and are disproportionately costly for cruising. We use the eye-bolt with several turns of light Dacron line as a lashing from sail to eye.

And note also that two or three turns in the lashing go down around the boom. Most of the strain is pulling upward on the sail - not forward - and so its clew must be lashed around the boom securely. Tape your knot. Notice also that the side of the boom is equipped with a Quick-Furl shock cord held by lashing-hooks like Wilcox #257. The hooks on the starboard side of the boom are bent closed to contain a length of ⅜" shock cord stretched loosely and knotted at the ends. On the opposite side of the boom, in staggered positions, are open hooks. When the sail is dropped, it can be quickly furled as follows; dump the whole sail on the leeward side of the boom; grasp the leech near the head and pull aft on it. Dump the sail's bulk inside of itself as you work down the leech, hand over hand, PULLING AFT on the leech each time. With the help of the crew also pulling aft and rolling the sail inside itself, you'll end up with a tight, neat roll on top of the boom. Now grasp the shock cord between closed hooks and stretch it up and over the sail, hooking it into an open hook on the opposite side. That's a quick furl. You need more ties of line ("stops") or the sail cover to contain the sail in a windy harbor.

Aluminum booms come with various outhaul methods and boom end fittings which can be bought from the sparmaker because they're harder to fasten on than with wood booms.

Sail tracks for wood masts and booms are installed with round-head wood screws (size ¾"-#6 for the ⅝" external track in the 25'er, and size 1"-#8 for ⅞" track in the larger boats). Stainless round head machine screws or Monel pop rivets are used to install sail tracks on aluminum masts. Drill the mast with the correct number drill for tapping the screws and then tap threads in the holes carefully. An electric tap gun or variable speed drill is needed because tapping all those screws by hand is a chore! Butt joints in sail track are best if welded to form a continuous track, but unwelded butts are satisfactory if great care is taken to align the ends exactly with the fasteners, placing an extra screw each side of the butt. File the sharp corners off the ends before fastening, and test with a sail slide to assure there are no hang-ups. It's not so bad if you can't get the sail up, but it can be very hectic if you can't get it down! Sticking slides are so common that one usually starts with a full length of track at the head, and works down. This places the butts as close to the deck as possible so the "deck ape" who shinnies up the mast to get the sail unstuck - as the vessel plummets onward toward the dock - doesn't have to shinny any higher than necessary. During periodic inspections aloft from the bosun's chair or with binoculars from the deck - always include an inspection of the sail track butt joints. Test for loose screws with a screwdriver.

Make a lightweight bosun's chair out of ⅜" 5-ply with the grain going lengthwise. Beans can is for holding tools but tying them is necessary for going aloft while underway.



While we're on the subject of going aloft, train yourself, or your "deck ape", to keep all tools tied to your belt with marline (or better, tied to a canvas bucket which is tied to the chair) so that they cannot be dropped. A screwdriver stuck in the deck - like a dagger - isn't as bad as one stuck in your skull! It happens, and a dropped shackle can cold-conk someone sitting in a central cockpit because that's where the mast is. Close the hatches and warn the crew when there is work going on aloft. Do the guy up there the favor of not jumping around the deck. This whips the mast and is downright inconsiderate, unless you're training him for going aloft at sea.

E. Gooseneck tracks and spinnaker-pole tracks are fastened to wood masts with big screws which penetrate the doublers provided inside.

Some aluminum extrusions have a thickened wall to receive machine screws for these tracks. On very thin wall extrusions the practice is to weld on an aluminum doubler outside like a batten, welded intermittently, over which a piece of stainless flat bar is thru-fastened (by tapping through the doubler) to form the track. Some gooseneck tracks are cast or machined to receive the goosenecks to which they belong, as shown in sketch E. Ideally, these let the sail track come right down over the gooseneck track if the gooseneck slide is cut away to let it slide over the top of the sail track. This allows the sail slides to come down all the way to the gooseneck for a neater furl in the sail. Without this feature the gooseneck must be somehow held at the top of the gooseneck slide to get a tight furl - but this can be nice because it gives more headroom in the central cockpit under the boom. A reasonable gooseneck track can be made of stainless flat bar (of the size to match your gooseneck slide) which is fastened over a smaller flat bar (batten) with husky fasteners and suitable stops top and bottom. Same for spinnaker tracks, and this goes for both wood masts and aluminum. These tracks take less strain in multihulls because vangs and guys and jibe preventers can lead to the outriggers, thus relieving columnar strains on the boom and spinnaker pole. But be sure they are rugged by installing them carefully with large, frequent fasteners.

Gooseneck fittings can be made or bought in such wide variety that I will describe only the roller reefing type, which I prefer. Roller reefing has gained disfavor among racing sailors because it is said to give the mainsail a poor shape when reefed. My experience has not substantiated this, especially with the wooden booms shown in Searunner plans. These booms have a deep alley into which the sail track is recessed. The alley serves two purposes: it forms a gutter to collect rainwater out of the sail. A canvas bucket tied under the gooseneck collects the torrent in a squall and has a hose leading to the tank; this also makes a good place to take a shower. And the edges of the gutter protrude to increase the circumference of the boom so that when the sail is rolled around it, the bag usually caused in the mid region of the sail with roller reefing is instead consumed by the boom's added circumference, giving a good shape to the sail when reefed. This would indicate that even if you buy an aluminum mast you should consider building your own wood boom. However, it is possible to attach a ¾" x 1" teak batten on edge along each side of the slot of an aluminum boom to accomplish the same purpose.

But the basic point here is that roller reefing forms a natural combination with the central cockpit. You can reef the mainsail without going on deck; as the weather worsens you stay in the cockpit. One man - even the helmsman - can reef the sail safely. In case you are an experienced racing sailor and prefer Cunningham or Jiffy reefing (where the sailor ties reefpoints around the boom after sweating down the tack and clew) then go ahead by all means. But for the inexperienced cruising sailor, roller reefing from within the central cockpit is strongly recommended to keep you out of trouble. With this system anyone can reef without danger of falling overboard, and because it is so easy, it doesn't get put off. Roller-reefing goosenecks are expensive but I consider them an integral part of these very integrated vehicles. Appropriate sizes and specs for Famet goosenecks are given in Appendixes #1 - #4 to serve as a guide. Most gooseneck makers offer a bell adapter to receive the shaped end of a wooden boom. Or, goosenecks built for aluminum booms can be fitted with a short piece of the correct extrusion, into which a wood boom can then be attached. Simple homemade non-roller reefing and non-sliding goosenecks are all right if the builder assumes the liability of point-reefing by providing for it with good fittings for sweating-down the tack and clew, and practices reefing prior to needing the reef. And wears a safety harness.

F. This view in the spar hardware sketches shows the method of glue clamping a wood mast using adjustable saw horses for a spar bench, as described in Building Wood Spars.

Mast winches are specified in the appendixes, but some explanation is included here.

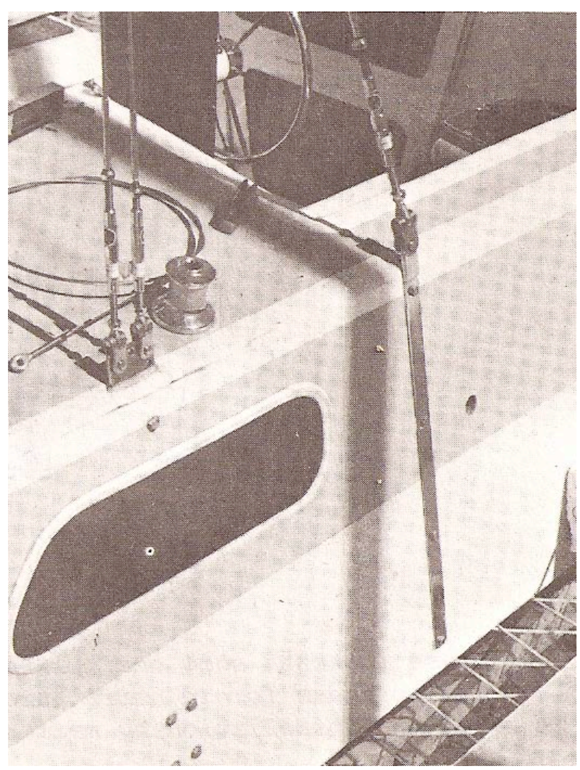
A whopping strain is required to hoist a headsail and stretch it tight enough to avoid puckering at the hanks in strong wind. So the jib or genoa halyard winch needs to be pretty husky. The mainsail, by comparison, needs less umph on the halyard if the boom is attached via a sliding gooseneck. In this case the sail is easily hoisted (if it is luffing, like a flag waves) and then the boom is stretched down the gooseneck track to achieve the desired tension - from the bottom.

In the case of a non-sliding gooseneck, however, the mainsail halyard has to be pretty rugged also. Some sailors prefer the reel-type halyard winch for mainsails because they store the halyard wire on the drum, thus relieving a potential tangle in the central cockpit. But these reel winches are expensive and slow. They are nice, however, for hoisting a man in the bosun's chair.

For economy and simplicity, we specify the same size standard drum winch for both headsails and mainsails, so that one may be used in place of the other in event of a failure. Staysail and spinnaker can be hoisted by a smaller winch than is needed for headsails. Top handle winches are preferred.

Mount all winches for easy operation by the crew, so that handles clear obstructions and halyards lead fairly from mast to winch to cleat. Some sailors contend that, in the 37 and 40-foot Searunners, the mast winches should be located 18" higher than specified because the crew usually stands on the cockpit seats - instead of the sale - when using them. My opinion is that the crew should stay as low as possible to prevent injury from falling; stand on the sole with one foot and put your other knee on the seat, etc.

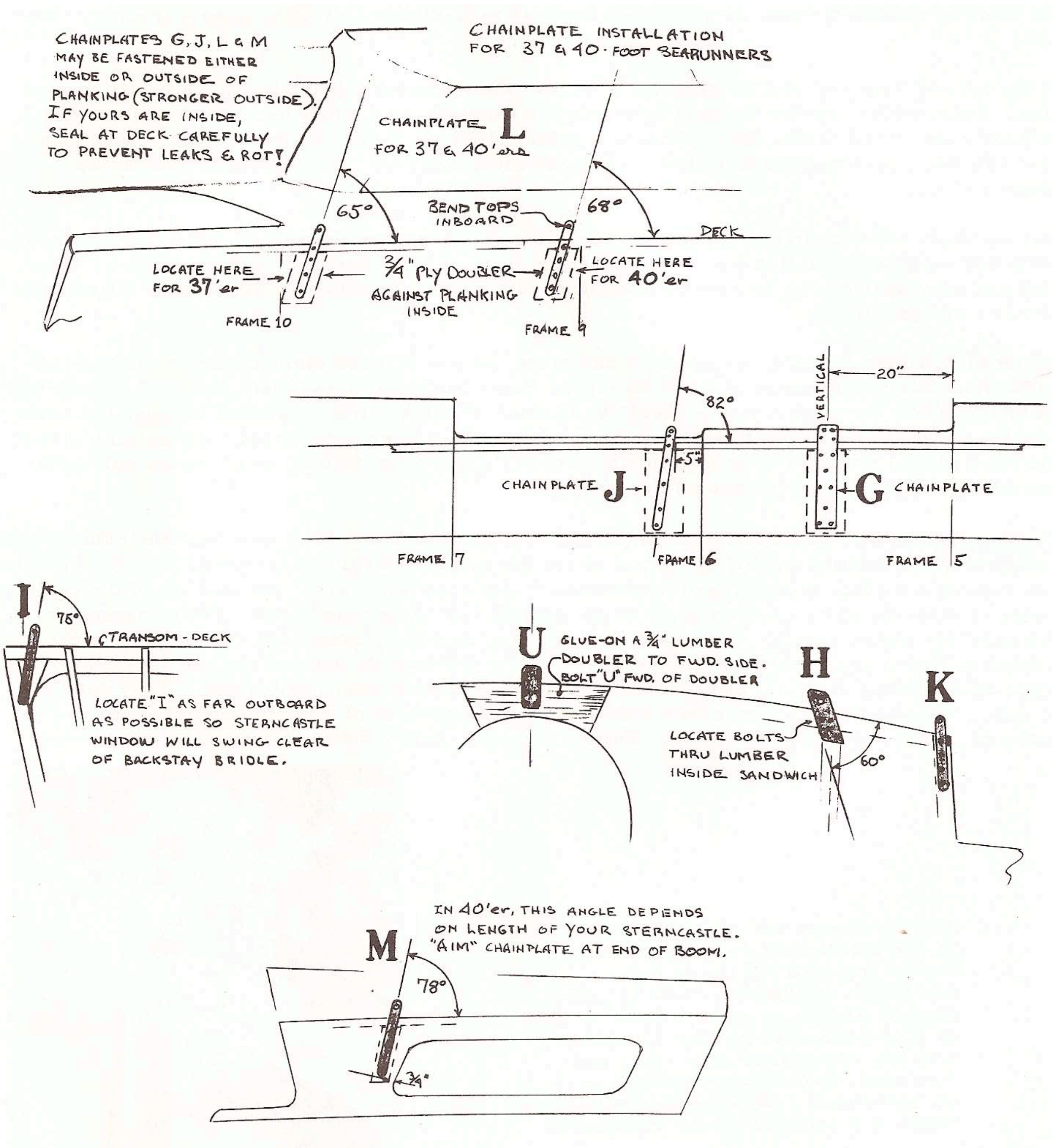
Chainplates are also given full-size in the metal parts patterns. Most of these are made of light stainless with doublers welded to the top where the greatest strain is delivered - at the top hole. Use the same method of layout and fabrication as for spar hardware. Installation of the chainplates is determined by the lead angle of the rigging that pulls from them. Some exemplary sketches are shown herein. You can determine lead angles by examining the sailplan; a protractor will give you the approximate degrees of arc between the shroud and the deck. Set this angle on a "sliding T bevel" and place it on the boat to locate your chainplates. They need not be exact. Incidentally, I have never seen a chainplate pull out of a plywood boat! I guess live heard of one or two, badly installed. But the strength of plywood in shear and bearing is incredible.



Outside chainplates (at right in photo) do not pierce deck and so are easily sealed from leaking around bolts. But inside chainplates (left in photo) require covers, or serious beads of calk on deck and below, to keep them from leaking. This photo also shows some very neat imported turnbuckles available through Almar. The wire terminal and the toggle are integral to the turnbuckle.

We've got plywood doublers and bolts enough in Searunners; don't be tempted to increase the chainplate size or beef-up the installation.

But be sure you install your chainplates so they do not leak. Rainwater seeping in around the chainplates can rot the wood and cause the whole area to become punky. With modern catalized mastics available like Calk-Tex and Life-Calk you can assure a tight installation or repair a crack in the mastic easily.



These sketches show chainplate installation details for 37 and 40-foot Searunners. See Appendix for identification by letter. Lead angles can usually be determined for any installation by measuring with a protractor from the sailplan.

Chisel out a small moat around the chainplate to give space for the mastic, and get plenty of this goop poked into the spaces around all thru-deck fittings, both above and below. Chainplate covers - slotted plates which screw down to the deck around the chainplate - offer additional protection if made of ¼" thick plastic like penolic board (or even plywood) but seem unnecessary with modern mastics. Especially if the builder will recalk around the chainplates after they have settled in to their final positions after hard sailing. A good practice is to notch and drill for chainplate installation and then apply wood preservative in the holes and to the raw edges of plywood. Let it dry thoroughly - several days before attempting to actually install the chainplates because the mastic won't stick to wet preservative.

In case I forget to mention it later, the rudder hardware is built just like the spar hardware and chainplates. Make them all at once for best efficiency. This requires that you have the rudder, ready to install, at the same time the mast is ready to receive hardware. It is a rare builder who can organize his project to this extent - as few changes from one operation to the other as passible - but this is the fastest, most efficient way to get it done.

Spinnaker poles. Spinnaker sails are optional, as discussed in the <u>Sails</u> section. Depending on whether the builder elects to have a spinnaker, the pole is also optional - but to a lesser degree. One of the features of Searunners, with their tall masts and generous sail area in the working sails, and their self-steering, is that they are well suited to passagemaking <u>without</u> the expense and complication of special downwind sails. So, the spinnaker is not as necessary as in most other boats, and “twin running staysails” are completely unnecessary.

The genoa, usually considered as a windward working sail, will serve admirably for running downwind in the trades if the boat is equipped with a long whisker pole which, for this purpose, closely resembles a spinnaker pole. So closely in fact that if the builder anticipates getting a spinnaker at some future date, he may as well get a pole that will serve for it, but use it as a whisker pole on the genoa for the time being. If he does not anticipate ever getting a spinnaker, the whisker pole may be one size smaller than the spinnaker pole specified in the Famet spars specs in the appropriate appendix.

These poles are made of schedule 5 aluminum pipe, which can be bought wherever tubing is sold, and is inexpensive enough to make building a spruce pole unrealistic. The expensive thing about the poles is their end fittings which, if purchased from a sparmaker, are rather costly. For light air use, particularly for whisker poles, we have made our own end fittings with reasonable results. The end of the aluminum tube is plugged with wood and the fittings bolted to the wood.

Searunner poles are extraordinarily long for reasons explained under Spinnakers in the Sails section. The same length applies for whisker poles used on the genoa, also explained in the Sails section.

Two whisker poles are sometimes used, one to wing-out the genoa and another, shorter pole to wing-out the mule on the opposite side. In this combination the mule is set on the forestay and the mainsail is not used. Mark Hassall has made two very comfortable tradewind passages in his 37'er, surfing and self-steering all the way, with this inverted kite sailhandling technique. The importance of this achievement is that no <u>special</u> downwind sails are required.

Two spinnaker poles of the same length are sometimes used, both on the same spinnaker! Frank Wurz has used this technique at sea in his 37'er to eliminate the need to jibe the spinnaker. Jibing a spinnaker in a Searunner cannot be accomplished by dipping the pole inside the headstay. Our poles are too long. But with the trimaran’s absence of rolling, two poles can be used without danger of dipping the leeward pole in the ocean, and great control over the sail is achieved. But the spinnaker is definitely a special downwind sail.

Even if you never have a spinnaker, you need at least one long whisker pole to wing-out the genoa. It is a great way to travel. Only in multihulls - particularly trimarans where overall beam is much greater than catamarans - can these unique sailhandling tactics be used with such ease and safety. Guying the pole to the floats relieves the columnar strain on the pole itself, and our wide decks and absence of rolling makes handling the long poles and the big sails much more feasible, even for amateur crews. Nonetheless, some sort of spinnaker net, careful helmsmanship, and precaution against falling overboard are very much in order. If you lose someone over while the boat is all set up for running, it is very difficult to get back and find him because of the speeds involved, and the time it takes to convert the sails back for sailing upwind. Particularly with the spinnaker. Don't leave the boat 'til you get where you're going!

MAST STEPS

Mast steps are the fittings that the bottom of the mast steps on. (See Mast ladders for the other kind of "steps" up your mast.) For aluminum masts they are simple cast plates with a ridge that extends up into the extrusion. They are inexpensive and should be bought or fabricated for all aluminum masts.

The degree of lateral strain at the step is very slight compared to the columnar loads. With the simple step plate bolted to the boat there is no danger of your mast sliding or jumping out of its step.

But the columnar strains are so great that, in the larger Searunners, a reinforcing plate under the step must be added to keep the mast from being driven down into the centerboard trunk. In the 37 and 40-footers this plate is ⅜" thick stainless or ½" aluminum or 1" Micarta or 2" plywood. It is wide enough to span the trunk walls and overlap about 1½" on each side. It is long enough to accommodate the step plate, plus about ½" on each end. It is fastened through the cockpit sole into the trunk-top glue strips with four ⅜" eye lags. The eyes are for attaching the ends of the halyards, etc. The step plate is bolted to the reinforcing plate with four ¼"-20 bolts. Locate the center of the step (and the center of the chainplates) exactly midway between frames 5 and 6.

In the 31' and 25' we have developed a simple mast tabernacle to allow stepping and un-stepping the mast with the boat's own winches using the boom as a ginpole. The drawings for the 31's tabernacle, together with photos of the method, are included in the section on Mast Stepping (putting it up).

The 31's mast step support is reinforced at the trunk with a ¼" stainless plate (or equivalent) to avoid being driven down into the trunk. A wood partner to contain the top of the support, against the cabin-top, is also necessary unless the pipe flange method is used. Some builders resist using the pipe support for aesthetic reasons, substituting a large wooden column. Actually the pipe can be made attractive with macrame or upholstery, but wood is perhaps nicer. The partner, fastened around the top of a wood support, can bolt through the cabintop and mount the tabernacle on deck with the same bolts. Get the length of the support exact, to fit snugly.

The 25's mast step can simply bolt through the cabin-top and screw into the hardwood doubler lining each side of the bulkhead below. Don't leave out these doublers! The bulkhead will break without them.

Mast steps for wood masts are a little more involved. Beginning with the same reinforcing plate as for aluminum masts, add to its top a step pocket. This is a ¾" to 1" thick piece of aluminum or Micarta (or even good plywood) cut to match the outside shape of the reinforcing plate, but with a pocket - a square hole - cut in the center to loosely admit the "toe" of the mast. (The toe is that protrusion of core material extending out the bottom of the mast beyond the ends of the mast walls.) This toe should project about ½" farther out than the step pocket is thick. The full columnar load of the mast is intended to bear on the toe only (in Searunner masts) and not on the walls themselves. This allows for an imperfect fit and for raking the mast without bearing on one wall alone. However, the full weight of the load is delivered to the center of the reinforcing plate - which is spanning the trunk slot. So the plate must be thick enough to resist bending. When driving hard to windward, the loading here equals about twice the weight of the boat!

MAST LADDERS

Mast ladders are the other kind of “steps”; these are for climbing the mast. The simplest ones are made of 3/16" x 3" x 3" aluminum angle cut in 2" lengths to form simple angle-brackets. Round the corners and ease the edges! Fasten to aluminum masts with #10-24 stainless machine screws - three each. For wood masts use 1¼" #10 wood screws driven into the doublers provided inside (mark the location of these outside when building your mast). Use a ¾" screw for the third, lower hole. Patches of “Scotch-Tred” anti-slip material are desirable on these steps. The purpose of a mast ladder is not to allow climbing the mast without a bosun’s chair. It is sometimes used for this in harbor, but the practice is discouraged. The real intention of the mast ladder is to allow the person going aloft in a bosun’s chair to climb, thus relieving the task of the crew pulling him up. A halyard (preferably the spinnaker halyard because it is all line, no line-to-wire splice) is led to a snatch-block at the mast step and thence to a large winch. The crew need only tail the halyard on the winch while the man climbs. But if he falls - they’ve got him safely hung in the chair. This allows going aloft at sea with confidence even if only your wife is around to assist from below. So mast ladders are important to small crews. And they offer a quick way to scamper up to the lower spreaders. Sitting on the spreader is a great place to ride while searching for shallows or islands or lighthouses.

STANDING RIGGING

Standing rigging is a term that applies to the wire cables and associated parts which support the mast. It stands still. Running rigging, discussed later, applies to the ropes and wires (a sailor calls rope line) which run through blocks (pulleys) or which change position in the operation of the boat. Running rigging moves. It works. But standing rigging stays put, fastened permanently at both ends.

These two distinctions explain the need for different types of rigging wire: flexible and non-flexible. The flexible stuff has to bend a lot, as it rolls over the sheaves of blocks with great strain on it while it is running. So, it is constructed of many small strands of wire twisted into several yarns which are then twisted into a single cable. The most common of these has seven strands of wire in each of nineteen yarns. The yarns are twisted into a single cable. Thus the usual wire specification for flexible running rigging is 7x19.

For standing rigging, the subject of this section, the usual cable construction has no multistrand yarns but instead each would be yarn is a solid fat strand, nineteen of these being twisted into a single cable. This is called 1x19 wire. Watch out in ordering to make your ones distinct from your sevens, so you'll get the right kind.

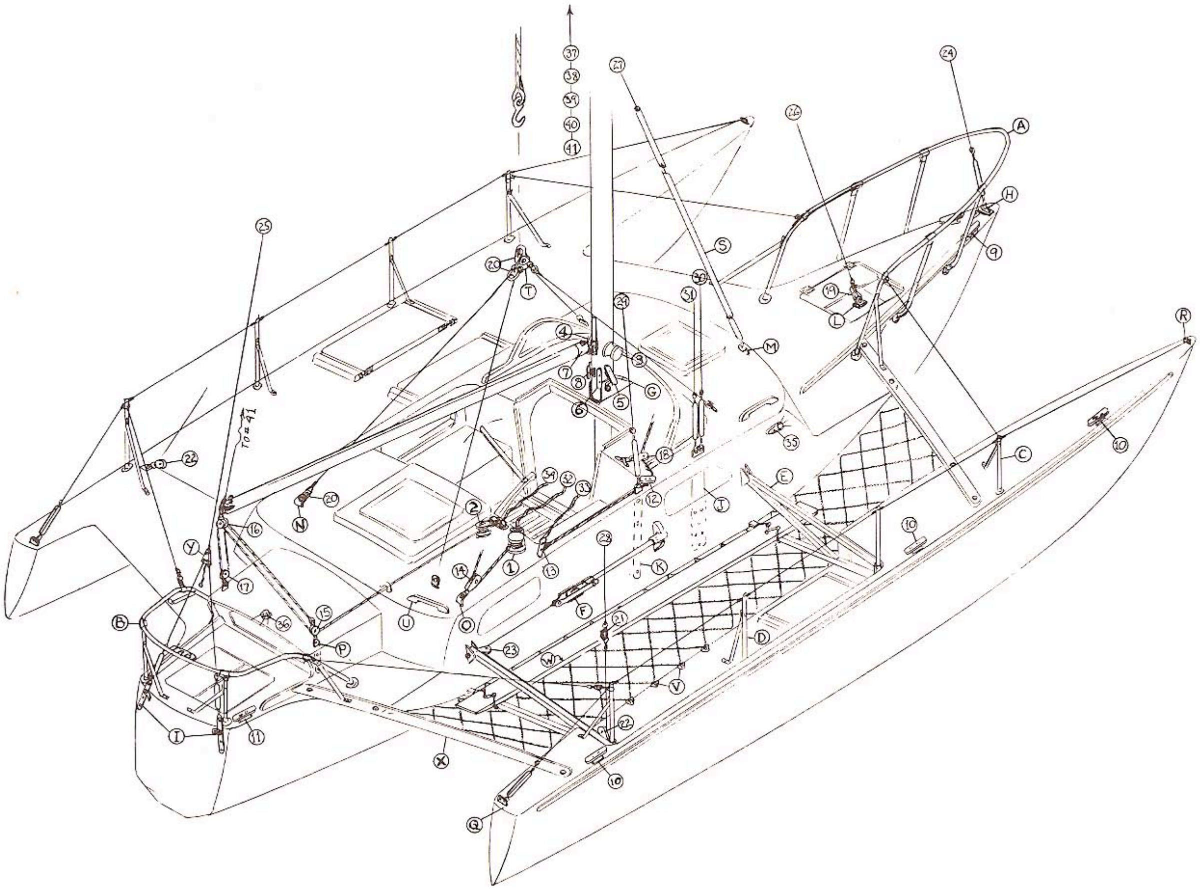
1x19 cable has greater strength, less stretch, but less flexibility than 7x19 cable. We use 1x19 in sailboats primarily because of its low stretch. Stretchy rigging makes it hard to adjust to “tune” the rigging turnbuckles to give correct tension on the cables to keep the mast straight in a blow. Tuning is discussed later. For now, don’t be tempted to use flexible wire where 1x19 is called for. The flexible stuff is more often available surplus but it will not serve for standing rigging in Searunners. Because our masts are uncommonly tall and the trimaran’s resistance to heeling causes rigging strains that are uncommonly high, stretch in the long pieces of standing rigging gives us tuning problems which are difficult for the amateur to solve. Therefore, all Searunners have standing rigging cable specified at least one size stronger than would be ordinarily used on even heavy cruising boats. If you increase the cable sizes specified in the plans, you’ll be using ridiculously heavy, costly wire. It is already way over-designed - mostly to reduce stretch and make your rig easier for you to tune. It also gives a large safety factor for longevity; Searunner rigging strains do not approach the safe working load of the cable specified (which is usually about half of the “breaking load”) and so your rigging should easily last for ten years without replacement - if the wire and terminals are made of good marine grade stainless.

The subject of terminals - the ends on the cables by which you fasten them to the mast or the deck - is fraught with controversy, at least for yachts. Tales of how the terminals can sometimes fail have a way of penetrating a sailor's psyche right to the paranoia center. The most popular type of terminal for standing rigging is the swaged terminal and this is the one we specify. It has a tubular ferrule into which the cut end of the cable is inserted. Then the assembly is put in a monster swaging machine - owned by industrial or yachting or aircraft cable companies - and the tube is rotary-hammered by dies in the machine to squeeze down upon the cable with incomprehensible force. The metal in the terminal actually flows into the weave of the cable. It is true that these terminals have been known to pull off the wire, but the occurrence is extremely rare - probably caused by using the wrong size terminal for that wire or by improper operation of the swaging machine. Another type of swaged-end failure is caused by corrosion. Inferior metal in the cable or the terminal causes corrosion and crystallization. It is evidenced by hairline cracks appearing in the side of the terminal, and is just cause for immediate replacement of the entire cable and ends. Some experts say to protect the lower ends of these cables by painting with linseed oil annually, or by smearing with lanolin (silicone grease works) and wrapping with tape for a distance up as high as you can easily reach. Metallurgists agree that stainless steel (all of these rigging cables and swaged terminals are made of stainless) depends on contact with air for its resistance to corrosion. However, a salt-soaked cable and its terminal near the deck may seldom have contact with air because of the omnipresence of moisture-attracting salt. My latest information is that premium yacht riggers protect the lower terminals from corrosion by squirting marine sealant (like Life-Calk) into the ferrule before inserting the cable end; then swaging. The pressure of the swaging process forces sealant into voids in the lay of the wire and prohibits seawater from entering the terminal area. Sounds good to me; see if your rigger agrees. Another way to avoid corrosion caused rigging failures is to make the stuff stronger than it needs to be. Strain is the culprit, and when combined with age and corrosion, strain will cause the failure. So, Searunner rigging is all very hunky, with all premium, corrosion-resistant materials specified. It will serve you for a long, long time without fear of failure. A racing yacht would be rigged half as strong, but these boats are for travel.

So, don't increase the sizes specified (reduce them one size if you want to really race) and don't mess with other types of terminals for 1x19 wire other than swaged terminals. One possible exception is the British "Norseman" terminal which you can install yourself, if you practice on a few first. They're good, but often unavailable in a good size range in the U.S. Nicopress eye-splices are unsuitable for standing rigging in a powerful rig like ours because the thimbles distort under strain, causing the rig to go out of tune. Also, eye-splices put a tight bend in the non-flexible wire around the thimble. But Nicopress splices are used in the running rigging, later.

Another possible alternative to using swaged terminals is discussed under Nicopress splices in the Running Rigging section.

To measure for length can be done in several ways. The various lengths of cable cannot be safely specified in the plans because everyone's boat is a little different. Even if everyone were to follow the plans, the rigging lengths can vary because of different types of turnbuckles or variations in the mast or tangs or chainplate locations. So, measure your own by buying all the rigging about a foot long, with the swaged terminals attached to the upper ends, and the lower terminals provided loose (see Appendix 1 through 4). When the mast is ready to step, attach the rigging to the mast with the terminals already on one end of the cables. Hoist it up via crane or other methods described under Mast Stepping; hold it there with lines leading out to the float bows and sterns. Make it secure, so that a strong wind won't blow it down. With the standing rigging dangling down, locate each cable alongside its turnbuckle. The turnbuckles can be two-thirds extended for this measuring process, with the loose terminals attached to the turnbuckles. Be sure all toggles are in place, that there is no twisting or fouling aloft, and that the boat is level and the mast vertical.



Above is part of the outfitting drawing from the 31-footer plans. Lettered items are fabrications to be made by the builder; numbered items are parts which can be purchased. Each item is described in detail in the outfitting Schedule and the Rigging Schedule in Appendix #2. Sources for these materials are listed in Appendix #6.

Below is a group of outfitting materials for the 37-footer. This does not represent a complete order. Some "lettered items" (the chainplates) are shown in the left foreground. Most other items in the photo are store-bought with green money!

Now, mark each cable by wrapping it with masking tape at the point where the cable comes even with the bottom of the ferrule on the terminal. Locate the tape so that when the final swaging is done, the cable is cut above the tape, so that the tape stays on the scrap. Notify the swager of this marking method. He simply cuts off the scrap, pokes the end of the cable into the tube of the terminal and sticks it in the machine. Some yacht riggers have portable swaging machines which can be brought to the boat. I prefer to remove all the rigging - by going aloft or unstepping the mast - and take it to a big industrial or aircraft swager for this critical operation.

Other methods of measuring for length can be used if the builder finds that returning his cable to the swager is a hardship. You can layout the lengths full scale on the ground using measurements of the boat and the mast. Or, you can draw the entire rig on the lines drawing of your plans at a scale of 1"=1', and measure the lengths to scale. Both of these give opportunity for error, whereas the direct measurement system, with the mast on the boat and the cables dangling down, is virtually foolproof. If the boat is level and the mast is vertical.

Actually, there is enough scope in the turnbuckles to give room for errors of an inch or two. Cables which come out too short can be used with two stainless straps to extend their length down to the turnbuckle. But cables which come out too long must be re-cut or discarded. The direct measurement system above is the most suitable for backyard builders - even if it is more physical work and inconvenience. And it’s exciting. Man! You’re rigging your boat!

Turnbuckles and toggles have a mystique about them, probably caused by the psychological importance they assume when, along with the rigging cables, the builder contemplates the consequences of their possible failure.

Turnbuckles are the “stretchin’ screws” used to adjust the length, the tension on the standing rigging cables. Toggles are the little links used below the turnbuckles - to attach them to the chainplates - giving a universal movement to that attachment so the turnbuckles may freely swing in all directions without binding.

The sailor calls some rigging cables shrouds and some stays. The shrouds support the mast from bending sideways, athwartships, and never have sails attached to them. The stays support the mast from bending fore’n’aft and sometimes have sails attached to them. All shrouds and all stays usually have turnbuckles. All shrouds need toggles, but only the stays that have sails attached need toggles. In our Searunner cutter rigs, it is sometimes possible to avoid using a turnbuckle on the running fore stay and running backstays by splicing them to length in place, as described in the section on running rigging. But these running shrouds and stays have toggles at the top to avoid wire fatigue.

Another point which is often unprotected from fatigue is the upper end of the head stay on aluminum masts. Our masthead fitting for wood masts, as designed, needs no toggle for the headstay; but in aluminum masts, the head fitting often does not allow for sag in the headstay. As explained in the Sails section, trimarans suffer from head stay sag because of elasticity in the hulls. If the terminal on top of the head stay is held rigidly between the jaws of the masthead fitting, and not allowed to aim off to leeward in the direction of the sagging stay, then this point can be a source of wire fatigue. A strap toggle is sometimes provided by the manufacturer of the headstay fitting. If it is absent, one can be made of strap, or a stock bronze toggle inserted between the jaws of the fitting.

You can relax about turnbuckle failure if you buy good, marine turnbuckles. This doesn’t mean that they cannot be galvanized steel, although bronze or stainless are most commonly used on yachts. But it does mean that the diameter of the turnbuckle’s threaded shank should be twice the diameter of the cable to which it is attached. And the diameter of the clevis pins or bolts through the jaws of the turnbuckle are also twice the cable size. Same for toggles.

These pins, or bolts, pass through the wire terminals and the chainplates. So, the rule of thumb is that if the cable diameter is ¼", the hole in the terminal and the turnbuckle size and the toggle size and the hole in the chainplate are all ½". For 5/32" diameter cable the holes and pins and turnbuckles are 5/16". In the 37 and 40 foot Searunners where the massive 5/16" cable is sometimes specified, you need the brutish ⅝" turnbuckles made by Merriman. This gives a true marine installation with miles of safety factor for wear and age and corrosion.

Many suitable turnbuckles made overseas give complications because their pin size will not suit US terminals, etc., and the plans call for hole sizes in the chainplates which will not suit other toggles, etc. If you make substitutions, do it with forethought and consider the whole rigging system. In the US , the system we use has marine eye terminals on the cable attached to forged bronze turnbuckles and toggles made by Wilcox-Crittenden or Merriman, which attach to chainplates given in the plans. Many substitutions are possible if the system's sizes are considered.

Use of dead eyes and lanyards or homemade substitute turnbuckles are discouraged in these modern rigs because of the uncommon strains involved. Quality turnbuckles facilitate tuning up the rig because a given shroud or stay can be adjusted even while sailing and the working strain is on the cable.

RUNNING RIGGING

Running rigging, as said before, is the stuff that moves - that runs - in the operation of the sails. It is the halyards which pull the sails up into the wind; the sheets which pull the sails in against the wind; and, in Searunner cutters, it is also the running back stays and running fore stay which support the mast in strong winds while using the staysail (small, inner jib). These running stays are peculiar to cutter rigs.

Running rigging is made from line (rope) and wire (cable). 7x19 wire is flexible so that it will bend easily while running through blocks (pulleys) while under tension. Stiff standing rigging wire, 1x19, would fatigue and fail if used for running rigging.

Line comes in a confusing variety of types and materials. As with most marine materials, the expensive stuff is the best. The prime requirement is resistance to stretch - low elasticity so that when strain comes on the sheets and halyards from stronger winds, the sails are not allowed to sag and bag. For low stretch, long life and high price there is nothing like Dacron for running rigging. The most pleasing stuff to handle is the braided Dacron line like Samson braid, etc. This doesn't say you can't rig with cheaper line - the best inexpensive substitute probably being multifilament polypropylene twist. Braided Dacron line is usually used but twisted Dacron is almost as easy to handle and is a little cheaper. Don't use anything smaller than ⅜" diameter for sheets and halyards because smaller stuff is hard to grasp and pull. For the 37 and 40-footers, use 7/16" diameter, and even for the 31 if you like the husky feeling. Splicing braided line is a relatively new skill of seamanship, and requires the correct size fid, but once learned it is faster and more secure than splicing twisted line.

Halyards are made from both wire and line combined. Half of each halyard is wire and the other half line. All-line halyards are acceptable in the 25, but not in the larger Searunners. The reason for this combination is that line stretches much more than wire (even Dacron line) and stretch in the halyards can have a very detrimental effect on sail shape; the stronger the wind the more sag in the sails. No good. The boat is not just slower, it is harder to manage.

The wire part of the halyard is the part which, when the sail is up, holds it up. If it is the headsail halyard, the wire begins at a snap shackle fastened to the head of, say, the genoa. The wire goes up through the sheaves at the masthead, out the aft side of the masthead fitting, down the mast to the headsail-halyard-winch mounted on the mast. Now, the wire goes around the winch about four turns. (That's right, wire on the winch.) It comes off the winch and heads downward toward the headsail-halyard-cleat.

But before it gets to the cleat it terminates in an eye splice made with a husky thimble and a Nicopress sleeve. Spliced through this eye is the line portion of the halyard. Make a neat eye splice in the line, but with no thimble in the line's eye. Then the line portion of the halyard continues down to make fast on the cleat. Note: the line-to-wire splice occurs between the winch and the cleat! The winch is used to create great tension on the halyard wire, thereby pulling up very hard on the head of the sail with a nonelastic wire halyard. But the splice falls below the winch and so has little strain on it compared to the portion above the winch. The line portion is easily made fast to the cleat. Don't attempt to wrap wire on the cleat. If the splice falls on the cleat, take another turn of wire around the winch.

Okay, the sail is up and is held by wire long enough to reach the winch and make about four turns, but not long enough to then reach the cleat. That's the line's job. And that's how to measure the length of the halyard wire. It can be an approximate length, adjusted to suit by taking the necessary number of turns on the winch. So, it can be installed and spliced while the mast is down, before stepping.

The length of the line portion is determined by letting the sail down. This pulls the line-to-wire splice up to the masthead where it jams in the sheaves. Leave enough extra line to secure the line's tail to an eye or hole near the mast step via a dog collar like snap, plus about 5 feet of slack. It is important that this end of the halyard line be secured so that it cannot be blown off in the wind, unreachable. And it is important that it be easily releasable so the crew can walk it outboard to clear fouling aloft.

When the sail is down, the wire portion may be released from the head of the sail (via a strong snap shackle like Nicro 1000-S) for attaching to another sailor securing to the deck or pulpit. But when it is released, hang on to it! The cardinal sin of sailors is losing the halyard. It is far more serious than spitting to windward because the spit comes back, but the halyard goes aloft - all the way to the head.

We've been talking about the headsail halyard. The mainsail halyard is similarly rigged and measured, and so is the staysail halyard. Note that when reefing the mainsail, the line-to-wire splice will go aloft leaving line on the winch. This is unavoidable, and acceptable because the mainsail halyard has far less working strain on it than the headsail halyard. Also note that when setting headsails smaller than the genoa, the line-to-wire splice will also go aloft. This is not acceptable. So, splice on a wire pennant to the head of all other headsails to make their effective height equal to the genoa. Same for the storm stays ail. These are head pennants. In determining the length of these pennants, consider the altitude above the deck at which the other headsails will fly.

Tack pennants determine this altitude. They are hanks of wire attached to the tacks of all headsails and then to the extra holes in the stemhead fitting on deck. Their length restrains the halyard from pulling the sail all the way to the masthead. Their length also plays an important role in the set and trim of the headsails. This seems far afield from our current subject of running rigging, but exemplifies the high degree of interdependence, the integration of features in a sailing machine. I'll explain:

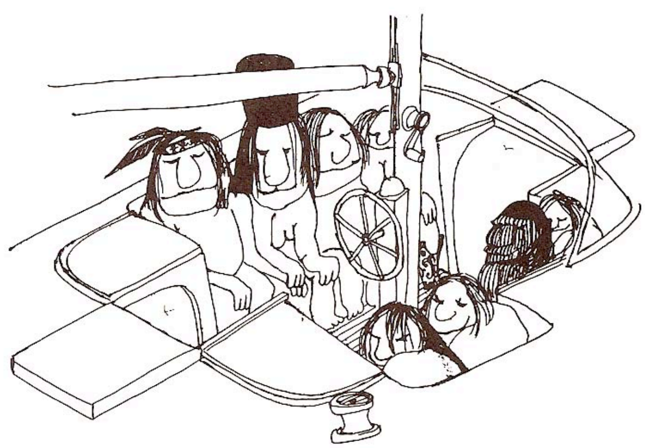
To reduce cost and weight and complication we have designed out all sheet-lead tracks in Searunners. These tracks are used in most sailboats to allow adjustments in the position of the sheet-lead blocks. This is done by fastening a robust track to the deck in the vicinity of the sheet-lead for the various headsails. A rugged car on the track mounts the block and the car can be advanced or retracted on the track to cause proper trim in the sail.

The Searunner method is to adjust the altitude of the sail itself, instead of the position of the lead block. We found that once the correct position of the lead block was determined, the car was never changed and the track was useless. So, by adjusting the length of the tack pennant so that the sail would fly slightly higher or lower on the stay, we gain the same effect on trim as with the tracks.

To effect a move of the sheet lead aft, shorten the tack pennant instead. Lengthen the tack pennant and the sheet lead is effectively moved forward. All this with no tracks or cars but instead a fixed sheet lead (see chainplate patterns in plans) and a simple change in the length of the tack pennants.

In practice, we start with a piece of light line for the pennant, a separate piece for each headsail, and make adjustments in its length while under sail. The correct length is determined by lying on your back and looking up into the sail. Sailing close-hauled to windward, adjust the sail's altitude above deck so that the entire sail has about the same camber or draft from head to foot. This can be determined by three different approaches: (1) Eyeball all seams in the sailcloth and get them parallel, as seen from below; (2) Head the boat up into the wind and note where the leading edge of the sail begins to luff - at the top or at the bottom. If it luffs at the top first, lengthen the tack pennant an inch or three, and vice versa. Get the sail to luff evenly, beginning about the mid-height; (3) Strap the genoa in hard against the shrouds when sailing. It should collide with the shrouds evenly - at the foot and at the leech about the same time. If it hits at the foot first, lengthen the tack pennant, and vice versa. Using all three methods, particularly (2), arrive at the correct length of tack pennant for <u>your</u> sails and mark this length by wrapping the headstay with masking tape even with the tack of the sail, while it is flying. Later you can Nicopress wire tack pennants to reach up to the tape. The better ones have small snap shackles for easy attachment to the sail. Or best, each sail can have its own head pennant and tack pennant permanently attached to the sail, leaving nothing dangling on the bow unused and no possibility of getting the wrong pennant on a given sail.

In Searunners, all this talk is superfluous because most headsails are drawn so that the altitude of the tack, above deck, is about the same: at the top of the pulpit. So one tack pennant will serve for most sails. (The mule sail has its own longer pennant in some Searunners.) But for fine adjustment, separate pennants are desired. In other trimarans, tracks and cars may be eliminated by using the above method of determining tack pennant length. Or if you buy used sails for Searunners you can often make them fit the fixed sheet leads in the design.



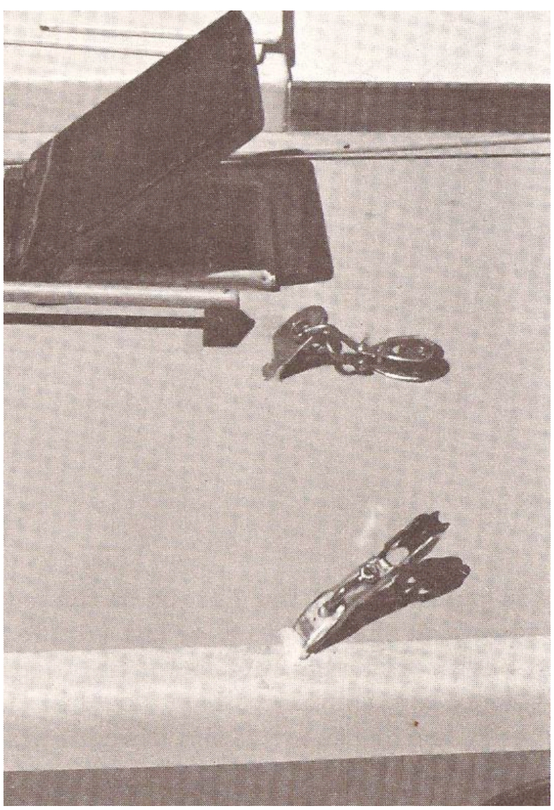
The Integrated Vehicle

But notice the interdependence between the length of the tack pennant and the height of the sail and the length of the head pennant and the length of the halyard and the position of the winch and the number of turns of wire on the winch. This discussion began with the subject of halyards and took us all the way through sheet leads and sail trim. They are inseparable. Lack of this kind of knowledge has been responsible for some very lubberly trimarans. If the discussion seems longwinded, it is because the subject is involved. It goes on!

Use sheet lead tracks and cars if you wish. My contention is that they are unnecessary in cruising trimarans because of the boat's beam. In monohulls, when the point of sailing changes from into the wind toward off the wind, racing sailors advance the cars on the tracks to gain better sail shape. In trimarans, we take the sheet leads outboard instead of moving them forward. The monohull has nothing out there to lead his sails to, but we have. That is why tracks in trimarans are unnecessary. But several sheet lead positions along the float rail are necessary. No tracks means carefully adjusted tack pennant length instead, and these may affect the halyard's length in some boats. That's where we came in - on halyards.

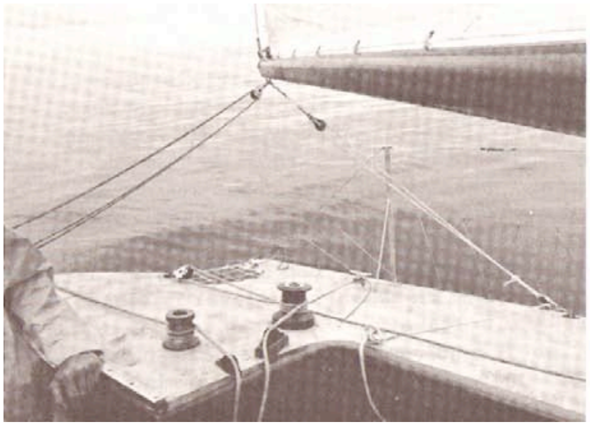
We're not going to have room to discuss all the outfitting headings to this extent. You'll have to accept on blind faith, or reject on your own firm opinion, much of what is said herein about outfitting. Stock Searunner outfitting is for backyard boats built for travel with a small crew. If you want to race, or single-hand around the world, the subject gets tremendously involved and painfully integrated. If you carry a given prejudice for something like no winches or semicircular travelers or bipod masts, consider the effect on the entire integrated vehicle.

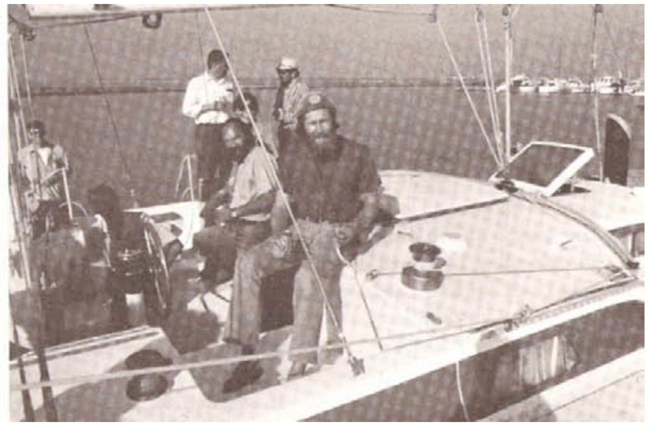
Sheet lines are measured for length by running them in place, on the boat. Using Dacron line, or something cheaper, run a mop handle through the spool of line and support the mop to allow the spool to rotate as you pull off line. Working in a calm, hoist the headsails one by one and pull each clew back into the close hauled or windward working position, holding it by hand or with a spare hunk of line on, say, the starboard side. Now, run the bitter end of the new line from the spool through the sheet lead block for that sail, on the port side. Run it forward outside the shrouds and outside the running fore stay and back to the clew of the sail you are holding. Tie it temporarily. Go back to the port lead block and grasp the line that goes to the spool. Pull enough slack to reach the cockpit and go around the winch four turns, thence to the cleat. Add ten feet (eight feet for the 31'er and six feet for the 25'er). Cut and tape the ends. So, we have measured the windward, or idle, sheet to assure that it is long enough so the end will stay in the cockpit when the sail is in use on the other side. Make two such sheets for each sail and splice them neatly into the clew. Sheet lines stay on the sails permanently. The staysail sheets lead outside the sub-forestay and headsail sheets lead outside the forestay. Remember this when setting sail!



Left: sheet-lead blocks fastened to fixed positions instead of' to cars and tracks. Genoa-lead block in foreground has plastic tubing slipped over chainplate and shackle and up onto block. Hole in tube admits shackle pin; purpose is to hold block upright to keep it from flogging the deck. Yankee-lead block in background needs a half-twist shackle instead of two shackles as illustrated. Use half-twist shackles wherever necessary to give line a fair lead through blocks without twisting the block. This is the 37-footer where the yankee sheets to the crane-lift chainplate.

The mainsail sheet is measured by taking the bitter end from the spool and, starting from the cockpit, run it through the mainsheet blocks backwards with the correct reeve - don't get the parts twisted. Terminate the bitter end at the becket block in the system with a bowline or an eye splice. Now, swing the boom outboard on one side until it collides with the lower shrouds, pulling line from the spool and through the blocks in the process. Take three turns on the winch, add six-to-ten feet, and cut. That's the length of the main sheet.





Left: 31 footer sheeting arrangement. (Don't use clam cleats as shown.) Note simple two-part "handy-billy" used to vang main boom out to float when sailing off the wind. Right: 37 footer custom deck layout for racing features wide main traveler across aft cabin brow, eliminating the need for a "handy-billy". Main sheet has several parts of purchase up to the boom, then leads to gooseneck and down to main sheet winch on mast. Note steering pedestal, separate from the mast. King Neptune holds end of headsail sheet (and a can of cold seawater) which leads from the sail through an adjustable lead block and back to a "foot block" and thence to a powerful winch. Such specialized hardware is of interest mostly to the competition sailor but also makes for fast sail-handling on a cruise. But it does not necessarily increase the speed of the boat - just the speed of the handling.

Blocks for running rigging are specified as to type and suggested catalog number in the appendix for each design. Or, you can make your own. Some examination of rigging blocks will show that there are several types used: singles, doubles, becket blocks and snatch blocks. All have various ways of attachment to the boat, like: front shackle, side shackle, snap shackle and swivel. Taken all the way to infinite development we have the famous "swivel snap shackle snatch blocks" of which two or four are desired for easy outboard transfer of sheet leads and for dragging the tire drogue or anchoring by a bridle. Sound confusing? Don't worry, you'll get into it, and you'll learn the lingo. Like seafaring, outfitting has a lot of stuff you may never have seen before but it's all common sense.

Running backstays are, in Searunners, almost like running shrouds instead. They lead out to the side (like shrouds) as much as they lead forward or aft (like stays). They support the mast at a point well above the deck and are in part responsible for the cutter being the strongest yacht rig yet conceived. They are running or releasable because you don't need them all the time - only in strong winds when flying the staysail - and at other times they can be released and carried up against the shrouds out of the way of the boom. Two consequences are implied by the above statement: when not released they can get in the way of the boom and/or the mainsail; and in strong winds with the staysail set you need the running forestay to fly it on. So the running backstays and the running forestay are usually used together. With the staysail flying on the running forestay it tends to bend the mast forward at the upper spreader. The running back stays are set up tight to oppose this bending - by pulling aft on the mast at the upper spreaders - thus keeping the mast straight. That's the object.

One running back stay starts from each side of the mast at the upper spreaders and goes down and out to the float rail at a point near the after main-strength bulkheads. Before it gets there, however, it is interrupted by a snap shackle above the deck about man's height. Current feeling is that this upper part of the running backstays should be 1x19 wire, possibly plastic coated to prevent chafing the mainsail, with a marine eye swaged on the upper end and an A-N fork swaged on the lower end. The snap shackle fastens to the fork end and is snapped into a continuation of the running backstay which we call the "whip". The whip has a Nicopress eye with thimble in its upper end to receive the snap shackle. Now the whip, made of 7x19 wire, continues downward to the float rail and passes through the first running back stay block. This block should be very robust and ideally it would be designed to receive wire, with a metal sheave. The block fastens to a special chainplate. Now the whip leads inboard over the deck to another running back stay block, this one of the cheek or flat-mounted type. (In A-frame boats this block fastens to the A-frame.) From here the whip leads forward to the running backstay lever. The function of the lever is to relax and tense all the wire in the system at the wish of the crew. By throwing the lever forward the running backstay is tightened - and to the very same tension every time; that's important. To adjust this tension it is sometimes necessary to install a turnbuckle in the whip. Do not install it at either end of the whip. Place it in the middle between the two blocks - near the cheek block when the lever is closed or just above the outboard block. Some builders are able to make the Nicopress splices in the runners for the desired tension without turnbuckles, but it's not easy. The desired tension is described as: with the forestay in place and one running backstay lever closed, the other lever should be hard to close. It should take a good grunt from the smallest reasonable crewman, leaning over the cockpit coaming from inside, to close the lever.

The levers themselves are shown for owner-building in the deck hardware section, or special Searunner levers can be purchased through Almar.

The running backstays may be released when the staysail is not in use (or the winds are moderate) by opening the lever. This causes slack in the wire which allows releasing the snap shackle. The standing part of the runner is now carried forward and attached to the shroud chainplates via a shock cord or lashing. Secure the whip or it will dangle overside. It is sometimes desirable to open the leeward lever to slack the runner when the mainsail bears against it, but without releasing it altogether. <u>Don't open both levers at once if the boat is driving hard to windward and the staysail is up</u>!

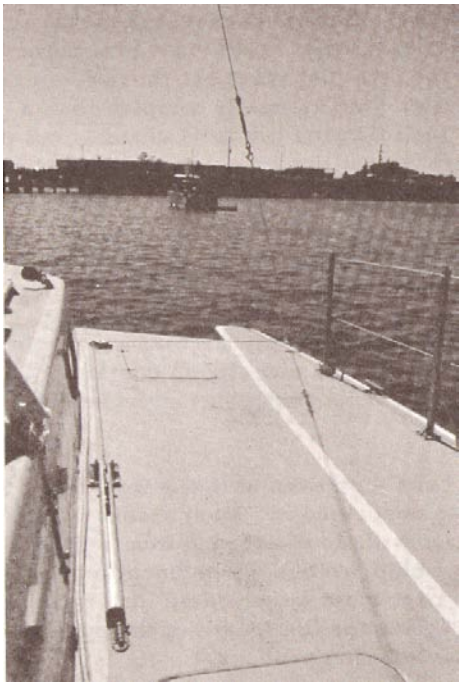
The running forestay can be similarly released and wrapped around the shrouds when idle. Connecting it is done with a large Merriman pelican hook (not lifeline pelican hooks) or with the special Searunner forestay release lever from Almar. If you desire a turnbuckle in the forestay, put it at the top instead of at the bottom. You'll have to climb to adjust it, but otherwise it will be swinging around on the end of the stay when released.

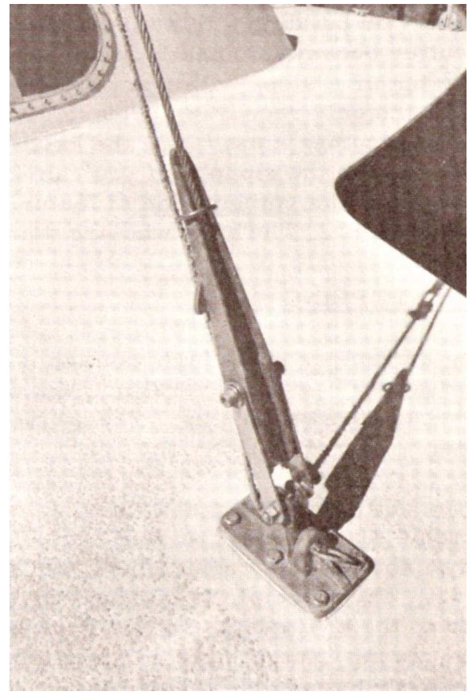
Note that all running stays have toggles at the top to avoid wire fatigue.

Nicopress splices referred to above are made with a special tool which you should have on board for cruising. The large bolt cutter like tools are expensive and heavy, but a small version, with instructions, is available from: S&F Tool Co., 1245 Logan Ave., P. O. Box 1546, Costa Mesa, Calif. 92626. [ed note http://www.swage-ittools.com/] The tool has dies for several wire sizes. The dies crimp soft metal Nicopress sleeves around the wire making a very strong seagoing splice for 7x19 wire. These are used on board for making halyards, running stays, pennants, lifelines, etc. And they give excellent capability for in passage repairs or jury rigging.

Nicopress splices have gained a new degree of acceptance for use in standing rigging (1x19 non-flexible cable) by the advent of new products from S&F. For the larger wire sizes, ¼", 5/16" (and ⅜" which we don't use in Searunners), they offer heavy duty thimbles which are said not to distort under strain. And there is a preforming tool available which bends the non-flexible wire around the thimble and avoids "bird caging" the natural lay of the wire.

If the builder's access to swaging facilities is limited, making Nicopress eye splices in 1x19 non-flexible cable for standing rigging may be considered acceptable. Use heavy duty thimbles, the pre forming tool, and two Nicopress sleeves for security. Time may show this method to be more corrosion resistant than other methods. But the prime advantage is that you can make your own.





