

Zephyr

Craft Print Project
No. 287

Speedy 14-ft. International Dinghy Class Sailer

By WILLIAM D. JACKSON
Naval Architect

ZEPHYR is a refinement of a type of boat developed by the English for use in the rough open waters of the English Channel. Not only is it fast under sail, but it can stand up under punishment. And it's light enough to be easily loaded atop an auto or light trailer.

The pre-fab method of construction used on Zephyr lends itself to mass production, but if you are going to build any quantity of these boats you'll want to make full-size templates of all parts. To do this, lay out the lines on $\frac{1}{4}$ -in. plywood and cut patterns from it.

Use spruce, hemlock or fir for framing; oak (or hard-grained Douglas fir) for keel and chines. Fiber-glass tape applied at the chines will render the hull permanently water-tight but you can fiberglass the entire bottom if you wish.

Construction. First, secure materials (see Materials List, p. 102), then draw full-size patterns of the frames (Fig. 2) on heavy wrapping paper. Cut out and lay aside these patterns and draw the bottom shapes of frames directly upon the lumber to be used for them and cut. Then, using the paper patterns as cutting and assembly guides, construct frames.

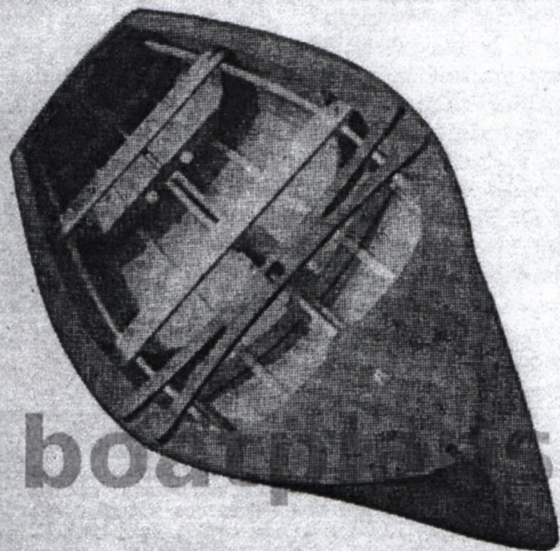
Cut the backing for the transom (#4 frame) from $\frac{3}{8}$ -in. plywood, coat all of its and #4 frame's contact surfaces with Weldwood or Elmer's glue and screw-fasten together with #6 x 1-in. fh screws. Gussets for frames #1, 2 and 3 are at-



Fast and rugged, the relationship between Zephyr's length and her displacement is such that she planes readily.

tached in the same way. Screw-fasten 1 x 2 cross-pieces temporarily to each frame to hold it in shape and for use later when attaching to building form.

Now cut coaming plates and #1 deck beam to shape shown in Fig. 5, together with $\frac{3}{4}$ x 2-in. deck center batten (which inserts at stem and #1 deck beam, see Fig. 6), and lay these parts aside and make up the bow stem (Figs. 6 and 7). Cut the stem from 2 x 8 spruce (or hemlock) and bevel, as indicated. To this piece attach the upper sheer plate (Fig. 7) with the aid of glue on contact surfaces and $\frac{3}{4}$ -in. knees. Screw-fasten with three #8 x 1 $\frac{3}{4}$ -in. fh screws. To the bottom of the stem attach the



STATEMENT OF USES

USES: Racing sailboat fulfilling requirements for the 14-ft. International Dinghy Class. Lightweight, strong, compact hull, maximum waterline length for competition or thrilling sailing speeds of over 15 mph. Will outsail boats twice her length and will keep going in rough waters.

CONSTRUCTION: Convex bottom with developed surfaces; adapted to plywood covering. Pre-fab method of construction makes possible the use of only three frames (similar craft have from seven to 30). Ideal for quantity production.

LENGTH: 14 ft. at waterline and over-all.

BEAM: 5 ft.

WEIGHT: 165 lbs.

DEPTH AMIDSHIPS: 21 in.

DEPTH AT BOW: 21 in.

DEPTH AT TRANSOM: 16 in.

SAIL AREA: 125 sq. ft.

SEATING CAPACITY: Racing—2 adults; cruising—3 adults.

Framework mounts at convenient working height on standard saw horses.

chine plate assembly (also with knees).

