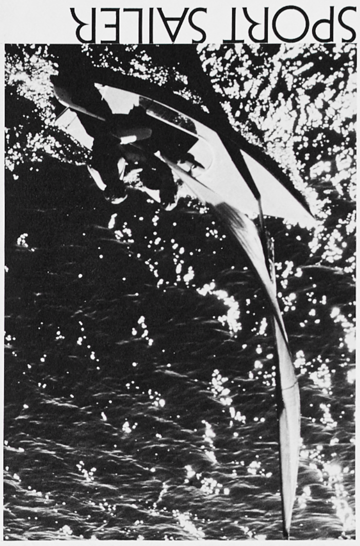
SPORT SAILER



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SPORT SAILER

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The 12' SPORT SAILER is a fast handling, agile little sailboat that can produce a lot of fun for the money and time invested in building her. With raising daggerboard and rudder, she's easy to beach-launch, and tie down hook/lifting handles make it a snap to car top the 100 pound hull. The plastic sail has been used by us in many wind-powered projects over the last ten years and will provide a cheap, easy-to-make, durable sail that can weather the stiffest gusts with the best of them.

GENERAL BUILDING STEPS
Materials:

Marine Grade Plywood can be used for construction, but we have found over the years that in many applications, ACX grade plywood can do just as well, costs about one third less, and doesn't have to be special-ordered. The only difference between the two grades, as we understand it from the American Plywood Association, is that the knots in the inner laminations of Marine Grade are filled—otherwise the wood and glue are the same. If using ACX grade, however, it's best to pick out the panels yourself, checking the back (or unfinished side) to choose ones without gaps or lots of knots.

If painted properly in the first place, plywood boats can last for many seasons with only a minimum of upkeep, even when stored out in the water. You can add a layer of fiberglass for extra protection, but we've found that unless the glass is carefully applied with multiple layers of resin, it isn't as much protection as is generally thought. On a dry-sailed boat such as the SAILER, with adequate applications of flexible seam seal and glue on the inside and polyester putty and oil base enamel on the outside, we've found that glass just isn't needed and isn't worth the added weight and cost.

We used water-mixed, waterproof marine glue found in most lumber yards. It seems to hold as well as the two-part resorcinol glue, is much cheaper, and there tends to be less waste.

Clear fir was used for the framing and control surfaces, although other medium hardwoods such as spruce or mahogany can be substituted if needed. Most pine is too soft to hold a screw well, which can be important when working with flexed panels.

Actual lumber sizes will vary slightly, but generally when we call for a certain "stock" such as 1" x 6", 2" x 4", etc. the actual sizes will be slightly smaller. A typical 2" x 4" is actually about 1⅝" x 3½", and a 1" x 2" is often ¾" x 1½" and so on.

Generally, the building steps are split up into four basic steps: Lofting, Cutting, Assembling and Finishing.

In Lofting the more intricate panel layouts, you may find it easier to follow the sequence shown, marking each line as it's numbered to simplify the geometry a little. When marking a lot of dimensions on parallel "station lines" (as in Fig. #2), it's often a good idea to write the dimension next to the mark to keep the sequence straight. And it's always a good practice to run a quick re-check of the dimensions and your marking of them, just before each cut. It's awfully hard to make it grow back together if it's cut too short.

LOFTING:

To loft the curves, we simply draw the parallel station lines one foot apart, mark the dimensions on each line offset from the centerline, then drive nails down into each offset mark. Then a batten (you can use a stringer) is pushed up against the inside of the curve marked by the nails. Starting at one end, push the batten up against at least three or four of the nails at a time, draw along the outside of the curve marked by the batten. Then push the batten against the adjacent nails farther along, and continue drawing the line, overlapping your marks as you go. After marking a complete curve, place your eye down near the panel at one end of the curve to check to make sure the curve marked doesn't weave in and out. If a nail needs to be moved more than about ⅛", re-check the dimensions and markings.

CUTTING:

One way we've found to cut plywood is to place it down flat on scrap boards, spaced about a foot apart on a firm surface. The depth of the blade of a hand-held circular saw should be set to ⅛" to ¼" below the depth of the plywood to be cut. A circular saw with a sharp combination blade can produce smooth, even curves, giving you a steady, straightening tendency to push against. Make sure there aren't any nails in the scrap lumber used as a back up, or they can ruin your blade in no time. It's much easier to follow a line with a sharp blade, and easier yet if you wear protective eye coverings so you can watch the blade closely. It's good practice to wear eye protection whenever running power tools.

ASSEMBLING:

To fasten plywood panels to the frame lumber, we used 1", #8 plated flathead wood screws (Phillips head, if possible). To attach 1" stock to other frame parts, we used 1½", #8 plated flathead wood screws.

Before driving each screw, a pilot hole is drilled. Since there are a lot of screws, it's worthwhile to get a 1", #8 combination screw hole/countersink bit for your drill (and a 1½", #8 bit, as well). Another tool that we think is essential to a boat builder is a push- screwdriver. With it and a countersink drill bit, you can cut your building time in half—and save your wrist muscles. Yankee screw drivers are expensive, but they'll change the way you think about assembling projects and you'll find yourself tackling bigger jobs with confidence.

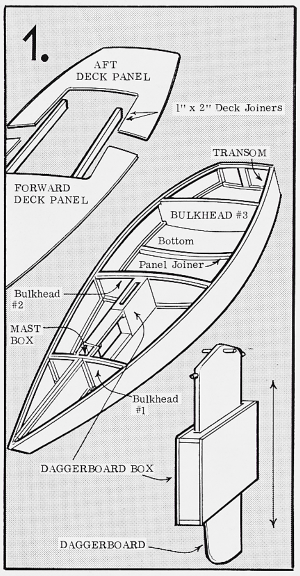
On all seams we marked the screwholes first with a yardstick, 3" apart, then drilled and drove screws in one at a time, aligning edges of the parts as we went. Screws should be inset from the panel edges so they sink into the centers of the stringers.

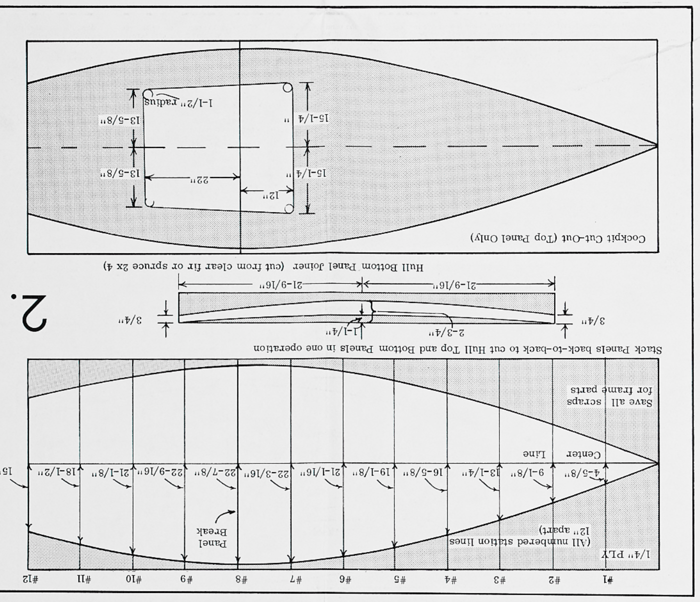
We used water mix, waterproof glue. Make sure it says on the label that it can stand immersion (it'll usually have a picture of a boat, indicating marine use on the label). Mix only a part at a time by adding just a little water and stirring until it balls up into a paste. Then you can add a little more water to thin it to a slightly runny paste, so it's wet enough to soak in, but not thin enough to run off.

