

RED BARN BOATS



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9.75ft PUD-g

Plan build — V.1.0.0 — 6-21-2007

LOA:	6' 9"
LWL:	6'
Beam:	48"
Draft:	2.5"
Weight:	65 lbs.
Maximum Outboard:	2.0 HP
Maximum Load:	440 lbs.
Maximum Persons:	400 lbs.
Maximum with 2hp Outboard:	375 lbs.
Oar length:	6ft

Note: Because of the heavy curvature of the panels at the bow of this hull, you must use a good grade of okume 1088 marine grade plywood. It is the only plywood that will bend enough to not "snap" along the grain when you wire up the hull. But you must still be careful, and pre-bend the panels for several days before assembly. Especially the bow end of the second panel from the bottom. Wetting the bow end of the panels before pre-bending them helps.

The 6.75 PUD-g

This design is a departure from what I had told myself about not working on any more short boats. Most people are looking for a boat somewhere in the 10 to 14 foot range. This isn't even close to that ideal. But I gave it a go anyway for the following reasons.

The design came about after I had gone up to Bellingham, Washington, to look at a 34 foot steel sailboat. As I was waiting for the broker to show up, I made a quick stroll up and down the docks looking at the other boats sitting in their slips. As I walked along, I kept seeing all the yacht's tenders stacked in dock racks at the end of the piers, in neat little rows. I then became more interested in them than their mother ships.

There were prams, skiffs, and dingy's; some homemade and some production boats. I was amazed at how short they were and how little volume they carried at their beams and ends. Some of the more stylish ones had tiny little wineglass transoms which carry no load until the boat is 6" deeper in the water and freeboard is at a premium. For a lot of them, twelve inches of freeboard sitting empty was stretching the point.

I decided when I got home to see what I could come up with that was small enough to fit on the fore deck, but still carry the captain and at least one crew member, plus supplies from the docks to the mother ship. I wanted to keep it short, somewhat narrow in the beam, and with low enough freeboard to be out of the way of either the main boom or the head sail on the mother ship.

A short narrow boat needs it's volume where the hull meets the water so to speak. So I made sure that I carried the volume all the way down in the stern. A wine glass looks pretty, but doesn't carry the weight well when more than one person is in the boat. I puffed out the volume in the bow area to give more displacement forward to keep the nose up and the extra flare helps lift her up in waves and keep some of the spray out. I also gave her some freeboard to keep the seas out when loaded down with crew and supplies. Sitting on the dock, her height at the beam is about 16" and this should help keep her dry. There is enough "V" to the bottom that I don't think she will need a keel strip to keep her going in a straight line. If you want to add a short one along the last two feet of the keel, be my guest as it can't hurt and can only help. It looks like six foot oars would work very well and could be stored in the hull with no overhangs.

I did rake the transom a little, and put a bit of a curve in the sheer. Nothing says she has to be practical, and homely. To get the most useful room out of the hull, I'm going to use a fore and aft seat with double oarlock stations; and maybe add a sailing option using the thirty six square foot Optimist rig. You should be able to find "slip sleeve" sized tubing at www.onlinemetals.com to make the mast, boom, and sprit into take-a-part sections.

Warren Messer

Red Barn Boats

P.S. The PUD-g stands for Personal Utility Dingy-model g. ;)

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Materials List

Platform:

..... 2" x 6" x 8 ft: (runners and cross supports).....	5 ½ Boards
..... 2" x 4" x 32": (legs).....	12
..... Sawhorse Brackets: (heavy duty).....	6

Plywood: NOTE! OKUME ONLY

..... 4ft x 8ft x ¼" (6mm).....	2 Sheets(2 1/2 for sail option)
..... 4ft x 8ft x 1/8" (3mm) Daggerboard and Rudder.....	1 Sheet

Hardwood: Philippine Mahogany

To be used for rails, stiffeners, and corners.(as straight grained as you can get.)

..... 1" x 6" x 12 ft.....	1 Board
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Softwoods (to hold sides apart at beam):

..... 2"x 2"x 8 ft.....	1 Board
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Stainless Screws:

..... #6 x 5/8".....	Box of 100
..... #6 x 1".....	Box of 100
..... #6 x 1 ¼".....	Box of 100
..... #8 x 2".....	8 for oarlock rails
..... #10 x ¾".....	8 for oarlock sockets

Stainless ¼" U-Bolt w/nuts, washers, and backing plate.....	One set
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Pan Head Bolts, ¼" x ¾", with nuts and (2X) washers:.....	100 sets
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Steel Tie Wire:.....	Roll
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Gorilla Glue:.....	12oz bottle
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Plastic Sheeting: (epoxy protection).....	10ft x 10ft
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Stain (water base).....	½ pint
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Used Toothbrushes.....	8-10 (or more)
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Sand Paper: (60 grit, 80 grit, 100 grit, 150 grit).....	5 sheets each
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Epoxy Materials From:

www.systemthree.com or www.duckworksmagazine.com

..... 2" and 3" tape – 9oz. From System Three (cheaper with 50yd roll)..	25/50 yards
..... (OR) 3" and 4" tape – 4oz. From Duckworks.....	25/50 yards
..... 60"- 4oz or 6oz fiberglass cloth.....	3 yards
..... Silvertip Resin.....	1/2 Gallon
..... Silvertip Hardener (fast-below 80°; slow-over 80°).....	Quart
..... Quickfair 24oz kit.....	1
..... EZ-Fillet 1.5 quart kit.....	1
..... 1oz graduated plastic cups 25 pk.....	1
..... 4.5oz grad plastic cups 20 pk.....	1
..... Mixing sticks 25 pk.....	1
..... Squeegee: plastic (3" and 5"), rubber (2" and 5").....	1 each

Paint Materials: (very high quality, but optional)

..... WR-155 primer.....	1 quart
..... WR-LPU two part linear polyurethane(outside only).....	1 quart
..... (OR) Marine Enamel paint(inside and outside).....	2 quarts
..... Marine Grade Varnish (for bright work).....	1 quart
..... 14oz grad paper cups 12 pk.....	1
..... 9" foam rollers {cut into 3" sections for paint and epoxy (cheap)}... 4	
..... 2" brush (good quality for tipping and varnish work).....	1
..... 1" masking tape ("blue").....	1 roll

Designers Comments and the Small Print

Study the plans and read the instructions completely before you begin.

Boating is a fun sport, but it is also a potentially dangerous one. Unless you are a fish; when you are in the water, you have to know how to swim. The only way around this dilemma is to have on a PFD that is sized for your weight and fits you well. Are you or your loved one's life worth more than the \$5.00 WalMart special? Get a good quality PFD that fits and has enough capacity for the wearers weight. A good quality PFD lasts a long, long time if you take care of it. They last longer if you wear them and don't sit on them. Have you ever tried to put on a PFD while you are in the water; and that maybe other people are in trouble and need help too? Are you conscious, and how long will it be until you are rescued? It's cool to wear a PFD, I always do.

Imagine the standard warnings about alcohol and boating here, as well as other dangerous behavior. Don't become a segment on America's Funniest Home Videos, or a story and photo in the Obituary section of your local paper.

Observe the weight limits for this design on the first page. They were calculated from U.S. Coast Guard regulations on small boat design. Just because you can carry a lot of weight, doesn't mean you should. Make sure you limit the horsepower on any outboard motor you use to the 2hp limit listed. Build a hydroplane if you want to go faster.

The lines and measurements for the basic hull; bottom, side, and end panels are correct to my knowledge from building the boat myself. If you think you have found a discrepancy; write, call or e-mail me thru the contact information supplied in the building package. I will recheck the plans and get back to you. If you have a question about how something goes together, contact me and I will see what I can do to explain it better and change the plan and building instructions to be clearer.

The one thing you should remember is that your boat may be slightly different from any other boat of the same design. This is not a "one design class" boat, that will have exact dimensions required for the hull and it's components. With a stitch and glue design, constructed without a building frame, widths and heights will vary. How far you open the bottom panels, how wide you pull the side panels apart at the beam, how well you square and level the boat, will affect all the interior dimensions. Try to get the boat as close to the design perimeters as you can. Even then you will need to measure all the "edge lengths" where any bulkheads, seats, and such are located and make adjustments for those parts to the real world size of your boat. Do not take the length measurements in the plans as carved in stone. Measure twice and cut once. Follow the instructions and think about what you are doing. If you have some large sheets of cardboard; use them as mock ups and templates before you mark and cut the plywood. Measure, Measure, Measure, before you cut. Building a boat is an art and like art, each boat is and will be different from the next. This will require some diligence on your part to maintain a certain level of quality. If in doubt, ask.

The fit, quality, and finish are up to you. You can make it yacht bristol or fishing easy. It's up to you, and you alone to decide what you want. The boat doesn't care, it just wants to be out in the water with you. Enjoy.