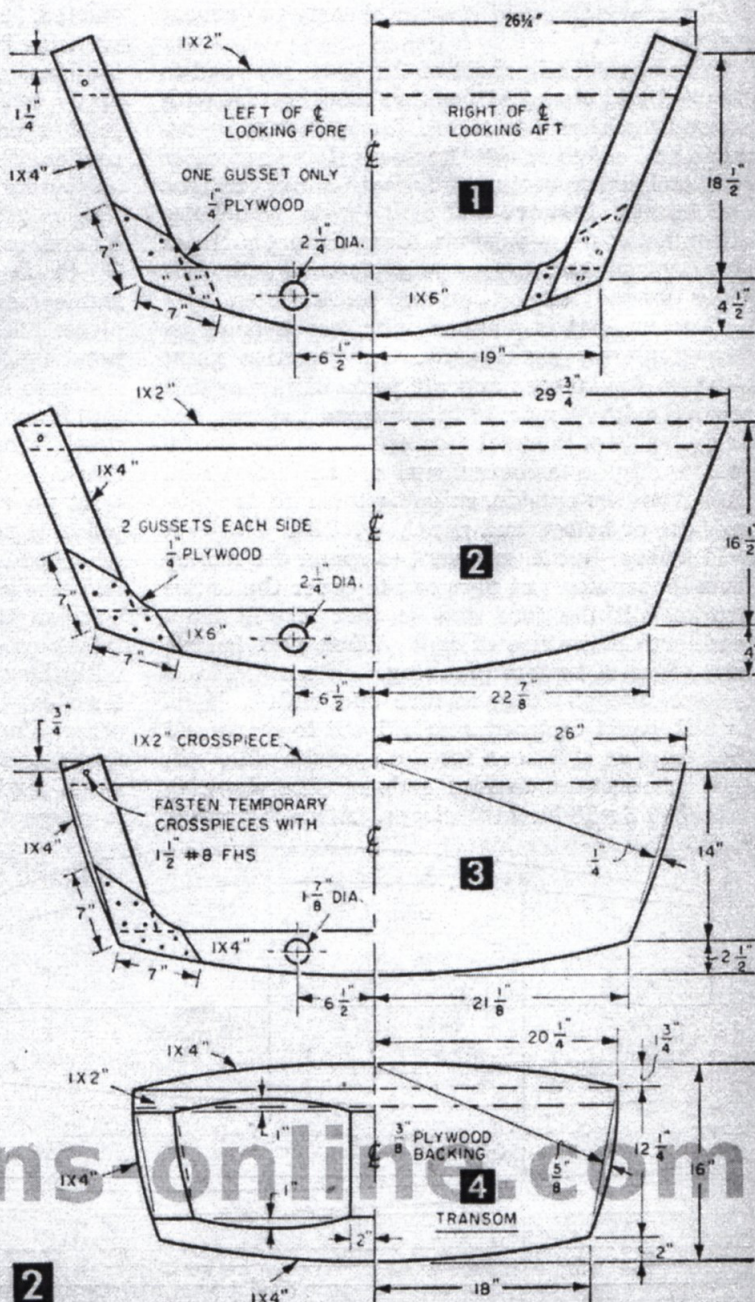
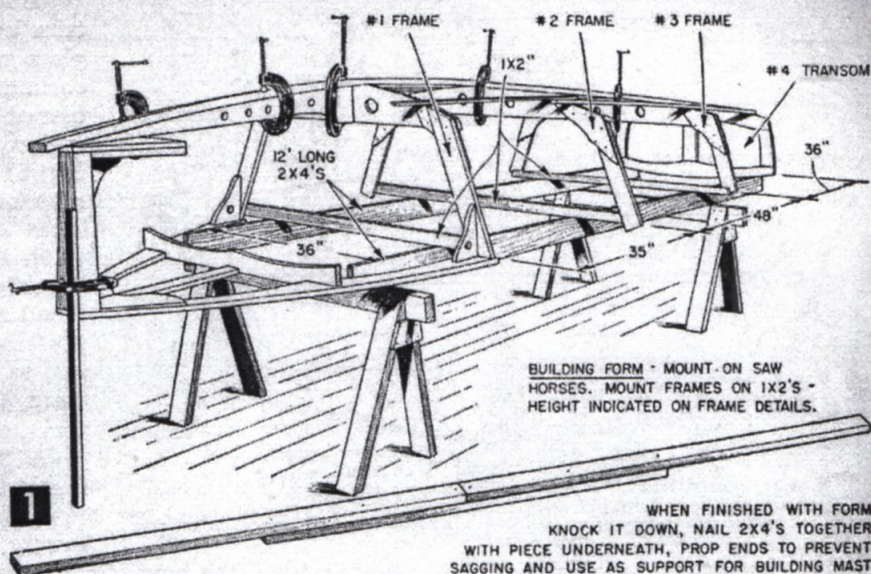
When bow stem assembly is dry, clamp coaming plates to top and position #1 frame to their after ends, cutting side tops of frame to fit flush with plates. Then provide a triangular knee (see Fig. 6), gluing and screw-fastening with #8 x 1 $\frac{3}{4}$ -in. fh screws, for reinforcement under the plates. Position and secure #1 deck batten and deck center batten and entire fore end of boat is completed. To hold stem to #1 frame, cut a 2 x 4 fillet strut as shown in Fig. 6, drilling 1-in. holes in it to reduce its weight, and fasten it to #1 frame and to chine plate with glue and #8 x 1 $\frac{3}{4}$ -in. fh screws.

