



HOW TO BUILD THE SIX-HOUR CANOE

Simple, elegant, and quick to build

Text by Dick Butz • Illustrations by John Montague
Photographs courtesy of Buffalo Maritime Center

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SMALL BOATS
MAGAZINE



A long time ago, Mike O'Brien, former senior editor of *WoodenBoat* magazine, designed this canoe as being "a pleasant end for two sheets of leftover plywood." The Buffalo Maritime Center in Buffalo, New York, subsequently revised the plans, and has taught hundreds of students how to build their own canoes.

The designer describes the essence of this simple boat: "With the paddle sitting idly in my hands, I've drifted through long afternoons in shallow Chesapeake coves. Six inches below, the life struggle of the bottom community played out like a movie. I've rested in the same coves on autumn evenings and watched silently as Canada geese crossed the moon and came down to sleep. Nothing, absolutely nothing, conveys the joy of being afloat quite so purely as a light paddling boat."

Indeed, if simplicity is a virtue, then the Six-Hour Canoe

is among the most virtuous of all small craft. This sheet-plywood boat is inexpensive and easy to build with simple hand tools. It can make boating accessible to anybody with a few hours' time and a few hundred dollars for materials. When completed, it is perfect for exploring sheltered waters and out-of-the-way spots.

The Buffalo Maritime Center has used the construction of this boat to introduce novices to concepts of craftsmanship and design in a college-level introductory boat-building course. We also feature the construction of the boat in self-esteem-building activities for at-risk and gifted-and-talented school kids as young as the fifth-grade level. Scout troops also have found the process useful. For parents, this is an ideal way to do something with their kids on winter weekends that will be challenging and full of long-term payoffs.



Wood

- Hull panels: Two sheets of $\frac{1}{4}$ " x 4' x 8' marine plywood, or one sheet of $\frac{1}{4}$ " x 4' x 16' marine plywood
- Stems: Two pieces 2x4 x 28" dimensional lumber; may be any reasonably clear, straight stock—fir, pine, or spruce are typical.
- Frame bottom piece: One piece $\frac{3}{4}$ " x 2" x 36"
- Frame side pieces: Two pieces $\frac{3}{4}$ " x 1 $\frac{1}{2}$ " x 13"
- Gunwales: Two pieces $\frac{3}{4}$ " x 2" x 16'
- Chine logs: Two pieces $\frac{3}{4}$ " x 2" x 14'

Fastenings and Glue

- One pound $\frac{7}{8}$ " bronze ring nails
- Fifty $\frac{3}{4}$ " No. 8 bronze flathead screws (for fastening the gunwales)
- Four 1 $\frac{1}{2}$ " No. 10 bronze screws (to secure each end of each gunwale)
- One pint marine epoxy adhesive (this is a two-part glue)
- One hundred $\frac{3}{4}$ " No. 6 or No. 8 drywall screws (for temporary fastening only)
- A handful of 10-penny finishing nails (for bending battens to lay out the lines on the panels)

Scarfing Jig Materials

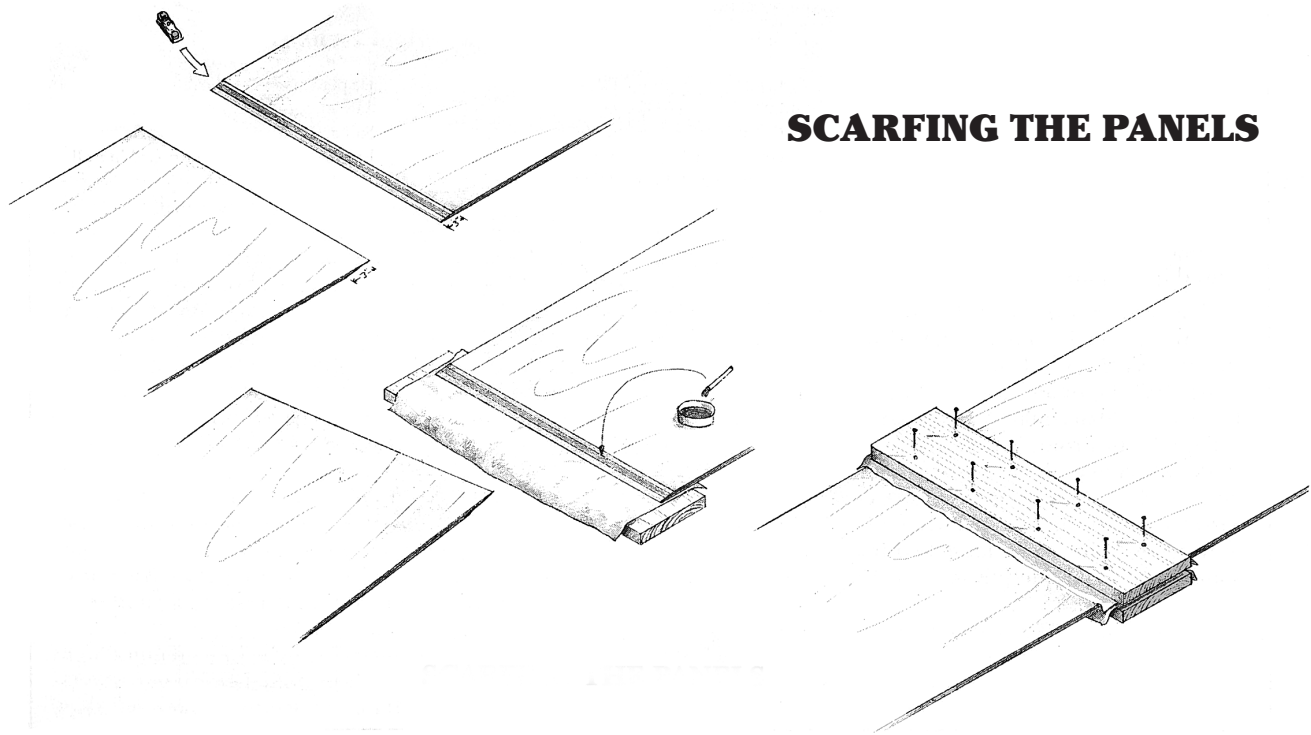
Used only if you are scarfing your panels together

- Two pieces 2x6 x 48" (pressure plates)
- Twelve 3" drywall screws
- Plastic sheet



Tools

- 16' tape measure
- Screwdriver
- Sliding T-bevel
- Combination square
- Framing square
- Chalkline
- Hammer
- Sharp handsaw
- Low-angle block plane
- Electric drill, with $\frac{1}{8}$ " and $\frac{1}{4}$ " bits
- Circular saw
- Bandsaw or tablesaw (either will suffice to cut your two stem pieces)
- Random-orbit sander (not essential, but nice)
- At least six 2" spring clamps
- At least two 12" bar or 4" C-clamps
- A pair of stable sawhorses