Warren

Work Platform

1. One of the first things to do is to make sure that you have a good, solid work bench/table to keep the plywood on while you store it, scarf it, and to do the lofting of the boats lines. You will also need the bench/table to assemble the hull pieces on, to keep it off the floor to make the project easier and to save your back. It also acts as a stable platform to tie down the boat to. It holds the sections in place after you have wired up the hull and "squared and leveled" it up before epoxing the seams. I have found that three sawhorses and four 2" x 6" by "X" boards (X is the length of the boat you are making) makes a good solid work platform. You can either make the sawhorses completely yourself, or buy the fittings that use 2 x 4's for legs and 2 by 6's for the cross members. Go for the good, heavy duty, metal sawhorse fittings. The cheap metal and plastic ones are not up to the task. You will need twelve 2" x 4" legs for your platform, and three 2" x 6" x 4ft cross supports.
2. A 30" working height is about right, so assemble one of the sawhorses and estimate how long the legs need to be and cut them all the same length. The final height doesn't have to be exact, but all the legs need to be the same. You don't have to angle the "feet" to match the floor. They can rest on their edges just fine. Set up the platform with working room on all sides. Place the outside sawhorses about a foot from the ends and the last one in the middle. By setting them in, you keep from tripping over the outside legs as you walk around the platform. Evenly space the lengthways boards on the sawhorses, with the outside ones set in at least 1" from the edges of the cross supports. That way you have room for the clamps you will be using around the perimeter of the plywood sheets to hold them together. Square everything up and screw the 2 x 6's to the sawhorses and check the platform with a level. Shim the legs as needed, but +/- 1/8" is close enough. If you need to scarf plywood together, level the platform as close as you can; or it will be very difficult to get a good, straight joint. To build a different sized boat, you only need longer or shorter 2 x 6's. Now that you have your platform assembled, its time to lay the plywood on it. Hopefully you have not just leaned it up against the wall for storage. The plywood probably has a few curves in it now. If the boat is based on 8 foot sheets of plywood, not to worry. But if you are building a longer boat and have to scarf two sheets together to get 10 or 12 feet, the curves make things a little harder. Its best to buy your plywood after you have built the platform, so you have a good flat surface to store it on until you are ready to begin. Place weights on the plywood to keep it from warping.

Note: Because of the heavy curveature of this hull, you must use okume plywood. It is the only plywood that will bend enough to not "snap" along the grain when you wire up the hull.

Lofting the Lines

- Note: Study the layout, and the mark up sheets, as you read these instructions and especially while doing the actual lofting. Make sure you understand the instructions fully before lofting and cutting out the marked sections. It helps to make the paper and cardboard scale model supplied with the plans. This will give you a 3D reference for the actual construction and let you know where things can go wrong. Once you have made the model, you have made the boat.*
1. Take two of the sheets and place the "good" sides together and the "scarfed" joints (if the design calls for them) on the same end. With high quality, sliced hardwood, 1088 marine grade panels it

will be hard to tell which is the good side. I use the faces that don't have the identifying "stamps" on them as the good sides. Line them up on the platform and make sure the plywood edges are flush on all sides. Now clamp them together with a couple clamps on the ends and on the sides. This is a good project to justify buying more clamps. Try to use clamps with "wide" faces so you don't mar the wood. Use pieces of thin scrap to protect the wood if there is a chance the clamps you have will mar the surface. You can estimate from the plans where not to place the clamps while doing the lofting of the lines. You will be moving them around several times as you cut out the panel pairs after lofting, but always make sure that you have **two clamps attached** at all times as you shuffle the clamps around. This keeps the "matched" pieces from shifting while you are cutting them out and "trimming the edges to the lines". **Be careful here.**

2. You now have two sheets, good faces together, scarfed joints (if the design calls for them) on the same end and clamped around the flush edges. Now determine from the plans which side the layout starts from and which is top, bottom, left and right. Start with the left hand edge as the stern and hook your tape measure over the end and pull it along the plywood, just short of the right hand edge before it falls off. Lock the tape with its button so it's sitting just short of the edge of the plywood. Start placing a mark for the vertical lines at one foot intervals from left to right. There will be several of them depending on the boat you are building. Move the tape to the opposite side and mark it the same way. Line up a straight edge on the two marks across from each other and draw a line. Use a good straight edge and clamp the ends if you need to, to keep it on the marks. This needs to be accurate. Continue with the rest of the matching pairs of marks. You will have the number of station lines shown on the plans when you are done.

The Hull Panels

1. The side sections are based on the outside; long edge of the plywood. Follow the plans to see this relationship. There is a plan page showing the relationship of which panels are marked on each of the plywood sheets. The plans will also show which is the bow and stern and which end and corner to start the measurements from. On my designs, the length of the boat is determined by the length of the top side panel. A "12 foot" boat will be marked up so a full sheet and one half of a full sheet, can be scarfed together. For a $\frac{1}{4}$ " (6mm) hull thickness plywood boat with a 12:1, 3" scarf, the full sheet remains the same, but the short sheet losses 3". So on a 12 foot (approximate) design the joined panels are actually 11ft 9 inches overall, and no odd or extra sheets have to be purchased. Longer designs have the scarfs placed in low load areas and will try to reduce wastage of panel material. So the longest layout is always going to be on the top panels and the measurements start at the lefthand end.
2. **Keep the panels clamped together!** Follow the plans and mark off the one foot (and listed exceptions) station lines. Then measure from either a noted base line on the drawings, or the plywood's "top" edge, using the values given on the lofting offsets plan sheet. Measure off and mark on the plywood, any special details given to determine corner points that do not fall on the one foot station lines.
3. Now hammer in lightly, 6P finishing nails at the lofting marks you measured off from the edge/base line to the station lines and the corner points. Use a straight edge to pencil in the straight bow and stern cut lines after you have marked and nailed the corner points.
4. One trick to see if everything went well is to run a string around the outline of nails and check this visual reference with the plans. If it doesn't look right, check you work again. The next step is to connect the row of nails in a smooth flowing curve that will maintain the arc between them

and not become a connected series of short straight lines. This is where you will need a long, flexible batten. You want something that is at least one to two feet longer than the boat you are building. A section of small diameter plastic pipe works well for this. You can also use a length of 1/2" x 3/4" wood molding. On anything over 12 feet, you may have to scarf shorter pieces together to get a batten long enough for that design. Use the "scarfed end of the batten towards the stern, or where the lines of the assembled hull are straighter. **You can jump ahead and read the section on "Fitting the Rails" for another source of batten material.** Try to find material that is fairly straight, same with the pipe, and keep them stored somewhere they will be fully supported when not being used; remain straight and do not take on a warp.

5. Lay the batten on the plywood and bend it to the outline shape of the nails and on the panels "top side", so the batten bends in towards the ends and against the nails. Use some small clamps to hold the batten to the nails and start in the middle and work towards the ends. If a nail comes out, drive it in a little deeper. You want a fair, even line from bow to stern. You may need to put a small clamp on the batten at each of the nails. Sight down the curve from both ends and from any other vantage point to make sure the curve is smooth and fair. If it seems off to you, remove a couple of the clamps holding the batten to the nails. See if this changes the curve for the better or worse. Slight errors in measuring the offsets will show up here. On designs where you are cutting two panels at once, the error will be cut into both pieces if you don't change it now.
6. Take your time here and if you have to move a nail in or out at a station line, do it until you are happy. If the curve looks good to you and the batten is not touching at a couple of the nails, don't worry about it. Move any nails that are not touching or place a weight on the batten to hold in place until you mark the line. You should now have a "fair" line from bow to stern. Place your pencil along the batten and mark lightly, this curving line between the nails. Remove the batten and pull the nails to check the pencil line. If it is off somewhere; adjust the nails in that area, re-clamp the batten and remark. Repeat this procedure until the lines are fair and smooth from bow to stern.

Note: Keep the plywood sheets, and all cut panel pairs, clamped together until all trimming, edging, and drilling are finished!

7. Measure the "arc edge length" of a lofted panel before you remove the brad nails for the last time. This is to make sure that "it's" mating edge on the next panel is within 1/4" of it's length. Make any changes at one, or both of the mating "bow" corners, to get the arc edge length difference to less than 1/4".

The Stern Panel

1. **This panel should be marked and cut after the eight hull panels are made and wired together as a unit.** Any changes or adjustments to the stern panel dimensions will be made at that time.
2. Measure the "edge lengths" at the ends of the eight hull panels. Check these with the "edge lengths" of the matching edges of the stern panel after you have laid them out, but before you start sawing. Make any adjustments to the stern panel now before it is cut. Make cardboard mock ups if you have the material.

Cutting out the Panels

1. One of the nice things about the working platform shown at the beginning of these directions, are the open areas that allow you to saw in the middle of it. Just make sure that you don't saw through the cross members. You can slide the **two clamped sheets** around on it's surface as needs be. You can then trim the ends and make the long cuts in the middle of the sheets through the gaps. Its nice to have some "sand bags" or weights, (*protect the surface with cardboard or old carpet*) to hold down the plywood when you are cutting along the inner lines. It keeps the plywood from moving up and down as you saw and keeps from binding the blade.
2. Now you pick your saw of choice. Some use a **Skill Saw**, set deep enough to just cut through the two sheets. Make sure you cut outside the lines with enough clearance so as not to hit them. You will sand, rasp, or plane to the lines latter no matter which method you use. If you use a **Saber Saw**, the same applies. Make sure to use a blade recommended for ripping and crosscutting plywood. Or you may do the job by hand. It takes me about 2 hours to cut and trim the panels to the lines for a four panel eight foot boat. I had switched to the Japanese style pull saw, but have come back to my trusty 26" Nickelson with 10 teeth/inch. It can follow the curves as I cut, and minimize the time spent trimming to the lines. It reduces the chance of the (*@#%\$*) and (\$\$\$\$\$) moment.

Note: Separate the hull panels from the excess main plywood sheet by cutting along the keel line first. Make sure you don't cut through the area reserved for the stern panel. Remember that you only have to use one sheet for the stern panel. Transfer "baselines" to the flip side of each panel pair set after you have cut them out and they are still clamped together. You will then have the matching line pairs on the inside after the hull is assembled.

3. You will be doing a version of the "clamp dance" as you cut out the panels. Make sure that there are always **two clamps holding**, at all times, as you move the other clamps around. You can also use a series of #6 x 1/2" screws around the edges, 3/8" **inside** the cut lines, to hold the plywood together while cutting out the panels. They can be removed and the holes drilled out later and be used as wiring locations for the "stitch" part of the process. Continue cutting out the panels.

