

MATERIALS LIST

Plywood, (A-C Exterior Grade, or Marine Grade):
5- 4 ft. x 8 ft. x 1/4" Panels

Clear Fir: (or Spruce or other medium hardwood)

- 1"x 10" - 6 ft.
- 1"x 6" - 8 ft.
- 1"x 3" - 14 ft., 14 ft., 7 ft.
- 1"x 2" - 4 ft., 4 ft., 18 ft.
- 2"x 6" - 6 ft., 6 ft.
- 2"x 3" - 6 ft.
- 2"x 2" - 18 ft.

#2 Pine

- 1"x 10" - 12 ft., 14 ft., 14 ft.
- 1/4"x 1" Pine Battens- five 6 footers
- 3/4" Dowel- 3 ft.

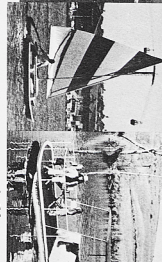
Hardware:

- 800-1", #8 plated flathead woodscrews
- 200-1-1/2", #8 plated flathead woodscrews
- PVC Schedule 40 Plastic Pipe: 1-1/2" i.d., 10 ft., 1/2" i.d., 20 ft.
- Eyebolts: 1, 1/2"x 5"; 2, 1/4"x 2"; 3, 5/16"x 3"; 2, 5/16"x 2"
- Screw-Eyes: 22, 1/4"x 3"
- Lag-Screws: 2, 1/4"x 3"
- Threaded Rod: 4, 1/2"x 24"
- Bolts: 10, 1/4"x 1-1/2"; 1, 1/2"x 6" (Round-head)
- 5, 1/8"x 1-1/4"; 5, 1/4"x 3"
- U-Bolts: 12, 3/8"x 2"
- Nuts: 10, 1/4"; 12, 1/2"
- Washers: 2, double 3/8" line; 2, single, 3/8"
- Cable Clamps: 18, 3/16"
- Cable Thimbles: 18, 3/16"
- 7/8" o.d. Aluminum Tubes: 1, 3 ft.; 2, 6 ft.
- 1/2" i.d. Galv. Iron Pipe: 1, 2 ft.

- 1 Grommet Kit
- 3 "Quik-Link" Chain Splicers
- 4 Spring Clips
- 2 Galv. Iron Straps: 1"x 9-3/4"x 1/8"
- 85 ft. Steel Cable, 1/8" Plastic Covered or 3/16"
- 2 Galv. Tie-Down Belts
- 4 Sliding Barrel-Block Locks
- 2 Turnbuckles, 5/16" Threads
- 70 ft. 5/16" braided Nylon Rope
- 3 Tubes Immersible Seamsealer
- 1 Gal. Catalysed Polyester Auto Body Putty
- 2 Gals. Oil Base Enamel Paint
- 1 Roll, 2" grey fabric-backed Duct Tape
- 15'-6"x 19'-8" Tarpuilan "Flextuff" Rip-Stop Polyethylene (with grommets and rope inside hem,) or "Super-Tuff" rip resistant Tarpuilan

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If you're interested in more low-cost recreation projects you can build, fill out this coupon and mail it to: Stevenson Projects, Box 541, Del Mar, Cal., 92044. To receive our illustrated brochure including: a 14 ft. x 8 ft. network fibro-tube; a 22' Pontoon boat; a miniature buoy; a one-man sailboat; and a 14' Bass-boat; a Modular Greenhouse; and an extra-complete Sewing Center.



MINI-CAT was designed to bring some of the newer speed features of the larger, second generation racing catamarans to a smaller boat that can be conveniently car-topped to the water. With lightweight, 65-pound hulls, two position rudders for easy boating, and one-man set-up ability, the MINI-CAT is one of the simplest and by far the cheapest catamarans to get sailing. Under sail we've found the MINI-CAT to be a delightfully faithful performer, dependable to take if you do things right, and in a gust she's fast enough to throw water off her bows like it's coming out of a fire hose. We like her because she's both docile and exciting—and a good boat for beginners and veteran sailors alike. Hull building is simple, using 1" plywood sides and solid lumber stock hull tops and bottoms, so you don't need stringers and the number of screws needed is cut in half.

Figure #1 shows the general building steps for the hulls. First one pair of plywood side panels is joined together and then attached to one edge of the hull top. Then the solid lumber bulkheads and transom are attached to the hull top and side. The hull bottom and bow nose piece are then attached. Finally, the opposite hull side plywood panels are attached, after sealing steps are completed.

If experienced builders will bear with us, we'll go into the basic techniques we've found well served by planning, cutting and assembling wood components. Then we'll get construction under way in the step-by-step building guide.

BOAT BUILDING TECHNIQUES

The first step is to mark down the shape of the parts on the wood. With large tools we mark straight across the plywood panels or across the board, spacing the lines 12" apart. We use a carpenter's square to mark the lines (called "board lines") across lumber pieces and we use an accurate, uncut plywood panel to mark the station lines squarely across the 1" panels. To mark them accurately, we mark the lengthwise "reference line" on the panel, then we measure out exactation line to the dimension shown and place a corresponding mark called the "offset." It's a good idea to number the station lines as shown and recheck each line before making and cutting to keep things straight.

Next, small nails are driven down into the offset marks on the station lines and then a batten (a stick about 6'-8" long and about 1"x 1/2" thick) is pushed up against the nails along the inside of the curve so the batten rests against as many nails at one time as possible. The curve is marked along the OUTSIDE of the batten and the smoothness of the bend is checked by placing your eye down near the panel surface and sighting down the curve from one end to make sure the curve has no unwanted S-bends in it.

The uncut edge of a plywood panel makes a good straightedge to mark straight lines, and intricate shapes like the rudder components can be lotted by sketching the 2" squares lightly on the lumber, then transferring key dimensions onto the wood by counting off the squares from the grid work in the plans and connecting the dimensions shown.

We use a hand-held electric circular saw to cut the panels and straight cuts, setting the blade cut depth to 1/4" below the bottom surface of the wood. Cutting with a shallow set circle saw blade gives nice, regular curves. You can use a hand saw or a saber saw to cut the tighter radius curves.