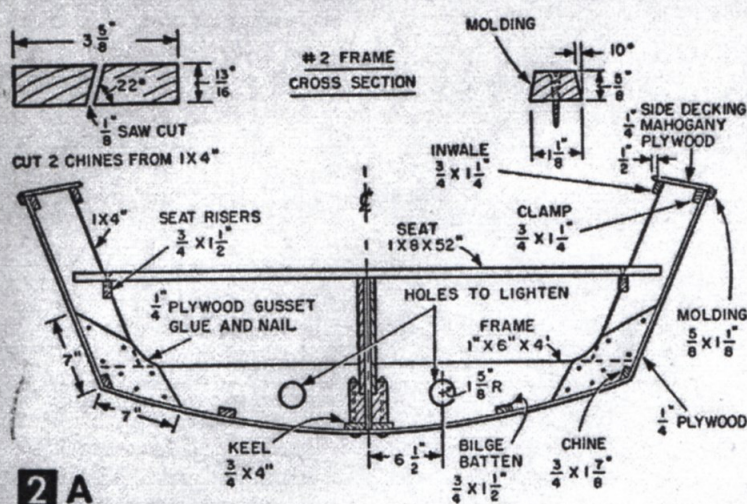
The building form for *Zephyr* consists of a 2 x 4 trestle nailed to saw horses (Fig. 1). Place frames #2, 3 and 4 and fore end of boat on trestle. Clamp light, long, 1 x 1 battens to frames to hold in alignment, readjusting clamp holds as you fine-align frames with straight edge and plumb bob, then nail them temporarily in place.

Cut two chines and the keel (Fig. 1) to size, saw off short piece of keel for pattern, use it to mark center of frames, and notch them. Fasten keel with glue and two #8 x 1 $\frac{3}{4}$ -in. fh screws at each frame. Forward section of keel fits flush with fore side of stem. Notch for and secure chines in same way.

Notch clamps flush into frames and coaming plates and glue and screw-fasten, then measure midway between keel and chines and notch for bilge battens, fastening these members with one #8 x 1 $\frac{3}{4}$ -in. fh screw at each joint. The bilge battens run only to fore side of #1 frame.

Now trim and fair entire framework with a sharp jack plane. Little trimming will be necessary but that which is should be done carefully to insure perfect contact between framing and plywood planking to be applied. When applying plywood, use *Weldwood*, *Cascamite* or *Elmer's* glue between all mating or adjacent surfaces and #8 x 1-in. fh screws. When placing screws near where center board slit will be cut (see Figs. 3, 4



**2 A**

and 6), keep them outside of slit area. Place with 2 1/2-in. separation and stagger slightly to prevent splitting.

Take one 4 x 8-ft. sheet of the 1/4-in. plywood to be used and clamp in position atop bottom with aft end flush with transom. Mark underside, remove and cut to shape. Reclamp shaped piece to hull and mark outlines of keel, chines, battens and frames. Remove and drill 1 1/4-in. lead holes at centers of these outlines. Coat contact surfaces of framework and underside of plywood with glue, place plywood in position and screw-fasten.

The fore end is planked with two triangular-shaped pieces (see Fig. 5). The junction point between fore pieces and aft piece of plywood is secured with 3/8 x 4 x 12-in. plywood battens, one on each side of the keel (see Fig. 6). Apply heavy coating of glue to contact surfaces and drive 1-in. nails from the outside, snipping them off to within 1/8-in. of batten and clinching. This joint will hold forever but if you want to spend the money for a longer sheet of plywood to cover the entire bottom, slit the fore end so that it will bend readily to curvature of hull. When glue is dry, trim edges of bottom planking.

Start side planking at fore end with a 1/4-in. 4 x 8-ft. panel clamped, marked, cut to shape and then used as a pattern for the opposite side. Aft ends are secured to fore ends of side planking with 3/8 x 3 x 18-in. butt straps. After fastening,

trim evenly along chines. If fiber-glass tape is to be applied, round corners slightly so that tape does not tear at chine edge.

Now shape the outer stem (see Fig. 6) from a 1 5/8-in. piece of white pine or hemlock, coat contact surfaces with glue and secure in place with three #10 x 2 1/2-in. screws. When glue is dry, sand smoothly to blend it into boat's contours and apply fiber-glass tape to chine edges and to jointed edges of plywood forward (if you are glassing the bottom), especially at the keel slit.

Use 3-in. fiber-glass tape. Start taping at transom and secure tape with 1/4-in. tacks every 3 ft., stretching tape snugly but not too tightly towards

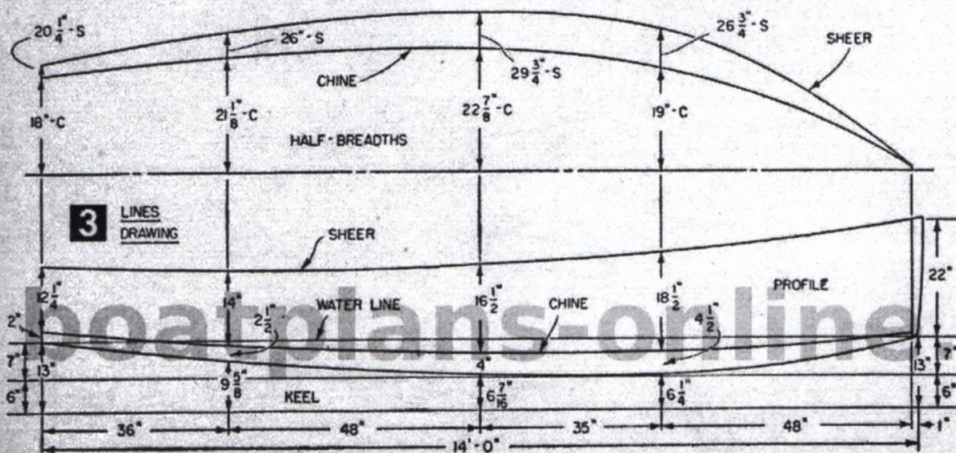
the bow. Go all around boat, ending where you started. Then apply a coat of polyester resin, working it well into tape and working out all air bubbles. Allow this first coat to harden, then apply two more coats. When last coat is hard, feather edge tape (at edges only) with a disc sander.