Almar running backstay lever (left, foreground) is used to tense or relax the running backstay. Note barrel-bolt latch. Also note absence of rubber handle grip; this is a no-no! For latch to engage a handle with rubber handle-grip included, the barrel-bolt shown would have to be raised above deck by mounting it on a ¼" teak or plastic pad. Backstay whip wire leads away aft to the cheek block on deck (this one is also from Almar) and then outboard to the lead block, thence up to the release. Note turnbuckle above release, also a no-no. Put the turnbuckle (if required) in the whip between the cheek block and the lead block. After adjustment, cover the turnbuckle with rubber hose to keep it from banging on deck.

At right, Almar's forestay release lever has a matching plate beneath the deck which receives the long forestay tang coming up inside from the stem. This lever is shown without the snaphook lanyard which holds the locking ring from sliding off the handle - also a no-no. Otherwise, these parts and these installations are very positive.

The topping lift is a piece of ¼" Dacron line which holds up the outboard end of the boom. It begins at the boom end and goes up through a block on the masthead, then down to the mast near the step where it secures on a small cleat. This should be the lowest cleat on the mast so that the loose tail of the topping lift does not become tangled in other running rigging on the mast. The topping lift is used to hold up the boom when the mainsail is down or during the reefing process. It doesn't have to be heavier than ¼" Dacron line. Anything heavier will chafe the mainsail because the lift is set slack while sailing and it whips around. The topping lift block, however, should be big and strong like the sheeting blocks so that it will serve as a spare halyard. By using the topping lift line as a messenger, you can send aloft a heavy piece of line, through that block, to use as a spare if either the main halyard or the headsail halyard should jam or fail or become lost aloft. This feature is important in cruising boats because it can save the need for a man going aloft in bad weather. For use with the topping lift, this block should be mounted as high and as far aft on the masthead as passible to avoid fouling the headboard of the mainsail.

Other aspects of running rigging like boom vangs, kicking straps, jibe preventers, etc., deserve space here but belong better in books on sailing, which this book is not supposed to be. (It's hard to keep it strictly on the subject of construction.)

The running rigging described above, especially the yak on running backstays, is confusing to neophytes. The seakeeping aspects of the cutter rig become clouded by complication when designing - or building - this bird's nest of wires and hardware. But the seakeeping assets of the cutter become eminently clear when a sailor is faced with a long, heavy beat to windward in a ketch or a sloop with a small crew. No staysail! "God, we just can't get there from here!" may be the only recourse. Please believe that all this cutter stuff is really simpler than a complete 'nother mast (as in the ketch) and really better than fighting headsail changes out on the bow (as in the sloop). If you can stand the task of working out the wrinkles and "learning the ropes", this combination of features in a full-blown Searunner will give you a real wind actuated *GO*er. The guys who are doing the <u>sailing</u> concur that it is worth it.

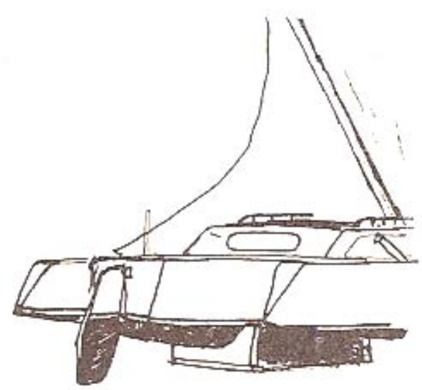
MAST STEPPING

Using a crane or some high vantage is the easiest means of stepping-up your mast, especially in the larger boats. Several helpers with lines led to the float bows and sterns can steady it and secure it when it's up. These lines should lead through blocks and back to winches or cleats.

But the ability to step masts in back yards or far-off harbors - or even at sea - would be a very desirable feature in a cruising boat. The mast tabernacle described in Mast steps was developed to answer this requirement, but it only works in boats with deck-stepped masts like the 25 and 31. The principle is simple - as shown in the photos and drawings. The boom must be guyed to the chainplates so that it cannot topple, and the mast must be guyed so that it cannot sway. In practice it's not so simple because as the mast goes up, the length of the guys varies slightly so some adjustments may be necessary during the hoisting process.

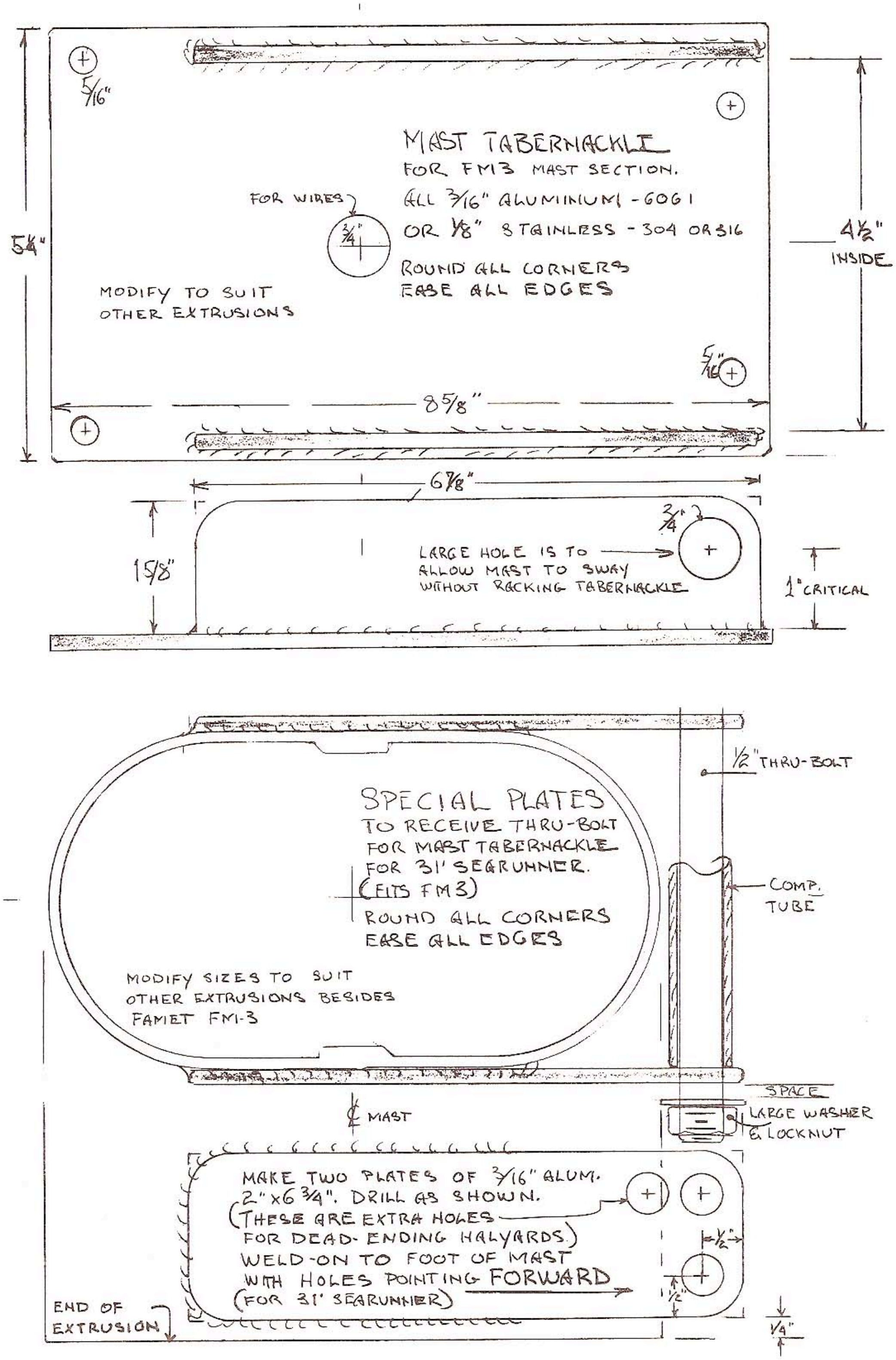
In the 37 and 40-footers the method is somewhat complicated by the step not being on deck, but down on the cockpit sole instead. A false tabernacle can be rigged at deck level by securely mounting a timber between the cockpit seat backs on special, removable angles. Mounted on the timber is a special gizwankus with a slotted detent which mates with a special, removable bracket on the mast. Now the method can proceed normally, as with a deck-stepped mast. When the big stick is upright, the mast is hoisted up so that the pins on the bracket come out of the detent and allow the mast to settle-down into the step. By keeping the special parts in a safe place, a timber can be scrounged up wherever you need it, and mast stepping for even the big boats can be self contained. We call this "De Don't Rush System" because it is a hairy operation and usually takes all day.

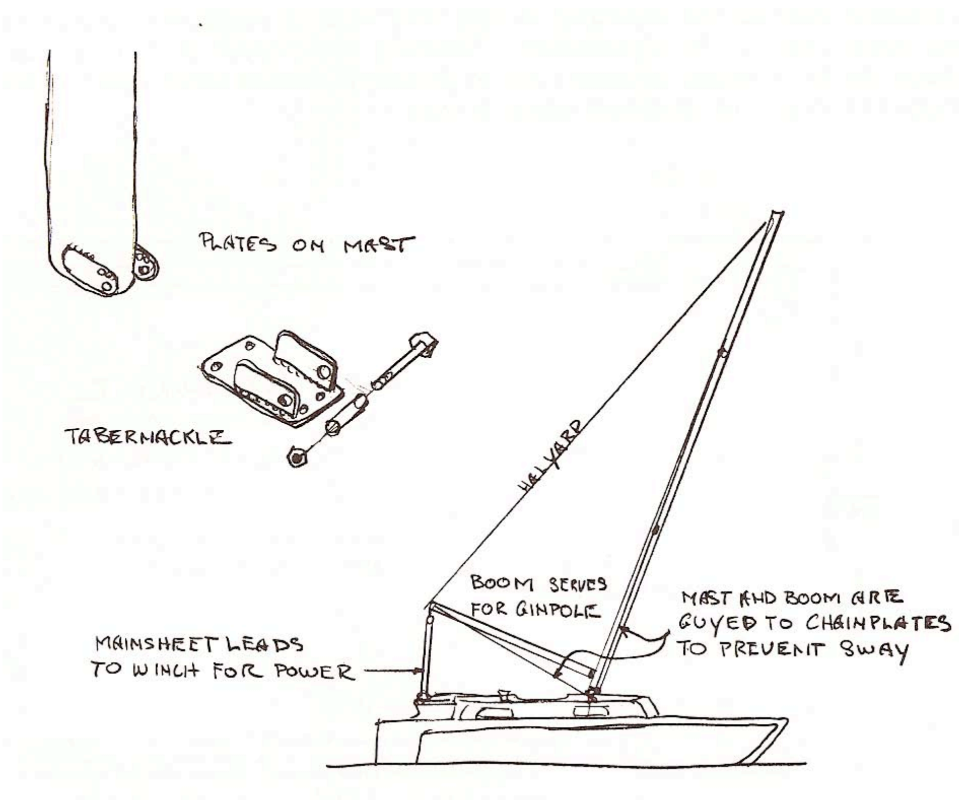
Further development of this method, to include a husky crutch for the mast on the bow and special guys made of wire, could afford the ability to step or unstep the mast at sea. But maybe that's asking too much.



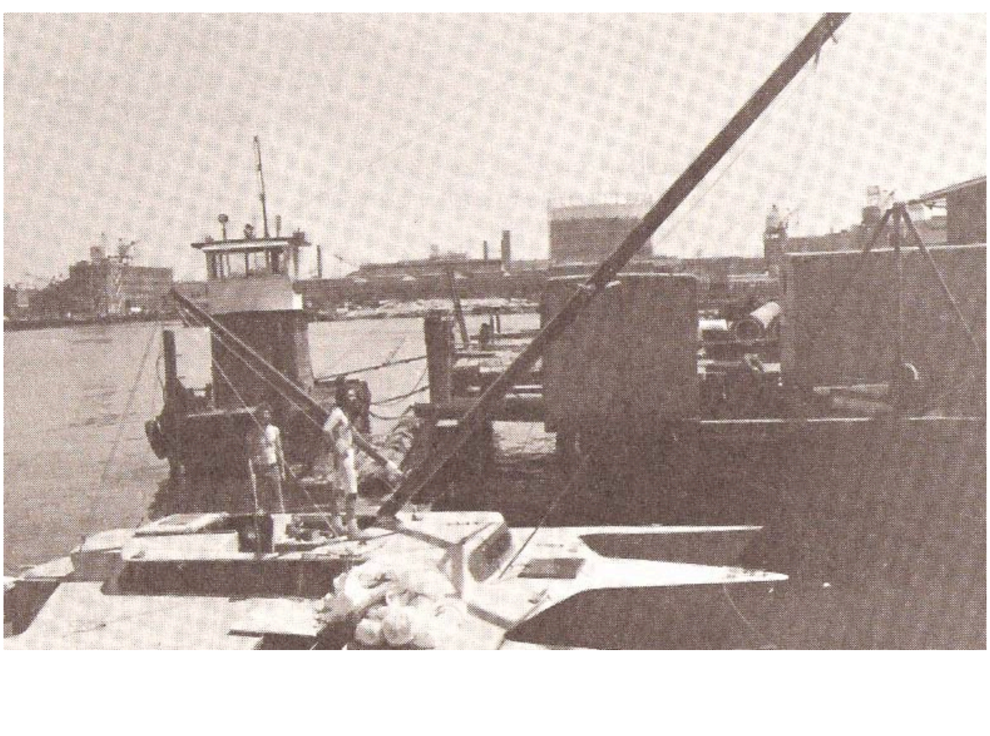
These drawings show dimensions for the mast tabernacle used in stepping method shown on next page. Designed to fit Famet extrusion FM-3, the dimensions may be altered to suit any extrusion. Not shown, but allowed for in the design, is the ¼" thick mast step plate on the bottom of the extrusion, supplied by the sparmaker. Welding the "special plates" to the mast is best, but for wood masts similar plates may be screw fastened with four large screws each, three of them staggered near the forward edge of mast.

FM-3 MAST TABERNACLE
½" = 1', HALF SCALE





Mast stepping with tabernacle can be accomplished by one man in the 25 and 31 footers. Mast tilts up from forward so boom and main sheet can be used for power. Cutter's midship location for the mast makes this feasible. In ketches, same system can be used in reverse by fitting a mount for the boom's gooseneck on the forward edge of the mast, allowing tilting up from aft.



DECK HARDWARE

Deck hardware is the jewelry. It looks like jewelry and it costs like jewelry but it functions. The items specified for Searunners are rather yachty, but if you know what you're doing you can make some of it yourself.

PULPITS

Pulpits can be purchased ready-made from stock for the bow, but usually a custom fit is required for the stern. So you may as well make them for both. There are various approaches.

The pulpit tubes are usually mounted to the deck, and to each other by cast fittings. Cast bronze marine bases and T's are expensive.

A substantial cost saving can be had by using aluminum bases and T's which are made by the Hollaender Manufacturing Co., [ed. note: Current web address is http://www.hollaender.com/; corporate address has changed from 1972 edition] These fittings are made for industrial use in pipe racks and railings, but their corrosion resistance makes them suitable for marine use. These parts are usually stocked by large metals warehouses but their angled T and angled base fittings, used in our pulpits, are not commonly available and may need to be ordered directly from the factory. The size used for nominal ¾" pipe will accept l" tube size.

Stainless tube, 18 gauge wall, makes the nicest pulpits but is difficult to bend. Some builders claim good results by filling the tube with packed dry sand to keep it from crimping, and bending around auto wheel or a telephone pole. I prefer to use aluminum tube alloy 6061 T6 or thereabouts, with a ⅛" wall minimum. Its corrosion resistance is good but it gets chalky looking, which can be reduced by scrubbing with cleanser. Aluminum is cheaper, lighter, and much easier to cut, etc. Bending can be accomplished with an electrician's or plumber's manual pipe bender, which will keep it from crimping, or the sand method also works.

Some builders have the skill and equipment to make pulpits of all-welded construction. Not me. Others are satisfied with water pipe and plumber's fittings. Not me.

This pulpit is made with two pieces of straight 1" diameter aluminum tube joined to the uprights by aluminum "Speed-Rail" angled Ts made by Hollaender. The straight pieces are joined at the bow by the only bent piece in the system, a short length of 1" inside diameter tube which slides over the ends of the straight pieces. Uprights go down through the deck and bolt to the underwing stringer with one bolt. Arrangement of the angles is critical. This pulpit forms a cage around the crew. It must be stepped over to enter or leave the foredeck but this is not really an inconvenience. A similar stern pulpit can be arranged to form a good cradle for the dinghy. The shape of these two pulpits should be carefully drawn on your lines drawing to give a visually continuous effect with slight up-sweep at the ends. The bent portions (around the bow and around the stern) can be accomplished by bending with a plumber's manual pipe bender or at a muffler shop.

Avoid the temptation to make the pulpits obtrusively high; 26" is the correct height for all Searunners. Higher ones get weak and are in the way.

Form the railings to approximate the sketches and photos, or make your own design. Consider the lines of the boat in so doing because pulpits can have a far-reaching effect on aesthetics.

These structures are not as effective as one might think in keeping the crew on board - they just make it easier to work on deck. Their presence doesn't necessarily constitute a safety factor, but instead a convenience - like the engine. A promenade of pulpits tends to relieve the crew of its ever present responsibility to stay with the boat. The psychological consequences can lead to disaster. I'm not against pulpits - in fact they are not considered optional. But don't make them so big that you come to depend on them for more than convenience. The safety part is up to you.

Installation of the pulpits is a fiddling process involving lots of fasteners and spacing the bases to avoid under-deck structure. Rotating the angled bases on the tubes will give good fit for angles but it's tricky. Cut the tube at the approximate angle to get as much tube into the sockets as passible.

A new method for pulpits has the legs going right through the deck (seal the holes with LifeCalk) and down into the boat to bolt through the under-wing stringer. This eliminates the bases - the weakest part of the structure - but involves careful placement of holes to avoid under-deck structure and to agree with the angled Ts. But they can't rip out of the deck!

LIFE LINES

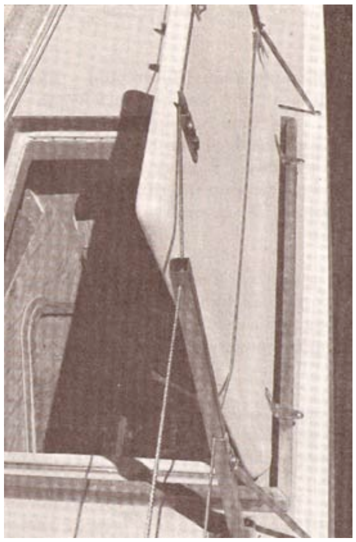
Life lines can be two inches higher than pulpits. The life lines do more to catch and hold a sailor who is thrown off his feet than do the pulpits. Damage to them is common.

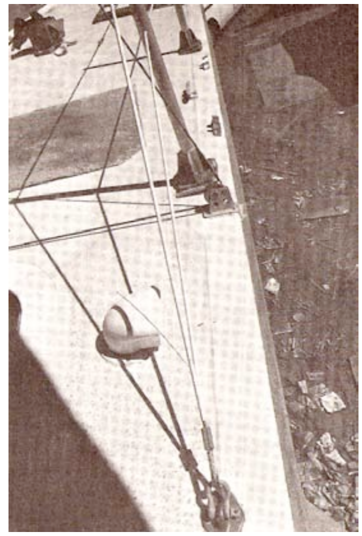
Stanchion bases of very rugged construction are available from Almar, but no base will make the deck stronger. The damage is usually to the deck, and so diagonal braces are prescribed on all stanchions. These braces are best if fastened outboard, through the deck stringer. This requires that the stanchions be located about 8" inboard from the edge (sheer) of the float, thereby consuming some deck space. But we've got lots of deck space, and the sidewalk outside of the life lines gives a very useful footing space when docking, etc. The stanchions are now protected from damage when docking and the life lines are less in the way of vangs and other lines which lead to the outboard edge of the floats when sailing. With diagonal braces, straight Ts by Hollaender are acceptable for bases, using 1" tube for the stanchions. Diagonal braces are also required on the stern pulpit to make it absolutely rigid for supporting the self-steering.

Stainless wire of ⅛" diameter is suitable for life lines; the plastic covered stuff is nice but not essential. Nicopress splices and a turnbuckle at one end will terminate the system. To give great support to the stanchions in a fore'n'aft direction, Nicopress sleeves can be slid on over the wire in assembly to rest one each side of each stanchion. After the system is tight, squeeze each sleeve on the wire. This prohibits the stanchions from bending fore or aft. Gates in the life lines complicate and weaken the system - we just climb aboard over the stern.

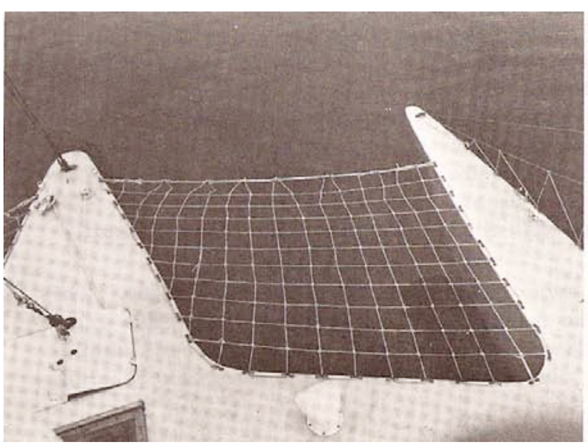
Life lines running across the leading and trailing edges of the wings are a worthwhile addition. Locate the stanchions to consider this, and the stanchions to which these wing life lines attach must have a large diagonal brace leading in the same direction as the wing life line. Also, the pulpits where the wing-lines attach at the main hull end need bracing. Put a pelican hook in these wing life lines so they may be released in harbor.

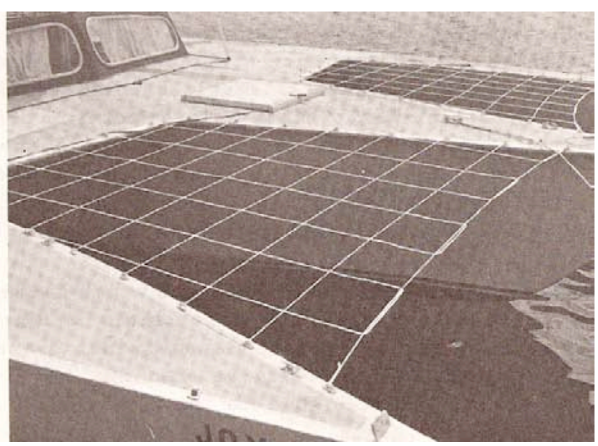
Our feeling is that, without these additions to the life line system, some sort of line must be attached across the bows and sterns, particularly at the stern. This is the easy place to fall overboard. Even if it's just a line at deck level tied from the main hull stern to the float stern, put something. Something a guy can grab if he starts sliding for the big splash! Similar lines across the bows are desired - at least two on each side - to offer overboard protection and to catch the headsails as they come down.





Lifelines at left have stanchions made of square surplus tubing with welded bases. Note the diagonal braces. Float hatch conflicts with life-lines usefully, giving a secure method of holding hatch open. Tops of stanchions should be fitted with tennis balls to avoid injury. At right, the robust Almar stanchion bases are mounted on teak wedges to make stanchions vertical on the cambered deck. Note lifeline terminus in foreground; this pad eye is better than using float stemhead fitting or stern chainplates. Note rub rail.





Both of these bow nets are nicely made except that the line across the leading edge should be much stronger, with tangs bolted flat to the deck for their terminals. Note absence of pulpits. Such extensive nets are not recommended for A-frame boats because of the whopping strains they can put on the float connectives. Something like the one at right - perhaps with the two forward rows omitted, and with no fore'n'aft lines at all - is recommended, with a pulpit. In the case of no fore'n'aft lines, the forward-most lateral line need be no stronger than the rest.

Bow nets are nice, but they can also be a problem. It takes a very strong wire, on special deck mounted chainplates, to form the forward edge of the net. Jumping in the net places tremendous strains on this wire and if you're going to have a bow net, better make it strong enough to jump in. Bow nets are a catch-all. They catch the junk that should be more securely stowed - like the dinghy - and they interfere with anchoring. Don't take the nets all the way to the bow; they offer lots of windage and we've seen a sea-way tear them out. Various netting systems are shown in the photos, but for myself a few ⅜" lines to catch a man - or the headsails - is enough. Especially in A-frame boats which have lots of net anyway. A husky line across the sterns is more important, and it serves as a nice sling for dragging up the dinghy or for climbing aboard from one. However, if you omit the bow pulpit, an extensive bow net is essential. Better to emphasize the pulpit and minimize the net.

WINCHES

Winches are a means of multiplying the strength in a sailor's arms. These modern sailplans develop phenomenal strains on the sheets; too much by far to pull in by hand. And the sails must be pulled up very tightly by the halyards in strong winds. While the old commercial sailors had other ways of managing these strains, winches are the only reasonable recourse for a small crew in a powerful boat.

Winch sizes and brands are mentioned in the appendix section for each Searunner, but some further discussion is necessary. Don't buy cheap plastic winches for these boats. Don't buy undersize for they will crumble in service, and don't buy over-size because the darn things are heavy. There are dozens of makes and models suitable. We have given the Wilcox sizes for the 25 and the Barlow sizes for all other Searunners. Barlow makes a good winch for the money, but not necessarily the best. In making substitutions compare the power ratios and get something at least as powerful as the ones prescribed. Bottom handle winches are generally less useful in practice than top handle.

Two-speed winches have gained great acclaim recently but are not essential for cruising. It is the low speed, the powerful speed, that is of interest unless you're in for racing. Many winches now come with aluminum drums to reduce weight. I'd like to see them on all Searunners. They aren't as pretty but a light boat is better looking when it is <u>moving</u>.

The mounted position of winches - on the mast and around the cockpit - has a great deal to do with the ease of operation of the boat. The positions shown in the plans can be altered to suit individual requirements. Single-handing would indicate positions as close to the helm as possible. Some Searunner sailors feel it is best to have the halyard winches located on the mast some 18" higher than specified so the crew can stand on the cockpit seats. Others agree that, when the boat is really leaping, you'd like to keep as low down as possible. This is certainly true for family crews. One foot on the cockpit sole and the other knee on the seat is a good stance - far better for steadiness than in boats with the mast remote from the cockpit.

Place sheet winches only about one winch diameter away from the edge of the deck alley. This makes it easy for the crew to reach the handle on the far side of the turn for 360-degree cranking. In the 31'er, optional staysail winches are located purposely close to the shrouds chainplates, prohibiting 360-degree cranking, but giving clearance for the handle everywhere else. The same position is good for the 37 and 40.

Each sheet winch has a cam-action cleat nearby to hold the line to keep it from slipping off the winch. Clam cleats are now discouraged because they sometimes bite the line so hard under strain that it cannot be easily released. It is imperative that the sheet cleats, especially for the headsail sheets, be positioned within easy access for the helmsman so that they can be quickly released in a heavy gust. Cam-action cleats are best for this because the helmsman can sit on the windward side and hold the leeward sheet loosely in his hand when sailing in gusts or squalls. If the boat is overpowered, he can release the headsail sheet with a quick flip-snap. So aim each headsail sheet cleat at the helmsman's seat on the opposite side of the cockpit.

Consider that all winches turn clockwise, and the tail of a line always leaves the winch on the right side. Position the cleats accordingly, but not too close to the winch; 4" away is close.

Most Searunner sheet winch installations could use a pad of teak or plastic beneath the winch. This pad is wedge-shaped to tilt the winch away from the lead block about ten degrees. This helps prevent overfalls or backlash on the winch. Also, the cam cleats need small beveled blocks beneath them to aim them up at about mid-height on the drum of the winch. If the cleat is not placed at the very edge of the cockpit, but out on a flat part of the deck instead, then the beveled pad beneath the cleat should be thick, to raise it up about ¾" above the deck so you can get your fingers under the line up close. Think about the human engineering aspects of the position of all your deck hardware, and make it easy for you to operate.

All cam cleats should be thru-bolted or installed with super long screws. Winches must be bolted through the deck to thick plywood doublers underneath at least twice the winch diameter. Careful attention to the way these doublers fit the cabin structure will give you peace of mind when you use the winches for anchoring. A separate horn type standard cleat should be provided in the vicinity of the headsail winches so you won't have to trust the cam cleats at anchor or when dragging a drogue.

Mast winches can be screwed to a wood mast provided there is a doubler inside the wall and the screws (bronze or stainless) are the maximum size and length you can use.

Remember that the winches are the only means you have of controlling - adjusting - the power which the sails will generate. And the sails will generate more power than the largest engine she will carry. They will also be used for heavy jobs like dragging the boat off a mudbank by the anchor or, using a tackle overside, hoisting a coral-encrusted cannon from a 15th century wreck you found while diving for a flashlight that rolled off the deck and landed on the cannon. Trouble is, you are dependent on the winches for these jobs and they must be periodically maintained. Carry a few spare pawls, at least one extra handle, and keep them lubricated. There are great advantages to having all your winches use the same size handle.

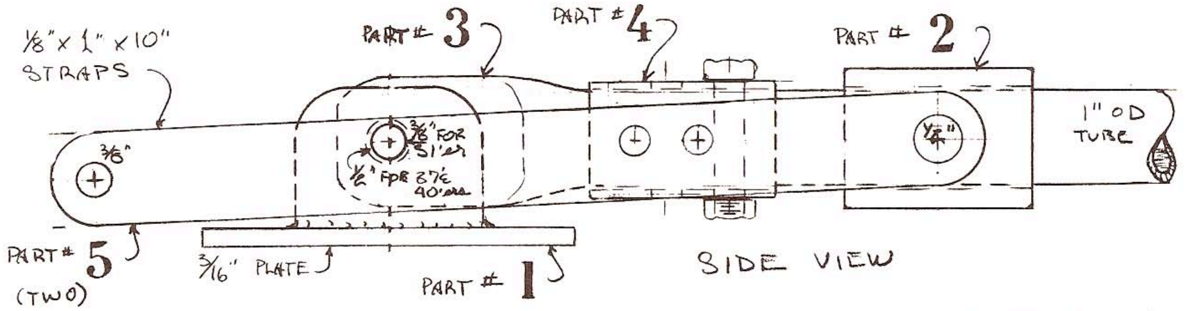
Winch handles with the lock in feature are prescribed for use on all halyard winches. The vertical mount of the winch can cause some handles to fall out. In the A-frame boats, if the winch handle falls out it will almost surely go overboard through the net.

Almar makes inexpensive spare winch handles of aluminum with the modern square lug to fit winches made by Barlow, Barient, etc.

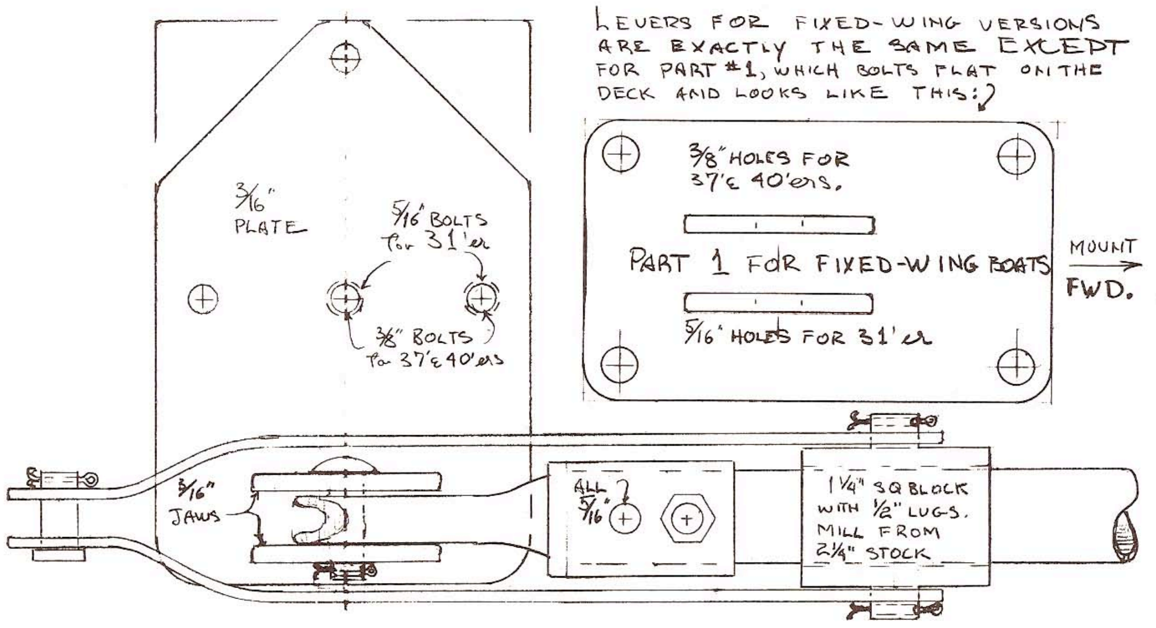
LEVERS

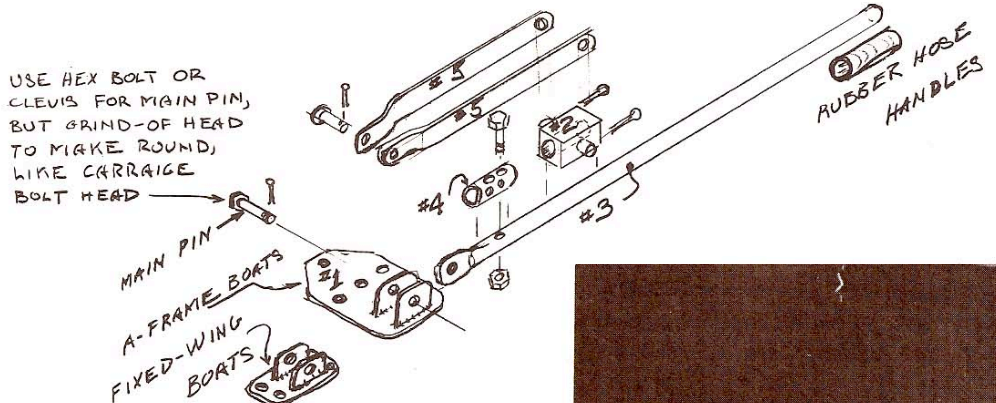
Levers for the running backstays can be home-made to the plans. This is straight sheet-metal work and welding. Except for the sliding block. This part is machined from solid stock, or the studs can be welded in if expertly done. It is the only part in all the Searunner metal work that requires machining. Very nice aluminum levers are available from Almar but other attempts to use smaller highfield levers have failed. Using blocks and tackle to tighten the running backstays is less than satisfactory because of stretch in the line, and the tension is never the same with each operation. But blocks and tackle have been used.

The installation of the levers has a few intricacies worth mentioning. Be sure to position the levers with the backstay whip in place (at least temporarily) so that you can be assured of correct alignment. The throw-axis of the lever must aim directly at the lead block. When the lever is thrown it must close with enough over-center to cause tension to hold it closed. A safety latch to hold it closed is also imperative. A barrel-bolt mounted on deck can engage the open end of the lever handle. This handle will, when released, fly up with great force if not controlled by the operator. It can be easily controlled with one hand if the sailor knows what's coming, but two-handed operation should be ordered to new crew members. On the chance that the lever handle does fly and hit someone, the end of the handle should not be left as bare metal! Fit a handle grip made of radiator hose or some thick rubber tube.

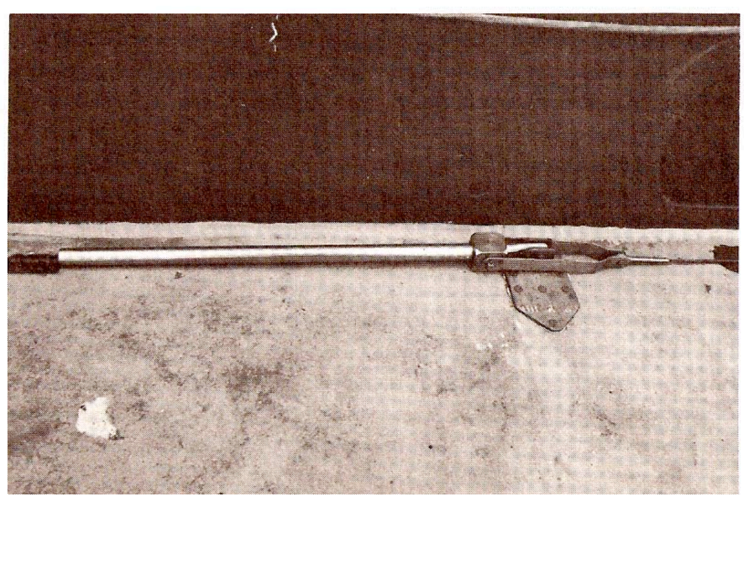


BACKSTAY LEVERS
Half Scale: 1/2"=1'





These homemade levers require machine work on part 2. Part 1 is different for A-frame or fixed wing boats. Photo shows part 1 for A-Frame boats installed on a fixed wing deck by simply turning it around. In the A-Frame version the wide plate would pierce through the cabin side and bolt to the bottom of the cockpit seat.



25-footer cutter rig also has backstay levers. The sliding block is like part 2 for the larger boats, but part 1 is two husky tangs that cantilever up from the aft A-frame tangs. Lever throws athwartships instead of fore'n'aft. This position eliminates one lead block for the whip, but cannot be used in the larger boats without causing the crew to leave the cockpit.

Allow the rubber to protrude ⅜" beyond the end of the handle, forming a cushion. If someone gets whacked, at least it won't cut. Leave the levers open in port and forbid children to play with them. For absolute safety, release the runner, thus depriving the lever of any power to fly. Safety rules are written in blood, which stains the deck!

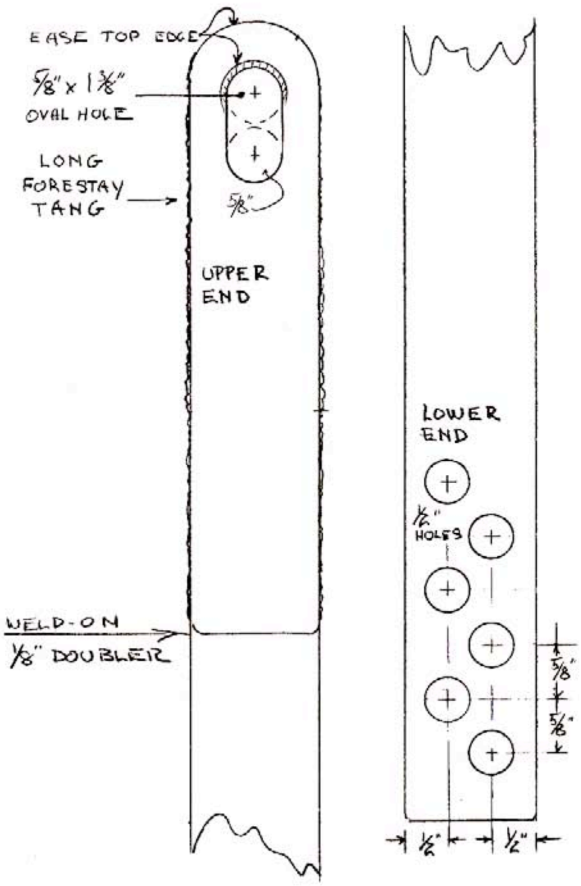
Forestay release levers are available from Almar. This unit employs a ring which slides on the forestay down over the lever handle to hold it closed. The ring must be tied down with a small snap hook on a lanyard to assure that the headsail sheets (which run outside, around the fore stay) will not lift the ring when tacking. Or zingo! The forestay is released!

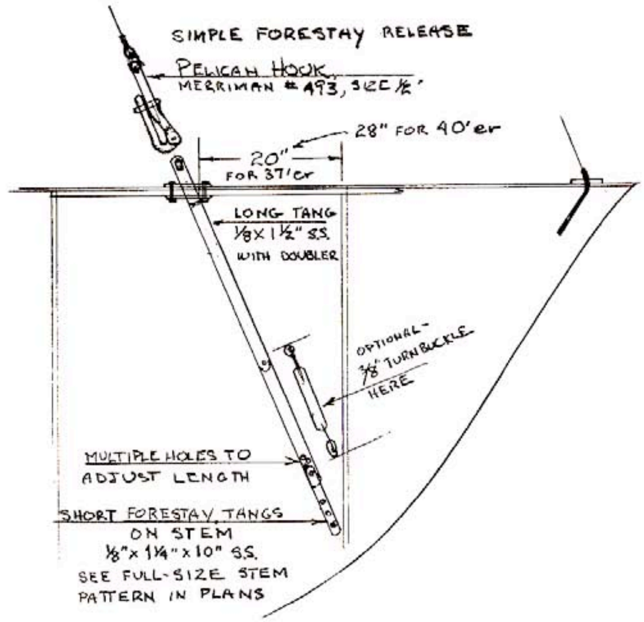
The same phenomenon is possible when using a Merriman pelican hook for the release. There is also a sliding ring on the stock of the hook. To prohibit the ring sliding up, drill a small hole above it in the stock and fit a small dog snap through the hole. Secure the snap on a lanyard so it will always be handy. The Merriman pelican hook, comes in several sizes of equal strength to the turnbuckle for a given wire size. Don't use pelican hooks of lighter design. When the forestay is released, the pelican hook dangles on its end and is dangerous; it may swing and break your front window. Some sailors prefer to fasten the pelican hook upside down, permanently attached to the forestay tang on deck, and hooking into a Nicopress eye on the lower end of the forestay when in use. The Almar release lever leaves the stay's end clean.

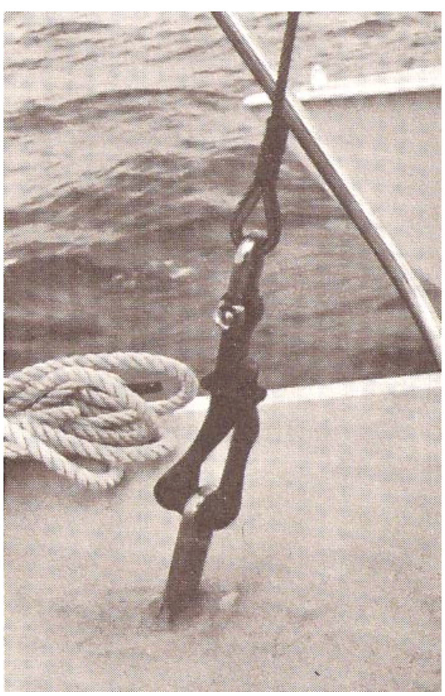
CLEATS

Cleats are the hands and fingers of a boat. They grasp the lines and hold them for you without the need of tying knots. You take a few crossover turns and make a hitch to allow releasing the line even while under strain. They hold the lines so you can go do something else, and they hold on long after strains would cause you to let go with scorched palms.

The breaking strength and chafe resistance of modern synthetic lines is phenomenal. One strand of your anchor line, or two or three strands of your sheet lines, would lift the whole boat! With such strength potential in the lines it seems silly to have cleats which would pull out with shoelaces. But it is practically impossible to attach cleats which are of equal strength to the lines.







Sketches and photo show the un-Almar system of forestay release. The long tang protrudes through the deck at a slot reinforced with plastic or teak doublers over and under to hold reservoir of mastic for seal. In the 25 and 31-footers, the tang emerges inside the anchor well. Nonetheless, the locking ring on the lever should be secured so it cannot slide up while sailing.

Cam-action cleats, discussed above, are for quick release of sheets, but all other cleats are of the bar or horn type. When a line is made up on these it is intended to stay until a sailor releases it so you need some room to make fast. Undersize cleats are not only a nuisance, they can be a hazard.

Anchor cleats on the bow and stern should accommodate ⅝" diameter line in the 37 and 40 footers; ½" line in the 31 and 25. These cleats should be securely thru-bolted with husky doublers under the deck. Anchor lines go down over the deck and so the cleats are installed in conjunction with <u>chocks</u> on the lip of the deck itself to feed the line overside. Chocks must be large enough to accommodate the anchor line <u>plus chafing gear</u> which is usually made of split rubber hose lashed onto the line. Without this chafing gear to protect the line at the chocks, the chocks will cut the line in time. Surprisingly little time, if you are anchored in raucous conditions.

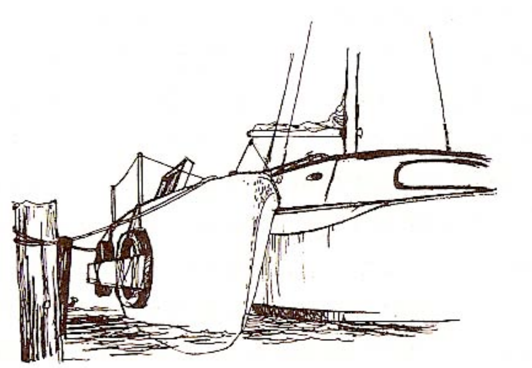
Docking cleats are spaced along the float rail - at least three each side - to secure spring lines at dockside. These spring lines are usually ½" diameter, and lead forward and aft of the boat to keep it from surging up and down along the dock. To feed the springs neatly overside without chocks, we usually locate docking cleats as far outboard on the rail as possible. In the case of "4-hole cleats" (four bolts through feet on the cleat), the two outboard feet can be screwed into the deck stringer with the largest screws which will fit. The two inboard feet are thru-bolted to a doubler under the deck.

These 4-holers are the strongest of the cast metal cleats (bronze or aluminum) usually sold. Two-hole cleats are for light duty unless specially made.

Aluminum cleats like the Wilcox Marinium jobs are recommended. Bronze ones are terribly heavy and their accumulated weight should be avoided.

Two large anchor cleats are required on each end of the main hull, each with its own chock. Combined with three dock cleats on each float and the various other cleats on the mast and around the cockpit, a dozen or two cleats are required. They get HEAVY. If you use aluminum cleats though, be sure to use stainless fasteners.

For a one-sided tie to a dock, arrange the lines thusly: locate the boat to fit between two bollards on the dock. Run one bow line and one stern line straight in from the main hull. These keep the boat from floating <u>out</u>, away from the dock. Now run two spring lines; one from the forward float cleat to the after bollard, and one from the aft float cleat to the forward bollard - crisscross style. (Or, you can lead both ways from the center float cleat.) These keep the boat from floating along the dock. Do not run the bow and stern lines from the floats and don't run spring lines from the main hull. Of course, this harness will vary with the docking situation and the location of bollards - or anything you can tie to. If the dock is floating, provide sufficient LARGE fenders between the dock and the float. If the dock is not floating, make all lines as long as possible to reduce the effect of tide on their length. To tie to pilings, a chafing board hung from the float outside your fenders and against the piles is essential. You can usually find such a hoard around a dock. Carrying one adds unnecessary weight. A-frame boats can use their net planks for chafing.



Don't tie your boat in a lubberly fashion: arrange dock lines so that it cannot get away! Don't leave her unattended in a questionable docking or anchoring situation! The local yachtsmen or commercials, or natives, will quickly peg you as a lubber and they'll be right. (There I go again.)

Deck Hardware describes a myriad other objects like ventilators, hatch hinges, handrails, fairleads, etc. Hopefully most of these are covered in your appendix and other sections. Accessories abound at the chandlers but watch out for the sales appeal of yachtie gadgets you can do without.

SAILS

Paraphrasing a statement by Winston Churchill about painting, I will say here that: If I get to Heaven (Churchill said, "When I get to Heaven ... ") I intend to spend a considerable portion of my first million years in sailmaking, and so, get into the subject. No other aspect of a wind machine is more important than its sails. And no other is so unapproachable by owner-builders, or designers. It is a shame that sail-making remains the one skill usually not learned by the builder of his own boat. We mostly rely on a professional.

If you wish to make your own sails for Searunners, more power to you. And more power to your boat - it's probably going to need it unless you spend a million years developing the skill. There are good books on the subject and some sailmakers offer use of their facilities, and advice. Aside from the above, the writer will make no further comments on making your own sails.

When you buy sails, you generally get what you pay for. Prices for Searunner sails made in Hong Kong - and distributed here by various distributors like Vancouver Sail Supply Ltd. [apparently defunct] - run about half of what you'll pay to a big name, competition, domestic sailmaker. And you'll find all ranges in between.

None of these sails are really bad. They're all strongly made with synthetic materials and, if you avoid chafe and keep the sun off of them during long periods of idleness, they'll last for years. A mainsail cover is essential. There is no reason for carrying duplicates with modern sails. You can make substitutions or repairs at sea - if you've got repair materials.

But some sails and some sailmakers are a lot better than others! Because sailing is essentially an aesthetic endeavor, and because the sails are perhaps the most aesthetic components in the sailing machine, the quality of the sails becomes critical. Quality here refers not to the color or the texture or the tailoring (though these are involved) but it refers to the SHAPE. It is the curves or cambers, or the draft or the cut of the sails that is important; the vaulting and arching of the blades and hemispheres of steel-cloth which you send up to use the wind. The shape of these is what you pay for. And the shape can vary so enormously from boat to boat and sail to sail, that it is up to the sailmaker to decide for you. If you can find a man who is genuinely interested in your boat, he may build sails with entirely different shapes than anyone else's; with different weights of cloth and even different sizes than the designer specifies - all with an empirical feeling for the results anticipated. A high price sailmaker is actually a consultant as well as a technician. He puts you and your boat together with himself and his sails. For a high price you should get some of this consultation, and your sails may come out differently than those described below. The sailmaker or his representative should be willing to examine the boat before making the sails, and examine the sails in use thereafter, making any adjustments necessary as part of the cost. Don't expect this kind of service for less than top price, but demand it if you're paying for it. If you order sails out of town or out of country, be very specific about all details of the boat and the sails. You may save money and complications by ordering from someone who has been making sails for your design, or from a multihull services firm like Almar.

Remember that we're not just trying to make her go fast. It is more important that good sails make the boat more easily managed. But the basic issue here is aesthetic; the sails will do more than any other single component to make your trimaran come ALIVE.

There are outfits that specialize in used sails and offer a catalog of sails in stock with dimensions for your comparison. Something close is sometimes close enough if you're trying to save on sails. The best approach is to be consistent with what you've done on the rest of the project. If you've built an economy boat, don't put silk on the sow's ear. If you've created a real lily, go ahead and buy gilded Dacron.

Mainsails are sometimes regarded as less important than headsails, but the sailor who understands the interaction between the two types knows that both are critical. We have come to favor a shelf-type mainsail (which has a deep pocket along the boom) whose point of maximum draft is located at 45 to 50 percent of the sails chord. Because our mainsails are of relatively high aspect ratio, it seems helpful to have slight hollows in the leech between battens, but with an overall modest roach extended by spring-loaded batten pockets. Leech lines are usually necessary and the bottom batten should parallel the boom for roller reefing. The headboard needs two or three sail slides firmly attached to it. In boats with wooden masts, the design of our masthead fitting has no "beak" to extend the back stay, so the headboard should not extend the sail either or they will collide aloft. Racing boats designed to a rating formula are so hard up for sail area that a wide headboard counts. We don't care about that stuff.

The mainsail's tack is a common point of fitting problems. Be certain to inform the sailmaker of the dimensions of your tack fitting: the cutback and the elevation of the tack shackle above the boom track. A sketch and a polaroid photo are desired. Same goes for the clew.

We disfavor a tack line in the mainsail because it becomes tangled in the roller-reefing gear. The bottom few slides can be attached with thongs to be adjusted in place by the sailmaker or builder. With this system the sailor must remember to top up the boom above horizontal with the topping lift when dropping the sail, or great tensions on the lower slides will result, stretching the sail out of shape. Specify track sizes, and slot size if the boom is slotted; and give your sail number and the Searunner emblem pattern (many sailmakers already have the pattern on hand). This emblem has been attached in all kinds of crazy positions by various sailmakers; if you want yours to be horizontal, perpendicular to the mast, and just above the upper-middle batten, then you'd better make a point of it to the sailmaker.

Sail cloth weights are specified in the appendix. Two weights are given for some mainsails: the lighter cloth is in order if your area is plagued with light winds, or if your boat has no engine. The reason for lighter cloth is that the boat's motion will shake the sail less if the cloth has less inertia. It makes a hell of a big difference in multihulls because of their jig-a-jig motion in some conditions. But with all of our stability, the sail strains are greater than in monohulls. So heavy cloth is indicated here, giving obvious conflict. The best solution is <u>good</u> cloth, as light and strong as they can make it, and this doesn't come in cheap sails. Only the high price sailmakers can afford to test each bolt for stretch and return to the weaver what they don't like. You know who gets it next. So if you buy cheap sails, better get the heavy main or it will blow all out of shape. And with the light main, reef it in time and protect it from chafe.

Running backstays can cause mainsail damage in cruising boats unless care is taken to release the stay when it is chafing. A steady, even pressure of sail against wire does little harm, but a whipping and zipping sound of wire sliding over stitches must be stopped. While a racing sailmaker would revolt at the idea, I favor chafing patches for all Searunners used for cruising. These are wide strips of light utility nylon sewn on both sides of the mainsail at points where it bears against the runners and the spreaders. After all, these are <u>cruising</u> boats. A short period of use will determine the position and extent of patches needed by the dirt in the rigging marking the sail. When the locations of chafe are apparent, return the sail for chafing patches. If you want something different, consider making the patches of a contrasting color - nothing like it on the water!

For point reefing, at least two rows of reef points are desired. For roller reefing, a set of storm reef points is shown on the sailplans for use in case the roller gear breaks down or to give a better sail shape for driving to windward under deep-reefed main. The mainsail chafing against the running back stay when reefed can be avoided by roller-reefing deep enough to bring the headboard below the runner, so that the leech of the sail now flies inside the runner and cannot chafe. For this and other reasons discussed in the spars section, roller reefing of the mainsail is preferred to point or "jiffy" reefing in the cruising boats.

Genoas are the big light headsails. For cruising boats they are a general-purpose sail used for all points of sailing in light winds. The genoa is sometimes supplanted by the optional reacher for sailing across the wind and the spinnaker for sailing downwind. Without the reacher or spinnaker, the genoa sees a tremendous amount of use in cruising. You can do without a spinnaker and especially a reacher, but you just can't do without a genoa. It seems that ocean sailing has you reefed down almost half of the time, and the other half you are ghosting in zephyrs. One of the real virtues of a trimaran is that in light conditions you can keep moving because the boat is light and the genoa is BIG.

We've done a lot of cruising in boats with very heavy genoas and found that the boats will easily stand 30 knots of wind with this sail. But it is hell to douse such a big sail in so much wind. Besides causing great discomfort from over-driving the boat, it can get you into trouble.

So, current philosophy favors a light genoa, one which must be taken down in 10-to-15 knots of wind or you'll blow it out of shape. (Unless, of course, you are sailing off the wind, where the light genoa will withstand 20-25 knots of wind. The real strains are developed only when closehauled.) This forces the crew to get the big sail down while the wind is still moderate. Now, with the cutter rig, we go to using the double headsail feature, flying both the yankee and the staysail (discussed below).

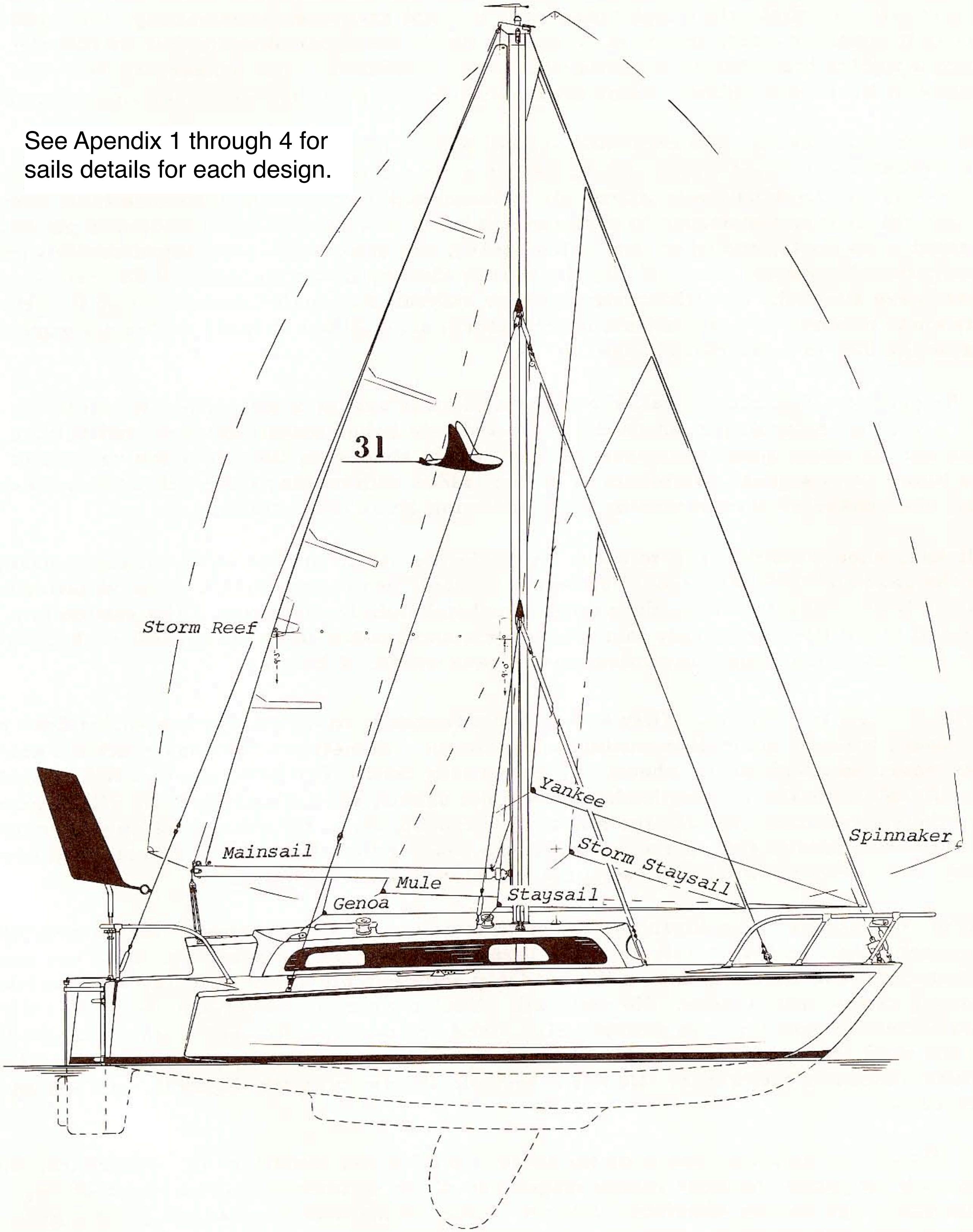
If the genoa is light, it reduces one of the sailmaker's major problems - that of shaping the sail to anticipate sag in the headstay. Trimaran headstays sag more than in equivalent monohulls because of elasticity in the lightweight hull. Tension on the stay combined with compression on the mast literally bends the bow upwards. You can't see this small deflection and it does no harm other than causing the head stay to sag. With a light sail used in light winds, sag is minimized and the good sailmaker can build you something splendid for those specific conditions. If you want a heavy genoa, specify "cut draft for considerable sag in headstay". Like all headsails in Searunners, the genoa's tack is drawn above the pulpit so the helmsman can see under it. All headsails need a heavyweight snap at the tack and at the head. Leech lines yes but tack lines no.

Colored sails are not favored because colored Dacron is usually not as stable. Mixing colors for alternate stripes requires mixing cloth from different bolts and the effect on shape can be considerable. White sails make a more visible boat in most conditions, adding a slight safety factor. But if you want colors, order them with the willingness to accept these possible disadvantages.