SCARFING THE PANELS

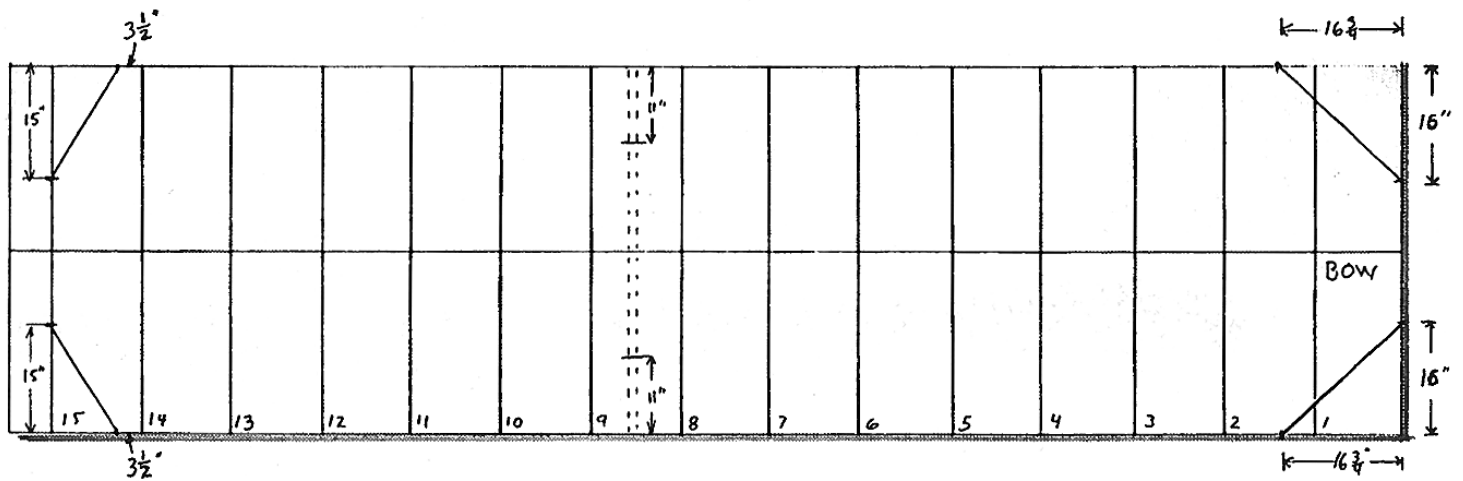
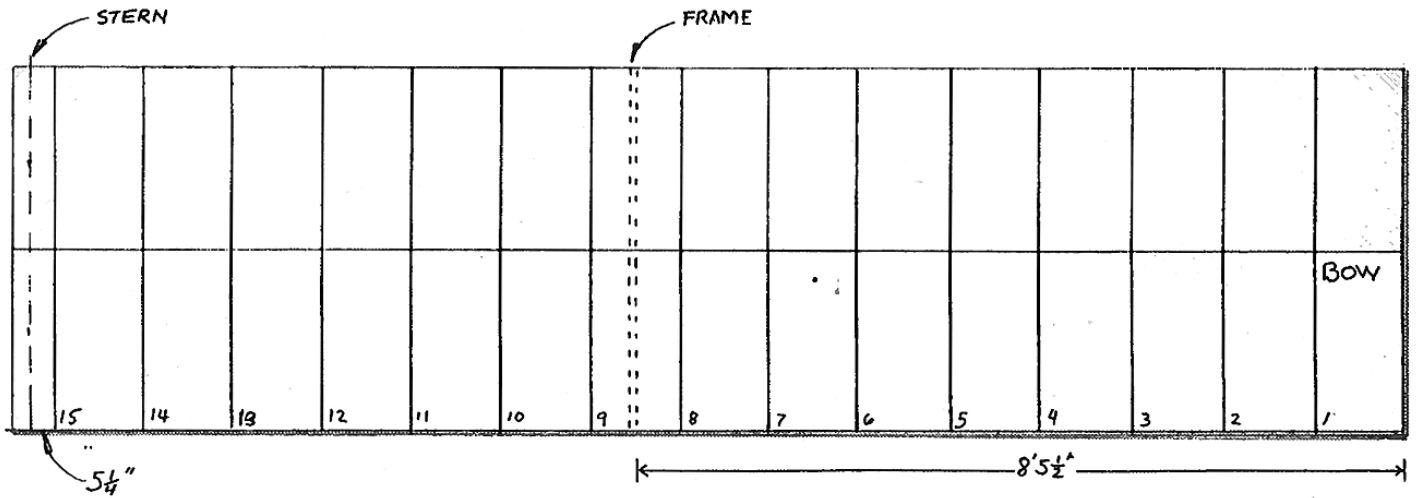
Joining the Panels

If you did not purchase your plywood as a 16' panel, you will need to scarf-join two 4' x 8' panels together end-to-end. This yields a (nearly) invisible joint, and is described in the following steps:

1. Plane a 3" bevel at one end of each panel as shown. Use the laminate lines of the panel to guide your cut; keeping them straight and parallel ensures a good joint.
2. Thoroughly mix up ample epoxy and wet out the two surfaces to be joined.
3. Add adhesive powder to another batch of epoxy until it is of peanut-butter consistency and apply this mixture to the two surfaces over the thin epoxy you've already applied.
4. Lay a 4'-long 2x6 on the floor and cover it with a plastic sheet.
5. Set the scarfed and glue-soaked edge of one panel on top of the 2x6, with the scarf facing up. Set the other panel on top of this, with the scarf facing down, so the two scarf slopes meet.
6. Carefully align the panels using a straightedge. (You might want to temporarily screw the sheets to the shop floor, so they won't slide apart.)
7. Place a piece of plastic sheet on the top of the joint, and then screw another 4'-long 2x6 down through the plywood into the bottom plate. Use only enough pressure to compress the two pieces to be joined.
8. When the glue has cured, remove the screw and plastic, and scrape and sand away any excess.