Now, turn hull right side up on form and position, notch into transom for coaming plates (Fig. 6) and screw-fasten carlins in place. Use #8 x 1 3/4-in. fh screws. Next, fit 1 x 4's between each frame (see Fig. 6) and glue and screw-fasten in place. Make and position seat risers (see Fig. 6), notching frames for them slightly as shown, and fasten to frames with #8 x 1 3/4-in. fh screws. The hull is now rigid enough to install the centerboard case (frame #2 must be cut into for this installation).

At your lumber dealer's, select a 2 x 4 x 12-ft. piece of spruce, hemlock or fir. If fir, it can be white or Douglas but it must be light in weight and free of large knots. Cut this piece into two 6-ft. lengths and plane these lengths to a 1 1/4-in. thickness. These are Zephyr's bed logs. Then, with the exact center of #2 frame marked (center-of-keel), mark 1 5/8-in. on each side of this center line and saw and chisel a notch into #2 frame (see Fig. 2A) to receive the bed logs. Position them along keel, mark to fit, remove, saw to shape (Fig. 4), return to position and fit exactly by planing

until wood-to-wood contact results. Then rabbet them to receive the 3/8-in. plywood center board casing sides (be sure to maintain a right- and left-hand log) and drill for bolt holes spaced at 8 in.

Now, make casing sides and shape 3/8-in. plywood top

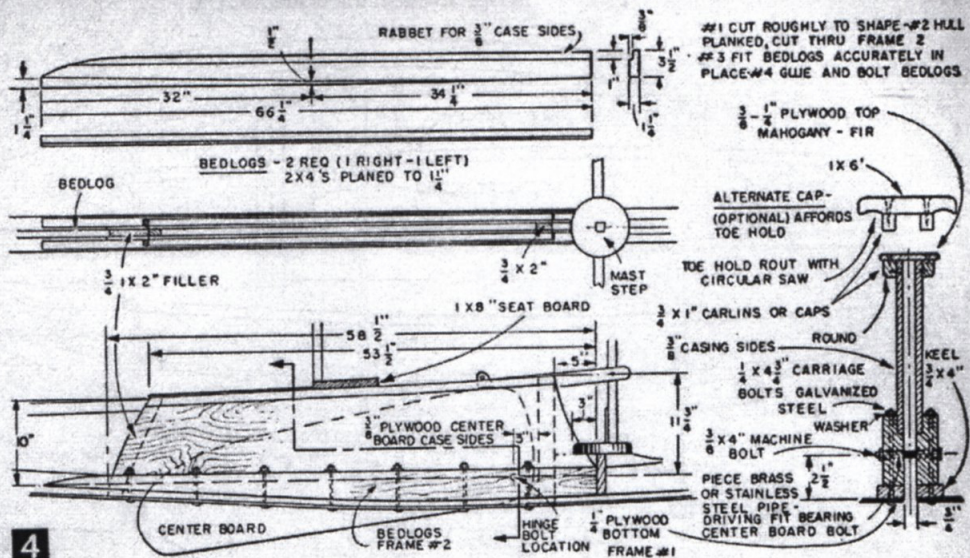


for sides (Fig. 4) and fasten sides to bed log rabbets with Kuhls "Avio" glue and thin cloth rags on contact surfaces and #8 x 1 1/4-in. fh screws spaced at 3 in., staggered, and placed to avoid bolt holes. Remove excess glue with turpentine-soaked rag. Joint sides together with through-bolted posts—all joints daubed with "Avio" glue—and position center board case in boat. Place a 1/4-in. steel rod about 8 in. long in bolt holes and tap to mark location for drilling. Remove case and drill keel for hold-down bolts.

Return case to position, mark fore and aft end limits of slot to be cut through keel, remove case and saw 3/4-in. wide slot in keel by first boring 3/4-in. holes at ends, then using keyhole saw, then hand saw. Now coat contact surfaces of keel with "Avio" glue, place strips of cloth over glued area and recoat. Then carefully place centerboard case assembly back in position and bolt in place, using washers top side. Remove excess glue with turp.

Now make and install struts (Fig. 6) gluing contact surfaces and nailing in place with 1 1/2-in. wire nails or screwfastening with #8 x 1 3/4-in. fh screws and make and install seats, fastening to seat risers with #8 x 1 3/4-in. fh screws. Next, cut plywood decking (1/4-in. mahogany or fir) to shape (see Fig. 6), glue underside and screwfasten with #6 x 1-in. fh screws spaced about 3 in. apart. Use 3/4-in. blocks to secure joints, gluing and either nailing or screwfastening. Finish by trimming outer and inner edges evenly, allowing about 1/2-in. overlap inside cockpit.