Roller furling genoas are a possibility for cruising, but the cutter rig generally reduces their need - it is so easy to reduce headsail area anyway. If you want this feature, under no circumstances should the sail's luff wire replace the standing head stay, especially in the 37 and 40 footers. This limitation requires the use of a special double-reeve halyard and a reel-type halyard winch. Controversy abounds on the subject of these sails, so if you want one, select an advisor who specializes in their development. Make your selection after studying the various schools of thought on the subject, and follow the advisor's design. Except, of course, if he says that the sail's luff wire can replace the boat's standing head stay. The strains in a multihull and loss of the other headsails make that approach unacceptable.

Typical Searunner Sailplan

See Apendix 1 through 4 for sails details for each design.



<u>Yankee</u> jibs are a relatively new addition to the Searunner sailplans. It was originally thought that, because of the wide sheeting platform available, the genoa or the mule (discussed below) could be used together with the staysail without backwinding or blanketing. But current opinion has it that the yankee is desirable as a sail designed especially for use with the staysail. Its distinctive high clew keeps the slot open even when sailing closehauled, and because it doesn't overlap the mast, it sheets inside the upper shrouds (but outside the lowers) for a tighter trim than is possible with larger headsails. Our yankees sheet to the after crane-lift bridle chainplate. (Extra winches in the 31'er are required; see Appendix #2.)

When used with the staysail, the combined area of both is only slightly less than the genoa. There is a greater combined length of luff, and on such a stable boat with a deep centerboard, the yankee-staysail combination is incredibly efficient and windward performance truly startling. Cloth weight is heavy enough to withstand 30 knots of wind (the light genoa was put away when it reached 15 knots) and when it gets that heavy, the yankee can be dropped easily - much more easily than the genoa. Best of all, the boat is already flying the staysail so heavy-weather sail changes are avoided. She will continue under staysail and reefed main right up to forty, even fifty knots of wind. Then it's time for the storm staysail but at least you're not working right out on the bow to make that change.

Back to the yankee. Technically called a jib topsail, this sail is a real puller when sailing downwind also. By extending it out on the windward side (when broad reaching) and holding it there with the spinnaker pole (see spars section) it sets absolutely flat and stays very quiet even in a blow. It is a great way to run in strong trades with nothing else; but if the mainsail is needed, the yankee's balance running wing-and-wing gives easy steering.

The sailmaker should cut this sail to allow for moderate sag in the head stay. It needs husky snaps at the head and tack, and should be boldly labeled "head" and "tack". A good sailmaker will attach a head pennant to make the yankee equal in height to the genoa. The yankee is a beautiful sail and it fits very nicely into the cutter's combination with the central cockpit, giving fine windward performance in moderate-to-heavy winds. I like 'em.

<u>Mule</u> sails are long low genoas. They are a good alternative to the yankee if a sailor does not wish to monkey with the staysail in moderate conditions. Sometimes the double-headed arrangement gets wearisome with all its sheets and halyards to tend. The mule can be used without the staysail. At this time the running backstays are not usually needed and the mule offers more area than the yankee alone (without the staysail). Trouble is, if the wind picks up you're not ready for it. You have to get out there and set the running forestay and the staysail and corral the kicking mule when the wind is blowing maybe thirty instead of fifteen.

But the mule has another nice advantage to compensate for its stubbornness. It is drawn with a short enough height so that it will fit on the forestay as well as the head stay. Now you see what happens; you can fly the genoa on the headstay and the mule on the forestay wing-and-wing while running in moderate trades. No mainsail. You've got a good light-airs downwind rig that is well balanced for steering - or self-steering - and you don't really need a spinnaker (at least not until the wind gets very light). This is Mark Hassall's "inverted kite" rig with which he has sailed many leagues in the trades. He has a second, shorter pole for the mule, and swears by the combination.

So, which should you get, the yankee or the mule? Both if you can afford it. Otherwise, my vote goes with the yankee because it encourages use of the cutter's double-headed feature, which imparts a high degree of safety. And the yankee flying with the staysail gives a grace and beauty to the boat which the mule cannot approach.

<u>Staysails</u> are the backbone of the cutter rig. I've come to think of any boat without one as "invertebrate". In Searunners, this little sail is centered nearly over the middle of the boat (because our masts are stepped so far aft) and so, when you leave it up or take it down it doesn't affect the balance of the helm.

That means you can leave it up in a lot of wind after dousing every other sail, and the boat will still balance. That's hard to achieve in a ketch or a sloop.

The staysail is heavy, the same weight as the main, and it should be cut to allow for moderate sag in the forestay. It needs a leech line to control flutter but no tack line. It needs husky snaps at the head and foot, and a clean shape with no hook in the leech. It is the simplest of our sails but not necessarily the simplest to use.

Sure, you can use it anytime. Pull it up with the genoa or the mule. Leave it up even when it disturbs the air flow in the slot between the headsail and the main. It'll never hurt much. But the time when it will help a lot is when you get that feeling - in the soles of your feet on the deck or the palms of your hands on the helm - that now you've finally got it trimmed right. The feeling will come someday while you're steering close but not pinching and, with one more click on the winch or one less point on the compass, the boat starts to breathe! You stand at the helm, at the mast, and listen to the whooshing and whooing of air passing through the slots. The wind gets a certain timber in its voice and says, "Now you've got me in your groove". A flow pattern is developed around the several sails that runs so straight and steady that the boat's motion cannot disturb it. Off you go in your own wind machine and you know that now it is functioning perfectly. You're not being propelled along the concrete by a succession of detonations pushing rods and turning gears. You're being thrust across the ocean by a clean flow of moving air that encounters your sails and bends aft to send you forward on your way.

It is a simple little sail, the staysail. But if you can come to use it in a certain way, which I would explain here if I could, you will understand the feeling of many other cutter-sailors who have come to regard the staysail as a precious thing. Its interaction with the headsail and the main can give a man a clue to where <u>he</u> fits in. A cutter, when it's going right, can show the sailor a rare view of his own relation to it all. Interacting with the elemental basics of his environment - air and water - and with a high form of correctness, he is truly working <u>with</u> the wind. Even while going in a contrary direction.

<u>Storm staysails</u> are just little versions of the real thing. When the wind gets up around fifty and you're <u>still</u> working against it (that's the way man is sometimes) the mainsail will be reefed so deeply that the staysail should be smaller so you've got an even match. Set the storm staysail. That's a job for a coolheaded deck-ape because leaving the cockpit under these conditions is frightful. If you can handle it by poking up your torso through the forward hatch, it's safer. If a wave comes aboard, fill the hatchway with your body to keep out as much water as possible.

When you decide to turn around and go along with the system, downwind, this sail serves as a guiding force. When running in a gale, it is often used as the scrap of canvas to pull the boat along, especially if you're dragging a line or a drogue astern. If you've got the nerve you can set it on the head stay for this purpose, but it's really something else to be working way out on the bow at surfriding speeds.

Because it may be used as a riding sail. the storm stays'l should be heavily reinforced, especially at the clew, to withstand heavy flogging. Mark it boldly at the tack and head and fit a head pennant to allow the staysail halyard wire to reach the winch. Never stow this sail in the float. Keep it accessible from the forward hatch. In fact, about the only sails that should be stowed in the float are the genoa and the spinnaker.

<u>Spinnakers</u> are those big balloonish jobs that look, from a distance, like huge colored bubbles blowing along the horizon. They are generally a downwind sail, and are often omitted from a cruising boat's equipment because they are thought to be unnecessary and dangerous; an opinion developed by their use in monohulls.

The only thing that makes them unnecessary is the crew's regretful willingness to turn on the gasoline breeze when the real wind is light. The thing that makes them dangerous is improper handling plus the monohull's lack of stability.

A big spinnaker in a rolling boat in a rolling seaway is a chore to get up or down, and its effect on steering can be dramatic.

But in multihulls, the stiff downwind stability and the wide decks make their use for cruising much more realistic, even for neophyte crews. This is particularly true of trimarans, which have an extreme beam somewhat greater than catamarans of similar length and mast height. Flown from such a stable, easily driven boat the spinnaker can be a completely agreeable sail. The huge chunk of area all in one piece will keep the boat going at those very frequent times when otherwise you would be drifting or living with that stinking, growling engine. (Motoring downwind often has the boat trapped within a cloud of its own exhaust - worse than the Lincoln Tunnel at rush hour!) By contrast, the alternative is exceedingly beautiful. Set the spinnaker. The huge vault of colored nylon inflates before your eyes and, carries you along in a moving calm. It is a completely opulent experience that has you working <u>with</u> the wind, but without going against anything.

Two types of cruising spinnakers are used on Searunners: the small "no-pole" 'chute that resembles those used on monohulls, with poles; and the huge "sky-blotter-outer".

The no-pole sail has a girth (width) of about 1.3 times the boat's <u>beam</u> and a height about .8 of the mast height above the cabin-top. It is sheeted to the floats using no spinnaker pole at all. It is a very convenient sail to use but its area doesn't take full advantage of the trimaran's spinnaker-carrying potential. Often these sails are purchased used from a monohull's inventory, or they are made by cutting down an old monohull 'chute. Not a bad way to go.

But the "sky-blotter" is something else. It is a sail like no equivalent monohull could carry. Its girth can be equal to, or slightly greater than the <u>length</u> of the boat! And the straight-line of its luffs can equal the mast height from the cabin-top. And (here's the hooker) the pole to fly this thing is about equal in length to the boat's beam. Two poles are sometimes used! This eliminates the need to ever jibe the spinnaker (which is difficult with such a long pole) and control of the sail is phenomenal. Compared with the usual spinnaker, the "sky-blotter" is unusually wide at the clews, but is rather sparse at the shoulders and fairly flat (see sailplans). The purpose of this cut is to give the sail good dynamic support; its own shape tends to cause it to stand full of wind despite the sometimes quick motion at the masthead or possible sloppy helmsmanship. It will often work with self-steering!

The size of this sail makes it dangerous when used on reaching courses in gusty conditions. An alert crewman should <u>always</u> be stationed at the leeward sheet while reaching as this practice can avoid capsize. The maximum designed windspeed for these sails is 10 - 12 knots so the sail is very light nylon. Get it down in time! Downwind sailing often disguises a wind speed increase because you're going with it.

Racing spinnakers must be designed to fit within the rating formula, which also limits the pole's length. Any sailmaker can fill your needs here but such spinnakers suit the rules rather than the boat.

Still, any spinnaker is a reasonable sail on a trimaran. The stability and the wide decks, the ease of steering and the absence of rhythmic rolling (which keeps the pole from dipping) are all unique to multihulls, particularly trimarans. And with the sky-blotter, your long poles are guyed to the floats instead of the main hull giving better control of the sail with much less strain on the pole. And because the pole is so long, the sail is held far outboard, forward of the usual spinnaker giving a remarkable safety feature: when a gust hits, the boat bears away downwind instead of dangerously rounding-up as with the "spinnaker knockdown". All in all it is the boat that makes this sail realistic for cruising.

If you're going to have both the no-pole 'chute and the sky-blotter, the small one can be heavier cloth and the big one lighter cloth. In any case the big one should be very light for its size and as such is quite vulnerable to damage. The no-pole sail can be made tough enough for kicking around and use in the trades.

Aside from these spinnakers, which are strictly optional, the Searunner sailplans need no special downwind canvas. All the fore'n'aft sails are for use on any point of sailing. With the centerboard and the skeg rudder and self-steering, no "twin running staysails" or other contraptions are indicated for making tradewind passages.

A <u>reacher</u> which is a special long, light genoa, may be desired by some skippers. Unlike the monohull's reacher, yours does not need a high clew because you can sheet it outboard to the float and thereby avoid backwinding the mainsail.

But I consider the reaching speed potential of the cutter-rigged trimaran to be so great that special reaching sails - or the use of spinnakers for reaching - are unnecessary except in close competition.

We have talked about nine sails so far, and those could be easily expanded to nineteen for the fanatic. But another virtue of the cutter is that she will take you very far with very few sails. Three is the minimum: mainsail, staysail and genoa (or possibly mainsail, staysail and yankee). Next in the budget comes the storm staysail if you're going offshore. Next the yankee, then the mule. Or the mule could be skipped before you get into spinnakers. A higher yankee and a longer staysail, with hollow in the leech, could be added, and possibly the reacher, or a roller-furling genoa.

Some deep-sea sailors feel strongly that a cruising mainsail should have no battens to cause damage to the sail. This demands that the leech be cut with a pronounced hollow or "reverse roach" to keep it from hooking. These sails are usually made of heavy, supple cloth and will take lots of punishment. But in boats with high aspect sailplans, depriving the mainsail of its roach gives a drastic cut in area. In Searunners it disturbs helm balance giving lee helm until the wind pipes up. I would prefer to make careful use of the regular main and optionally select the no-batten main only as a supplement for downwind use in high latitudes.

No storm trysail is in order, especially with roller reefing. Use the storm staysail instead.

You can see that, taken all the way, this sail inventory thing can run to a fantastic cost. You can start with the minimum at first because you can add anytime. If the minimum is too expensive, or doesn't satisfy you, consider omitting the engine and putting that money into sails. You can always add the engine later, too.

CENTERBOARDS

The design and construction of the whole boat is, in Searunners, largely centered around the board. In order for the boat to meet its potential you've got to get the board built right and working right.

Plans call for all of our boards to be built of plywood. Any expert will tell you that it would be stronger if made out of lumber instead. But we have never broken a board in sailing (yet) and the one that broke in a shipwreck did so to thereby save the trunk from tearing out. Our boards are so thick, and have so much chord (width) where they emerge from the bottom that they are plenty strong. Don't make them any stronger.

Do make yours fair; get a good smooth foil shape to each side with virtually no flat spots. It is thick enough to give some meat for shaping, and the flats will cause vibration at speeds. The method shown of using a thick plywood core, and laminating-on thin plywood layers of diminishing size, will relieve much of the job of shaping a solid chunk of timber. The strata in the plywood gives the appearance of contour lines when shaping and you can read the contours side-to-side to get a fair, symmetrical foil.

Glue the layers together using scaffold nails driven every 4" for reasonable glue joints. They don't have to be perfect because there is so much glue surface. The nails can then be pulled.

Rough-shape with power plane or grinder. Fill with microballoons where necessary, and sand with a long, coarse sanding block to relieve high spots.

Fiberglass with two layers of 4 oz. cloth and carefully tape the edges. See Fiberglassing instructions. The board will finish out to be monstrously heavy, but when in the water it will displace more than its own weight.

The control lines have to pull the board down because it is unballasted and will want to float up.

Plans show the thru-trunk gland with axle to form the pivot point and mounting pin for the board. The gland is made from two simple thru-hull fittings installed opposite each other in each trunk wall. Delrin plastic is prescribed for these because bronze fittings will eventually corrode from electrolysis and are hard to replace at sea. But use bronze thru-hull fittings if you question the strength of the plastic ones. Replace every 4th year during haul-out. The ⅝" diameter pin formerly specified for the axle won't quite fit inside the new ¾" thru-hull fittings so use ½" rod for the pin instead. Monel or bronze is best. There is very little strain on this pin.

Installing the board while the boat is in the water is not difficult. The amount of water which comes in while the cap is off the gland is very little - hardly a spongeful if you're quick - so pulling the board for maintenance while the vessel lies afloat is definitely possible.

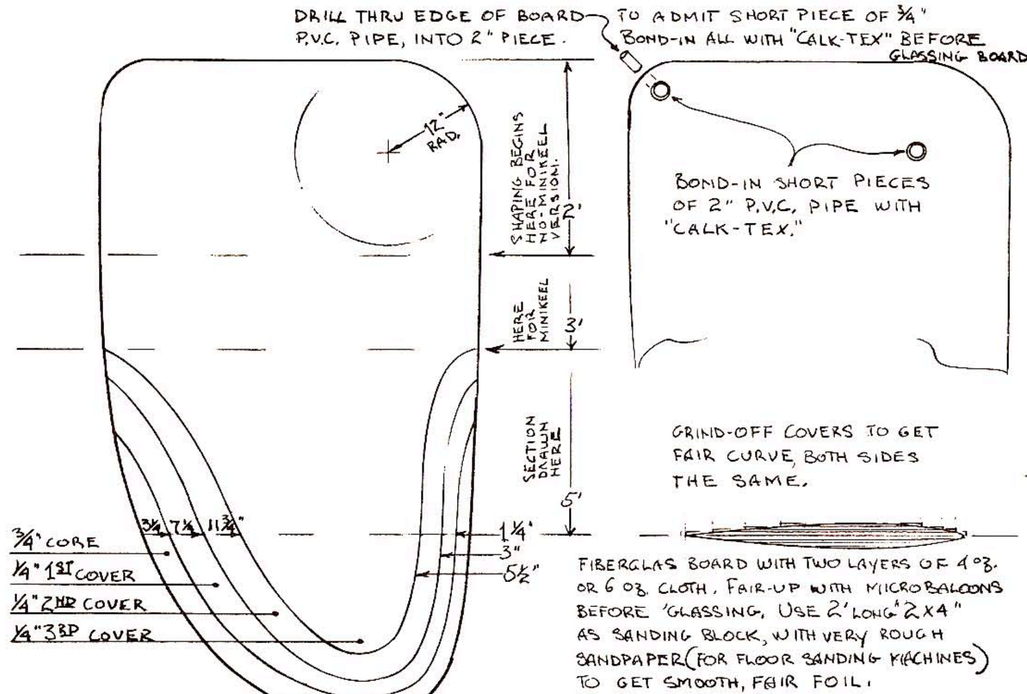
The only hang-up comes if you can't find the hole in the board with the pin. That's why the hole in the board is specified so oversized -- you don't have to hunt for it. This hole for the pin in the board is lined with a piece of plastic pipe bonded in with Calk-Tex. Similar holes in the board receive the control lines. The object of this design is to have no underwater metal parts on the board - they'll corrode in time and leave you boardless someday. It seems best to cut the holes (with a large hole saw or "flycutter" or expanding bitt) and bond in the plastic liners before glassing the board. 'Glass right over the holes and cut them out later, relieving the edges.

A critical step in completing the board is the rubber or plastic tube which is split lengthwise and fastened in a long strip to a certain pattern on each side of the board. Note that the board is designed to give a sloppy fit inside the trunk - about ¼" of clearance each side. This clearance is important to trouble-free operation. If the board were to fit snugly without some cushioning effect it would inevitably stick solid in the trunk, from marine growth or debris from beaching or dirt falling from the cockpit. These problems have discouraged designers from including centerboards in their work.

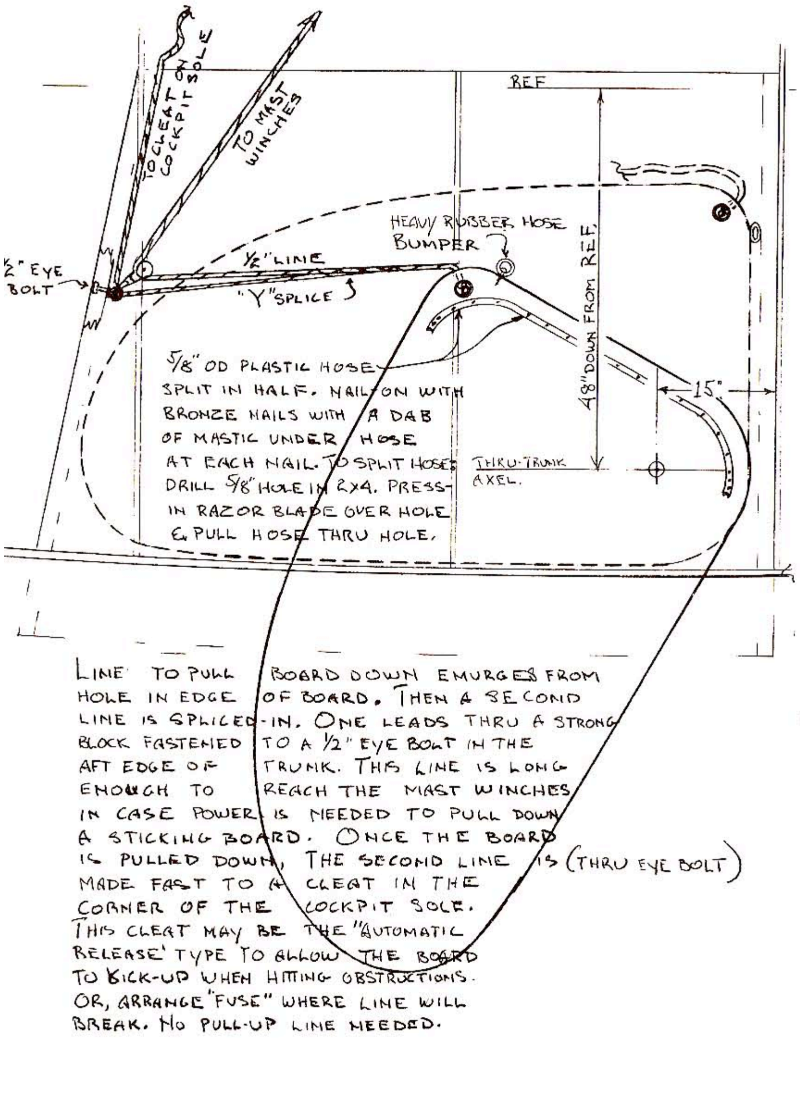
A simple solution is clearance. But if the board is allowed to fit loosely, it will swing side to side and bang around in the trunk causing a great deal of ruckus. So we use the above mentioned split tube as a fender - a gasket to give the board a snug fit, but with an ELASTIC material.

Measure the inside dimension of your trunk and the outside thickness of your board. Make several measurements in different locations and take a good average of the difference in your measurements.

Using good neoprene or soft plastic tube, select a tube size which, when cut in half lengthwise, will just fill the gap. To split the tube, place a scrap of 2x4 in a vise and drill a hole through it the size of your tube. Push the tube through from one side of the hole into a razor blade which has been stuck into the wood - centered over the hole - on the other side of the hole. A simple splitting die.



CENTERBOARD DETAILS
for 40-foot SEARUNNER



Laminar centerboard construction (above) is designed to minimize the shaping required to give a good fair foil section. A drawing in Appendix 4 shows the outside perimeter shape of the ¾" plywood core for the 40-foot Searunner. Below, this basic control line rigging is used for all Searunners. If your board tends to stick in the down position, a pull-up line can be similarly rigged to an eye-bolt at the forward end of the trunk. Note the heavy rubber bumper. This must not be omitted because if the board is knocked-up by hitting an obstruction at speed it could damage the trunk or the gland. NOT SHOWN in the sketch is the full extent to which the split-tube fender material extends down the centerboard and back across at a point just up inside the trunk. Locate this continuation of the tube to agree with your trunk depending on whether your boat is the minikeel or no-minikeel version.

Fasten this split tube to both sides of the board using ¾" bronze nails. Drive the nails home but put a small dollop of Life-Calk under the tube at each nail to seal the nail holes. The pattern of the tube should protect the perimeter of the board from ever touching the walls of the trunk except perhaps at the slot in the bottom of the hull (or minikeel) where the board emerges.

Remembering that you have wrapped heavy fiberglass up inside this slot, locate the tube on the board so that, when the board is in the down position (which is, NOTE, thirty degrees from vertical as shown on the sailplan profile drawings) this lower strip of tube just begins to contact that area of thick fiberglass at the slot. This sounds exacting but you can determine it by making a cardboard mock-up of the trunk pattern and pivoting this on your board. Now, your tube fastened on your board should fill your trunk for zero clearance!

When the board is in the down position and you are sailing hard, there are tremendous lateral strains imposed on the board which are delivered to the trunk walls at the slot, and at the upper extremity of the board. These strains cause the split tube to collapse - but not with a clunk! The board may contact the thick glass at the slot, but not with a clunk! And when you swing the board up or down the tube will bounce over a barnacle or a drip of resin or a goober of bottom paint. If done right, it won't stick and it won't clunk.

The lateral strains mentioned above are generated by the trimaran's speed and stability. When sailing fast, the board dynamically locks itself into the water - it doesn't want to swing at the tip. But the boat's outriggers generate great stability, and the boat must rock enough to conform with the surface. When the boat rocks, the board has got to swing. The board effectively dampens the rocking, a virtue of boardboats, but the strains created by these opposing forces are delivered to the trunk. This is why the trunk must be solidly supported at the point where the upper extremity of the board bears against the inside of the trunk. "Permanent sole" panels are provided in the design for this support. Don't leave them out.

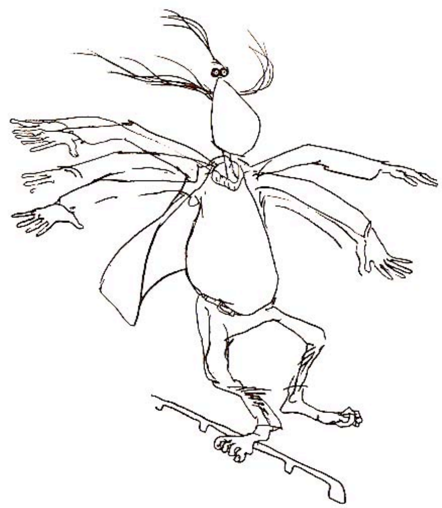
Centerboard control lines are shown in the diagram. The object is to arrange a line leading up to the cockpit which will pull the board down. In order to lead at an angle which will have good purchase on the board when it is approaching the down position, this line should lead through a block or fairlead fastened in the after end of the trunk, then up into the cockpit. If the board is stiff, some considerable tension may be required to pull it down, so this line should be long enough to be led to a mast winch. That'll do it.

To hold the board down, the line may be secured to a small cleat in the corner of the cockpit sole. But if the board strikes an obstruction, the line would probably pull out the cleat or break the fairlead. So the ideal system is to have a second line spliced or tied into the first. The second line has a fuse in it comprised of ⅛" line like parachute cord or seine twine or something with a breaking strength of less than 500 lbs. If the board hits a reef top, the fuse breaks, the board comes up and you turn around and get the hell out of there (the board acts as a sounding device and has averted disaster). Getting out of such predicaments is best done by sailing back over your incoming course - you know the water was deep enough for you to blunder in there! But you might have to sail to windward on the way out, and you can't do that with the centerboard kicked up. So, even though the fuse has broken, you've got the first line there to pull the board down with.

In the 31-footer, the board control line can be attached to a cleat on the steering box right next to the tiller head, or right under it. An up line is sometimes desired to pull the board up, if it is stiff in the trunk. One can be arranged through a block or fair lead in the forward end of the trunk.

In the 25 and 31-footers, the action of the water in the trunk makes unpleasant noise in some conditions, and tends to splash out the top of the trunk at high speed. This is because the slot is open at the bottom and the passing current sets up considerable turbulence in the trunk. To stop this turbulence, a simple loose-fitting board can be inserted in the trunk which fits diagonally between the after edge of the slot down deep, and comes out the top as far forward as possible, to be held by shock cord or whatever.

This still allows the trunk to perform its function as a huge drain for the cockpit. Some builders have fitted a cap to the top of the trunk, which leaves the bailing up to small scuppers. This is reasonable so long as the cap can be easily removed in heavy weather. A central cockpit filled with water is better than any other cockpit filled with water, so long as the hatches are closed! But you'd still like to be able to get rid of that weight in a hurry - before the next big wave. In the worst weather I've seen, the central cockpit has been no more than ankle deep with water, but somebody's bound to take a bad "greenie" someday. If it's you, don't have the trunk plugged and the hatches open at the time! Even at that, you've got a better chance than if all that weight was hung out on the stern as in some cockpits. But think of the improved chances if the cockpit can free itself through a drain the size of that centerboard trunk! That's the kind of stuff Searunners are made for, and of.



RUDDERS AND SELF STEERING

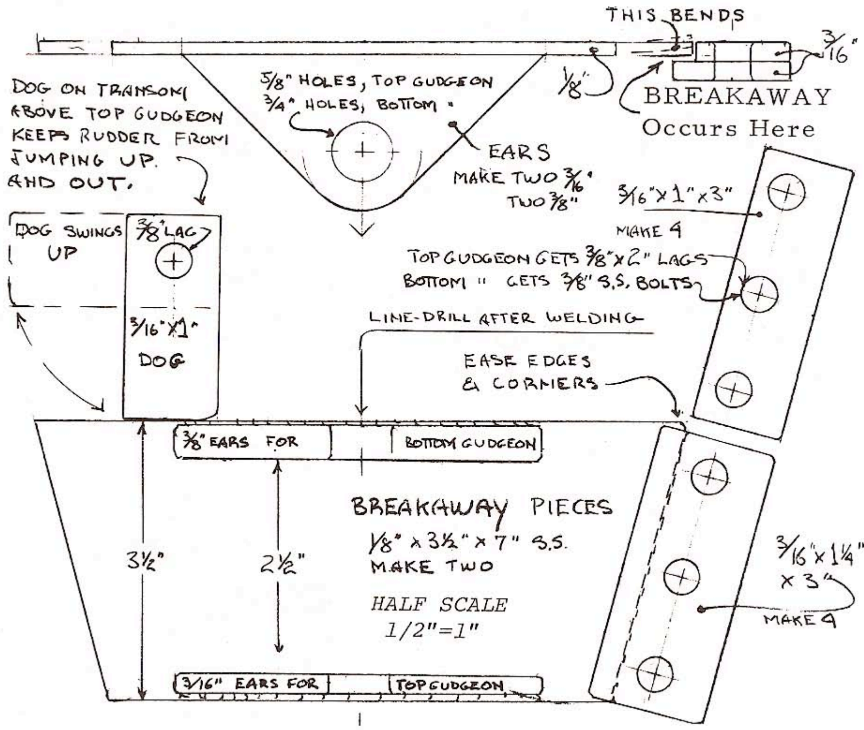
In the last 15 years I have seen perhaps fifty different rudder styles in trimarans, all of which work with varying effectiveness.

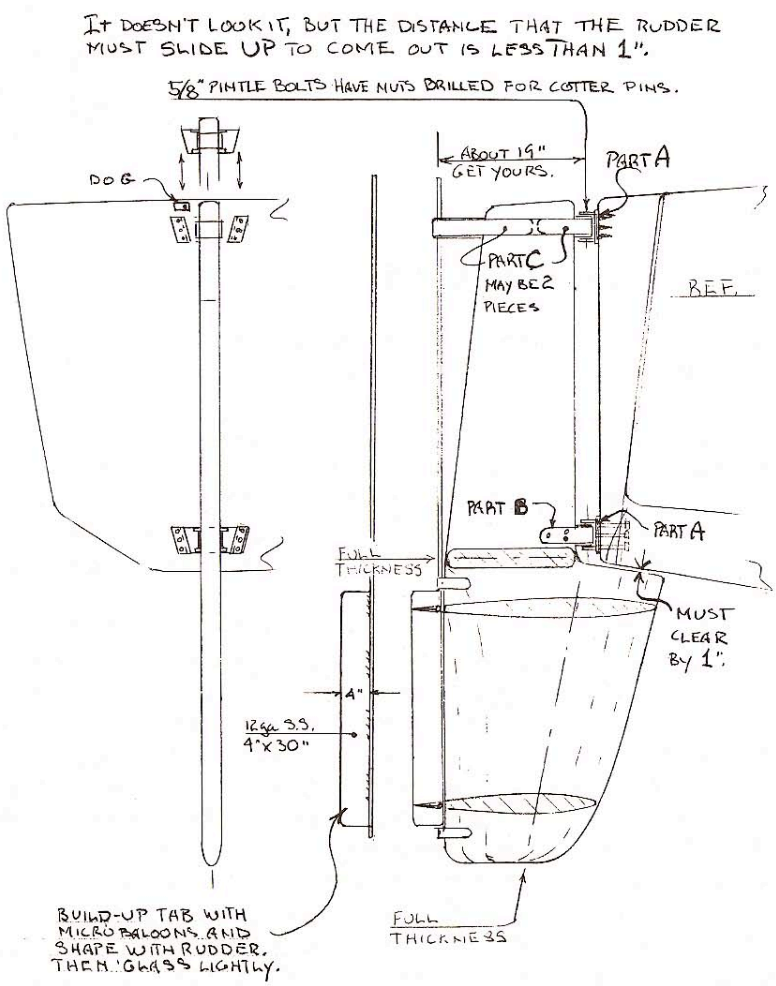
Why so many? I'm not sure I can explain, but we've learned a lot. The requirements are stringent: we need a deep rudder on a shallow boat; something that will keep her going straight at extremely high speed while surfriding; something for maneuvering in ghosters; something for sailing and something for motoring. And then there is self-steering: one rudder or two? Trim-tab or helm-actuated? And how much complication can the backyard builder sustain?

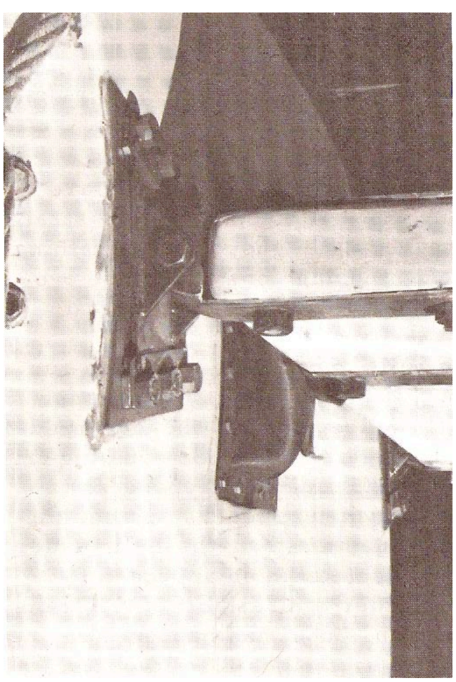
One thing we've learned is that trimarans, with their shallow hulls, need rudders which run <u>deeper</u> than the hull in order to gain high-speed control. Now, if the rudder is the deepest portion of the vessel, it is extremely vulnerable in grounding. A deeper-than-the-hull rudder simply is not a cruising man's best choice unless it is somehow retractable. So cruising trimaran rudders should either be of the kick-up type, or else the hull must be <u>deepened</u> by a deadwood something like our minikeel to protect the rudder. Kick-up rudders are complicated and minikeels are controversial; but lacking either one, a deeper-than-the-hull rudder could be designed to breakaway. The breakaway rudder is a blacksmithian approach to gudgeon-and-pintle (rudder hinges) design which allows the rudder to break off of the transom without breaking the rudder or tearing out the transom (laugh, but it has happened). The rudder hinges are made so that they will fail when the rudder strikes a solid obstacle at speed - fail in a way that can be repaired at sea with a hammer.

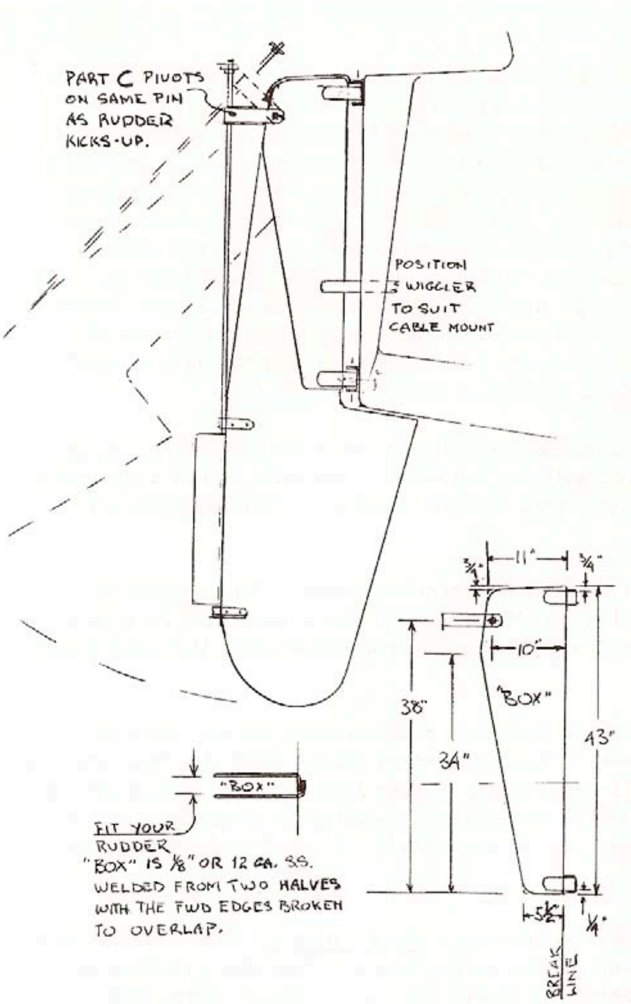
BREAKAWAY RUDDER

Blacksmithian "hinges" are designed to yield and allow rudder to disengage from transom if it strikes obstacle very hard. The "breakaway pieces" (right) will bend and come out of the keystone shaped slots on the transom. But the rudder doesn't float away in the wake; it is held by the steering linkage at the "Wiggler" and by rudder "stop-lines" (see following pages). The steering linkage and the rubber "gland" may sustain damage, but this hardware prevents breaking the rudder or tearing out the transom. Parts shown below are for the 37 and 40-footers. For use in the 31 and 25, reduce metal sizes one or two sizes respectively.



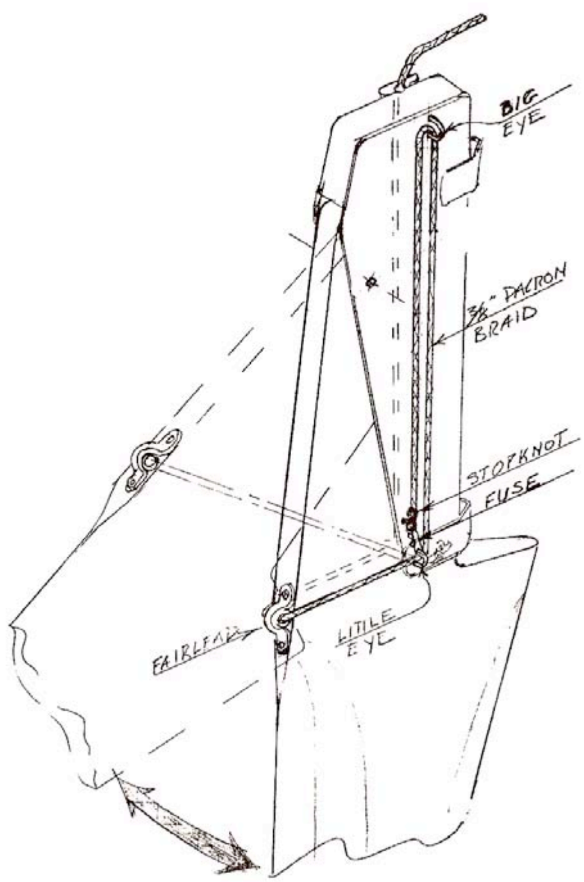






KICK-UP RUDDER

Drawing at left gives dimensions for 37 and 40-footer kick-up rudder box. Rudder dimensions are in Appendixes 3 and 4. Check dimensions to make your box fit your rudder and your transom. If both halves of box have edges broken for butt-weld down center, or slight overlap for near-center fillet weld, it will reduce tendency for welding to warp box. Photo shows installation on OFF SOUNDINGS trimaran with box extending above deck to receive emergency tiller in case of steering breakdown. Sketch below shows method for "Kick-Up, Pull-Down" rudder. If rudder strikes obstacle it will retract, but can be extended again immediately. Here's how: the stop knot is secured to the little eye with a "fuse" of 200 lb test nylon cord. When rudder strikes bottom, fuse breaks. Stop knot goes up to big eye, and passes through, but then goes down to little eye and stops (eyes are ⅜" rod welded to box). This throws about 6 feet of slack in line, allowing rudder to kick-up. Now, a sailor can pull on line at top to pull rudder blade back down - and secure on cleat at top. In practice, ⅜" Dacron line has too much stretch so ⅛" wire can be used. Be sure rudder blade is held tightly forward in box at high speed.



Because the minikeel is optional, boats without minikeels carry the kick-up or the breakaway styles. These blades may be balanced with a portion of their surface extending forward of the rudder's axis to make for easy effort on the helm while under sail. But balance design is tricky for boats with inboard engines. The prop-blast at the rudder can cause the balance area to take over, and feed back through the steering system, making the helm steer the helmsman instead of the other way around. This is a bad feature. The helm must be forcibly held amidships - if you let go the rudder will turn all the way to one side or the other and slam against its stops. To avoid inevitable rudder or linkage damage with such rudders it is advised that very strong stop-lines be rigged. Make them out of ½" nylon line to give some elasticity which absorbs the shock. These lines must restrain the rudder from swinging beyond its intended scope. This is a good idea for ANY rudder because a deep sea vessel can get caught aback and be made to gather sternway which can also cause rudder damage.

For the guys who want the least drag and the best maneuverability for round-the-buoys racing, there is a straight inboard balanced spade rudder with no minikeel. But this is not a cruising alternative and so is not included in the plans. If you tear out the rudder or the transom - it makes a bad leak!

Searunner self-steering is only for outboard, transom-mounted rudders. Other types of self-steering can be worked out for inboard rudders, but they actuate the helm itself or a separate rudder instead of a trim-tab. A much greater energy must be generated by the wind vane, and somehow transmitted to the helm.

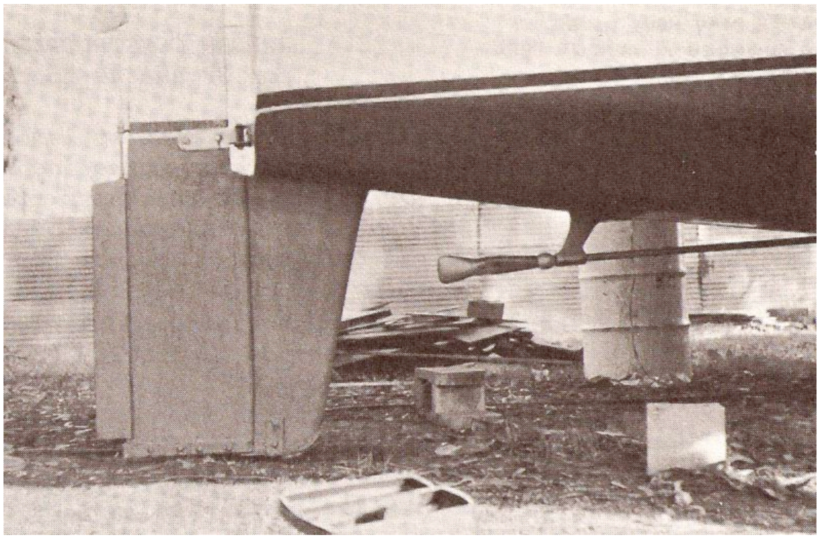
The experience gained from lots of sailing with lots of different rudders has led us, finally, to one favored steering <u>system</u> for cruising trimarans, and that system starts with the centerboard. Boats without boards would steer better, under all conditions, if they had boards. Then comes the minikeel: its purpose is two-fold - to protect the hull and the propeller in grounding or shipwreck, and to allow a <u>deep rudder</u> without kick-up or breakaway. A fixed rudder that has the same draft as the minikeel is deep enough.

If it's not a kick-up or breakaway, then what? The answer is, a skeg rudder. This rudder has a fixed portion - the skeg - ahead of the articulating portion - the blade. The skeg rudder is known to offer the best possible control at high speed. It is not best for maneuvering, but if you've got a centerboard, maneuverability is assured, even with the skeg rudder. The skeg, when combined with the blade into one foil-shaped control surface, develops far more steering force (lift, if you're an aviator) than any spade rudder, especially in the first few degrees of actuation. Its response is extremely crisp with the slightest nudge from the helmsman. Or from the self-steering wind vane.

There is an important point. With the Searunner system, we get the self-steering wind vane to talk to a skeg rudder on a centerboard boat! <u>That's</u> the combination that does it. That's why Searunners self-steer so remarkably well. It's the system. The whole business from board to minikeel to skeg to rudder to self-steering trim tab.

So, for Searunners we now offer plans for three types of rudders; all three are outboard, transom-mounted. They are the kick-up rudder, the breakaway rudder and the skeg rudder.

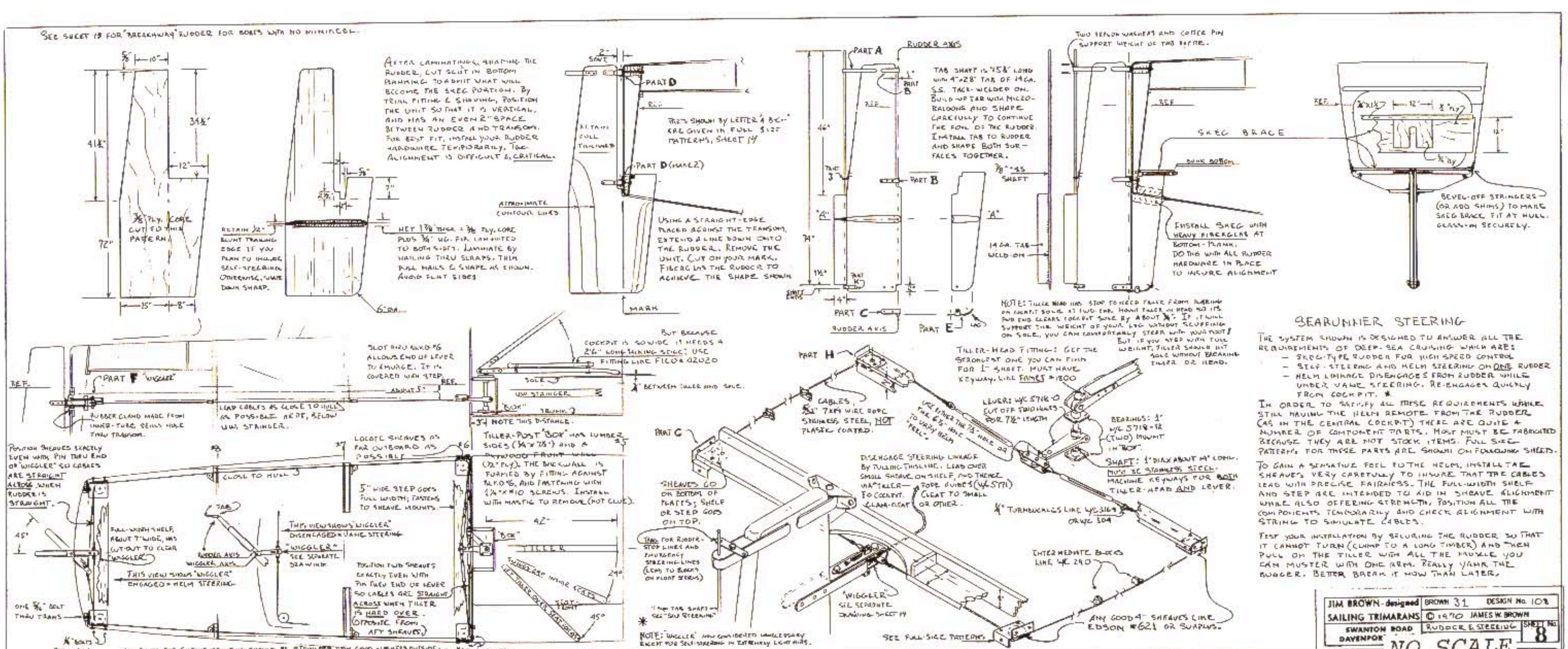
To summarize, the first two types are for boats without minikeels. They will either retract or come off when striking obstructions and must do so because they run deeper than the hull. The third type, the skeg rudder (now preferred), does not have to retract or yield to reef tops because it is used only with the minikeel and so is not deeper than the hull. One exception is the 25-footer, which cannot have a minikeel and so must carry a kick-up or breakaway rudder only.



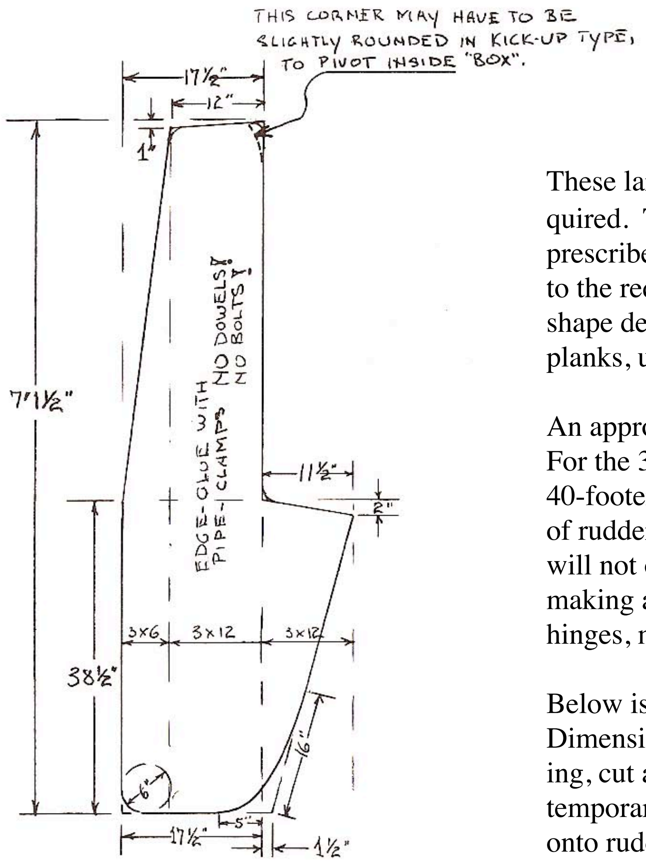
SKEG RUDDER

This is the currently favored Searunner steering system. The photo shows a skeg rudder installed on a 37-footer. The right-hand portion is fixed into the hull. The center section is the articulating blade, and the narrow strip at left is the self-steering trim-tab. Note the close clearance between the moving parts. Great strength is imparted by the third, bottom "hinge", compared to spade rudders used for kick-up or breakaway versions. Notice the Martec folding propeller with streamlined strut bearing. The high-speed control and self steering qualities afforded by this system are largely cancelled by a fixed propeller.

Drawing below shows 31-footer rudder construction and pull-pull cable linkage to the helm. Note particularly the special angle-brackets for mounting the sheaves. Sheave alignment is critical, but this system can be used for any boat. In larger craft a wheel would be used instead of a tiller. Tiller steering has the virtue of not obstructing the cockpit with a pedestal (important in the 31) and if the tiller will lay flat on the cockpit sole (but without dragging as it swings) the helmsman can steer with his feet while using both hands for the sheets when maneuvering. Quadrants can be substituted at the wiggler and the lever for smoothest steering. Full-size patterns for the lettered parts are in the 31 plans.



Parts letters refer to 31-footer only

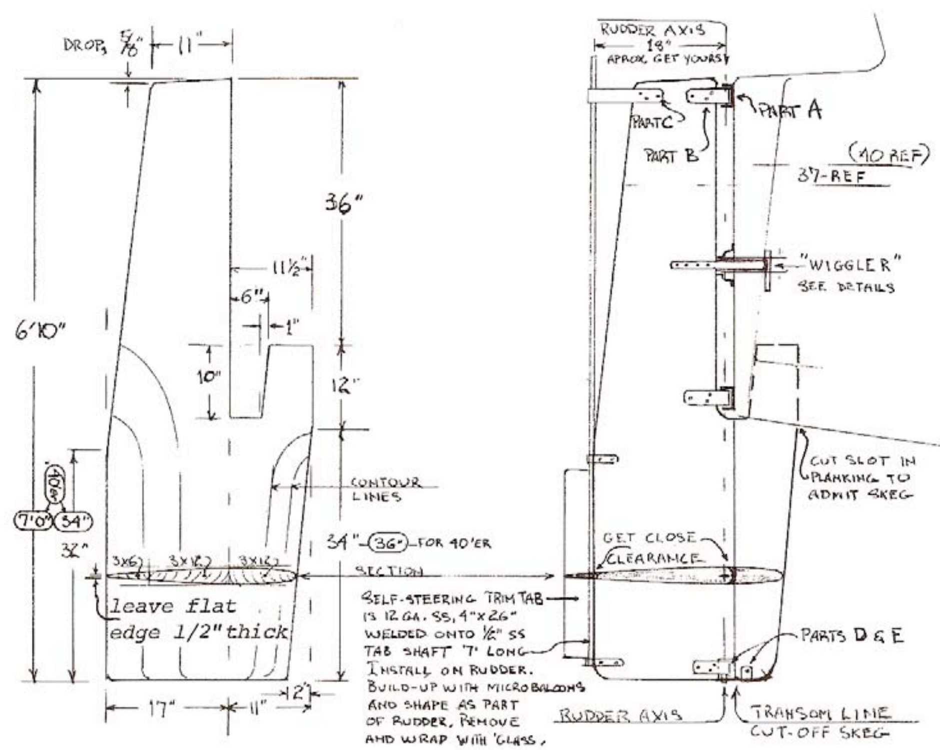


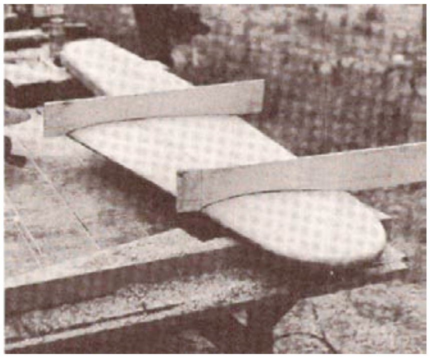
RUDDER CONSTRUCTION
for 37 and 40 footers

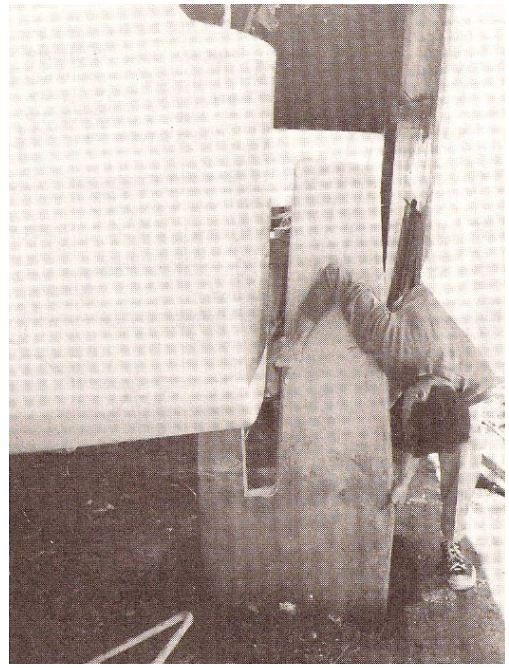
These large rudders are made of lumber planks glued up to give the sizes required. Three-inch thick planks, surfaced to 2⅝ " or 2½" net thickness are prescribed, with the option of two or three laminates of thinner boards glued to the required thickness. Another approach is to cut a plywood core to the shape desired and laminate-on boards to each side. In edge-gluing thick planks, use adequate pipe clamps but do not use thru-bolts or dowels.

An approximate pattern for a kick-up or breakaway rudder is shown at left. For the 37-footer, the depth of the blade can be 2" less than shown; for the 40-footer, 2" deeper than shown. For boats with inboard engines, the extent of rudder balance, shown here as 11½", should be reduced to 5" so prop-blast will not oversteer the rudder. Determine the exact shape for your rudder by making a pattern to hold against your transom. Allowing a 2½" space for hinges, make the top line and the balance line express the lines of your boat.

Below is an approximate pattern for the skeg rudder for the 37 and 40-footers. Dimensions shown within ovals are for the 40. After shaping and fiberglassing, cut a slot in the planking to admit the skeg and install this one-piece unit temporarily with your gudgeons and pintles. Extend the transom line down onto rudder; remove unit and cut off skeg on transom line (<u>not rudder axis</u>). Shape the edges of the cut for close clearance (⅛" maximum gap) between rudder and skeg. Reinstall rudder <u>with third gudgeon</u> to determine exact position of skeg; then install skeg with heavy fiberglass at slot, inside and out.







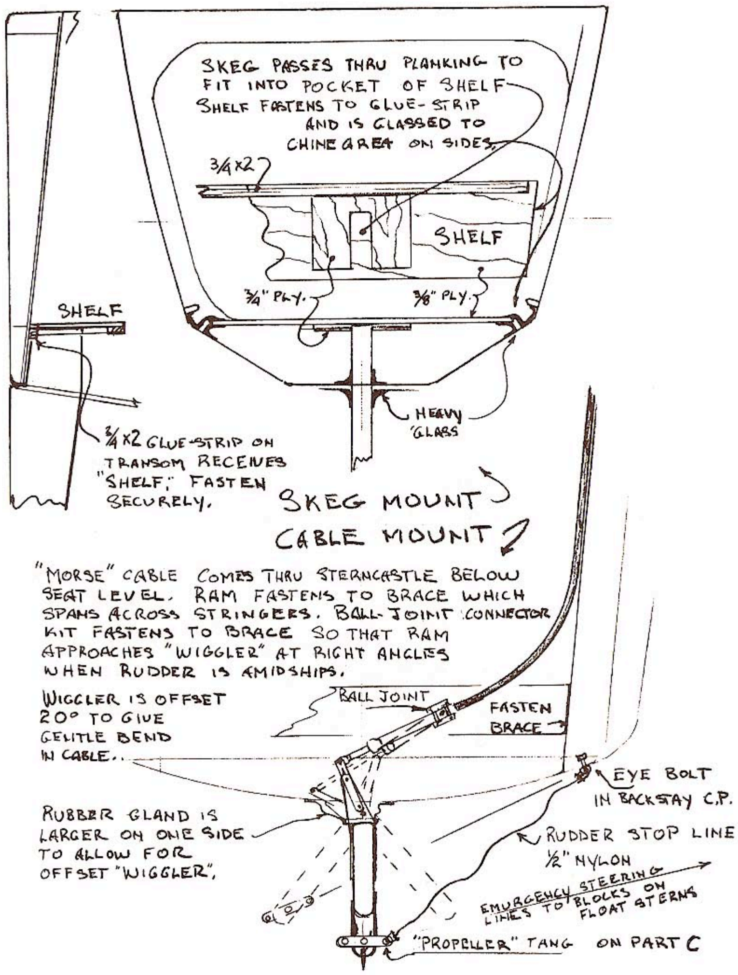
Shaping rudder with power-plane begins by scribing a center-line all around the edges; in the center of the edge, splitting the thickness. Then make templates (above) to check one side against the other for symmetry. Installing a skeg rudder (right) is best done with skeg and rudder attached. Install as a unit with your gudgeons and pintles - then cut skeg off on a line extended down from the face of the transom (not the hinge axis) and shape for close clearance between rudder and skeg. Install bottom hinge for good three-point alignment between all gudgeons and pintles.

