

One-Man Folding Kayak

Construction & Assembly Instructions



Boy Scout Troop 390
San Jose, CA

General Information

These plans have been developed from a variety of sources that all trace back to plans drawn up in 1968 by Jess Rathburn, Coordinator of Industrial Arts, San Francisco School District. These plans have been edited and modified December, 2005 by Dan Brady and Wayne Fields to make a stronger and more durable kayak designed to hold up to the rigors of a 50 mile or more trip.

These plans make a kayak weighing less than 40 pounds and will carry a full sized man. The cost of materials will vary between \$100 and \$150. This design is for a 10 foot model. All the materials listed here are purchased bulk by the troop.

Description of materials used:

Plywood - Use AC-Exterior (good one side). Marine plywood is too expensive and the only difference is it has no voids.

Mahogany - Provides a more durable and water resistant material in areas that will get a lot of wear.

Canvas - Canvas is sold according to two methods of specification. One is to list the ounces per yard. Canvas from 10 to 18 ounces per yard has been used satisfactorily.

Duck canvas is given a number (the smaller the number the heavier the canvas). A number 10 can be used for a lower cost. However, number 4 will provide maximum durability and life. Canvas is most easily cut by laying it on a board and cutting it with a razor blade.

Don't buy treated canvas unless you first test to make certain your cement will stick to it.

Contact cement - 3M Fastbond Contact Adhesive 30-NF in 5 gallon container.

Paint - This is purchased individually by the builder. Any water based paint or varnish can be used. Be sure to give the boat one coat of primer before applying paint. The paint on the canvas should be flexible. Exterior latex works well. Some paint solvents will dissolve contact cement through penetration of the canvas.

List of Materials

(All measurements are in inches)

Wood

Item	Quantity	Size	Material
Body panels	4	1/4 x 11 7/8 x 120	AC-Exterior
Floor board	1	1/4 x 11 x 48	AC-Exterior
Back rest	1	1/4 x 11 x 14	AC-Exterior
Paddle blades	2	3/8 x 8 x 15	AC-Exterior
Spreader boards	2	3/4 x 11 x 24	AC-Exterior
Paddle bar	1	1 5/16 x 72	Fir clothes rod
Inside floor strips	2	5/16 x 3/4 x 48	Mahogany
Bottom runners	2	5/16 x 3/4 x 117	Mahogany
Inside cockpit strips	2	5/16 x 3/4 x 48	Mahogany
Outside cockpit strips	2	3/4 x 3/4 x 48	Mahogany
Seat reinforcing strip	1	3/8 x 2 x 11	AC-Exterior

Canvas

Item	Quantity	Size	Material
Side strips	2	2 1/2 x 96	#4 Duck Canvas
End strips	2	2 1/2 x 46	#4 Duck Canvas
Center strip	1	10 x 198	#4 Duck Canvas
Tow strips	4	2 1/2 x 15	#4 Duck Canvas

Hardware

Item	Quantity	Size	Used on
Brass flat head machine screws	6	10/32 x 1 1/4	cockpit edging
	4	10/32 x 1 1/4	paddles
	6	10/32 x 3/4	floor strips
	4	10/32 x 3/4	bottom runner ends
	4	10/32 x 1/2	seat hinges
	4	10/32 x 3/4	seat hinges
Brass nuts	4	10/32	bottom runner ends
	4	10/32	seat hinges
Tee nuts	20	10/32	floor strips, cockpit, seat hinges and paddle
Brass gromets	4	#2 - 3/8 hole	tow strips
Brass hinges	2	3/4 x 2	back rest / floor board

Miscellaneous

Nylon tow rope - 2 pieces 1/4 x 36

Disposable container for applying glue

Carabeeners

Newspapers for placing under canvas while glueing

Parachute cord - 2 pieces - 1' each for cockpit gear loops

Paint brushes - 1" cheap brush (for applying glue)

Silicone caulk or waterproof wood glue (Titebond 3) to seal screw holes in bottom of boat

Contact cement - 2 to 3 quarts (we use Grip)