NOTE: From now on, anytime you are working on/with, the edges of the plywood, remember to go with the grain as you work. If you do not, you will invariably pull up the wood of the thin surface veneer and it will get caught or broken off in the tool you are using, or most likely stuck in YOU!

4. Clamp the (still clamped or screwed together) newly cutout panel set so their edge hangs over the side of the work platform. Use a rasp, sandpaper, or low angle block plane to smooth the edges to the lofted lines. **Work with the grain and take your time.**
5. With all the edges of a panel pair set smoothed to the lines and still clamped together, its time to put a small bevel to the "outside" edges. The 1/8" x 1/8" bevels stop at the center layer of the plywood sheet. *Study the drawing in the plans section.* All the edges, **except the upper "shear line" of the sides, and the top of the stern panel** get the bevels. The bevels help the edges match up better and provide a "V" groove for the epoxy wood fillets to penetrate.

Marking and Drilling the Stitch Holes

1. Now we will mark the perimeter of the panel sections for drilling the stitch holes. For $\frac{1}{4}$ " (6mm) panels, this will be $\frac{3}{8}$ " from the edges. You will mark only the edges that have been "beveled". The top edges of the boat are not marked or drilled. The reason for using $\frac{3}{8}$ " is the rule of "the thickness of the plywood plus $\frac{1}{8}$ ". Thicker plywood will have a wider offset to the scribed line. Use what ever you have for making this mark. The line will go around all of the edges, of all of the panels; except the upper edge of the stern and top panels. Also mark the side edges of the stern panel. **You can also add 1" and 1 $\frac{1}{2}$ " lines to help line up the 2" and 3" tapes.**
2. The size of drill you use will depend on the size and type of wire you are using. Match the drill to the wire size and go $\frac{1}{32}$ " over. Some people use 12 gage copper house wire stripped of insulation. Others use 16 gage steel baling wire. I have used both and usually go with the 16 gage steel. It's cheap and you don't have to dispose of the insulation.
3. You will only pre-drill **on all sides**, the still clamped pair of keel panels. Make sure the panels are still lined up on all sides and clamped tight. At about 1" from the bow corner of the keel edge set back line, drill the first hole. Drill holes at all the spots where the 1 foot gridlines cross the $\frac{3}{8}$ " set back line. This will give you a reference location from which to make later measurements. Drill at a 3" spacing along the set back line for the first 1 $\frac{1}{2}$ feet from the bow, and then halfway between the gridlines in the middle. On the top edge of the middle two hull panels, repeat the drill pattern, **but do not drill the bottom edge** of these panels. The reason is that when the side panels are being bent/curved while you wire them to the lower panel, the relationship of the "edge length" changes. You will see this as you wire the side panels together, by the offset of the grid line marks between the bottom and side panels. The chine edge of the bottom panel is the same length as the chine edge of the first side panel, but as you look at the draw lines you will see that when the panels are joined there is an offset from the lofted marks to the wired positions. So do not pre-drill the bottom side of the upper three hull panels. Some of the holes in the other panels will be drilled at an "offset" to reduce or induce end to end edge movement between the panels.
4. All the clamps may now be removed and the panels separated. This is a good time to sand off all the pencil marks and raised wood fibers along the edges from the sawing and drilling.
5. **Remember to go with the grain of the wood as you work on the edges!** This relationship changes direction between the top curve on the side panels and the curves on the bottom panels. The bottom panel edges are worked "center out", and the top edge of the side panels are worked "ends to center". If using sand paper by hand, never let a paper edge lay flat. Always roll the paper up on the edge of a sanding block and sand at 90° to the edge. I would never recommend using a power sander on or near the plywood edges yet.

Wiring it all Together

1. Start with the two bottom sections and place the sides you determined as "inside", face to face. **All the beveled edges will now be on the inside.** Cut about 50 lengths of tie wire around 4" long. This is long enough to do the job and still be easy to work with. It helps to wear a light weight pair of leather gloves while wiring the panels together. Line up the keel line edges and start wiring from the stern. Insert the first wire, center it and pull both sides back and put a twist in them. Do this all the way to the bow. Now take a medium sized phillips screwdriver, one

with a shaft about 3/16" thick and stick it in the loop of a wire. Take your linemen's pliers and twist the wire down to where it's just snug on the shaft of the screwdriver. Pull out the screwdriver and continue on with the rest of the wires. This procedure will ensure that there is enough slack in the wire so that the two panels can be pulled apart without ripping the wires out of the wood. Now set the wired panels on the keel edge in the middle gap (if you used my platform design) on the platform and slowly pull the chine edges apart. There will be some screeches and groans as the wire slides through the holes. Just use a slow steady force and the panels will part and the bottom panels will take on their shape. To hold the panels open, place a piece of scrap wood about 2 ft long, going from side to side, above one of the tie wires near the 3 ft grid line and use a wire or piece of cord, through the loop of that keel wire, and over the scrap, to pull it down and hold it open, but not too much. The final shaping will come after all the panels are wired together. Now stand back and have a "wow" moment. Looks great doesn't it.

NOTE: You will notice after about the first 1ft to 1 ½ ft of joining the keel or side panels, that the butting edges are not staying even. Some designers say to use a hammer and tap them back into position. I found a better way. At about 6" along the seam from where you started at the bow, take an electric drill with a ¼" bit and drill a hole in the middle of the seam, between a set of wires. Have on hand about 100, (¼" x ¾") pan head bolts, nuts and washers. Install the bolt and a washer from the inside and put on a washer and nut on the outside. Tap the panels back into alignment and snug up the nut, but not tight. You will do this about every foot, and closer at the harder curves. Install as many as it takes to keep the edges aligned, but no closer together than 6". On the stern panel seams, you will install a bolt in each of the corners where 3 panels join, and along the bow seam where 4 corners come together. *See the diagram in the plans section.*

2. Next is the first side panel and it doesn't matter which one you pick, and start wiring from the stern. Now is when you may need a helper. Someone needs to hold up the other end, level with the end you are working on and at an angle that keeps the holes being wired one over the other. As you move along from hole to hole, the helper is pulling the side panel in, and towards the bottom. Line up the lower stern end of the side panel with the bottom panel. Drill a hole to match on the 3/8" line, on the side panel that you have already marked earlier. Make sure that the holes are in line. Drill the hole and wire them together with a "snug" twist. I have found that if you bend the wire over a finger and form a long "U" shape it will be easier to start the wire in the holes. You do not want the panels to start "walking apart" as you drill and wire toward the bow. By that I mean, do not let the panels lose their alignment and have the side panel come up short or extend beyond its mate at the bow. Make sure the panel corners are lined up evenly at the start and maintain that relationship to the bow. Once you have installed the first bolt, the panels will not shift even if you want them to. If you have to reposition a panel, you will have to redo any bolt holes you have already drilled. Get it right from the start.
3. Continue on drilling and wiring to the bow and adding pan head bolts along the way. Repeat the process on the other side panel. Check that the bow ends are matched up between all the panels. Loosen or tighten wires and bolts to "make it so" Everything should now line up fairly well. An 1/8" off here and there on the ends can be lived with, but make sure the panel seam edges are held flush by the bolts, washers and nuts. If there are small gaps at any of the edges or end seams, the fillet material and glass tape will fill the gaps and cover the errors. You will never notice it after the boat is built.

Laying out the Stern Panel

1. What you are doing now, is to make sure that the end "edge" lengths of the already wired up side panels, match the "edge" lengths of the stern panel on the plans. If there are no large "wedge shaped gaps" at the ends of the wired panels, then the dimensions for the stern panel on the plans will be correct. But, if the lofting and the saw cuts were off a little, then this is where you can fix it and still have a beautiful boat.
2. Laying out the panels. Make sure the grain runs horizontal (long direction) on the panel from side to side. Follow the dimensions in the plan sheets and layout the panel. Use the factory edge of the plywood sheet as the "top" edge of the stern panel. Mark off the width of the panel and the centerline too. Use a rafters square to mark the centerline and measure down on the centerline the marked depth of the panel. Use the rafter square and the plans measurements to determine the "chine" corners and measure down to these points and mark. Measure your pencil layouts on the plywood and compare these drawn edge lengths with the real edge lengths of the wired up hull. If you are within 1/8" (+ or -), then that's good enough, the epoxy fillets and glass tape will fill the gaps and cover it up. If things are not equal, redraw the cut lines on the plywood to match the real edge lengths on the wired up hull. Make sure the opposite side edges are equal to each other, and their matches on the wired hull. Reverse the stern panel to check for symmetry.
3. **Make any changes to the stern panel only.** Bevel the inside edge and mark the 3/8" drill lines on the bottom and side edges only, not the top edge. Drill and wire in the stern panel. Drill the corner wires 1" from the top edge, and 1" in from each corner point in the stern panel. Do the same for the hull panels. Make sure the tops of all the panels match up. No more that 1/8" off at the upper corners. Repeat the technique of using the 1/4" bolts, washers and nuts. With one where three corners meet; at the junction of the two hull panels and one of the corner points of the stern panel.

Note: Do everything you can now to make sure the upper panel edges are as close to flush with each other as possible. It is very important that this is so when you begin to fit the corners and gunnel rails. Otherwise you will be spending a lot of time reshaping the upper plywood edges to get everything square and the lines fair and smooth. If you need to, cut the stern panel so the top is a little higher than the side panels. You can trim after the rails are installed. On hull #1, using the plans measurements, the stern panel was 1/4" higher than the two side panels. I am leaving it that way. You can trim it later after the corners and rails are installed.

4. You may also need to use **1" fender washers** when bolting the seam edges at the bow and stern, because the gaps may be bigger and the larger washers spread the load farther around. Fear not, as any gaps there will be filled with wood filled epoxy and have at least 4 layers of fiberglass over them.