You can stack the panels to cut out pieces for both hulls at one cut, but make sure the surfaces face up on one set and down on the other so you end up with a finished surface on the outer of both hulls. Be sure to keep an eye out for angled cuts noted in the plans and check to make sure you end up with opposing angles to form an opposite pair to fit together and left hulls. The hull sides are straight down the outside (outboard side) and curved on the inboard side (which are also Fig. angled side).

To attach the plywood panels to the edges of the lumber parts we first mark placement for screws 3" apart and 1/4" in from the edges of the panel (so the screw can sink into the center of the edge of the lumber). Next, we drill pilot holes for the screws at these marks as we progress along (with the joining

parts in position) using a combination drill bit/countersink called a "screwmate." These are either adjustable or come in different sizes to match the screws used, and they'll save a lot of time over drilling with a 1/4" bit, then going back to countersink the tops of the holes). All screw holes are drilled with the parts held in position together. If you're attaching two straight edges, you can drill and drive the end screws there first in between once the parts are held in position. If you're attaching a curved edge, however, you'll probably work from one end, spreading glue along as you drill the pilot holes and drive the screws. We use 1", #8 plated flathead wood screws when attaching 1/4" plywood to the lumber and 1 1/2", #8 plated flathead wood screws for attaching 1" lumber stock to other lumber stock.

The kind of screwdriver you will use will determine more than anything else how fast the project goes. A regular screwdriver will take a long time and wear out your wrist. A Yankee Push-type screwdriver (using Phillips head screws) will speed things up a lot. And a screwdriver attachment for the power drill or simply a screwdriver bit for a Yankee (bought separately) in a variable speed, electric drill will do the job fastest. You can drive a long line of screws in a few minutes with a drill screwdriver, and we've found that plain old slot head screwdrivers work best with this set up.

Before joining parts, we paint all finishing surfaces with waterproof glue, and glue which is a water mix that's cheaper and much easier to work with than the two-part resin/epoxy type, and it holds up just as well as the epoxy.

We'll go into sealing, finishing and painting techniques later. Right now, we can get boatbuilding.

STEP ONE:

LOFTING AND CUTTING HULL PARTS

Use the methods discussed to mark the four plywood hull panels shown in Fig. #3, being careful to use the hull top and outboard side and draw around its position on the hull side and top (you can use a square to mark its position across the bottom of the hull top). Drill 1" pilot holes 1/4" out through the side panel and up through the top, placing the holes between the bulkhead position line and 1" apart. Then glue the side edge of the bulkhead and side panel and drill and drive screws in through the side and down through the top at the pilot holes and attach with 1" screws on the side and 1 1/2" screws at the top. (You can use this same mark, drill, then redrill from the outside method to attach any part that has to be mounted "blind" this way.) Attach the other bulkheads and transoms this way, remembering NOT TO GLUE the tops to the hull panels.

Next, mark and cut a pair of forward bulkheads, at bulkhead positions on the 1"x 10" stock, as shown in Fig. #2. Note that the bottoms of the bulkheads are notched to allow water to drain within the hull.

STEP TWO: HULL ASSEMBLY

Fig. #5 shows the sizes of the plywood panel joiners. Cut a pair of each from 1"x 3" stock. To join the outboard panels, lay the forward and aft panels from one hull down on a flat surface, butted end to end in position with their finished sides up. Spread the parts apart a few inches, place an outboard panel joiner along under the forward end of the aft panel with the centerline of the 1"x 3" joiner lying along the forward edge of the panel, and the bottom end of the joiner 1/4" up from the bottom edge of the panel, and its sides parallel to the end of the panel. Mark and drill screw holes down through the panel and into the joiner, spacing the holes 2" apart along the end of the panel and 1/4" in from the end.

Glue and attach the joiner to the aft panel as positioned. Then repeat to attach the forward panel and the joiner, butted up against the aft panel and flush at the top edge. All plywood hull panels can be joined together in the same way, keeping the finished sides "out" in all cases. Handle the joined panels gently until attached to the hull tops and bottoms.

Mark screw placement marks on the finished surfaces of all panels, spacing marks 3" apart and 1/4" down from the top edges or 1/4" up from the bottom edges.

To complete Step "A" in Fig. #1, drill and drive screws to attach the starboard side of the hull top outboard edge to the inner, or unfinished, surface of the outboard hull side, flush at the top. However, DON'T USE GLUE at this point.

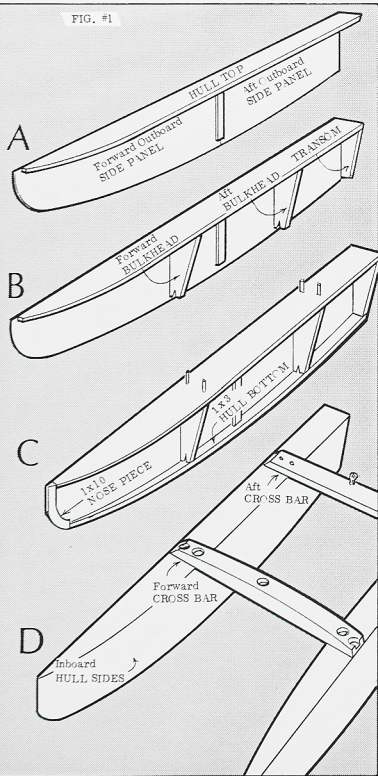
Next, use a square to measure and mark the positions of the 1/4" sides of the two bulkheads, as shown in Fig. #5, placing the square on the aft side of the forward bulkhead to avoid the top curve at the bow. Position the forward bulkhead in place, up against the hull top and outboard side and draw around its position on the hull side and top (you can use a square to mark its position across the bottom of the hull top). Drill 1" pilot holes 1/4" out through the side panel and up through the top, placing the holes between the bulkhead position line and 1" apart. Then glue the side edge of the bulkhead and side panel and drill and drive screws in through the side and down through the top at the pilot holes and attach with 1" screws on the side and 1 1/2" screws at the top. (You can use this same mark, drill, then redrill from the outside method to attach any part that has to be mounted "blind" this way.) Attach the other bulkheads and transoms this way, remembering NOT TO GLUE the tops to the hull panels. This completes Step "B" in Fig. #1.