List of tools needed

Razor edged knife for cutting canvas

Cutting board for backing canvas while cutting it

Spring clamps (4) or other variety of your choosing

Marking pen or pencil

Power jig saw with plywood blade for cutting curved edges

Belt sander with 60 or 80 grit sandpaper for smoothing and rounding curves

Finish sander with 150 grit sandpaper

Wood rasp for rounding edges

Hammer or rubber mallet and wood block for insuring full contact of glue joints

Saw horses to hold kayak at a good working level

Hand punch gromet set (#2)

Power drill and if available a drill press

Table saw for ripping and rough cuts

Counter sink

Straight edge

Tape measure

Safety goggles

Extension cords

Purchase Materials and Rough Cutting

Prior to the first session all of the wood, canvas, hardware and miscellaneous items need to be purchased.

4' x 10' x 1/4" boards need to be ripped to 1' x 10' to make the 4 body panels and cut 11 x 48 pieces for the floor boards and 11" x 14" pieces for the back rests.

(see figures A & B)

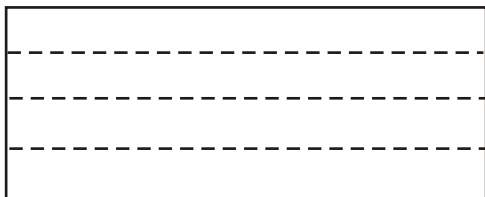


Figure A

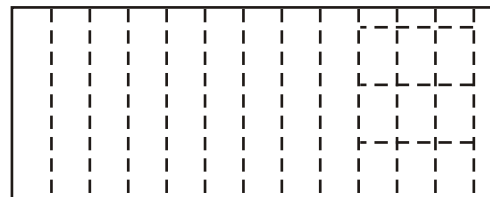


Figure B

4' x 8' x 3/8" board needs to be cut to 8" x 15" pieces for paddle blades and cut to 2" x 11" for the seat reinforcing strips.

(see figure C)

4' x 8' x 3/4" board needs to be cut to 11" x 24" pieces for the spreaders.

(see figure D)

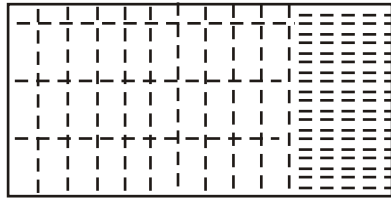


Figure C

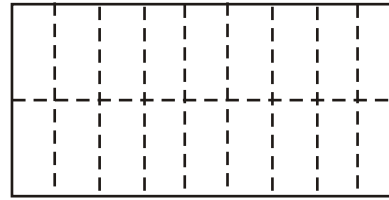


Figure D

The mahogany needs to be ripped to 3/4" x 1 1/2" strips (we use 2" x 8" x 10' deck boards which makes using the mahogany economical) and then ripped into 5/16" strips for the floor strips and inside cockpit strips, and 3/4" strips for the outside cockpit strips.

(See figures E & F) These strips are then cut to the various lengths needed.

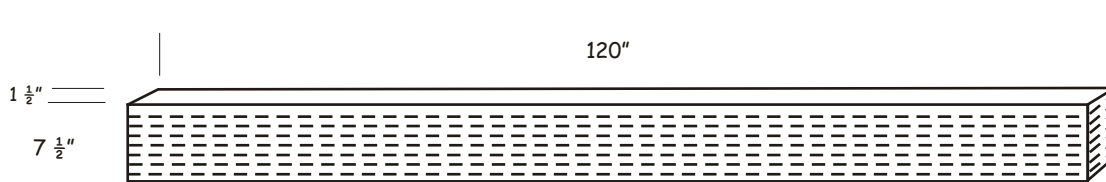


Figure E

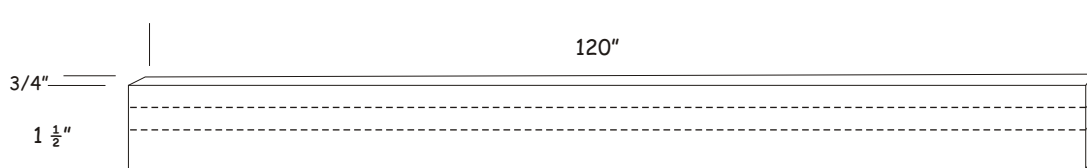


Figure F

A notch 3/8" wide and 6" deep is cut parallel into the ends of the paddle bar. You can use the jig saw or use a 3/8" dado blade in the table saw.