Make and fasten beveled sheer moldings (oak or mahogany), drilling and countersinking for #8 x 1 1/4-in. fh screws. Round ends of molding and return to seats, providing a seat bench (Fig. 6) glued to strut at #3 frame and nailed in posi-

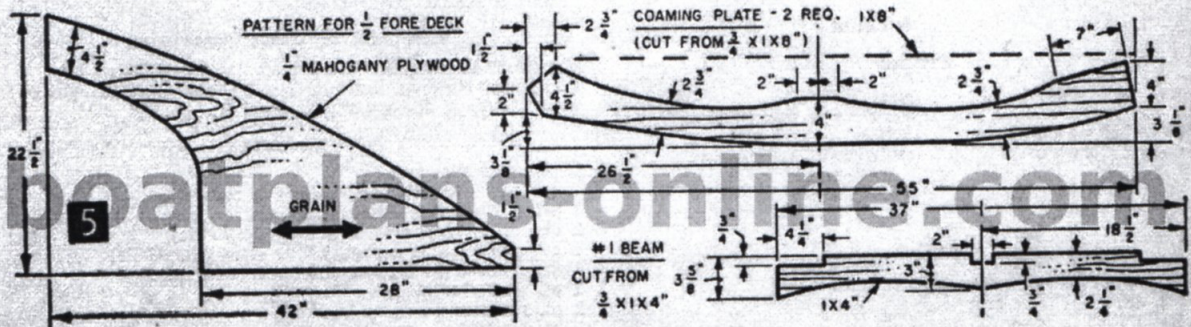


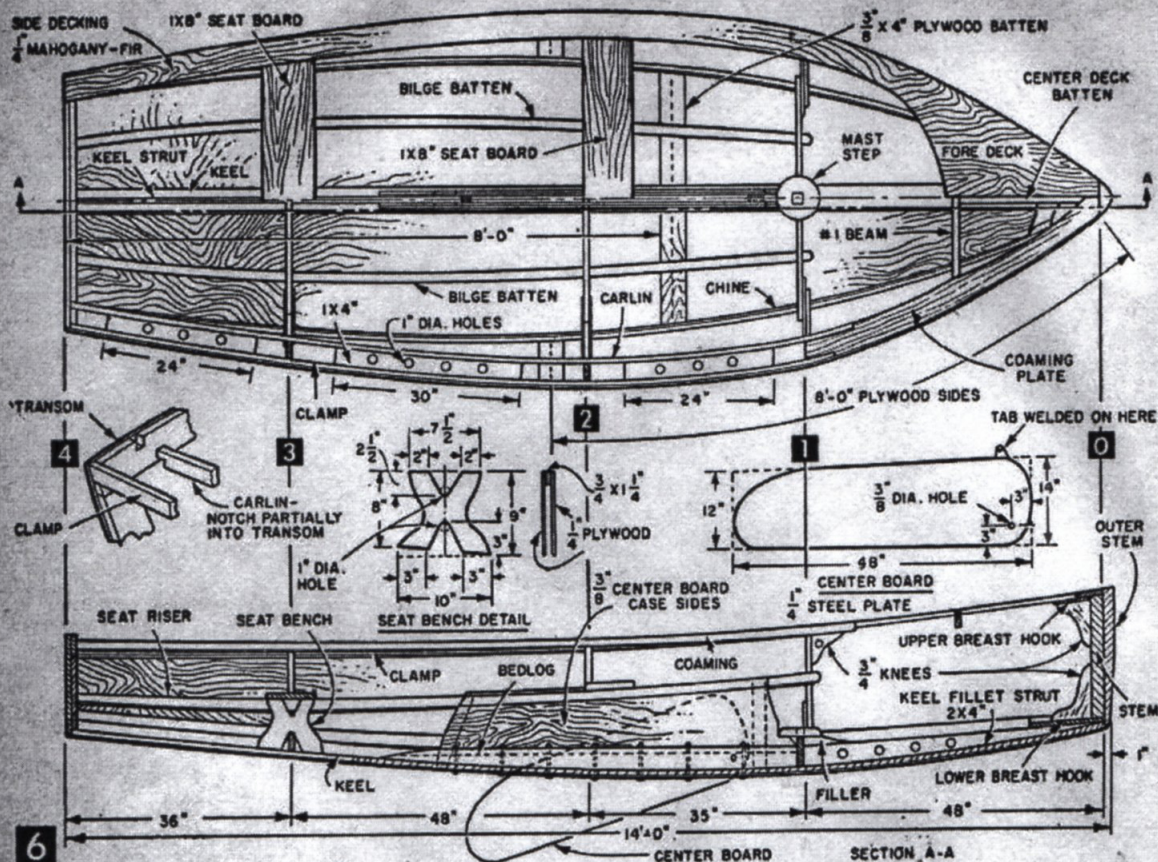
tion with 1 1/4-in. galv. shingle nails. Screwfasten after seat to this bench.

Flooring is 3/8-in. plywood positioned between frames and screwfastened to keel and bilge battens with #8 x 1-in. fh screws with a finishing washer inserted between head of screw and plywood. Fasten flooring after painting or varnishing bottom.