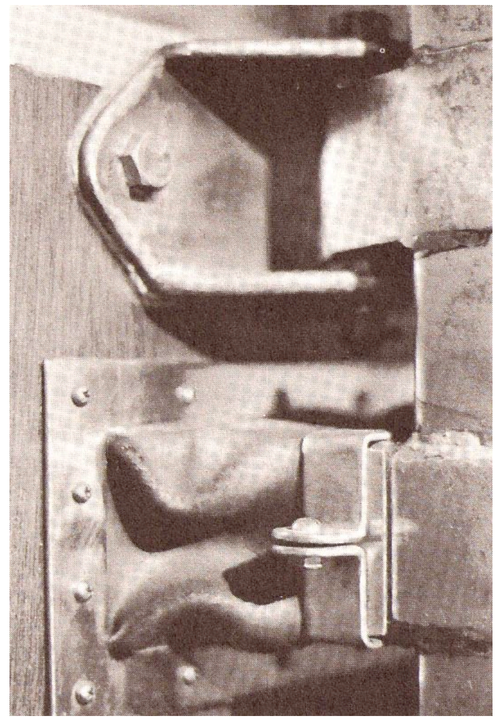
With the 25-footer excepted, this Searunner steering system could employ only one type of rudder - the skeg rudder - IF the designer could convince all builders of the virtue of the minikeel. It's a big job to build a minikeel, and it does reduce ultimate speed fractionally. But to meet the purpose for which these boats are designed - travel - the minikeel's worth is indisputable. For the protection it offers to the propeller and shaft; the safety margin increase in grounding or shipwreck; the convenience it affords when beaching for maintenance; and the degree to which hauling out on a marine railway is simplified (without a special cradle) … all these considerations outweigh the disadvantages. But a total of the above plus factors does not equal the additional volume of logic to support the skeg rudder! For downwind control in threatening conditions, and for self-steering in all other conditions, there's nothing like the skeg rudder at this writing. The skeg rudder goes together with the minikeel just like the centerboard goes together with the central cockpit and the cutter rig. It is the combination of all these features that makes the Searunner what it is: the most highly developed cruising sailboat suitable for backyard building.

Forgive me for implying that development stops here. There are certain to be steering system advances in the future, or even at the present. One area where advances are definitely needed is in the linkage between the rudder and the helm.

With any outboard rudder in a central cockpit boat, the steering linkage to the cockpit must come through the transom.

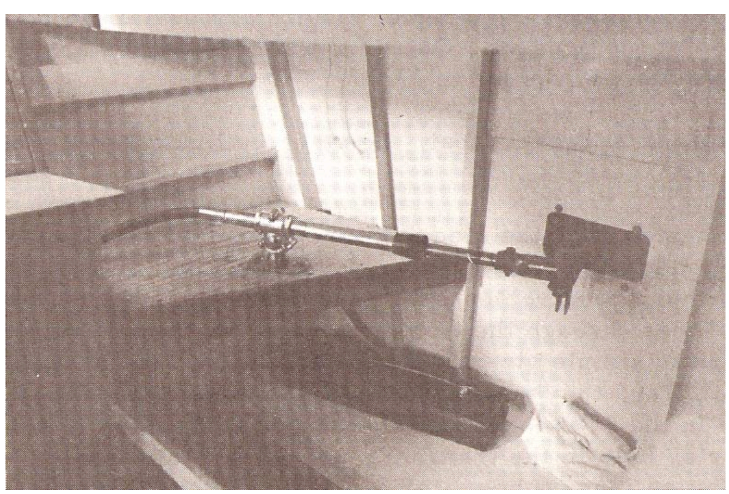
To attain the best possible self-steering, the steering linkage should disengage from the rudder. This allows the rudder to respond to the wind vane unencumbered by friction in the linkage to the helm. To accomplish both of these requirements we have developed a gadget called the "Wiggler". It mounts on the rudder, protrudes through the transom, receives the steering linkage and includes a disengage. It is a pretty simple gizwankus for all of that, but it still takes work and money to build. In all but the 25'er, the wiggler must be sealed with a rubber gland where it passes through the transom. In the 25 it leads into the anchor well which is self-bailing; but in the larger boats, the wiggler's hole in the transom must be carefully sealed to keep splash out of the sterncastle. Truck tire inner tube material works; neoprene diaphragm stuff or wetsuit material is better. Once inside the transom, the wiggler hooks up with whatever steering system you've got. For the 25 and 3l'ers, a pull-pull system of cables and sheaves is prescribed in the plans.

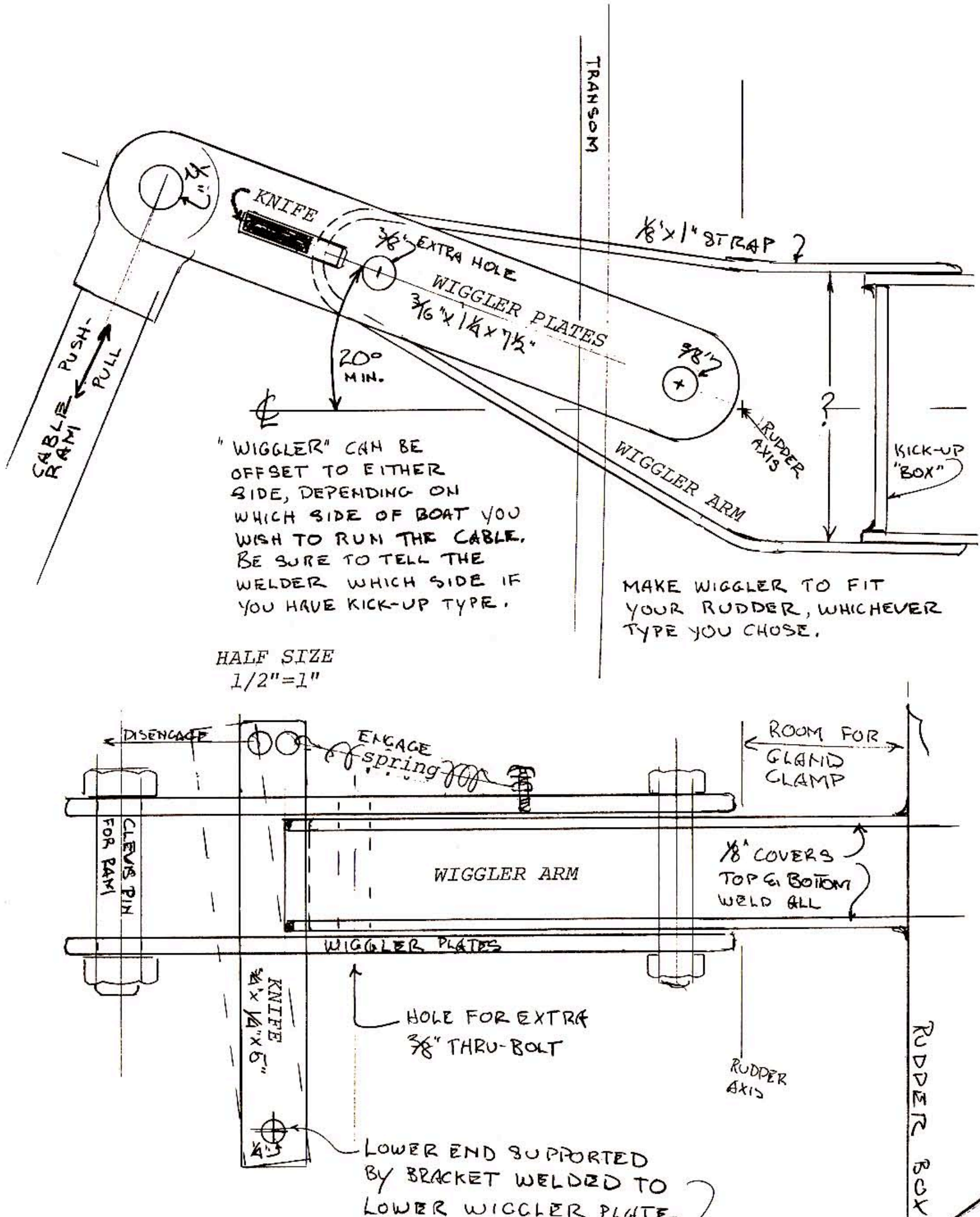


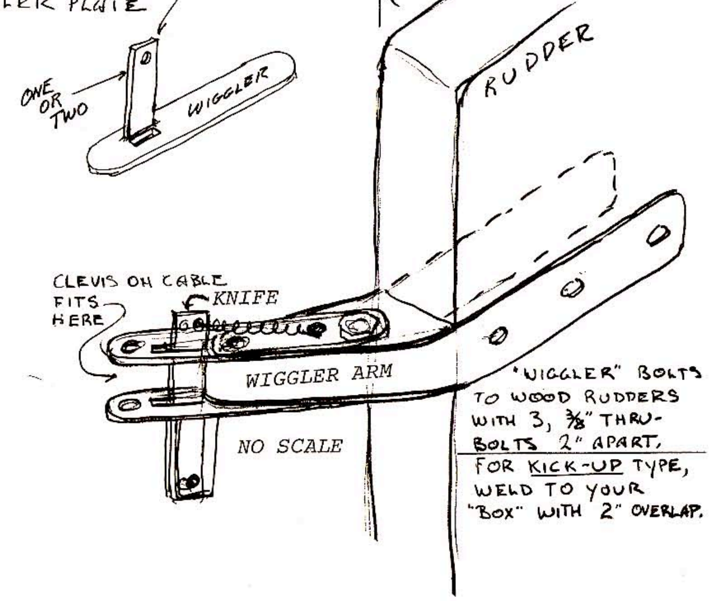


Drawing above shows how rudder may turn independently from wiggler plates when wiggler is disengaged. Cable ram is mounted to separate corner-shelf (below). Note that cable ram must approach wiggler at 90° when rudder is amidships. Full-width shelf which fastens to top of skeg is shown in bottom of photo with a satchel resting on it. Dinette seat is at left.

"Wiggler" enters transom through this gland. Rubber around the wiggler, where it is clamped with hose clamps or a special bracket, should be carefully sealed with mastic to avoid leaks. Upper part of photo shows closeup of rudder gudgeon and pintle (hinge) as welded to a kick-up rudder box.







WIGGLER DETAILS

Wiggler plates (top) hold “knife” (center) which can be made to engage or disengage a deep notch in the end of the wiggler arm. When knife is disengaged, rudder (and arm) can swing independently from plates (and cable ram). A <u>disengage line</u> to the cockpit is used to pull knife forward. Helm is then turned all the way to one side which removes knife from the vicinity of the arm while under self-steering. To re-engage, the helmsman spins the helm toward center and knife-automatically engages arm. This <u>instant re-engagement</u> is a vital part of self-steering with this system.

This is an excellent friction-free system if the sheaves are correctly aligned with the cable and if it is strongly built. The largest aircraft are still controlled with cable and sheaves. This method is so free from friction (if properly built) that the disengage feature is hardly necessary. It is nice to have in extremely light airs, but can be omitted.

Even where a push-pull Morse cable is used, as in the 37 and 40-footers, the self-steering rudder will drive the steering linkage and even spin the helm in winds over 15 knots. But the boat self-steers much better with the wiggler disengaged. A wiggler control line to the cockpit is essential to allow the helmsman to engage the helm quickly if he wishes to take over from the wind-vane. But this is just another complication, and some sailors prefer to go aft to the wiggler themselves and engage or disengage manually, because this usually occurs in light airs. But this practice is strongly discouraged. Imagine sitting in the cockpit, surfing along and suddenly lunging for the helm to avoid that whale! And being disconnected? Or what about man overboard? That freighter's red and green lights looming out of the fog? Do you dive into the sterncastle and grope for the wiggler or do you yank loose a line in the cockpit and boot the helm over? For safety, choose the latter. Rig a disengage line to the cockpit, if you've got self-steering. The best disengage I've seen employs bowdin-wire for motion transfer and has a knob at the helm, like a choke cable.

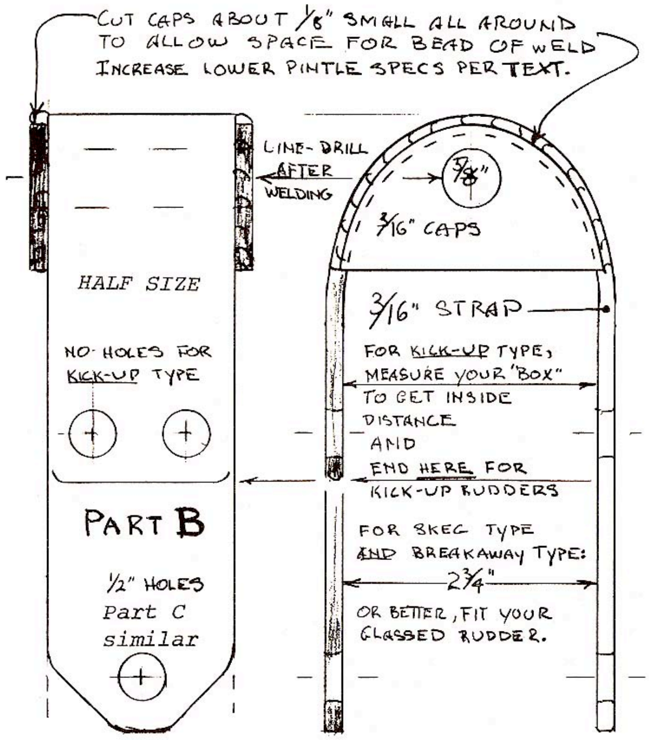
The individual parts for building Searunner rudder hardware, and, self-steering hardware, are shown in the drawings and photos which follow. Most of these drawings were made at a time when we had no idea of the impending popularity of Searunners. The sketches were knocked-out in a hurry to keep up with builders who were building the boats faster than we could draw the plans. While some of these sketches were drawn full-size for later inclusion in the plans, we have chosen instead to reproduce them here - HALF SIZE - so that anyone with this manual may take advantage of the information. To get full-size metal parts patterns from these sketches, simply double the dimensions. Dimensions not given can be scaled at ½"= 1". Drawings marked NO SCALE are photo-reduced from the plans to illustrate basic concepts. Do not scale from these. [ed note: assume all drawings in this version are no scale]

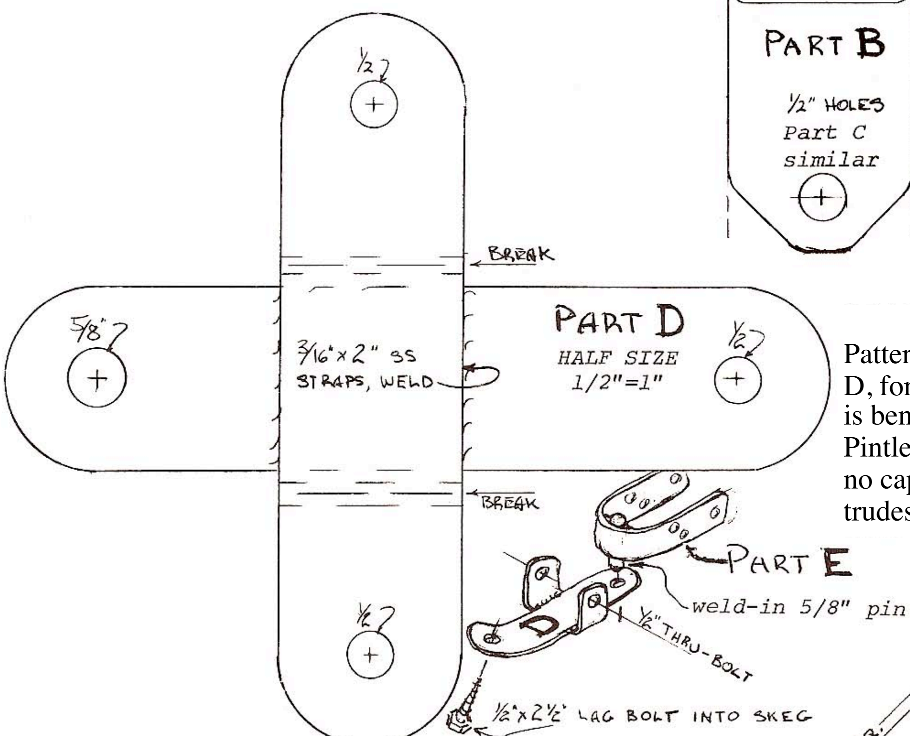
One area of difficulty has appeared in parts A and B when used on kick-up or breakaway rudders. Because the rudder blade cantilevers down into deep water so far below the transom, steering strains on the lower gudgeon are extreme causing excessive wear. Skeg rudders have a third gudgeon at the bottom of the skeg and so don't encounter this problem, at least not as much. These extreme strains cause the holes in the gudgeon and pintle to enlarge. Bearing pressure against the pin is just too much. The simplest solution is to increase the metal stock thickness. Using welded (instead of bent) construction for part A, increase the thickness for the protruding ears to ¼" stainless in the 31-footer and ⅜" in the 37 and 40. Same for the caps in the pintle, part B. And increase the pin size to ⅝" diameter in the 31, ¾" in the 37 and 40. These increased specs apply only to no-skeg rudders and to the lower set of gudgeon and pintle only, at the bottom of the transom.

An alternate solution for those with access to machine-shop facilities is to add bushings to the standard parts and increase the pin size - lower gudgeon and pintle only.

GUDGEONS & PINTLES
for 37 & 40-footers

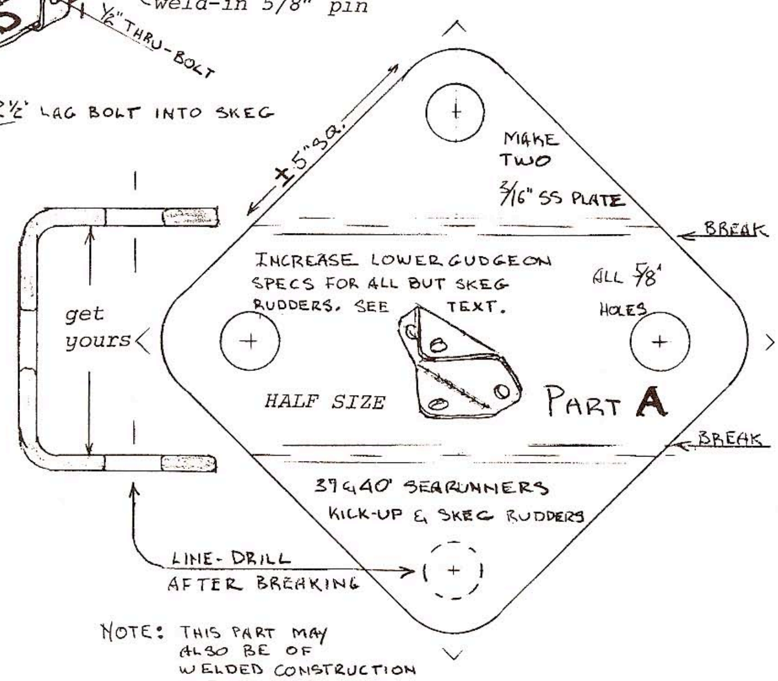
A rudder "pintle" (right) is the part of the hinge that fastens to the rudder. This is Part B, made by bending a rugged strap in the shape of a "U" to fit over the rudder or, in the case of the kick-up type, over the rudder box. Caps are welded top and bottom and line drilled to receive the pin. For kick-up or breakaway types, increase the cap thickness to ⅜", or install a bushing; this for the lower pintle only. For self steering, the top support arm for the trim-tab shaft, Part C, has similar, but lighter construction to Part B. It may be all ⅛" material, with the caps extending up to the rudder.





Pattern at left shows bottom third gudgeon, Part D, for skeg rudders. Sketch shows how pattern is bent, and how it mates with the pintle, Part E. Pintle construction is like Part B above, but has no caps. Instead, weld-in a ⅝" pin that protrudes 1" below strap to engage hole in gudgeon.

Rudder gudgeon, Part A (right), is the part of the hinge that fastens to the transom. It can be bent (or "broken") from plate stock to the pattern shown or made from three separate pieces welded together. For kick-up and breakaway rudders, the lower transom gudgeon (and pintle) takes tremendous strain. The protruding ears should be increased to ⅜" thickness by welding on doublers or making the ears from ⅜" stock. With these increased specs., build Part A with inside distance between ears to receive your Part B allowing at least 3/16" clearance. A teflon washer between will reduce friction caused by the weight of the rudder.



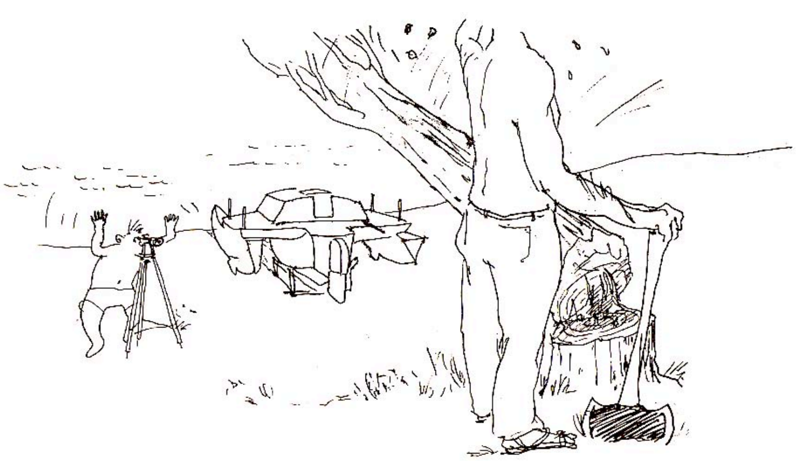
Remember that all articulating mechanisms are subject to alignment problems. Get the rudder axis pins to fall directly one-over-the-other so that there is no binding in the hinges as the rudder turns. Same for the self-steering tab shaft and vane shaft.

Underwater metal parts are subject to corrosion. The best material for these is silicone bronze - but its cost is high. Monel is also good, but costly. The most common stainless alloy is #304, but #316 is a little more corrosion resistant. Sacrificial electrolysis zincs are, according to the latest information, of use only in protecting steel and iron and may actually accelerate corrosion of stainless and bronze. If you're planning on an extended voyage it may be wise to build one extra set of parts A and B, and maybe D and E If you ever need them, you've got them. If the holes are drilled and new bolts included, you can install them without hauling-out.

Morse cable, the push-pull type, has been used with great success in steering the larger Searunners. Size 4 or 400 is prescribed, and to date there have been no cable failures reported for the Morse products, but there have been in other makes. The advantage to this type of motion transfer system is that you can run it through the accommodation to avoid conflict with any other features. However, it is wise to arrange as direct a route as possible to minimize bends and thus minimize friction. We have experienced delivery problems from Morse because the cables must be ordered to length from the factory. To determine length it seems wise to install the helm assembly and complete the rudder installation. Then, run a stiff garden hose (to simulate the cable) through your boat (to simulate the installation). Using dimensions given in the Morse Catalog for the cable ram, mark the garden hose to length, remove and measure it. Then order well ahead of launching.

In the 37 and 40-footers, it appears wise to build the wiggler offset at least 20° to one side (22° or 23° may be better). This makes it possible to avoid bending the cable tightly when attaching it to the wiggler. The ball joint on the ram is mounted to a strong shelf that spans across appropriate stringers and also fastens to the transom, This can also be a corner shelf if desired. Build the shelf to accept the ball joint at a level that allows the cable to lead aft underneath the dinette seats.

Rudder and steering-linkage failures have been so numerous in trimaran history that all of this stuff is designed extra strong. This is your guidance system, Build it with care. I hope you will use it a lot.



Following is an excerpt from "The Telltale Compass" (see Appendix #6) which wisely questions the use - or misuse - of auto-pilots and self-steering. It is included here, by kind permission from the publisher, as a caution to unsuspecting sailors who may be duped by the lure of convenience into flying blind.

MINDLESS MACHINE

Ever since the advent of the automatic pilot for both wheel and tiller-steered boats and their increasing use on smaller and smaller craft, we have wondered whether this technological development is not more of a pother than an amenity.

Despite the blandishments of the manufacturers and despite the often enthusiastic reports from users, we still wonder, and thus were more than casually interested in a letter we received recently from M.J. Corwin of Los Angeles, California.

“It was bound to happen!” Corwin writes. “Last Sunday while day-sailing with friends in their Cal 28 “Pinata” out of Marina del Rey, the skipper rigged an automatic tiller device and we all relaxed, enjoying a perfect sailing day.

“About a half hour later, we noticed a sloop bearing down on us ahead, but since we were on starboard, we felt safe. But the sloop kept coming on, and on an obvious collision course. Prudently, we finally did bear off and both boats passed close aboard.

“Only then did we realize they were sailing with a windvane steerer. The other skipper yelled his embarrassed apologies, pointing to his wind vane, and we shouted back we were on autopilot, too, but we were looking where we were going.”

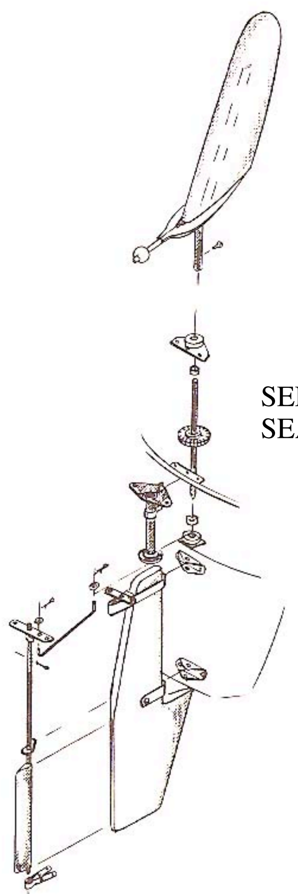
Having been caught a few times ourselves crossing boats on autopilots, and one memorable meeting with a big powerboat which steamed by like the Flying Dutchman without a soul in sight anywhere aboard, we can appreciate the shock Corwin experienced when he realized the other boat was in the hands of a mindless machine.

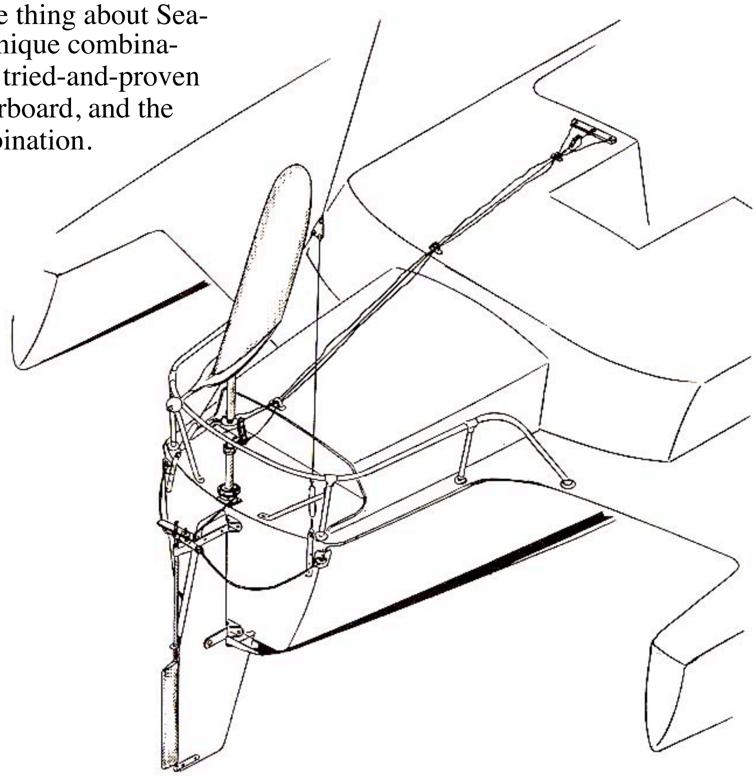
But then none of those stories will match the one about the old professional hand who was bringing a big powerboat up the Intracoastal Waterway alone. In the long arrow-straight section of the Windy Hill cut north of Charleston, he put the boat on auto while attending a call below. The only trouble was he hadn’t checked the chart closely and in a bit the boat and her mindless master came to one of the low bridges which cross the cut. It neatly swept the deckhouse into the wake behind. The old pro, clutching his pants, stuck his head up through the splintered wreckage, somehow managed to turn the boat into the bank, jumped ashore and disappeared.

While there is little doubt that a good autopilot may be worth its weight for the man making long passages at sea in relieving the tedium of the wheel, still there is even less doubt that too often it has the psychological effect of letting the skipper, as Corwin noted, relax. While he is steering, he is naturally watching; while on autopilot, the ship will be lucky to have the occasional glance.

Thus we think the use of an autopilot on crowded waters just to show off a gadget, or even for the purpose of relaxing when there is little call for it, is something a great deal less than seamanlike.

This is nothing new. It is the oldest, the simplest, most basic and most sea-tested self steering principle. The concept was the work of some imaginative hobbyist who wished to go voyaging vicariously in his model yacht. One wonders if he imagined that his invention would someday be used on real boats making real passages. The only unique thing about Searunner self-steering is Searunners: It is the unique combination of this modeler's mechanism with other tried-and-proven features like the outrigger sailboat, the centerboard, and the skeg rudder. Nothing new - except the combination.





SELF-STEERING
SEARUNNER

HOW IT WORKS

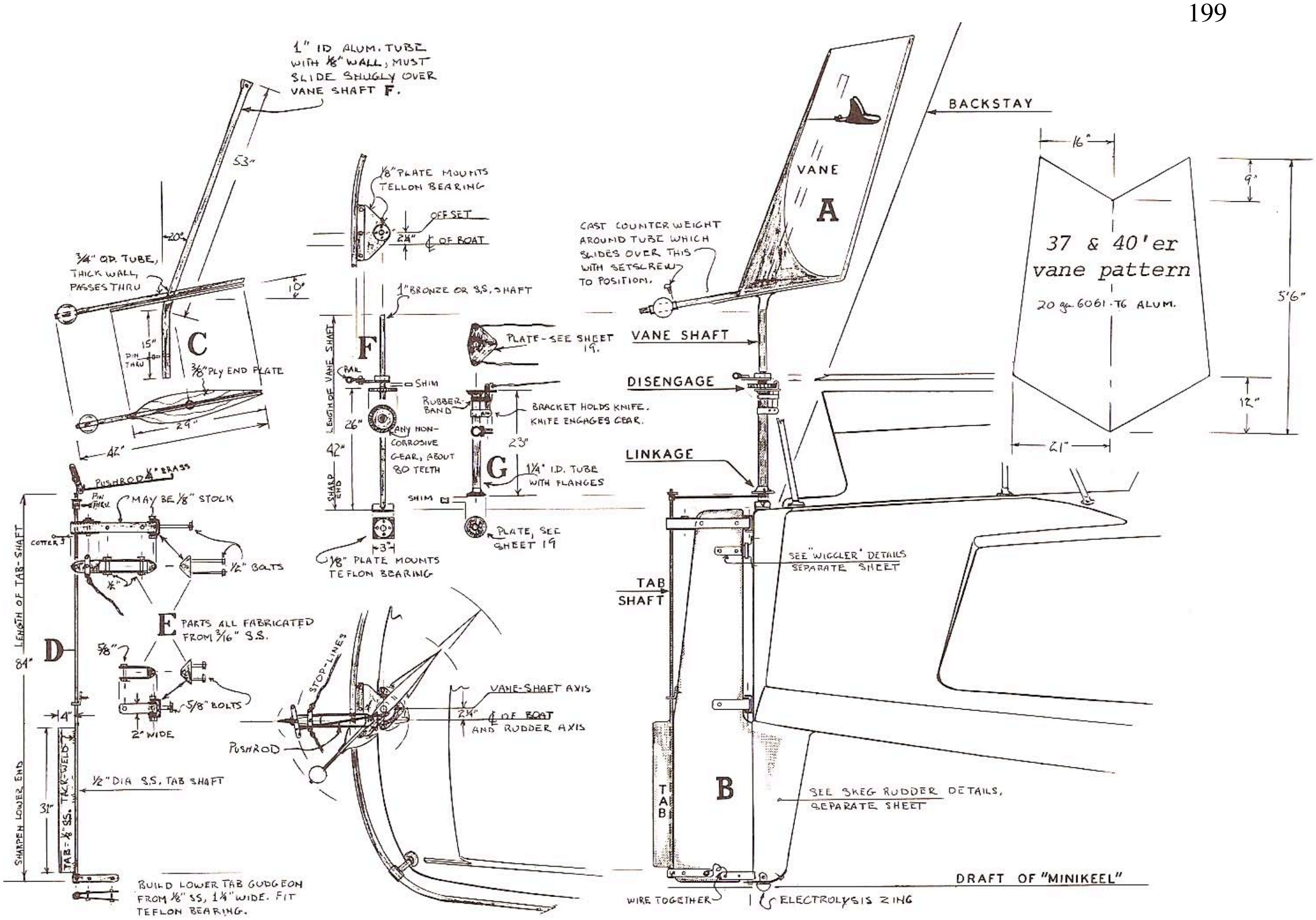
These sketches show that, besides the boat and the rudder, there are only two basic parts to this self-steering: the trim tab and the wind vane. Both of these rotate on vertical shafts.

To understand their workings, start by assuming that the wind vane does not rotate; it always points into a theoretically steady wind, like a weathercock. But the <u>boat</u> rotates; it is constantly wandering, hunting, pointing its bows to right or left of course. But the vane keeps going straight!

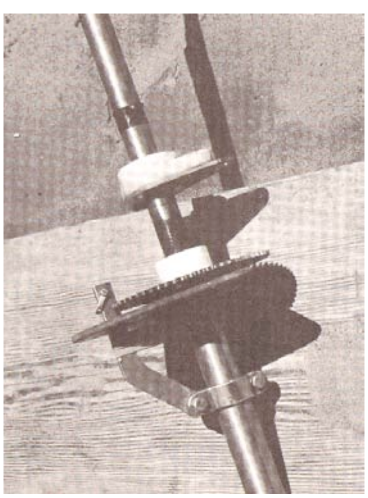
The purpose of the mechanism between the vane shaft and the tab shaft is just to get the wind vane to talk to the trim tab. If the tab knows what the vane knows (which direction the wind is blowing) then, relative to the wind, the tab can steer the boat. This is because the trim tab has a great hydrodynamic authority over the rudder. If the boat turns right, then <u>relative to the boat</u>, the wind vane and the trim tab have turned left. Whichever way the tab turns, the rudder must turn opposite; the rudder guides the boat back on course.

The purpose of the pushrod and bell crank is to provide a "differential linkage"; usually you'd like to have the trim tab turn a little less than the wind vane to avoid oversteer.

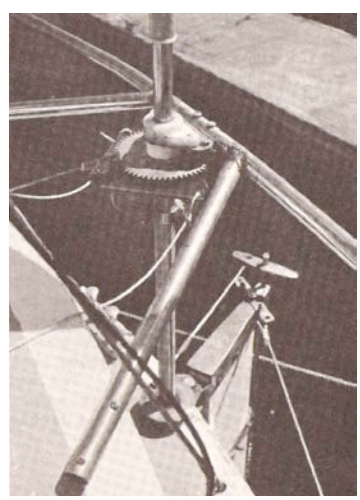
The purpose of the linkage tube and gear is to allow the vane to weathercock no matter which direction - over the boat - the wind is blowing. Each cog in the gear is a different course on the compass; a different place in the world.



Self-steering parts by letter are: A) wind vane. B) Skeg rudder. C) Vane frame • 1" I.D. tube is bent 20° at point where counterweight shaft (¾" O.D. tube) passes through sloping 10° from horizontal. D) Trim tab mounted on rudder with small trim tab gudgeons. E) Rudder gudgeons and pintles. F) Vane shaft • a 1" bronze or stainless shaft has minimum 80 tooth gear brazed on. Upper bearing slides on shaft (photo, below left), can have teflon bushing; fastens to stern pulpit. Lower bearing mounts to deck. Lower end of shaft is pointed to bear on plate under bearing. G) Linkage tube, about 1⅛" I.D. tube has flanges both ends which mount upper plate and lower plate, both of which have holes which admit the vane shaft and act as bearings. These plates can be stainless or plastic. The upper plate has a slot which guides a knife which engages the gear, locking the vane shaft and the linkage tube together when sailing under self-steering (photos below). The lower plate has holes to receive the pushrod.



SEARUNNER
SELF -STEERING

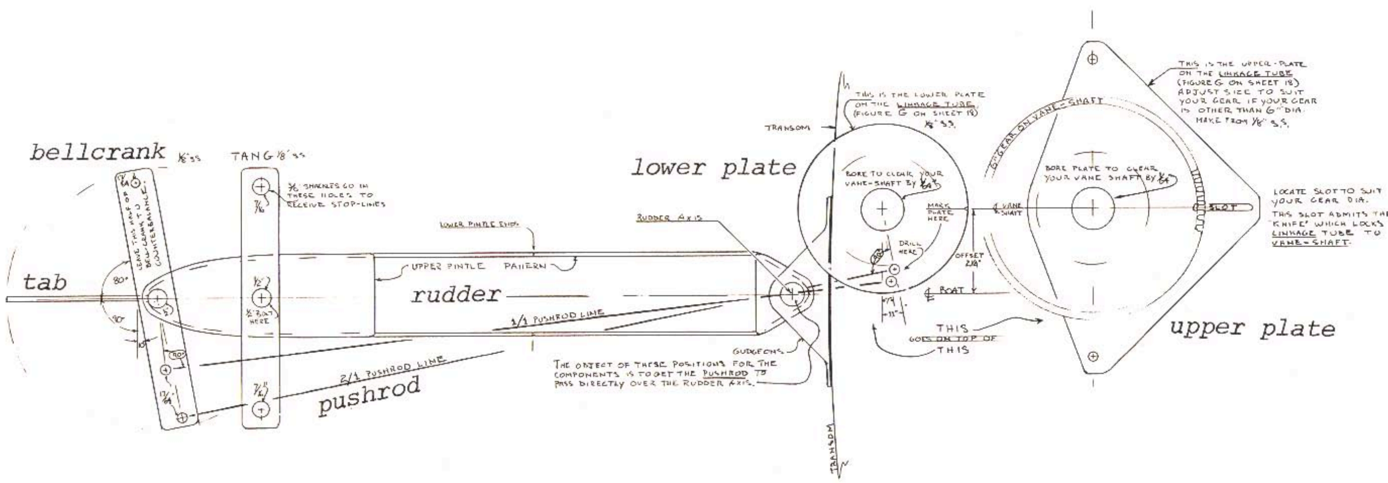


SELF-STEERING DETAILS

This photo-reduced drawing indicates that there are a few intricacies to the mechanism. These deserve explanation.

Reduce friction to a minimum for best light-airs self-steering. This means using all noncorrosive materials for bearing surfaces and making all bearings slightly sloppy to allow for salt accumulation, etc- don't make any of the "running fits" snug; use a 1/64" oversize hole for each shaft.

The linkage tube has an upper plate and a lower plate attached. These can be ⅛" stainless welded to the tube; or plastic, like ¼" sheet nylon bolted to flanges on the tube. The upper plate size is determined by the size of your gear. For a 6" gear the upper plate would come from a 7" x 9" blank to allow space for the slot where the knife passes through. Holes in the widest corners of this plate accept lines that go to the "puppet-stick" in the cockpit. Another, slightly shorter, line goes from the knife to the puppet-stick. To disengage the self-steering and allow manual helm steering, the helmsman pulls on the stick and secures the knife's line at a small clam-cleat at the cockpit. This holds the knife away from the gear. A special trigger-latch at the knife could be devised to hold (and release) the knife without steady tension on the line. To engage the self-steering the helmsman releases the knife's line. He can select any cog in the gear by wagging the puppet-stick and then releasing all tension on the lines.

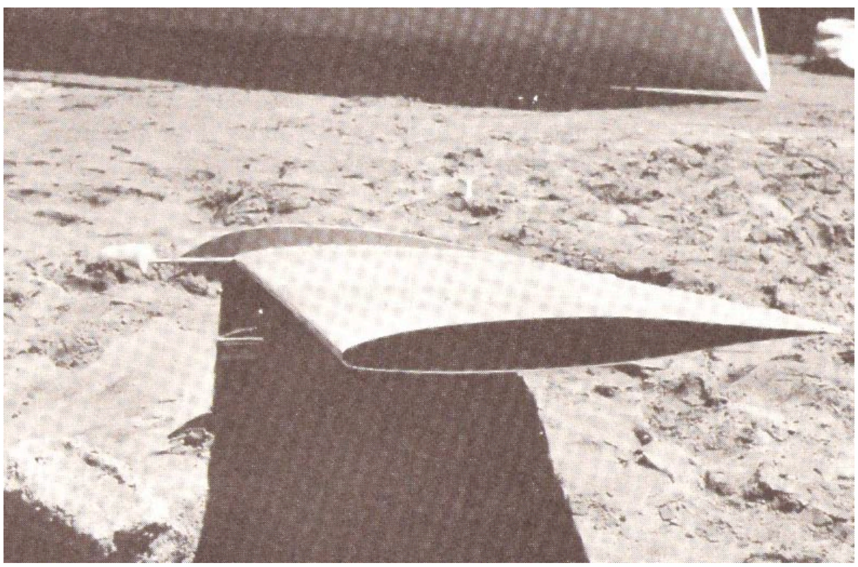


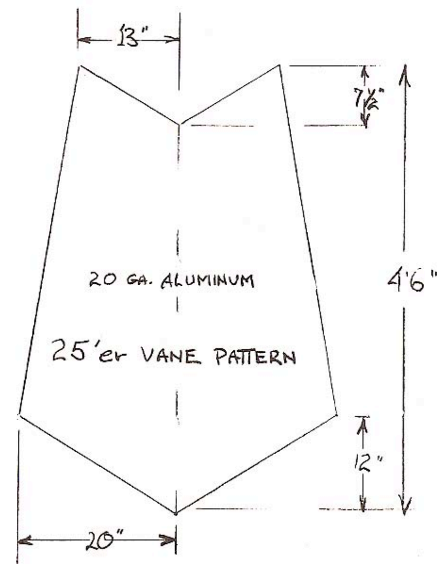
The lower plate on the linkage tube is about 4½" in diameter, and may actually be square if cutting the circle is a problem. Two ¼" holes in the lower plate are carefully positioned near the edge to receive the forward end of the pushrod. The pushrod's aft end attaches to either of two similar holes in the bell crank. Selecting between these holes for mounting the pushrod gives "direct drive" or 2-to-l differential linkage between the vane and the shaft. The latter is usually chosen, depending on conditions.

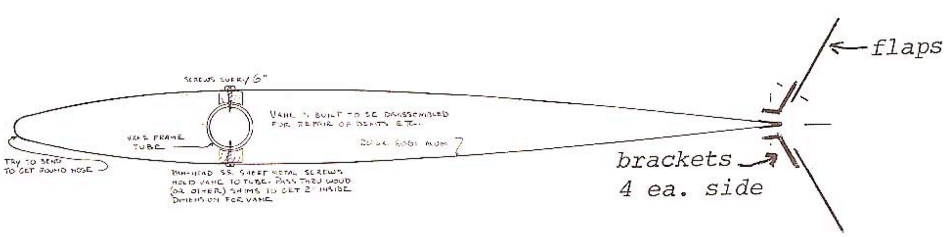
Note that the vane shaft, and the vane itself, are mounted about 2¼" off center to port of the boat's centerline. And note that the holes for the pushrod are positioned at certain angles, namely 70º and 110º, measured from "dead abeam". The bell crank is cocked at a certain angle, 100º, and the pushrod holes in the bell crank are also positioned expressly; 2" and 3¼" from the tab shaft center. These apparently mystical complications are to accomplish a very plane geometry in the mechanism, which is this: locate all these components so that when the rudder is amidships and the tab is amidships and the knife is amidships - all straight ahead the pushrod acts on the tab-shaft and the vane shaft at 90º angles; simple "straight lever angles". And as the pushrod goes from one shaft to the other, it should pass right over the rudder axis. This crude geometry avoids most of the inherent imperfections that have plagued self-steering development. The angles and distances are not too critical - just get close. The length of the pushrod is peculiar to individual installations. You can make the pushrod from a ¼" stainless rod, a little too long, and just bend it in the middle to adjust.

VANE CONSTRUCTION

The shape of the wind vane is a developed foil, to reduce dwell or time lag between right and left course corrections. The simplest vanes are flat plywood, but they cause dwell. The vanes shown here are made by cutting 20-gauge aluminum sheet, alloy 6061 or similar, to the pattern shown and bending it around a broomstick. Drill through the broomstick every 12" and nail the stick through the center of the aluminum down to the bench. Bend the edges up. Fasten the vane to the vane frame using spacers to give a foil about one eighth or one-tenth as thick as it is wide, with the thickest place about one-third back from .the leading edge. Build the vane so it can be opened-up to pound-out dents. Counter balance carefully with weight to avoid the effect of heeling. Set-screws for the vane and the bell crank and the counterweight must go through the shafts all the way.







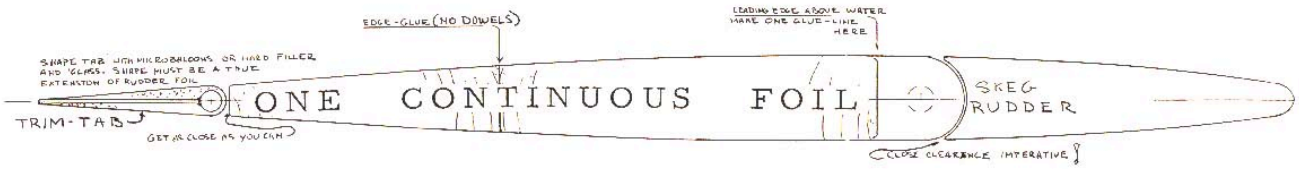
VANE FLAPS

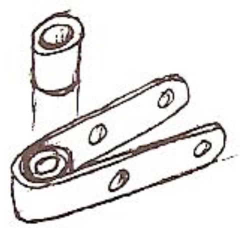
can be seen (at a distance) on the front cover. Using a kick-up rudder, CALAFIA would not self-steer on the passage out. Using flaps she self-steered all the way back.

A recent development which may improve self-steering on a reluctant boat is flaps on the vane. These are two strips of about 16-gauge aluminum about 4" wide fastened full length along the trailing edge of the foil, with an angle between them of about 120^0 and a space or slot between them and the vane of about ⅝". These flaps are known to greatly improve the efficiency of a vane-steering system, and may be required on Searunners which do not have skeg rudders. (Watch out for a conflict with the backstay.)
Full details are available from the A.Y.R.S. (Appendix 6).

RUDDER & HELM DETAILS

In shaping all these rudders, avoid removing too much material near the water-line; this area must be thick and strong. Leave a flat edge ½" thick on the trailing edge to accept the trim tab.

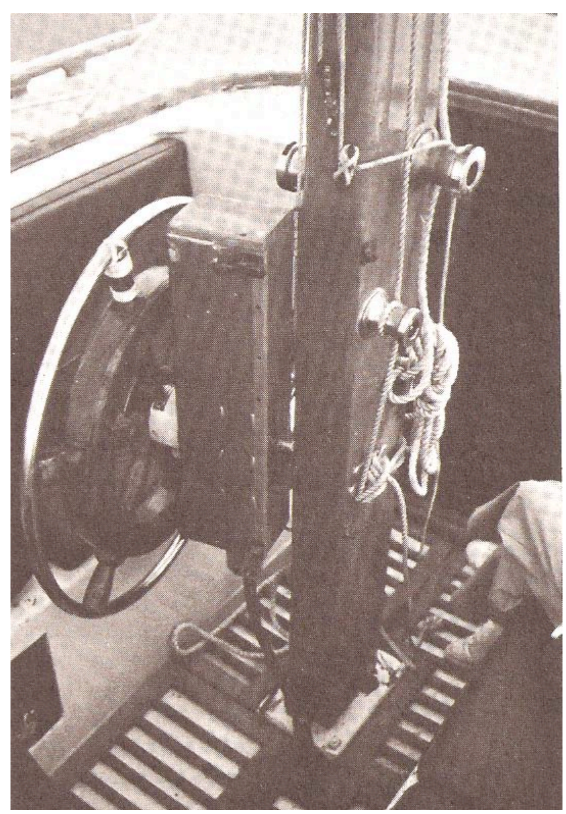




Trim-Tab Gudgeons have plastic or nylon bushings. Bond in place with tab installed for best alignment.

The trim tab for self-steering is a 12-gauge stainless plate 4" x 26" welded <u>only intermittently</u> to the ½" stainless tab shaft which is about seven feet long. Install this on rudder with the small trim tab gudgeons and build-up the tab with microballoons. To get 'balloons to stick, sand tab metal and paint first with bonding resin. Shape tab as part of rudder so that all three sections present <u>one continuous foil</u>. Remove tab and wrap with light fiberglass. Check all parts for alignment problems. Get friction-free articulation.

Helm assembly at right is built to swing off center while in port to allow easy passage through the cockpit. Morse cable has sufficient flex to allow this swing.



Here's where it all happens! The helm is where you and the boat come together - especially this helm. No other sailboat helm has this combination of features: you can sit on either side of it and reach it comfortably from a seat with a high back; you sit facing <u>athwartships</u> so you can see aft as well as forward - see the waves overtaking from astern and see the ocean clear ahead with no obstruction to your vision; you can stand behind it with headroom under the boom; the wheel is at a comfortable height for standing, and from here you can see all the extremities of the vessel - all bows and all sterns and all sails; you can hear the wind working with the sails a sound rarely enjoyed by the helmsman because in most cockpits it is masked by the ruckus of the wake; you can communicate with the crew in both cabins and on all parts of the deck. Whether you're maneuvering at the dock or dodging breaking seas at surfriding speed, you're in control.

When conditions indicate, you can engage the wind vane and disengage the wiggler and sit there and do nothing, wondering why. Or you can check the chart and grab a snack or practice your knots, while the vessel bears you onward in this something-for-nothing ride. But it can cost you dearly if you fail to keep a lookout.

EQUIPMENT

Don't carry too much. The amount of yachting equipment hauled on many modern yachts has the reverse effect of its intention; instead of giving you increased chances for a better, safer trip, it weighs you down with paraphernalia that insulates you from the cruising experience and overburdens the boat. Nonetheless, some equipment is of course essential.

LIFE RAFT

Life raft. Don't go offshore without one. Or along shore, or even out in the bay on a dark night. The high degree of ultimate safety afforded by a good, canopied, inflatable raft - when combined with a non-sinking vessel - is enormously greater than when combined with a sinkable vessel. This is because the raft may be tethered to the stricken mother-ship (be it fire or capsize or collision or shipwreck on a lonely reeftop) so that the crew has access to whatever might remain. And the chances of sighting by rescue craft are greatly increased. To assure that your raft remains tethered to the boat, secure it with a 50-foot painter of ½" nylon line. The chances of the tether chafing through on some part of the boat are reduced by this, and it can even be reinforced with eighth-inch 7x19 wire.

Any situation which could cause the crew to be left clinging to the wave-washed decks of a completely scuttled trimaran, or clinging to the underside of one which has been hit so hard by a freighter or a wave that it has survived in an upturned position (instead of going down) can be met confidently by wriggling into the raft. It's warm if not dry, or shaded if not cool; so you don't just die of exposure. There's a little food in there. You can care for each other and sing songs or tell lies until conditions change and you can get back to the boat for more sustenance.

Unless you're highly skilled at working in the water, you need a self-inflating raft of the Avon or Winslow type. This is not a dinghy - it is for emergency only. For the larger boats, two 4-man units offer more security than one for 6 or 8 men, but at least have one. Even if you just pile-up on the rocks you can take the raft ashore and live in it on the beach. The valise pack is best for stowing in the Searunner life-raft hatches, but the canister pack is better for mounting on deck. In A-frame boats, perhaps the valise is best, lashed into the net. You can lock it below while in some ports.

The confidence you gain from this almost never used equipment will go very far indeed in allowing you to enjoy the whole adventure.

MAN OVERBOARD

Man overboard is the greatest single danger facing ocean sailors. Prevention is the obvious first step, and life lines, pulpits, safety harnesses, etc. are all part of prevention. But they can constitute a psychological weakening of the primary defense - which is HANG ON!

Because of the terrible consequences which can result from falling overboard, some equipment to aid in retrieving the victim is in order. With the paramount standing of this hazard one would think that some truly splendid gadget would have been devised to <u>mark the spot</u> where the man went over. There are many gadgets, but in my opinion none are really workable.

The problem is extreme. A dark night, the boat set up for downwind running, high waves and high speed; how are you going to locate the castaway? Motoring back over the reciprocal compass course being steered when the incident occurred seems the simplest answer. But there you are, dependent on that undependable engine again. And with the engine running, you can't hear a man's cry. So, a <u>whistle</u> in the pocket of every lifejacket, and attached to every crewman's knife, may be the best way to mark the spot.

The boat's own searchlight would be an aid at night, especially if there were something besides the man to shine it on, marking the spot.

In the only man-overboard maneuver I have ever witnessed, the captain - an old Norwegian named Otto - flew into a fit of throwing everything overboard: cushions, hatch covers, clothing, dinghy oars, sail cover, everything he could grab in a hurry. The ocean was strewn for half a mile with clutter from the deck. When searching with a light, there was always something on the crest of a distant wave to spot. The man, floating alone, would have had to be on his crest at the same instant that the vessel was on another crest in order for one to see the other. The rescue was achieved, and much of the clutter was retrieved as well. For this reason I suggest that cockpit cushions, sail covers, dinghy oars and clothing be of light, bright colors. They could mark the spot.

The man overboard float is a common piece of equipment on offshore yachts today, but I consider it largely undeserving of the confidence it seems to instill. These markers can be made of a fishing rod or bamboo pole with a weight on the bottom and a float in the middle and a flag on top. They can be seen in flat water but not when down behind an ocean wave. A light on the top along with the flag is a great aid in sighting, and a small sea-anchor will help keep it from drifting. But the usual installation of these floats makes it difficult to get them overside in a hurry. The light may not function, the flag may not unfold, and it can't blow its own whistle. The castaway would likely have to swim a long way to reach it if the light is supposed to be turned on by him.

Nonetheless, I guess these floats should be required equipment. But so should be the whistles. So should be the man overboard drills and so should be the ever-present doctrine in a sailor's mind - "HANG ON !"

Not just when the wind is heavy and the seas are cresting loudly, but also when the dawn is thin and flat and the boat is dawdling under self-steering and everyone's asleep except for you. You stiffly leave your mound of cushions in the cockpit and venture toward the float stern to take a leak. That's the time you might not think "HANG ON !"

DINGHIES

Dinghies of any description will be found on trimarans, and personal preference determines the choice. My choice is for something with good rowing properties.

The little plastic Sportyak is about all that you can handle on the 25, and a pram-bowed skiff like the El Toro is usually found on all other sizes. Something larger is nice for the 37 and 40 but consider the weight. Better to take two, an eight or nine-foot skiff and a Sportyak, than a big heavy outboard-powered barge. Two dinghies are a tremendous convenience because it allows the crew to separate in port without leaving anyone marooned. A good second boat might be an inflatable one, but they don't row very well. A collapsible punt like the Stowboat is good for compactness s but they row like a football.

A strong painter and a light anchor and a buoyant cushion are essential to a real cruising dinghy. Good oars of the correct length, with strongly installed rowlocks are important, as is fender material attached all around the gunwales. Good soft garden hose screwed all around is satisfactory to keep the dinghy from beating up your topsides, and to protect the dinghy itself from banging against pilings and the like. When you tie it up ashore and leave it, you will discourage thieves and adventurous kids by securing her with a light flexible chain. 1" holes drilled through the oar blades, with the chain passing through and padlocked around a piling, is the way the fishermen handle the problem.

Stowing the dink on board is usually done by lashing it to the side deck; but rugged mounting chocks to hold it firmly, upside down, are recommended for going to sea. We know the dinghy can be smashed by boarding seas and washed over in pieces. The safest place is a similar, very secure mounting on top of the sterncastle. In the 31 it has to fit athwartships. In this position it helps keep the wind out of the cockpit. Hardwood handrails on the bottom are a real asset in getting around the dink on deck.

Running in and out from beaches through surf is no job for any short, fat, ordinary dinghy. If you've got to do a lot of this, get a canoe or surf-boat native to the area.

But it will probably be too heavy for you to take along when you leave unless it is a one-man size. Running surf in a dugout is great sport, but requires considerable skill. Watch the locals closely before you try. A good combination rowing-sailing dinghy of fiberglass construction with foam floatation and a real bow and a small skeg, is a reasonable choice. If you must anchor far from the landing, the sail is a much nicer addition than the outboard motor, and if the thing sails at all it will row nicely.

Dinghies see a lot of work and a lot of recreational use in cruising. And they can be dangerous. If the kids take off in it, insist that they go only to where they say they are going. School them, and yourself, to never lose the oars overboard. It can lead to disaster. And, never lose the dinghy itself. It will take you to remote spots which, without the dink to bring you back, might also lead to disaster. The dinghy is a tool, not a toy. But it sure is a fun and useful tool. Rub-a-dub-dub.

ANCHORS

Anchors come in the same assortment as dinghies, but there's nothing toylike about them if they're any good. Nonetheless, selection seems largely dependent on personal preference. Weight is not necessarily a deciding factor in how well an anchor holds. The lighter the better for all anchors because <u>you've</u> got to pull them up and <u>your</u> boat has got to carry them around. But they've got to be big enough to hold.

Different anchor styles hold in different bottoms. Clean, hard sand or soft mud indicates a style with large fluke area. These types dig in like a shovel, and the more sand or mud in the shovel, the better they hold.

Gravel or small rocks, called a rubble bottom, need something with more of a hook or sharp point than a shovel, but some fluke area is also desired.

Anchoring in big rocks is a matter for almost any anchor. It depends on which crevice between which boulders that the anchor lodges in. This situation is the hardest to break the anchor out of, and the most vulnerable to dragging the anchor if it gets pulled on in a new direction caused by tide or current change swinging the boat. If you've got to anchor in rocks, may as well buoy the anchor at first to facilitate pulling or diving it up. Coral is a similar situation, and the grapnel hook seems to grab on when nothing else will, but these anchorages are precarious and require a vigilant anchor watch to make the boat - and the crew - secure.

Newcomers to cruising often express surprise that anchoring is so often an extremely insecure situation. We cannot include here all the lessons of a primer on anchoring, but let's face it - you've got years of work and lots of money (besides life and limb) hanging on a little hook that is bouncing along the bottom looking for a place to lodge. If it doesn't, you're still under way. If it does, it may easily dislodge and send your ship sailing with no crew. So anchoring is essentially an insecure procedure not to be confused with parking a car.

Whenever possible, anchor in sand or mud, or don't anchor at all. If you can see the bottom, make several passes at the anchorage and pick the cleanest patch you see to drop your anchor on. Consider where the boat will go if the anchor drags. Dragging isn't so bad in a trimaran if you go in on the beach, but avoid, if possible, hooking in upwind of crashing surf on jagged rocks. Don't throw the anchor over with a tangle of line or chain; let it down. Set the anchor with a good jerk by motoring back, or sailing down behind a stern anchor. Always get the boat into a state of readiness for getting under way should the anchor drag or conditions change, and that doesn't mean depending on the engine! If the anchorage is marginal, leave the halyards on and the sails uncovered; lash things down with bows and preplan which way leads out of trouble. Eyeball objects ashore to get a good idea of your position and check often to see if you are dragging. The most likely time to anticipate dragging is right after the wind or current changes and the boat swings. Or after any increase in wind force.

A limitless variety of circumstances makes each anchorage different but the one constant to look for is clean sand or mud. For its weight, nothing holds as well in good bottom as the Danforth type anchor.

It has the greatest fluke area for its weight of any portable anchor. It is easy to stow flat and it will dig into the bottom and then dig in again after being pulled up and set in a new direction by the vessel swinging. But the popularity of the Danforth anchor has been challenged with the advent of the plough anchor. The plough has almost as much fluke for its weight, but a sharp point also. It will grab in rubble as well as sand, and it stands resetting in a new direction without choking up with weeds or clumps of rubble. It is a better anchor for imperfect bottoms, but it doesn't stow as compactly as the Danforth.

Another popular anchor style is the Northill utility anchor. It has a bigger hook - bigger and deeper than the plough - and it even has two whereas the plough has one. It has good fluke area like the plough but with more stuff sticking out to grab onto unfavorable bottoms. It will stand resetting but has the important disadvantage of the extra fluke, which sometimes becomes tangled in the anchor line when the vessel swings over the anchor. This breaks the anchor out by its head and prohibits resetting, so the Northill is not to be trusted in a swinging situation. The plough is best for this.