Next, place the hulls on their tops and attach the straight sides of the hull bottoms to the insides of the hull sides and to the bottoms of the bulkheads and



Stevenson Projects

FIG. #1



transoms, using plenty of glue. Drive 1/4" screws into the bulkhead bottoms on each side of the notch cutouts.

With the hull on its outboard side, place a 1" x 10" under the bow so the curve can be traced onto it, then mark the rear side of this low nose piece so it humps back against the front edges of the hull top and bottom, as shown in Fig. #2, bottom left. The rear curve of the nose piece can be free handed, maintaining at least a 3" width of the part. Attach this nose piece to the inside of the outboard hull side with glue and screws placed 2" apart.

Mark and drive 1/2" holes down through the hull tops to they'll be tangent against the rear side of both bulkheads, and 2" in from the curved inboard edge, and 1" in from the straight outboard edge, as shown in Fig. #2, Fig. #3, and Fig. #5. Next, bend 24" x 1/2" galvanized threaded rod as shown in Fig. #2, bottom right. Slip the rod through the holes, as shown, then drill at the bottom bend to attach a 1/2" U-bolt (tap the U-bolt onto the wood with a hammer to mark its hole placement). Mount a U-bolt near the top of the bulkhead (about 1/2" down from the top piece) to secure the tops of the rods and tighten all nuts on the U-bolts firmly. Slip a pipe down over the rod ends to adjust so all ends are perpendicular to the hull tops. This completes Step "C" in Fig. #1.

The angled edges of the hull tops and bottoms are an average of the actual angles along the inside of the hull from stem to stern. The next step is to use a belt sander and/or Surform wood shaper to plane off the exposed edges of the hull framing so the inboard panels will lie down evenly against them to make a good, watertight joint with all parts, especially at the nosepiece, hull bottom, and transom. Lay a straight edge across the frame pieces to get an accurate idea of how the edges should be shaved off to allow a good, even joint with the side panel. The nose piece should be shaped down to about 1/2" thick at the bow, fairing back into the bottom piece. You may have to back off the nose piece mounting screws to do this, redriving them after the inboard panel is mounted.

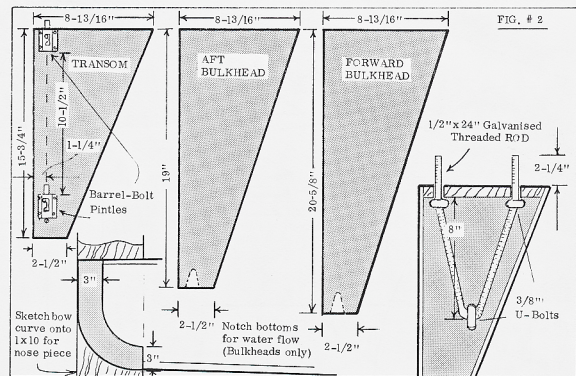
Mount the barrel bolt rudder "pintles" to the aft side of the transom in the position shown in Fig. #2. Use 1" screws instead of the screws provided on the top pintles and 1/2" x 1 1/2" bolts to mount the bottom pintles. Raise the bottom bolts (only) to the "up" position, then drive in a screw just below the bolt so the screw head is 1/4" out from the transom, so the bolt cannot return to the "down" position.

When you're satisfied that the inboard edges of the framing have been faired off, attach the inboard panels to the edges using plenty of glue on all surfaces EXCEPT those touching the hull top. Attach the side panel flush at the top and at the rear of the transom, driving in positioning screws at the corners, then working fast to attach the entire inboard side to the bottom, the transom, the bow, up the bulkheads (marking their positions on the hull top and bottom), across the top of the nose. Place the hull down on a flat surface when attaching the inboard side, you can align the bow from parallel to the outboard side at the transom, when driving the first placement screws. Allow the hull to cure overnight, then remove the screws holding the hull top and pry out the hull top to remove.

We used galvanized iron straps for anchor points (chain plates) to the most rigging. (See detail in Fig. #8, top right). The straps we used came 1/4" x 1" x 1/2" and were pre-drilled. We mounted the straps to the outside of the hull, centered on the centerline of the 1" x 3" panel joint on the inside of the hull, with the top of the strap set 1" above the hull top. We drilled through the bottom five holes in the strap and through the hull side and panel joint, then mounted the strap with 1/2" x 1 1/2" plate bolts.

We used a cartridge gun to apply immovable seam seals to all joints, cracks and knot holes inside the hulls, pushing the sealant down into the seams by running a finger along the bead after it has been laid down. When this was cured according to the directions on the label, we painted the hull insides with two coats of Thompson's Water Seal (or you could use oil base enamel). If you want positive flotation (for over 750 pounds) more than the natural buoyancy of the wood hulls, crossbars and mast, you can fill the compartments of the hulls with Expanded Polystyrene foam chips available at packing and shipping supply companies. Ask for "EPS Stacks" or "Peanuts" foam cushioning.

FIG. #2



When the seam sealer was dry, we replaced the hull tops (after gluing joining surfaces) and re-drove all set screws holding the tops in place. Then the hatch cutouts were lifted and cut by plugging-cutting the side cuts with the circular saw, then cutting out the rounded corners with a salt saw.

We cut 2" x 2 1/2" to fit up under the hatch cutout with their centerlines lying along the four straight side cuts to form stops that the hatch covers could rest down on, as shown in Fig. #6. A 2" round disc was cut from a scrap of 1/2" plywood and then trimmed to form a flat disc. The disc was then mounted to the hull top so the flat side would allow the hatch cover to be removed when the disc was turned.

We drove a screw part way into the centerpoint of the rear end of the hatch cover, facing aft. Then we cut out the head of the screw and drilled a 1/2" hole into the centerpoint of the rear side of the hatch so that the hatch could be held in place by inserting cut screw into the hole, slipping the cover down in place on the stops and twisting the disc so it covers the forward end of the cover. We drilled a 1" finish hole near the front ends of the cover and sealed these with plywood screws nailed to the bottom to keep water out. Adhesive-backed sponge rubber door caulking was laid down on top of the stops to make the water seal complete (you're going to get a lot of spray on the forward hull when you're really moving).