Squaring up the Hull

1. In the plans there is one 2x2's called out that is used to set and hold the beam measurements while the hull is being epoxied together. The plans call out where it will be mounted in relation to the "sawn notches" you made in the upper edge of the top panels. The 2x2 will be used to set the maximum width of the boat. Cut a 2"x2" piece of wood to the length listed in the plans and mark on one side "Top". On the "bottom" side of the 2x2, and at each end, measure in 5/8". Mark and cut off these two end wedges with a saw. The bevels you cut should match, or be

close to the taper of the side panels. **Do not worry about the fit**, you only want the "top" to be correct. Place the 2x2 so the "aft" side lines up on the marks you cut in the side panels, and **the top of the 2x2 is 1" below the upper edge of the plywood**. Put a sheet rock screw through the side and into the end of the 2x2. Go to the other side and either pull out the side panel to fit the 2x2 forward of the cut line, and screw it in place. You will later fill and finish the screw holes.

Note: Leave the 2x2 in place until all the rails have been installed, and the glue has cured, and the stainless screws have been driven in. Do not ever remove the 2x2 before the "inner rail" has been installed!

2. Now's the time to go around and check all the seams and make sure the edges line up flush. By using the "bolt" method, everything gets pulled together. If you have some places where it's still out of alignment, you can add another bolt. You will probably wind up having them about 4- 6" apart up front where the curves are more severe.
3. Before you give the wires their final snugging up, you need to square and level the hull panels. With all this work, and money, the last thing you need is a boat with a twist.
4. You will need some cord to tie the boat down to hold it in place while you get it squared up, and to keep it that way. The cords help to keep the boat level while you add the interior components, so do a good job of installing them. Recheck your knots occasionally to see if they are still tight.
5. Center the hull on the platform and cut some cord to hold down the stern corners and the 2x2 cross brace in the middle, and maybe some where on either side near the bow. It helps to have some bits of rolled up carpet to jam under the sides of the bottom panels to keep the hull from flopping around. Run a cord through the upper "wire" at one of the corners and down and around the ends of one of the sawhorse supports, or a fencing staple driven into the outer ends of the cross pieces. Tie a loop in the middle of the cord and run the other "bitter" end through the loop and loosely tie off. Do this at all six points. Run another cord through the upper wire in the stern "port" corner and then up to the bow, through the top bow wire and back to a loop in the cord. Do the same from the stern "starboard" corner and run a cord to the same bow wire, and loosely tie them off.
6. Start with the stern and place a level, a four footer if you have one; or place a board across the top of the stern panel and use a shorter level. Loosen or tighten both sterns cords as is needed to hold the stern section in a level position. Move the level to the middle and forward cross braces and repeat with their cords. Now take a tape measure and check the diagonal distance from the bow and stern corners and adjust each cord until you get the same measurement. Tighten one or loosen the other until this happens. Then go back and check the middle and forward cross braces, and stern panel for level again. Check all dimensions a couple of times until you are satisfied that everything is correct; the hull is level and square, and the cords are tight.

Gluing the Stitched Boat

Safety, Safety, Safety. Read all the manufacturers product instructions and warnings. Wear your disposable gloves, face masks and eye protection equipment. Throw them away if worn out, broken, or damaged.

The Jump Stitch

1. Now you get to play with the "sticky" stuff. The first thing you will do is to "jump stitch" the seams of your straight, true, and flush edged (seams) boat, using a wood filled epoxy mixture. You can also use System Three's GelMagic®; the 2:1 non-saging epoxy that "mixes" in the nozzle and is applied with a calking gun. For first time builders the slight extra cost of GelMagic in the uTAH tube is more than offset by the ease of use. I also like to use a wood filled fillet mixture like System Three's EZ-Fillet® if I am out of GelMagic. EZ-Fillet is premixed into 2:1 A&B parts, so you don't waste limited "pot life" mixing in all the added stuff of some secret formula you found in a book or magazine to make fillet material.

Mix according to the manufacturers directions. The first time I mixed up a batch, I made way too much and wasted a lot of time trying to use a putty knife to get the mix into the seams. That hardened cup of fillet material sits on a shelf next to the cup with the hockey puck of "straight" epoxy and "fast" hardener I didn't use quickly enough. Mix in small batches if you use the wood filled epoxy systems.

Note: I have found that the best brush for working with epoxy is an old, used "toothbrush". Nothing comes close to it's ease of use and ability to spread straight epoxy on whatever you are doing. It picks up the epoxy without dripping it all over your work and spreads it evenly when you want to. When taping seams, the toothbrush is easy on the fiberglass and has a squeegee on the flip side to move the excess to dry areas of tape. Check out the "dollar stores"; you can get 6 for a buck sometimes!

Note: Cover the heads of all the bolts with a bit of masking tape to keep the epoxy and fillet material out of the "slots", or you just made a lot of extra work for yourself.

2. Mix up a small batch of "straight" epoxy and paint the exposed bevels of the hull seams. Put some masking tape on the outside of any large seam gaps so you don't epoxy your floor. The epoxy pre-soaks the edges of the plywood to keep them from sucking out the juices from the jump stitch fillet material, and then creating a weakened "starved joint". This soaking step doesn't have to cure before going on.

Note: I have found that a 3oz mix of fillet material gives me control of the process with enough volume to make the work go smoothly, but limiting the amount I can possibly waste if things go wrong. Before I mix the epoxy I take a plastic bag, one of the "rip off the roll" type, saved from grocery shopping. Make sure it's not the type with "pleats" in the corners; old Zip Locks® work too. I have an old tin can that peaches came in, about 4x5 inches. I stick a finger in the corner of a bag and push the corner to the bottom/middle of the can and drape the excess around the outside of the can. Sometimes I put a rubber band around the can to hold the bag in place. Mix up the wood fillet epoxy, per manufacturers directions. Now pore and scoop the mixture into the middle of the bag. Remove the rubber band and lift the bag out of the can by the excess around the outside and twist it closed. You can hold the twist, use a bag tie, or tie a knot. I like to put in a knot close to the material. You now have the mixture in the corner of the bag. You are going to use this like frosting a cake. Cut off the corner tip to the size you want (start small at first) and squeeze along the seam where you need it.

3. The "jump stitch" is like it says. Go along the seams and squeeze out a 2" to 3" long fillet epoxy stitch, skip 6 to 8 inches (or closer) and make another stitch. Do all the seams, but not the top 1" of the corner seams. Make sure the masking tape on the outside still covers the large gaps in the

seams and corners. Try not to get any on the wires or cover up the bolts. It doesn't take a lot, just fill the bevel with a ¼" bead and go on. Try not to dribble everywhere and try not to lean on the sides of the boat and knock it out of alignment. Its handy to lay some old newspaper on the bottom of the boat to catch spills, dribbles, and to protect the finish as you work. **No spills, no sanding.** By keeping the epoxy in small volumes, you will increase the working time and not have to be rushed and make a mess of it. After you have emptied the bag, just toss it in the trash, epoxy supplies are a use once item. Now take a popsicle stick or the end of your **gloved** finger and push the fillet material into the bevel. Keep your stick or **gloved** finger clean with a cloth. Great way to finally use those ratty old T-shirts your wife has been nagging you to throw away. Scrape up the lumps along the edges with a putty knife and clean up. Let the boat sit overnight for the epoxy to cure.

SIDE BAR: You may want to skip ahead here to the instructions on "Cutting Corners" in the "Fitting out the Interior" section. It will be easier to cut and fit the corner pieces at this time and install them after you have taped the seams.

Fillets and Taping the Seams

Note: This is a construction sequence that is going to take some time to do right, and to keep from wasting a lot of time sanding between coats if it can't be done in order. If there is more than a couple of days between applications with System Three Silvertip Epoxy, the joints will have to be sanded for the next layer of epoxy to stick. Try to do this starting on a saturday morning. If you have a *trusted friend (no beer please)* to help mix and apply the epoxy, and to help in the taping, things will go smoother and hopefully quicker. This is critical! You have to make sure the epoxy is measured and mixed correctly or all is wasted. Money, money, money. Try to fillet the seams and wet out the tapes as one operation.

1. Now is the moment of truth. Bullfight music please. The cutting of the wires. Before you do, dig a fingernail into a stitch fillet and see if it leaves a dent. It shouldn't! If it does, let it set for another day and then use the end of a small screwdriver to test again. It should be hard as rock. If the shop temperature is 60 degrees or higher, there should be no soft fillet material on the boat after a 24 hour cure. I also like to check the mixing cups and the plastic bags for cure hardness too. I can't stress the importance of following the manufacturers instructions. Epoxy is not like fiberglass resin where more or less hardener only changes the cure time. Epoxy is like boys and girls at a dance where every boy has a girl on each arm. Two girls(part A) and one boy(part B), everything is good. You add in an extra boy or short the mix a boy and there's hell to pay. Everything is sticky and has to be scrapped, ground, sanded, dusty, sweaty, worked off! **Mix Right, OR IT WILL NEVER CURE!**
2. Get your toes wet by removing the nuts, washers, and bolts first. Save them for your next boat or sell to your neighbor's when they see your finished creation. By removing the bolts first, you can see what happens to the high stressed places like the panel corners, and in the highly stressed curved areas in the bow. They shouldn't move. Start removing the wires in the less stressed places along the straighter seams, then finally the corners, and then the bow area last. I like to leave the top wires in the corners just for insurance until I get ready to fillet and tape those seams. The stitch fillets should be more than able to hold it all together after they have cured. If you made enough of them!

Note: Check the boat again for level and square. Leave the boat tied down! Take a 2x2 or some other

scrap (around 38 inches) and clamp it along the top edge of the stern panel. This will insure that it stays straight, doesn't curve, or distort from the curing fillets and tape. Leave it on until you mount the rails. Even then keep the stern clamped with extra support while the glue/epoxy sets on the rails, and until the stern seat is epoxied in place. Keep an eye on it, they seem to want to take on a cure.

