How to Build a Boat

Three Parts: Building the Frame Bonding the Panels Finishing the Job

Little boats are perfect for trips around the lake. They fit on the roof of your car and in the back of truck beds, making them perfect for spontaneous camping trips. This article describes a method for building a canoe, (12'x30", with 11" depth), using a stitch and glue style of boat building. See Step 1 below to get started on this project.

Part 1 Building the Frame

1 **Rip and attach the plywood sheets.** Rip two sheets of 4'x8'x1/8" (door skin plywood) into 24" wide sheets, stack and attach these 24"x 8' sheets together at the top and bottom edges with small nails in a few spots.

2 **Mark out your measurements.** Lay out the attached panels and mark a vertical line every 12" along the entire 8' length of the plywood. From these 12" vertical lines, measurements are made by marking points on these lines.

- A long stick or batten is used to draw a line between these points giving the outlines of the canoe's panels. Make sure the lines drawn for the panels are all fair, smooth curves.
- Only three panels are needed per side. The four half sheets of 8' plywood are used to make 12 boat panels, then these 12 panels are put together in matching pairs with butt blocks or scarf joints to make up the total 6 panels or 3 per side.
- Finger joints, using a dovetail template and a router will also make good joints to join the panels. You have to allow for the 1" overlap of each panel when making the finger joint, as this gives the boat an attractive finished look.
- This system makes a simple but very nice boat and has a recognizable canoe look and shape with a gentle "v" bottom, rather than a flat bottom.

3 **Cut the panels.** Once the panels have been drawn out and checked for nice curving lines, it's time to cut them out using a saber saw.

- Once you have cut the panels out, use a woodworkers rasp (file) to smooth up the edges as close to the lines on the panel as possible. A small block plane could be used instead.
- Now you can put the panel pieces together as stated above with finger joints, scarves or butt blocks. More specific instructions on how to do each of these joints is easily available online.

4 **Drill holes in the panels.** Now that the panels are done, it's time to drill some holes along the bottom edges, about 3/8" from the top and bottom edges of each panel.

- This job is easier and faster if you lay the two matching panels (the corresponding panels on either side) together and drill the holes.
- This boat has only three panels per side, with each of the three being the same on either side of the canoe.

5 **Stitch up the panels.** Get some bailing, copper or any soft, easy-to-bend wire from the hardware store. Cut short pieces of wire about 3" long, you will need quite a few of these, about half a pie pan full. However, you can always cut more if you need them.

- Lay the two bottom panels on top of each other and wire the center/bottom edges together, but don't pull the wire too tight. Leave the wire loose, so you can open the bottom two panels up like a book. This will be the bottom of your canoe.
- Now, starting in the center, wire (stitch) on the next panel, putting a few stitches on each side of the center line. Keep working from side to side doing a few on each side until you get to the ends.
- When you get to the upper panels, line up the ends and stitch them together. Try to keep them as even as

possible, with a nice canoe end curve. You should begin to see the canoe coming together at this point.

6 **Review your work.** With the panels stitched together, put a stick about 1" square and 29" long at the top center inside of the canoe. This will hold it to the right width and shape. Now, stand back and look it over.

- Is it fair, with nice flowing lines and no twist? If not tighten or loosen the wire stitches as necessary, or even add a stitch if needed. Make sure it looks pleasing to the eye.
- Check to see if there is any twist in the canoe, using winding sticks. Make sure the panel edges are all sitting on top of each other nice and tight and not overlapping at any point.
- You can also do a trick called cutting a transition joint, which is a 1/4 or 3/8" notch cut 24-36" (depending on the width of the panel and length of the canoe) into the bottom front edge of the top panels. This gives you a nice smooth side. More detailed instructions on how to do a transition joint can be found in many books covering stitch and glue boat building or on the internet.
- Finally, be sure that the panels are not pushed out from each other at any one point, you want nice, smooth-stitched seams.

Part 2 Bonding the Panels

1 **Apply some epoxy.** Mix up just enough epoxy to cover the joints between the panels. This is done by using a mixing cup (8oz.) and a stick. Then use a foam paint brush to apply the epoxy to the joints.