STEP THREE: BRIDGEDECK ASSEMBLY

The first step to making the bridge deck (crossbars and transom) is to mark two lines across the bottom (best finished) side of the two clear fir 2" x 6's, 72" apart, using a square. Set the blade bit at 15° and cut across the board head angle in at the top when the finished side is up.

Prep one hull up and set one crossbar on its top with its rear edge against the aft threaded rod "mounting bolt," and with its end flush with the outboard side of the hull top. Use a square to mark lines across the 2" x 6's at the centerpoints of the bolt ends, then mark hole positions at the center of the board so you'll end up with bolt holes through the center of the crossbar exactly the right distance from the crossbar end.

Slip the holes of the crossbar down over the bolt ends and secure with washers and nuts. Then repeat all set screws holding the tops in place. Next, do the same to drill and mount the forward crossbar to the forward ends.

Next, lift and cut out the 1/4" plywood forward crossbar front and rear pieces, as shown in Fig. #6. Attach the unfinished sides of the crossbar to the front and rear edges of the crossbar, flush at the bottom and both ends, using glue and spacing screws 5" apart. (Once we've made a "channel" with the 2" x 6's on the bottom, sandwiched in between the 1/4" plywood front and rear pieces, we can attach the rear fir 1" x 6" that follows the bend of the top edge of the plywood pieces. We inserted one end of the 1" x 6" between the plywood, aligning it flush at one end and at the top of the plywood for about one foot or so from the end. The 1" x 6" was mounted with screws and glue, as shown in Fig. #6, top right. Then we pushed adjoining boards down in more screws, pushing down farther as more screws were driven until the 1" x 6" was mounted to the other end, arched over the top, flush with the top of the plywood pieces.)

We went through the bottoms of the center of the mounting holes of the crossbar with a 1/4" bit, coming out through the 1" x 6" above all four holes. Then we used a 2 1/2" diameter hole saw attachment for the power drill to cut large holes down through the 1" x 6" directly over the mounting holes, giving access for bolting the crossbar down. Next we cut out the ends of the outboard holes parallel to the front and back of the bar to remove the thin end of the 1" x 6" between the end and the hole, (as shown in Fig. #6). We trimmed off the ends of the 1" x 6" and flush with the ends of the 2" x 6" and rounded down the top edge corner of the 1" x 6" and plywood. While we were at it, we drilled a 1/4" hole down through the centerpoint of the top 1" x 6" for a mast hole, then drilled with the 1/2" hole saw attachment.

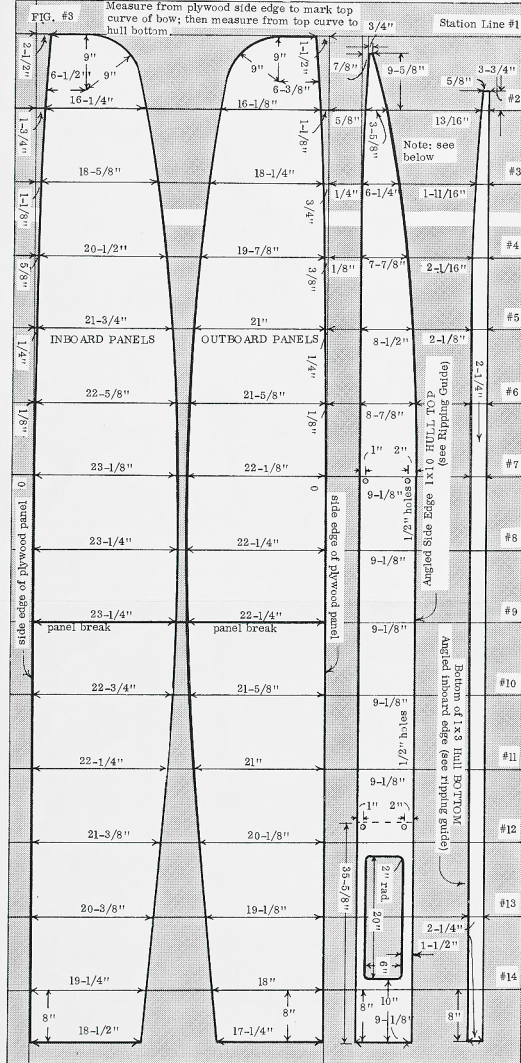
We made the transom from plastic tarpaulin material, doubled over three times, gronommeted and laced to the hulls. The mainmast, jib and both halves of the transom are all cut from the same material. Before cutting the tarpauline sheets, to make sure you will be able to use the right parts of the tarp later for the sails.

The kind of tarps we're using come in orange or blue and are widely used for covering machinery and lumber. They're usually found at wet surplus and camping supply stores, as well as some lumberyards. The tarp material is a reinforced plastic with woven plastic coated with another layer on each side. A 16" x 20" piece ran under \$30, and had seams every 33" with grommets set into a seamed edge doubling over a rope. The material has proved to be extremely rugged, tear-resistant, and it stands up well to exposure to sun. No mil thickness was given on the package because of the variance due to the weave.

If you want to complete the transom right now, we should skip up to the sail layout and note that the sail was cut from the tarp so the front edge or half of the sail makes use of the hem that runs at right angles to the seams of the material, and also uses the reinforced corner grommet for the top point of the sail. The jib makes use of another grommet for its bottom, rear corner (or clew) using two adjoining hemmed edges for its bottom and rear edges (or foot and leech). If you have these out in place first, you can have a lot left over for the transom halves, which run lengthwise parallel to the seams.

We cut two 6' x 6' pieces, running a seamed edge along a lower edge of both pieces. Then we folded it back over again, as shown in Fig. #6, at left, ending up with a 20" x 20" or triple-thick piece, 6' x 10', with a seamed edge along the bottom of one side. The grommets were punched and attached firmly to the folded material as shown. Then both grommeted halves were laid out side by side with 5" between them and with the adjoining grommet laced up fore and aft. A 46" x 1" x 2" was slipped under both ends of both halves and the mast was stapled to the wide side of the 1" x 2". Then the tarpauline assembly was flipped over, the front 1" x 2" was rolled back under the material one corner, and then mounted to the underside of the forward crossbar (centered) by drilling and driving 1/2" screws up through the 1" x 2" and into the crossbar, spacing the screws 6" apart.