(See figure G)



Figure G

We precut the canvas to size at this time to expedite the work for session one.

Session One

Using two clamps, clamp together 2 body panels to make the left side of the boat. Using a jig saw and the bow/stern template cut the curves for the bow and stern at each end of the boards (see figure H) making sure the good sides are out. Repeat the above with 2 body panels for the right side of the boat (see figure H). Start the curves $1\frac{1}{2}$ " from the center edge of the panel. This leaves the front and rear square to reduce wrinkling of the center strip of canvas. Round the edges with the belt sander or rasp.

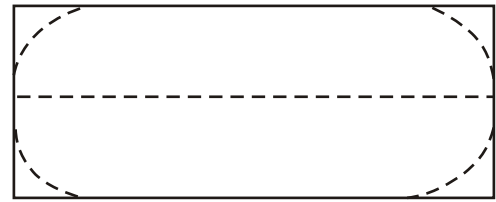


Figure H

Take the 2 top body panels, put them together with the insides against each other. Clamp the cockpit template centered along the long edge and cut out the cockpit (see figure I). Sand the edges smooth with the belt sander.

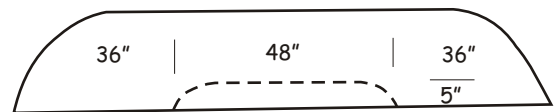


Figure I

Make 2 spreader boards per boat using a jig saw and cutting to the dimensions in figure J. We have a template that we place on the spreader board rough cut pieces to draw the cut lines. Drill a hole next to the inside line to get the inside started. Using a router and a $1/4$ " or $1/2$ " round over bit route all the inside and outside edges on both sides of the spreader.

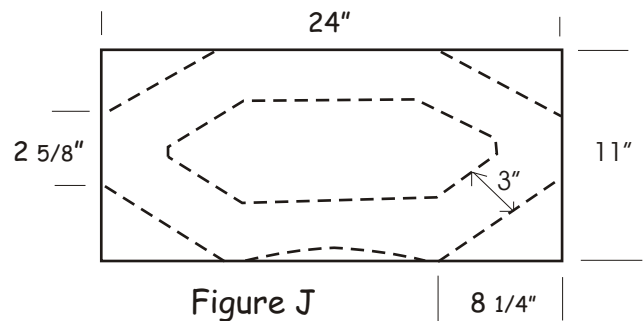


Figure J

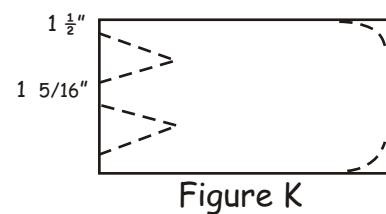


Figure K

Clamp two paddle blade rough cut pieces together. Then, with a jig saw, cut out pieces similar to figure K. We have a paddle blade template that we use to draw the cut lines. Sand the edges and curves. With the water proof glue or wood putty fill any holes along the edges of the plywood.

Using the $3/4$ " strips of mahogany made in the rough cut session, cut the floor and cockpit strips to the depth and length specified in the wood list of materials.

This completes session one. Each boy should take home the following:

- 2 top body panels, 2 bottom body panels, 1 paddle handle, 2 paddle blades, 1 floor board, 1 back rest, 2 spreader boards, 2 inside floor strips, 2 outside floor strips, 2 inside cockpit strips, 2 outside cockpit strips, and 1 seat reinforcing strip

Homework between session one & two

All of the wood pieces need to be sanded with a finish sander with 150 grit sandpaper.

Apply one coat of primer and 2 coats of paint to the insides of the four body panels. Do not paint in the green areas because they need to be glued (contact cement does not stick to the paint). See the green/shaded areas in figure L. Do not paint the outside yet.