Depending on the dryness of your lumber and the grain of each particular piece, some stringers will have to be "kerfed" in order to make the bends without cracking. To Kerf, simply figure out which side of the stringer faces the inside of the curve (as shown later), then make cuts into this side, every 3" to a depth of ¼" to ⅜".

HULL BUILDING STEPS:

Fig. #6 shows the four basic hull building steps. To get under way we first cut one 4' × 8' plywood panel across at midpoint, to get two 4' × 4' panels. Then one of the two 4' × 4' panels was aligned with a 4' × 8' panel (with the grain aligned parallel). The side curves of the hull bottom were lofted onto these panels (using the method already mentioned), then we placed another set of ply wood panels directly under the marked panels and cut through the hull top and bottom panels simultaneously. We chose the better set of panels to form the bottom panels. Then the cockpit cut out was lofted onto the hull top panels only, and cut out, rounding the corners with a keyhole saw or saber saw. Next, the bulkheads, hull sides and interior hull framing parts were cut, as shown in Figs. #3 and #4.





Stack Panels back-to-back to cut Hull Top and Bottom Panels in one operation

Hull Bottom Panel Joiner (cut from clear fir or spruce 2x 4)

Cockpit Cut-Out (Top Panel Only)

Marking the tops of the bulkheads and transom with an arrow, the hull bottom panel joiner (shown in Fig. #2) was cut as shown from 2" × 4" stock and planed smooth on its bottom side for a good, watertight joint. Then screw placement marks were placed on the bottom panels at the rear of the front panel and front of the rear panels, ⅜" in from the edge and spacing the screw holes 2" apart.

We placed the formed bottom panel on a firm, flat surface with its better (finished) surface showing up, then placed the arched panel joiner down with its bottom surface facing up. Glue was spread onto this surface and onto the top surface of the hull bottom panel (facing downward at this point). The bottom panel was placed onto the bottom of the panel joiner with the joiner positioned in from each side edge of the bottom panel equally

Next, screw holes were drilled through at the positions marked, and screws were driven down through the panel and into the joiner, squeezing out a little glue as the joint is tightened. Then the forward edge of the aft bottom panel was butted up against the forward panel and screwed down onto the joiner in the same way, to complete Step "A" in Fig. #6.

The next step was to rip and attach the side stringers to the hull bottom and to the bulkhead frames. We used a skilsaw (hand-held circular saw) with the blade tilt and rip guide set as shown, to cut the stringers from a straight-grained piece of clear fir 1" × 6" stock. Depending on how green your lumber is, the side stringers may have to be "kerfed" (cutting half way through the stringer every 3" along its right angle side) to provide the kind of flexibility needed to follow the side curve of the bottom and top panels. We placed the joined bottom panels bottom side up on the floor, then positioned a stringer under the side edge of the panels, with its narrow side up against the panels and its angled side facing outward and aligned flush with the side edge of the bottom panel for about 1' forward from the rear (with the front of the stringer sticking out to the side).

Screw placement holes were marked along both side edges of the bottom panels, positioning the marks 3" apart and ⅜" in from the side edge. We spread glue onto the narrow edge of the stringer for about 3' from the rear end, and onto the unfinished surface of the bottom panels (facing down) about 1" in from the side, and for about 3' from the rear. With the kerfs of the stringer midway between the screwhole placements, we drilled the first two screw holes and drove in 1" screws. Then the forward end of the stringer is pulled gently in toward the center of the boat until the outboard angled edge of the stringer is aligned with the side edge of the hull bottom at the next screw hole mark. The next screw pilot is then drilled and the screw is driven in, and so on, working forward one screw placement at a time, to attach the stringer bent into position.

The next step was to cut and attach stringers to the unfinished sides of the three bulkheads, across the top and bottom edges. The top and bottom stringers are attached with their right angled side against the bulkheads and their wide side aligned with the outline of the bulkhead shape.

To position the bulkheads at the front and rear of the cockpit on the hull botton, we drew a centerline across the top of the panel joiner, ¾" in from the sides, then measured back 22" and forward 12" from the center of the panel joiner and drew lines across the hull bottom panels (on their top side) at right angles to the hull centerline to mark the front and rear of the cockpit. Next, bulkhead #2 was positioned with its finished side on the line marked across the bottom of the cockpit and the outline of the bottom of the bulkhead was marked down on the bottom panel.

Next, screw placement holes were marked so that screws driven through the hull botton, spaced 3" apart, would sink into the center of the bottom stringer of the #2 bulkhead. We removed the bulkhead, drilled through ⅛" pilot holes at the positions marked, then spread glue onto the joining surfaces, tilted the hull bottom up on its side, positioned the bulkhead onto the hull bottom between the lines marked (with the sides of the bulkhead aligned with the side edges of the hull bottom), and screw holes were drilled back in through the pilot holes in the hull bottom and up into the center of the bottom stringer on the bulkhead. (The same method can be used to mount any subsequent part that is mounted "blind" in this way.)

We attached bulkhead #3 in the same way, with its finished side forward and aligned with the rear cockpit line across the hull bottom panel to complete step "B" in Fig. #6.

The next step was to cut and assemble the daggerboard box and mast step box. To cut the daggerboard box, cut the top and bottom pieces as shown, then cut the longer rear vertical piece and shorter front vertical piece, as shown. The ¼" plywood sides were cut to shape as shown in Fig. #7, then the slots for the daggerboard were marked on the top and bottom sides of the box. These can be cut by drilling ¼" holes at the corners of the slot cutout, then completing the cuts between corners with a saber saw.

Next, we drilled and drove 1½" screws down through the box top piece, down into the tops of the end pieces to attach. The bottom piece was attached to the bottoms of the box ends in the same way, using plenty of glue for a watertight fit. Then the box sides were attached to the side edges of the framework with 1" screws, spaced 3" apart.

The daggerboard box was positioned squarely over the centerline of the hull bottom and aligned vertically against the front of bulkhead #2, and its position was marked. Screw pilot holes were marked on the top side of the hull bottom so screws could be drilled up through the hull bottom and into the bottom of the daggerboard box, spaced 2" apart down both sides of the slot in the bottom, and 1" apart around the front and rear ends of the slot (to pull the hull bottom solidly up against the bottom of the box). The pilot holes were drilled for 1½" screws to be driven forward through the bulkhead and top bulkhead stringer and into the rear of the box at the top.

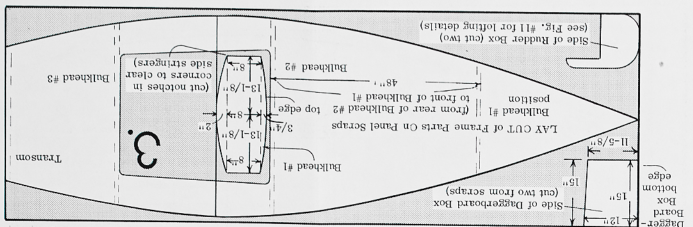
We spread plenty of glue onto the joining surfaces, then placed the hull bottom on its side, placed the daggerboard box squarely in position, and drilled and drove the screws in through the hull bottom and into the bottom of the box around the bottom. Finally, the two 1½" screws were driven forward through the bulkhead and into the rear of the box near the top.

To assemble the mast step box we ripped two lengths of 1" × 3" to 2¼"wide, as shown. Next, we cut a 3¾" × 10¾" piece of ¼" ply and marked screw placements 2" apart and ⅜" in from the side edges, and drilled and drove in 1" screws to attach the edges of the lumber to the plywood, flush at the sides and top. Next, a centerline was drawn down the rear, finished side of bulkhead #1 and then two lines were drawn down parallel to this 1⅞" out to both sides, the edges of the sides of the mast box were positioned against the bulkhead and screw holes were drilled back through the bulkhead and into the edges of the sides, spacing the screws 3" apart. With the mast box fixed to the back of the bulkhead, 2½" scraps of stringer were screwed to the box sides, flush at the top and bottom, using 1½" screws.