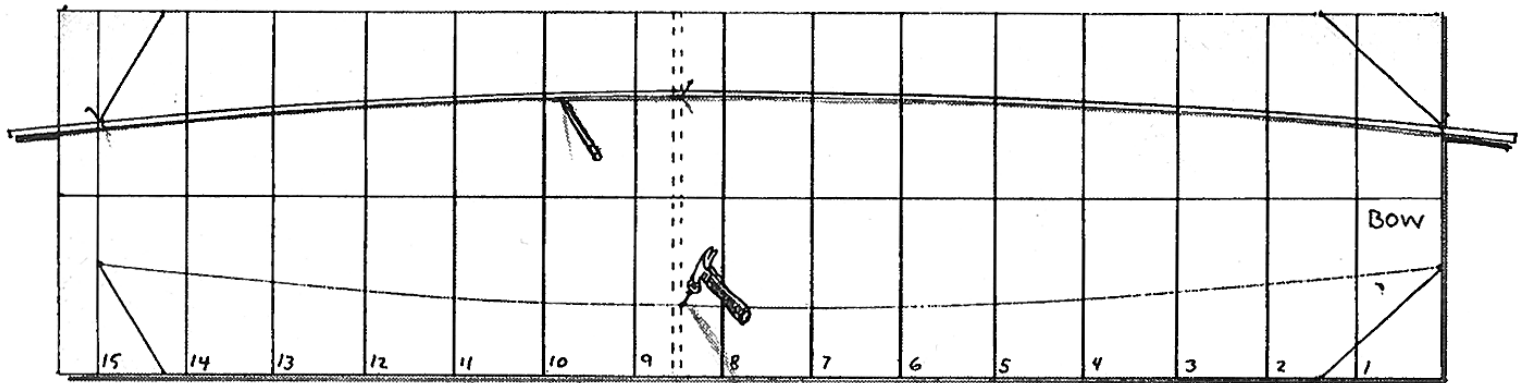
Instead of scarfing the panels, you may butt them end-to-end and reinforce the joint with a piece of 5"-wide 6mm plywood, centered on the joint and spanning the complete width of the panel. If you do this, be sure the joint does not land where the frame will.





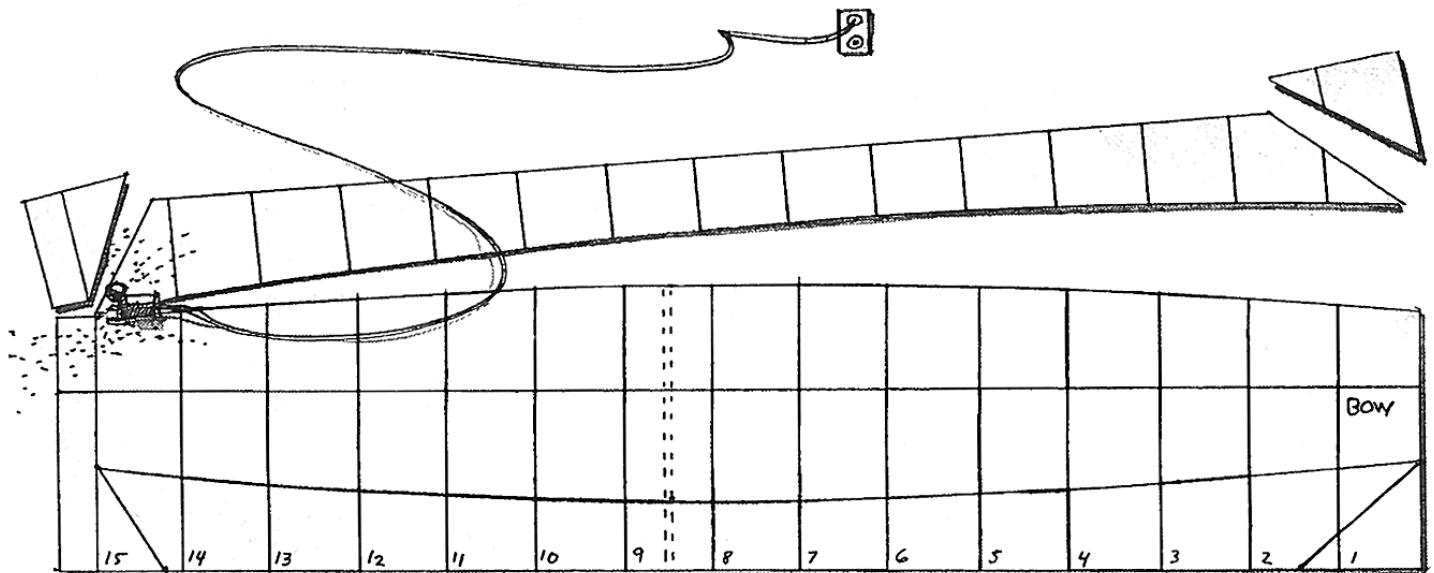
Laying Out the Panels

1. Mark a line down the center of the 4' x 16' panel, lengthwise.
2. Mark one end of your panel as the bow and, starting at that end, mark lines perpendicular to the center line at 1' intervals, as shown. These will be your layout lines. Number these lines, starting at the bow end, 1 through 15.
3. After line No. 15, draw another line $5\frac{1}{4}$ " from No. 15 and parallel to it. This is the stern end of the panel.
4. Locate and mark the position of the frame $8'5\frac{1}{2}$ " from the bow.
5. At the bow end, mark points 16" in from each edge.
6. At the frame line, mark points 11" in from the edges. These points indicate the top of the sheerline, on each panel, at the frame position.
7. At the stern end of the panel ($5\frac{1}{4}$ " aft of No. 15), mark points along the line, 15" in from each edge.
8. Lay out the angle of the bow end by marking a point $16\frac{3}{4}$ " aft of the bow end along each edge of the panel. Connect these points with lines running to the points where the sheerlines end at the bow (see Step No.5).
9. Mark another set of points along the edges of the panel $3\frac{1}{2}$ " aft of layout line No. 14. Connect these points to the points where the sheerlines meet at the stern (see Step No. 7 above).



Laying Out the Sheer

1. Drive finishing nails lightly into the following points: the point where the sheer ends at the bow; the frame position on the sheerline; the point where the sheer ends at the stern.
2. Bend a batten (use your gunwale stock if you don't have an adequate batten) over the nails and draw the sheerline as shown for each side panel.