With the crossbars mounted on the hulls, we pulled the free end of the tarpauline back under the rear crossbar, rolled the 1" x 2" under one revolution, then drilled and drove 1/2" screws up through the 1" x 2" and into the rear crossbar with the tarpauline material pulled as tightly as possible (again, spacing screws 6" apart).



To pull the trampoline tight across the boat, we drilled 1/4" holes through the inboard side panels and into the side edges of the hull top pieces, spacing the holes across from the adjacent trampoline grommets. Then 1/4" x 3" screw-eyes were twisted into the holes. We laced the center grommets together with 1/2" nylon line permanently, as shown in Fig. #6 at the bottom. Then the side grommets can be laced to the screw eyes as shown, and pulled tight before sailing.

STEP FOUR: BUILDING THE MAST

The mast is made from 6" wide strips of plywood, sandwicheing in 2" x 2" and 1" x 2" to form a symmetrical air foil-type cross section for a leading edge to the sail. The mast pivots automatically to cut into the wind and is fully stayed for rigidity (and all parts can be bought at the lumberyard).

The first step is to cut five 6" wide strips of 1/4" ACX plywood (try to use a good panel with no large gaps on the back side). Next a straight-grained clear fir (or spruce) 2" x 2" and 1" x 2" were trimmed to 18". Fig. #7 shows the mast frame layout from the side at the top of the drawing. The plywood strips are bolted together end to end and a third length, cut to 24", is bolted against these to form the mast bottom.

Four tapering strip joiners were cut from scrap 2" x 4" (as shown at top left of Fig. #7). These joiners were cut with a slight S-curve as shown to fit between the 2" x 2" and 1" x 2" providing a solid backing behind the butt joints of the plywood strips (these strips will assume a slight S-bend after all screws are driven in).

To complete Step "A" as shown, we glued and screwed the panels (spacing screws 6" apart so they

Note:

When inboard panel is bent into position, front edge will be a little aft of the outboard panel front on the noseline. Rounding off bow will fair both panels off.

sink into the centers of the 2" x 2" and 1" x 2" so that one edge of the 2" x 2" extends out beyond the edge of the strip 1/4". The flat side of the 1" x 2" was mounted to the same (unfinished) side of the strips with the narrow edge of the 1" x 2" parallel to the other edge of the strip and 1/4" in from the edge.

Next, two strip joiners were mounted in place with their centers 2" and 10" from the mast bottom end, as shown. Three screws were driven through the 1/4" plywood strips, rear end butt joints and into the strip joiners to help pull the strips down into the gentle S-curve they will assume. A 1/2" hole was drilled in through the center of the front (exposed) edge of the 2" x 2" 63" down from the mast top and a plaid or galvanized 1/2" x 2" eyebolt was bolted in place securely with wide washers and lock nuts on both sides (see Fig. #7, lower right).

Then the opposite side plywood strips were screwed into place, attaching them first to the 2" x 2" then the 1" x 2" with the same positioning as the plywood on the first side. A strip joiner was glued and drilled down into the top end of the mast and then screwed in place. The remaining strip joiner was slipped through in bottom with a 1/2" hole, 16" back from its front (1 1/2" wide edge as shown in "C"). A 1/2" x 6" roundhead bolt (threaded all the way) was bolted through the bolt to extend down 2 1/2" below the mast bottom to form a pivot pin for the mast) as in Fig. #7, lower left.

The halyard line which raises the sail is run inside the leading edge of the mast, so the next step was to mount the halyard pulleys to the mast head. We cut open the ends of two single pulleys (as shown in Fig. #7, top center), to allow the line to turn through pulley 90° instead of 180°. Then the pulleys were mounted on the top edge of the mast, back enough so that the halyard line can come up from the rear of the 2" x 2", through the two pulleys, as shown, and back down the mast, about 4" beyond the rear edge of the plywood strips. We mounted the pulleys by drilling the top joiner block through the pulley mounting eyes with a 1/4" drill, then driving down 4" x 1/4" lag screws with wide washers to clamp the pulleys firmly down into the grain of the mast member.

To cover the front of the mast, we cut a 9" length of 1 1/2" Inside Diameter schedule 40 plastic pipe down the center (use a Skilaw with rip guide, table saw or band saw), so that each half of the pipe could fit down over the 2" x 2" where it extends out beyond the plywood 4". With a hole saw attachment we drilled 1 1/4" holes through the pipe halves 63" down from the top and 36" up from the bottom to clear the eye bolt near the top and provide a nutlet for the free end of the halyard rope near the bottom. (If the hole doesn't quite clear your eyebolt, you can slice through one side of the pipe at the eye-bolt hole and slip it through the base of the eyebolt).

We drilled pilot holes to anchor the pipe halves to the 2" x 2" (spacing the holes 12" intervals), laced the halyard line down on the 2" x 2" forward side (facing up this step) and screwed the pipe halves to the 2" x 2", making sure the halyard was free to move.

To hold the bolt rope hem of the sail is a plastic made from 1/2" inside diameter schedule 40 plastic pipe. We cut a length to 18" then with the rip guide on the Skilaw (and blade depth set for about 3/8") we sliced a cut along only one side of the pipe (a table saw would work even better, but try to use a blade that will cut a narrow kerf).

By setting the mast on its front edge and running the rip guide of the Skilaw (circular electric hand-saw) along the outside surface of the plywood edge on the far side of you, you can adjust the cut to trim away the inside surface of the plywood close to you, if needed, to allow the 1/2" inside diameter pipe to be slipped in the slot in between the plywood at the rear and to be pushed up against the rear of the 1" x 2".

We anchored the 1/2" pipe "hail track" in the slot by laying two beads of waterproof adhesive caulking down in the corners of the slot, then pushing the pipe firmly down into the slot and smoothing the squished-out caulking into the joint between the pipe and the plywood on both sides (making sure the slit in the pipe faces directly toward the rear, or away from the thinner edge of the mast, as in "D", Fig. #7). To cover the top of the mast we cut a rounded shape (Fig. #7, top right) from light aluminum flashing sheet, bent it over the top and screwed it to both sides of the mast with roundhead screws. A galvanized cleat was screwed to the side of the mast about 3" below the exit hole for the halyard to provide a tie-off place for the halyard.