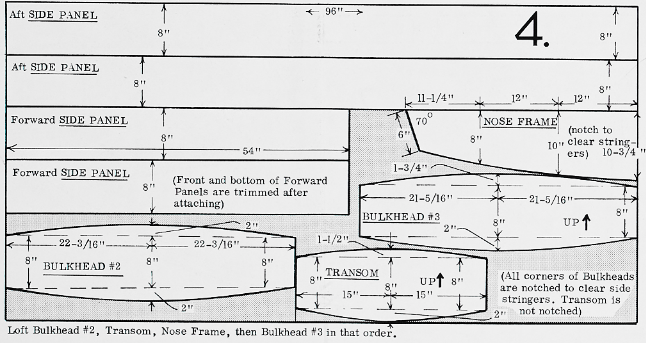
To position bulkhead #1, we drew a line across the top surface of the hull bottom panel at right angles to the centerline of the hull 48 "forward of the *rear* of bulkhead #2 (or 47 "forward of the bottom stringer on the front of the bulkhead). After placing the bulkhead and box squarely in position, the placement was marked and then the assembly was mounted with screws and glue, using the same pilot hole pre-drilling method used to mount the other bulkhead.

We mounted 4" scraps of stringer across the back side of the mast box and across the front side of the daggerboard box, with the top edges of both ¾" down from the tops of the boxes (driving the 1½" screws through the rear of the mast box and into the back edges of the box sides.

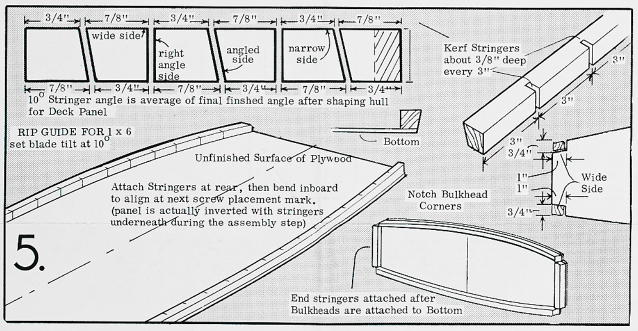
Next, we cut lengths of 1" × 4" to fit between the rear of the mast box and the front of the daggerboard box both at the top and bottom (when the front bulkhead is squared up at 90° with the bottom of the hull behind the bulkhead). Screws were driven up through the hull bottom and into the lower 1" × 4", using the blind mounting method. A 2¼" square

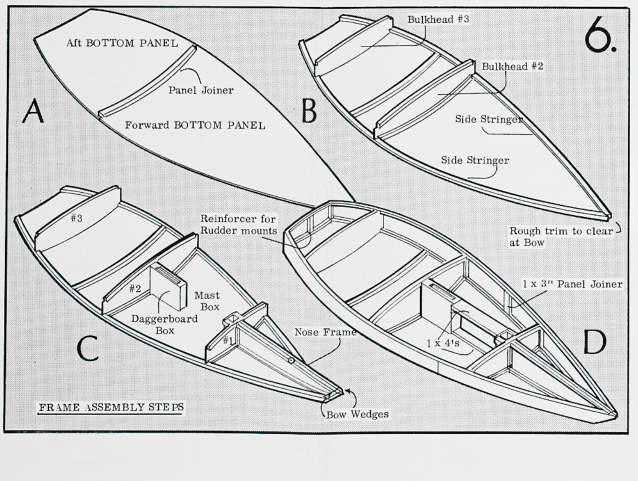

Dagger-Board Box bottom edge
rear edge
12"
15"
15"
11-5/8"
Side of Daggerboard Box (cut two from scraps)
LAY CUT of Frame Parts On Panel Scraps
Bulkhead #1 position
(from rear of Bulkhead #2 to front of Bulkhead #1
48"
Bulkhead #2
top edge
3/4"
Bulkhead #1
8"
13-1/8"
8"
13-1/8"
8"
2"
(cut notches in corners to clear side stringers)
3.
Transom
Bulkhead #3
Side of Rudder Box (cut two) (see Fig. #11 for lofting details)

Loft Side Panels before Frame parts

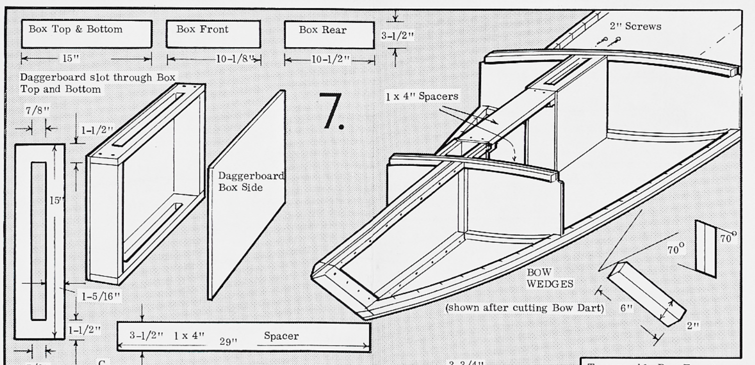


Loft Bulkhead #2, Transom, Nose Frame, then Bulkhead #3 in that order.


3/4"
7/8"
wide side
right angle side
angled side
narrow side
10° Stringer angle is average of final finshed angle after shaping hull for Deck Panel
RIP GUIDE FOR 1 x 6 set blade tilt at 10°
Bottom
Kerf Stringers about 3/8" deep every 3"
3"
3/4"
1"
Wide Side
Unfinished Surface of Plywood
Attach Stringers at rear, then bend inboard to align at next screw placement mark. (panel is actually inverted with stringers underneath during the assembly step)
Notch Bulkhead Corners
End stringers attached after Bulkheads are attached to Bottom
5.



FRAME ASSEMBLY STEPS



To assemble Bow Framing:

- Cut and assemble Daggerboard box.
- Attach stringers to the front and Mast Box to the rear of Bulkhead #1.
- Attach stringers at top and bottom of Nose Frame.
- Mock-up components in place (with 1 x 4 spacers) and trim for exact fit.
- Attach Daggerboard Box, Bulkhead #1, 1 x 4" spacers, and Nose Frame in that order.

piece of scrap ¼" plywood was cut and inserted down into the mast box where it lays flat on the hull bottom to provide a resting surface for the bottom of the mast.

To assemble the forward longitudinal frame (or nose frame), we first notched the rear corners of the frames to clear stringers on the front of bulkhead #1. Next, we attached a stringer to the side of the nose frame with the wide side of the stringer against the frame and the angled side flush with the bottom of the frame so the angle roughly follows the curve of the bottom at the bow. Another length of stringer was mounted to the opposite side of the nose frame with glue and 1½" screws in the same way with the angled edge of the stringer flush with the bottom of the frame and with the angled edge roughly aligned with the upward curve of the hull bottom.

Two more lengths of stringer were attached to both sides of the frame along the top edge in the same way, with their right angled sides facing up, and a short length of stringer was mounted down the rear edge of the nose frame with its right angled edge flush at the rear. The nose frame can be attached at the rear 12" only at this point, before cutting the dart at the front of the hull bottom.

To attach the rear of the nose frame, we placed the frame, centered down over the centerline of the hull and back against the centerline of the forward bulkhead, and drew around the part to mark its position. Then we smoothed the bottom surface of the frame with a Surfoam shaper, drilled pilot holes through the hull bottom so that screws would be driven into the centers of the bottom stringers (spacing screws 3" apart fore and aft) only at the rear 12" or so that lies down onto the bottom panel before cutting the dart.