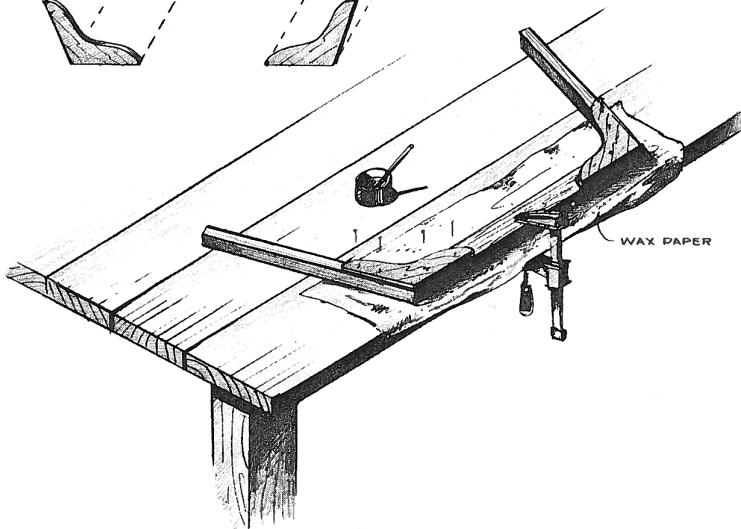
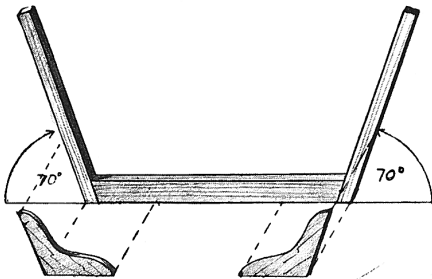
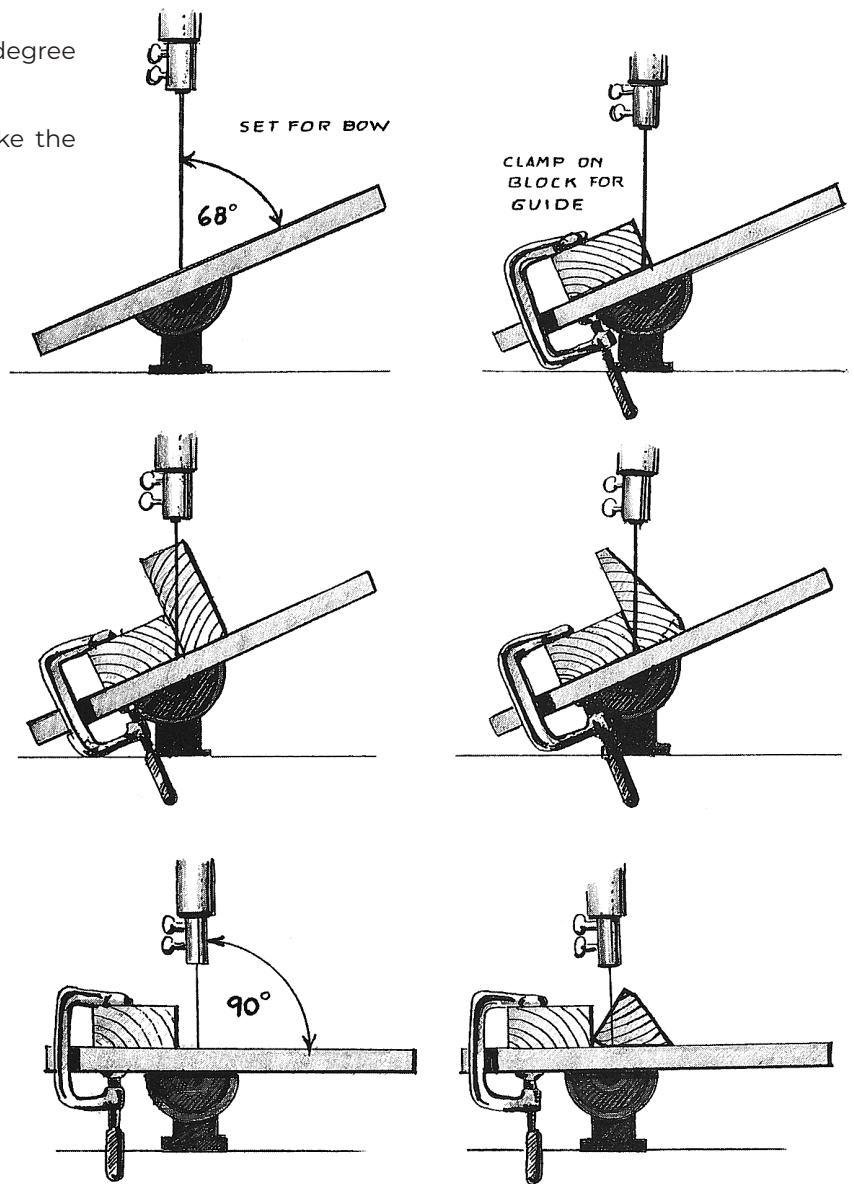


Cutting Out the Panels

You should now have the sheerline and bow and stern angles clearly marked on your panels. Use a circular saw to cut out the side panels. If you are inexperienced with a circular saw, cut $\frac{1}{8}$ " or so away from the line, and then clamp the two panels together and plane them to the lines with a block plane.

Cutting Out the Stems

1. Set a bandsaw or tablesaw table to a 68-degree angle, and attach a fence as shown.
2. Cut the 2x4s as shown.
3. Reset the table to 90 degrees and make the final two cuts.



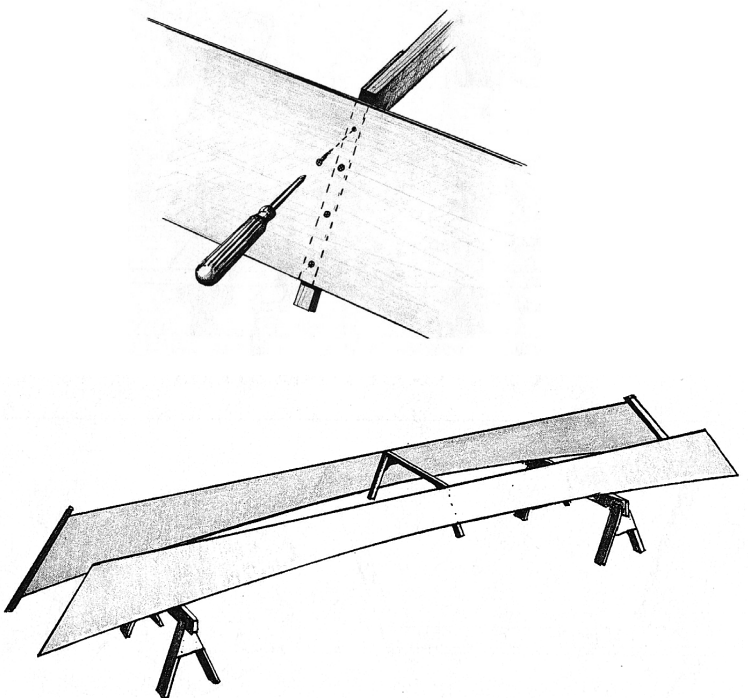
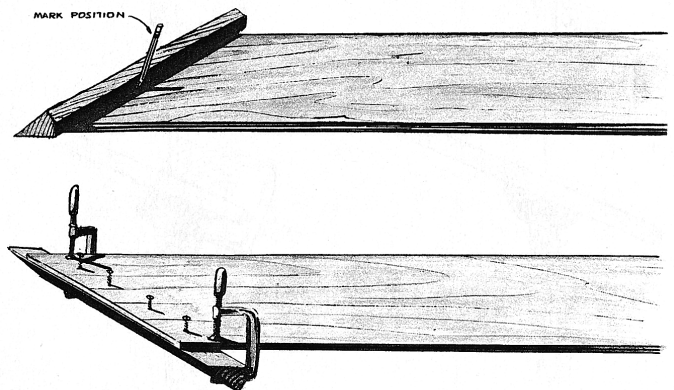
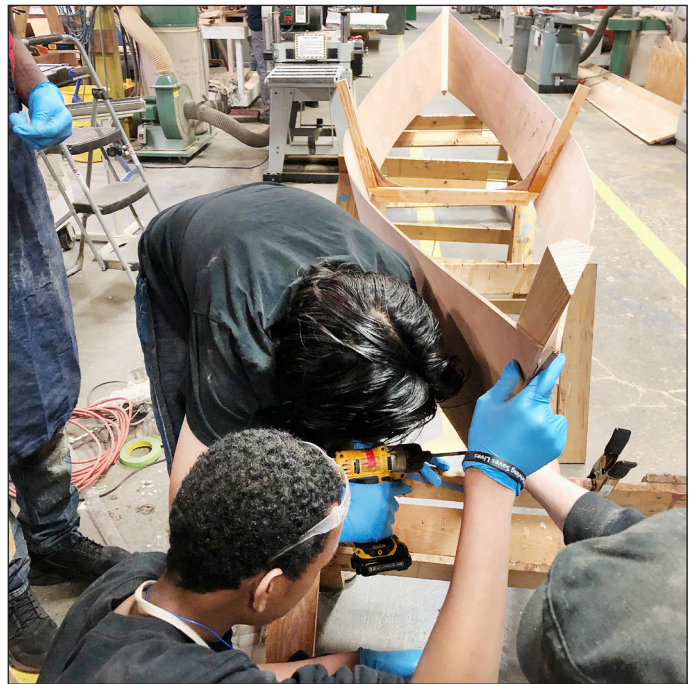
Making the Frame