To stiffen the mast against side bends, we attached spreader bars to form a "diamond" truss of mast stays. We used 1/2" plastic covered steel cables throughout the standing rigging of the cat. To anchor all cable ends we wrapped the cable through the anchoring hook in question, slipped a cable thimble through the anchoring hook, wrapped the cable tightly around the thimble and clamped the cable back on itself with a 1/2" cable clamp. When finally setting the rigging up for sailing (after tuning), grasp the cable clamp with a pair of channel lock pliers and use a wrench to tighten the nut on the clamp as tightly as possible (and check lightness after the first sail).

If you're sailing in extra heavy winds in your area, you may want to go to 3/4" cable, trimming away the plastic coating at the cable clamps. We snugged our clamps tight down onto the plastic coverable and have had no problems with slipping. However, it's a good idea to put your rigging under tension by pulling hard out to all sides with the halyard and then checking all cable clamps to see if the plastic coating is creeping under the clamps.

To mount the spreader tubes, we drilled a 1/4" hole

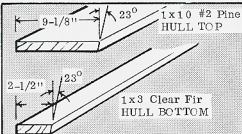
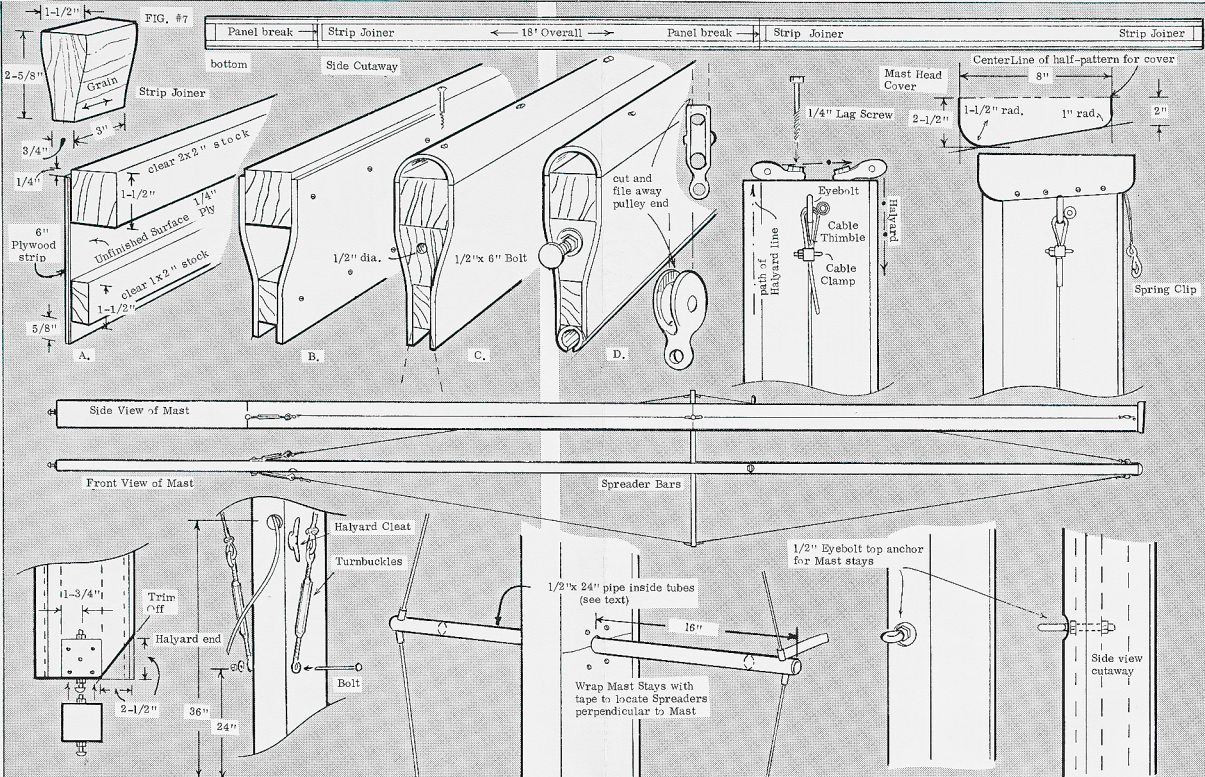


FIG. #4 RIPPING GUIDE



overlapping). A 6/32" aluminum strap was mounted to each side of the mast (as shown in Fig. #10, at center). The straps are mounted with 2 1/2" x 1/4" roundhead bolts, 4" apart, with the aft end of the straps 1 1/4" aft of the rear of the mast plywood straps. The straps were bent parallel at the aft end and 1/2" holes were drilled through the straps 1/2" from this end. We trimmed off all bolt ends and rounded off all sharp corners with a file.

To join the boom to the mast we drilled a 1/4" bolt down through the hole in the top boom strap, through the vertical holes in the 1/2" pipe, and through the hole in the bottom boom strap. A 4" x 1/4" eyebolt was inserted through the hole in one of the mast straps, through the horizontal hole in the 1/2" pipe, and through the hole in the top boom strap. The vertical bolt was secured with a nut and lockwash, while the eyebolt was fastened with a wing-nut for easy detaching.

The boom is controlled by a 25 x 1/4", braided nylon line (the "mainline") running through the double pulley block mounted to the centerpoint of the rear crossbar with a 1/4" eyebolt (twist open the eyebolt in a vise, slip on the block and close it in a vise). A second double pulley was mounted to another 1/4" eyebolt and inserted up through the hole in the boom, as shown. A knot was tied at the end of the line, then the other end was inserted back through the lower block, up through the upper block, and so on, coming out forward through the upper block to your hand.