Screws were driven in (using the blind mounting method), then we drilled and drove three 1" screws in through the vertical stringer at the rear. This is one place 1" screws were used to mount a stringer to plywood rather than vice versa. Since the screws are short and a little to one side, they shouldn't reach into the center of the mast box to interfere with the mast; but if your countersinking is a little deep and they do show inside, they can be backed out again after the glue dries. The wedges up the front edge of the bow (as well as the end stringers on all bulkheads) weren't attached until after the bow dart was cut and the upward curve of the bottom panel at the bow was complete. So we have to skip forward to Fig. #8 to complete the bow dart before the framing can be completed as shown in Fig. #7.

To cut the bow dart, we placed the hull upside down and marked a centerline down the bottom panel from the bow back 24". Next, we cut this centerline with the blade of the skilsaw set at a ⅛" to ½" depth. When the bottom panel is pushed down against the curved bottom of the nose frame, it overlaps the nose frame at the front, so we trimmed away the stringer attached to the bottom to clear the stringer on the bow frame when the bottom panel is pushed down against it. We pushed the bottom panel down against the nose frame and then marked a new centerline onto the pushed down side of the bottom where it rested on the bow frame at the front. This new centerline will end up a gentle curve, as shown in "B" of Fig. #8. After cutting the new centerline we spread glue onto the joining surfaces and then screwed the trimmed half of the bottom panel at the bow down onto the nose frame, spacing the screws ⅜" in from the cut and 2" apart. We pushed down the other side, marked the new centerline to butt up against the first side, then cut and attached this side to the nose frame the same way.

Back at Fig. #7 we can see the nose wedges cut from Clear fir stock. To make these, we ripped a short scrap of 1" x 4", or wider, down the middle at a 45° angle, then trimmed the opposite edges so each wedge is about 2" wide overall. Then the top and bottom angled end cuts were marked by laying the parts roughly in place with their pointed forward edges lying along the front edge (or stem) of the nose frame. After cutting the angled ends we attached one wedge by driving 1" screws in through the nose frame and into the side of the wedge, spacing screws 2" apart. The opposite wedge is attached with 1½" screws driven through this wedge and into the frame.

We cut short lengths of stringer to be screwed to the front sides of bulkheads #1 and #2 and the rear side of #3, extending down from the notch at the top corner to the bottom panel stringer. When viewed from the top there will be a angle at each bulkhead between the direction of the hull side and the direction of the bulkhead. We simply turned the short stringer pieces, trying different positions until the angle cut of the stringer approximated the angle between the hull side and bulkhead at each point when viewed from the top. These stringers were attached flush with the bottom panel stringer at the outside and parallel to the end cut of the bulkhead, vertically . At this point we've reached "C" in Fig. #6.

To attach the transom we attached stringers to the front (unfinished) surface with the right angled edges of the top and bottom stringers flush with the top and bottom, respectively, of the transom (and trimmed flush at the ends of the transom with no corner notches). End stringers were attached with their angled sides flush with the end cut, and extending down between the top and bottom stringers. Next, we cut and trimmed away the bottom panel side stringers 1" forward of the rear cut of the bottom panel with a hand saw and wood chisel, to clear the transom and transom stringers. Then we drove screws (spaced 3" apart) in through the hull bottom and into the bottom transom stringer to attach the transom, using plenty of glue.

The hull side panels are cut 8" wide, as are the ends of the bulkheads which means that top and bottom edges of the sides will overlap the top and bottom side stringers (attached to the hull top and bottom), but the side panels *won't* overlap the end grain of the hull top and bottom. Since we're going to round off the corner edges of the hull, we would have removed this wood anyway, so neither the hull tops, bottoms, nor sides need to overlap the end grain of its adjacent panel (as shown in Fig. #10).

Before attaching side panels, we smoothed off all exposed surfaces of the frame (the bulkhead and stringers, the bottom panel stringers, nose wedges and transom ends) to provide a smooth surface for the side panels to lie against (using a Surform shaper, or a belt sander if you have one). After making sure the joints at the transom and bow wedges have been faired down to the correct angle to follow the curve of the hull side, we began attaching the 8' side panel to the bottom stringer, flush with the rear of the transom and the bottom of the bottom panel stringer (*not* the bottom of the bottom panel), spacing screws 3" apart, and using enough screws to pull the panel securely against the transom at the bottom. After both rear 8' side panels were on, we attached a 6½" length of 1" × 3" scrap to the inside of the side panel at the front, with the centerline of this panel joiner lying along the vertical end cut of the side panel, so that the rear of the front side panel can be screwed to the outside of these joiners.

Next, we attached the rear end of one of the shorter front side panels to one of these panel joiners, butted back against the rear panel, then drove in the first two or three screws into the bottom stringer. At this point we pushed down and in on the panel at the front to screw it to the nose wedge, flush at the top. It's a good idea to place the hull down on a flat surface, blocked up so it sits level (as shown in Fig. #10). When attaching the side panels to the bow wedges, check with a square to make sure the stem of the bow (or the nose frame) is kept vertical as the side panel is attached. We drove in the remaining screws to attach the side panel to the bottom at the front, then trimmed off the front and bottom of the panel where it overlapped the bottom and front of the hull frame. The opposite side panel was attached in the same way (checking to keep the stem vertical when viewed from the front), and then trimming off excess panel material.

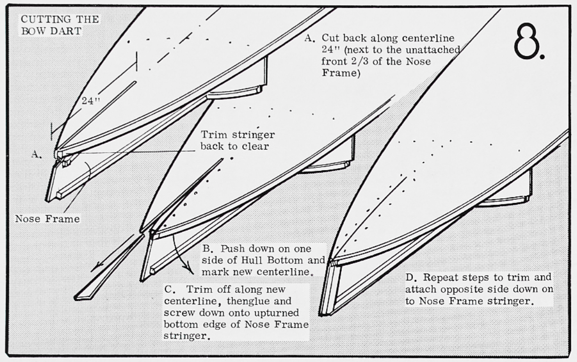
The two top side stringers were trimmed to fit inside the side panels with their angled sides flush at the top of the panels. We attached these with glue and screws spaced 3" apart. We mounted a 10" piece of 1" × 2" or 1" × 3" to the front of the transom (driving screws in through the rear of the transom and into the piece) so that its centerline was aligned on the vertical centerline of the transom.

In a later step we used sliding barrel bolt locks for rudder pivots, so we mounted the longer part of two sets of barrel bolt locks so their centerlines were aligned with the transom centerline, as shown in Fig. # 9, bottom. The top lock was attached to the rear of the transom, flush at the top, with 1" screws (not the screws provided with the lock sets). The lower lock was mounted with 1¼" × ¼" bolts extending through the transom and backup frame pieces. The bolt of the lower lock was raised and locked in the "up" positiion and then a 1" screw was driven part way in just under the bolt to prevent it from sliding back down.

At this point we reached "D" in Fig. #6 and were ready to seal the inside of the hull. Any large gaps or splits were filled with catalyzed auto body putty. Then all interior corner joints, especially at the bow and transom, were caulked with an immersible seam sealer out of a tube or caulking gun. A good way to get an effective seal is to lay a bead of the sealer in the corner, then run your finger along the bead, smoothing it and forcing it into any cracks. We filled all cracks and holes in the unfinished side of the plywood with sealer as well. When this was dry we painted the hull with two coats of Thompson's Water Seal (you can get the same result with thinned oil base enamel—a good place to use up your old paint). We watersealed the bottoms of the deck panels, except for a 1" strip along the side edges where they will be glued down onto the tops of the side stringers.