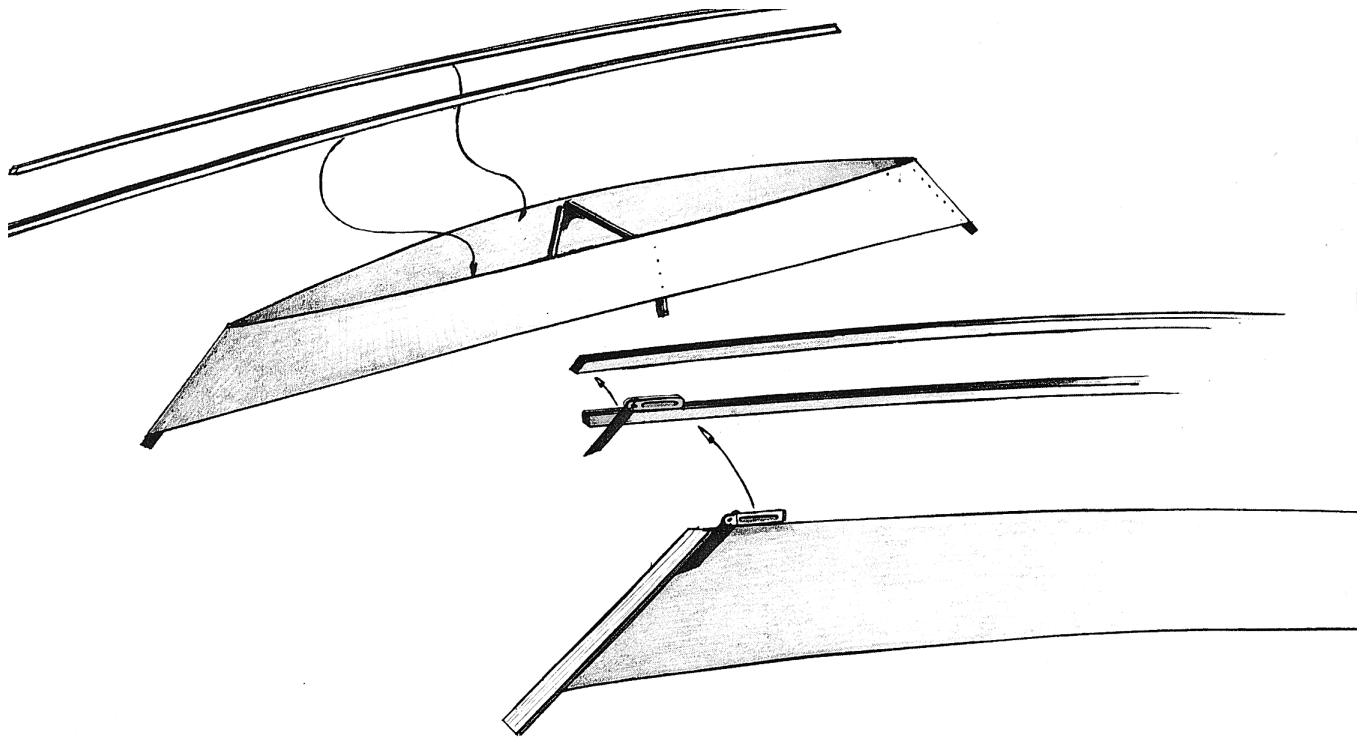
1. Using the pattern in the plans, cut out two frame gussets from scrap hull-panel plywood. Clean up their edges with sandpaper. Mark the nail-hole locations shown on the pattern, and drill $\frac{1}{8}$ " holes in these locations.
2. Using a gusset as a guide, mark the angle for the bottoms (aka "heels") of the frame sides and cut the angle with a handsaw.
3. Using the gussets again as guides, cut the angles for the ends of the frame bottom as shown on the plans. Remember that the assembled frame measures 24" across the bottom edge.
4. Epoxy, clamp, and nail the gussets to the frame pieces with bronze ring nails.
5. After the epoxy cures, remove the clamps and mark the outline of your chine logs on the frame assembly and cut out two notches to receive the chine logs.

Assembling the Side Panels, Stems, and Frame

Before gluing the boat together, it is wise to assemble it with drywall screws and no glue. This allows time for careful alignment and gives you the opportunity to check measurements and positions before committing to gluing.