My choice? All three (plus maybe a small grapnel). I would carry a big Northill, a medium sized plough, and a small Danforth. But any combination of sizes would be good. In a treacherous situation you'll use all three and nobody knows which one will hold and which one won't.

Referring to the 37 and 40-footers, I'd put 300-feet of ⅝" polyethylene line and a boatlength of 5/16" chain on the largest anchor - about a 30 pounder. The big line made of polyethylene will resist chafe better than nylon and, because it floats, it might float over a coral head that would otherwise catch it - and cut it - when the boat swings.

But this is personal preference talking; most sailors prefer nylon for anchoring.

On the medium anchor, about a 20 pounder, I'd have 200-feet of ½" nylon and half a boatlength of ¼" chain.

On the small anchor, a 10 or 12 pounder used for a lunch hook or a downwind anchor to prevent swinging, I'd have 100 feet of ½" nylon and no chain.

For the smaller boats, everything could be reduced one step in nominal size for the 31 and two steps for the 25. The 31's largest anchor would be about 20 lbs. and the smallest maybe 10. The 25's largest would be about 15 lbs. and the other about 10 for a total of two only. The 31 would have ¼" chain on the largest two, and perhaps 200 feet of ½" nylon line on one, 100' on the other. The 25 could have maybe 15' of ¼" chain with 150' of ½" nylon line on the largest anchor only, using lighter line and no chain on the little anchor. All lines should be eye-spliced over thimbles and all shackles wired closed. Some sailors insist that all chain is necessary for anchoring but I contend that 1½ boatlengths, possibly used together at times, is all you should ask the boat to carry.

These suggestions are all approximations and no absolutes are implied. It's a matter of personal preference. But if your preference runs for one step heavier in everything, watch out for a huge accumulation of weight in the ground tackle, and in the boat.

Trimarans are easier to anchor - and hold - than equivalent monohulls because they are light weight. The vessel's inertia, as a swell lifts it up and back, is what yanks the anchor out. So keep her light for a better time at anchor.

LINES

Lines for miscellaneous use in docking, etc., will probably be the pieces left from full 600-foot spools bought for anchor line and running rigging. It is sometimes necessary to be able to assemble extremely long lengths from shorter pieces to anchor in deep-water or tie off to a distant seawall or palm tree to keep from swinging. If you have twice the line aboard that is suggested for anchoring, that should be enough.

Lighter lines are necessary in cruising for miscellaneous purposes. After all the running rigging is done, you should have some 20' - 50' hanks of small stuff like ¼" and 3/16" polypropylene braid. And a ball of tarred marlin and a spool of heavy seine twine will come in handy. It's amazing how much line gets consumed by little applications in a cruising boat.

Miscellaneous items of boating gear, like the mop and buckets and fenders and a boathook and a horn and a bell and flashlights and flares and life jackets and fishing stuff and diving stuff … now there's one that we should stop on. I was going to say that the miscellaneous items don't really bear specification because of space and personal preference. But even if you're not a skindiver you should consider learning to use swim fins. I consider fins to be eminently more useful than life jackets. A real sailor is not afraid to get into the water, and if he's got some fins handy, he can perform in the water with much added power. Tasks like retrieving anchors or objects dropped overboard require diving, but many other operations can be performed on the surface. Use fins for swimming lines out for mooring when it's too rough - or there's not enough time - to launch the dinghy. Or even for swimming out an anchor when you've drifted ashore by accident. Fast action by a strong swimmer could save the boat (and he'll be much stronger with fins). But you'll need a float - like a big fender or a bunch of life jackets - to hold the anchor up until you want to drop it, preferably by releasing a snap shackle. Wearing your own life jacket at such times is wise unless you have to dive. What I'm saying is that a good pair of swim fins handy to the cockpit can be more useful than a big engine when you're sitting on the sand.

MEDICAL SUPPLIES

Medical supplies for cruising is a subject for your doctor. But it is likely that you will take much more than you need. Trouble is, you never know and paranoia sets in. Because the stuff isn't really heavy (unless you get ridiculous) then may as well take whatever makes you feel safe.

There are a couple of books - Merck's Manual and The Physician's Desk Reference (PDR) which will make you feel safe if you can understand them. They give all the dosages, etc.

Mostly you'll need band-aids, gauze bandages, burn medications, laxatives, diarrhea treatments and seasick pills.

Current feeling is that use of stitching stuff or sutures should be avoided, substituting butterfly bandages or other means of holding a bad cut closed.

A supply of oral, long-lasting antibiotics is in order; even injectable stuff if you have a refrigerator. But don't displace all the food. To fight a bad systemic infection or something like appendicitis, they say to poke 'em full of pills and hang on until you can get trained medical attention. Don't mess with a big deal operation if you can control the infection.

And the pain. Most of us fear pain tremendously and the stress of fear aggravates the cause. So pain killers are in order. Aspirin or super-aspirin is probably all you'll ever need; but for real far-off passages into remote parts of the world, injectable morphine is thought by some to be the best pain killer. Even though it has legal complications, it gives fewer physiological complications than the substitute injectable pain killers.

Probably your most serious medical problems will require no more medication than you keep at home, except for stomach trouble. In low-latitude countries they have a marvelous Swiss drug called "Entiro Vioformo" which puts the skids on the runs better than anything, unless you've got something worse than Montezuma's Revenge.

Ask for local information to solve a local problem, always wear shoes (at least sneakers) and watch out for the galley stove and sunburn.

TOOLS

If you have built your boat, you will by now have accumulated quite a bunch of tools. You can take them all, including a generator to run the electric stuff, and that will do it. One might think. But the weight of tools and machinery can cause more problems than the implements will fix, and you probably won't have what you need. It is folly to consider electric tools as necessary for cruising because it is folly to depend on the generator. Plan your cruising toolbox for minor boat repair and maintenance, not for boat construction. Or reconstruction. If you have a major wipe out you'll have to depend on what you can get locally, including electric tools, more than on what you've got on board.

For onboard tools, get substitutes for electric tools. Get a good egg beater type hand drill of the that will drill a ⅜" hole in steel. Take two small sets of bitts and a small hand crank grindstone to sharpen them. Two good rattail files will allow you to enlarge a ⅜" hole to any size. And take a brace and bitts for larger holes in wood. Get a keyhole saw to replace your saber saw, and a good sharp handsaw to replace your skilsaw and table saw. The hardest electric tool to replace is your disc sander: get some good rasps and files and a heavy duty paint scraper; take a small supply of wet-dry sandpaper in various grits, and some emery cloth. You'll also need: a hatchet and a plane and a few good chisels; galvanized bailing wire in three sizes; a variety of tapes including that fiberglas reinforced stuff; nails, screws, bolts, washers, etc. Obvious basic hand tools. You'll need a small, portable vise.

The engine will likely require more maintenance than any other item on board (which makes dependence on it sound risky) and the tools for engine maintenance are heavy. Don't take tools for engine rebuilding - just for maintenance. A few spare parts for the ignition system - or the fuel injection system - is all you can carry.

If you're a real mechanic who prides himself in his ability to make anything, your attachment to your tools can literally ruin your trip. For this part of the operation is different from building. This is the using-what-you've-built part of the project. For maintenance, you'll have to depend on what's in your head and your hands more than what's in your shop at home. The experience is very rewarding. Seldom is a boat really incapacitated for want of a torque wrench, especially if it's got sails. Aren't you trying to get away from all that stuff?

Care of tools afloat is complicated tremendously by seawater. Keep the saws and files well coated with oil and wrapped in plastic. All other steel tools will need periodic de-rusting and lubrication. If you cruise for long enough, seawater will get <u>everywhere</u> inside the boat so nothing ferrous is safe. Only vigilance will keep your hand tools worth carrying. And not even vigilance will save the electric ones.

If there's one electric tool worth carrying it would be a good ⅜" drill motor. Fairly fast. A dinky sanding disc to fit, and an assortment of paper (well sealed in plastic) may aid in making repairs when you can get power to the boat or the broken piece ashore for plugging in. But to hope to generate the juice on board is asking a lot of the generator (likely it will be what needs the fixing) and it's asking a lot of your boat to carry it, plus all the other electrical machinery you will suddenly "need" if you have a generator. 110 volts was a tremendous convenience while building the boat, but 110 pounds - or maybe 220 pounds with tools and generator and fuel combined - will be a tremendous burden if you try to take it with you. You've surely had enough of that plug-it-in-the-wall-and-see-it-go syndrome for awhile.

SPARE PARTS

Spare parts is another group of equipment which I contend is usually overdone. There exists among modern sailors a belief that they should be able to fix <u>anything</u> on the boat. Does that mean carrying all the facilities used in construction, and replacements for everything he didn't build himself?

If you mash-in a fender on a motor trip, it would be nice to repair it to original condition. But if there is no body shop around, should you have a spare fender on hand?

The vehicle will likely continue to function with the mashed-in one simply mashed-out again, or with no fender at all. Even autos carry a spare tire though, you'll say. But you can sail a boat with no boom. No steering. No engine even.

No doubt about it, you'll need some spares though. Shackles and blocks and wire and line are expected to break or wear out once in a while. Stuff for jury rigging like clamps and scraps of wood and metal will come in handy. But you can often pirate a part from a less important place to fix a more important failure.

A little fiberglass - no more than a gallon - and some scraps of matt and cloth is all you need for minor repairs. A little paint; not enough for repainting. Major repairs will have to go jury rigged until you get the stuff to fix it right. You can sail a long way with a big hole patched by a floorboard nailed on over it and sealed with Life-Calk, or margarine-soaked rags. So you've got to pump once in a while. That's better than carrying a boatyard around all the time.

You'll need enough spare wire to replace one halyard, and some short hunks of larger 7x19 for jury-rigging. In case of dismasting you can almost always get the boat to sail with half a mast and the sails hoisted up clew first, if the boat is light. The S&F Nicopress tool, a pair of good wire cutters, and several spare Nicopress sleeves of several sizes will give you good re-masting potential. The real seaman, like the real woodsman, learns to do with what he's got.

NAVIGATION EQUIPMENT

Navigation equipment will be added to the boat as the sailor's knowledge of the subject requires. If you've never sailed, you don't need a sextant because an offshore passage in a new boat with a green crew is no fun anyway. Stick around the coast and learn the basics of "where you're at" before getting sophisticated.

This is not a treatise on navigation; but some basic navigation equipment is part of your outfitting. Before launching the boat you should gain some knowledge of local water and have a chart for everywhere you might sail when the boat is new. Don't even go for a joy ride without a chart. The local power squadron courses or some formal training is desirable. A good book on the subject will help but navigation gets dull without the practical component. Navigation gets very interesting when you're lost, and you can get very lost in your own harbor.

Probably the best piece of beginner's navigation equipment is the hand-bearing compass. Practice with this, in conjunction with your boat and your chart, will give a keen awareness of the navigational aspect of sailing. The great single handed world voyagers like Slocum and Chichester and Knox-Johnston all consider the navigation to be the real achievement of their voyages. It is a beautiful, pleasureful endeavor that relates a man to his surroundings in a universal way.

The boat's own steering compass is the primary navigation tool however. An array of styles and prices and mounting arrangements are possible, but don't go to sea with a cheap, small, hard to read and poorly-lit compass. The smallest suitable instruments for Searunners have an apparent card diameter of 4".

Mounting the compass in Searunner cockpits isn't easy. Most serious offshore boats end up with an integral bulkhead-mounted unit on each side of the forward hatch. External bulkhead mounts should be arranged with something beneath the compass to support it very firmly - so it can be walked on! Integral bulkhead mounted units cannot be easily put away in port and may be vulnerable to theft. One suggestion has been to mount a single unit in the lowest drop-in hatch door. Now, when sailing offshore, you've always got the lower door in place; not a bad idea should a freak wave jump into the cockpit. A spare lower door without compass is used for locking up the boat, and the compass. A small spare compass mounted near the navigation area down below is a necessity, and a telltale compass near the skipper's bunk will help keep check on the helmsman, or the self steering vane.

Years ago I had a surplus lifeboat compass that we used in *Moondog* (ex-*Juana*) on that first trimaran voyage down to Mexico. The instrument has long since succumbed to the tamperings of my curious sons, but the instructions for correcting compass error have survived. They were inscribed on a plastic card affixed to the instrument, and I always keep this card in my navigation stuff. Because so many inexperienced sailors shove off with lying compasses, let's consider "swinging the compass" a part of outfitting, to be performed immediately after launching, and before every cruise. This lifeboat method can be done at sea without any instruments also.

HOW TO FIND AND ADJUST NORMAL COMPASS ERROR

First, stow <u>all</u> iron and steel items in seagoing positions.

To find error using SUD, moon or star near the horizon; suppose sun is rising and com pass is mounted. Head boat west by compass; and the sun is bearing, for example, 70 degrees by the compass. Head boat east by compass and suppose sun bears 100 degrees. Added together these give 170 degrees, half of which is 85 degrees, the correct bearing of the sun at that moment.

Now suppose you want to steer SW: head boat 225 degrees by compass and take sun's bearing. It now bears 65 degrees, but should bear 85 degrees, indicating a 20 degree compass error. Thus, card is turned 20 degrees too far right. To offset this, steer 20 degrees left, or 205 degrees by compass, to make good 225 degrees, your desired direction.

Error can be found for any desired heading by above method. To adjust error proceed as follows in order given:

1. Bring adjusting controls (buttons marked N-S and E-W) to neutral with slots vertical and letters right side up.
2. Find error on north heading by above method. Then swing <u>north compass point</u> to forward lubber line by turning N-S control with brass key as needed.
3. Find error on east heading by above method. Then swing <u>east compass point</u> to lubber line as needed to eliminate error, turning E-W control with key.
4. Find error on south heading by above method. Then swing <u>south compass point</u> toward lubber line as needed to halve any existing error.
5. Find error on west heading by above method. Then swing <u>west compass point</u> toward lubber line as needed to <u>halve</u> any existing error.

REPEAT ABOVE AS A CHECK. BEST POSSIBLE COMPENSATION HAS BEEN ACHIEVED.

RADIO

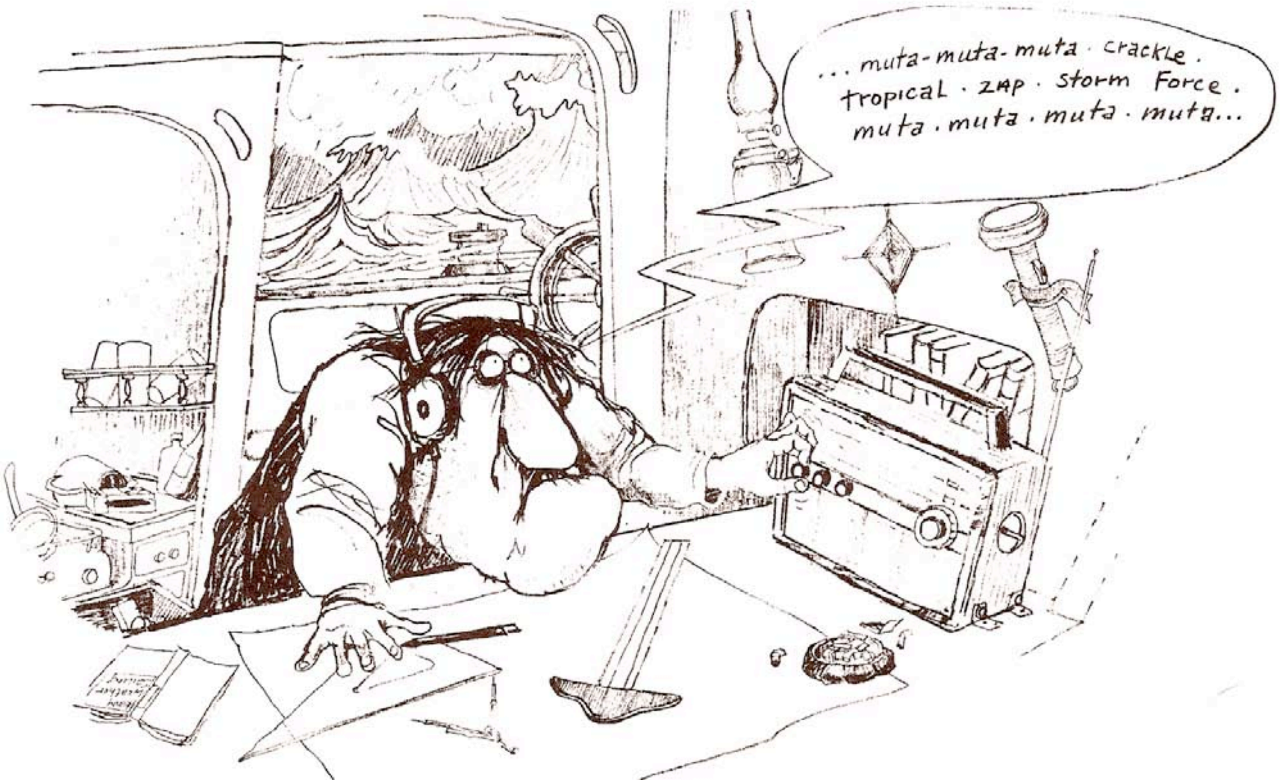
Radio equipment is a matter of preference, but if you have no background in sailing or in radio, don't put too much stock in radio telephones or radio direction finders (RDF). The latter is an important piece of gear, but radio bearings used for navigation must be used strictly as a <u>supplement</u> to other lines of position or to dead reckoning. The RDF will lie to you with authority depending on weather conditions and interference from the boat's rigging. Often a little portable radio, used for going to the beach, can be held outside the rigging. It may give a truer null on a distant station than will the RDF in the cabin. You do need an RDF, but you, can believe it like you can believe the newspapers. Go to other sources for the whole scoop.

The radio-telephone is thought by many serious radiomen to be absolutely worthless if you're using it to call for help. Its short range and high power drain give it huge limitations for distance cruising. Most alongshore yachtsmen use it for talking to each other or making phone calls. First thing you know they've run out of gas or broken a rudder and there they go, calling the Coast Guard. Well enough, but without the radio perhaps they would have had more fuel aboard or learned to sail without the rudder. And how can one take refuge in the fact that there is a transmitter aboard while knowing that they are probably less dependable than engines.

For calling help, many cruising boats carry emergency transmitters, sometimes available surplus, which broadcast distress messages on the distress frequencies usually monitored by ships and aircraft. If you want a radio for safety, that's the one to get.

Unless you're really into communications as a hobby, like copying code and listening to military weather broadcasts etc., minimize the radio's importance.

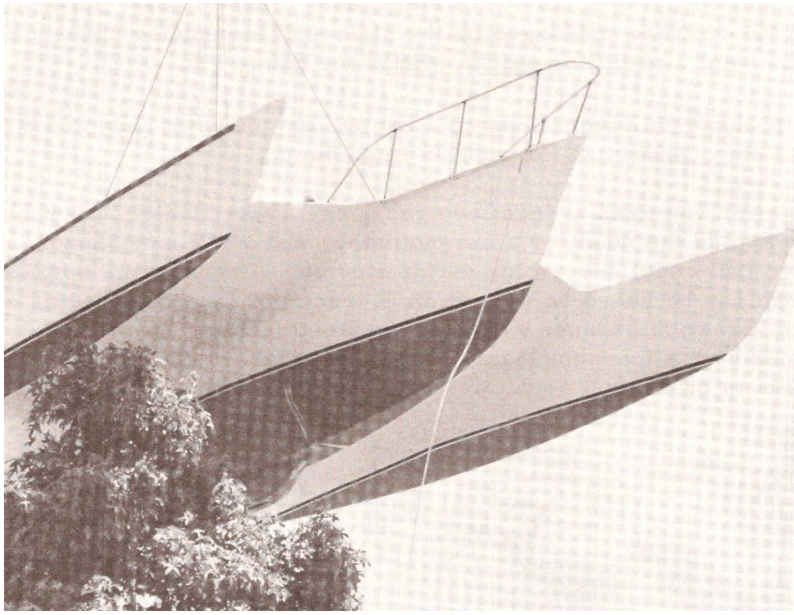
For celestial navigation you need at least two receivers aboard which will receive the time signal stations. This avoids the need for a chronometer, and WWV now broadcasts world weather information in voice (not code) describing major storms. The marine operator for the telephone system ashore can be heard on your RDF receiver if you're sailing coastal U.S. waters. It's a one-sided conversation because without a radio-telephone transmitter you can't talk back to her. But she does give a frequent local weather fore-cast. I don't think you need anything else for your introduction to cruising. Sophisticated radio gear can be added later if the need is apparent.



DEPTH SOUNDERS

Depth sounders are perhaps the most attractive pieces of equipment to add first to a boat that is otherwise free of black boxes. The current drain can be minimized by turning it on only when really needed. Be-cause radio bearings are so often inaccurate, the depth sounder is a valuable supplement to finding your way in poor visibility. Mariner's charts show soundings; if you know the depth below your boat to be, say, six fathoms, and that agrees with your radioed educed position, you've got more reason to believe the radio. If it disagrees radically, you don't know which instrument to disbelieve, because they can both lie with the voice of authority. Nonetheless, if you're lost and can't see but suspect the area is dangerous, the sounder might at least tell you to go the other way. The safest way out of shoaling water is right back over your incoming course.

Because the sounder is just another black box to go on the blink, it is no substitute for a good sounding lead with a well marked line for taking manual sounding.



LAUNCHING

It's really going to happen isn't it! All that money and all that work. Those rich fantasies of how it's gonna be after you put her in the water. You've been working with a single-minded diligence toward a conclusion that now looks like a commencement instead.

Many builders experience a reaction to launching - or the approach of launching - which we call the post-natal blues. It comes naturally from a man's reaction to creating something nearly alive, and then realizing the nature of his commitment. It's out in the ocean with you now!

The threat of that prospect won't be quelled until you realize that sailing it will be accomplished with exactly the same approach as building it; you do one part and then go and do the next. What you've done already will get you doing what comes next. Because building a boat is an achievement, friend.

Go on, admit it. You're pretty special and a lot of other people are standing around wishing they had done what you have done. And wishing they could do what you are going to do. This is no time for the blues. Break out the champagne! Who do you suppose they're drinking to?

Launching preparations are nothing new - just more hard work. But this is it now. We have seen that virtually any launching predicament can be solved no matter whether you build in a boatyard or a hard-rock mining town in the heart of the Rockies. The boats are bulky but they're not heavy. A little savvy and some simple equipment will get the cradle jacked up high enough to back a trailer underneath. Don't get too much help. Two hydraulic jacks and a good supply of blocks and maybe two other guys. Two who will understand if you start coming on like Hitler or the mother of a newborn. Position the jacks and blocks so that the boat cannot fall. Test for stability as the load gets high and think about what's happening at the stern when you jack up on the bow. For big boats you can hire a house-mover who has insurance.

Launching by dunking the trailer down a ramp is usually the cheapest and probably the safest. Except that you must consider the tide and re-pack the wheel bearings of the trailer if it is dunked in seawater. Launching by crane is a more costly alternative. The crane-lift bridle in the plans is better than using slings around the hull.

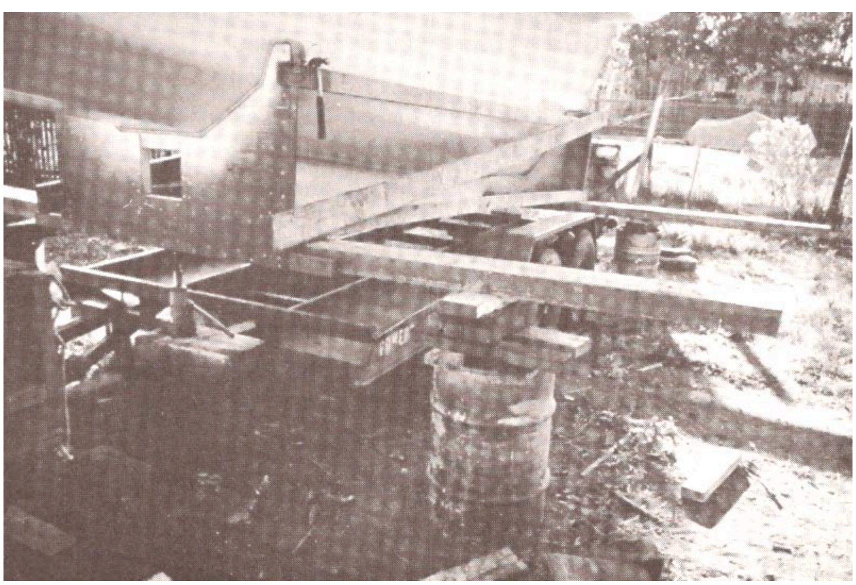
If slings are used, locate heavy padding at the points where they lay across the edge of the decks and wings. Be sure to tie a stout line from one sling to the other - under the wings on each side - to insure that the forward sling cannot slip off the bow. Failure to follow this has caused trimaran tragedies.

Surf launchings are discouraged because the drama can get so strong. Who wants a shipwreck at the launching? But if you must launch from a beach because of no alternative, use the tide to save you trouble. At the lowest possible tide, drive the trailer down to the water's edge using planks under all wheels of all vehicles all the way. Organize the project so that the boat can be unloaded and left sitting on the sand and all vehicles cleared away as the water rises. A towboat or heavy anchor offshore should do the rest. Don't try to back a trailer over wet sand right into the surf because the tires will bog down instantly.

A well organized launching is much preferred to a slapstick fiasco. Your newborn deserves a clean start. Boats with minikeels can be launched and hauled out and transported with the real weight of the vessel resting on the minikeel. Shoring-up under the floats or under the wings, at the main-strength bulkheads, is all that is necessary to keep it from toppling. Marks in the paintwork to indicate the exact position of the main-strength bulkheads will be a convenience in hauling out on a marine railway.

Boats with no minikeel are dependent on a form fitting cradle to support their weight <u>at the frames</u>. If you go cruising, you may have to build this cradle yourself in order to haul out at a distant facility. Keep the main hull pattern sheet on board in a plastic bag to aid in building this cradle.

It is a good idea to make deep scratches in the fiberglass (above the water line) to mark the exact positions of the frames which will receive the cradle. Make the scratches with a three cornered file before painting the boat so you can see the fasteners at those frames through the fiberglass. Painting over will hide the scratches unless you're looking for them someday way down the road. The position and fit of the cradle can be critical in the larger, heavier boats as haul outs could damage the molded chines if the weight is not taken at the frames any frames. This is one more good argument to favor minikeels. You can haul out anywhere on any marine railway trolley without a cradle.



The 31' A-frame is tricky to jack up because, without the floats attached, there is nothing handy to hold the hull up while backing the trailer under. In fixed wing boats you can block-up under the floats leaving the main hull clean. With the cradle on the trailer, you just back it under the main hull; jack the cradle up and lift the boat to remove the drums under the floats, and then jack the whole works down onto the trailer. But with no floats to block up under, you need two very husky timbers (as in photo) under the cradle. Block up the timber with drums spaced wide enough apart to allow the trailer to pass between. Note diagonal braces on cradle. This trailer is an automobile or equipment carrier often available for rent. You can pull it with a pickup or flatbed truck with the <u>stern</u> of the boat overhanging into the bed of the truck.

TUNING UP

Step mast from crane or other high vantage (or see Mast Stepping section).

Secure sub-forestay and lower-shrouds first. Set them snug and get the stepping-line off. Mast will stand alone with this rigging only (if water is calm).

Trim boat at dockside by getting all but one man off the boat so that it is resting level on its lines.

The one workman should stand at the mast while two others sight the mast for him - one from abeam and one from ahead or astern.

By adjusting the sub-forestay and lower shrouds, the mast can be set vertical. No rake. The 31'er may require a slight rake to balance helm.

Each sighting man should be at least one boat length away. He can drop a plum bob (or a tape measure) in front of his eye to sight the mast vertical, with the lowers snug.

Now set the intermediate shrouds snug also. Sight up the sailtrack by putting the side of your head directly against the mast. (Was the sailtrack installed straight? If not, sight-up the leading edge of the mast.) <u>Without altering</u> the lowers, the intermediates should be set so the mast is straight as far up as the upper spreaders.

Set up the headstay and back stay so that they are slack - almost sloppy. Sight the mast to see if one or the other is pulling the mast forward or aft. If so, slack the offender.

Set-up the upper shrouds tight (about twice as tight as snug). Sight the mast to see that it is straight.

<u>Without altering</u> the lowers or intermediates, adjust all uppers to make the mast straight. Tighten back stay and headstay little-by-little, both-at-once, until they are <u>very</u> tight (they should sing when you slap them with your fingers) while keeping the mast straight - both fore’n’aft and laterally. If middle of mast bends forward, tighten the head stay more. If the middle bends aft, tighten the back stay more.

When the tuning of this standing rigging is complete, the mast should be straight with the degrees of tautness graduating from snug for the lowers to tight for the uppers, with headstay and backstay <u>very</u> tight; tight enough so that when a man standing on deck grasps the headstay and yanks aft on it, violently with all his weight, it will yield only 2 or 3 inches.

Set up the forestay by splicing it in place now, with a Nicopress splice at the large pelican hook. Determine the length so that (without the running backstays) the forestay pelican hook can barely be closed by a map squeezing with both hands. This will bend the mast slightly forward at the upper spreaders.

Then make up the running backstays by splicing in place with Nicopress splices so that one man is just strong enough to throw the levers with one arm by leaning out of the cockpit. Some length adjustment at the runners is necessary. The first lever will be easy to throw because it will pull the mast toward that side. The second lever will be the hard one; when both are tight the mast must be straight in both directions, or bent slightly aft at the upper spreaders. Releasing the forestay pelican hook will not be possible until the backstays are slackened.

For sailing trials, choose a mild day. Do not sail first trial in winds over 15 knots!

FIRST check all turnbuckles for missing cotters or slack lock-nuts. Bend cotters only slightly, as some turnbuckles will need adjustment. Take your time. Be relaxed. Wait until tomorrow if you've done all the above in one day. One small oversight can cost injury, or damage, or money.

Let's say your first tack is the starboard tack. Reach-off gently with the sails set on a luff and sight the mast. While the helmsman sights the mast, the crew can pull in the sheets gradually until the boat is close-hauled OR until the helmsman sees the mast is bending. Under no circumstances should the mast be allowed to bend laterally as much as its own width, or bend fore'n'aft as much as its own breadth.

To tune-out bends, mark the shrouds which need tightening by sticking on a flag of masking tape; and now come about.

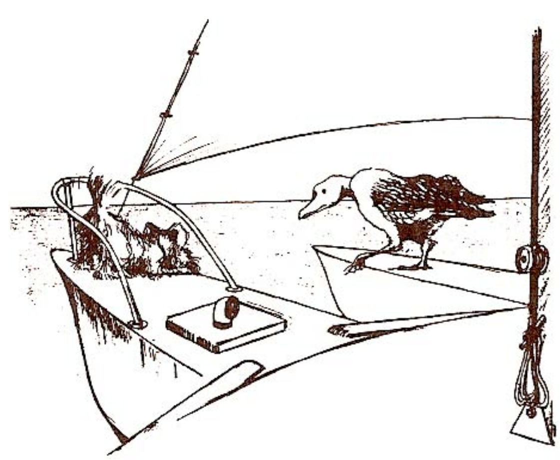
On the new tack follow the same procedure as before, coming up into the wind gradually while sighting the mast. Fall off the wind and mark the turnbuckles which need adjustment. Now, adjust those marked on the previous tack. Come about again and adjust those marked on the second tack. Repeat this procedure until the mast stands straight sailing close-hauled on both tacks.

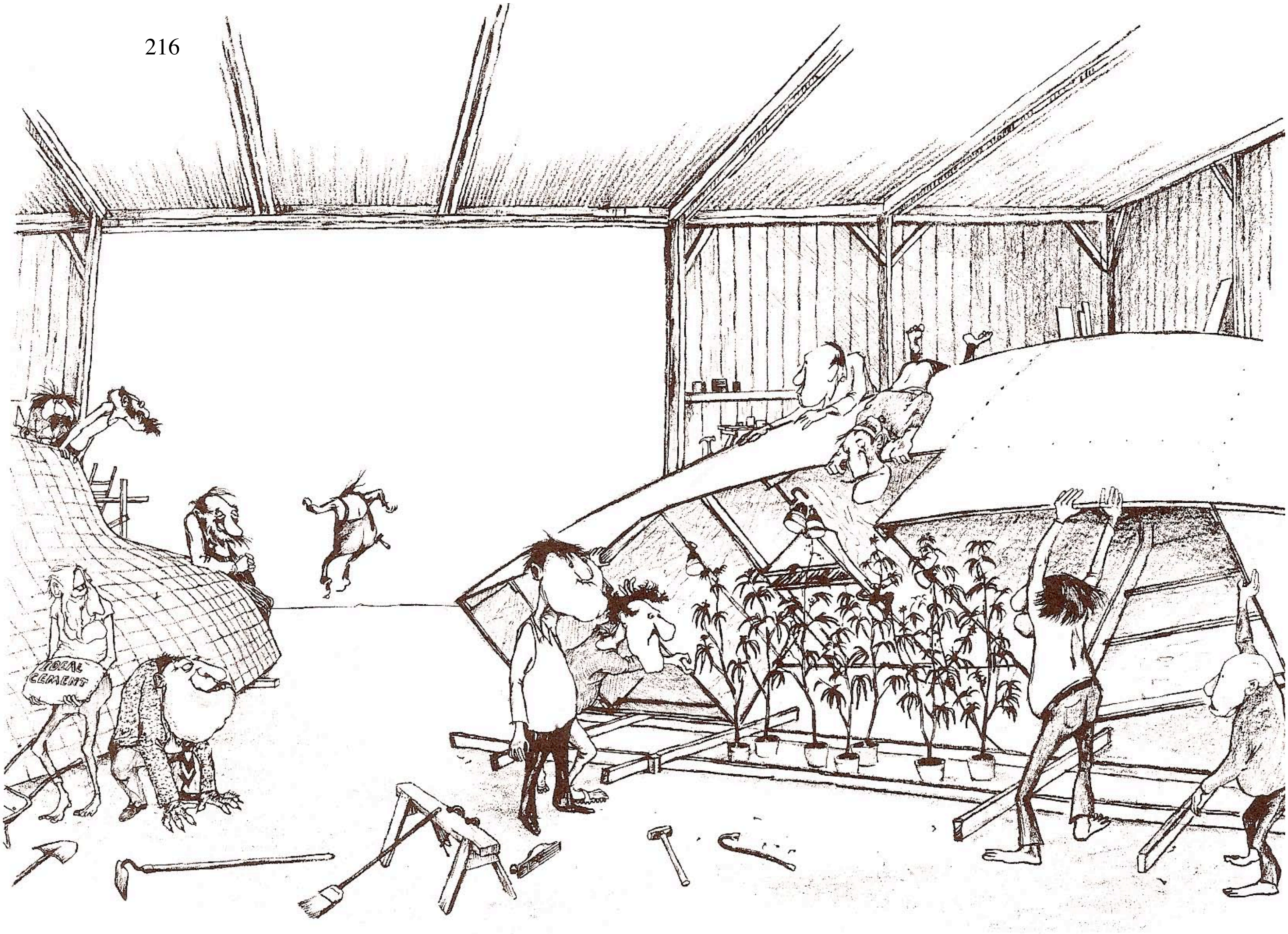
With good turnbuckles (not galvanized) it is possible to tune the windward rigging without coming about. The usual adjustment is to tighten the upper shrouds more than one would imagine; keep the masthead from bending off to leeward. In the end, they may have as much standing tension as the headstay.

In later trials, be certain to continue tuning each time the boat is sailed in harder winds than it has known before. The object of this tuning is to get the mast to stand straight when the boat is being driven very hard to windward in 25-30 knot winds. If the rigging is tuned for that stuff, the mast will not bend enough to matter at any other time.

Cutters commonly carry a slight lee helm in very light airs with the genoa. If this does not turn to slight weather helm as the wind increases above 5 knots, then make sure the centerboard is down to the three-fourths-down position.

Or, rake the mast aft a little. Very little rake (like three turns off on the head stay turnbuckle) will usually generate weather helm. To allow for this adjustment, the builder may wish to postpone setting-up the forestay and the running backstay until after the desired rake is determined. The forestay is not provided with turnbuckle adjustment; once the wire is spliced at the pelican hook, raking the mast may require a new forestay.





GOOD TRIP

Good trip or bad trip, happy ship or sad ship; which will it be? You'll find your answer somewhere between profundity and profanity; probably with a sampling of each. Good-bad; happy-sad; profound-profane; well prepared-overloaded. These are all sort of synonymous pairs of opposites.

By now the reader is surely dulled by my recurrent volleys at the trimaraner's concept of weight. But I've been leading up to something: a trimaran is a very forgiving kind of vessel. It will tolerate badness and sadness and profanity or insanity, and still give a guy a good trip. But one thing it cannot forgive is overweight. It simply cannot. Like a monkey cannot be toilet trained because it has no sphincter muscle, the trimaran cannot he overloaded because it has a narrow bottom. If its hull were twice as wide, it would respond less to additional weight because of its already bloated underbody. It would also respond very little to the other forces in its environment which might give it grace and motion. But if it has a narrow hull, and all the other shapes and sizes that go to make it into something like a Searunner, then the quickest way to kill the nearly-living creature you have built is to pile on a lot of plunder!

Freud theorized that our modern psychological equivalent of excrement is money. Most trimaran owner-builders have to scrimp and save and borrow to complete their projects, and the chance of overloading is thereby reduced. But the guys who can easily layout a lot of loot are often the ones who drag their transoms across the ocean.

It's not just affluence that is the cause. Motorcycles in the floats and twice the tankage in booze is involved alright. So is a great big engine and enough hometown food to rescue you from ever shopping in another language, or getting stuck with unfamiliar brands. But the results of that approach are predictable. It will obviously send you off flapping your wings against the wave tops.

The sneaky part of overloading is the part disguised as "safety." The superfluous equipment and tools and spares come aboard, dollar by dollar, because one of these and two of those will "increase your chances for a better trip." A lot of it is bought because using it would be fun, but the underlying motive is: if you can afford it, you won't feel safe without it. The manufacturers are well aware of this phobia and some design, and advertise, to meet this market.

So, the extra weight of spares and tools and yachting equipment is the prime offender. So are books. Cruising people trade their books and charts; you don't need a large library. But how are you to know what items are extra? It has been wisely suggested that necessary items be specified. "Tell me exactly what I need…" This has been done in this publication within the limitations of a book about construction. And within the limitations of one writer's experience.

However, one thing wrong with the Searunner series is that the boats are too highly developed. The builder is too locked-in to the plans and specifications. They are over-determined. And if I ever draw another backyard boat (that is if my wife will ever let me) it's going to be very loose.

If there's another thing wrong with Searunners it is that they won't safely carry the weight that is being loaded on them. To this extent, the designs do not meet the ultimate requirements of the clients. The designer's only defense is to say that the client is trying to do too much with a boat of a given size.

The physical trimaran has only one inherent feature which makes it less than perfect. It is an Achilles heel which will not bear weight - the under-wings. On windward courses, and sometimes reaching, they will pound. They can bang distressingly on the crests. All the extra little things you've brought along can now add up to ruining your trip. It's hard to realize that a gallon of vinegar weighs just as much as a gallon of bilge water. You can sink a ship down just as deep by adding cargo to its hold as by adding ocean to its bilge.

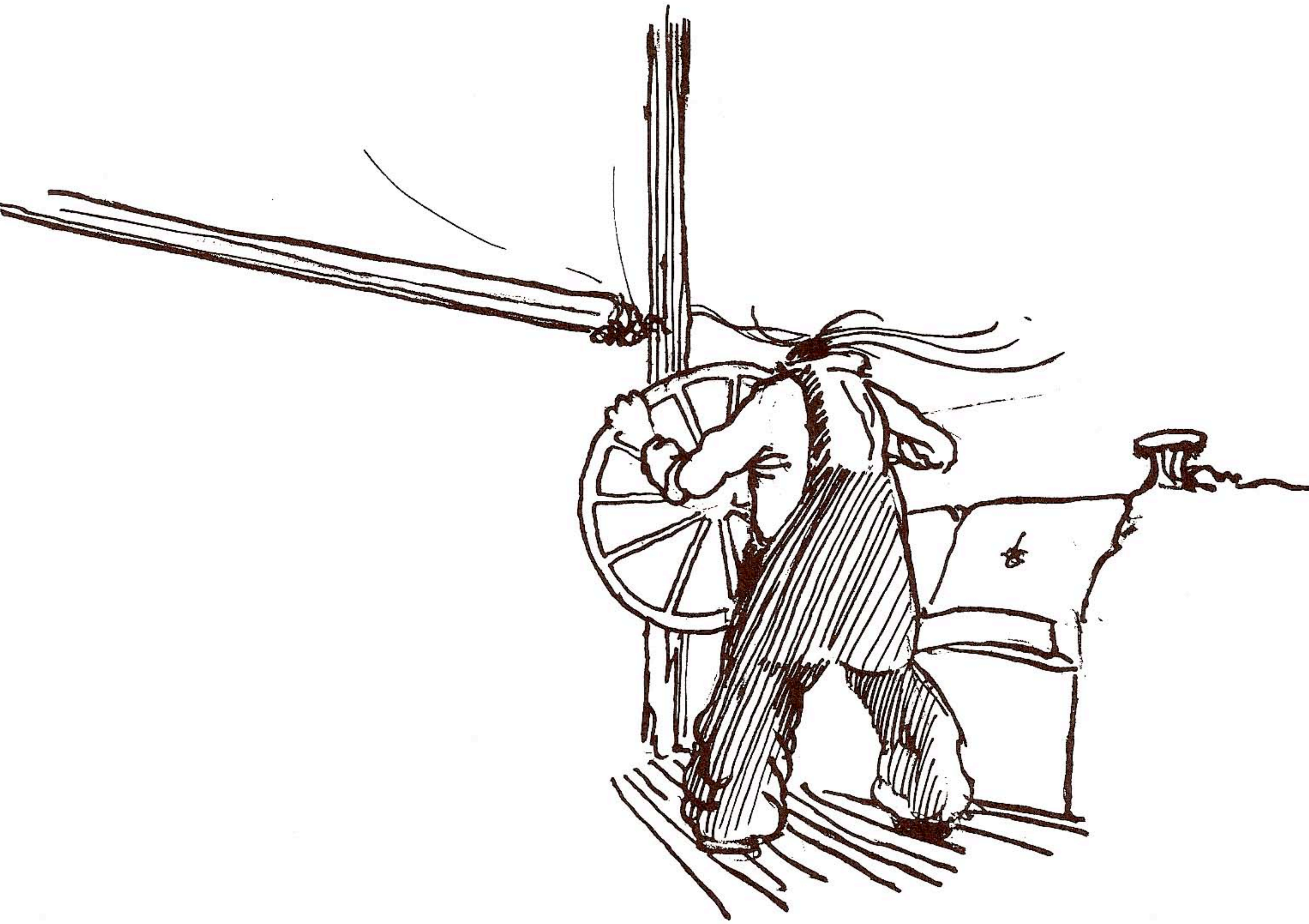
Yet I believe that the conflict between preparedness and overweight is more philosophical than physical. Modern man's dependence on equipment and tools for his survival has burdened him with much pedestrian plunder which has little use afloat. A wish to be liberated from this burden is surely prime among motives for seafaring. And it can be absolutely liberating.

But behavior patterns aren't easily adjusted. Going from landsman to seaman leaves us clinging to the crap we are trying to expel. The sailing outrigger ill-befits this modern mania for things. The ancient Pacific people whom we credit with the outrigger concept used feathers for money, and their idea of things was more for doing things than having things. They were on a good trip.

By contrast, modern man can place unprecedented emphasis on the acquisition of belongings. If he would wish to take good trips in sailing outriggers, that pattern must change.

And it is changing. A whole new generation of men and women are moving about the earth unencumbered by the tools and equipment which their forebearers, and their parents, have used to shape the very world they move in. Backpackers and surfriders and tri-sailors are really getting out there, doing things more and having things less. It is this philosophy which suits the modern trimaran and without it the modern trimaran would be just another ancient concept.

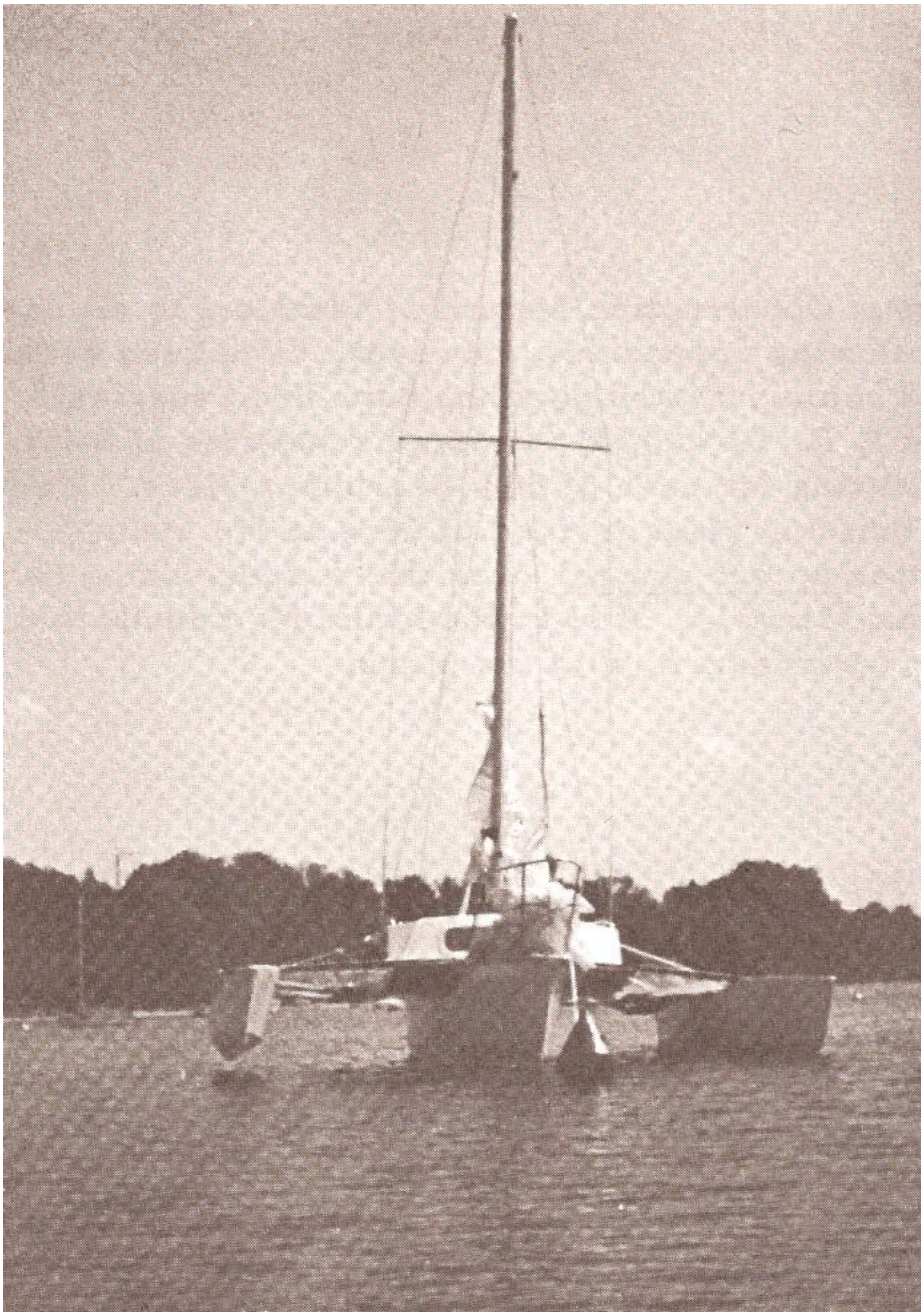
The trimaran's place in the modern world is with people who wish to extend their liberated way of doing things right on out to sea. The only way to really go trimaran is to go light, and have a GOOD trip.



APPENDECTOMY

This printing of your Construction Manual is identical to all earlier editions up to this page. The following appendixes, however, have been rebuilt to include some new material, and some outdated portions have been surgically removed. Formerly, Appendix numbers I, II, III and IV contained schedules of Sails, Rigging, Spars, Materials and Outfitting for each of four Searunner sizes. This information is now included with the building plans instead of here in the Manual. The new format gives us much better update control over these items which have a way of changing faster than we print Manuals. It is to the builder's benefit that these schedules can now be made contemporary with his plans.

For those of you who are using this book for general reference while building something other than a Searunner, don't worry. You're not missing anything big; all general aspects of sails, masts, rigging, materials, etc. are covered earlier in these pages, and your own plans should contain the specification schedules for your own boat. Those old appendixes, as far as Searunners are concerned, had become a vestigial thing. We hope that you agree that the operation was a success.

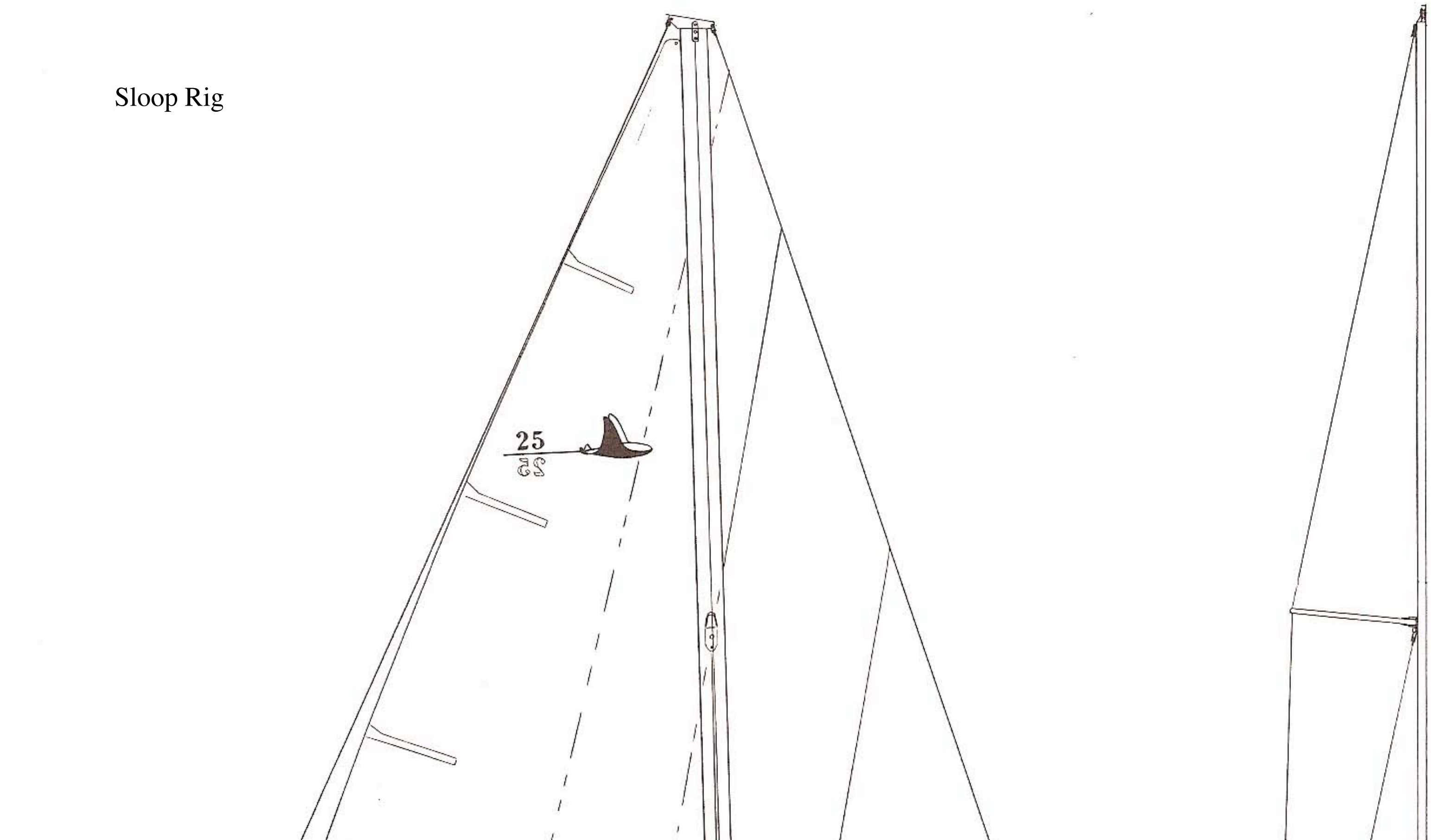


Aside from ocean crossings and continent crossings, the 25-foot Searunner is enjoying that special kind of sailing found only in Alpine lakes. This photo was received by the designer as a color postcard with the message “Greetings from Bavaria.”

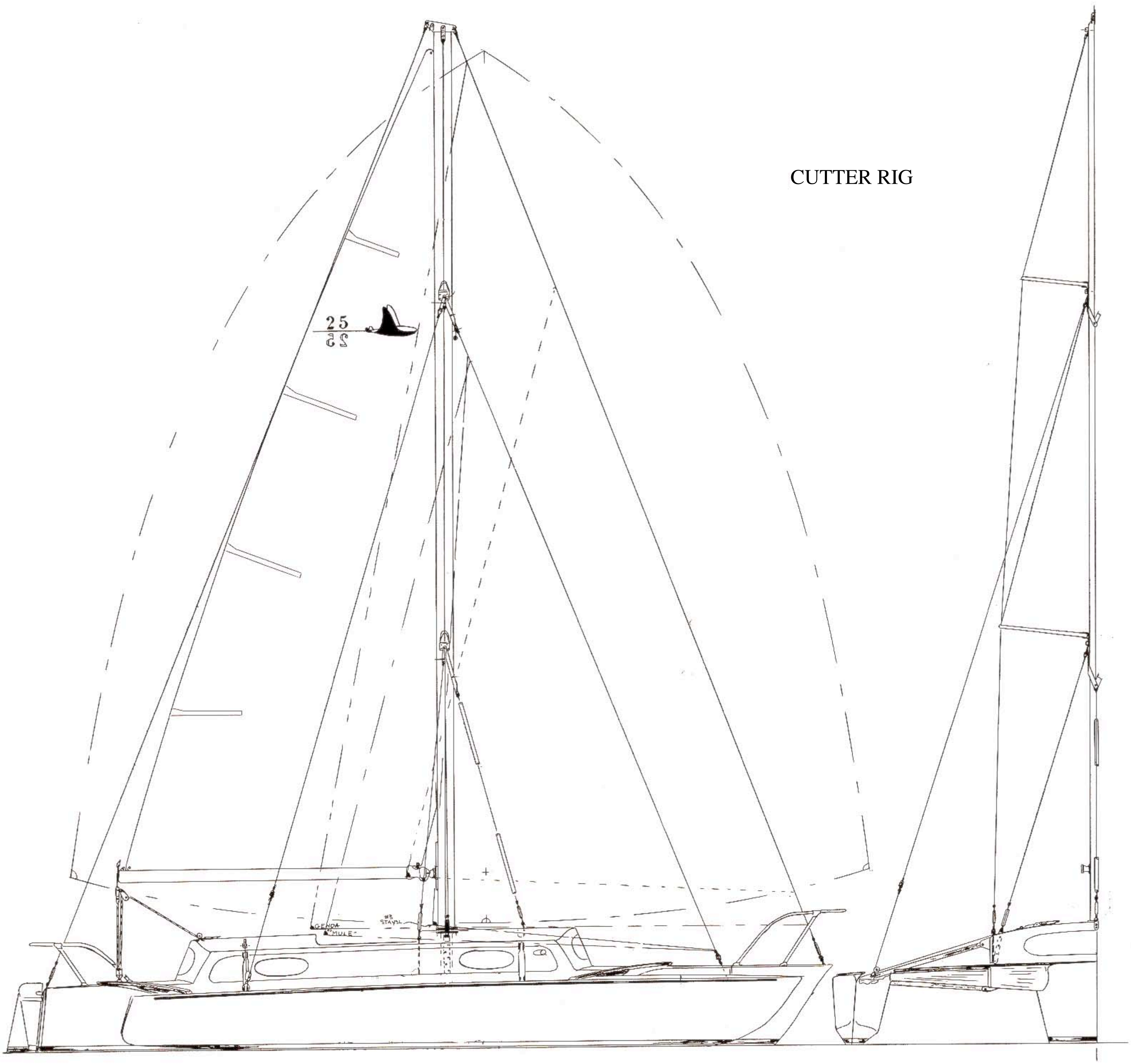
Jochen Geske took the picture.