We drilled 1" holes through the #2 and #3 bulkheads near the bottom so that if any water leak develops, the water can be drained. The holes are plugged with sink stoppers when sailing. Since the forward and rear compartments should be watertight, and the wood hull is inherently buoyant, it's a pretty safe hull as is. But if you'd like an extra safety margin, you can fill the forward and rear compartments with EPS (Expanded Polystyrene) packing foam chips so you can keep sailing even if you run it on the rocks. The compartments do represent a little wasted space inside, but they provide the watertight advantage of allowing you to capsize, pull the nose into the wind and set it back up, so you can sail away without even bailing (only about 2"-3" of water gets caught in the cockpit when you roll her back over).

To attach the deck panels we laid them down in place driving in positioning screws in the corners and aligning the forward and aft panels to the best average position to cover the top stringers of the


CUTTING THE BOW DART
8.
A. Cut back along centerline 24" (next to the unattached front 2/3 of the Nose Frame)
24"
A.
Trim stringer back to clear
Nose Frame
B. Push down on one side of Hull Bottom and mark new centerline.
C. Trim off along new centerline, thenglue and screw down onto upturned bottom edge of Nose Frame stringer.
D. Repeat steps to trim and attach opposite side down on to Nose Frame stringer.

side panels. We marked the positions of the top stringers of the bulkhads and nose frames, then removed the panels, spread glue onto the joining surfaces on the bottoms of the panels and top edges of the hull stringers, then drove in all screws, spacing them 3″ apart, to pull the panels down evenly onto the hull frame (with the frame block up level). We used the directions shown in Fig. #10, first driving in locating screws marked with stars, then driving in screws along the directions shown by the arrows, working rapidly while the glue was fresh. Then we drove screws down into the tops of the #1 bulkhead and nose frame.

1″ × 2″s (as shown in Fig. #12) were cut to fit along the sides of the cockpit, up under the deck panel. These were attached with 1″ screws spaced 3″ apart. Then short scraps of 1″ × 2″ were mounted under the deck panel butt joint to hold the surface of the panels flush (like the panel joiners used on the hull sides).

We carefully measured where the slots in the daggerboard box top and bottom, as well as the mast hole in the hull top, would lie. Then we drilled ¼″, holes within these marks and cut out the daggerboard slots flush with the slots cut in the daggerboard box top and bottom. We squeezed sealer between the deck bottom and box top, then drove screws down through the deck and into the box top, spaced 3″ apart. We drilled a 1″ hole down into the deck over the mast box, then sighted down into the box, centered on outline of the box opening over the walls of the box, marked a 2¼″ circle within these walls, then cut out the circle with a saber saw. Again, sealer was squeezed in between the bottom of the deck and the top of the box and screws were driven down through the deck and into the stringers to the outsides of the box sides.

FINISHING:

The first step in finishing is to round off all corner edges with a Surform shaper to provide nice smooth curves with evenly radiused corners (the rounder the better)—except for the transom side and top edges (rounding the bottom edge only to prevent it from being too fragile). Next, all gaps, cracks and screw heads should be filled with catalyzed polyester auto body putty. There are a few tricks to using this that can save a lot of time and make it an easy job to smooth the hull.

Mix up small batches (about ½ cup at most) on a smooth board or palette. Squeeze out about a 25 cent piece size blob of catalyst and mix quickly with turning strokes using a 2'' or 3'' putty knife. (Use a separate stick to dish out the putty from the can, preventing the catalyst from entering the can). As soon as the putty is mixed to a uniform gray-red (or gray-blue, depending on the brand), smooth it into the largest gaps to be filled first. Too much catalyst (making a dark colored putty) will make the putty harden too fast; too little (making a light gray mix) will prevent it from hardening, so stick with a ''hotter'' mix to begin with and work fast. On a hot day you'll need less catalyst, and never work in full sunlight or it will always harden too fast.

Work the putty rapidly into the depressions to be filled, smoothing out air bubbles and leaving a lump where there was a hole (smoothing it flat will result in a dent when the putty ''goes off'' and shrinks).

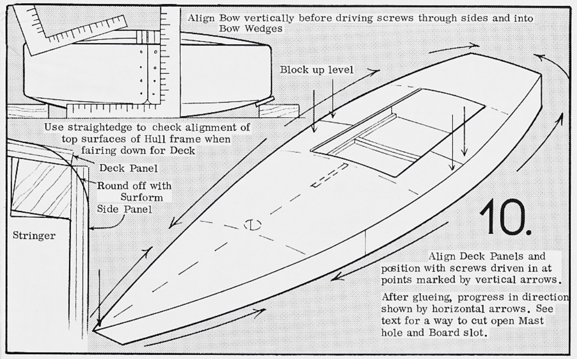
As soon as the putty begins to lump like cottage cheese on the palette, stop applying it and clean up the palette and putty knife. In a few minutes it will get like Swiss cheese (a good time to peel any spills off the floor). Then it will gradually harden to the point where you can scratch it with your fingernail and leave a white mark. At this point you can use the Surform (gently at first) to shave away great amounts of putty easily and quickly (like grating cheese). This will last about ten minutes, so work fast and you can smooth the whole batch in a few minutes. After the whole boat has been filled and smoothed, you can mix up slightly ''cooler'' batches and give the filled spots a careful second treatment to fill any exposed air bubble holes, smoothing them off flush with the surface.

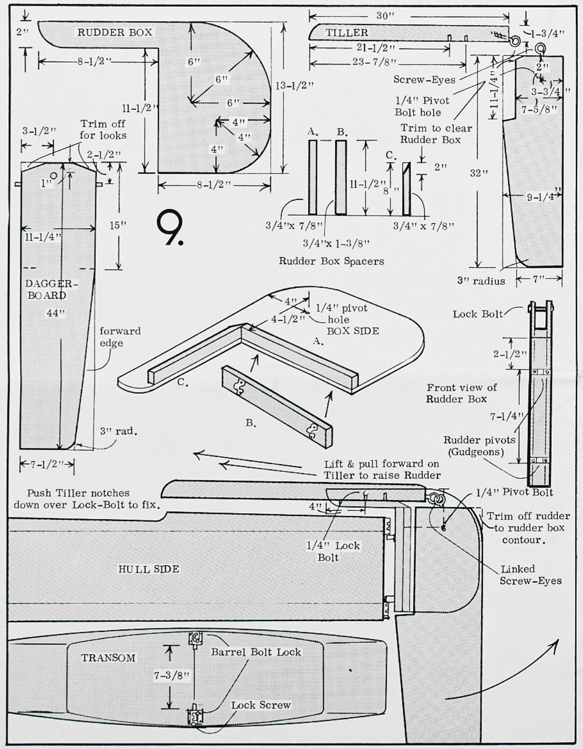
Next, sand with about 80 grit paper, then sand with 150 grit paper, and begin painting, sanding with finer paper between coats.

A good initial paint job of oil base, gloss enamel will prevent maintenance problems later on. The first coat is only a seal to permit finish sanding. The second coat will show where any final finish puttying is needed. Make sure coats are well dried before applying the next. Just before painting, give the hull a light sanding and rub down with thinner to clean it well and prevent ''fish eyes'' from forming and to remove dust. Don't paint in direct sunlight (to prevent bubbles), nor outside late in the afternoon (any dew will turn the paint flat). Thick coats tend to dry on the surface, then run into sags underneath. Even applications of thinned paint prevents drips. You can thin with paint thinner (but then you lose covering ability) or you can thin the paint by warming it in the house to retain coverage and get a good flow. If the brush tugs or loses bristles as you paint, the paint probably needs thinning. Use parallel, long strokes as you finish a surface.