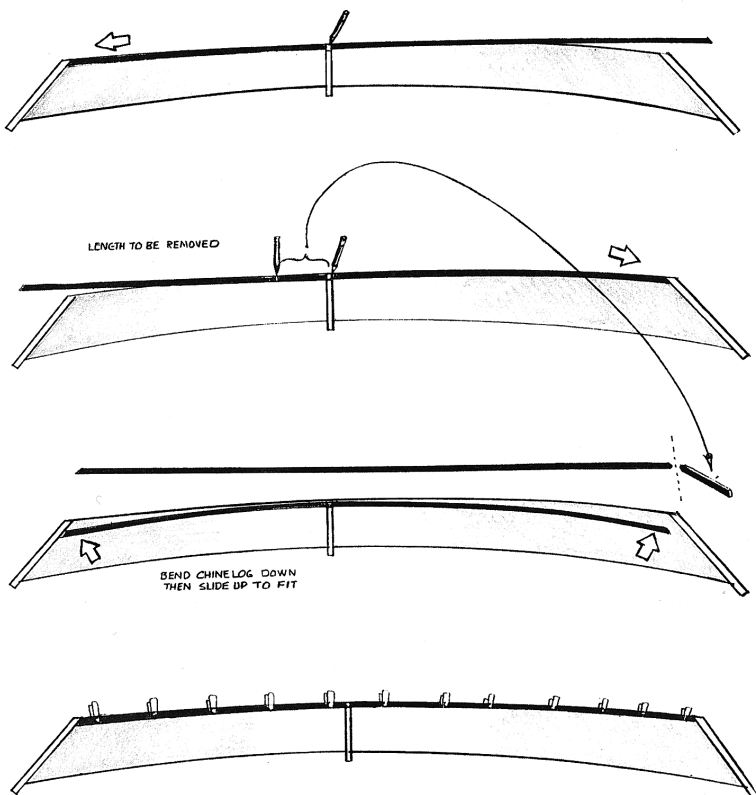
1. Lay the side panels on the floor with their insides facing up.
2. Mark the positions of the stems and attach them to one side panel with four $\frac{3}{4}$ " drywall screws.
3. Cut a short (3") piece of chine log and clamp it to the bottom of one side panel at the point where the frame will be located. Then position the frame, aft of the frame line and with its gusset facing forward, so its notch fits over the chine log piece. Screw the frame into place with four evenly spaced drywall screws driven through the panel and into the frame, as shown in the drawing.
4. Unscrew the frame from the side panel and repeat this process on the other side panel—but leave the frame in place this time.
5. Gather a few helpers to assist in attaching the panels together at the stern. Be careful to line everything up. Drive four more drywall screws to complete this stem assembly.
6. Pull the panels sufficiently close together to permit attaching the frame to the still-unfastened panel. Drive four screws into the existing holes in that panel.
7. Pull the bow ends together and fasten the unattached side to the stem with four drywall screws.
8. Stand back and look at the boat from all sides and ends to check alignments and positions. Refit if necessary.
9. When the pieces are properly aligned, take them apart, apply epoxy to all joints in the same manner described in the scarfing instructions, reattach everything, and wait for the glue to cure.





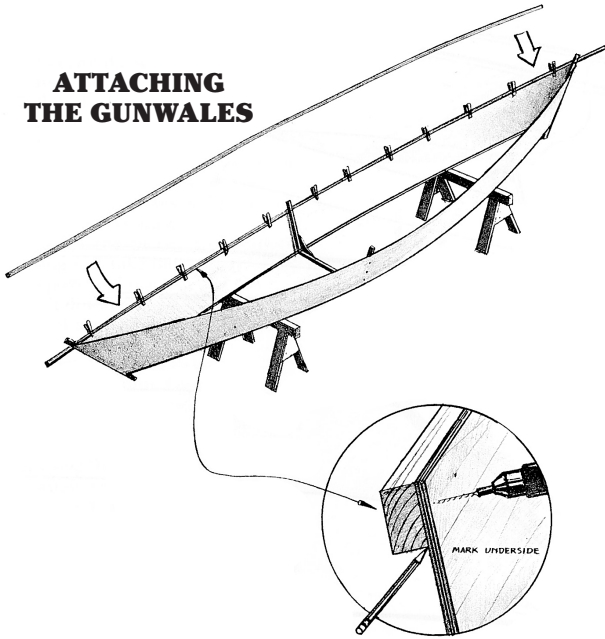
Installing and Planing the Chine Logs

1. With the boat upside down, cut the protruding ends of the stems flush with the bottom of the boat.
2. Using the sliding T-bevel, take the angle of the bow to the bottom edge. Use this angle to scribe a line on one end of each of your chine logs (the 14'-long pieces of 1" x 2" stock). Cut the ends off, and mark each "bow."



3. Do the same for the stern angle and mark these ends "stern." Although both ends of the pieces will now fit in the boat one at a time, the chine logs are too long. The following steps will adjust them to the proper length.
4. Bend the chine log into the boat and fit it into the bow and frame notch so the edge of the chine log and the bottom edge of the boat are flush. Clamp it with spring clamps. Mark a line across the chine log where it intersects the forward edge of the frame.
5. Remove the chine log, bend it into the stern and frame notch, and clamp it with spring clamps. Again, mark a line across the chine log where it intersects the forward edge of the frame.
6. Remove the chine log. The distance between the two marks is the amount of stock to be cut off so the chine logs will fit into the boat. Transfer this distance to one end and cut off the excess stock, being careful to maintain the correct angle. Repeat this process for the other chine log.
7. When both chine logs are properly fitted, glue them in after coating the mating surfaces with epoxy. Use drywall screws, spaced 4" apart, to hold the pieces in place. Use spring clamps to close any gaps that remain.
8. After the epoxy cures, plane the chine logs and heels of both stems so they are perfectly flush with the bottom edges of the panels and so that a straight stick laid across the boat at any station will bear fully on the planed surfaces. This is necessary for a tight-fitting, waterproof joint along the edge of the bottom. We glue 30-grit sandpaper to a 30"-long 2x4 and use this sanding board to true up the bottom edges after planing.
9. Once the epoxy is cured, remove all of the drywall screws so you don't forget them. Fill the holes with thickened epoxy.

ATTACHING THE GUNWALES



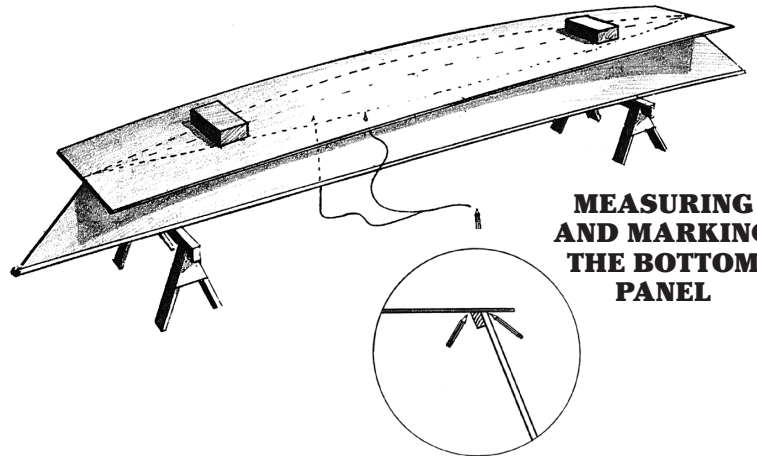
Attaching the Gunwales

1. Turn the boat right-side up and attach one 16' gunwale to one side with spring clamps. Mark screw positions every 4" and, beginning at the center, drive drywall screws, moving toward each end.
2. At each end of the gunwale, drill pilot holes for the 1½" bronze screws through the gunwale and into the stems and drive the screws.
3. Trim the ends of the gunwale to match the angles of the bow and stern.
4. Remove the gunwale, apply epoxy to both surfaces, and reattach it.
5. Repeat this process for the other gunwale.
6. When the epoxy has cured, trim off the upper ends of the stems and the tops of the frame and plane the gunwales flush with the sheer edges.