The line coming from the jib ("jib sheet") passes back through a 3" x 3/4" "crowfoot" twisted down into 1/4" holes drilled down into the top of the front crossbar 13" out from the center on each side. From there it passes back through a home-made quick-release cleat made from 1/2" inside diameter plastic (left over from the mast). We cut 4" lengths of pipe, trimmed off one end at an angle (as shown), cut 1 1/2" x 1/4" wide wedge cut out of the top of the pipe, and drilled and countersunk screw holes through the remaining pipe at the ends. These "jam cleats" were mounted directly behind the screws on the rear crossbar, with the wedge cut out and the rear of the cleats pointing toward the center of the rear crossbar. The ends of the jib sheet pass back through these jam cleats and a knot is tied in the ends.

When sailing, the jib pull back on the leeward jib sheet until the jib stops fluttering (or "luffing"), then by pulling on the line and letting out slightly the sheet will jam in the wedge, locking in your adjustment until you pull the sheet again and release it.

STEP SEVEN: SAIL MAKING.
As we said in the trampoline building instructions, the front edge of the sail (the "luff") is formed by one xamed edge of the tarp. We used the reinforced corner grommet of the tarp to form the top corner of the sail. The seamed edge with the cord sewn in is inserted into the 1/2" plastic pipe at the rear of the mast, and slid up the slot in the pipe until the rope seam is caught inside the pipe and the sail material extends back through the slot. The sail shape is improved by the use of six full-length battens made of 3/4" x 1" pine strips, available pre-milled at most lumber yards. To bond the battens to the tarp, we used grey, fabric-backed duct tape on both sides of the sail material so that the adhesive on the two layers of tape can reach through holes cut through the tarp material with a 1/2" hole punched, spaced every 4". After cutting the mainsail shape, we laid out the six battens as shown with the forward ends of the battens about 1/4" back for just enough to any grommets on the leading edge (so that even though the tape is wrapped around the front edge of the tarp for strength, the total thickness of the sail is not too wide to slide up the slot for the sail).

The hole punch is simply a 3" length of 1/4" tube with a sharpened lip on one end so it can be tapped with a hammer, cutting through the material. After the holes were cut (as in Step #8, Fig. #10), the top of the batten was taped with two overlapping strips of tape to cover the batten and the adjacent hole. Then, the sail was carefully flipped over so that the two overlapping strips of tape were laid out on the opposite side of the sail to cover the holes (being careful not to get the adhesive on the holes dirty in the process). Next, we hammered the tape flat so that the tape layers grafted onto each other in a manner that the adhesive is pressure-sensitive and is extra strong (repaired). A small length of tape is affixed around the aft end of the batten, as shown in Step #2. The rear of the battens were attached in the same manner. At the bottom batten only one

row of holes is punched along the edge of the batten, with the overlapped layers of tape wrapped around the bottom of the batten and extending up the opposite side of the sail to "grab" through the holes from the other side.

Finally, we doubled over the tape at the bottom of the battens around the ends to about 6" in length, and then drilled 1/4" holes in through the tape, the sail, and the batten, about 1 1/2" in from the ends of the battens. The hole in the batten was 1/2" in diameter and was tied to the aft corner of the sail which was then fed down through the hole at the aft end of the batten (after raising the sail, and tied off to a small cleat mounted to the bottom of the boom, about 8" forward of the hole). A small spring clip was tied to the hole at the forward end of the bottom of the sail as shown in Fig. #10, center right, which is clipped to the eyebolt in the gooseneck when raising the sail.

To be able to feed the sail into the sail track at the back of the mast, we used a 1/2" drill bit to drill two holes into the back of the 1/2" pipe on the mast, one 16" from the bottom and the other 24" up. Then we used the Skilaw to plunge cut two slots 1/2" apart, parallel to the mast track and connecting the two holes so the track is 1/2" wide, as shown in Fig. #10, top right.

We kept the two corners of this cutout the 1/2" wide, so the sail tapers down to the narrow slot smoothly, to keep the sail from hanging up. To raise and lower the halyard it is hooked to the top corner grommet and the hemmed forward edge of the sail is fed up into the track. The top grommet may be a little thick where the rope reinforces the sail top, so a thin spot may be carefully cut into the top edge of the sail on both sides, just behind the hemmed rope. The sail may be hard to pull up at first because of thick spots at the top or at the battens. We fed the sail into the track with the mast down flat so the sail could be pulled easily by hand along the track several times to loosen up the passage in the track. If the track is a little too wide, you may be able to pull the sail out of it. However, the pressure of the wind will put a uniform pull on the sail and we'll find if the track will hold the sail well in actual sailing even if you can pull it out from behind with your hand.

To make the jib which adds a great deal to speed performance, we first cut one corner of the tarpaulin material (as shown in Fig. #10, left of the mast). The rear and bottom edges are formed by the hemmed edge of the tarp. The corner grommet is used to tie on the jib sheet. The forward edge of the sail is doubled over pocket 3" wide; so we measured the length of the sail foot and rear, then marked a light line connecting the front and top ends of these doubled material was trimmed where it extends out beyond the triangle at top and bottom. The edge of this pocket was attached to the mast by punching 1/4" holes through both layers (when the pocket is pulled flat, Step #13 at upper left).

Next, we cut a strip of 2" wide fabric-backed duct tape was laid down over the seam and the holes. Then the sail was carefully flipped over and a second strip of tape was laid down along the same path on the opposite side (Step #13) and then hammered to retire the bottom through the holes. The fore-stay can be laid down on the pocket before taping, or it can be threaded through afterward.

We fastened a grommet screw at the lower front corner of the jib (check similar detail in Fig. #10) leaving the lower front corner of the mainsail. Another grommet is placed at the top corner of the jib. A snap hook is tied to this grommet (as in the detail in Fig. #10). We are attaching the jib to a sail, the snap at the top of the jib is attached to the "quick-link" at the top of the forestay before the line is raised. The bottom of the jib is attached by clipping the snap on the "quick-link" on the cross stay through the grommet at the bottom front of the

The first step is cut four opposing pairs of rubber box sides from 1/4" ply (1/8" one one and use for a pattern for the rest). Cut two rudders, as shown in Fig. #9 at left, from clear fir 1 1/2" x 10" stock. The sides of the boxes are held apart by 3/4" x 1/4" strips of scrap strip. Rip and cut 1/4" wide strips, as shown in Fig. #9, lower left, as shown in Fig. #9, lower left. Strips. Mount the 3/4" strips to the inside surfaces of two of the box sides, as shown, so the inside of the bottom or foot of the box will be 1/4" apart (using one glue). Attach the second side to each box with screws and glue, then attach the 1/4" wide cap strips ("C") in Fig. #9 to the inside of the boxes with 1 1/4" screws and glue the short strip "D" can be trimmed off to match the curve of the draw after mounting in place. Drill 1/4" pivot holes through the boxes and the rudders as marked. Draw a line down the center of the side and bottom edges of both rudders, then shave off the leading and trailing edges with a Surform wood shaper, as shown in Fig. #9, lower right. Don't taper the rudder edges that sit inside the rubber boxes. However, taper the edges that move through the water not only cuts drag a good deal, but also adds to the control power of the rudders.