If mahogany has been used for decking, apply one coat of *Dolphinite* #9287 filler to surface, allow to set about 10 minutes and rub off across grain with burlap or coarsely woven cloth and allow to dry one day, following with additional finish of your choice. Coat entire hull inside and out except for the deck with one coat of Kuhls 3 Way Preservative followed, when dry, by one or two coats of *Dolphinite* #400 clear plywood sealer (this, to filled deck also). Then apply one or two coats of *Dolphinite* #958 white exterior undercoat to bottom and sides, tinting bottom white with final coat color. When this is thoroughly dry, apply two thin coats of either *Dolphinite* #9856 "Flaming Red" to bottom or Maurice L. Condon's red *Boatlife*. To sides, apply two coats of either white *Boatlife* or *Dolphinite* #9501 semi-gloss white.

If you paint the inside you can use two coats of *Dolphinite* #9595 gray interior hull and bilge paint. If you varnish it (and decking) use two coats of *Dolphinite* #1100 super marine spar varnish or two coats of clear *Boatlife*.





MATERIALS LIST—ZEPHYR

No. Req. Description

Use

Lumber

2 pcs.	3/4" x 1 1/2" x 14'	chines (1 x 4 makes two)
2 pcs.	3/4" x 1 1/2" x 10'	seat risers
2 pcs.	3/4" x 1 1/2" x 12'	clamps
2 pcs.	3/4" x 1 1/2" x 12'	carlins
2 pcs.	3/4" x 1 1/2" x 14'	moldings
1 pc.	3/4" x 4" x 14'	keel
2 pcs.	3/4" x 1 1/2" x 10'	bilge batts
1 pc.	1 x 4 x 40"	deck beam
1 pc.	2 x 8" x 4'	stem-inner-outer
1 pc.	2 x 4" x 12'	bed logs
1 pc.	2 x 8" x 8"	mast step
1 pc.	1 x 8" x 10'	coaming plates
2 pcs.	2 x 4" x 12'	building form—also makes platform to build mast
1 pc.	1 x 4" x 10'	transom frame
1 pc.	1 x 4" x 8'	#3 frame
1 pc.	1 x 6" x 6'	#2 frame
1 pc.	1 x 4" x 4'	#2 frame
1 pc.	1 x 6" x 4'	#2 frame
1 pc.	1 x 4" x 4'	#1 frame
1 pc.	1 x 8" x 10'	#1 frame
1 pc.	2 x 4" x 4'	fore strut

Plywood

2 pcs.	1/4" x 4 x 8'	sides
1 pc.	1/4" x 4 x 8'	waste makes gussets, knees
1 pc.	3/8" x 4 x 6'	bottom
1 pc.	1/4" x 4 x 8'	centerboard case, transom,
1 pc.	1/4" x 4 x 8'	mast bench
1 pc.	3/8" x 4 x 6'	decking, rudder
1 pc.	3/8" x 4 x 6'	flooring

Fastenings

- 6 1/2 doz. #7 x 1 1/2" fh screws, galv. or brass
 6 doz. #8 x 1 3/4" fh screws
 3 #10 x 2 1/2" fh screws

- 4 doz. #8 x 1 1/4" fh screws
 2 doz. #8 x 1" fh screws
 2 lbs. Weldwood or 2 qts. Elmer's glue
 1 qt. Kuhls "Avio" glue