APPENDIX I

Sloop Rig

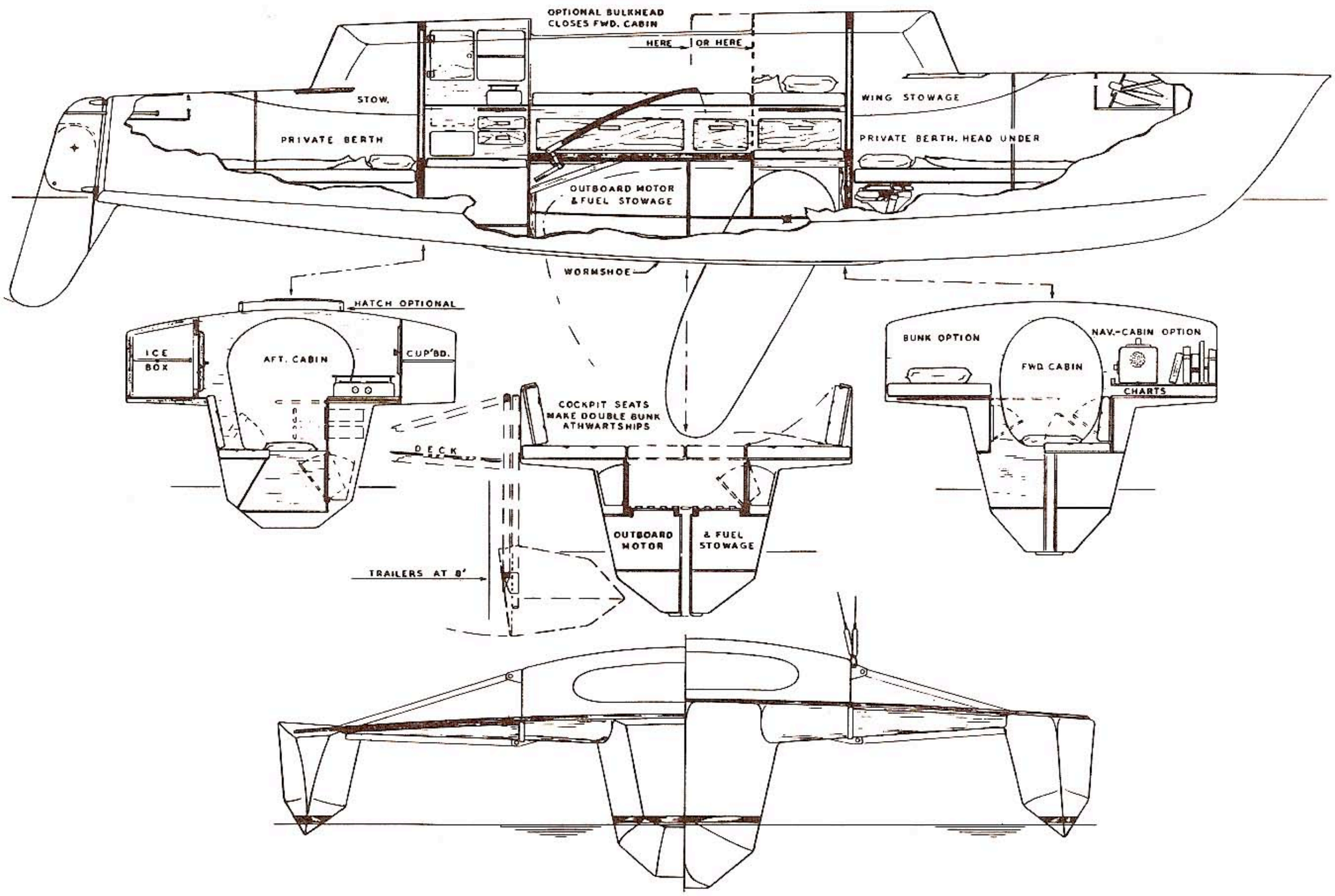


SEARUNNER 25

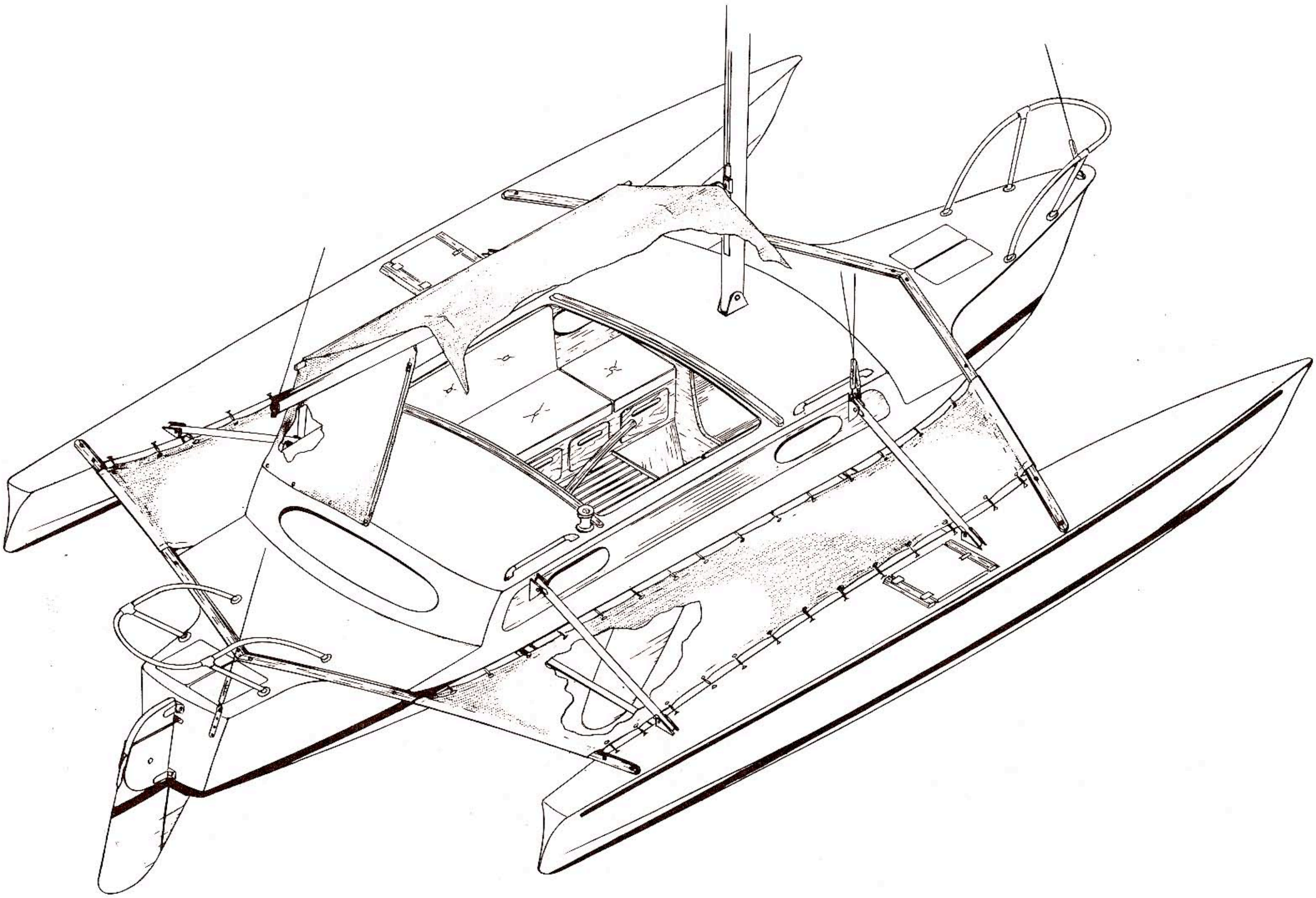


SPECIFICATIONS--SEARUNNER 25

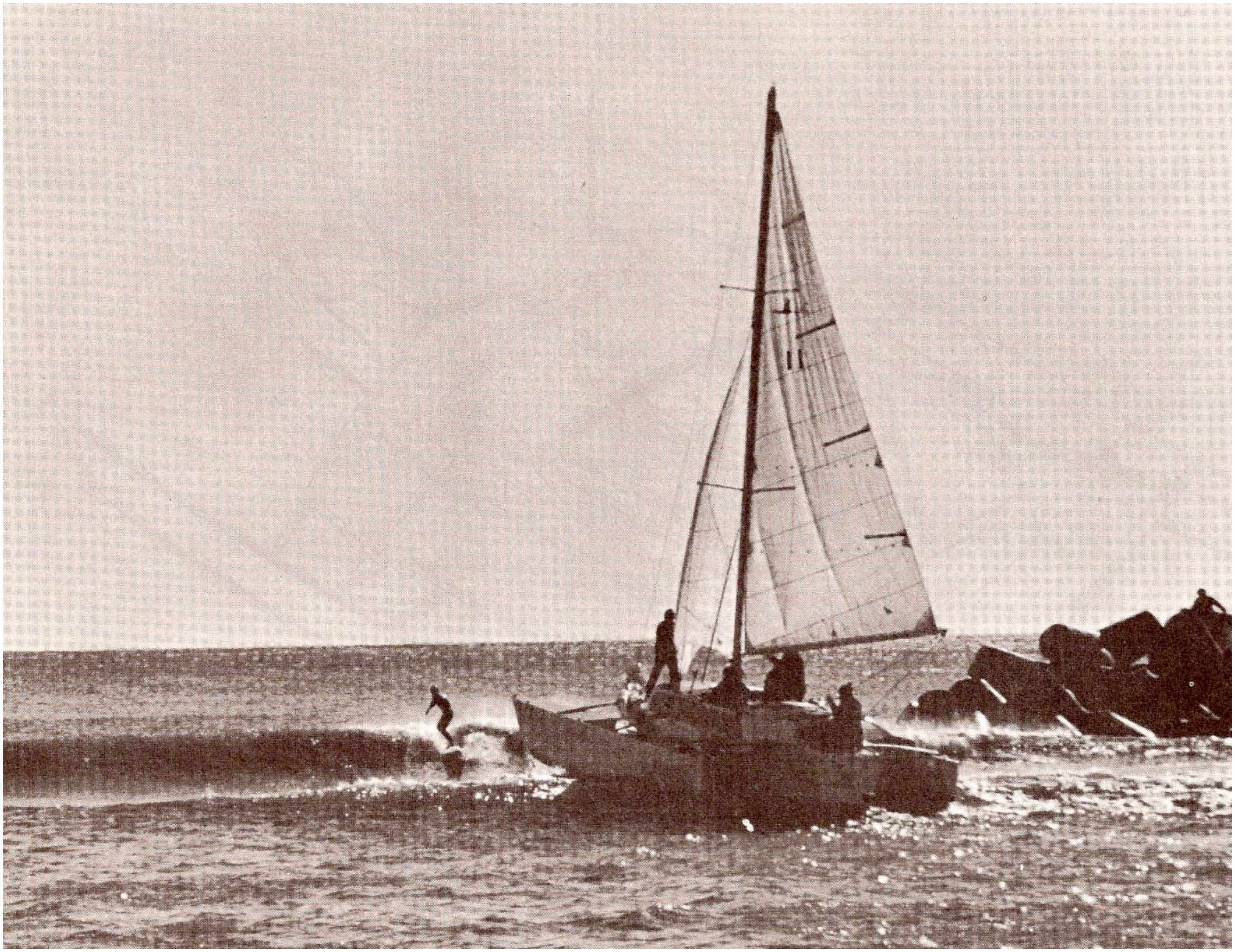
Length on deck	25' 0"
Float length	21' 5"
Beam, main hull (at under wing)	3' 9"
Extreme beam (outside rubrails)	16' 7"
Float beam (on deck)	1' 0"
Draft, hull only (with wormshoe)	16"
Minikeel adds	none
Draft, center-board up	16"
Draft, c. b. down	4' 6"
Minimum planking thickness	¼"
Bottom plank, no minikeel	½"
Displacement, loaded for cruising	2500
Displacement, weekend	-2100
Cruising payload margin	400
Sail area, mainsail	122'
fore triangle	+152'
"projected area"	274'
Mast length (from trunk)	28' 0"
Engine, maximum weight	40
Engine, maximum horsepower	o.b. 5
standard tankage	6
cruising speed	5
Standard water tankage, gals.	10
Number of bunks singles only	2
Number of bunks using cockpit, add	2
Suggested cruising crew, maximum	2
Suggested cruising crew, minimum	1
Maximum cockpit seating	4
Material cost proportion (as of 1976)	$ 5000



25' SEARUNNER INTERIORS



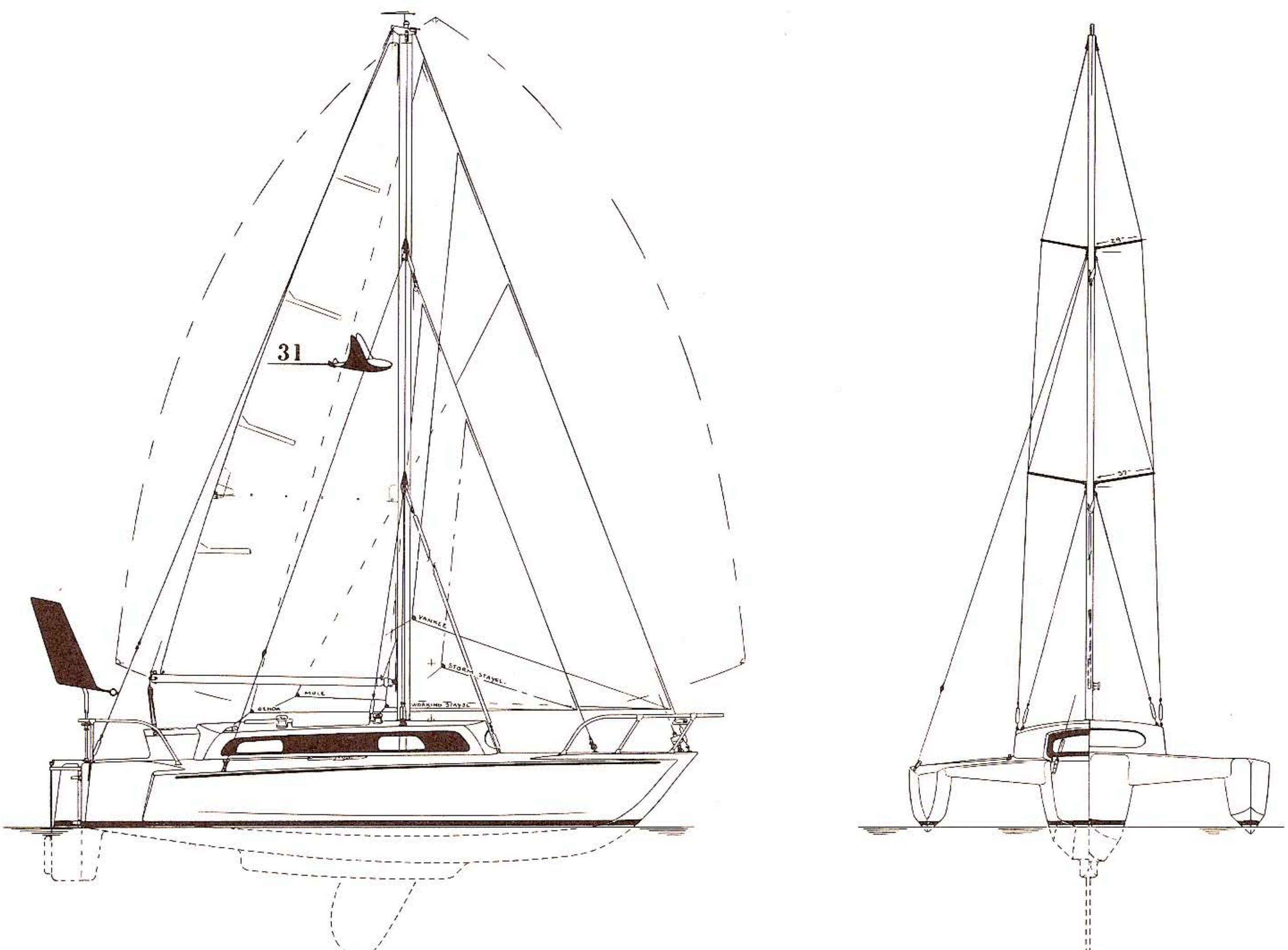
25' SEARUNNER INTERIORS



Outbound for a midwinder romp, this 31' A-frame Searunner shoots the break at Santa Cruz while dodging high speed traffic coming in.

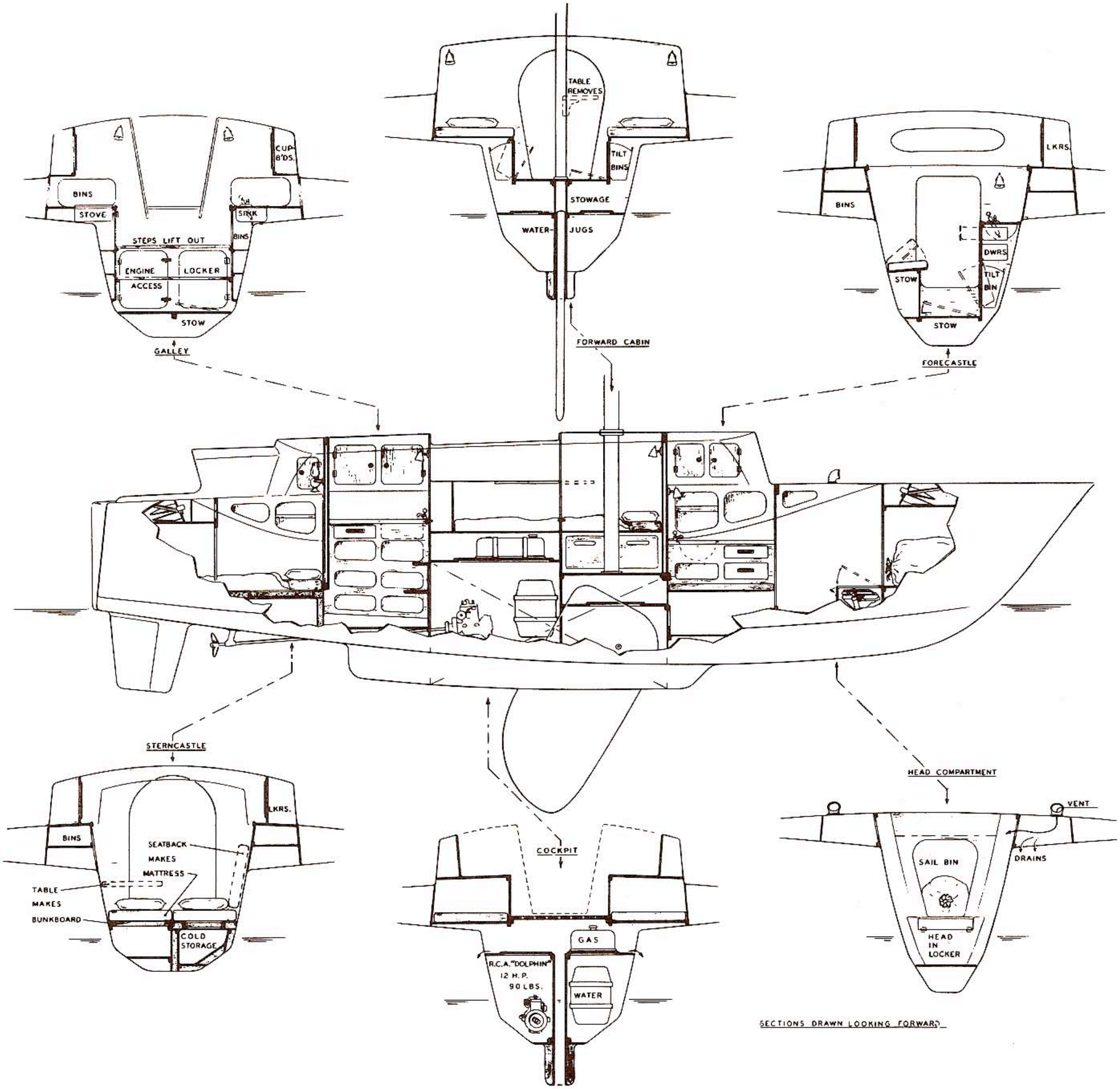
Bill James took the picture

SEARUNNER 31



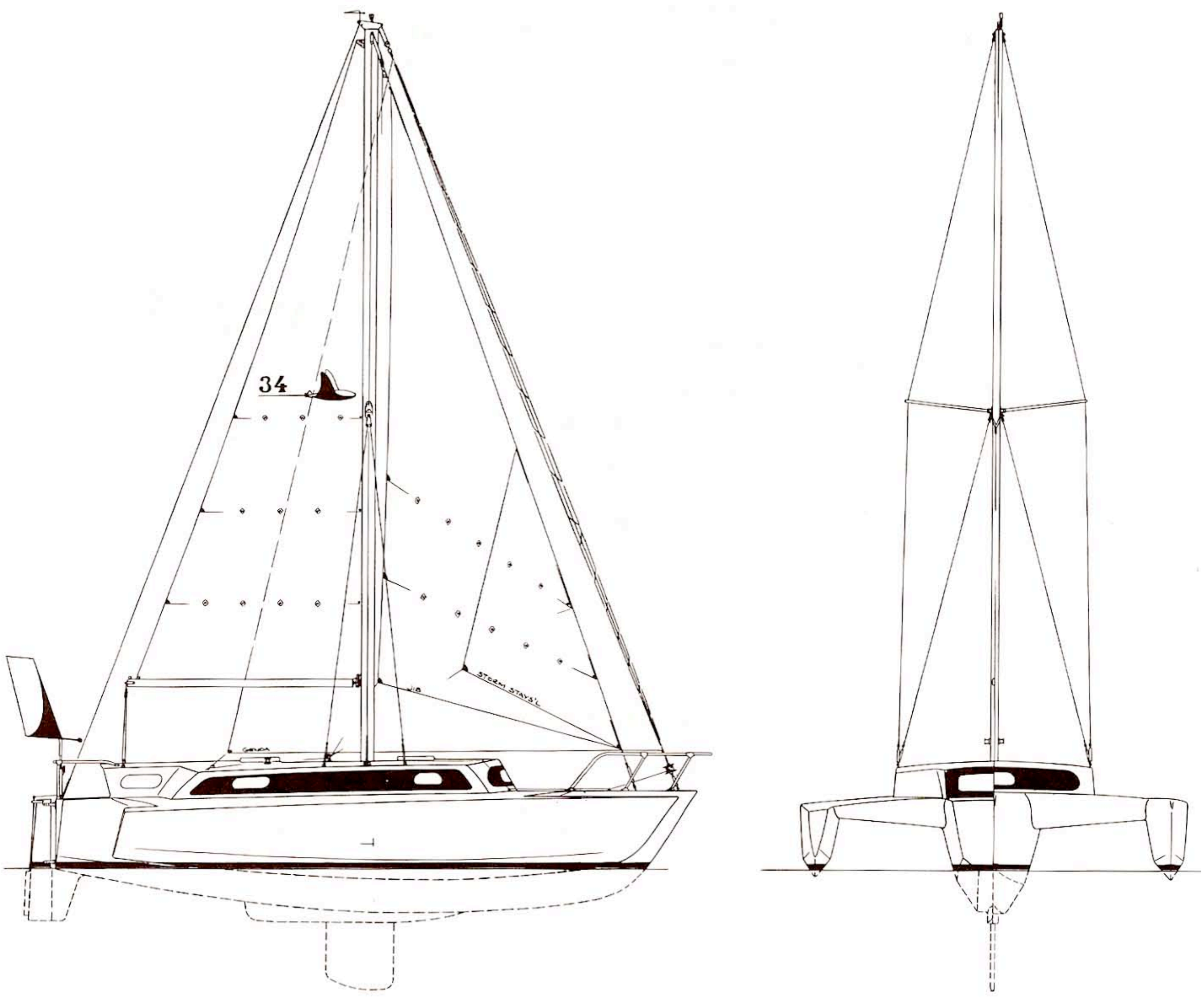
SPECIFICATIONS--SEARUNNER 31

Length on deck	31' 2"
Float length	27' 2"
Beam, main hull (at under wing)	5' 0"
Extreme beam (outside rubrails)	18' 8"
Float beam (on deck)	2' 5"
Draft, hull only (with wormshoe)	23"
Minikeel adds	+10"
Draft, center-board up	33"
Draft, c. b. down	5' 9"
Minimum planking thickness	¼"
Bottom plank, with minikeel	½"
Bottom plank, no minikeel	¾"
Displacement, loaded for cruising	7000
Displacement, weekend	5600
Cruising payload margin	1400
Sail area, mainsail	195'
fore triangle	+255'
"projected area"	453'
Mast length (from trunk)	35' 0"
Engine, maximum weight	200
Engine, maximum horsepower	20
standard tankage	20
cruising speed	6
Standard water tankage, gals.	25
Number of bunks using doubles	4
Number of bunks using cockpit, add	2
Number of bunks using singles only	3
Suggested cruising crew, maximum	4
Suggested cruising crew, minimum	1
Maximum cockpit seating	4
Material cost proportion (as of 1976)	$ 10000

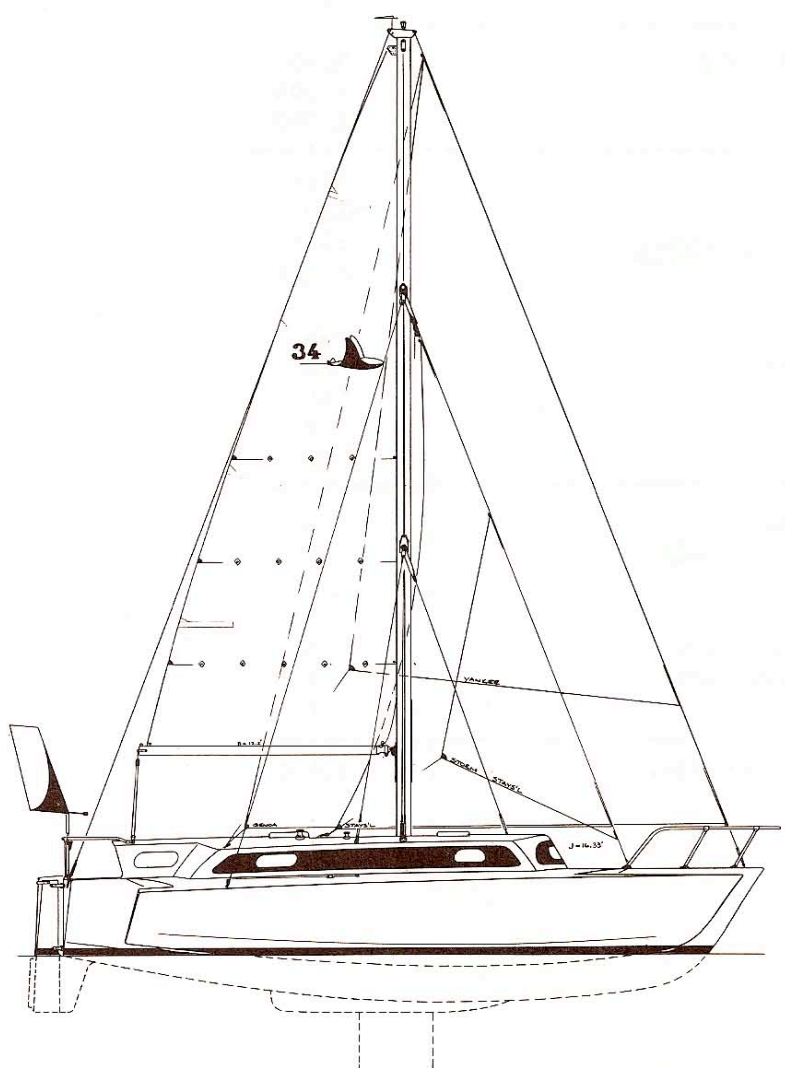


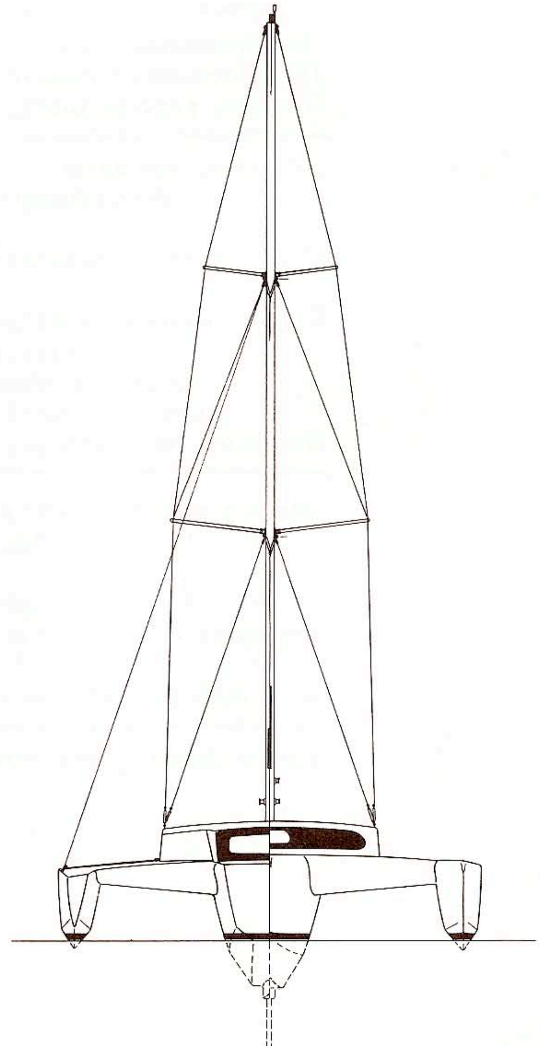
31' SEARUNNER INTERIORS

SEARUNNER 34



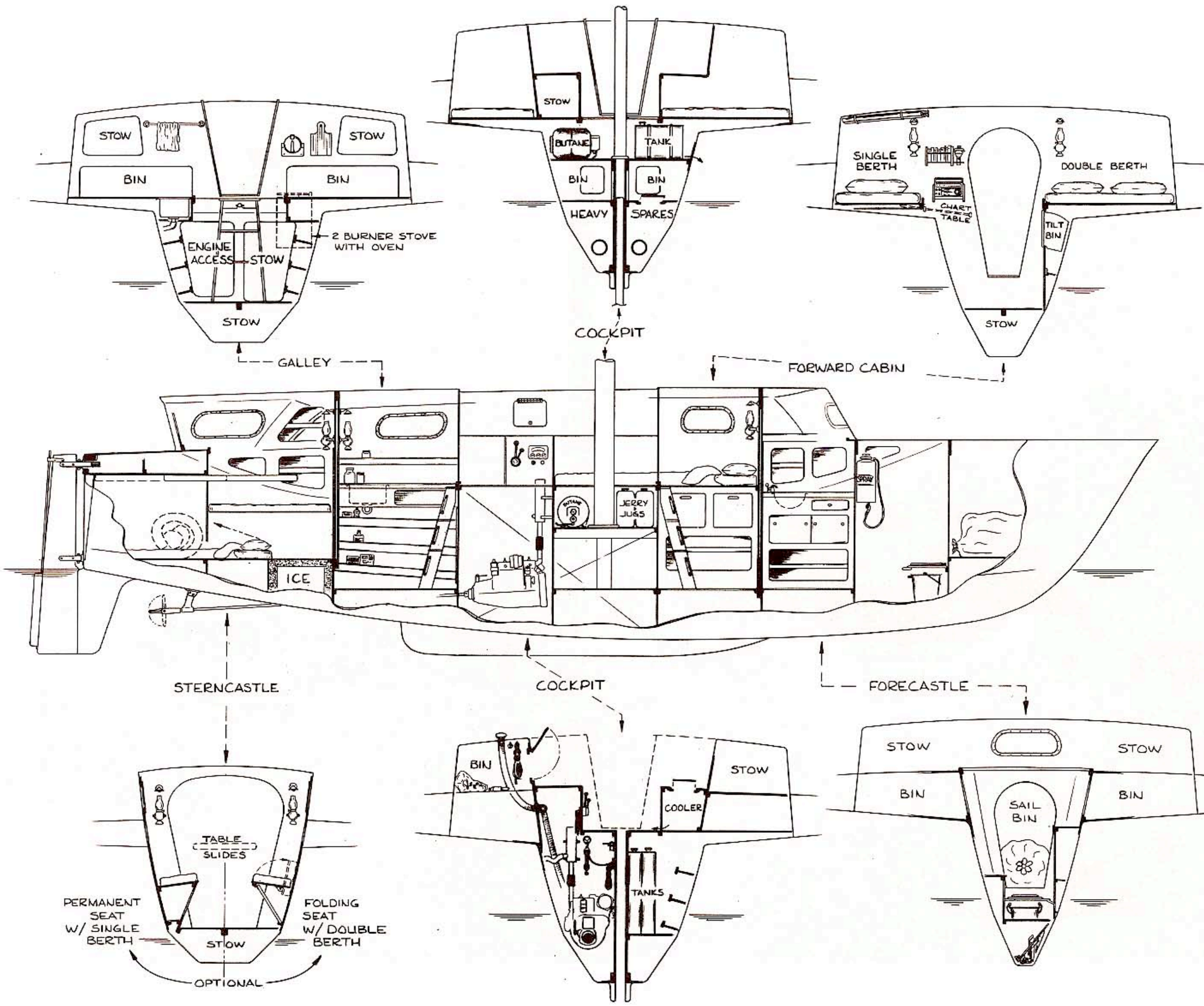
SEARUNNER 34



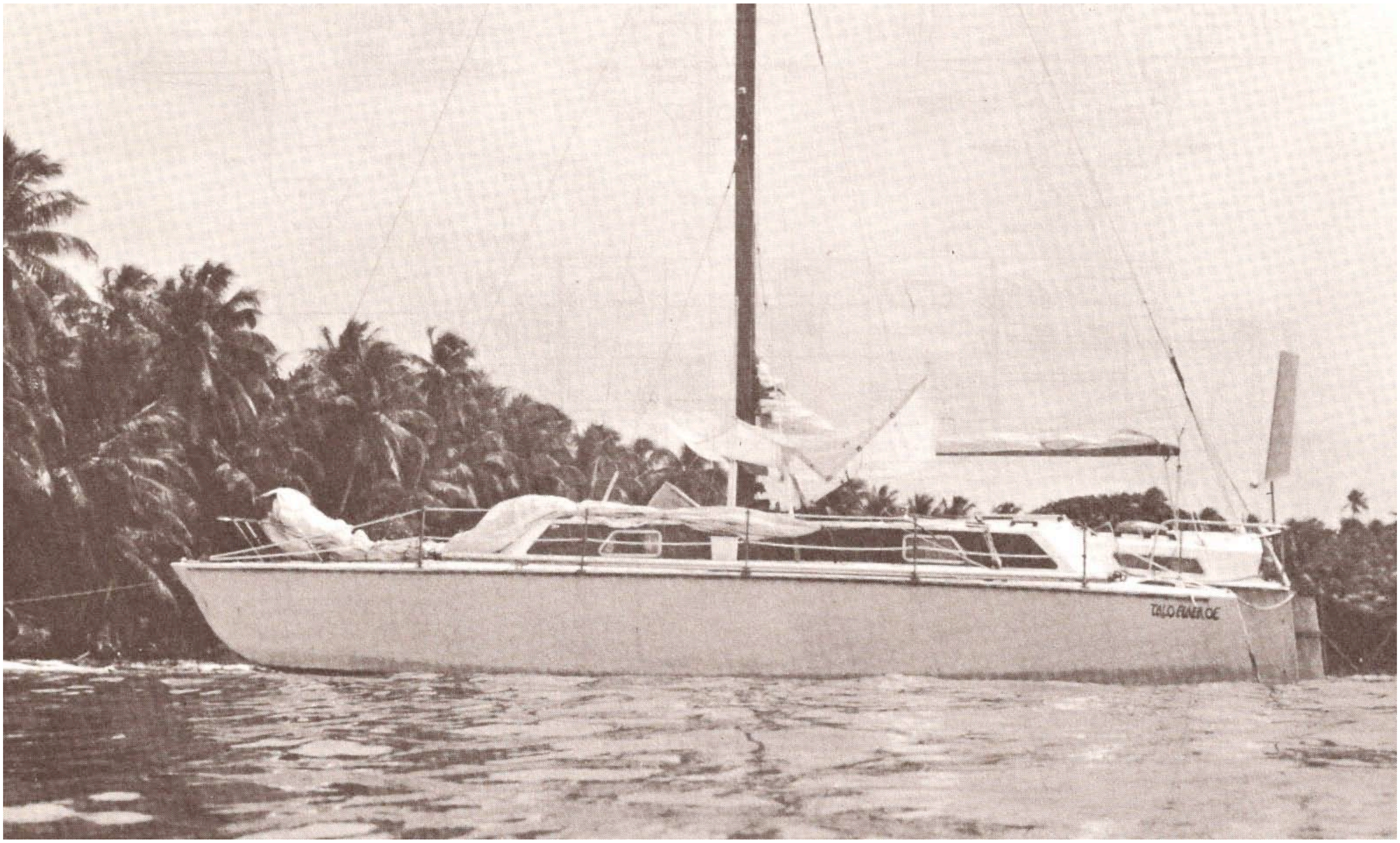


SPECIFICATIONS--SEARUNNER 34

Length on deck	34' 4"
Float length	30' 3"
Beam, main hull (at under wing)	5' 5"
Extreme beam (outside rubrails)	20'11"
Float beam (on deck)	2' 5"
Draft, hull only (with wormshoe)	27½"
Minikeel adds	+ 6"
Draft, center-board up	33½"
Draft, c. b. down	6' 5"
Minimum planking thickness	⅜"
Bottom plank, with minikeel	¾"
Bottom plank, no minikeel	¾"
Displacement, loaded for cruising	8000
Displacement, weekend	6000
Cruising payload margin	2000
Sail area, mainsail	208'
fore triangle	+329'
"projected area"	537'
Mast length (from trunk)	43' 6"
Engine, maximum weight	300
Engine, maximum horsepower	25
standard tankage	30
cruising speed	7
Standard water tankage, gals.	40
Number of bunks singles only	6
Number of bunks using cockpit, add	2
Number of bunks using singles only	3
Suggested cruising crew, maximum	4
Suggested cruising crew, minimum	1
Maximum cockpit seating	6
Material cost proportion (as of 1976)	$ 14000



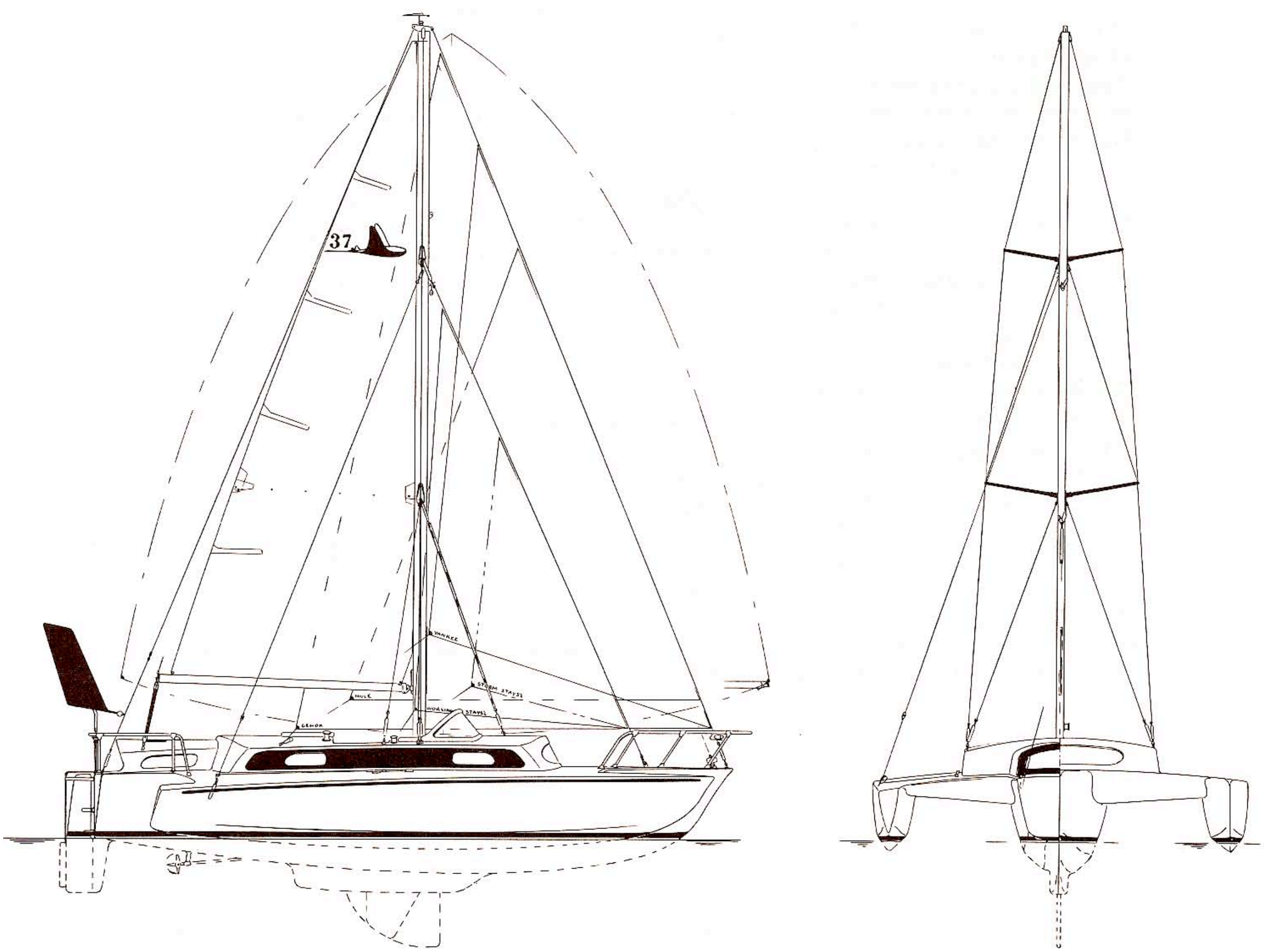
34' SEARUNNER INTERIORS



Mark Hassall took this photo of his 37-foot Searunner and I don't know where. But, sailing with his wife and son, he has visited over ninety islands in the Pacific.

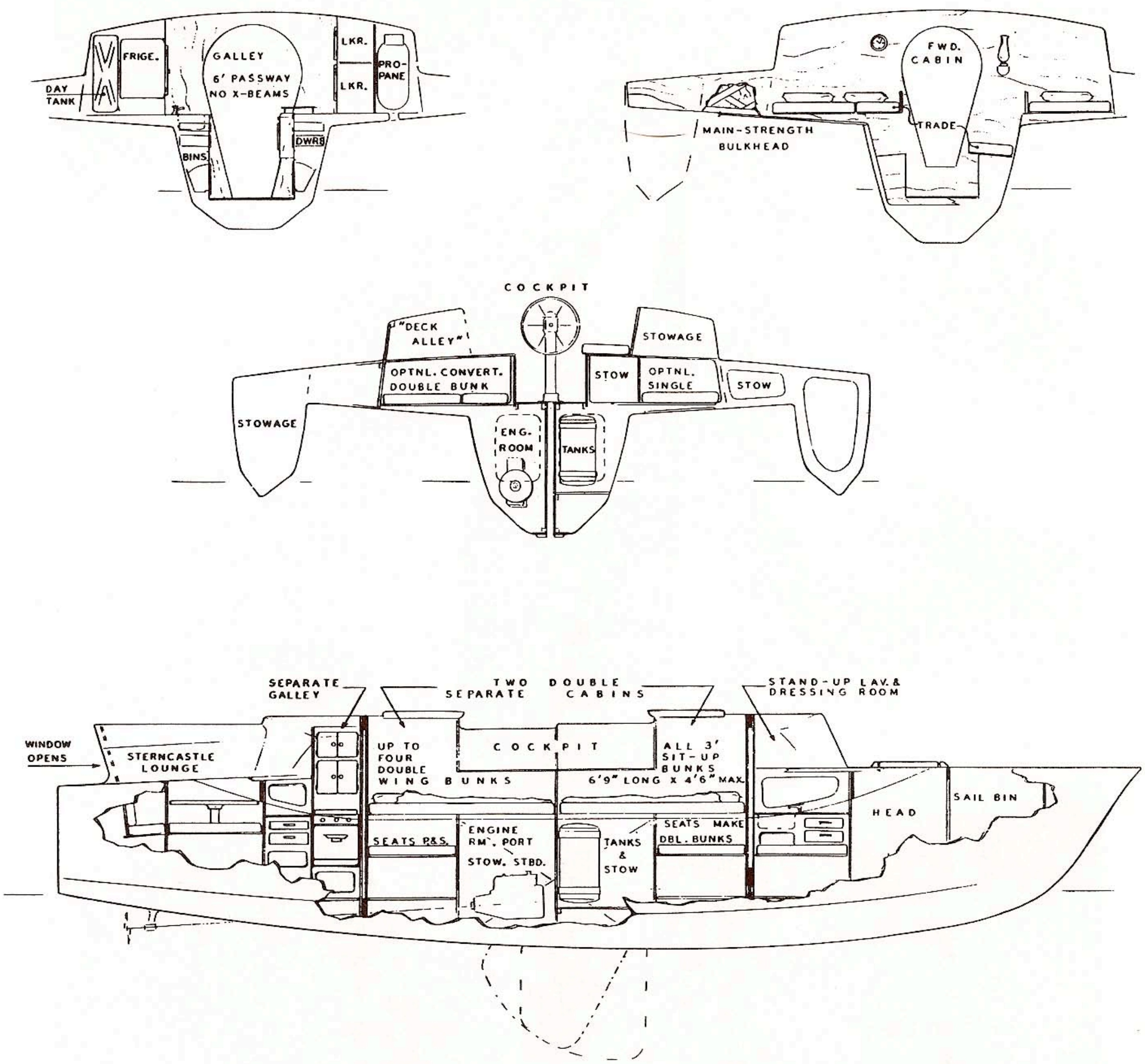
This is the first Searunner to sail in true hurricane conditions. Using the tire-and-bridle storm drogue, the boat survived undamaged through the worst storm in thirteen years to strike the North Island, New Zealand area. Experiencing winds of seventy knots and seas of thirty feet, measured nearby, the boat was certainly threatened. But at least the crew knows what she'll take now!

SEARUNNER 37



SPECIFICATIONS--SEARUNNER 37

Length on deck	37' 4"
Float length	33' 2"
Beam, main hull (at under wing)	5'10"
Extreme beam (outside rubrails)	22' 3"
Float beam (on deck)	2'10"
Draft, hull only (with wormshoe)	25"
Minikeel adds	+ 12"
Draft, center-board up	37"
Draft, c. b. down	6' 4"
Minimum planking thickness	⅜"
Bottom plank, with minikeel	¾"
Bottom plank, no minikeel	1½"
Displacement, loaded for cruising	11000
Displacement, weekend	9000
Cruising payload margin	2000
Sail area, mainsail	272'
fore triangle	+374'
"projected area"	681'
Mast length (from trunk)	45' 0"
Engine, maximum weight	300
Engine, maximum horsepower	30
standard tankage	30
cruising speed	7
Standard water tankage, gals.	45
Number of bunks singles only	8
Number of bunks using cockpit, add	2
Number of bunks using dinette, add	2
Number of bunks using singles only	4
Suggested cruising crew, maximum	5
Suggested cruising crew, minimum	1
Maximum cockpit seating	8
Material cost proportion (as of 1976)	$ 20000

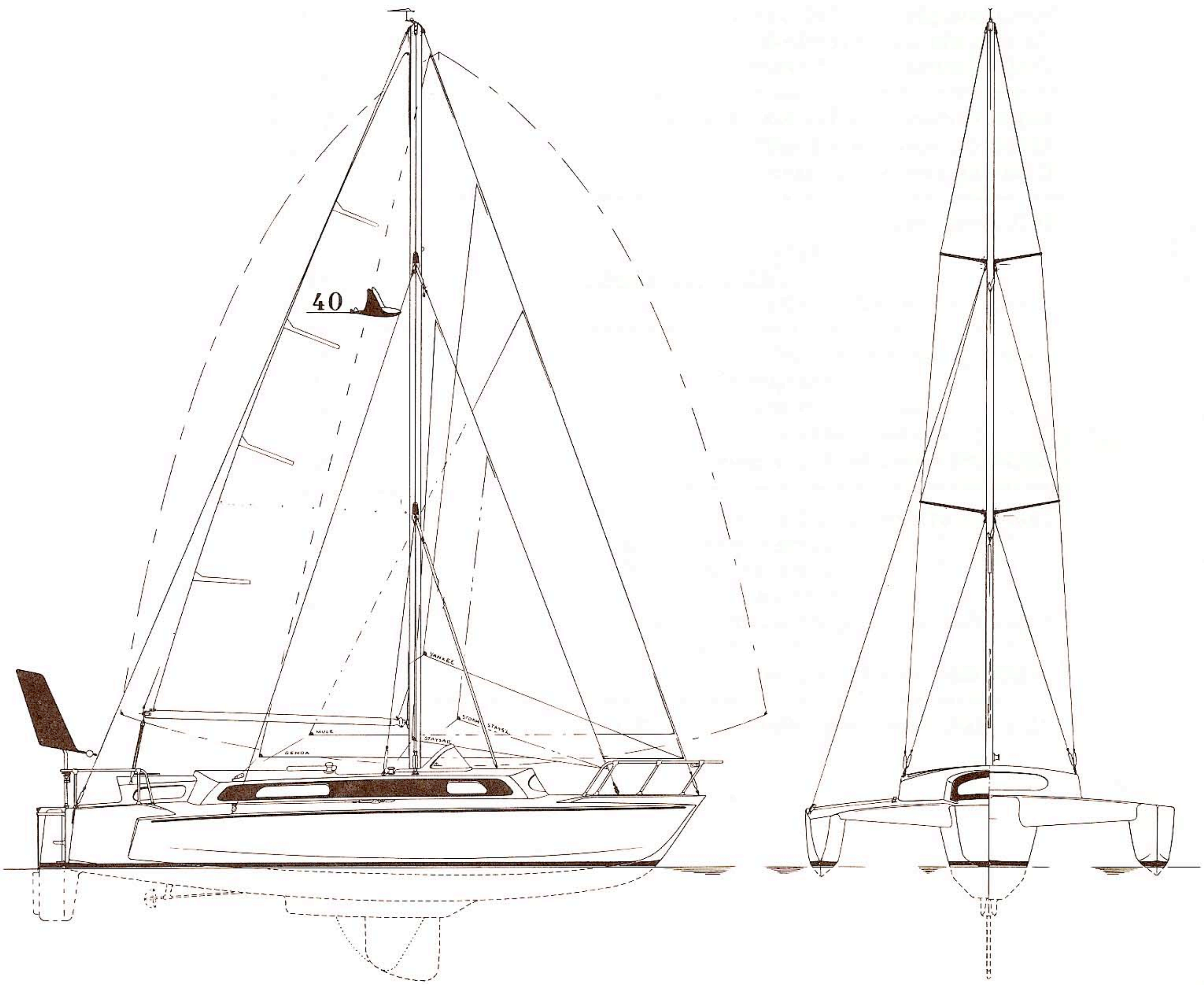


37' SEARUNNER INTERIORS

“World’s highest Trimaran*”. The 40 foot Searunner *Woodwind* sails in charter service on Lake Tahoe. With a Coast Guard approved capacity of twenty four passengers, she has introduced thousands of highland tourists to sensational big boat sailing.

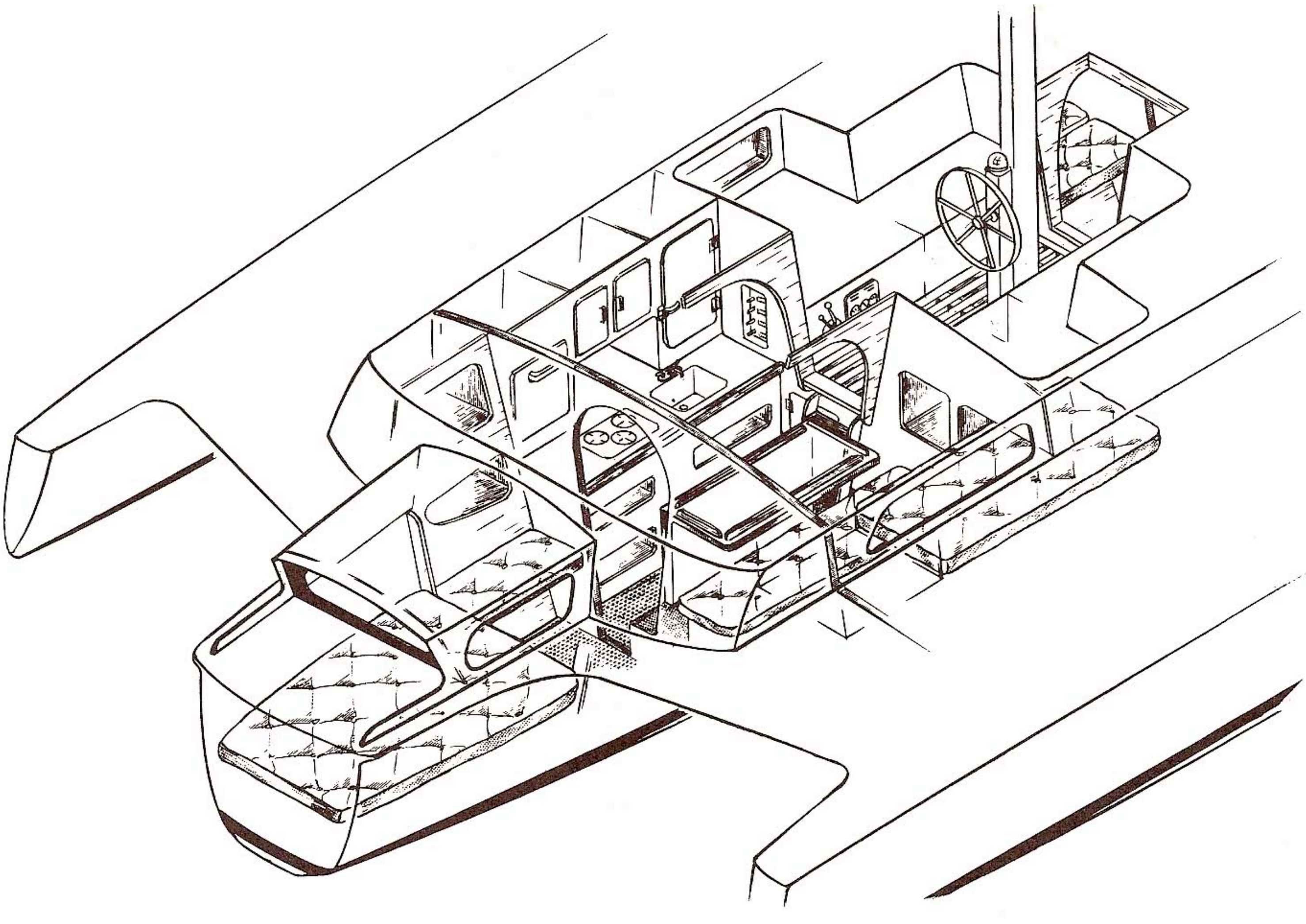
*(Wait until they hear about the one on Lake Titicaca!)

SEARUNNER 40

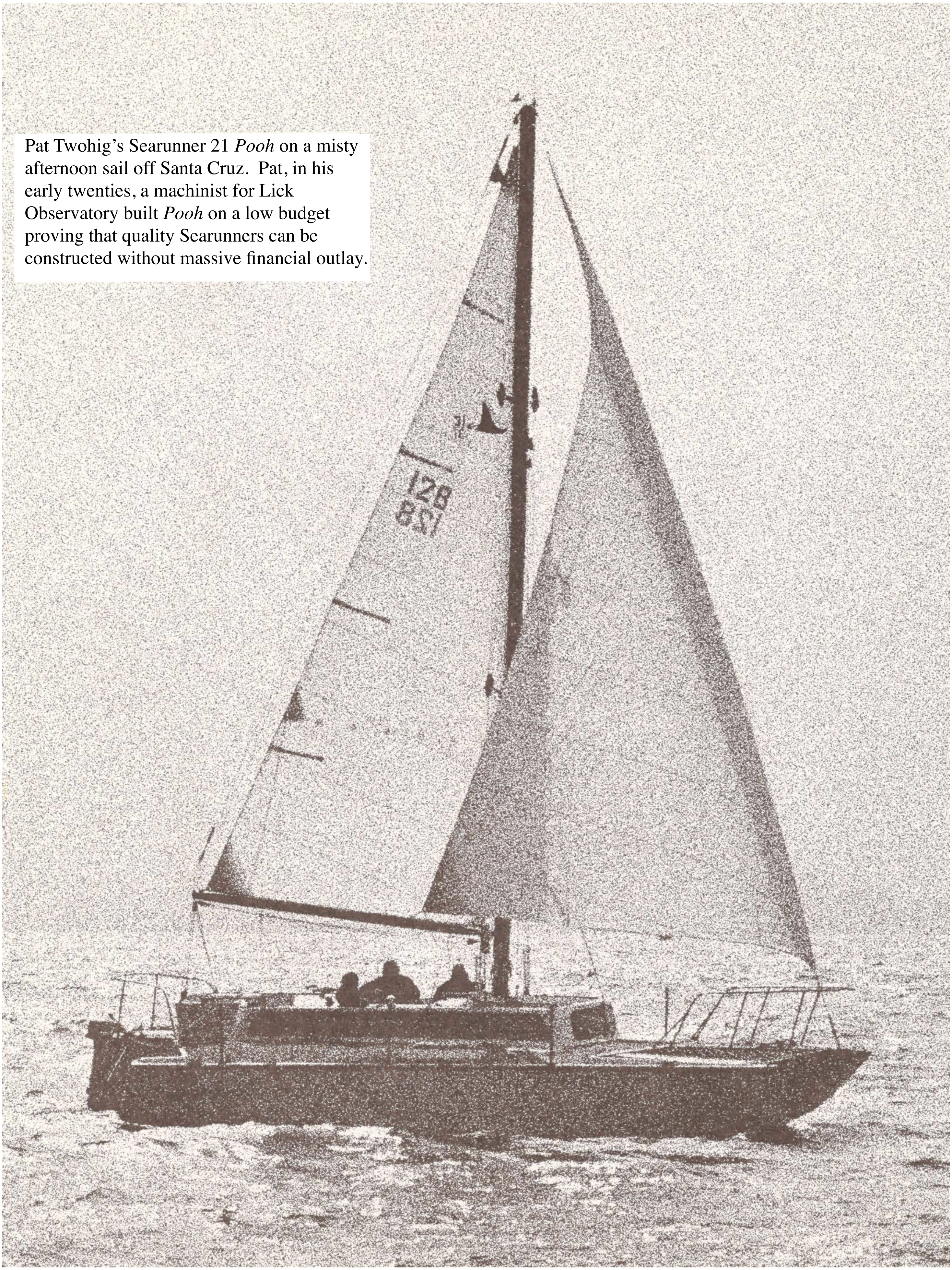


SPECIFICATIONS---SEARUNNER 40

Length on deck	40'10"
Float length	36' 2"
Beam, main hull (at under wing)	6' 2"
Extreme beam (outside rubrails)	23'11"
Float beam (on deck)	2'10"
Draft, hull only (with wormshoe)	28"
Minikeel adds	+ 12"
Draft, center-board up	40"
Draft, c. b. down	6' 9"
Minimum planking thickness	⅜"
Bottom plank, with minikeel	¾"
Bottom plank, no minikeel	1½"
Displacement, loaded for cruising	13800
Displacement, weekend	-10200
Cruising payload margin	3600
Sail area, mainsail	336'
fore triangle	+382'
"projected area"	727'
Mast length (from trunk)	50' 0"
Engine, maximum weight	400
Engine, maximum horsepower	40
standard tankage	40
cruising speed	8
Standard water tankage, gals.	60
Number of bunks singles only	8-9
Number of bunks using cockpit, add	2
Number of bunks using dinette, add	2
Number of bunks using singles only	4-5
Suggested cruising crew, maximum	6
Suggested cruising crew, minimum	1
Maximum cockpit seating	8
Material cost proportion (as of 1976)	$ 25000



This accommodation plan for the 40-footer suits the vessel well, however many options are possible. If you decide on a sterncastle dinette, consider that the 40's stern is not quite as wide as the 37's, and a dinette is on the narrow side if located all the way aft. One alternative is to locate the dinette from the main bulkhead aft as far as the end of the short sterncastle. This short sterncastle is illustrated above and in the sailplan. If the sterncastle is extended further aft, as in the 37, one loses the extra sterndeck area for working lines and anchors afforded by this large boat. With the sterndeck area available as in the illustrations, you can build a wet hatch like in the 31 for storing lines, etc.



Pat Twohig's Searunner 21 *Pooh* on a misty afternoon sail off Santa Cruz. Pat, in his early twenties, a machinist for Lick Observatory built *Pooh* on a low budget proving that quality Searunners can be constructed without massive financial outlay.

APPENDIX 2

THE ECONOMY SEARUNNER

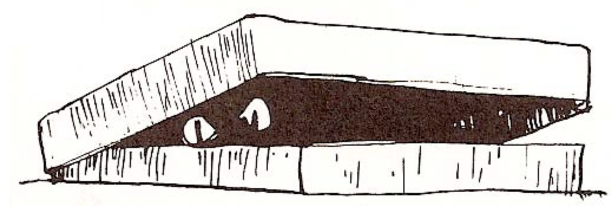
There is perhaps no higher symbol of luxury than the yacht; and yet ocean cruising, I can say, is no soft life.

This is being written as my family and I are bucketing down the Costa Rican seaboard in *Scrimshaw*, our 31-foot Searunner trimaran. Russel is building a model motorboat, Steven is making a leather handle for his knife, Jo Anna is reading in the cockpit and the boat is self-steering in a perfect breeze. "Very dreamy" one might say, and it is. Yet this is our first steady wind in days, squalls and light variables have kept us up for nights, and we all concur that however much smooth sailing we get, we earn.