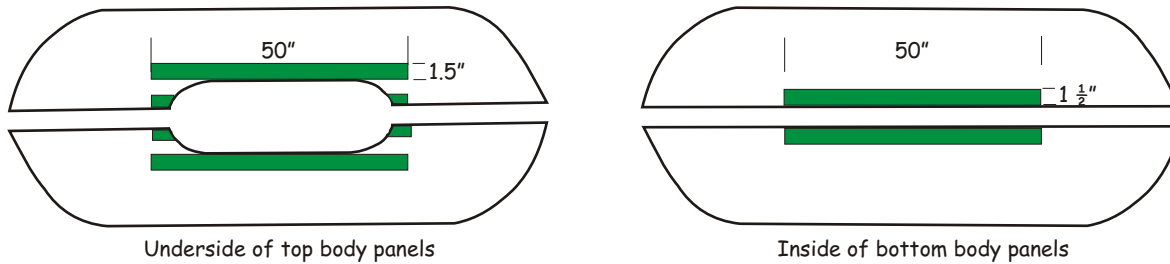


Figure L

Make 2 spacer jigs per boat. (See figure M)

To make the spacer block, cut 2 pieces of $\frac{3}{4}$ " plywood to 2" x 12" and cut 1 piece of $\frac{3}{8}$ " plywood $3\frac{1}{2}$ " x $3\frac{1}{2}$ ". Center the $3\frac{1}{2}$ " piece between the 2 longer pieces, drill a $\frac{5}{16}$ " hole through the center of all 3 pieces and connect with a $\frac{1}{4}$ " bolt and wing nut. The jigs can be shared between 2 or 3 boats since you are working in teams of three.

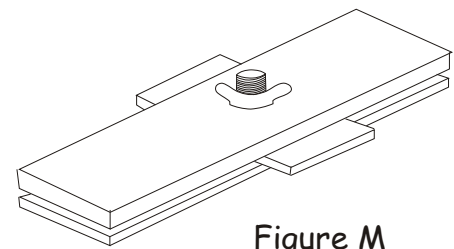


Figure M

Session Two

Clamp the four body panels together with the spacer jigs you just made. Painted surfaces are on the inside facing each other, with the curves matched.

Place on 2 sawhorses.

See figure N.

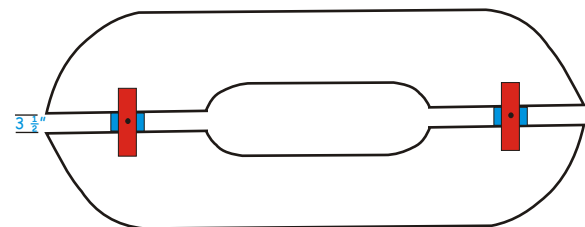


Figure N

Draw a line around the entire boat, 1" in from the edge, on the top and bottom of the boat (see figure O). This marks the area you will be glueing on the boat. Apply the first coat of glue to the top panels, then turn them over and glue the bottom panels.

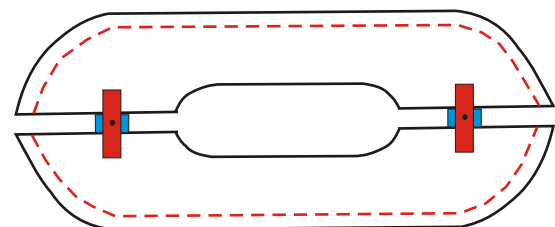


Figure O

While waiting for the glue on the panels to dry, lay out a row of newspapers or plastic tarp about 17' long for glueing the canvas. Lay out the two end strips, the two side strips and the center strip. Apply the first coat of glue to the end and side strips. After the first coat of glue has dried, apply a second coat to the top and bottom body panels, and then to the end and side strips of canvas. The seat assembly, paddle assembly and tow strips can be worked on during drying times.

While the second coat of glue is drying, mark the areas to be glued on the center strip as per the layout in figure P. Mark the center of the center strip (this is important). Then apply the first coat of glue to the blue (shaded) area of the center strip.