Fittings*

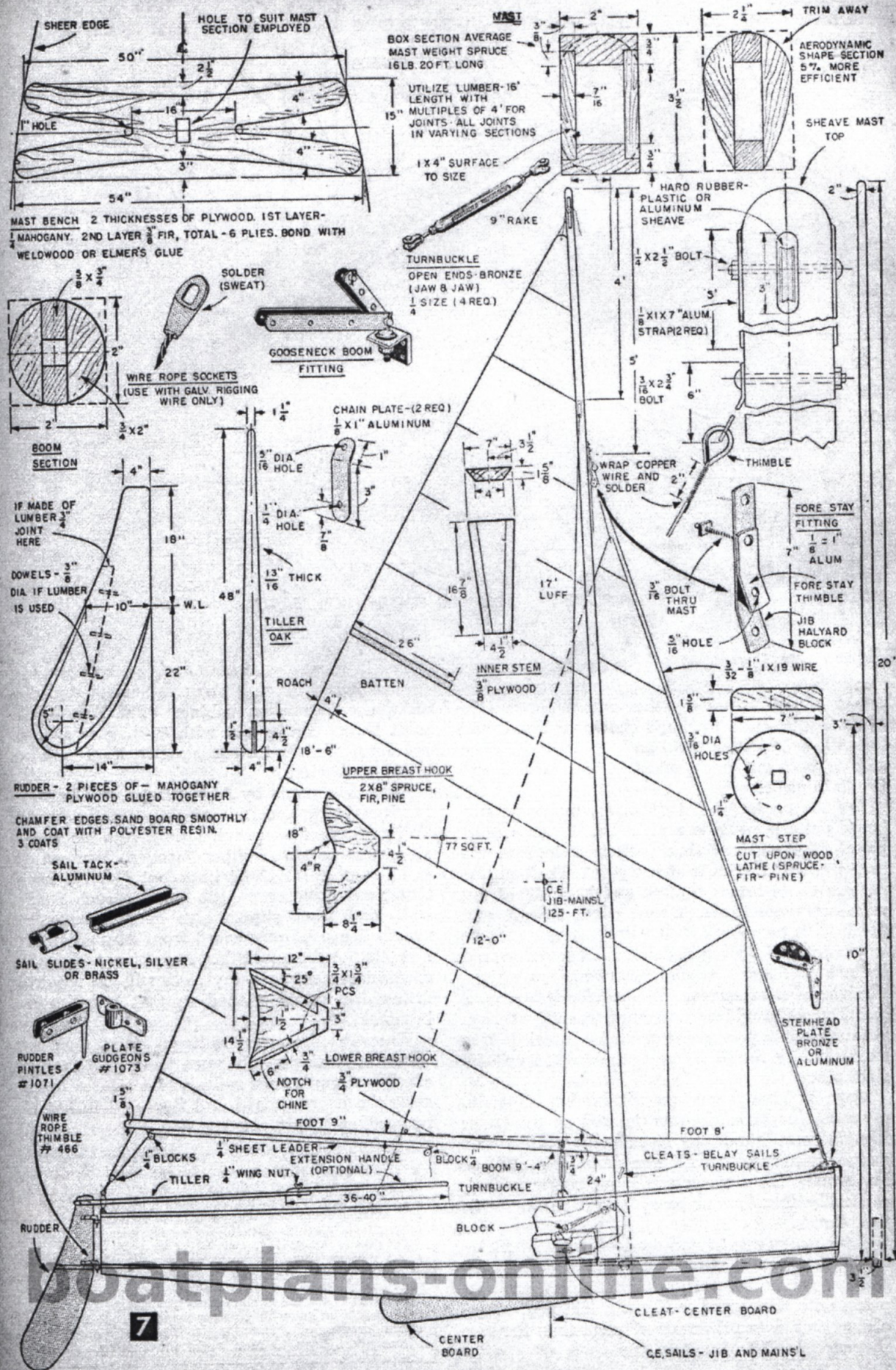
- 1/4" turnbuckles (Perko: Fig. 394 or Fig. 459)
 4 4" cleats (Perko: Fig. 544 or Fig. 572—4 1/2")
 1 #1 centerboard block (Perko: Fig. 827)
 4 blocks (Perko: 2—Fig. 808—aluminum #0 size—boom;
 2—Fig. 802—aluminum #0 size—mast)
 1 1 3/4" dia. sheave
 2 pintles (Perko size #0—Fig. 1071)
 2 gudgeons (Perko: Fig. 1073)
 1 gooseneck (Perko: Fig. 888)
 24' sail track—3/8" aluminum
 22 sail slides (customarily furnished by sailmakers)
 1 stem head plate (Perko: Fig. 343 or Fig. 1032, head & jib stay fitting)
 5 1/8 x 1" aluminum strap (mast fittings)
 10 3/16" thimbles (Perko: Fig. 466)
 1 saddle fitting for sheet traveler (Perko: Fig. 466)
 1/2" wire rope thimble
 50' 3/4" stainless steel wire rope or galv. 1/4"-3/16", 7 x 19 size
 100' 1/4" nylon or manila rope
 *Perko catalog numbers for Perkins Marine Lamp & Hardware Corp., Pitkin & Snediker Aves., Brooklyn 7, N. Y.