3. Make up some rounded plastic or wooden squeegees to shape the fillet material. You want the fillet depth to be the same as the plywood's thickness, and the fillet shoulders to be 2 times the thickness. Check your trash for plastic lids that may work for this. The vertical corner seams will take a smaller diameter lid. On the "flatter" seams up high and near the bow, you will have to make a squeegee with a "reversed/inward" arc along the edge to give the fillet material a little more depth there. Make the arc in the squeegee about 1" wide and 1/8" deep for the fillet to stand "proud".
4. Mix up some straight epoxy and paint the seams 2" on either side of the joint. Let it soak in for a few minutes.
5. Start mixing up the first batch of wood fillet material. Use the bag method, but cut a bigger hole, since you will be making a bigger cross section of fillet material. Use the straight squeegee, plastic lid, or "arched" squeegee, to move and shape the fillet material along the seams. Add more material from the bag as needed, while trying not to move too much material at one time and creating excessive edges along the sides of the squeegee that may slump off into your epoxy free bottom. Scrape off all of the excess material with a putty knife that was "windrowed" outside the fillet area and reuse somewhere else.

Note: If it is over 80 degrees in the workspace you have two choices.

1. Do a complete process of applying the fillet, then the 2" and 3" tape on one seam before going on to the next seam. If you have time, try to interweave the tapes at the corners. Read the manufacturers instructions on the maximum and minimum temperatures the fillet material and straight epoxy can be used in. Be careful when the temperatures are high, as things happen fast, fast, fast.
2. Just do the filleting of the seams and come back later and apply the glass tapes.

Works both way, but you aren't rushed if you take path #2. For first time boat builders and high room temperatures, I would recommend path #2.

6. Return to where you began the fillets, and start laying down the 2" fiberglass tape. The straight epoxy you painted earlier and the fillet material should be in the "green" stage now. Semi-firm, but still tacky.

Note: If the workspace is warm to hot and the fillets are firming up, mix up some straight epoxy and paint the fillet material lightly before laying the tape. This helps keep the tape in place while you wet it out.

7. Start at one of the hull corners, center the tape and start rolling it out, lightly smoothing it into the fillet material with a brush or your gloved fingers, but be careful not to squish the fillets out of shape. Mix up straight epoxy and "wet out" the fiberglass tape until it turns "clear" and you can see through it. Brush the excess straight epoxy along the tape and to the sides getting rid of any

trapped air bubbles. Paint epoxy an extra 1" beyond the 2" tape edges, to prep the plywood for applying the 3" tape later. Do this lightly so you don't squish the fillet and put kinks in the tape. Trim the tape ends at the corners so you don't wind up with a thick wedge of fiberglass tape. Go to the seam ends with the bottom tape. Trim the ends of the side seam tapes so they butt up in the middle and lay flat on top of the bottom tape.

8. This hull has some strong curves near the bow, so you will need to make "darts" (cuts halfway through the tape) to the bottom edge of the tape and overlap the rough edges and wet out. The two lower seams should have about 4 "darts" made in them starting at the 4 foot "station cut mark", and about 6" to 8" apart for the next 3 darts as the tape curves toward the bow.

Note: If your gloves start sticking to everything, change them. Change them often anyway to keep from fingerprinting hull surfaces and everything you touch.

9. If your workspace is cool enough, you should be able to complete laying all the 2" tape before everything starts stiffening up. Repeat the process with the 3" tape as described before. If it's hot in your workspace, mix small batches of epoxy and lay the 2" and 3" tapes one after the other on the same seam. Cut the tapes you are working on to the correct length, but stop epoxing 6" from a corner. Now start laying from the bottom up, one of the 2" vertical corner tapes. Interweave this tape with the the end of all the waiting 2"tape and the end of the next 2" tape heading away from the corner. Keep laying, weaving and wetting out, the corner tapes as you progress around the hull. You can do the whole process this way if you like, but there's just a lot going on if you do. If your workspace is around 60-75 degrees, do the filleting, then the 2" tape, then the 3" tape.

Note: Let the boat cure for 1-2 days before you continue.

10. With the hull still tied down and level, it's a good time to clean up the inside of the hull before you continue. Trim to the upper edges of the bow/stern corners, the protruding glass tape. Sand all the spots where you dripped fillet material and excess globs of epoxy. Grind out any areas in the tape where an air bubble formed or the tape itself has lifted off the plywood. Mix up some epoxy and tape/fill them in. You will also notice that the "selvage", the hem that keeps the edges of the fiberglass tape from unraveling, is standing "proud". Take a grinder, rasp, or what ever you have and remove the "selvage", but do not rip up the surrounding wood or tape while you do it. I have found that by holding a slightly bent hacksaw blade, I can pull the teeth along the selvage and remove it without damaging the tape or the wood. A Dremel ® with a small grinding attachment would be perfect for this. Depending on the final level of finish you want, you may not care if it's removed or not. It does look better if you do though!

Note: Take a rag and pull it along the cured, taped seams to check for "sharp fangs and nasty things" that may cause a trip to the medicine cabinet later.

Adding the Sheerline Components

Cutting Corners

1. This isn't where you do it, as these parts take time to measure, mark, cut, and fit. If you have an adjustable angle measuring tool, now is a good time to get it out. If not, buy one or make one out of some scrap hardwood. You will be using this tool a lot while measuring and fitting the corners.

2. What kind of wood should you use? You can make them out of the same material as the gunnels or of a contrasting colored wood. They should be a "hardwood" species for strength and durability.
3. Which corner type will you use? I have made them out of $\frac{3}{4}$ " thick stock, but find that there are problems with this thickness. The lower edges don't match up with the lower edges of the rails unless you cut them out of thicker stock. I have also found that the $\frac{3}{4}$ " material poses problems on top too, when shaping the inside/outside rails to blend into the corners and plywood edges. A lot of hand work is involved to make for a smooth, flowing transition. If you can find some 1" or 1 $\frac{1}{4}$ " thick material, some of the fitting problems will go away. An alternative is to epoxy some of the scrap 1/4" plywood you will have generated to the bottom of the corner blocks before or after you have cut them out. Then have the corner blocks standing proud by 1/4" when installed. Then shape them during the finishing of the rails.
4. You can make them as big, and fancy, and with as much scroll work, carvings, and whalebone inlays as you wish.

Note: If you add the "thicker" corner blocks; set them 1/4" above the tops of the side panels where they meet the stern panel, and NOT to the top of the stern panel. Install all the outside rails "even with" the top of the side panels. The spacer blocks are set even with the tops of the side panels. The inside rails are set even with the spacer blocks. The rails are then shaped to, and with, the corner and bow blocks. Use your eyes to do the final shaping.

Cutting the Corners

Read this Section Completely before Cutting the Wood.
You may want to do this with scrap wood first.

1. You have at least **Five Angles** to deal with, and the pieces are not that big in the standard version. This is a job for a table saw or some very fine hand saw work. Consider a stern corner. There is the horizontal angle where the side and stern panels come together. There is the side panel vertical angle which is different from the stern panel vertical angle. Then the forward edges need to be squared up to match the side rail "butt ends". When you have mastered this piece, the other side is the exact opposite. If you still have hair left when starting the bow corner, you will find those angles are completely different. That all depends if the hull is exactly symmetrical; if not, the two stern corners will be different. *See the details in the plans.*
2. Figure out what size or how fancy you want to make them. Read the section on rails and study the plan sheets before you start cutting wood for this step. The corner sizes will depend on the style and size of rail you use. A "spaced/raised" inner rail will require bigger blocks.
3. After you have cut out the two (have more stock on hand for whoops) blocks (or one longer block) of wood for your corners in the size and type of wood you want to use; mark the separate corner locations on the block. I place the marked blocks in their separate ends of the hull to keep from confusing which one I am working on at the moment. Each block set will have one matching angle to cut on one side only. It helps to mark on the blocks which side is "forward", to keep the orientation in your head. **See the plan details.** You may use a 3"x 6", a 4" x 8", or a size of your choice for the corner blocks. The blocks will be cut in half when the angle/bevel

cuts are finished. A 3x6 becomes two 3x3 blocks, one port and one starboard. Make sure to mark which is which and which side is what.

4. Take your "bevel gage" and measure the horizontal angle between the port side and transom panels near the top edges. You will have to do this on the outside of the hull since the fillets and glass keep the bevel gage from making an accurate inside corner measurement. Flip the "locked" bevel gage over and see if that angle matches the starboard side. It should be close, but a couple of degrees off from side to side is good enough. Transfer this angle to the block and mark it "port stern" and mark it on the "aft and left" edge of the block. Flip the bevel gage and mark "starboard stern" on the block on it's "aft and right" edge.

If you are not experienced with using power saws, do this all by hand! The pieces are small and difficult to hold.