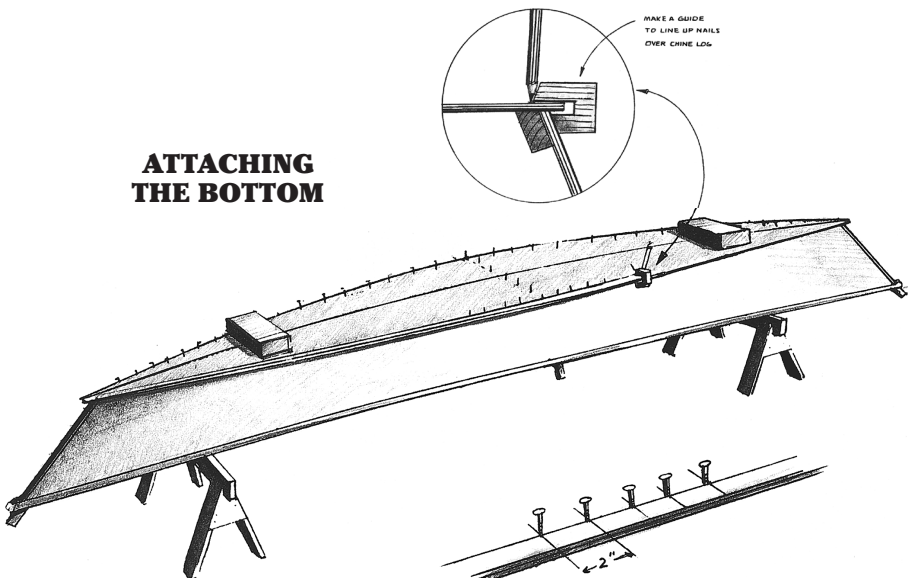
Measuring and Marking the Bottom Panel

1. Turn the boat upside down. Lay the bottom panel on the boat and attach it temporarily with a drywall screw driven into the stem bottom at each end.
2. With a pencil, draw a line on the bottom panel around the outside of the boat where the sides meet the bottom, and on the inside where the chine logs meet the bottom. Also draw lines on the bottom panel to show the location of the frame. These lines will show you where to trim the panel and where to apply epoxy after the panel is trimmed.
3. Remove the bottom panel and cut along the outside line, leaving about ¼" excess.



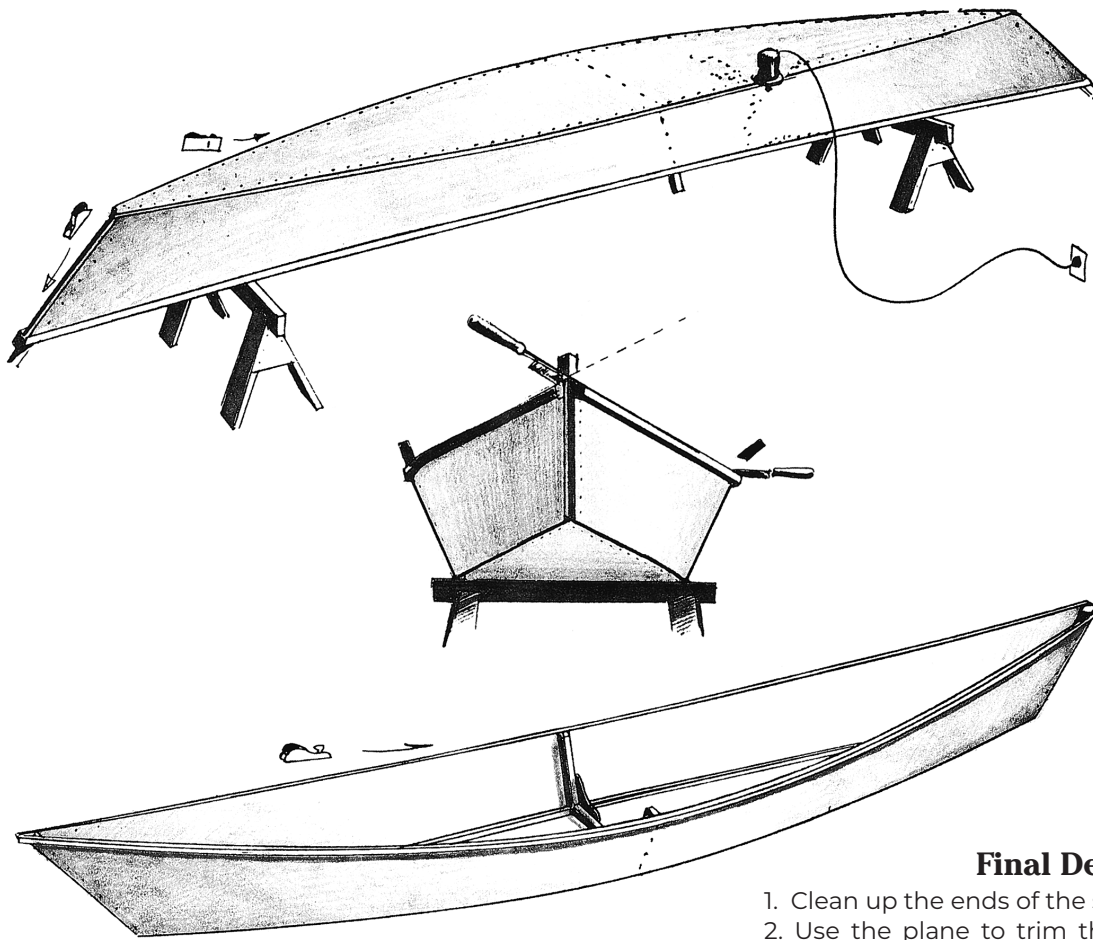
MEASURING AND MARKING THE BOTTOM PANEL

ATTACHING THE BOTTOM



Attaching the Bottom

1. Put the bottom panel back in place and use a marking gauge, as shown in the drawing, to mark the nailing line. This line should lie about ⅜" in from the side panel.
2. Remove the bottom panel, apply epoxy to the mating surfaces, and put it back on with two drywall screws.
3. Beginning near the middle of the boat, drive a bronze ring nail about every 3" on the nailing line. Work toward each end. After you have hammered in a couple of dozen nails, remove the drywall screws at the ends. Don't forget to nail the bottom into the frame, too.
4. When the epoxy has cured, trim off the excess plywood along the chines. A router with a flush-trimming bit works well for this. So does a block plane. Regardless of which you choose, finish off with the plane.