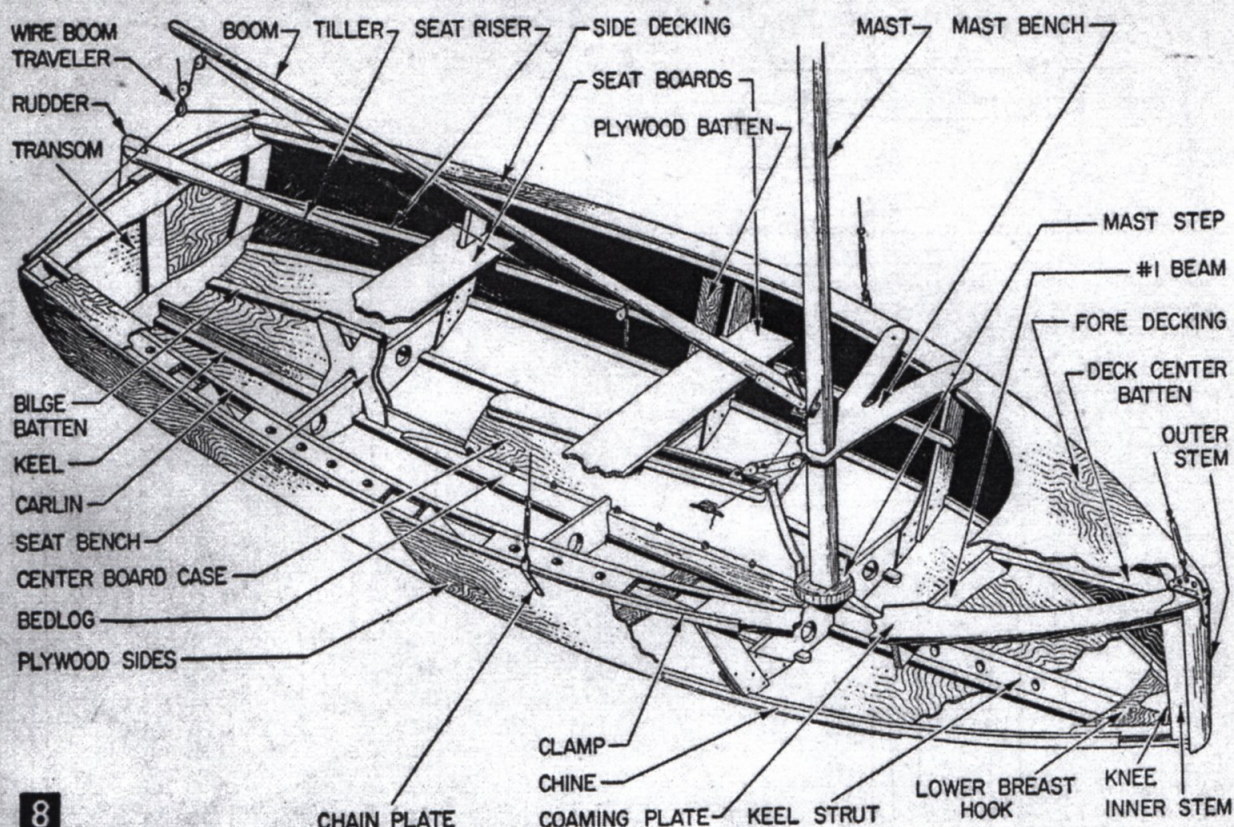
Mast and Boom Lumber Requirements

- Box Mast: 40 lineal ft. 3/4 x 2"; 40 lineal feet 1/4 x 2 3/4"
 Pear-shaped Mast: 40 lineal ft. 3/4 x 3 1/2"; 40 lineal ft. 3/4 x 1"
 Boom: 20 lineal ft. 3/4 x 2"; 20 lineal ft. 1/2 x 3/4"

Finishes

- 12' 3" Fiberglass tape
 1 qt. polyester resin and hardener to equal
 1 gal. Kuhls 3-Way Preservative
 2 qts. #400 clear plywood sealer (Dolphinite)
 1 pt. #9287 light mahogany filler stain (Dolphinite)
 1 qt. #958 white exterior undercoat (Dolphinite)
 1 pt. semi-gloss white
 1 pt. red enamel
 1 pt. marine spar varnish





Sailing Equipment. Make the mast bench from waste left over from decking, bonding two thicknesses of $\frac{1}{4}$ -in. stock together with *Weldwood* or *Elmer's* glue. Cut to shape shown in Fig. 7 and fill with #9287 filler. Seal and varnish. The mast step is best cut on a wood lathe. Finish, and fasten in place.

For the center board (Fig. 4), make a cardboard pattern, provide a pivot bolt in the center-board case and see that pattern swings in the case without striking it at any point. Then outline pattern on $\frac{1}{4}$ -in. steel plate and have it cut out with acetylene torch. Grind edges smooth and finish with two coats of aluminum paint or have it galvanized. This board is raised and lowered by means of tackle attached to mast (see Fig. 8). The use of steel instead of wood for it increases stability and provides momentum to carry through in rough water, preventing crabwise travel. Where exceptionally rough water is the rule, use $\frac{3}{8}$ -in. steel plate.

Make rudder from two thicknesses of $\frac{1}{4}$ -in. plywood (or $\frac{3}{4}$ -in. lumber jointed as shown in Fig. 7), and attach to stern with pintles and gudgeons as indicated. Tiller should be made of hardwood. The extension will give better control, especially if only one passenger is sailing with the pilot.

Screwfasten mast bench to deck with #8 x $1\frac{1}{4}$ -in. f.h. screws and make mast and boom. Make these of spruce (to reduce weight aloft), bonding pieces with *Weldwood* or *Elmer's*. The pear shape of mast is 5% to 10% more efficient than the box shape.

For fittings, use aluminum aloft and brass or bronze at deck level. Don't use wooden spreaders aloft, use aluminum tubing. (The hole in the mast bench can be cut with $\frac{3}{8}$ -in. clearance all around.) Use $\frac{1}{8}$ -in.—or smaller if of stainless steel—stay wires.

Have sails made by Alan-Clarke, 96 Chambers St., New York, specifying light-weight materials. To haul sails aloft, provide aluminum blocks and aluminum or hard rubber sheaves. You can use $\frac{1}{4}$ -in. manila for sheet lines but $\frac{1}{4}$ -in. nylon is better and costs very little more in such a small size. Sail track should also be aluminum, not brass. It can be purchased from Aluminum Marine Co., Auburn, N. Y. Experimentation with cleat placement to belay sails will be required; fittings should be placed so that handling can be quick.

When you're out sailing, place passenger weight amidships to balance your craft fore and aft. When you're out sailing with a brisk breeze, raise the center board and *Zephyr* will literally take off and start planing.

● Craft Print No. 287 in enlarged size for building *Zephyr* is available at \$1.50. SPECIAL QUANTITY DISCOUNT! If you order two or more craft prints (this or any other print), you may deduct 25¢ from the regular price of each print. Hence, for two prints, deduct 50¢; three prints, deduct 75¢, etc. Order by print number. To avoid possible loss of coin or currency in the mails, we suggest you remit by check or money order (no C.O.D.'s or stamps) to Craft Print Dept. B58, SCIENCE AND MECHANICS, 450 East Ohio Street, Chicago 11, Illinois. See coupon on page 192. Now available, our new illustrated catalog of "186 Do It Yourself Plans," 10¢. Please allow three to four weeks for delivery.