5. Place a straight board (a 1x4 is fine) long enough to span the full width of the stern, to use as a temporary side for measuring the "stern panel" angle. Measure the angle between the bottom of the board and the stern panel. Use this angle to set the blade angle on your saw or mark the end of the block for hand sawing. Both corners use this same stern panel angle and can be cut in the "aft/long side" of the full length block in one pass.
6. **Look at the plan details while you read this section.** Now pick a corner to start with. Measure under the board again to one of the side panels. Do this within 1" of the corner to get the correct angle. Use this angle and check to see if it's the same or close to the other corner. Use this angle for setting the tilt to your table saw blade, or to mark the "beveled" edge of the block for hand sawing. If you are using a table saw, the horizontal angle between the side and stern panels and the vertical angle of the side panels can be made with one cut by setting the blade angle and the adjustable sliding miter gage to the combined measured angles. The blade is set to cut the vertical side angle bevel, and the miter gage is set to cut the horizontal side to stern panel angle. Simple, right? Make a test cut with some scrap, or a couple of passes outside the "final cut" line. The "other" side is the exact opposite, and will have to go through the table saw backwards. If you have a compound angle sliding miter saw this will be no problem, but watch your fingers.
7. You should now have a single block of wood with a horizontal angle cut and beveled edge, equal and opposite, in each end of the block. Now is the time to "square" the edge where the inner side rail butts up. You want to use the angle/bevel side of the block as the baseline for the 90° cut. Place a sample of the side rail material on the forward end of the block and mark how wide this is. Hold a combination square along the angle/bevel edge and at this mark. This is how much needs to be cut off. Mark and cut this 90° on both ends of the block. Cut this block in half for the port and starboard stern corner pieces. Look at the plan details while you read this section.
8. If this seems confusing, it can be. You have several angles coming together because of the shape of the boat and their relationship with each other.
9. The following is the "de-worded" version of the same instructions for the stern block. Follow with the plan drawings.
 - a. Cut the block to the size you want. 3x6, 4x8, etc.
 - b. Measure the vertical angle of the stern panel, same for both corner pieces.
 - c. Mark and cut this vertical bevel angle on the stern side of the block.
 - d. Measure the horizontal angle between the stern and side panels.
 - e. Measure the vertical angle between the side panel and the temporary board laid from port

- to starboard. Should be the same on both sides.
- f. Cut this angle.
 1. First the horizontal angle.
 2. Or in conjunction with the vertical "side" panel cut.
 - g. Mark and cut a 90 degree angle at the forward end of the block where the gunnel's butt up with the corner blocks.
 - h. Cut the block in half for a port and starboard corner.
10. Shape the "outer corner" of the two blocks to snugly fit the contours of the glassed fillets. If you have a band saw, you can precut the "inside radius" in the blocks, but give yourself plenty of wiggle room for later, when you shape the rails to the corners. If you have a coping saw, do this later after the rails are installed and shape everything at one time.
 11. Take a short sample of your gunnel wood that's been cut to it's final size and use this as a gage for determining how high/low to set the corner blocks. The stern block height should be set by it's relationship with the "inside" gunnel rail section. Hold the corner block in it's corner and clamp your gunnel sample "flush" with the plywood side panel and tight against the block. Determine how much "shaping" you want to do for the final fit. Set the corner block to the height that matches the "upper" edge of the rail. If you used the 1" to 1 ½" thick wood as I said earlier, there should be no problems. If you used straight ¾" stock, set the corners flush with the upper edges of the bow and stern panel plywood and shape after everything is installed. This is where you wanted to make sure that the upper edges of all the panels are even with each other.
 12. Glue and screw the corner pieces to the heights you have just established. Mark on the hull somewhere the locations of the corner block screws. You can place masking tape on the hull below where the gunnel's go to mark the locations. That way you won't drill into them when attaching the outer rails, and making extra holes that will have to be filled and hidden later.
 13. On Vee hulled designs, the bow corner is fitted pretty much the same way. It's a wedge with beveled sides and squared on the outside aft edges to fit the inner rail ends. The biggest problem on a Vee bowed hull is the curvature of the side panels. There is nothing straight to work with. If you laminate the bow block, make sure you fit it with the laminations parallel with the centerline and centered with it too. Make some cardboard lockups to check the fit and maybe a scrap block to test your methods. Making the block is not an impossible task; though at times it seems that way. Just take your time while you do the fitting. If you worry about your laminating skills, epoxy a piece of ¼" plywood on the bottom side and set back from the edges to hide it. I do this to all my boats just to be safe.
- Note: To increase the strength of the upper bow seam, and to make it easier to do the final shaping of the transition of the rails to bow block, add another piece of ¾" material to the bottom. Shape this extra material to fit after you have gotten the upper block to fit the hull. Then mount the whole "block set" 1/4" higher than the upper side panels. Then when you shape the block and the rails, the lines will flow with a smoother transition between the separate pieces.

Fitting the Rails

Cutting and prepping the Side Rails

1. The rails give shape and strength to the hull and can be installed in several different ways. But! Because of the heavy curvature of the bow, I went to an inner and outer rail system with spacers between the plywood and inner rail. This necessitated less thickness in the rail material to induce it to bend without breaking. The prototype hull seems very strong even with only using 1/2" x 3/4" material.
2. By using this style, you can add lots of fancy trim, various colors of wood, and use thinner laminated rail sections of different woods for the same strength. But this does involve a lot more trimming, fitting, and finishing work, and will require different sizes and shapes in the corners. The details of the rails will draw the eye and highlight the hull shape; and any extra effort here will be more than offset by your pride of workmanship, and the comments of others on the beauty of the boat.
3. Start with a wood species that's tight grained and not prone to splitting, is limber, takes a finish, and also has some resistance to getting banged around. I have had good luck with Philippine mahogany.
4. It is almost necessary that you have a table saw to rip out the rails or a friend or lumberyard that can do it for you. The outside rails need to at least 2" longer than the "edge length" of the top panel of the boat. Plan ahead on how many rail pieces, and the needed lengths you can get out of your wood. **Mark all the pieces after you rip them out so you won't forget which is which.** You don't want to use a keeper for something else and then have to get more wood because all the other pieces are an inch short. Cut out the four main side rails, and enough material for the stern as well. Also any "special" woods you may want to use for trim color.

Note: If you have rail material longer than the boat, rip out the rails before you start construction. You can use/make a thin strip of the rail material into a really nice batten when you fair the marks during layout. I hope you have read these instructions first!

5. Remember that the total "edge length" of the shearline is longer than the overall length of the boat. So make sure you know the "edge length" of the shearline (were the rails go) before you cut any rail material. Give yourself an extra inch or so at each end of the rail material to be safe.
6. Mark each of the four "main" rail pieces, "inside", "outside", "top", and "bow" for orientation. Also you will need to group them into two sets; port and starboard. This is needed to separate them because of the difference in the direction of the curvature of the hull.
7. Place the "outside" two rails on the bottom. Lay the two "inside" rails on top. Tie some cord around them at 4-5 places along their lengths to loosely hold them together. You need to pre-bend the rails for several days to relieve and change, some of the internal stresses in the rail material before you attempt to install them on the hull. Lift the bow end about 2ft off the floor, and the stern end about 6" off the floor. Tie down one end so the rails can't move around as you add weight to pre-bend them. Use sand bags if you have them, or something that will weigh them down, but not put a "point load" to any one place. You want a uniformly applied load. Place most of the weight near the "bow end" of the rails. You will see what I am writing about when you do this. Add weight over a period of several days to achieve the desired results.

The Stern Rails

1. Take the extra material you cut and set aside for the inner and outer "stern" rails, and measure out

the lengths you will need. Make sure that the "outer" rail is long enough to extend beyond the hull's width by at least 1/2" on both sides. This will give you enough material "length" to safely trim and not blow out the edge while cutting.

2. Shape, sand and trim the "inner" rail to fit between the corner blocks on the inside of the stern panel. The ends of the inner stern rail should be square. The ends of the outer stern rail will have a slight angle to them to match the outside pitch of side rails. The outer side rails are cut off flush with the aft edge of the outside stern rail after they are attached.
3. Apply glue to the inside edge of the **outside rail** and clamp the "outside" rail to the stern panel, flush with the upper edge of the plywood/corner blocks (**level with the corner blocks if you added extra material to the height of the stern panel (for insurance while wiring the hull panels together) to be trimmed after the rails are installed**). Drill from the inside and countersink flush using #6 x 5/8" stainless screws. The first holes are 2" inside the corner blocks on both sides. Drill two more holes equally spaced inside the first two. Mark their locations on the top of the rail. On the outside, drill and countersink by 3/16" using #6 x 1 1/4" stainless screws, a hole 1" in from the outside edge of the stern panel. Screw the ends of the outer stern rail into the corner blocks on both sides.
4. Check the drawing plans for the lengths and placement of the "spacer" rails that fit between the stern panel and the "inner" rail. You only need to glue/epoxy them in place. Sight down the top of the outer rail to gage the mounting locations for the spacer rails. Because of the angle of the stern panel, there will be a slight angle to the top of the finished rails. You may want to mount the spacer rails down 1/8" below the inside edge of the plywood stern panel. Then rasp the plywood flush with the rails.

Note: If you add the "thicker" corner blocks; set them 1/4" above the tops of the side panels where they meet the stern panel, and NOT to the top of the stern panel. Install all the outside rails "even with" the top of the side panels. The spacer blocks are set even with the tops of the side panels. The inside rails are set even with the spacer blocks. The rails are then shaped to ,and with, the corner and bow blocks. Use your eyes to do the final shaping.

5. Apply glue to the **inside rail** and ends. Clamp the "inside" rail to the stern panel flush with the outer rail. Drill from the inside and countersink by 3/16" using #6 x 1 1/4" stainless screws. The first hole is 1" inside the corner blocks and missing the screw for the outside stern rail. Repeat on the other side. Mark and drill holes, 1" from the ends of each of the spacer blocks; making sure to clear the outside rail screws.

Note: I use #6 x 1 1/4" screws and countersink them on the inner rail, because of the heavy shaping near the corners. If you added material to, and set the corner blocks higher, you can use the #8 x 1 1/2" stainless screws instead. Be careful placing the screws near the corners, as they may not work aligned in the center of the rail. It may be wise to just glue them in for the time being, and drill for the inner rail screws after all the shaping has been completed.