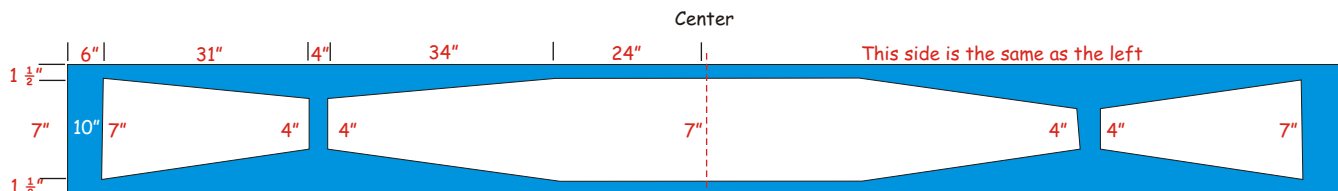


Figure P

When the second coat of glue is dry on the panels and the side and end canvas strips, you are ready to start the assembly of your kayak.

Work in groups of three for this part of the assembly. Start with the side strips. Two workers stretch the side strips and hold over the 1" glue area while the third worker presses the strip down on the kayak, being careful to keep the strip even and without wrinkles. Next press the canvas to the edge of the kayak, then turn the kayak over and press the canvas down on the bottom side. Repeat this for the other side of the kayak. With a block of wood and hammer or mallet tap down the canvas to help make a better glue seal. Now apply a coat of glue to the ends of each side strip at least 4" long (this is where the overlap of the end strips will be glued).

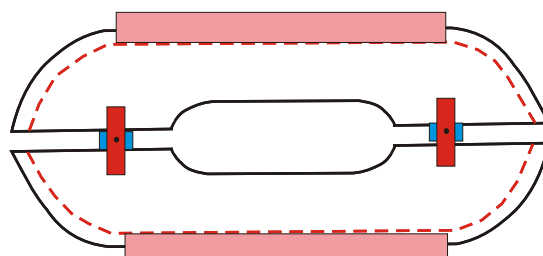


Figure Q

When the glue is dry, apply the end strips, taking care that they are even and wrinkle free. See figure R.

The ends should overlap the side strip end by 3" to 4". This area is the most likely to wrinkle. If you start on one end and slowly work your way around the curve you can press out the wrinkles. Then tap the canvas all the way around the perimeter.

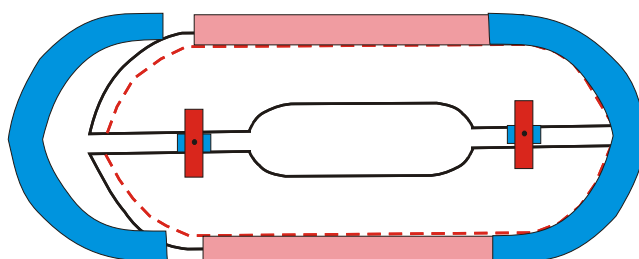


Figure R

Remove the spacer jigs. Use a pencil to mark the glue areas on the top and bottom body panels per the drawing in figure S. Be sure to mark the center line on the bottom body panels. Now apply the first coat of glue to the yellow (shaded) areas. Also glue about 2" on the underside of the top body panels at the corners of the cockpit area. When the first coat is dry, apply a second coat to the top and bottom body panels as well as to the center canvas strip.

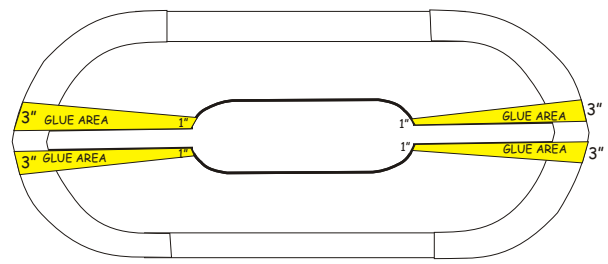


Figure S

While the glue is drying, put the spreader boards in to open the body panels to their normal position, then turn the kayak upside down on the sawhorses. Again using three workers, have two workers hold the center strip above the kayak, while the third worker carefully presses the center of the canvas (previously marked) to the center of the kayak bottom (previously marked). Working carefully from the center to each end, the third worker needs to make sure the canvas is centered equally on each side and is wrinkle free.

Taper the ends of the 117" bottom runners with a belt sander. Apply 2 coats of glue (wait for the first coat to dry before the second) to the 3/4" side of the bottom runners, and to a matching area on the canvas center strip. The runner goes on top of the canvas and flush with the inside edge of the body panels. See figure T.