A good paint job will take four to six coats, but can effectively prevent checking and cracking for years, even when the boat is stored outside.

Attach hefty lifting handles to the hull ends (two at the rear) about 2'' in from the ends so long screws will grab into the framing stringers.


Align Bow vertically before driving screws through sides and into Bow Wedges
Block up level
Use straightedge to check alignment of top surfaces of Hull frame when fairing down for Deck
Deck Panel
Round off with Surform
Side Panel
Stringer
10.
Align Deck Panels and position with screws driven in at points marked by vertical arrows.
After glueing, progress in direction shown by horizontal arrows. See text for a way to cut open Mast hole and Board slot.



CONTROLS:

The daggerboard was cut from a 44″ piece of clear fir 1″ × 12″. After cutting to the shape shown in Fig. #9, left, we drilled a ½″ hole in the front and rear edges (as shown) and through the side at the top. Then we drove in short lenghts of ½″ dowel (with glue) and trimmed them off about 1″ out from the sides to provide stops and a lifting handle for the board. To prevent the board from floating up, a short length of shock cord can be screwed to the deck over the slot in the deck, which can be slipped over the top of the board when under way.

We marked where the board stuck out below the hull bottom, then drew a line around the center of the edges of the board below the hull line and faired off the edges of the board to a slightly rounded point (fairing the board and the rudder not only increases top speed, but also adds to the control power of these surfaces).

To build a rudder box to hold the pivoting, raisable rudder, we lofted the rudder box side (shown in Fig. # 9, top, left), onto a plywood scrap, cut it out and used it as a pattern to mark and cut an opposite box side from another plywood scrap.

Next, we cut the spacers to the sizes shown in Fig. # 9, then attached spacers ''A'' and ''C'' to one box side with screws and glue with the ¼″ side of the spacers against the box side so the box sides will end up ⅞″ apart. We marked and drilled the ¼″ pivot bolt hole as shown, then attached the second side to the spacers, drilling the pivot hole on through this side as well. The cap strip ''B'' was then screwed to the front of the box, as shown, with 1½″ screws and the pivot strips from the barrel bolts were then screwed to this cap strip in the position shown at center, right in Fig. # 9.

The rudder was rough-cut to the shape shown at upper right, Fig. #9, then the tiller was cut to the shape shown. We drilled ¼″ holes about 2″ deep into the top edge of the rudder and the back end of the tiller as shown. Then we twisted open a 3″ × ¼″ screw eye, slipped another 3″ screw eye onto the opened one, and retwisted the first screw eye closed, linking the pair.

Next, we twisted one of the screw eyes down into the top edge of the rudder, then twisted the tiller onto the corner screw eye. We drilled the ¼″ pivot hole in the rudder as shown, then drilled the ¼″ hole for the lock bolt on the front arm of the rudder box, shown at lower right, Fig. # 9. This bolt was inserted in place, then we slipped the rudder/tiller assembly into the rudder box and inserted the pivot bolt. We marked where the tiller rested on the lock bolt with the rudder in the ''down'' position. Then we pulled the tiller forward, raising the rudder, and marked where the tiller rested on the bolt in the ''up'' position. Notches were then cut into the bottom edge of the tiller so that the rudder position could be locked by pushing the tiller notches down over the lock bolt. Finally, we trimmed off the top, rear corner of the tiller and rudder to follow the curve of the rudder box, and faired the lower edges of the rudder off to a rounded point. We twisted the screw eyes a little so they could clear the sides of the rudder box.

RIGGING:

Sometimes the hardest step of rigging your boat can be finding the right tubes, and we've come across a couple of tricks that may save you headaches and time. First of all, never use the phone to hunt down a tube supplier. When you call up to find a certain material, you rarely get a chance to talk to the person best qualified to answer your questions. What you usually get is a fast answer rather than an accurate one—one that will get you off the phone in a hurry.

Many times we've found that a distributor may actually have just what you're looking for, but it may take a bit of game-playing to get access to it. First, it's a good rule to show that you're sufficiently concerned about tracking down the material to show up in person. Next, don't scare the man off by loading him down with a bunch of confusing specifications until you get a chance to look over what he has in stock.

Just have a general idea of what you're looking for, and ask to help look around for it. If you simply call and rattle off a bunch of numbers, they'll usually pass you on to the next supplier in the Yellow Pages. Large distributors of tubing and raw materials won't want to bother with such a small retail order and will quote an astronomical price—if they deign to give one at all.

Salvage scrap and surplus yards sell aluminum tubing and material by the pound, and you shouldn't spend much over thirty dollars for a rig. Another good source is irrigation suppliers, who can usually sell three twenty foot lengths for under thirty dollars. However, irrigation pipe is a little thinner and softer than most tubing stock, and should be reinforced with clear fir 1'' x 3'' boards trimmed to fit snugly inside the pipe. Shorter pieces can be spliced together in the same way, with 2'' x 2'' stock trimmed to fit.

What's the best tubing to look for? Anything from 2'' to 2⅜'' diameter aluminum tube (2¼'' is best) with a wall thickness of around ⁄₁₆'' or .065''. If you have a choice of tempers, 6061-T6 seems to have the right sort of hardness, springiness and resistance to corrosion. As we said, however, wood reinforcers can beef up softer pipes enough for use. Some builders report good luck with auto exhaust pipe welded up from 10' lengths.

To start rigging the boat, cut the tubes to the lengths shown and rip the 1'' x 3'' clear fir or spruce reinforcing strips to fit snugly in the tubes (if needed). If the tube seems to lack springiness, or is a little on the thin side, we generally run reinforcing up the mast about three quarters of the way to the top, and down from the top of the upper boom (or gaff) down to about the center of the tube. After inserting the strips, drill all hardware mounting holes so that the strips will be held with their wide sides lying across the direction of the boat (athwartship).

After the rig is assembled, the sail will be cut, and the rig is attached to the gaff and boom pockets. Then the mast can be slipped down into the mast box, and the gaff can be raised by pulling down on the line running from the gaff, through the pulley block at the top of the mast and back down to be tied to the cleat near the base of the mast.

To connect the front ends of the gaff and boom, drill a ⁵⁄₁₆'' hole through both tubes about 1'' back from the end (and through the reinforcers, the long way, if used). Then slip each end of a ⁵⁄₁₆'' x 3'' U-bolt (check the materials list for exact specifications of the galvanized iron hardware used throughout the construction of the rig), through the tube holes, run on a nut, slip on the two-hole washer strip, and run on double locknuts and tighten securely.

The gooseneck is made up of two galvanized iron eyebolts. With pliers or a vise, twist the loop of one eyebolt so the loop of the second eyebolt can be slipped onto it. Then hammer or twist the opened eyebolt back closed again. Drill a ⁵⁄₁₆'' hole, as shown, through the mast (and through any reinforcer the long way) and through the boom, as shown, parallel to the hole drilled through the same tube at the front. Insert the ends of the joined eyebolts through the holes in the tubes and secure with double locknuts, and trim off the leftover bolts.

The halyard pulley block is held to the top of the mast with a ⁵⁄₁₆'' eyebolt mounted through a hole drilled about 1'' down from the top and at right angles to the hole drilled through the mast for the gooseneck below. Open the bolt eye, slip on a block and reclose. The halyard line is tied neatly to the gaff in the position shown, then the knot is wrapped tightly with 2'' grey duct tape to lock it in position.