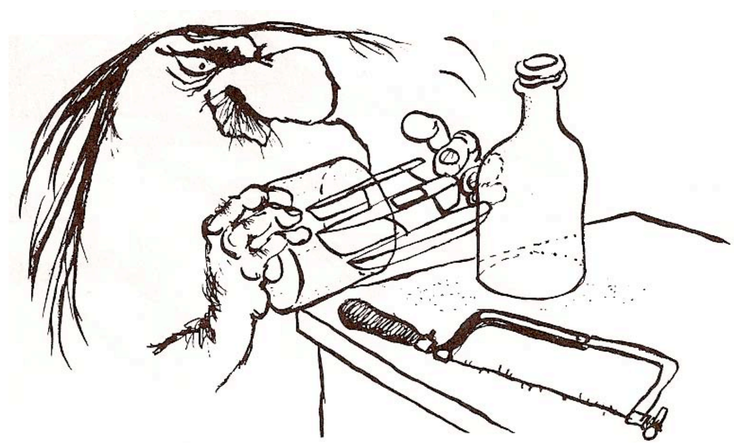
There is something about the word luxury that connotes gratis, but a cruising sailor must invest himself heavily to gain pleasure in return, especially if he has built the boat himself.

The money that financed my building *Scrimshaw* and which now supports her travels was earned from the sale of plans for construction of similar craft. These plans were bought, and are being bought, by individuals who aspire to build their own seagoing sailboats, Which is nothing more - nor less - than to pay the price of pleasure.

For instance, it cost me about eleven thousand dollars and three years of part-time labor to build *Scrimshaw*. On this investment I have reaped several squalls of temper, eleven thousand light variables of the mind and three million tons of pleasure in the first year of operation. Something there is about social unrest, political crisis and rising prices that makes a man think of going to sea. I have always considered that the trimaran sub-cult is a sociological phenomenon, much more than just a bunch of boat-bums tinkering with an ancient concept turned new fad. Our first real burst of plans sales occurred at about the time troops marched into Berkeley, and ever since then there seems to be a motive in the buyer's mind to build himself a retreat, his own mobilized San Clemente.

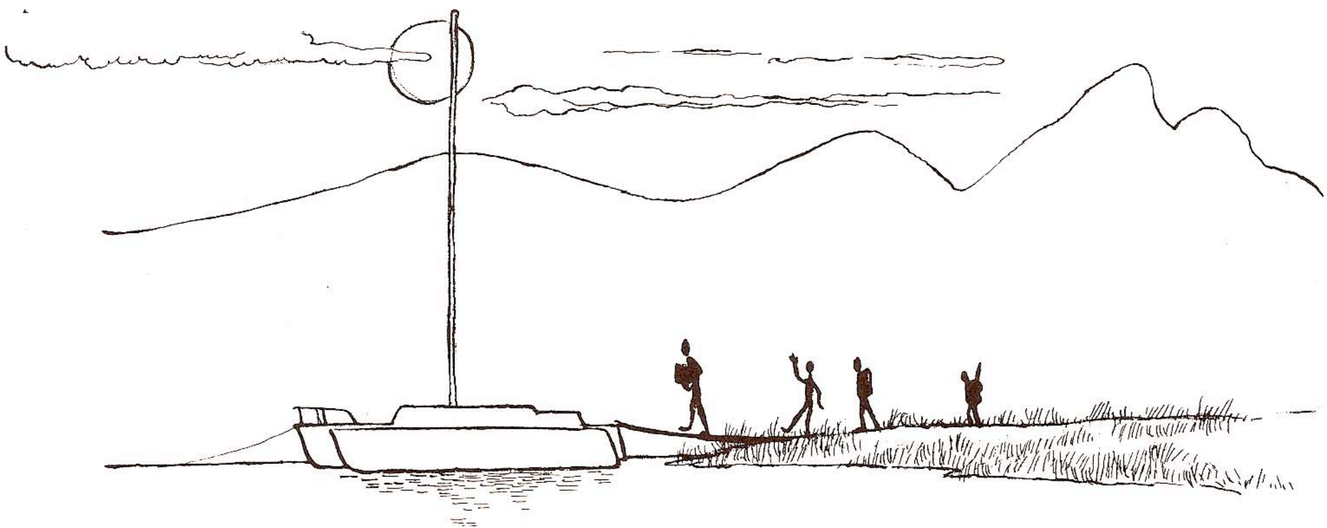


A paradoxical sense of guilt comes to the person whose position it is to profit from such motivation. As bankers decline to finance boat buyers, and "for sale" signs bespeckle the marinas, still the private man contemplates the piece-by-piece creation of his own trimaran, beginning with the plans. Is it the designer's place to suggest that those who are buying plywood might best be saving for bread instead?



Like most things of honest value, Searunners sell for honest money. In fact, an enigma exists which appears at last to give the backyard boatbuilder a chance to make money on his time; whereas most used trimarans sell for materials cost or less, recent sales of secondhand Searunners sport price tags approaching twice their cost. This says something of their supply versus their demand. It also tells the boat buyer to look elsewhere if he wants a good used homebuilt for a cheap price. Nonetheless, and at whatever price, I wish to voice agreement with the private man who looks at public plight and decides to consolidate his assets in a seagoing sailboat. We have learned that while avocados were cheap in Antigua, onions are steep in Puntarenas.

Prices are going up worldwide and it's nice to have no rent, car or fuel bills! While most marinas have become a madhouse rip-off, there are still lots of tide flats in the world which invite the shallow multihull to moor. And should a do-it-yourself sailor find himself to be one more product of industry, out of a job, at least if he's got himself a boat then he's got himself a place to live.



Maybe it's not that bad. A year in Central America has exiled us from the true tempo of things at home. All we get is "The Voice of America" and an occasional magazine. Plus the jaundiced remarks of other travelers fresh from the frying pan, or those girding their wallets to return. But just how bad it is says nothing of how bad it may get. Searunners are not well suited to construction from scrounged materials, and we all hope it doesn't come to that.

It has come to this -- my associates at ALMAR have informed me that the energy crisis, among other culprits, has affected the home-builder's procurement of several key boatbuilding materials: plywood (because of the large amounts of butane used in drying the veneers), polyester resin (because its styrene monomer is a petroleum distillate) and metals like stainless steel and aluminum (because of the large amounts of electricity used in their production). At this writing, the net effect has mostly been higher prices, but non-availability - especially of polyester resin - now occurs in some localities.

Tom Freeman and John Marples, who distribute our plans at ALMAR, are also engaged in a materials procurement service for our builders. At the present time, procurement, they say, is less problem than price. These men have made continuing efforts to supply the stuff at backyard prices by buying in bulk from the corners of the marketplace. And they have queried the designer regarding substitution of more economical and more available materials for some of those specified in the plans.

One would suspect that removal from the local scene might disqualify me for suggesting such substitutions, because it has been over a year since I have visited a backyard boatworks. Instead, I have visited the cruising ports of five countries, and been aboard several operating Searunners and many other assorted cruising boats. From this I have gained the disturbing impression that much of what is specified in Searunner Construction is overspecified; "over" meaning overpriced.

The boats that are out here <u>doing it</u> are much too glossy for their own good! Their materials, their outfitting and their workmanship may give them rank among marina boats, but their finely finished fiberglass and yacht-shoppe accouterments show on their shoulders as little more than tattered stars and bars.

If *Scrimshaw* were truly built for the cruising campaign, then she would be better suited to do battle with the wakes of harbor tugs while anchored in the scum of some banana port. Rough service is depriving her of that costly sparkle, and so she doesn't seem quite so audacious when seen against the splendor of sun, sea, palm and sand.

It is evening now. The wind held all afternoon and closed the day with a squall. We rounded Point Burica into northern Panama and anchored near a heap of native huts just as the squall hit and the sun set. On rereading the above I sense that the prospective boatbuilder might think I'm feeding him a line. Well, make no mistake: I built *Scrimshaw* with my own hands, and what is more my own plans. I'm proud of her. I think she's beautiful and I know she's safe. She's a sensuous dish yet she handles like a baby buggy. But the best thing about her is that she's done. Built. Paid for. If she had cost me something less in time and money she would probably yield me less in squalls, variables and pleasure. Yet if she were cheaper, she would be cheaper to keep; not because her stuff would be more biodegradable, but because peeling paint and bleeding rust wouldn't matter so much in the mind of her owner. The psychology of her appearance would be less vain.

Now, if that sounds like a line to you, I'll admit that *Scrimshaw* has been described as "awfully sharp", But try me. If I ever build another (please notice I said if), brother, it is going to be <u>rough</u>!

So the intent of all this jive is to introduce reasoning for <u>The Economy Searunner</u>. These yachts were never more expensive, tit for tat, than any other complete trimaran design; but because the builders are inquiring and the times are changing, we shall now attempt to make them cheaper. From where I sit (in the sterncastle at 8° 08' N - 82° 54' W) it is hard to be specific. So the following list of suggested substitutions is intended to generally point the way, and give the designer's concurrence with a manifest but selective cheapening of the product - in order to further enrich the lives of would-be ocean sailors (howls that for a line?). I am serious in hoping that these suggestions, when combined with the builder's own inventiveness, will result in more and better Searunners out here <u>doing it</u>; more boats better suited to cruising and better sailors more suited to the cruising life. There is not a lot of luxury. There are some squalls. And there are lots of light variables. But there's also tons of heavy pleasure if one wants to pay the price.

<u>THE ECONOMY SEARUNNER</u>

The reader will find that some familiarity with the <u>SEARUNNER CONSTRUCTION MANUAL</u> will assist him in comparing materials specified there with those suggested below. I am going down the table of contents for the Manual, and writing off the top of my head:

PHASE I - TO BUILD THE HULLS

Searunners were designed as plywood boats (instead of "other materials") to insure availability of the basic structural stuff. Now it happens that plywood procurement is a basic problem. Many mills are not making the premium marine grade panels as before, and even the A-B grade specified for so much of our boatbuilding is rare these days. A-C grade is still generally available.

So, what to do? What can I say with confidence? I say, with confidence, use whatever you can get! Knowing what we now know about the boats - what they can take and what they can give backit seems unreasonable to expect that some future failure could be traced to the fault of economy plywood.

On the contrary, you could build them out of solid gold but still expect to tear them up if this maniacal, Barney Oldfieldish kind of hell-bent sailing that's been going on continues.

So, my confidence in the currently available exterior-grade plywood comes from knowing that some Searunners have already been built from really crummy stuff and they seem to hang together. Also, many early multihulls were similarly built as experiments, and they have survived time. Given some care in their construction, and adequate treatment with preservatives or sealants, and given decent ventilation poor plywood seems to work well in multihulls. In fact, I don't recall ever seeing a strain failure that was the plywood's fault!

The A-C grade panels have one side showing unpatched knotholes and small splits. The A-B panels have patched faults to make them paintable. Well, hell, patch your own faults if you wish or paint of them anyway. Very few of them will appear on the finished interior of the boat and if one does you can hang a picture over it.

" Exterior A-D. Why do you ask? "

There are some places in the plans where marine grade ply is specified; the most important being for the forward main-strength bulkhead and a short portion of the cabin side panels in way of the chainplates. If you can't find some nice clear panels for these, whatever the grade, then apply larger doublers behind the chainplates and around the forward cabin side windows. For the main bulkhead use whatever's right, ranging from A-C fir to that wonderful, beautiful, exorbitant Bruynzeel African mahogany. If you're faced with having only junky stuff available for this part, then go ahead and increase the thickness by one size (for the forward bulkhead only!). That means more weight, but what can you do? It also means that if you're building an A-frame boat you'll have to add shims in the metalwork because the bulkhead will be thicker. Okay, add shims. If you order your A-frames ready built from Almar, be sure to specify the thickness of your main bulkhead so that they can add the shims for you.

Other parts where marine ply is specified, the "marine" can be overlooked, but this business of increasing the thickness must not be overdone! In one place, the main bulkhead, it is reasonable. Here and there and everywhere would be disastrous. To use ½" ply on the deck for instance (instead of the ⅜" specified) would seriously disturb the weight of the structure.

This general degrading of your boat's basic stuff may seem risky, but in line with all the other rather radical things that have gone into Searunner design, this latest step is something I would do myself, for <u>my</u> boat. Especially if it would make the difference between boat or no boat.

Framing lumber presents a similar but less critical problem. The quality of logs going into the mills means boatbuilding with knotty lumber. You'll probably have to cut around the pitchpockets, trim off the sapwood, and select your best stuff for the critical parts. For instance, I would avoid putting anything tinged with sapwood on the inside of the sandwich bulkheads. If you can't buy dry lumber, buy it wet and dry it yourself, especially the pieces that will be closed-up like those inside the sandwiches. The rest will have plenty of time to dryas you use it. Knots can be tolerated in big thick pieces, but not in skinny stringers. If you must rip your stringers from knotty stock, cut the knots out by making extra scarfs. The "vertical grain" specified can be overlooked. It is straighter and easier to work than "slash grain" but any grain at all is better than none, because the ocean will likely never know the difference.

The mahogany specified for building the centerboard trunk spacers is probably available, but any fairly hard, dry, rot-resistant wood may be substituted. And the rather exotic hardwoods can be not so exotic.

We have just finished what we call a shrimp glut. The crew of a shrimp boat, which shares our anchorage now at Isla Parida, brought aboard a bucketful of prime crustaceans. They were fresh from the trawl so we stuffed ourselves. The fishermen admired our boat, and marveled that this gringo had done <u>such</u> interior woodwork. But I caught them remarking to each other, "todo mueble", almost with a jeer. I take that to mean "This whole thing is built like a piece of furniture, and what for?" After visiting aboard their boat and noticing the carefree manner in which they decapitate a coconut with machete, using their railcap as a chopping block, and after feeling the crude but wholesome comfort of their cabin, which is not "todo mueble", I ask myself - "What for?" Is it to anchor here in a perfect tropical gunk-hole? To eat fresh shrimp and to drink fresh coconuts?

Or is it to show a crude fisherman my workmanship in exchange for his generosity!? Or is it to build a boat that will sell for twice its cost? Perhaps. But more likely, I built my boat to be "all furniture" I so that I could show my friends in California that I could do it like I said it could be done in the Construction Manual. So I did it, and now I'm here. That's what for. Think. I'll chop another coconut, drink half, drop in a chunk of ice and fill with rum.

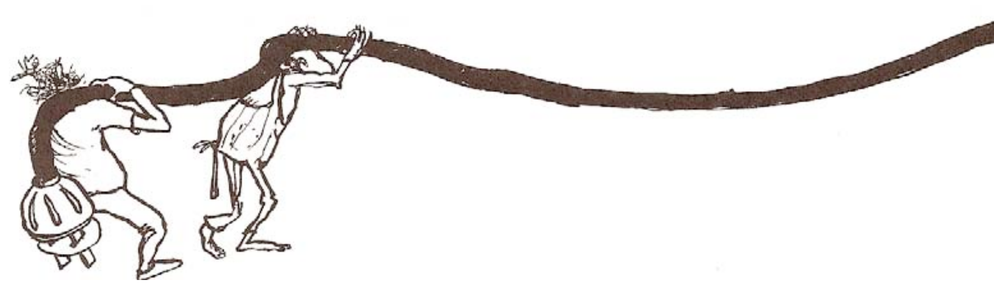
Power tools is an area where some savings can be made if the builder is willing to reduce his standards of detail. For instance, no router would be necessary if the edges were adequately eased with rough sandpaper. And one of the most expensive tools, the large disc sander, could be omitted if there is a marked change in the fiberglass sing procedure. This change is suggested in the next section.

PHASE II - FIBERGLASS

Omit fiberglass.

It's almost as easy as that. If fiberglass cloth and - more likely - polyester resin were totally unavailable it would not stop the construction of your Searunner. You would cast around for a suitable substitute and find it in a new system using epoxy saturation. Many multihull builders had gone to the new method even before the energy crisis. According to those who know, it is a technical advance, a work saver, and it comes through at the same money or less.

For myself I don't know that much. The epoxy system was developed at a time which made it impossible to include in the Manual or to use on *Scrimshaw*. Except near the end. I used it on our hatches, cross - spars, centerboard and rudder. I purposely left the finish unpainted in places to give maximum exposure for the test, and so far I am dumbfounded at the results. The stuff, I think, is good.



Epoxy, I am told, is in good supply because it does not require the styrene monomer, though it is basically a petrochemical nonetheless. But there's more to it, and less. Less fiberglass. The epoxy resin is such a better material than polyester that it does not generally need reinforcement with 'glass fibers. So, omit the fiberglass! Instead the epoxy resin is mixed with various common fillers to give it texture while being worked. In certain applications, certain other fillers are used to give reinforcement after it cures. The method was initially developed by the Gougeon brothers who are the famed builders of fine sailing ice boats and space-age racing trimarans. A similar system has been described by Pat McGrath in Eastern Canada. Seems the polyester shortage hit Canada before the U. S., and Pat has logged lots of experience with epoxy-finished backyard multihulls. Current information is available by contacting Searunner.

I'll say that for this old-line polyester man, using epoxy demanded some adjustments. It was hard to realize that I needed only one type of resin instead of two, one for bonding and one for finish. It was difficult to believe that no sanding was required between coats, and it was very hard to omit fiberglass entirely.

But something still awaiting me is to work with the totality of the epoxy-saturation concept. It is used as the glue, the sealer, the preservative, the everything inside and out. You literally mummify every stinkin' piece of the structure. If it's as good as it looks it may just make the use of inferior plywood quite acceptable.

One thing it does not reduce is the builder's exposure to toxic materials. More than with polyester, the health of the epoxy worker is threatened by skin contact and inhalation of vapors and sanding particles. One of those certain fillers is asbestos; to inhale these particles is to ask for serious damage to your health. You've just gotta work CLEAN.

And it doesn't necessarily reduce cost. The savings from omitting fiberglass are invested in the higher price of epoxy resin, but that now relates to the increasing price of polyester,

I suppose. It does reduce weight! A lighter boat usually results, which to me is a prime attraction.

So, taken together, the current plywood, lumber, and epoxy combination doesn't exactly give an Economy Searunner. What we're trying to do is build a better wood-'glass boat with worse wood and no 'glass. It seems conceivable that we can.

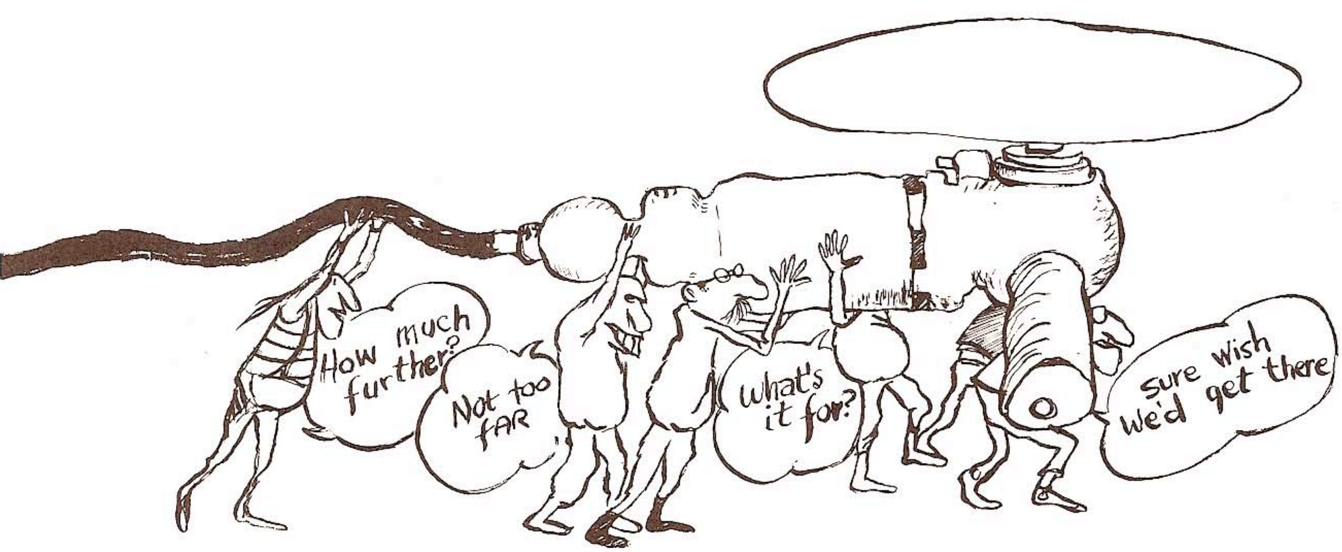
The real savings is in work especially if the builder can content himself with less furniture on the inside and less finish on the out. The roller application of epoxy to the exterior leaves a stipple effect which, if the builder can resist sanding it off, will give his boat a more business-like appearance when seen tied beside a Panamanian shrimp fisherman. And if, for those of us accustomed to an automotive shine on our sailboats, the whole idea of a workboat finish seems revolting, then maybe we'd better try sanding on ferro-cement! If switching to "other materials" seems attractive at this point in economic time, don't expect the switch to save money (have you checked the current cost of re-bar?) and suspect that it might make work. Epoxy appears to offer the simplest means of making a reasonable finish on a backyard hull construction costs a small fraction of the all-up boat. There is still no lighter, stronger, cheaper, easier material from which to build a backyard boat than good ole plywood. While it is still too early to tell for sure, the effects of the energy crisis may well serve to further punctuate this truth.

PHASE III - WINGS, DECKS, AND SUPERSTRUCTURE

The basic procedures for joining the hulls and building the decks and cabins is unchanged. Whatever your wood or resin, the structure goes together as shown in the plans and as described in the book.

If you're using epoxy you won't be using another glue. You'll glue the parts together with epoxy and, in the case of the decks for instance, you'll apply epoxy to the entire underside of each deck panel. This accomplishes the gluing, and eliminates the difficulties of later spreading wood preservative and paint on those impossible-to-reach portions of the overhead. Hull planking will be done similarly; and without building your boat both ways, both with and without epoxy, it will be impossible to fully appreciate the labor saving of with. Those who have built boats with both systems contend that the saving is in more than labor. They say that the cost of spreading paint inside a mousecastle, and the price of agony on the painter's part, are hard to add together.

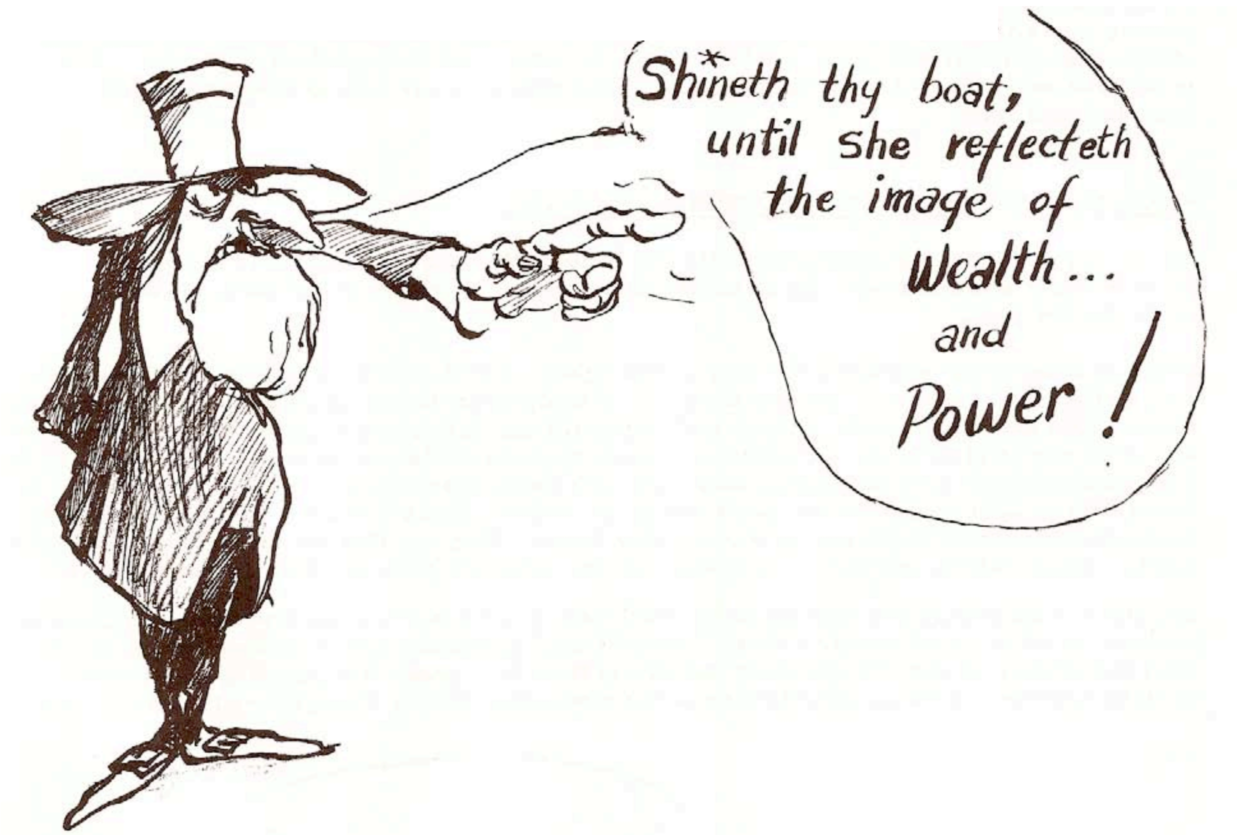
The underwing panels would go up in the usual way, except no fiberglass tape need be applied to those miles of overhead corner fillets. Epoxy "Gunk" fillets are considered sufficient, if you must have fillets at all! The primary purpose of them is to make fiberglassing these "inside" corners possible. Without something to radius these concavities, fiberglass cloth develops an air bubble where the fillet should be.



If you omit fiberglass, you omit the air bubble. My guess is that the builder could smear out excess resin with his finger, or run along later with something like Life-Calk, or epoxy gunk in a cartridge, and thereby produce a perfectly suitable surface in concavities. At another enormous labor saving.

The hatches will be finished just as described in the Manual for using Gluvit. (As a matter of fact, Gulvit is epoxy resin with certain fillers). Take care to sand the sharp corners off of your hatches, and to soak the end-grain edges with an extra swash of the roller. Sand lightly again when cured, to remove any mummified whiskers, and coat with epoxy again. Done like so, our hatches on *Scrimshaw* have proved very serviceable.

So now we get to painting! Our hatches are roller-painted with Brolite #107 which is a two-part epoxy primer. I never got around to finishing them with enamel, and I'm glad. I truly wish the whole boat had been finished with this method. She wouldn't be as beautiful, but she would have been built a year sooner and I'd be cruising Panama a year younger.



We have come twenty five miles up the Chiriqui River, just for a change. Our little four horsepower Evinrude brought us through the beautiful delta and all the way to Pedregal, without missing a stroke. But we never would have found our way without Julien, the young native pilot whom we picked up on Parida Island. And without his girlfriend Liza, who steered round the meanders most of the way with her foot on the tiller, sporting purple-painted toenails.

Being gringos as we are, all we knew of Panama was that here somewhere there is a great canal. And we had heard that the local folks very much resent the American soil which cuts their country, like a belt that steadily grows tighter around a gaining waist.

But it seems that this province of Chiriqui is almost a nation unto itself. The people are about the most open-handed we have found, their territory among the richest we have seen, and their great coastal Gulf with its many beautiful high islands and deep anchorages about the best Pacific cruising we have had.

Rowing back from dinner ashore last night, *Scrimshaw* sat still as a great white stork, poised above her glass-gloss image, mirrored absolutely in a perfect upside-downside mating with the surface of the river. "She's beautiful", we all agreed. She looked alive in her motionlessness. A strange place for a stork to sit, there within the loom of nearby city lights. Despite the fidelity of her reflection, it seemed that both the upside and the downside were finished-off with feathers. Only when we bumped her with the dinghy and touched her smooth coldness with our fingers, did her machine-made texture materialize. And did I remember the reams of sanding discs and months of heavy labor that had gone into making her look like something she is not. Many Searunners so built have been examined by dockside onlookers who remark, "you mean that isn't a fiberglass hull?" I suppose this means that we have succeeded in giving the boats a molded, organic appearance with the finishing methods described in the Construction Manual. But as we clambered up from the dinghy and sensed that "good to be home again" feeling, I was slightly disturbed by the recollection of that old folksong about "What are old women made of? They're made of powder and paint, till they look like they ain't …" So it seems that when viewing *Scrimshaw* in her most beautiful poses, I have sometimes wished she were without makeup. She could flash just such a fine reflection on the streamlined strength of her straightforward form alone.

At times like last night, I resent the cosmetic beauty of my boat. It cost me too much, work. The gestation of her molded, organic appearance, I now suspect, is too much to ask of even the most gifted individual craftsman. It makes this do-it-yourself (alone) project so demanding that the fulfillment is taxed to equal the anticipation.

Speaking of paint, as we were, I wish we could omit it like the fiberglass. For all the trimaran's acres of area, there must be some other solution to the problems of the final surface besides enamel. The epoxy primer on our hatches has served surprisingly, but bears the standard disadvantage of being white, dirty white. What else can we use but white paint to keep the sun from cooking the life out of the boat and its occupants? Primer has a flat porous finish which picks up dirt, but so does enamel after a few months in this kind of sunshine. Even fiberglass boats with well waxed gel coats eventually turn chalky and require painting, usually white. With most backyard Searunners, this paint is often spray-applied, embracing all the painstaking surface preparation, all the costly and sophisticated equipment, and - most of all - the skills required to make a reasonable attempt at the hoped-for but impossible perfection. It can never be perfect! Even the surface of the stork is feathered, and marred by lice, nicks and oil sustained in the daily feat of simply being in the world. *Scrimshaw* may have started life with a surface like a baby's butt. But! After bouncing off of mudbanks and ramming a restaurant, and then being trod upon by many hobnailed harbormasters, she has aged. Greasy tires and vagrant oil slicks have smeared her makeup. Then come bevies of dinghies bumping at the door, unnoticed while their slew of sailors blithely slug this evening's batch of hot-buttered coco-loco to the noise of impossible sea stories - and bumping dinghies.

Or instead of dinghies it's dugouts! "Here's a fish or some shrimp or some coconuts" say the natives. "Do you have any cigarettes? Yes, we'd like to come aboard to 'conocer el yate'." Bang! Thud, grate.

Our float topsides look like the flanks of a filly who's been pinned against the fence and roundly kicked in the ribs by a drayhorse. The baby's butt now resembles the bruised and boney bottomside of an old bulldozer which only a year ago had been for some reason, painted white!

Nowhere in boatbuilding does such a wide range of requirements apply than to the paint. An impossible parallax of virtues would befit the perfect paint. There is all of the obvious stuff about resistance to acids, abrasion, immersion and so on, plus requirements like ease of application, quick drying time, recoatability, hardness, flexibility and adhesion. There is also cost! But besides all of these there is the color conflict: not until you have sat beneath the boomtent in the so called shade, wearing two pairs of sunglasses to screen your scorched eyeballs from the glare, and felt the tropic sun cook its way through the overhead canvas and burn your back on its way to warming up the ocean beneath the bottom of your boat; not until you've danced barefoot like a firewalker across your light colored decks, and then stuck your head down the hatchway to feel the infernal atmosphere inside - only then can one appreciate the enormous <u>power</u> of sunlight. So you paint your boat white and your decks near-white and when the sun sinks low you live with the muddy reminders of hobnails, hoofmarks, tire tracks, dinghies and dugouts. Nothing shows dirt worse than white; unless you turn yourself into a scrupulous scrubnurse, your traveling hospital is going to be "unsanitary".

So the color conflict is not between red, yellow or blue, but between black and white. Between heat reflection and dirt inspection. Seeking to find a least offensive middle ground, the Navy (like politicians) has selected grey. Not a bad color for a battleship, or a yacht. Except it's got black in it, which makes it too hot.

So here is one area where the individual backyard builder has room for a real technical first. Find us a paint! I have admired the aluminum paint used on oil storage tanks. (Go ahead, laugh. I think it's funny too, but it turns a dull silver-grey and yet sheds heat. And dirt. It sounds drab, but I've seen it on workboats effectively trimmed with any color.) Or maybe a primer coat of aluminum, for heat reflection, would allow final-coating with something <u>cleaner</u> than white and <u>cooler</u> than grey. We need something other than enamel and if you find it, please let us know at ALMAR.

Short of sailing in an oil tank, some commercial boats are using latex based paint. It's cheap, it sticks, and it's easy to recoat.

Whatever you use on your economy Searunner, it should be easy to apply. Despite all the complications of spray painting, once you get going, it goes fast. There's nothing faster except - yes - the totally uncomplicated <u>roller</u>. That's the way to paint, I say. With some heat reflective, stuff that hides dirt and goes on with a roller!

We can justify this general downgrading of your yacht's finish on the basis of economy. The saving in such things as sanding materials, equipment rental or cost, paint brushes and thinner, work clothes and respirators, and the price of time and human suffering - when added to the saving on the paint itself - can make a significant difference in the boat's cost.

And we can justify this general downgrading of your yacht's finish on the basis of the grade itself. A plywood cruising boat that looks like a plywood cruising boat will be more pleasing in appearance, and more satisfying to own and use, than a filly that's been kicked in the ribs and shows it.

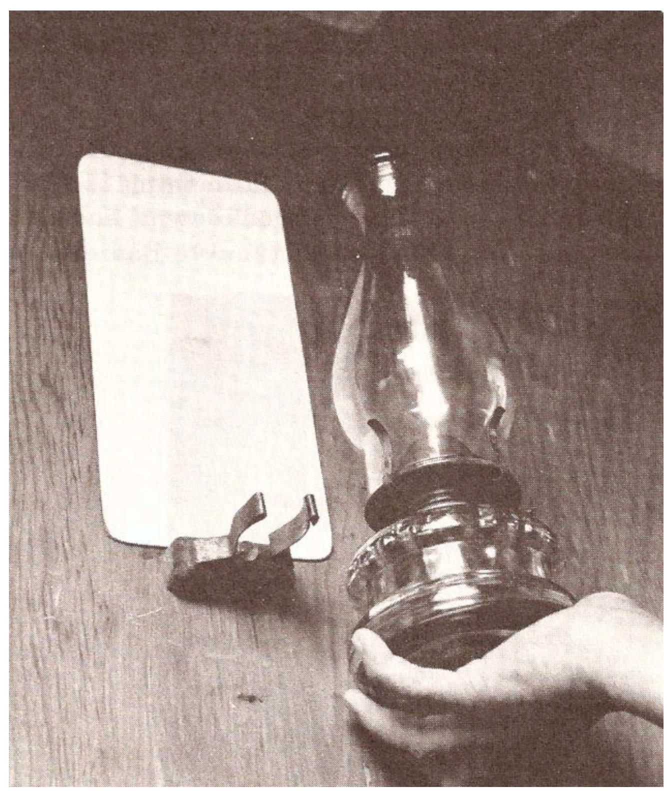
This doesn't mean that an economy Searunner has to look like an oil tank. You've got something more to start with - her shape. Judging by the feeling for detail displayed by most Searunner builders, I am expecting the new generation of economy boats to be a finely finished fleet, highly evolutionized to better belong in the cruising environment. And I'm being honest when I say that I wish I had a boat like that myself.

PHASE IV - INTERIORS

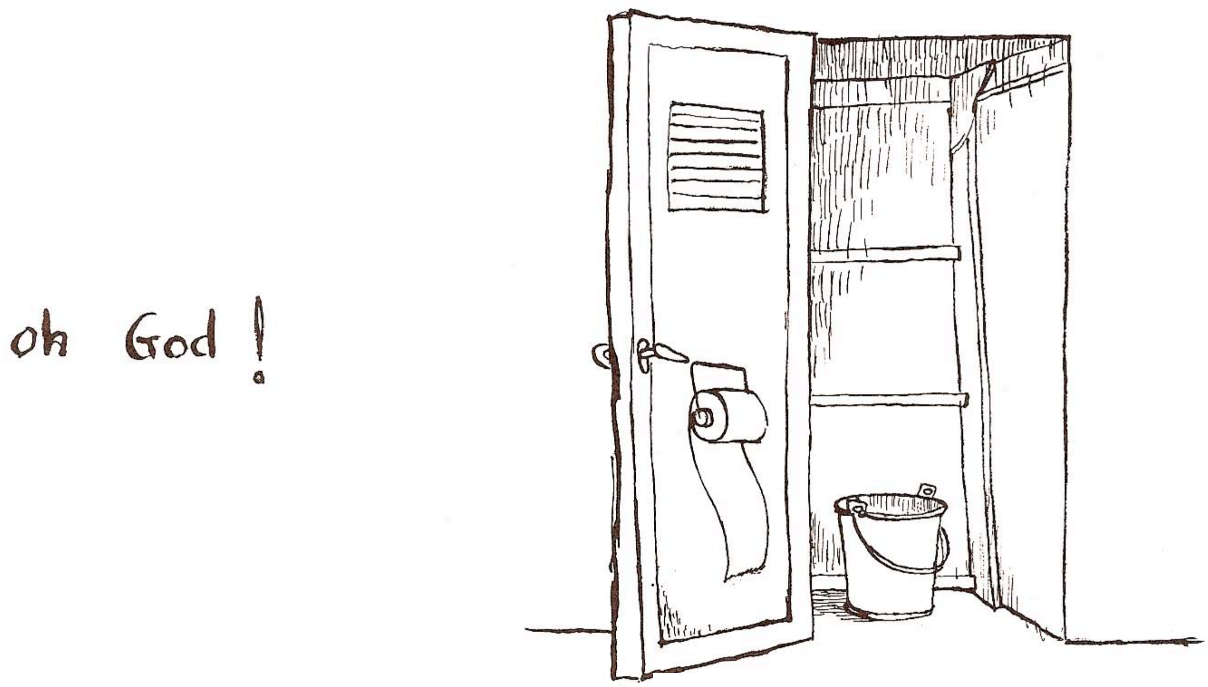
An economy boat is certainly going to have less fancy stuff on the outside. The general selection of options could include such things as all kerosene lighting, but with the possible addition of a portable battery-powered fluorescent lantern strapped to the overhead in the galley.

Inexpensive "hurricane" lamp for cabin lighting. Carry spare burners, wicks and chimneys.

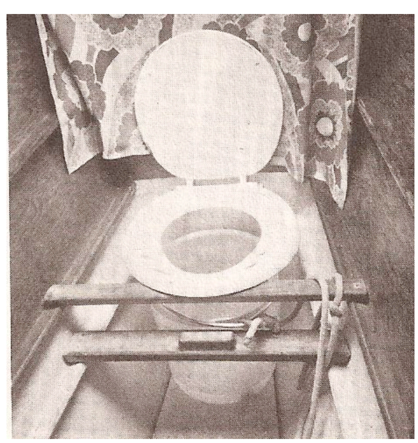
Note simple spring-clip mounting, secured to wooden block of required thickness to receive your lamps. Formica reflector on bulkhead combines with flameproofing overhead to give good, safe lighting.



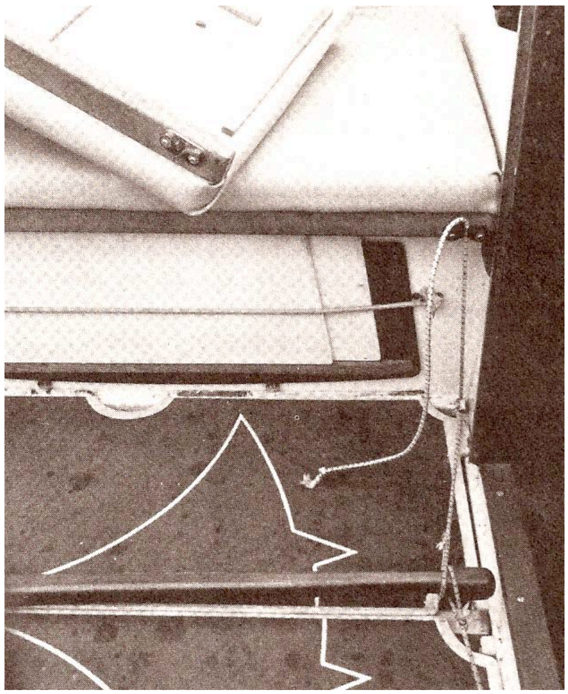
The stove would be kerosene also, without oven -unless you're willing to contend with the stovetop variety, which we are. Primus or Optimus stove burners are not everlasting and are very hard to find, so carry spares. The plumbing could be somewhat simplified by omitting the forward cabin sink and pump, keeping a gallon jug of fresh water securely stowed there for taking seasick pills, etc. Waste water can be discarded into the head bucket.



Yes, bucket. I now consider the bucket head to be the only marine toilet worthy of mention. Where marina laws prohibit its use, use the facilities ashore or add a shot of Clorox and empty it at night. Except in city-sized concentrations it seems that sewage is not a marine pollutant; did you ever see a whale turd? And there are few "yacht cities" for the cruising boat. All this nonsense about holding tanks and chemicals comes out pure crap when you get away from the yachting centers. Emptying the bucket is easier than you might imagine. Searunners are small enough so that one needn't even leave the forehatch - just stand on the seat, reach out and dump to port, rinse to starboard, and that's that. Easier than pumping, literally. A legitimate toilet seat can easily be mounted over the cross-sticks which hold the plastic bucket in place, and the whole thing is easier to clean than a fish. Whereas a marine toilet with its pipes, valves, breakdowns and cramped position is much harder. Use a bucket head and save yourself lots of trouble besides lots of money.



The garden-sprayer shower, as described on page 114 of the Searunner Construction Manual, is a very suitable means of keeping clean. Tropical skin infections, caused by longterm exposure to seawater in a warm climate, can be controlled with the help of this freshwater economizing sprayer. We use ours a lot. And incidentally, the most common place for seawater boils to occur is on your bottom, especially if you are not well padded naturally. We have finally reverted to 3" thick foam cushions in the cockpit. They are made without stitching, by wrapping light colored best quality naugahyde around the foam. Fasten with copper tacks to the ¼" plywood backing, sealing the folded "hospital corners" with mastic. The plywood backing is raised up above the cockpit seats by ⅜" thick wood battens glued underneath, around the edges and across the middle. The battens hold the cushion up out of the water, and thus keeps the foam dry. It really works, and it really helps.



.

"New" method cockpit seat cushions with 3" foam, showing both sides. This photo also shows how cushions can serve to reduce excessive space between cockpit seats, to give a more comfortable seating position for helmsman, desirable in the 3l-footer. Inboard edge of cushion protrudes into cockpit 3", which forms convenient stowage space beneath overhang for stowing drop-in hatch boards; secured in place with shock cord. Note also shock cord harness on tiller which can be adjusted to aid in steering. Cockpit floor boards shown are lightweight alternatives to traditional grating; have half-circle holes at edges to make self-bailing.

Some economy interiors go so far as to eliminate the galley sink and its two pumps, with attendant plumbing. Not a bad idea if you're willing to wash dishes on deck in a bucket. Which we are not. The galley seems the wrong place to save money because you spend so much time there. Too much time there. You've gotta eat! And the largest single failing in our skills as seafarers seems to be in this department. The detailed knowledge acquired in our lengthy trials at procurement, storage and preparation of foods, and in cleaning up the mess, has been the area of our greatest practical learning and our largest lack as well. Efforts to gain in this department are especially satisfying because they lead to less time spent in the galley, and to some truly scrumptious meals! Eating gets to be very important when you cruise, but cooking would be hard without a big sink, with a big drain, and big pumps to supply both fresh and saltwater at sinkside.

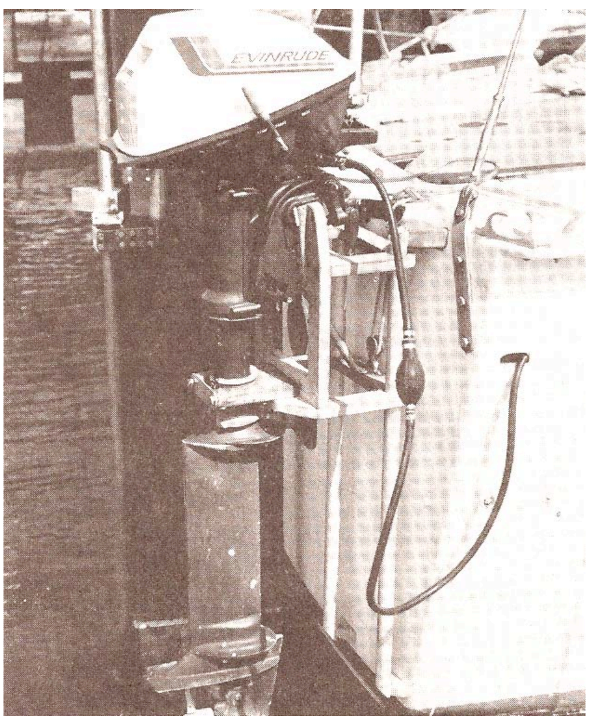
The only galley economizing we have done is in the usage of the stove. Meals which require less cooking, and washing up without the aid of hot dishwater, seem to be our only advances so far. But if we could hear from you, those of you who face the same problems but find different solutions, perhaps someday we could do a Searunner cookbook which starts in the marketplace and ends in a final burp, after the dishes are done.

If you can't economize in the galley, you can in the engine room. By filling it with food! Nowhere is there a larger single money saving possible than by leaving out the main engine. If this sounds like a brutal, brash attempt at thrift, let me explain:

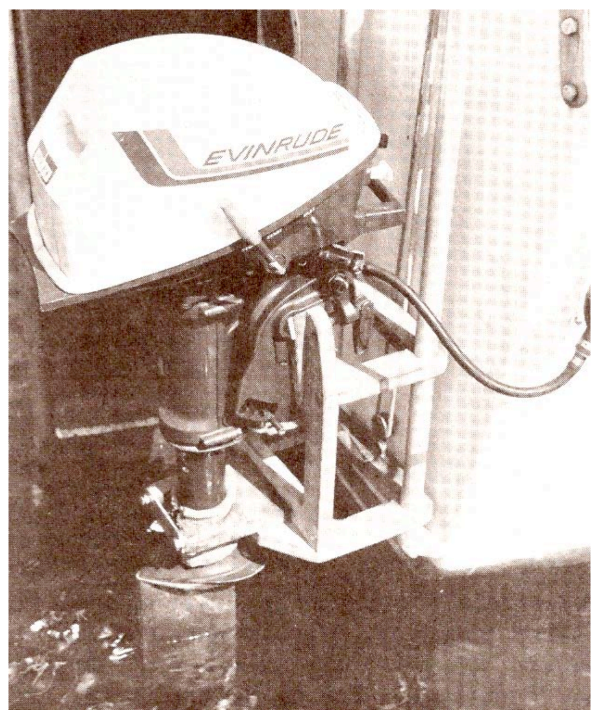
The Searunner's potential for high sailing speed is not of as much interest in cruising as its potential for low sailing speed. More than any other auxiliary cruising boat we've seen, we use our motor less because the boat is fast when going slowly; when the wind is light. And when we do use our motor it is usually because there is no wind at all. <u>That</u> is why we can get by with an outboard!

Don't get me wrong. If we had no motor at all we would have given up cruising long ago. This area of the world is so plagued with calms that if we were engineless, we'd be senseless.

Our little outboard looks ridiculous perched on the transom. Its position seems like a super-casual place to stow the mix-master, used for mixing brownies in the galley. But our four horsepower drives the boat at four knots at ¾ throttle for ½ gallon per hour! (That's on a 30-foot boat, so you can see why the thing sails!) We carry about 15 gallons of fuel, and that will keep the boat moving, and keep a cooling draft moving through the boat, for a very long calm.



Up position. Note extremely long shaft, equal in length to three 5" extension castings used on larger motors.

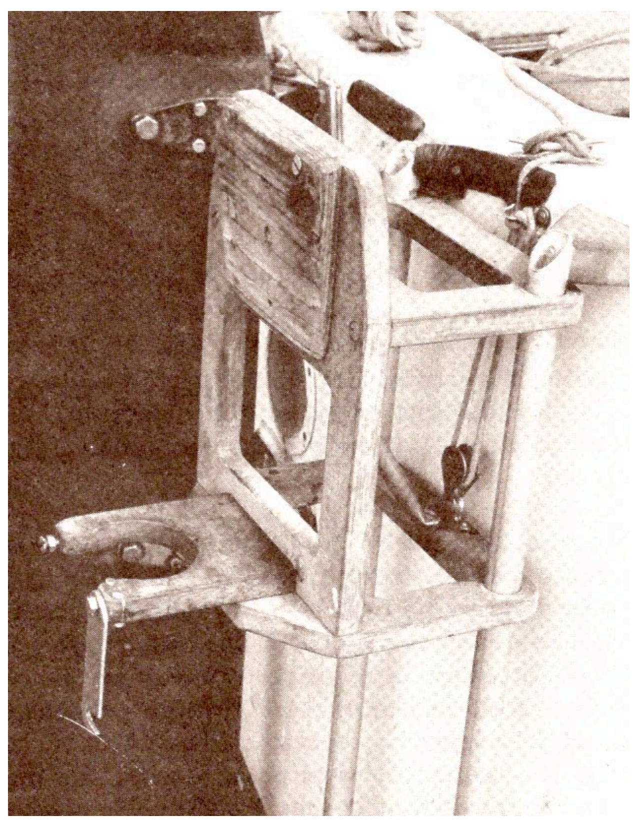


Down position. Extra fuel hose allows for 360° steering on this 4 hp. motor. Larger motors have neutral and reverse gears.

We have motored a lot. We have motor-sailed a little, and this seems a good combination when trying to get in before dark or when maneuvering in a windy harbor. The boost of the motor when added to the thrust of sails gives us confidence of better control when maneuvering in crowded quarters under sail, and the sails hack up the risky business of maneuvering with motor alone. With the above experience now gained, I am willing to recommend small, transom mounted outboard motors for all Searunners. Except perhaps the 40-footer.

The details of how small and how mounted are not well established, but going by the educated guess I would say that our 4 hp really belongs on the twenty-five footer, 6 to 10 hp would be right for the thirty-one, 12 to 15 hp for the thirty-seven and 20 for the forty. (The main disadvantage to a 20 hp outboard motor is that it is big enough to be hard to hand-start by the smaller members of a family crew. And a forty footer is an awful big thing to manage with a small propeller.) If these stated sizes seem small, remember that a large chunk of weight on the transom will disturb any boat's trim and motion, and that the larger outboards really gobble fuel. I consider the above sizes adequate so that cruising throttle can be reduced to about two-thirds of the wide open rpm, and still retain a flat calm speed of about 5 knots. This reduced throttle workload seems to be the key to fuel economy, and it imparts a reasonable lasting quality to outboard motors.

Mounting such motors on the transom of a trimaran seems to require two special design features for the installation: an extra-long shaft on the motor, and a vertical sliding bracket. These two features are not easy to provide but they are far simpler (and cheaper) than a standard inboard installation.



Phenolic board bracket on *Scrimshaw*. Note jaw at bottom to grasp motor down low, with gate for running in reverse.

For convenience we will speak of OMC motors, and this convenience extends into the remotest cruising areas where OMC motors are about the only ones for which parts and maintenance are available. We have seen them pushing lobster-loaded dugouts all up and down the Central American seaboard.

The four horsepower has, in the past, been available with a 15" shaft extension from the factory. This makes it especially well suited to the 25' Searunner without a sliding bracket, but we have heard that this extra long extension is not always available today. A certain amount of shopping around may produce a serviceable extension on an otherwise worn-out motor, if you can't find a new one by inquiring at local dealers or going direct to the regional OMC warehouse.

For the larger motors, OMC offers a standard five inch shaft extension casting, with the required internal drive shaft. But this makes the motor still too short to keep the propeller immersed when motoring in a chop. However, by fitting the motor with multiple five inch extensions (three for the 31, four for both the 37 and 40) a suitable totaling may be obtained. In this case, however, a custom made internal drive shaft with a thrust bearing must be made by a qualified machinist.

The design of the sliding bracket has the following requirements:

1. In the up position the power head of the engine should be above the deck level. This keeps it away from the wave tops when sailing, and allows for routine maintenance without dismounting the motor. (You sit comfortably on the sterndeck in the fresh air to change spark plugs instead of crawling in the smelly bilge, hunting in the dark for that certain hole on the inboard engine where you insert the greasy pump to change oil.)

2. Also in the up position, the propeller should ride clear of the water. This eliminates drag under sail (a very worthy cause for using outboards) while also eliminating the damaging electrolytic corrosion which attacks the motor's lower unit if left immersed while unused. This means that the lower tip of the propeller should ride level with the top of the lower rudder gudgeon on the transom.

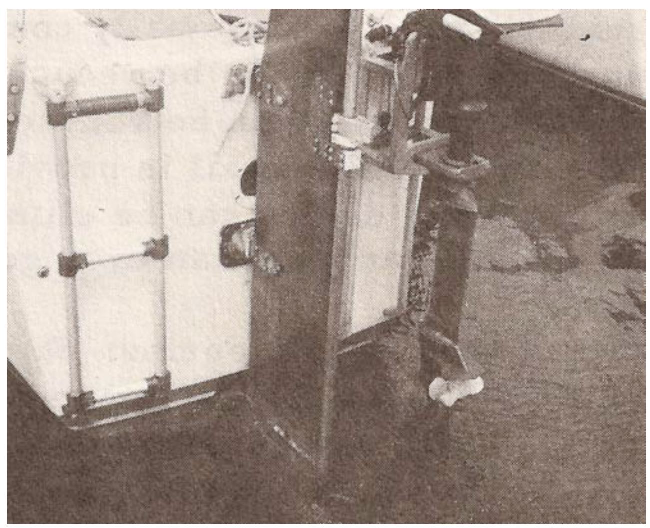
3. For the down position, the bracket slides should drop down to the same level as the rudder gudgeon. This will allow extremely deep immersion of the propeller, to keep it from caveating in extreme conditions. But in practice the motor is run with the bracket at about half-depth position to reduce back-pressure in the exhaust passages of the motor. Adjusting the depth, or pulling up the motor, is easily accomplished with small blocks and tackle, the pulling end of which cleats off on deck near the motor. A small pulley over the starter cord will allow pulling upwards on the starter when the motor is in the down position.

4. A final feature of the bracket is to compensate for the strains on the motor's transom clamps caused by the thrust of the engine being delivered at the end of the extra long shaft. This is done by providing a jaw-shaped shelf integral with the bracket, located down low enough to grasp the motor's shaft at a point just above the first (standard length) cavitation plate. The shaft is protected in way of the jaw by heavy rubber padding, and a gate is provided to close behind the jaw, which provides the necessary low down support even while running in reverse. Because the motor can be <u>steered</u> (as well as the rudder) by the crewman at the transom, it is possible for one man to maneuver a trimaran, so equipped, with such adroitness that it may be literally backed into a garage. Be sure that your bracket allows clearance space for steering the motor. This becomes doubly important when considering that outboard motor propellers are not designed for efficiency in reverse; it is sometimes easier to turn the boat around than to try to stop its forward motion by backing up.

5. The construction of the bracket can take any form, and use any materials, which satisfy the above requirements. Our bracket on *Scrimshaw* is made of phenolic board, but welded aluminum would be a better choice. For the larger motors, of course the construction should be more robust than with our little 4 hp. The slides can be of track, but tubular slides are better, ideally having runners with nylon inserts. However, the whole contraption can be built up with galvanized steel and water pipe if you'll be satisfied with a little rust and grease. It's all outside the boat and is easily reached for maintenance. Lock the motor to the bracket with a large case hardened security chain.

The fuel supply should be stowed as close to 'midships as possible, with an extra long hose running from the tank to the transom, and a squeeze ball primer at both ends of the hose, and a fuel filter in the line. Carry extra squeeze balls and clamps, extra filter elements, spark plugs, ignition parts, lubricants, tools, and a factory service manual. I believe you have a better chance of keeping it running, yourself, than with an inboard. And if you need major maintenance, you take the motor to the man instead of the super-costly business of bringing a mechanic aboard, or removing the engine for overhaul.

Mounting the motor on the transom protects it from being washed with waves because the boat is in the way. Searunner transoms are wide enough to allow space for the rudder in the center, and the motor to starboard and a permanent boarding ladder to port. For swimmers to climb aboard the boat via this ladder, a small streamlined protrusion on the rudder - about 20" below the transom - will serve as a welcome underwater step. This addition; and the ladder itself, is a most useful feature. Without it, climbing up on the boat is nearly impossible for most people, whatever may be their reason for being in the water; perhaps an emergency situation.



Scrimshaw's permanent boarding ladder. Not visible is small step on rudder under water.

Do not consider a wing-mounted outboard, or an outboard well for Searunners. If you do, the myriad disadvantages will become known to you in time, as they have to us.

And do not consider that any auxiliary motor is a safety factor worthy of great emphasis to provide security. Because it can provide danger as well. If you go sailing with a tugboat engine in your bilge, ostensibly to allow motoring into strong winds or currents, or to provide the power for steaming out of a nasty anchorage or into high seas - better analyze how secure you and your boat will be in these predicaments, dependent on the engine. The truth is that an engine can cost you as much security as it brings, for however much money you spend. The real reason for its existence in the boat is CONVENIENCE. On this level, the outboard auxiliary is hard to beat if it goes on the transom of a trimaran that really <u>sails</u>.

PHASE V - OUTFITTING

This is the most expensive area of boatbuilding, and the area in which it is most difficult to be specific about economizing. Part of the reason for this difficulty is that the plans are so highly specific about outfitting, and part of this expense is because Searunners are such highly developed sailing machines.

No doubt about it; the cutter rig, with its double spreaders and running stays and levers, and the extra winches, and so on, is an expensive rig. It is certainly no more expensive than a ketch or a schooner - with the extra mast and all the hardware that is entailed in those popular rigs. It is marginally more expensive than the standard masthead sloop. So here we have our first possible economy: simply eliminate the forestay- and running backstays and the staysails of your Searunner. You'll have nothing worse, nor better, than the most popular rig afloat, and you can always add your cutter rigging at a later date. Aside from the above I can't figure a major cost maneuver for the rigging, unless it would be such a bold regression as to rig your trimaran as a Chinese junk! Now there, friend, is a highly developed rig; but to use it would require the merging of two ancient cultures, Polynesian and Chinese, with our own. A preposterous undertaking!

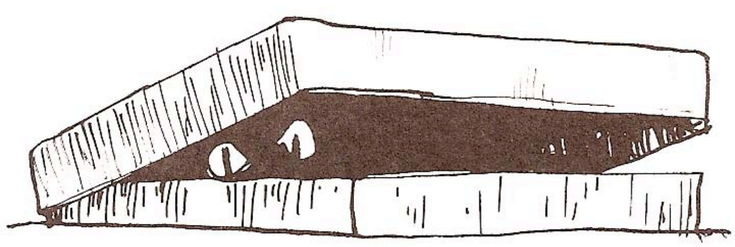
A marginal cost maneuver could be applied to the rig, and to all of outfitting, by selecting parts and materials which are marginally less expensive than the best you can buy. Such options would include, for instance: build your own wood mast or build up a bare extrusion; eliminate the spinnaker and its associated rigging; use Nicopress splices with heavy S&F thimbles for standing rigging; substitute galvanized turnbuckles for the more shiny ones (grease the threads and tuneup shrouds from the leeward side only); and use galvanized hardware for things like cleats, pulpits, stanchions, shackles, fasteners, A-frames and the like; galvanized rigging wire could be used if one wishes to undertake the maintenance required; galvanizing is suitable protection for deck hardware (on a businesslike-looking cruiser) if it is occasionally coated with a corrosion preventive; the number, size and quality of winches can be reduced in a boat not intended for racing or single handing; the sail inventory can be reduced to mainsail, genoa, and staysail (or a working jib) if the smallest headsail is provided with reef points to serve as a stormsail also; the self-steering device can be eliminated because it is not altogether necessary if you sail with a crew; and you can even go so far as to make your own anchors.