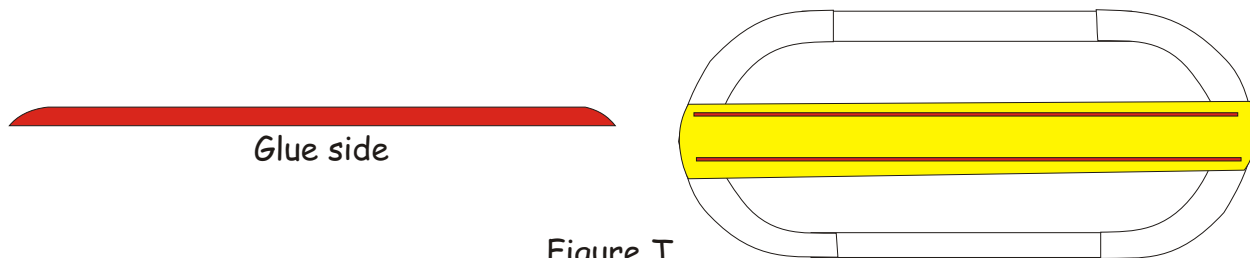


Figure T

When the glue is ready, take out the spreaders and apply the bottom runners. The runner ends should be 1 1/2" from the ends of the kayak. Put the spreaders back in and drill 2 holes, using a 13/64" drill bit, 2" from the ends of the runners. Drill all the way through the runner and the body panel (be carefull not to drill into the top body panel). Counter sink the outside of the holes. Put a dab of silicone adhesive in each hole, then fasten with 10/32 brass screws and brass nuts. Turn the kayak over. Continue to press the canvas to the top body panels. Use a block to set the joints and rub out any wrinkles.

Before turning the edges of the center strip onto the inside of the cockpit area, apply the second coat of glue to the inside corners of the cockpit area. When the glue is dry turn the remaining portion of the center strip to the inside of the body panels.

The spreader boards can now be removed and the joints lightly pounded with a rubber mallet.

Put the spreaders back in the kayak. Taper the ends of the cockpit strips and the inside floor strips the same as the bottom runners. Mark the center of the inside floor strips and the center of the inside bottom of the kayak. Trace the area to be glued on the kayak using the strips as a guide. Apply 2 coats of glue to the bottoms of the strips and the matching areas of the kayak. When dry, match up the center marks on the kayak and the inside floor strips and press down along the edges of the body panels. Drill holes, using a 3/16" drill bit, 2" from each end and one in the middle of the inside floor strip. The holes need to go all the way through the inside runners, the body panels and the bottom runners. Widen the holes on the inside of the kayak to 1/4" and to a depth of 3/8" to accommodate the t-nuts. Countersink the outside of the holes, then put a small dab of silicone adhesive in each hole from the outside. Put t-nuts on the inside and secure with 10/32 x 3/4" brass screws.

Now place the outside cockpit strip against the edge of the body panel centered to the cockpit, then place the inside cockpit strip on the inside of the body panels directly under the outside cockpit strip. See figure U. Clamp the strips and drill 3/16" holes 2" from each end and one in the middle. The holes need to go through the top cockpit strip, the body panel and the inside cockpit strip. Widen the hole on the inside to 1/4" and 3/8" deep. Countersink the outside of the holes, put a dab of silicone adhesive in each hole and secure with 10/32 x 1 1/4" brass screws and t-nuts on the inside.

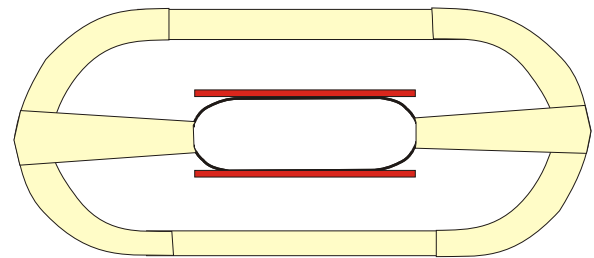


Figure U

Tow Strips

Mark a 2 1/2" x 5 1/2" area adjacent to each side of the center strip on both ends of the kayak (see figure V). Apply 2 coats of glue to one side of the 4 tow strips and the glue areas (red / shaded) on both sides of the kayak.