- Try to cover each edge about an inch on either side of the joint, making sure that it soaks into the joint to get a good bond. Make it look like you're painting a strip down the joint. Remember that the joints of the panels and stems only get epoxied on the inside for now.
- Repeat this process for each of the joints. Try not to let the epoxy run down the sides of the panels -- you only want it on the joint, no runs. If you have any runs, use another brush to wipe them up. This just makes life easier when it comes to sanding the inside of the boat. Remember to check the outside of the seams for runs as well.
- Put two coats of epoxy on the joints and stems (stems are the ends of the boat), letting the epoxy dry before re-coating. Be sure the stems are pulled tightly together (using the stitches) before applying the epoxy. Don't use clamps to pull the stems ends together, stitches only!
- Each coat of epoxy needs about 24 hours to dry, so try to have a little patience while dreaming of that smooth glassy lake!

2 **Remove the wire stitches.** When the epoxy is dry, check to ensure that the joints are fully epoxied with no dry spots (areas without epoxy). If they are, you can start cutting and pulling out the wire stitches.

- Do this with care, as the panels' joints are still fragile at this point. Try not to break the epoxy join, and don't leave any wire in the boat.
- If you pull out a wire and the joint opens, put a stitch back in and epoxy that joint area again.

3 **Apply a mixture of epoxy and wood flour.** Once all of the wire is out, mix up some epoxy and wood flour (very fine sawdust). You can find wood flour at any boat building supplier. This mixture is known as a fillet.

- Mix the wood flour and epoxy to a smooth creamy mixture -- it shouldn't be runny. Apply this fillet to the joints that you put the epoxy on.
- Make a nice smooth bead about 1-1/2-2" wide over the center of each joint, then apply a smooth bead of fillet to the inside of the stem ends.
- Make the stem end fillets about 3/4" thick on the inside -- although this adds weight, it has the benefit of making the stem nice and strong.
- However, you should be careful not to add too much epoxy, as it can become brittle.

4 **Add fiberglass tape to the inside of the boat.** Now it's time to add a 3" wide fiberglass tape (which is cloth-like, rather than sticky) to the freshly fillet-coated joints and stems.

- Apply another coat of epoxy, smoothing it over the fiberglass until it turns clear. To make the joint as smooth as possible, add just enough epoxy to turn the fiberglass clear, then use a squeegee to remove any excess.

Remember that applying too much epoxy is as bad as applying too little.
- Be gentle while doing this, as you don't want to push the fresh fillet mix out of the joint when you push down on the fiberglass with the squeegee.
- When you get to the stems, add a 3" wide strip of fiberglass to the inside of the stems (over the fillet). Allow the stem end fiberglass to come down over the center strip of fiberglass tape, as this will make one complete, strong joint.
- You will need to add a second coat of epoxy to these tapes after the first coat cures, again waiting 24 hours between each coat.

5 **Sand the boat.** Once the second coat of epoxy has dried, it's time to turn the boat over. Enlist the help of another person to turn the boat over -- remember to be very gentle, as the boat is still fragile at this point.
- Now use a fine rasp (woodworkers file) to smooth over the edges of the bottom and lower panel joints, being careful not to splinter the thin plywood. Then use sandpaper (80 grit) to smooth up the joint edge, being careful not to sand too deep into the plywood.
- Sand the entire outside of the boat, using a 120 grit sandpaper. Make sure to clean up any drips and runs from the epoxy that ran through the joints. Remember to sand with care - don't sand into the thin layers of the 1/8' plywood as this takes away from the canoe's outer skin and leaves hollow flat spots.
- When the sanding is done wipe off the excess dust using a cheesecloth, then use compressed air and a clean cloth to remove the more stubborn dust. Sweep the floor, and wait until the dust has settled before proceeding.

6 **Apply epoxy and fiberglass to the outside of the boat.** Once the dust has settled, you can apply a thin, even coat of epoxy to the smooth, bare wood on the outside of the canoe using a good foam brush. Again, 24 hours to wait for the epoxy to dry.
- Lightly sand the epoxy-coated outside of the boat with 120 grit paper. This is only necessary to provide a tooth for the next coat of epoxy and fiberglass to hold to.
- Now it's time to add fiberglass cloth to the outside of the boat. The fiberglass can weigh anywhere between 4 oz and 8oz, depending on the intended use of the canoe. The larger the fiberglass the heavier the canoe will be as the heavier fiberglass requires more epoxy.
- Use the same technique of applying the fiberglass to the outside of the boat, then applying a layer of epoxy on top. If you have never done this before, it's a good idea to read as much as you can about it first. Being informed will help you do a really nice job on the boat.