A word about self-steering: the device specified in the Manual has been installed on many identical boats but with varying degrees of success, which is mystifying. Apparently no one has had as much perfection with self-steering as Mark Hassall, who used it as his exclusive open water helmsman for the entirety of this world cruise - a story told in our newly published book Love for Sail. The fact that Mark's stock steering, vane works better than anyone else's may be just because it is Mark's! But seeking a physical answer I have noticed that his rudder skeg is oversized. So, I suggest that Searunner skeg rudders be modified to increase the chord of the skeg (at the top where it meets the hull) to be equal to the chord (breadth) of the rudder blade itself. See the photo of Mark's rudder and skeg on page 189 of the Manual.

These above suggestions are just to indicate the myriad ways in which the builder may use a newfound freedom to express himself in his boat, a liberty provided by a general relaxation of the manifest yachtiness specified in the plans. We've seen enough, sailed enough now in these boats to believe that they are better than they need to be for their intended purpose: cruising. Now if you want to surf the boat at flank speed for days in competition, or haul a heavy load for two thousand miles hard to windward, then better build her of premium stuff - if you can get it. Or better yet, build a boat designed for such purposes. And no matter what sort of Searunner you produce, take it easy! How the hell much can we expect of a backyard boat, anyway?

Now we're out in the ocean again, anchored at Coiba Island by a fishing club where rich gringos come to troll for the big ones by day and socialize in pink painted, air conditioned motel rooms at night. Last night we joined the socializing and found it fun to sit in on fish-talk instead of boat-talk. But it didn't last. Their questions kept popping up: "How long have you been gone?" "Oh, more than a year." … "How do you afford it at your age?" "We've got some friends running our business, but mostly we just don't have any external expenses." … "What a great education for your sons! But what about school?" "They don't think cruising is so unique, because they can't relate it to much of anything else. They've been working on their correspondence courses today, but not without a lot of forceful encouragement, shall we say." … "I like to hunt and fish, myself. That's my kind of reaction. But I've always wished I'd had the guts to take off like you have, while you're still young. How'd you ever manage to get away? "Well, we're forty, and that doesn't seem so young to us (swoons and laughter). And taking off like this isn't recreation. This is just the way we want to live for awhile. But I agree, we are pretty lucky to have been able to provide for this way of life in only about ten years of hard work. And I suppose that the longer you stay home, the harder it is to leave. It was a real wrench for us to get away. Like, for instance, walking away from our parents and our clients and our dog and cat. "Isn't seafaring a hard, dangerous life? "Yes, but so is landfaring, as I call it. The most arduous part of sailing for us has been the calms, and being without our friends. We've made some new friends though - good ones too. And they say we'll get plenty of wind down here by Point Mala. "How was the fishing weather outside the islands today? "Rough! Blew hard from the east. Isn't that the way you'll be going, against the wind?… "

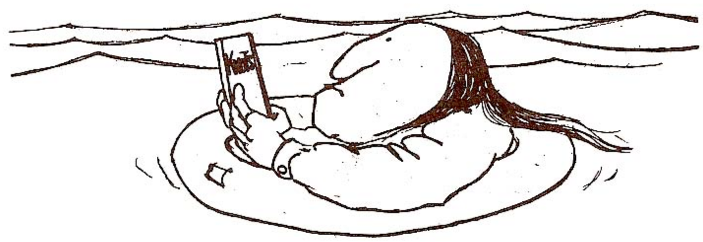
So goes life aboard our symbol of luxury; our homemade yacht. I suppose if *Scrimshaw* were less yachty, she'd be just as symbolic, to the gringo sport fisherman, or the Panamanian shrimp fisherman. Both kinds of these opposite onlookers see us as a lucky family who by some mysterious maneuvering of materials and economics, managed to put a boat together so they can make a trip together. This foregoing supplement to the SCM is intended to make just such a maneuver of materials and economics possible for more of our clients. Here's hoping we meet in a foggy anchorage somewhere.



First, go out on the port float—that's the one to your left. Then rove—uh, stick—the jib boom preventer—the rope—thru the snatch block—the little thing you think is cute. Then . . . .
Are you listening *Patricia*?

APPENDIX 3

TRIMARAN SEAMANSHIP



There once was an old North Sea fisherman whom I heard say, “The sea is an absolute element. We go to sea in our beautiful ships and still the sea will let us use them only the way she wants. If you take your boat across a bank, where there’s a hell of a rip tide and a gale o’wind pushing against it, you’re going to lose that boat. But that’s not the sea’s fault. That’s your fault.”

“Absolute element” is far from the emotional definition we all hold for the ocean in our minds. The ocean, to us terrestrial creatures, is another world.

So it was with us trimaran sailors. There were darn few of us at first that knew anything about sailing. Fewer yet who came into trimarans with some blue-water monohull experience. Figuring out how to sail a trimaran still has its surprises for anyone, especially anyone whose reflexes and brain patterns have been previously exposed to travel in that other world on earth. In those other boats.

We still have to learn, for example, that maneuvering in waters crowded with unimarans is dangerous. Even if your trimaran is as quick as a dinghy in the tacks, there are other trimarans that are “as slow to come about as a trimaran” But once the sails are full, we’ve got to really watch it because those guys in the leadmines can’t judge our acceleration. Up there in Sausalito where we played with the first ones, the wind is often very gusty. Those early tris were toys, and we played with them as children. But the 1958 monohull man could not be expected to anticipate a toy boat jumping from a dead stop to ten knots in four or five boatlengths. The same generation gap exists today because there are still a lot of boats around that depend on ballast for stability. They cannot accelerate like a multihull because of their inertia. They must yield to a gust sideways before moving out ahead. The traditional sailor is accustomed to noticing the traffic lay down before it gets up and goes; so when you sail a trimaran in a gusty harbor watch out for the monohullers. They didn’t see you heel to that gust, and they don’t even know you’re coming. It’s not their fault. It’s up to you to avoid collision. That’s good seamanship on any boat. Absolutely.

Maneuvering the tri is a perplexing job for some sailors because some tris are perplexing to maneuver. Not all. Mostly it is those which slide sideways through the turns because they have too little lateral resistance; have deeply immersed outriggers when floating at rest; have high, boxy superstructures added to their windage; foul bottoms and inexperienced crews. We can’t do much about any of these features that the designer (or the builder) hasn’t already done except the last one, or two. Don’t attempt to even move a multihull under sail if it is growing a green beard. Scrape off at least the worst of it before sailing to the beach for a bottom job.

Once you’ve got her under way, keep her moving. The inexperienced sailor is always buffaloed by the sprawling nature of the trimaran in close quarters, and he tries to sail slowly. The more slowly he moves ahead the faster he moves sideways, out of control.

When tacking out of the harbor, drive her at her normal speed right up to the instant you wish to tack. You’ll hear the fellows on the dock asking their neighbors if they have paid their insurance, and the only way to put them at ease is to pull a smart tack right under their fantail.

You can't do that while sliding slowly sideways. When attempting a tack in a choppy sea and strong wind, the boat must be driven hard to windward before the tack. Strap her down tight and really go to windward; then tack. Many tris, especially those without centerboards, will end up in irons if you try to come about from one reach to another. If you find yourself in irons, first thing, slack the main sheet (or in the case of ketches, the mizzen sheet). The headsail, now, will push the bow around onto the old tack, or the new tack, depending on which one you prefer. You can determine which by steering backwards. Watch the water to determine when the boat is making sternway and then reverse the helm to get the wind on whichever bow you wish. But remember to slack the aftermost sail or you'll keep going onwards backwards; out of control.

Jibing the trimaran in a strong wind is less dramatic than jibing the monohull because the moment of jibe is not accompanied by a drastic change of heel, and the boat's speed is more nearly the wind's speed: less wind pressure on the sails. Nonetheless, control the jibe by pulling in the mainsheet as much as possible before jibing, and above all, hold the course. It is best to have the helmsman steer and only steer. Someone else should handle the sheet, especially if you're jibing at surfriding speed. On such occasions in a ketch it is best to have the mizzen down. It is always best to maneuver with some headsail set. Close-quarter jibing with a sloop is sometimes impossible under main alone; the same in a ketch with mizzen set but no jib. Some trimaran sloops and cutters have complete maneuverability with headsail only, but not with mainsail only. The major maneuvering rule is: keep her moving. Forward.

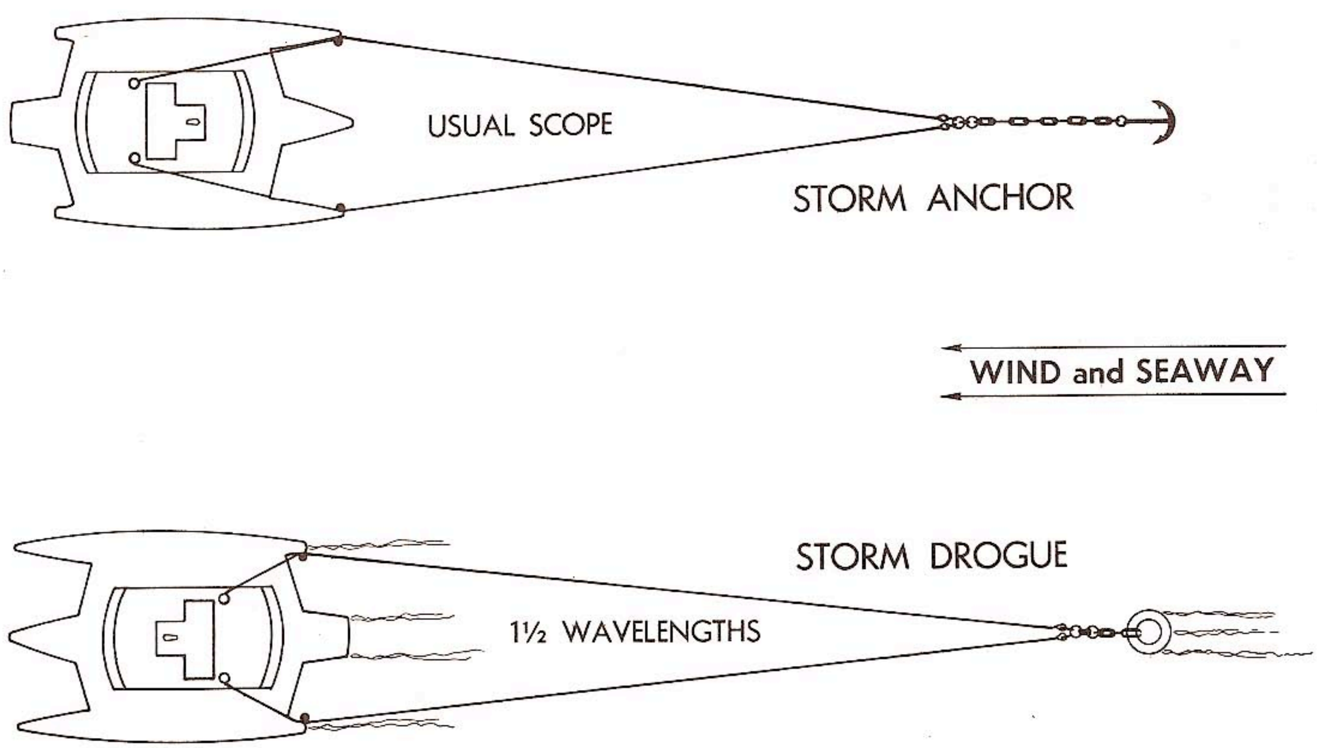
When you've got your maneuvering down pat - I mean so you <u>can</u> work through a gusty crowd, then's the time to think about coming into your first harbor after your first ocean passage. Very possibly there won't be a dock. This has perplexed many trimariners because some of us are the type that will take off for the moon without first considering the landing. Anchoring! Like how do you get your bird to roost when it won't even fold its wings. For one thing, out there on a tether she'll probably be better off than if she is tied up with her wings against the wall of the cage. Like where you are keeping her now perhaps.
Yes, you have to come and go with the skiff. Do you know that there is a preponderance of yachtsmen today who have never known how it feels to scramble over the rail from a dinghy (having rowed from the beach alone, stopping all along the way to watch the bottom glide by in the moonlight)? A dock is a convenience for which you pay by losing the using of your dinghy and your anchor. But you can also lose your anchor, and your boat.

So how about taking some advice: get some chain. I know, the designer will have a fit if he knows you are overloading her with chain. But you don't need much. Maybe just a boatlength. Enough to weight down the rope portion of the rode so it doesn't pull upwards, but flat along the bottom instead. When you really get to cruising, you'll come to know the anchor is a blessed thing. It is the best chance you've got for getting back to the world you came from. You can get the basic skills out of Royce's or Eric Hiscock, except that with a trimaran you do it backwards. Stern first. That's why a trimaran should have good footing on the sterndeck, a sternrail and bits aft. Nothing new about that, but lots of yachts don't have these features, especially tris with their superstructure dragged-out all the way to the transom. The reason for anchoring from the stern is that the boat will ride better. Better motion in a head-chop and less sawing left and right on the rode. At least if she saws and pitches while on anchor by the stern it is definitely time to get out of your bunk and see if she is dragging. If the barometer is down, consider getting under way if your landing site is unprotected. Or else turn her around and anchor head-to-sea. May as well put out another anchor and get one of them - the one that has the chain - to come up from the chain by a bridle of two rodes. Up through snatchblocks on the float bows and thence to the winches, port and starboard. You can then be assured that if it really picks up to be a nasty anchorage, you'll be ready for it because the bridle will keep you riding directly head-to-sea. That Tahiti ketch anchored off the beam may sally over into you. The skipper can't do a thing to keep from sawing if the wind is right - maybe across the tide. But your trimaran won't saw this way and that because of the bridle on her wingtips. With the bridle you have absolute directional control. Directional control is the key to several aspects of trimaran seamanship.

You are less likely to drag than the ketch over there. She's so heavy that the surge on the line, as a swell lifts the boat up and back when the line is already bar-taut, is possibly equal to the boat's weight. So if your boat is lighter, the strain is lighter. Trimarans weigh about half as much as equivalent cruising keel boats, and so, stand maybe twice the chance of holding in good ground. But that's the kind of strain anchors can take; your ultimate ground tackle should be designed more for hanging up the boat rather than tying it down. The whole system could be that strong; strong enough to pick her up by the anchor without being ridiculously strong. Most of us never encounter an anchorage that tests ground tackle like that, but you never know what you'll find when you go traveling the ocean.

One thing is sure: things don't always go your way. So let's consider going against the ocean, as opposed to going with it. If you want to go the same way the wind is blowing, a trimaran will really take you there, if you can steer it. Some of them always want to stray - right up to the point of zipping off left or right on their own, regardless of the rider's tight-rein on the tiller. To a cowpoke she'd be acting like a runaway; sailors call it broaching. It is like riding a bucking bronc sideways down a moving hillside of water really kicking up the dust. And then wheeling around to a rearing stop, the beast snorting in the spray it made itself. If it keeps up, you'll wish you had a centerboard or something. Something to keep the boat from sliding sideways down those waves. It's a lot to ask of the rudder alone. Skegs and float-fins help. You need something deep. Down there in solid, quiet water, hanging on. If you don't know yet whether your boat is a broacher, you'd best be ready for anything because there's no other way to prepare yourself for the exciting helplessness you'll feel, riding a runaway out at sea. Reports are coming in of widely varying behavior from this type of vessel.

It seems that the good ones are fabulous - real sea boats. The fastest trimarans are the fastest sailboats. The ones that go well to windward, well, <u>really</u> go to windward. Steering qualities (directional control) can be excellent, even downwind. Windvane steering is known to be capable of controlling a trimaran, a capable trimaran, when running dead down a sixty knot wind/seaway. This quality of directional stability is not necessarily a feature of the windvane mechanism, but of the boat itself. Good steering qualities when going straight ahead are not found in mounts which easily slide sideways. But downwind, even in a tri which tends to broach, you can usually control a runaway with a special piece of trimaran seamanship equipment. It is called a bridle.



But first, let me say that if you can steer, and want to, let 'er rip. Most of the men who know say that a trimaran is safest and most comfortable when it is plummeting headlong down the slope well ahead of the crest. That means you are sailing at about the same speed as the seaway. It is quite a ride. Quite a ride when the wave you are staying with is in among waves which have developed from a wind that blows with what they call "unlimited duration and unlimited fetch." If it is being pushed by a 30 to 55 knot wind with no land mass in the way and it has been steady for a day or so, your wave is traveling about 16-18 knots. Stay with it brother! It will subside in a few hundred yards. Some will overtake and pass you without cresting. You may see some of these have their moment way up ahead. You can tell a breaker from behind by the white streaks of head running down its back. Now, if you happen to be scudding along in the trough and one decides to have its moment with you, it is truly a great moment. You are a ball balancing on the nose of a seal which is swimming over the brink of a waterfall, one that has an initial drop of five or ten feet and then turns to a long hollow sloping spillway. The boat sinks to its wingpits in water so broken-up with air that it won't float you. The wing-deck slices through it like your tongue through cotton candy, eating it up and smearing it all over everything.

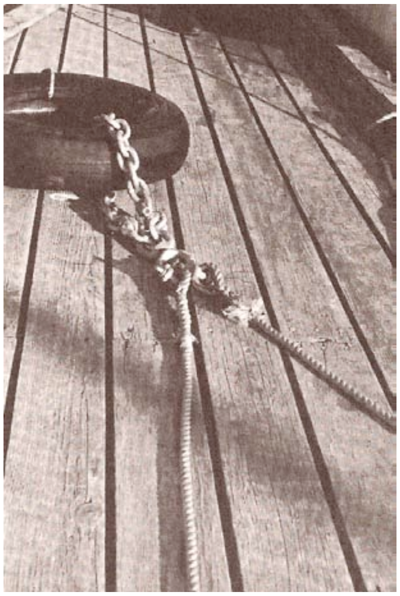
If you can keep your eyes on the trail through much of that stuff you've got what it takes to be a great trimaran sailor. But you can always slow down too. Slowing down means that when you're not surfing with the wave you should be going about half surfing speed; less in the smaller boats. This reduces to near zero your chances of "going over the falls." Only when you are flying enough sail to drive you along in the trough at the same speed as the crests will you have an undulation build beneath you and crest with you there. But you can have your cotton candy and eat it too. Let's say you are traveling more slowly than the seaway; a wave advances from astern and breaks near your transom. The added steepness, and the broken water falling down the face, will boot you out ahead at sufficient speed that you simply run away from that hotspot. This is the inherent rightness of the multihull, it can jump away from the punches. The speed envelope of the trimaran is open at the top because of narrow hull form, and lightness. The displacement vessel, contrarily, must lie down and take it. Its inertia and wide hull generally prohibit acceleration above the optimum hull speed.

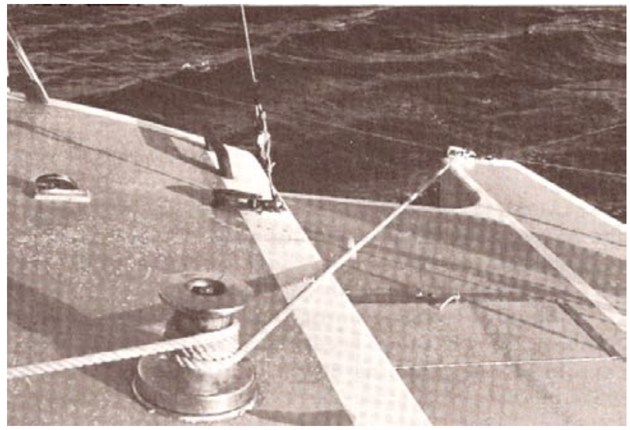
But in order for us to use this inherent rightness, we must be able to control the direction in which we dodge. Some trimarans need reins.

Drag something. Just a line helps. If that's not enough put a short piece of chain on the end. Not your best anchor chain, just 5 or 10 feet. Drag one line from the main hull stern, not one from each float stern. Unless the broaching gets really bad. Then use the bridle, just like over the bows when anchoring, but over the sterns instead. Attach a tire to the bridle junction. The junction should be one and a half wavelengths astern or so that when you're on the crest the tire is in the trough. Run the bridle rodes through the snatch blocks as with anchoring, but now they are fastened to the float sterns. Take the rodes to the winches again, and now you are dragging a tire across the ocean by a bridle. If the boat turns to port, out of obstinacy, the port side of the bridle goes slack. Because the boat is so wide, the bridle has lots of purchase; the starboard side is tight, and pulls her back on course. Directional control.

This is sort of a last resort in a boat that steers well, yet it can do wonders to control a runaway no matter what the conditions. But don't overdo it. Too big a tire will "stop" the boat and hold it down for the waves to pounce aboard. A standard 14 or 15 inch auto tire is enough for a 35 - 40-footer. You may as well carry two. Combined with a chafing-board, they make great fenders when you're tied to pilings in a surge. So long as you're taking two tires, may as well make them different sizes. With experience you'll learn which one is best for your boat and you've still got one if you lose one. Unlike most sea anchors or drogues, you know you're not going to break a ruddy tire. It'll stand as much strain as the anchor, which it will receive, and it could be as important. It'll be the snatch blocks or their mounting or the winch bases or the bridle junction that pops, so these must be unquestionably solid. The tire you can trust.

Dragging something is a matter of adjusting your speed and direction so that the seas overtake you as gently as possible. A whopper will push you out ahead, dragging the tire at great speed. But you've got control of the runaway. You know where it is going and you can guide it a little to port, or to starboard (to avoid that island up ahead) by adjusting the lengths of each part of the bridle.





Tire bridle junction (left) is a large swivel. Three feet of chain passes through tire. Bridle rodes are eye-spliced over thimbles and all shackles wired closed. Bridle rodes (above) lead through snatch blocks on float sterns and pass around to winch. Secure rodes to separate standard horn cleats; do not use quick release cleats for this job.

You've got the power of the winches there to help you with the adjustments. If the seas are smacking you in the transom, but good, then get up a little more headsail. If you've got sea-room, give with the punches as much as possible. Running in a gale with sea room is a matter of, first: directional control; second: move ahead of the worst crests; but third: don't go so fast that you are overtaking breakers, climbing up their backs and diving over the falls. Winning the race isn't worth that kind of thrill. But I admit, it sure is fun in anything but gale conditions. And it's safe enough even in a gale so long as the crew is not cold-tired-hungry-wet-n-seasick. If you haven't got sea room or for some reason you have to really slow down, try both tires, but better put the storm covers on your sterncastle windows.

To stop her dead in deep water use a parachute with the bridle over the bows. Don't stop stern first in a seaway. And don't proceed backwards, with the tire out over the bows. You'll have water approaching the trailing edge of the rudder and a big head sea will turn you around sideways.

A trimaran is safe lying beam to sea if the waves are not breaking heavily - not enough to really wash the decks. If you must present your broadside to big waves, let the boat move sideways when it gets hit. Don't restrain it with a drogue on the beam. Light boats won't take that kind of pounding. Neither will heavy ones.

If it is zero hour - say you've been dismasted and the engine's drowned and the rudder's broken - then go on in. Right through the surf, tire, bridle and all. You've got a good chance in a trimaran. It's been done.

But if the boat is able to sail at all and you haven't got room to run, I'd say it is better to turn around and go against the ocean. A real seaman hangs onto the last floating stick-of-a-chance to save his boat from shipwreck. If you refuse to quit trying you'll very probably get a chance to refuse again in the same boat. And going against the wind is the only way to avoid cyclonic storms. Running from a hurricane takes you right into its path.

Going up a very rough seaway is like going down. It is a question of control. Except that very often control upwind is easier to achieve than downwind, especially if your boat is a broacher.

Keep her moving. Upwind that means reduce sail only to the point where she will still keep going ahead. Ahead so you have water going past the rudder fast enough to steer; to control. With a centerboard, your boat will keep going forward, with control, in greater wind force than without.

Balance the sail so that there is not so much area on the bow that she wants to steer off downwind, and not so much on the stern that she wants to head up and stop. If she stops, you're out of control. The safe thing to do then is quickly slack the sheets. You'll drift backwards (so you steer backwards) and eventually turn sideways to the wind. If the sheets are slacked for reaching you can get going ahead more easily; when you're moving again you can strap her down and go again to windward, but this time, dammit, keep her moving.

Don't be afraid to drive her to windward. If the rig is strong and the rudder is good and she has something like a centerboard you'll be able to crawl out of a tight hole, even if you shouldn't have stumbled in there to begin with. Better yet, a sailor who can drive his boat to windward can go more places, and back.

Squalls deserve some treatment here because they feel the same about you. They figure you deserve whatever treatment you get from them, so it's up to you to avoid the worst they have to offer. Running downwind in a squall is not so bad because you're going along with the treatment. Get the big sails down in time. You can see squalls coming usually even at night. Just run. But if you don't want to go that way, weathering a squall head-to-wind is, again, a matter of control. Squalls often have rain, or they will blow the wave tops off and make it hard to see anything but the compass. So watch it. Don't head up and stop. Keep her moving so you can steer. If you get stuck in a real mast-buster you may need the engine to hold her head-to-sea. Once you've committed yourself to weathering this one head first, try not to turn around. The turn itself can be dangerous in a trimaran. But if you're forced to turn your side to it, do it with the sheets slack. Set them loose so that while you are receiving the wind beam on, in the middle of the turn, the sails aren't trying to break your mast. It's the same with any boat. The engine can help hold the bow to windward by kicking water past the rudder even if the boat is not making headway. That is why it is nice to have the prop ahead of the rudder, which you can't have with a wing-mounted outboard motor. Don't even try to hold the bow up with the engine unless your boat has a real one. A forty foot tri with about twenty diesel horsepower can hold her head up against lots of wind - fifty to sixty knots. Even if the boat is making sternway! Turning around to run before the squall strikes is safer. It lets the boat's forward motion absorb the wind force, and it puts the rain or hailstones smacking the back of your ears instead of bouncing off your eyeballs. And you've got to keep your eyes open to see the compass. If you are trying to get to windward, turning around will cause you to lose some of the ground you gained by hard work, but squalls usually don't last long and they have little effect on the sea. A real downpour will take the edge off of sharp crests.

I've heard it said that roller-furling headsails are at their best when you're sailing in squalls. They are so easy to douse. But make sure your kind can't come unrolled at the height of the blow. If it does, release the sheet completely. This may be impossible if the stop-knot in the sheet's end is jammed into the lead block. For these occasions, and others, it is wise to keep a hatchet handy to the cockpit. Like your knife, it must be sharp, and <u>always</u> available. Nothing peculiarly trimaran about that.

Trimarans have very shallow draft but that doesn't mean you can go where the old North Sea fisherman cannot. If there's a disturbance nearby - or far away - that is causing a big swell or a steep chop, beware of going from the depths to the shallows. Ordinary ocean waves can "feel the bottom" in soundings deeper than fifteen fathoms, and it gets heavy when they start to curl like surf. Wind against current can cause something similar. On the charts they call this "overfalls" and if conditions warrant, stay out of that stuff. If you're caught in the curlers, you've got to go hard to windward (keep her moving and use the engine with the sails) or run with it. Avoid reaching if at all possible but if, because of sea room, it is not at all possible, then dodge the bad ones. If you see one coming that is going to break about the time you get there, turn up and let it pass ahead (but keep her moving). If you see one coming that is definitely going to burst on your beam, turn and run. In centerboard equipped boats, if you really get trapped in overfalls and you must take them on the beam, pull up the board. This will let the boat slide sideways when it gets slammed, reducing the possibility of damage or capsize. The possibility of capsize, if is ever imminent, will probably involve the shape of the sea more than the force of the wind. It is the same with monohulls and sinking. Control is the only way I know to put capsize in the same bag with sinking. With directional <u>control</u> one is as likely as the other and multihull sailors need worry about capsize no more than ballasted-boat sailors need worry about sinking.

Once you've sailed without ballast you may come to think that the lead mine drivers should worry about sinking more than they do. Well, they have come to think that you should worry more about capsize. I suggest that neither of you worry. Just be ready for it. Then you don't have to worry. Capsize is not as final as sinking. If you have a liferaft. It must be accessible from under the wing (via a special hatch or by lashing it in the wingnet) and be the canopied type. Tethered to the mother vessel which is stricken by fire or explosion or collision or capsize, the raft inhabitants can return to the non-sinking trimaran and survive, for months maybe, on its contents. So don't sweat the capsize scare. Just get ready for it. Assume it <u>will</u> happen. Then avoid it by developing your boat, and your skill, to achieve <u>control.</u>

I would now, if I could, describe another aspect of trimaran seamanship. The feeling. It is much easier to verbalize on a sensation while it is being experienced. Perhaps someone will be under sail while reading this. I hope so. But for those who are not, let's consider ourselves in the cockpit right now, tonight. We are running down the California coast in the fog. It has been tough. We should have stopped at Avila when we discovered the radio was inoperative, but the fog bank was holding well offshore and we decided to go on around Point Conception, the "Cape Horn of the Pacific" as it is called in the Coast Pilot Book. By reckoning, it should be 3 miles off the port beam but we can't see the light. We have slowed the vessel, hoping to quiet the water sounds and listen for the diaphone, but there are ships blowing and we can't distinguish which is which. This is hot stuff, trying to round a promentory outside the rocks but inside the steamer track, in the fog. We've got to turn East, down the Santa Barbara Channel, but if we turn too early we'll hit the Cape. If we turn too late we'll cross the steamer track. If we really overshoot, there is San Nicolas Island out there. We've got to go by <u>feeling.</u>

The wind is from behind and these big coastal seas are unidirectional this time of year no other wave systems here probably. Until we pass the Cape. Then, possibly, we'll feel a little lump rolling up from the East. If not, or even if so, these ocean waves we're riding on will wrap around the corner and rumble on down toward Santa Barbara. We can't see them. Now and then we hear a big one go by. They don't seem to be breaking regularly. When we hear them we soon take a stinger in the broadsides - a mean snap of water against the float from someplace else. Must be the wakes of freighters. They're coming from the starboard so we must be inside the steamers. Okay. But damn, when do we turn? I promise, when we get to Los Angeles I'll pick up another radio so, with ours repaired, we'll always have two. There's a radio beacon at Point Conception which could save us. Literally save us. But if we can't hear the Point, or see it, maybe we can feel it.

It is a feature of the trimaran that it responds to the surface. It must conform to surface changes, both longitudinally and laterally. Monohulls respond similarly fore'n'aft, but the lateral motion of outrigger craft is completely different. Running dead downwind, as we are now, gives no lateral motion whatever. The crests are arranged at exact right angles to our course. The stern rises until the crest passes under our midpoint - feel - and then the bow lifts as the stern settles into supporting water on the back of the wave.

Are we on course? She seems to be walking on her elbows a little now. There. The westward outrigger rises a little, with the stern, as the crest approaches. As the crest passes, the eastward outrigger lifts with the bow. There is a new, lateral component to our motion. Our course hasn't changed, but the seaway has. The difference in direction between the course and the seaway - the change - can be determined quite precisely by feel. It works best if the seas are running nearly parallel or nearly perpendicular to the course, but if you'll open your senses to this information, like the ancient Polynesians, you can develop a very useful skill. There's another one. They're coming from the quarter now. Let's follow them East on around the Point.

Crunch! No, seriously, the outrigger vessel will communicate with the seaman in a different, sensual manner that can be an important aspect of trimaran seamanship. Course changes, tide changes, wind changes, seaway changes all come through the seat of your pants in a very communicative manner. This, because of the tri's light weight and responsive configuration. Like a motorcyclist or aviator, the multihullist doesn't drive his boat, he flies it. He's not in it or on it, he wears it. This added aspect of lateral motion, compared to the monohull, can be overdone, especially in tris which combine the features of no centerboard, a heavy mast and heavy payload in the floats.

These tend to exaggerate lateral motion to the point where you're flopping from one side to the other with brain jarring snaps. Other trimarans are designed to respond to the surface without over responding. To get the feeling.

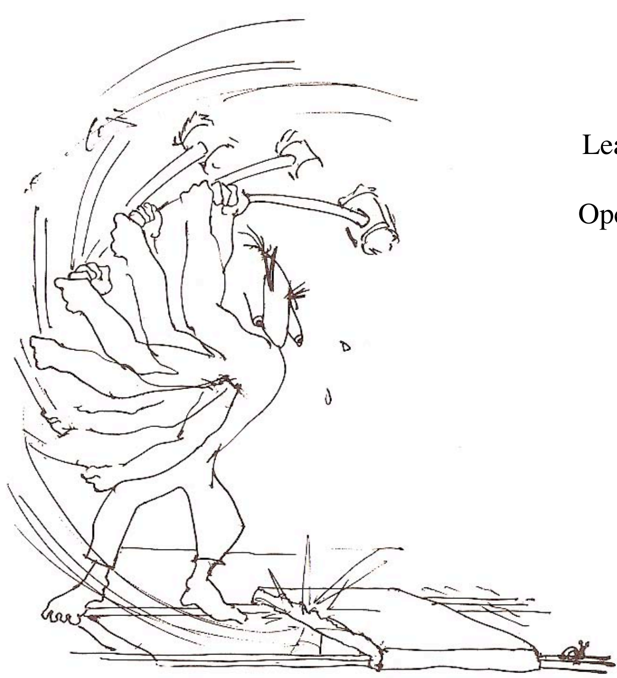
So trimaran seamanship, like the ocean, has its absolute elements. Don't blame the Tupperware slush-bucket if you run him down. Anchor by the stern until it's time to anchor by a bridle from the bows. Don't let her run away with you downwind and keep her moving upwind. Stay out of shallow water when conditions might cause overfalls, and if you must reach across the wind when it is really nasty, pull up the centerboard.

Get the feeling. It can be at least as good in a trimaran as in any vessel. You will find that when you visit the land of ocean, seamanship, more than landsmanship I guess, is absolute common sense.

The preceding article "Trimaran Seamanship" was published in <u>Sea</u> magazine. Portions of the following article "Heavy Weather Handling" appeared in <u>Multihull Sailing</u>. Both were written by Jim Brown and appear here by kind permission from the original publishers.

The reader may wish to pursue the subject of Multihull Seamanship by reading Jim Brown's investigation of the capsize of the trimaran *Meridian*. This series of articles on capsize examines preparation, prevention, survival and rescue. It begins in the Fall 1975 issue of <u>Multihulls Magazine</u>.

For a story of survival weather with a happy ending, read Mark Hassall's tape recorded accounts of riding out pacific hurricanes in <u>Love For Sail</u>.



Leak-proof?
or
Open-proof.

HEAVY WEATHER HANDLING
for
TRIMARANS

These ten axioms are an attempt to distill a wide cross-section of personal opinion on what to do in a trimaran when it blows. Gathered empirically from experience and conversation, there is no claim made to originality or worth.

1. Do not continue into head seas of such power that, as your boat jumps off the worst crests and falls into the troughs behind, she is no longer moving forward with good steerageway.

2. Do not continue surfriding downwind to the extent that the boat has broached to a near standstill or until it attempts to overtake the wave ahead; without restraining its speed with warps or tire-bridle.

3. Beating to windward, reduce sail when the leeward float is, for half its length, forced through the crests right to the deck.

4. Running downwind, reduce sail when the helmsman allows yaws approaching 30° off to one side of the course, or when the boat attempts to overrun the wave ahead.

5. When sailing a reach, reduce sail or change course when breaking seas regularly board the weather float or, when skating down the back of the wave, the leeward float is all buried to its deck, or the main hull nearly lifts out of the water.

6. Beware of "overfalls" or confused, curling sea conditions caused by a deep rolling seaway encountering shallows or strong currents against strong winds. If you must sail a reaching course in such conditions, pull up the centerboard. If you must beat to windward in such conditions, use the auxiliary to aid in steering (prop must be forward of rudder for this). If you must run downwind in such conditions drag a warp or tire and bridle.

7. If strong wind and/or very confused sea force the vessel out of control, try logical combinations of power, sail, centerboard and warps to retain best steering possible. For instance:

> <u>Downwind</u>: broad reaching for the harbor in tumultuous conditions threatening a broach or cap size, your best possible combination might be the tire-bridle with storm headsail, half center board, and the engine running slowly; you with one hand on the helm and the other on the throt tle.
>
> <u>Upwind:</u> beating for the harbor against overpowering waves may find you with storm headsail and deep-reefed mizzen (ketch) or stays ail only (cutter) with full-down centerboard and half power on the engine, or idling with hand on throttle.
>
> <u>Reaching</u> in similar conditions should be avoided but if demanded, pull up most of the board. Carry much reduced sail but keep good speed and steer diligently (requires visibility) to dodge breakers. Avoid getting slammed in the broadsides. Use of the engine is not strictly necessary, or wise, because forcing the boat in such conditions with mechanical power may (if the engine suddenly quits which they OFTEN do in rough weather) put you in a perilous position. Only when fighting to gain shelter might it be wise to use the engine's thrust of water - past the rudder - to improve directional control. Outboard motors are generally useless in these conditions. If you've got sea room, handle her by <u>sail.</u>

8. Obey traffic regulations. Many ocean sailing routes are well marked with stop lights, one-way signs, detours and other clearly obvious, cosmic commands including "road closed!" Sea lanes for sailors are extremely seasonal, directional, and periodic. To read the language of this system you simply need to know it exists.

Generally, to avoid storms, avoid the high latitudes in winter months. To avoid cyclones, avoid the low latitudes in summer months. During the off seasons, beware of making anything more than short hops with good forecasts between well protected harbors. Ocean winds and currents are generally systems of fairly well defined and predictable behavior. Study these with pilot charts, and the many other available sources, to grasp the system. When you gaze at a pilot chart and see all those swirling colored lines, you get the idea that whatever's going on down on the surface of Earth has got to have a lot of system to it. And that's one system nobody's got the energy to fight. Don't kid yourself that you can sail in the place of your choice at a time determined only by your vacation. Fighting through a perilous situation on Sunday so you can get back to work on Monday is the same exact kind of lunacy it takes to drive on the wrong side of the road through a curved tunnel - right after the bars have closed. One can do both, and survive for awhile. But he learns.

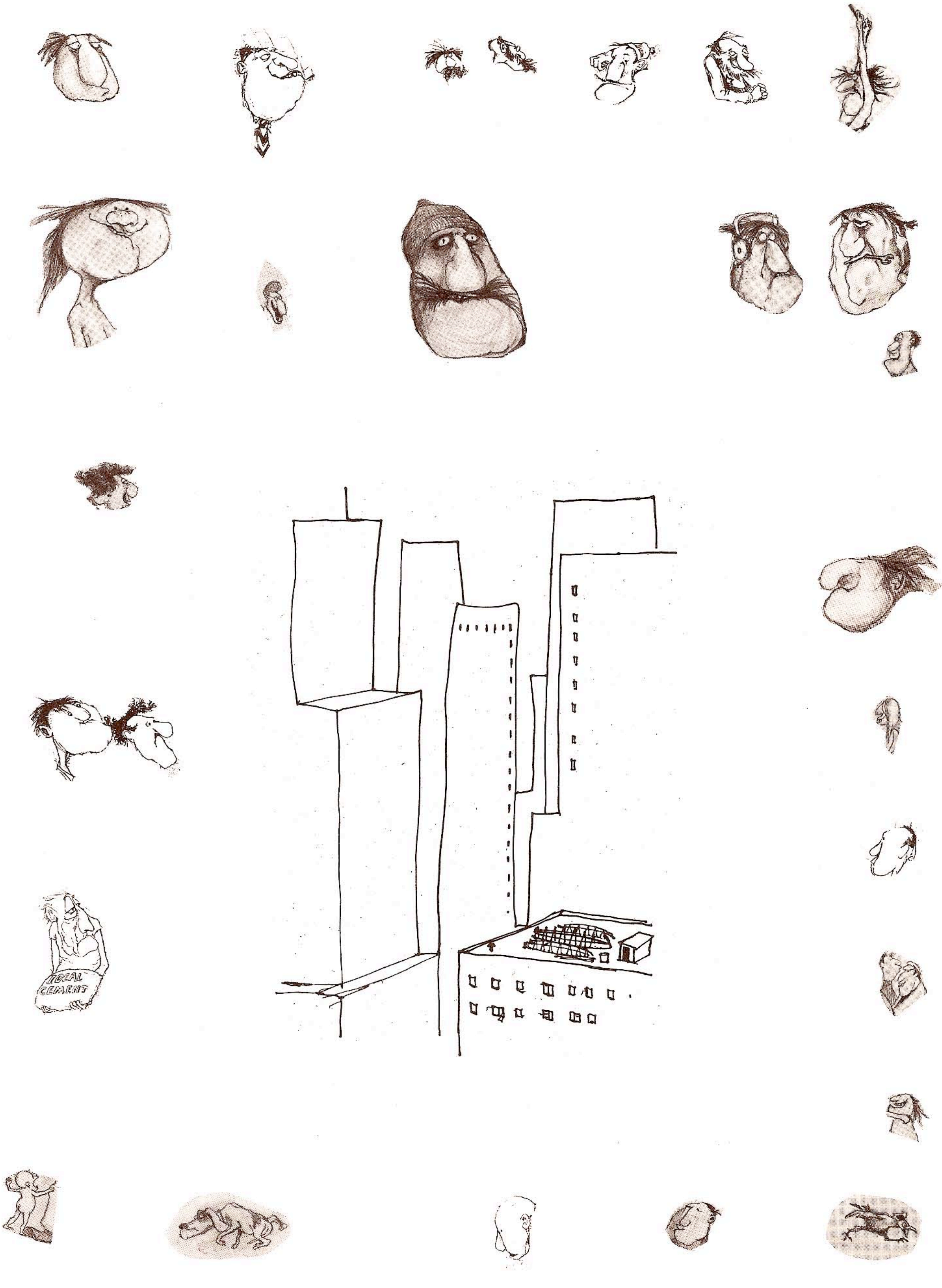
9. Know your boat! Until you know your boat, sail in carefully selected conditions with good visibility and in waters where you can be seen if you get into trouble. As your confidence increases, sail the same waters but in more wind. In protected water, work up to the point where you feel capable of really driving the boat in strong winds - before going out into big waves. When you first intentionally go out into threatening conditions, sail in the company of another boat - an initiated boat - or sail with definite plans known to someone ashore. But GO! Get threatened on purpose. When you're expecting it. Take a willing crew and a willing boat and go on out there and try to tear it up. Just beat the daylights out of it! You're certain to return knowing of improvements to be made. And then when you get caught out you'll have the advantage of knowing something about what it's gonna be like. A very great advantage this is; it makes it hard for you to lose.

Never drive your boat that hard when you're way out in the ocean, all alone. You can beat a boat harder in a trial, or a race, than in a gale. A multihull, especially, is a boat you can baby in a gale, if it is not overloaded. This implies that, if there is one occasion when multihulls are more dangerous than monohulls it is in heavy weather ocean racing. A good multihull will achieve levels of performance, and levels of stress, unattainable by monohull counterparts. Something like a Searunner is potentially hot enough to sail along with the most competitive traditional ocean racers, and yet it is a home made cruising boat. When sailed with seamanlike reserve, a modern multihull will continue comfortably and safely in rigorous conditions while its equivalent monohull takes a licking at the same speed.

Why go faster? Is it to prove and improve your prowess as a seaman, or is it to beat another sportsman 'round the mark? One can't help suspect that mixing the two adulterates a lot of the primary ingredient: seawater. And I think the admixture is the only thing about trimarans that is dangerous. Under its influence one loses track of the distinction between aggression and survival. Take any vehicle with real racing potential, and drive it with reserve. It has got to be pretty safe! At two-thirds throttle you can relax. Full throttle is safe enough in the right conditions. Anything you can do to make the boat go faster in moderate conditions, like up to thirty knots of wind, is gravy. You'll be romping around at superior speed and be very safe and comfortable. But pushing her beyond what she wants to do when reefed - like not reefing enough - is dangerous. Arthur Piver said it like this: "Don't worry about the boat, just don't forget the sails. Get 'em down in time."

If you know your trimaran well enough to know when it is time to slow down, and you do slow down, then you've got the safest boat you can get. When sailing offshore, or at any time other than when you're trying to get to know the boat's extremes, your trimaran deserves to be handled with the tactics of reserve as described in axioms 1 through 8. Even when racing! As for number nine, this one, you cannot get to know your boat - know her for what she really can be like - until you know her when she's sailing *light*.

10. Never complain about calms. It's bad luck.


IDEAL
CEMENT

PLANS

We feel it is important to maintain contact with our builders. Unless the use of the plans is limited to one builder, this contact is lost. Adherence to the designs is necessary to create a full line of trimarans which are recognizably uniform and strongly oriented toward quality. However, variations on the plans may be made in consultation with the designer.

We do not lease plans. We sell a service, and the plans are instruments of that service. Technically they remain the designer's property to clarify that the designs themselves are not for sale. But the plans need not be returned; they stay with the boat.

To order plans, complete the "Owner-Builder's Agreement" (following page) and forward with the design fee. Subtract prior payment for this Manual and/or our Searunners Trimarans Catalog from your check or money order. These are part of the plans. Plans are mailed promptly; distant orders are sent Airmail directly to you.

The working drawings are printed by the "Ozalid" process, and will fade rapidly in sunlight. We suggest making a cardboard or masonite folder for the sheets <u>currently in use</u>, and keeping the others <u>safely</u> put away. Faded or damaged sheets will be replaced for printing cost (about 15¢ per square foot) upon the return of the old sheets.

The lines drawings are scale versions of the lofting used by the designer in working out the boat. You may study them to advantage, and scale from them. Bear in mind that paper is not stable dimensionally - it stretches with humidity. The pattern sheets particularly should be protected from dampness.

Any questions which you may have will be answered by mail if you type or print the question, leaving sufficient space for the answer, and enclose return postage. Address these questions to the agent from whom you purchased your plans. He receives a commission for consulting with builders. Plans purchased directly from the designer do not necessarily earn consultation from the designer himself; the designer's wife or your nearest agent may perform this assistance. We feel, however, that a great deal of consultation should not be necessary because of the scope of these plans and this Manual. Telephoned questions are discouraged because they have proven inefficient, but the builder may sometimes wish to telephone his agent or the design office if his questions are urgent and easily explained verbally. Because current projects involve more sailing than drafting, it is suggested that calls to the design office be placed during week days, and between the hours of 9:00 and 12:00, pacific time. The most current address will appear in the Classified Sections of many boating magazines.

Whichever design you select, and whichever designer, we hope the building and sailing bring you lots of pleasure.

OWNER-BUILDER'S AGREEMENT

I, the undersigned, desire to build the trimaran sailboat known as ______________________________(A-Frame______, or Fixed-Wing_____) sail #________, as designed by Jim Brown, and hereby state my understanding of and agreement to the following provisions:

The plans and specifications are instruments of service and as such remain the property of the designer.

The plans and specifications are for the construction of one boat only, as built by myself, the undersigned. I will not let, or have let, the privilege of building from the plans to another individual, group, company, or corporation without the written consent of the designer.

I will not copy, or allow to be copied or reproduced in any way, said plans and specifications, or any portion thereof.

I agree to follow said plans and specifications in the construction of the boat. I agree that any material deviation from the plans and specifications, without the designer's prior written consent to such deviations, will require me, at the request of the designer, to refrain from identifying the boat with its class name or the designer's name.

Because the designer has no control over the actual fabrication or use of the boat, I agree that his responsibility shall end with providing said plans and specifications as available. I hereby waive all implied warranties in regard to the above-mentioned trimaran design.

Signed____Date__________________

Mailing Address:

Optional Information:

Current Phone No.:

Permanent mailing address (while cruising):

ORDER BLANK

(PRICES SUBJECT TO CHANGE)

NEW PRICES IN EFFECT JULY 15, 1976 NOTE INSERT

Please send ________ copy(s) of your **$4.00 SEARUNNER TRIMARANS** Catalog $________

Add 40¢ each postage and handling, for airmail add $1.50 $________

Please send ________ copy(s) of your **$8.00 SEARUNNER CONSTRUCTION** Manual $________

Add 50¢ each postage and handling, for airmail add $3.00 $________

Please send ________ copy(s) of **LOVE FOR SAIL** ($6.00 each) $________

Add 45¢ each postage and handling, for airmail add $2.00 $________

Please send ________ copy(s) of **THE ECONOMY SEARUNNER** ($1.00 each) $________

Add 16¢ each postage and handling, for airmail add 40¢ $________

To order plans send check or money order with signed "Owner-Builder's Agreement" for:

SEARUNNER 25—$150, SEARUNNER 31—$300, SEARUNNER 34—$450,
SEARUNNER 37—$400, SEARUNNER 40—$450 $________

Deduct price of Manual and/or Catalog - ________

Total payment enclosed $________

Name________________________ Address________________________

City________________ State________ ZIP________ Phone________

NEW ADDRESS
P.O. Box 2877
Santa Cruz, CA.
95063

FOR FOREIGN AIRMAIL POSTAGE TO:

SEARUNNER TRIMARANS CATALOG:

Canada, Mexico, West Indies or Central America	add	$1.50
South America, Aurope or North Africa	add	2.25
U.S.S.R. and all others	add	3.00

SEARUNNER CONSTRUCTION MANUAL:

Mexico, West Indies or Central America	add	$3.00
Canada	add	2.65
South America, Europe or North Africa	add	5.00
U.S.S.R. and all others	add	6.75

LOVE FOR SAIL:

Mexico, West Indies or Central America	add	$3.00
Canada	add	2.00
South America, Europe or North Africa	add	3.25
U.S.S.R. and all others	add	4.20

THE ECONOMY SEARUNNER:

Mexico and Canada	add	$ .50
West Indies or Central America	add	1.26
South America, Europe or North Africa	add	1.56
U.S.S.R. and all others	add	1.56

JIM BROWN-designed SAILING TRIMARANS

241 WEST 35th STREET, SUITE K, NATIONAL CITY, CALIFORNIA 92050

APPENDIX 4

UPDATES

PHASE I-UP

INSTALLMENT 1 EPOXY

The "Design" essay that opens the original text for this Phase contains many statements that still apply. In particular:

> Plywood is stronger, and stiffer for its weight than fiberglass, and stronger/lighter than many of the recent exotic materials for its cost. Technically and practically, it is the ideal material for owner-built trimarans, if properly considered in the design.

This truth is especially applicable now that petro-based materials have become outlandishly expensive, and that epoxy has been added to the wooden boatbuilder's craft. Also a petrochemical compound, epoxy used with wood is still a bargain as compared with foam-and-fiberglass construction, wherein *t*he entire structure is petro-based. Furthermore the foam-glass sandwich must be strongly sheathed on both sides, which uses vastly more resin and fiberglass than when coating or sheathing over plywood. Comparing cost of materials and labor hours to complete, wood/epoxy structures inherently can be about half the cost of foam-glass structures. Relative to using the powdered urea-formaldehyde glue and the old polyester resin for fiberglassing – both recommended in the original manual – here are some additional advantages of using epoxy for building your own wooden boat of any kind:

<u>For bonding</u>

With most wood species, epoxy is a tremendous adhesive, forming bonds having greater strength than the wood itself. That is, if you try to break the epoxy joint, the wood breaks first. This can be true of other adhesives, too, if sufficient clamping pressure is used, but epoxy requires no real clamping pressure at all to create strong joints, and this results in a huge simplification in this type of boatbuilding. For example, epoxy, when mixed with the proper fillers, has the ability to span the inevitable gaps in amateur joinerwork, which substantially reduces the need for close-fitting joints and advanced woodworking skills.

Like most adhesives, epoxy shrinks very slightly during cure, but unlike most adhesives, epoxy shrinks *while still fluid* instead of after becoming solid. On a microscopic level, this prevents cured epoxy from pulling away from its grasping action into and around wood fibers, whereas other adhesives can shrink enough to leave their grasp microscopically loose-fitting from the start.

These advanced bonding properties extend into requiring far fewer clamps and fasteners to hold wood parts in proximity until the epoxy is cured. Indeed, too much clamping pressure can squeeze all the epoxy from between the wood surfaces being joined, actually reducing joint strength.

For coating

Most adhesives and coatings turn from fluid to solid by "drying," whereas epoxy "cures" from inside and throughout, more like concrete than paint... When most coatings dry, their "thinners" and/or "reducers "outgass" as vapor. This leaves countless molecular "holes" in the coating, holes large enough to allow molecules of water to pass through the coating. Conversely, epoxy's curing process retains most of its thinner as a "reactive diluent" which remains in the mix as a permanent component of its cured makeup. This leaves essentially no holes for water to pass through, which makes epoxy coatings extremely "moisture exclusive," meaning they are, for our purposes, absolutely water proof. *If properly applied, and if the integrity of the coating is maintained,* epoxy coatings can effectively prevent water from entering wood. Dry wood is not only twice as strong as wet wood; no water no rot!

Furthermore, in a laminated wooden structure, if the laminations are made with epoxy, water is prevented from migrating to the adjacent layers of wood across glue lines. This isolation can greatly extend the longevity of even badly neglected boats.

For Sheathing

Epoxy is the preferred resin for saturating fiberglass sheathing applied over wood. The fiberglass really sticks to the wood, and it provides far greater durability than a simple coating of paint or resin to protect wood from moisture, abrasion and impact. It also can add strength and stiffness to lightweight wooden structures.

For Sculpting

There are a host of different fillers –powders of various kinds – that can be added to epoxy to form putty-like compounds. With a little experimentation, the builder can mix his own epoxy goop that ranges in consistency from heavy cream to peanut butter. Depending on the need, any of these consistencies can be tailored to produce either very high strength or very easy sanding-and-shaping or any combination in between. These mixes are used for filling gaps and holes, making structural fillets and reinforcements, bonding-in fasteners, and even for adding local size and shape to an otherwise wooden structure. After curing, these compounds can be sculpted as desired, and will remain impervious and durable as a bonded member of the structure.

With all these capabilities, epoxy can add a whole new realm of craftsmanship to woodworking, and this realm is filled with lots to learn, but we now have the potential for wooden boats to last for generations.

Getting Started….

In this first construction Phase of building the hulls, the initial application of epoxy is as a glue for joining – "bonding" – the various wooden components together. Building the frames of your hulls, for example, is the simplest part of the epoxy realm, a good place to start.

Because gluing with epoxy is relatively simple, let's assume that you will jump right into it without cluttering your mind with a bunch of "unnecessary" instructions. Arrange a few pre-cut wooden parts, ready for gluing, and mix some epoxy. Ready, fire, aim!

This means combining some "resin" with some "hardener," and the proportions depend on the brand and product you have selected. And these proportions can be critical – errant proportions and incomplete mixing can definitely reduce cured strength and sanding properties. Depending on your brand, and the different epoxy products within that brand, the proportions can run anywhere from one part of each to five parts of resin to one part of hardener. Follow the directions carefully, and use whatever measuring devices are prescribed by your manufacturer.

Mix no more than a dollop – less than a double shot of rum – for your first trials. Then, don't dally with it! Stir it up, scraping the sides and bottom of the container with your mixing stick, and then stir in a teaspoon of the filler prescribed for gluing. Mix quickly, and add filler if necessary to produce a result something like the thickness of ketchup. Now, using a disposable brush, spread your mix lightly on both faces of the wooden parts to be bonded together. Spread it quickly, roughly, not trying to achieve full, even coverage at first; just get the mix out of the container right away! This e*xtends its working time.* If it sits in the cup while you spread carefully, it will heat itself up and start to congeal in as little as five minutes on a hot day, whereas if you just *get it out of the container*, that alone will give you about twenty minutes to spread it evenly and close the joint. Apply clamps or drive fasteners just snug, and, using rags or paper towels, try to clean up your mess without getting discouraged. What a gooey joke on you, eh?

After a dose or two of this go-round, consider coming back to this text to slowly absorb the following information.

Working Smart….

Some old boat builders have been heard to say of either polyester or epoxy resins, “This stuff is so bad that we wouldn’t use it if it wasn’t so good.” Indeed, working with these sticky, smelly, itchy materials strongly suggests developing a fastidious, fussbudgety --even clinical – shop etiquette. Those who follow this suggestion can enjoy a whole new realm of craftsmanship, and those who don’t can work in a filthy, potentially dangerous and expensive, mess.

This book is about building wooden boats, but it is not a definitive treatise on epoxy workmanship. There are a host of manufacturers of the craft-type, room-temperature-curing epoxy formulations, and these manufacturers all publish how-to manuals that suit their respective products. All the brands work, but the reader should know that we often use WEST System® brand epoxy products. This is partly to express our loyalty to the guys who pioneered in this new realm, and partly because we like the handling properties, the minimal toxicity, and the complete instructions and consulting services attendant to this brand. (For an exhaustive primer on this subject, see the now-classic text, “The Gougeon Brothers on Boat Building.”

If you are new to this realm, you are in for a marvelous adventure no matter which brand you use, but start small by building your frames with epoxy used as a glue, and then try coating your frames with epoxy before even setting them up on the strongback. There is a lot more about working with epoxy in the pages that follow, so study up. Come to understand the difference between gluing, filling, coating and sheathing with epoxy/fiberglass, and the different purposes of the various fillers.

Then, take this to heart: Sloppy working habits with fluid materials can be very wasteful of this expensive stuff (still the cheapest component of the structure)... What’s more, the resins, in their still fluid and recently-cured state, and the vapors and dusts they create, are marginally toxic. Certain people, especially incautious, fair-skinned, blue-eyed smokers of Irish extraction, are said to more readily develop an allergic reaction to these materials. If you develop a skin rash or swollen, cracked skin on your fingers, it can terminate your project and all future projects utilizing these marvelous materials. Once you become “sensitized” to epoxy, you will probably have to stay completely away from it for good. In extreme cases, where builders “take a bath” in epoxy and solvents, or keep using it even after breaking out with skin rash, it can lead to rather serious health problems. In contrast, it is easy to avoid these consequences. This is not the whole story, but here are a few cardinal rules:

- Develop a “glass blower’s mindset.” That means your medium is too hot to touch or to allow it to touch you. This takes finicky working habits, but it will avoid “burns.”...

- **Keep epoxy off of your skin,** whenever you mix a batch, wear rubber gloves. In fact, don't even get near your epoxy materials without them, and above all, do ***not stick your bare fingers in this stuff for any reason***.

- **Employ generous ventilation.** When spreading large areas of wet epoxy, which may cause the vapors to concentrate (such as in a small, heated shop or the bilge of a boat), open the doors, use a fan, or wear a carbon-cartridge respirator.

- **Strictly avoid breathing the dusts.** When sanding epoxy and handling fillers, and when sanding by hand, wear gloves and a two-strap dust mask (the 3M #6300 is especially recommended for its all-day comfort and effectiveness). When sanding by machine, wear a hooded sweatshirt with a baseball cap under the hood; long sleeves and pants, and safety goggles or at least some kind of glasses. When doing heavy sanding by machine on freshly fiberglassed or coated surfaces, ideally you should be wearing a disposable, hooded sanding suit and a carbon-cartridge respirator. Sand outdoors when possible, or with an exhaust fan in the shop.

- **Don't use solvents such as acetone for cleaning your hands!** They can dissolve un-cured epoxy, and they can also carry it right through your skin and into your blood, from where your liver cannot filter it out, so it accumulates in your system. Just don't get epoxy on your skin in the first place! The awful truth is that this advice applies to all paints, solvents, thinners, lubricants, fuels and chemicals. ***Use those gloves!***

- **Dedicate a special bench space for mixing and storing these materials.** Shelf space behind and/or beneath the bench is needed to keep your supplies organized and quickly accessible. Cover the bench top with several layers of polyfilm, stapled down over the sides, so that contaminated layers can be peeled off occasionally. Keep a trash can, lined with a plastic bag, adjacent to this bench.

These items above are just the cardinal rules of conduct in this new realm. There is a lot more about using epoxy for sheathing with fiberglass in Phase III, but by then you will be a trail blazer in your own territory, experimenting with the boundaries and ready to write your own directions to the place of buried treasure.

Further updates to Phase I of the original **Searunner Construction** manual appear in the next installment.

JIM BROWN-designed