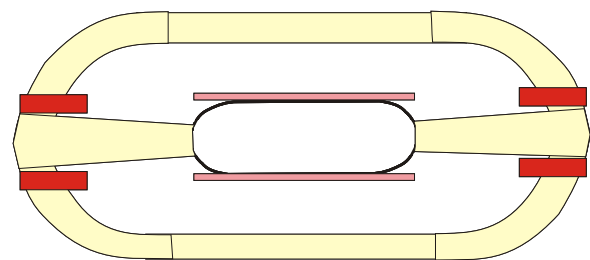


Figure V

When the glue is dry apply the canvas tow strips to the kayak $5 \frac{1}{2}$ " in from the ends and press the excess together (see figure W). With a #2 grommet punch set, punch 1 hole in each tow strip 1" from the end and press a grommet in each hole.

Lace the $\frac{1}{4}$ " x 36" nylon tow rope through both holes on each end of the kayak and tie together with a fisherman's knot.

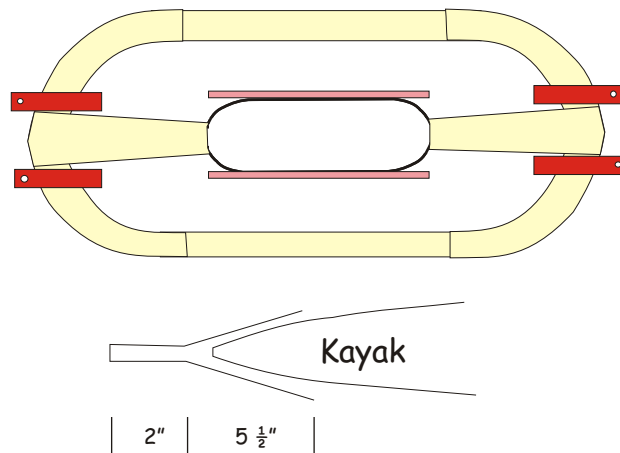


Figure W

Seat assembly

Glue the seat reinforcing strip to the floor board 1" to 3" from one end (depending on the angle desired for the back rest). Place 1 side of 2 hinges on the reinforcing strip, mark the 2 outside holes on each hinge and drill 4 - $\frac{3}{16}$ " holes. On the bottom side of the floor board widen the holes to $\frac{1}{4}$ " for the t-nuts. Secure with 3 - $\frac{3}{4}$ " brass flat head screws. Place the back rest against the reinforcing strip and mark the 4 outside holes on the hinges. Drill $\frac{3}{16}$ " holes and fasten with 4 - $\frac{1}{2}$ " brass screws and brass nuts.