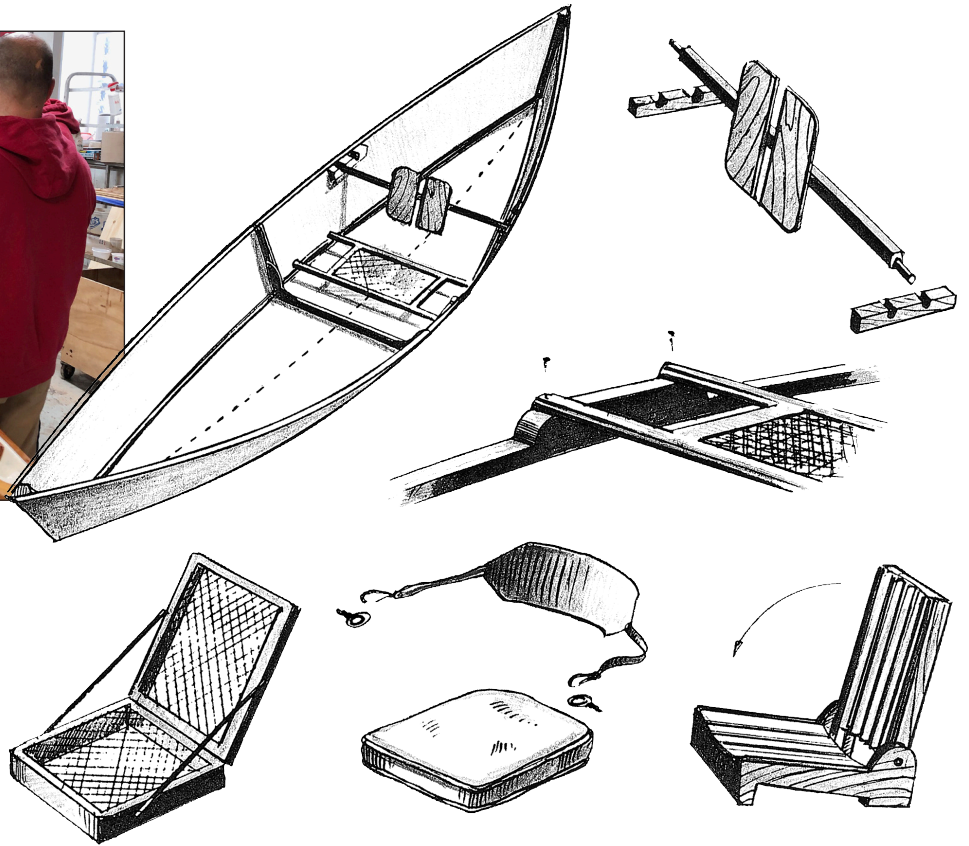
Final Details

1. Clean up the ends of the stems with a block plane.
2. Use the plane to trim the ends of the gunwales, being careful to not split them as you plane across the grain. Finish them off with a sanding block or cabinet rasp.
3. Use a cabinet rasp or sanding block to round over the tops of the frame ends.
4. Use a block plane to radius the corners of the gunwales, the inner corner of the sheer, and the bottom corner at the chine.
5. Sand all surfaces with a random-orbit sander or sanding block.



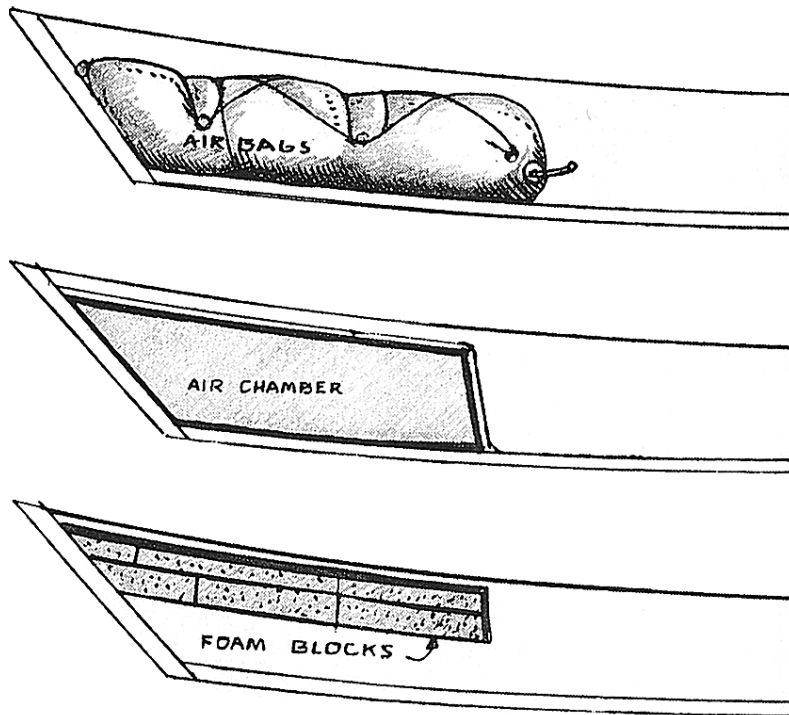
Finishes

1. Seal all plywood edges with epoxy. After this cures, sand these surfaces lightly.
2. Apply plywood sealer to the entire boat.
3. If you are varnishing the gunwales, apply one coat of thinned varnish now.
4. When the varnish is hard, apply marine primer to all surfaces that are to be painted.
5. When the primer is hard, lightly sand all primed surfaces.
6. At this point you can apply the paint of your choice.
7. If you are varnishing any details, apply subsequent coats now.



Seats

This boat is intended for one adult. The paddler sits facing forward, just aft of the frame. It's nice to sit up off the bottom about 1". We use canvas canoe seats that are laid on the chine logs as a quick solution. But you can get innovative and use old chairs with the legs cut down—or employ any number of other ideas. We've provided some drawings for inspiration. In any case, keep the seat low in the boat and locate it just aft of the frame.



Flotation

Positive flotation is a good idea. You can install bulkheads and decks and fill the voids with foam, or you can purchase kayak flotation devices and secure these to the chine logs with bungee cords. Regardless of your positive flotation choice, always wear a U.S. Coast Guard–approved PFD when on the water. And keep in mind that this boat is intended not for expeditions, but for exploring protected shorelines.



This article is adapted, with permission, from one published in WoodenBoat magazine No. 125 (July/August 1995). That article was written and illustrated by Dick Butz and John Montague, respectively, who went on to found The Center for Watercraft Studies (CWS) at Buffalo State College in Buffalo, New York. CWS has since transformed into the Buffalo Maritime Center (www.buffalamaritimecenter.org), which has launched hundreds of Six Hour Canoes.

*Although this canoe can be built directly from the directions given above, more detailed advice is offered in the book *Building the Six-Hour Canoe* (Tiller Publishing, 1994), which can be ordered from The WoodenBoat Store (www.woodenboatstore.com).*