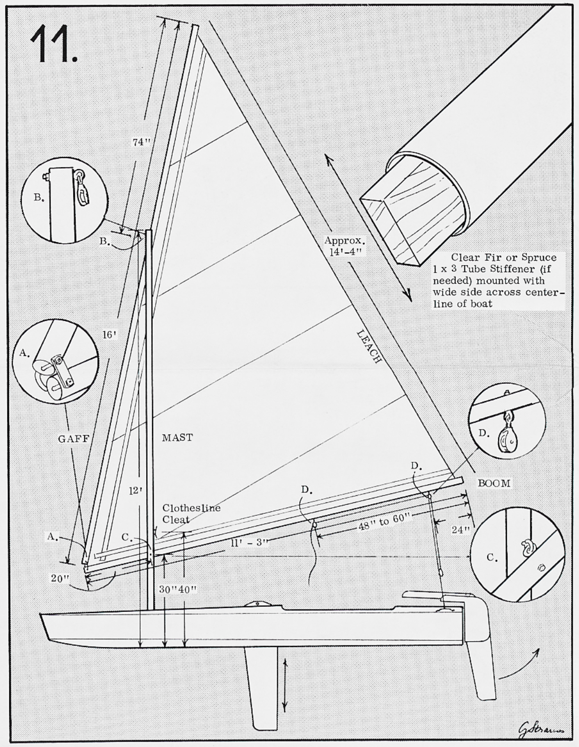
After raising the gaff with the halyard, the free end of the line is tied to a galvanized cleat mounted vertically, as shown, near the base of the mast. Mount the cleat to the mast by drilling starter holes and then attaching the cleat with large sheetmetal screws driven into the mast.

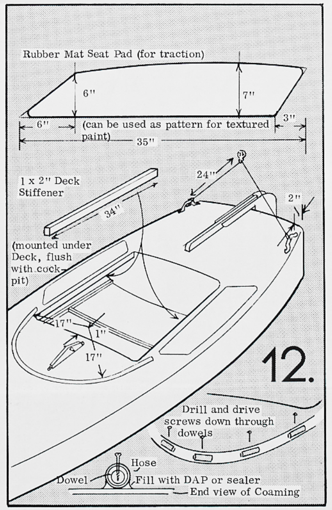
To tie a line to a cleat, pull the line tight, wrap it once around the base of the cleat, then lead the line up over the center of the cleat, looping it over one ear of the cleat—then back over the center and loop it over the other ear. After looping the ears of the cleat a few times, make a final loop, twist it so that the free end of the line is now under the line from the previous, slip it over the ear and pull the free end tight.

When you pull the gaff up, you'll have a lot of loose line lying around the deck and to prevent this from falling overboard, loop the free line in a coil and tie to the top ear of the cleat by reaching through the coil to grab the line leading from the cleat to the coil, pulling it back through the loop in a twisted loop, and slipping this loop over the top ear of the cleat.

Twist open two 3''x5/16''eyebolts and slip a single pulley onto one and a double pulley on the other and close both. Drill a vertical ⁵⁄₁₆'' hole through the boom about 2' forward of the aft end and bolt the double pulley to the bottom of the boom. Drill and attach the single pulley forward on the boom in the position shown.

To hold the mainsheet (the line controlling the sail position) to the hull, cut a 4' length of the mainsheet line. Tie a single pulley to the very center, then tie a snap hook to both ends. To rig for sailing, snap each of the hooks over one of the left handles at the rear of the boat, then insert one end of the mainsheet through one side of the double pulley on the boom and tie a simple knot so it can't be pulled back through. Run the free end of the mainsheet through the pulley attached to the hull, then back up through the other side of the double pulley, forward through the front boom pulley and from there back down to the cockpit. It's a good idea to tie the mast to the forward lift handle, as well (you can use the end of the halyard) to attach it to the boat.




Rubber Mat Seat Pad (for traction)
6"
7"
6"
3"
(can be used as pattern for textured paint)
35"
1 x 2" Deck Stiffener
34"
(mounted under Deck, flush with cock-pit)
24"
2"
17"
1"
17"
12.
Drill and drive screws down through dowels
Hose
Dowel
Fill with DAP or sealer
End view of Coaming

COAMING AND COCKPIT DETAIL:

You can use a grit texturing, described in the FINISHING steps, a texturing additive for the paint or rubber matting contact glued to the cockpit floor to give some traction for safe sailing in higher winds. We also cut ribbed rubber matting to form slip-resistant seats on both sides of the cockpit (as shown in Fig. #12).

In rough water you'll get wet in a boat like this, which is why hot sailers are wearing wet suits for real action. But even in smooth water a thin film of water can creep up over the deck on a fast tack, and spill into the cockpit, unless you have a coaming.

We used regular garden hose to form a knock-resistant flexible coaming for this purpose. We cut about ten 2″ lengths of wood dowel to fit inside a hose (we used ⅞″ dowel in a ¾″ hose), pushed the dowels into the hose about 5″ apart using a stick, then drilled ³⁄₁₆″ holes down through the hose and the dowels and drove 1″ screws down through the holes in the dowels and hose to attach it to the deck (following an 17″ radius arc with its front 16″ forward of the cockpit). We used a white hose, then filled the screw holes and the corners between the deck and both the front and rear side of the hose (as shown in Fig. #12) with DAP flexible tub and tile caulk.

MAKING THE SAIL:

Years ago we brought out a way to make inexpensive sails in a couple of hours out of 6 mil polyethylene. The plastic sails proved themselves (in land sailer speeds above 30 knots) to be rugged and good for high speed use, but a little reduced on power in lighter winds, and somewhat vulnerable to abrasion in transporting them to the water. Recently we've tried out a new sail material using sun-resistant, rip-stop woven and laminated plastic tarpaulins and sewn-in seam ropes. They cost about $30, but they're extremely rugged, resistant to ultraviolet rays, have an already sewn-in leech line and they take on a nicer shape for better low-wind performance. Plus you can get two sails out of one tarp which brings your cost down to a little over $15 per sail!

They come already colored in either orange or blue and stand up to frequent transporting extremely well. You can use the same building steps for either the rip-stop plastic or polyethylene sails with one change: When laying the rig down onto the plastic, align the aft ends of the boom and gaff with a sewn hem so that the seams in the tarp extend forward from the leech (as shown in Fig. #11) at right angles to the leech or rear hem of the sail.

If you have any difficulty in locating a hardware or surplus store that stocks plastic tarpaulins, you can use the order blank included in the plans to order a tarp directly from us. Another option is fabric, two color sail kits available from Sailrite Kits in Columbia City, Indiana.

To mark the sail shape, use a 12'' wide box as a guide to slide along the outsides of the tubes while marking the plastic 12'' outside the tube with a felt tip pen. Cut along the lines marked, then trim the plastic off at the boom ends at right angles to the tubes, as shown.

With small scissors cut holes along the top and bottom (but not the rear) edges of the sail. These holes should be about ¼'' in diameter, with about ½'' margin in from the edge of the plastic. Space the holes about 4'' apart.

Next, fold the edges with holes back over onto the sail, making a 12'' wide pocket along the boom and gaff edges. Smooth the plastic flat along the fold, pulling the pocket material tight from both ends; then use the pen to mark the exact positions of all the holes through onto the lower layer of plastic while the edge is held in position.

Cut out these holes and fold the plastic over into a pocket again and smooth out flat. Now run an unbroken strip of 2'' wide grey duct tape (use the fabric-backed kind, not the all-plastic type) along the row of holes, overlapping the seam of the pocket edge. When reaching the end of the pocket at the edge of the sail, cut a 1'' diameter semicircle in the sail edge and then run the tape over this, as shown. Work on a carpet, if possible, to prevent picking up dirt on the adhesive side of the tape.