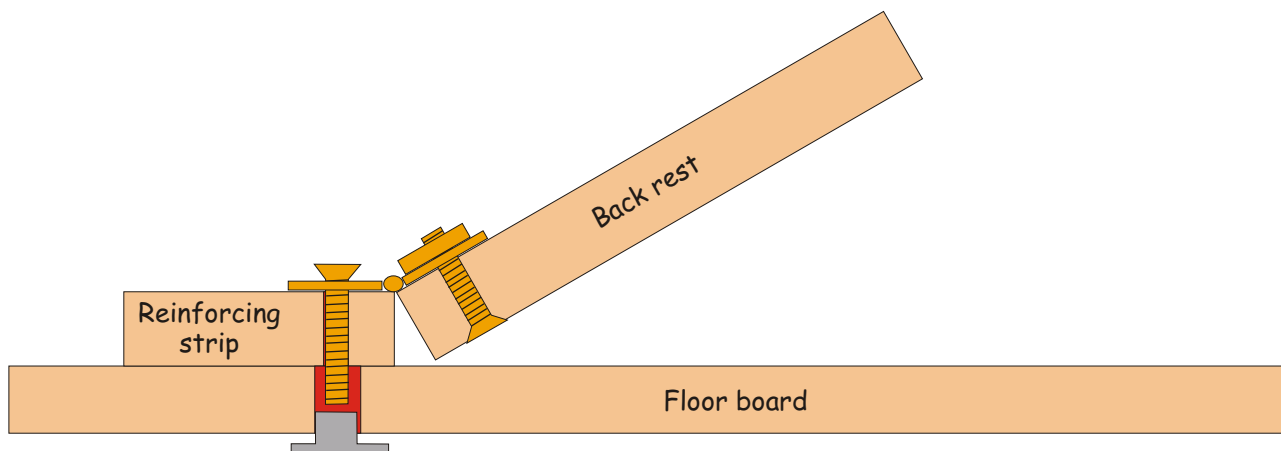


Figure X

Paddle assembly

Put woodglue in the slot on one end of the paddle handle and slide the paddle blade into the slot (see figure Y).

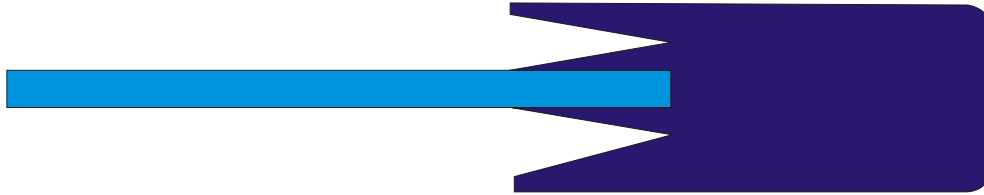


Figure Y

Drill 2 - 3/16" holes all the way through the handle and blade. On one side drill the holes 1/4" wider for the t-nut, and to a depth of 3/8". Counter sink the other side of the holes. Fasten the blade and handle together with 2 - 1 1/4" brass flat head screws. The screws can be more permanently secured with some loctite. Repeat the above on the other side of the paddle.



Figure Z

Painting

The outside of the kayak and the paddle should be primed and then painted with at least 2 coats of flexible paint. Exterior latex is a good choice. The painting needs to be finished at least 1 week prior to using the kayak. After the paint is dry, place the kayak upright on two sawhorses and pour 1 qt. Of Thompson's Water Seal inside the kayak. Slosh the sealer around, turning the kayak over in order to coat the underside of the hull top and canvas side strips. Coat all inside surfaces, then invert the kayak and pour the sealer out (disposing of it properly). Make sure all the sealer is out, as the sealer is a solvent that could affect the contact cement. Sponge spreader boards and let dry for at least one day before floating.

Where to go Kayaking

Flat water

- Lexington Reservoir - Miller Picnic Area
- Los Gatos Creek Percolation Ponds
- Coyote Reservoir
- Del Valle Reservoir
- Vasona Lake

One day river trips

- American River - east of Sacramento
take Sunrise Ave. North off US 50
- Stanislaus River - Knights Ferry beyond Oakdale
take Orange Blossom off CA 120
- Kings River - east of Fresno
- Russian River - several sections between
Cloverdale and Jenner

Multiple day trips

- Sacramento River - Redding or Red Bluff to
Colusa - 100 to 120 miles
- Russian River - Cloverdale to Jenner - 74 miles
- Lake Tahoe - Arch Rock, NV - Clockwise to Sand Harbor, NV - 64 miles

What to bring

Boat equipment checklist

- Kayak
- Spreaders (2)
- Seat
- Seat Cushion
- Paddle
- Throw Rope
- Tarp to lay out equipment

Stuff for in the kayak

PFD

2 liters of water

Waterproof bag

Sunscreen

Lip Balm

Wide brim hat

Long sleeve shirt

Swimsuit

First aid kit

Lunch and/or snack

Sunglasses

Strap to secure sunglasses

Footwear (boat shoes or sandals with a rear strap)

Bailer (or water canon)

Whistle

Where to get materials

Lumber

Pinecone Lumber - Sunnyvale 408-736-5491

Economy Lumber - Campbell 408-378-5231

Southern Lumber - San Jose 408-297-9663

Aura Hardwood Lumber Inc. - San Jose 408-275-1990

Minton's Lumber - Mt. View 650-968-9201

Hardware and cordage

OSH

Canvas

City Canvas - San Jose 408-287-2688

Bay Area Canvas - Santa Clara 408-727-1242

Adhesive

R.S. Hughes - Sunnyvale 408-739-3211

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