6. Trim the outer rail ends flush to the outside edge of the hull. Shape and finish sand later.

The Side Rails

(The Outside Rails)

1. Now you will need lots of clamps. Take one of the **pre-bent** "outside" rails and place the end marked "bow", at the bow and even with the shearline, and overhang the end by 1". Clamp the rail to the side panel at the bow next to the breasthook. Because the breasthook/bow corner block, is already in place, you will not be close to the bow end of the rail to clamp to the hull.
 2. Measure the hull at the shearline again to be sure you have cut the rail material to the right length! Make sure you have enough material at the bow to trim, and at the stern to overlap the outside stern rail by at least 1/2". Have at least 1" extra at the bow, and 1" extra at the stern!
- Note: There is some wiggle room here depending on what type of wood you used for the rail material. By using Philippine Mahogany cut to 1/2" thick, I was able to get the rail to bend to the hull with one clamp behind the edge of the bow block, and two #6 x 1 1/4" stainless screws. I could then continue clamping the glued rail to the hull.
3. Apply your glue. I use a waterproof glue here as opposed to epoxy, as it is much easier to use and you don't wind up with epoxy on everything and have to do some difficult sanding. I use Gorilla Glue ® and have found it does the job and is easy to remove the "foam" with a pointed scraper. Along the undersides of the rail to hull joints, I use a "paint can" opening tool, with the "hooked end" sharpened like a scraper. This removes the excess foam with ease and can get into those hard to reach places. Give the rail a good coat, but don't over do it. A little goes a long ways. If you use Gorilla Glue ®, spray the plywood side of the joint with a mist of water and then drag a cloth along the hull to spread and remove any excess.
 4. You will need to drill and set some stainless screws to hold the bow end tight to the hull for fitting and gluing. Support and hold in position, the stern end of the rail so that the bow end of the rail is flush at it's top edge with the hull and breasthook. Mark and drill a hole about 1" back from the leading edge of the hull, through the hull and into the breasthook. Use a #6 x 1 1/4" stainless screw to hold the rail in place. Make sure everything is lined up correctly and place the first clamp at the aft end of the breasthook. You want to tighten this clamp down hard to take the pressure off the screw in the bow. Slowly bend the rail down and in as you add more clamps working towards the middle of the hull. If the rail at the bow still looks good and in it's proper place, go back to the bow end and drill another hole. Counter sink these holes at this time, and place one more screw to take the pressure off the first bow screw. Continue with the rest of the rail.
 5. Stay close and a hair below the shearline as you proceed. At the midpoint you will have to start lifting the rail to follow the rise in the shearline towards the stern. Place a clamp at the midpoint and continue. Clamp the rail at the stern; there should now be at least 1" sticking beyond the stern. There may be more if you did not trim the rail for length (a better way to go). This is to over lap the end of the outside "stern rail" and still have enough wood to trim flush to the outer stern rail.

Note: Sight down the rail and check how it follows the plywood edge. This is necessary as a check for the "fairness of the curve" you made when you lofted the curve on the plywood and cut it out. The outside rail should be flush to, or a hair below the plywood if all is fair. If the plywood is not fair, adjust the rail so it is fair and slightly below the top edge of the plywood. Match the inside rail to the "fair" outside rail. You want to trim the plywood and not the rail material when

you do the finish work. Leave the rail tops even and pitched to the outside. Do not bevel them level to the waterline. Do not worry if there is a slight dip in the top edge of the plywood at one or more places from cutting inside the lines. You can lower the rail on that side slightly, or fill the depression with EZ-Fillet or clear epoxy, and not be noticed. Its a boat not a rocket.

6. Come back to the bow after the first set of clamps and place more to remove any small gaps between the rail and the hull panel. You will need more clamps near the curved part of the bow than the straighter stern area. But if you have them, use them. Clamp and adjust/tap the rail to the correct height before you start drilling and adding the stainless screws for final placement. Have at least 10 clamps to hold the rail in place while you drill and screw through the plywood into the outside rails. Tap and adjust the rail into position at or a hair below the shearline and clamp tight. You want the screws in the middle of the rail, That will be 3/8" below the upper plywood edge "if" the two edges are flush. Adjust the height of the screw hole up or down to match the center of the rail. **Make sure that there are no gaps between the rail and the plywood. Use more clamps!** The first screw is 2" behind the bow corner block(to leave room for the first inner rail screw), drill and countersink flush to the surface. Use #6 x 5/8" stainless screws. The rest of the screws are placed at the one foot "station cut marks". The last "inside" screw is 2" ahead of the stern corner block(to leave room for the last inner rail screw). **Are the screw locations for the corner blocks still marked?** Pencil mark all the new screw locations on the top of the outside rail.

Note: A better way is to transfer the marks to the "underside" the rails on the hull panels. I have found that if left on top, they get lost as I work on shaping and finishing the rails.

7. On the outside, drill and countersink by 3/16", a hole measured 1" forward of the sterns plywood edge, (not the overhang excess). Use a #6 x 1 1/4" stainless screw to anchor the outer rail through the plywood and into the stern corner block. *Check the plan drawings for the screw location details.*
8. If you have enough clamps, do the other outside rail. Be observant to how the first rail was attached. This rail should follow the same ups and downs since both side panels were cut and shaped as a unit and have the same "fairness of curve" (or errors) lofted into them. Don't rush, watch what you're doing. Match the other outside rail to the positions and screw locations of the first installed rail.
9. You will later rasp or plane down the high spots in the plywood to match the upper edge of the inside and outside rails after all the clamps have come off. You want to keep it square! You should not be removing any material from the tops of the rails. You will shape and finish sand later.

(The Spacer Blocks)

1. Because of the heavy curvature at the bow of the PUD-g, this design uses a "spaced rail" gunnel system. Here you can either use up some of the left over rail material, or add some color by using a contrasting wood tone. With a light color like Maple, Oak, Ash, or Holly. Or a darker color with the wood of your choice. I prefer the lighter colors to high lite the differences. You will need to add some "relief" cuts to the outer edges of four of the spacer blocks on both sides, where the hull curvature is the greatest. *See the plan drawings for the details of what to do, and the spacer blocks to do it to.*

2. Some of the measurements will depend on how big you make the breasthook and stern corner blocks. The prototype hull's measurements are in the drawing plans. They call for a spacing system of "2-2-2-6-2-2-2-6-2-2-2-6" and so on. This is a system of 2" and 6" spacer blocks with open spaces on either side of a 2" spacer block, set between 6" spacer blocks centered at the "station line cut marks". *See the plan drawings for the numbers needed.*
3. The 6" spacer blocks will be centered at the #1, #2, #3, #4, #5, and #6 station line cut marks. A 2" spacer block will be added and centered between the 6" spacer blocks. That will give a 2" open space between the block sets. The spacer blocks and open spaces going into the breasthook and stern corners, will be determined by the sizes of the corner blocks you chose to use.
4. The #2, #3, #4, and #5 six inch spacer blocks will have to have a series of cuts made to the outside face to allow the spacer block to bend to the curvature of the hull. Such a short length will not easily bend, and will put too much stress on the outer rail; possibly causing it to break. *See the plan drawings for the details on the placement, depth, and number of cuts each spacer block receives.*
5. Apply glue to the spacer blocks and clamp to the hull in their designated locations. You can use some screws to hold the blocks centered in place, but remove them before adding the inner rails.

(The Inner Rails)

1. Take one of the "inner rails" and clamp at the bow and up tight to the corner block. **Make sure the butt end of the rail is square.** Start clamping toward the stern, bending the rail slowly as you go. Try to make the top edge as flush to the plywood and the outer rail as you can. When you get to the stern, rest the rail on top of the corner block. Making this cut mark is a critical measurement. **Make sure there are no gaps between the rail and plywood. Add more clamps and make sure it is flush with the spacer blocks!** You will be tempted to just mark it even and cut. If you cut flush you will have a surprise when you fit the rail. It will come up short! Mark the rail 1/8" longer than you think will be needed. Trim the end in place if you can. If not, remove from the hull, trim, and check again until it just fits with a few taps of a hammer. To hold the curvature of the hull, the inner rail will have to be a tight fit. Remove the clamps and the rail, and apply the glue.
2. Re-clamp the rail starting at the bow and working toward the stern using just enough clamps to hold it in place. Try not to get glue on everything as you go. Tap the stern end of the rail in place next to the stern corner block and return to clamping the rail. Tap, adjust and re-clamp the rail to get it even with the trimmed plywood, the spacer blocks, and the outside rail. Add enough clamps to remove any gaps between the rail and plywood.
3. See the plan drawing for the locations to drill for the stainless screws. Drill and countersink enough so the heads of the screws are just below the surface by 1/16". Use #8 x 1 1/2" stainless screws. The end holes at the bow and stern end of the rail will be close to existing screw locations; be careful. You marked there locations right? **Do not shape the ends of the rails, breasthook, or stern corner blocks yet! This will be done later.**

Oarlock Brackets

1. The style of oarlock socket to install on this hull is the "insert" type, that needs a hole bored into the rail system from the top. This works well on both the inner/outer rail system and the

"spaced" rail system used here, and is the strongest option.

2. The insert will need an extra section of rail added to the inside rail. It is needed to widen the rail so the inserts oarlock hole will clear the inside of the hull and still have enough rail material for strength. An 18 1/2" long piece of rail material is glued and screwed in place at locations given in the plan set. This longer piece, by spanning two full rail space blocks, makes for a stronger setup. The outside corner of each piece is 45'd on the ends to blend into the inside rail and is shaped to match.
3. An extra piece of material will also be added on top of the rail system to give it more thickness and strength. Also to help reduce the angle of the rails upper surface, and so that the oarlock socket does not protrude below the bottom of the rails. The blocks can be left with "parallel" sides, or shaped to follow the curvature to the rails too. Align and mark the locations for the rail "caps". Shape, sand, and glue in place. Be careful they don't slip out of place while curing. I used a plastic covered (removable) scrap of wood, clamped to the outside rail to prevent this; as they all wanted to keep slipping out of place. *See the plan drawings for the details and placement of these riser blocks.*
4. Use one of the oarlock brackets turned upside down to position the clearance hole so that the outer edge of the "oarlock insert" just clears the inside edge of the hull. With this system, you can give yourself an extra 1/8". *But check with your own hull.* This will give enough room for the end of the oarlock's shaft to clear the sides and still have enough room to tie a lanyard to the end of it. *See the plan details.*
5. Final shaping and sanding will be done in the following section.