Carefully turn the sail over and apply a second strip of tape to the other side of the sail, following the path of the first strip of tape, so that the adhesive of both strips of tape can grab onto each other through the holes in the sail. This is the real strength of the seam, so make certain the holes are aligned before taping. Now rub down both sides of the seam thoroughly with your fingernail, burnishing the two layers of tape adhesive together to make a good bond. Place a block of wood behind the sail and tap the taped seam with a hammer all along the edge to get an extra-strong seam. Then repeat this to tape the other seam of the sail.

To attach the sail to the rig, remove the gaff and boom from the mast and insert each into its pocket in the sail. Pull the rear ends of the boom and gaff apart so that the sail is pulled tight, then wrap tape around the tips of the sail at the ends of the tubes to attach. Cut rounded holes so that the halyard, pulley blocks and gooseneck can stick out through the pockets, then reassemble the rig.

The plastic sail itself has proved to be extremely durable in heavy wind conditions, and has given years of service. Like a dacron sail, however, it should be stored out of direct sunlight when not in use.

Before heading out for a sail, make sure you have a paddle aboard in case the wind quits early, plus a sponge to dry things off, and a Coast Guard approved life-jacket for each crew member. Keep one hand free to hold onto the boat, don't sit on the mainsheet, and keep an eye out for what's coming up.

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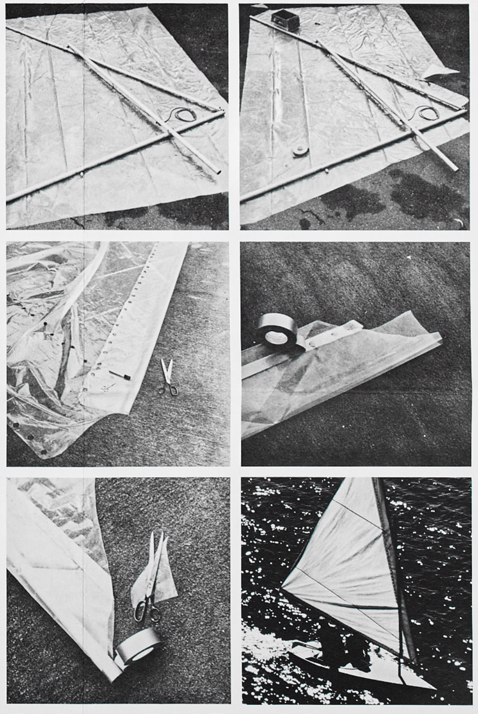
Because the construction of a SPORT SAILER is dependent on factors of materials used and craftsmanship that are beyond the control of the designer and the magazine publisher, neither the designer nor other contributors can accept responsibility for the performance of the boat as actually constructed.



Photos show clear polyethylene sail. When using colored Tarpaulin material, run hemmed edge along Leech (as shown in Fig. #11) with seams at right angle to leach.

One builder wrote in to tell us that instead of cutting holes for the tape with scissors, he filed the end of a piece of ½″ to ¾″ pipe (O.D.) about 2″ long, so the end edge was sharp all around. Then he folded the pockets over, placed a board behind the seam and tapped the unsharpened end of the pipe or tube with a hammer to punch a neat hole through both layers of poly in one operation. This saves a lot of re-positioning and re-marking and will more than pay your time to make a simple punch. Or you can buy a ½″ diameter grommet hole punch. Using a punch this way, the builder added, he and his wife were able to make their first sail in less than two hours!

SAIL OPTIONS

Sail Kits:
For information regarding kits for building sewn, nylon sails tailored for the Sport Sailer, write to Sailrite Kits, R. R. #1, Columbia City, Ind., 46725. Ph. 219-244-6715

Tarps:
The Tarpaulin material described in the plans is usually found in surplus and camping stores. However, if you find any difficulty in locating the Tarps we can supply you with one large enough for two complete sails for $30, plus $5 handling and shipping (California residents please add $1.80 for sales tax).

If you're interested in more low-cost recreation projects you can build, check the box in the coupon at right and include your address to receive our free brochure including: our 14' Catamaran; 22' Pontoon Boat; Redwood Hot-Tub; miniature Indy Race Car (for kids and adults, -no welding required); super-simple beginner's Sail-boat; Hydrofoil; 12' Pram for motoring, rowing, or sailing; Touring Kayak; light-weight Land Sailer; 14' Fishing Boat; Power Catamaran; Modular Greenhouse; and Traditional Skipjack Sailboat.

Please send me _____ tarpaulin(s) at $30.00 each Total: $_____
Available in orange or blue. First color choice: _____
Second Color choice: _____
Shipping and Handling Charges ($5.00 each) $_____
California Residents please add $1.80 each for Sales Tax $_____
TOTAL: $_____

Please make check or money order payable to Stevenson Projects OR you may charge to your MASTERCHARGE account (SORRY, we cannot accept VISA)
Account Number: _____ InterBank Number: _____
Expiration Date: _____ Signature: _____
Please check if you'd like a free Brochure _____
SHIP TO:
NAME: _____
ADDRESS: _____
CITY: _____ STATE: _____ ZIP CODE: _____
(Please include your phone number in case we have a question:) A/C _____ Phone _____
NOTE: Please advise if United Parcel does not service your area and we will ship via Parcel Post. Please allow 2 to 3 weeks for delivery.

MATERIALS

LUMBER:
-ACX Exterior Grade Plywood (or Marine Grade):
  Four- 4' x 8' x 1/4" Panels
-Clear Fir or Spruce:
  Two- 14' 1" x 6" (one for side stringers; one for bulkheads and framing parts)
  One- 7' 1" x 12" (for Rudder, Tiller, & Rudder Box spacers)
  One- 4' 2" x 4"
  One- 12' 1" x 4"
  One- 6' 1" x 3"
  One- 6' 1" x 2"

HARDWARE: (all galvanised)
- 2- sets Barrel-bolt Locks
- 2- 1/4"x2" Bolts
- 2- 1/4"x3" Screw-eyes
- 1- 5/16"x3"x 1-3/4" U-Bolt
- 1- Clothesline Cleat
- 1- Double Pulley (for 1/4" line)
- 3- Single Pulleys
- 5- 5/16"x3-1/2" Eyebolts
- 3- Large Grab-Handles
- 2- Plated or brass Snaphooks
- 4- 1/8" x 1-1/4" bolts, nuts
- 800- 1" plated, flathead, #8 woodscrews
- 100- 1-1/2" plated, flathead, #8 woodscrews

MISC.
- 1- quart polyester auto body filler putty
- 2- quarts waterproof glue
- 1- gallon oil-base gloss enamel
- 1- tube DAP or Silicon seam sealer
- 15- cu. ft. Expanded Polystyrene packing foam particles
- 50'- 1/4" or 3/8" braided nylon or dacron line
- 5 lbs "Agrashell" medium grit or "Rol-a-Tex" paint texturing

RIGGING
- 1- 16' Tube, 2- 12' Tubes, (2" to 2-3/8" dia., 1/16" or .065 wall thickness; -aluminum tubing or irrigation pipe)
- 1- 60' roll of 2" gray duct tape (fabric backed)

Tubing Reinforcing (if needed):
- 1- 16' clear fir 1x3"
- 1- 10' clear fir 1x3"

SAIL:
- 1- 16' x 20' (15'-6"x 19-8" finish size when hemmed) Tarpaulin material, ("Flextuf" or "Super Tuff" rip-stop layered, woven polyethylene). 6-mil clear clear polyethylene can be used

COAMING
- 3' x 1-1/2' Ribbed Rubber stair Tread
- 36" x 5/8" Wood Dowel
- 4-1/2" -3/4" Garden Hose