7 **Trim the fiberglass and epoxy.** You will need to trim the epoxy and fiberglass cloth approximately two hours after applying, just before the epoxy starts to harden.
- If you wait until the epoxy hardens, it will be very hard to trim the excess fiberglass cloth from the edges of the canoe.
- To trim the fiberglass cloth, use a razor knife and trim off the cloth along the gunnel's edges. Be gentle while trimming -- try not to pull on the cloth as it is still wet and it will move and cause you problems.

8 **Add another coat of epoxy, then sand the boat.** After the first coat of epoxy has been applied to the fiberglass cloth and is dry, add another coat to fill the weave of the cloth, giving you a nice smooth surface.
- Be aware that it might take more than two coats to fill the weave of the cloth depending on the type and weight of the cloth.
- With the fiberglass on and trimmed, give the outside a light sanding with 220 grit sandpaper, then clean off all dust. You can now clear coat or paint the boat.

Part 3 Finishing the Job

1 **Turn the boat over.** Carefully turn the boat right side up and place it in a cradle or in slings. This is a good time to build a set of saw horses to set and cradle the canoe in so it won't move while you work on the inside.

Attach the gunnels. Gunnels are the top rails of the canoe, which are placed on the inside and outside edges on both

2 sides of the canoe.

- Gunnels give a completed look to the canoe, while also serving to protect the sides of the canoe as rub rails.
- Each gunnel should be about 1-1-1/4"x3/8-1/2" square, with the top outside and inside edges rounded over. Use epoxy and brass or bronze screws to attach the gunnels at the front 24-30" of the gunnels. You can use the epoxy and spring clamps to attach the gunnels to the canoe until the epoxy dries.
- At the stem ends on top of the canoe you can fit small decks, on top of the rails or between them, if you take the time and effort to make a good fit. Flush decks look the best.

3 **Apply a second coat of clear varnish or paint.** Keep in mind that you will have to do one or the other, as epoxy alone will not last when exposed to the sun. When you've finished painting or varnishing the outside, it's time to turn the canoe over and do the inside, clear coat or paint.

4 **Sand, epoxy and paint the inside of the boat.** Sand the inside of the boat, removing any drips or runs. Try to not sand through the top plywood layer.

- When all the sanding is done, it's time to coat the inside of the boat with. For best results, do this in two or three thin layers of epoxy, waiting 24 hours between coats.
- When this is all done you can sand the last coat lightly with a 120 grit sandpaper and then a 220 grit to get a really smooth finish.
- Wipe away any dust, then paint or varnish the inside.

5 **Add seats.** You can add seats before or after you epoxy coat the inside of the boat.

- All seats should be about 1-1-1/2" from the bottom of the canoe, not hanging from the gunnels.
- On a light canoe (such as this one) with a low freeboard, it's best to keep the center of gravity as low in the boat as possible.

6 **Give the boat time to dry.** Let the whole thing set for about a week -- this gives the layers of epoxy and finish time to dry completely.

Tips

- Only use epoxy plenty fresh air (ventilation) when boat building to avoid possible permanent nerve damage caused by inhaling fumes.
- Read all you can find about stitch and glue boat building. The more you know the less problems you'll have and the happier you'll be.
- Don't get into a hurry, this is very hard to control, but an issue you must work on.

Warnings

- A wooden boat won't sink; it may swamp, but will still float, so if you fall out and the boat fills with water, stay with it, it could save your life.
- Always use Personal Flotation Devices (PFDs) when you are in a boat. Do not sit on your PFDs. Certain states and local laws specifically require PFDs for young people.
- Epoxy is toxic and you can get very sick from prolonged exposure to epoxy. Try not to breath the fumes or let the epoxy (or its components) come in contact with your skin. Use safety gear, safety glass' prevent splatter into your eyes, an air filter (charcoal) and lots of ventilation are recommended, rubber or vinyl gloves, and an old long sleeve shirt.
- Keep the area you work in clean, well vented and a fire extinguisher on hand all the time.

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