Car 3/4" aluminum tubing (the "tiller") shows, cutting two tillers and one tiller bar. Bend as shown by placing in a vise or between two solid pieces of wood and making lots of small bends along the tubing to form a gentle curve. Note that the tillers not only have to overlap the top of the rudders, they also bend inward toward the front on both sides to produce a little "Ackerman steering," where the tiller bar turns more tightly than the rudder on the outside.

To mount the rudder boxes onto the points on the transom, we cut a "recess" out of the bar and bolt lock rudder pivots to the front side of the 1 1/2" wide cap strip attached earlier, centered in the slot and about 1/4" from the front edge of the rudder box at the bottom of Fig. #9, with the top of the upper pivot "gudgeon," 2 1/2" down from the corner of the cap strip and 1/4" from the front edge of the top of the lower gudgeon 10 1/2" below the joint.

At the right in Fig. #9 the sketch shows how the front, outboard corner of the cap strip is chiseled away, to allow full swing of the rudders and control of the upper rudder to the pin can be raised to remove the rudders.

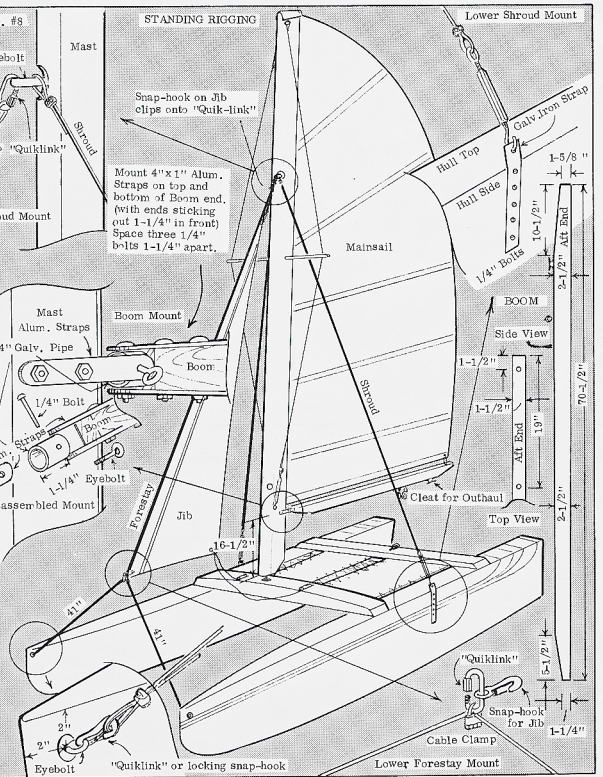
Next, open two 1/4" x 1/4" screw eyes in the vise, or with a wrench, then slip another screw eye onto each and release. Drill a 1/4" hole down into the top edges of the rudders at the angled notch, as shown, and twist one of each pair of screw eyes down into these holes. Cut a 3/6" length of 1/4" anchor into six 3/4" lengths. Insert one into each of the tillers and into each end of the tiller bar and draw them flush at the end by drilling in through the side of the tube and into the rudder box from the bottom.

Drill 1/4" holes into the corners of the dowels at the aft end of the tillers, then slip the rudders up into the boxes and push the holes through with a 1/4" x 1/4" pivot bolt through all pivot holes. The screw eyes in place so they pivot freely in the boxes. Then the sail was carefully flipped over and a second strip of tape was laid down along the same path on the opposite side (Step #13) and then hammered to retire the bottom through the holes. The fore-stay can be laid down on the pocket before taping, or it can be threaded through afterward.

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To control the jib we tied the middle of a 12' length of 7/8" braided nylon line to the bottom rear grommet of the jib. The ends of the line are fed back through the hooks and jam cleats on both sides of the mast, then a knot is tied in each end.

STEP EIGHT: RUDDERS
Each rudder sits loosely sandwiched in between the sides of plywood rudder boxes, so the rudder blades can be pivoted up for easy back launching by pulling down on the tillers.



4-Step Sail Pocket Construction

A. Fold pocket and cut holes through both layers

B. Align Holes

C. Run Duct tape over seam, covering holes

D. Run Duct Tape along other side of sail so adhesive of both tape layers touch through holes

3-Step Batten Attachment

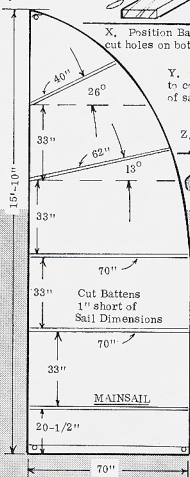
X. Position Batten and cut holes on both sides

Y. Overlap 2 layers of tape to cover Batten and both sides of sail

Z. Tape over ends

3" wide pocket

After taping pocket, attach grommet to top and bottom corners of Jib. Tie Spring Clip Snap Hook to top grommet.



MAINSAIL

Screw-Eye

Quick-Release Cleat

13"

1/2" Plastic Pipe

Forestay

148" Tip to Tip (after clamping)

If using 6 mil clear polyethylene sheet for sails, reinforce corners with tape on both sides (grabbing through holes as with pocket)

Tie Snap-Hook to Grommet in corner, -clip to Eyebolt on Boom

Widen Sail Track to allow feeding of sail into track

Eyebolt to attach Boom

MAST

Drill through bottom Batten and sail, -Tie on Cuthaul rope (attached to aft end of Boom) and Snap-Hook

Screw-Eyes