Shaping the Rails

1. Do a rough shaping using the tool of your choice. I like to use a wood rasp, and I have a new one now that a neighbor gave to me. It is English made, and is a 1" wide steel bar about 12" long, with "carbide bits" embedded in the surface. One side has a medium surface, and the other has a fine surface. I love this thing, and I wish I knew where to get another one. I hold it at an angle and pull it towards me in long smooth strokes, using just enough pressure to see some results. You should only be removing spots of plywood that are standing proud if you followed the directions. If you do have some places where the rails are higher than the plywood, think about what to do before you remove any rail material. Come back to those spots after you have shaped the corner block areas.
- Note:** Caution! If you use a router, be careful of blowing out the edges. One false move on the highly tensioned surface of the rail material and its glue and putty city!
2. The shape of the rails as they lead into and away from the corner blocks will be what catches the eye and complements the lines. You want everything to flow smoothly. Take your time with this step. Do a little bit at a time and what you change on one side, you change on the other side too. If you have to lower a rail to match a corner block, measure out 6-8" and make a mark. Fair from that mark towards the corner making it smooth and even. Work it all at once, going around the boat a bit at a time. Try for symmetry in shaping the rails. Shape and look. Shape and look. When you are close, give the rails a rough sanding with some 80/100 grit paper. **BY HAND ONLY!** Use no machines on this task.

Note: If you added extra material to the bottoms of the breasthook and stern corner blocks, the trimming decisions will be easier to make. Since the abruptness of the ends at the rail to corner block transitions will be nominal.

3. You may need to remove and countersink deeper, any screws near the bow/stern that may show up while shaping the rails. This may occur at the screws closest to the corner blocks on the inside rails. Just take them out and countersink a little deeper. You only need to go in enough so the filler material has something to cling to. If you are letting the screws stay "bright", only countersink them enough to keep the screw heads from snagging things. Say 1/8" for everything.

Filling the Holes

1. When you are happy with the results and everything looks smooth and fair, then stop. If there are low spots and gaps, don't worry. Go back to any low areas in the plywood between the rails, and anywhere there are gaps in the rail/corner joints and use fillet material. You will also be filling the countersunk screw holes now if you are not leaving them bright.
2. Blow off and out, any sawdust in those areas. Mix up the fillet material (very small amount) and use the "plastic bag" technique again for this job, but with a very small hole. You don't want to use a putty knife here, as it spreads it everywhere you don't want and never in the place you do. For the screw holes, squeeze just enough into the hole to fill just above the surface, so it looks like the top of a small "soft" ice cream cone. After all the holes are filled, return and place a bit of masking tape over the material to push and hold it in. On the gaps and such, use a tooth pick or a splinter of wood to poke the fillet material into the gap for a better hold. On the low areas between the rails, use a plastic bag covered scrap of wood to push and level the fillet material into the low areas. Clean off any excess quickly, or line those rail fill areas with masking tape before you start. Anything you do now to limit the amount of scraping and sanding you do later will pay off in sweat equity.
3. After the fillet material has set, take a cabinet scraper or sharp knife pulled sideways like a cabinet scraper, and remove the excess material down to the surrounding wood surface. Be careful not to gouge the wood with the corners of the scraper or to dig too deep in one area. If you were careful not to use excessive fillet material you will not have that much scraping to do. It is better to come back again with just small bits of new fillet material to fill any depressions left from the first application, than to have to scrape and sand big globs placed in haste. A "no-kerf" dowel saw helps remove the high spots too.
4. Once the fillet areas are scraped flush with the surrounding wood, rough and finish sand for your final smooth surface.
5. I recommend finishing the rails before the interior and exterior hull finishing has been done. Use a good quality masking tape and lots of old newspapers to protect the hull from excess wood stains that may bleed through your final hull finishes.
5. Stain the rails with a penetrating stain; either oil or water based. Again check with your epoxy manufacturer to see what they recommend. I have had good luck with both. I would not recommend staining any wood edges that will be glued or epoxied together. Do the gluing before the staining. Make sure that whatever type of stain you use has been wiped down, cured, hardened and ready. Wait a few days between the staining and any varnishing or epoxy coating to make sure it's cured and any solvents in the stain have evaporated.

6. Once the stain has cured, you can either apply a straight varnish or epoxy/varnish coating to the rails. Two coats of epoxy will give the wood some protection against physical damage and rot, but will need some varnish to protect it against UV damage. Whenever the varnish starts to discolor from exposure to the sun because you're having so much fun with the boat, put on a couple more coats.

Installing the Interior Parts

My version of the PUD-g

1. For the PUD-g, I have gone to a non-traditional interior design. Since it is such a short boat, the weight placement of the occupants in relation to the hull, is of most importance. The hull is too short for the normal three seat layout to work, so I have combined some aspects of the 8ft Nuthatch and the 9.5ft Laura Bay. I took the fore and aft center seat of the Nuthatch and combined it with the boxed in daggerboard trunk of the Laura Bay.
2. Because the distance from the center of the hull to the stern panel is so short; I had to narrow the stern seat so the rowers feet could be placed on either side of it. At a height of 12", a tall persons feet could not fit comfortably under a traditional (open underneath) seat spanning the hull. There would also be no place for any extra flotation to be installed. With this modification, the "boxed" seat could be either filled with foam, or made into a waterproof compartment (air chamber) and storage area by using a good quality hatch.
3. The center seat and daggerboard trunk area have also been turned into storage and extra flotation; with the use of small and medium sized watertight hatches. For the world cruiser, these areas can hold your emergency food, water, and important papers if in the unlikely event of having to abandon ship.
4. I have gone without the use of traditional bulkhead's, since the shape and curvature of the hull should produce an "egg like" structure, with a lot of self support from the use of hard chines along the multiple seams. The spaced rail gunnel system also gives the hull extra strength.

The Stern Seat Panels

Note: Layout and mark as many of the interior parts as you can, before cutting them out. You don't want to waste plywood because the wrong piece was cut out of the wrong hunk of leftover scrap.

1. Follow the building plans and cut out the stern seat parts from the plywood left over from cutting out the hull panels. Read the above note and double check everything before you cut out the first panel.
2. Loft, mark, and cutout the stern seat panels. Make sure you made and marked a "good" centerline on the forward seat panel. You will use this to line up the assembled seat later.
3. As with the hull panels, you will need to bevel the "interior" edges along all the seat's "mating faces" only (not those along the stern panel or hull panel faces). Also mark the 3/8" set back line for drilling the tie wire holes along these edges.

4. Drill holes along the setback line at 1" from all corners, and one at a point halfway in between.
5. Cut some 4" tie wires and start assembling the stern seat. Twist them only enough to hold together. You will tighten them later.
6. Drill 1/4" holes in the two forward corners, and in the seams at 2" from the ends away from the corners. (see the plan drawings or the flickr photo site for the details) Insert the bolts, exterior washers, and nuts in the 1/4" holes you just drilled and tighten. Make sure everything looks square, then twist the wires tight. If it looks a little off, loosen the wires and nuts, and make right; then re-tighten.
7. If the seat assembly looks good to you and fits the hull, it is time to put some jump stitches on the interior of the stern panels. Reread the section on mixing and placing jump stitches. You will only need them near the corners and a couple along the middle edges to hold everything together so you can remove the wires and bolts.

Note: The finishing of the stern seat assembly can wait until you have finished the center seat assembly and do everything at once.

8. Remove the wires and bolts. Seal all the interior edges and seams with some mixed straight epoxy. Mix up more EZ-Fillet; apply and shape as before, making sure you have enough fillet depth for strength. Cover with a layer of 2" or 3" glass tape and wet out. Let cure overnight.
9. Coat the interior of the seat assembly and all exposed plywood edges with at least two coating of mixed epoxy to seal off the wood from the elements. Also coat the hull and stern panel with two coats of epoxy where the seat will cover them up. **Do this now and not later.**
10. Line up the seat assembly with your hulls centerline marks (you made them right!) and place a weight on the assembly to hold it in place. Now mix up more jump stitch material and epoxy the assembly in place. Let cure over night.
11. I have been using masking tape to "square" off the glass tape corners in the next step. The masking tape will delineate the outer perimeter of the glass tape and clean up the rough ends where the tapes overlap. Wet the tape to halfway across the masking tape, and let the epoxy turn "green". Come back a while later and trim off the excess tape and pull up the masking tape. Press back down any tape edges that may have lifted, and add more epoxy if it is needed.
12. Coat with mixed straight epoxy, all exposes surfaces where the fillets and glass tape will be added. Apply a fillet along all the outside edges where the seat assembly meets the stern and hull panels. Cover with a layer of glass tape and wet out. Let cure overnight.
13. The rest of the exterior of the seat assembly will be coated with epoxy when the rest of the hull interior is finished.

Daggerboard Trunk

1. Cut out the pieces following the plan drawings. Make sure the opening is wide enough to accept the daggerboard that you are making. You might want to make the daggerboard before you make the trunk. Then you will know how thick the daggerboard really is and it won't be to loose or too tight. Make the daggerboard opening at least 1/4" more than the thickness and length of the

daggerboard you plan to use. This will give you room to add a layer of fiberglass to the inside of the daggerboard trunk for wear, and to the daggerboard itself if you choose to do so.

2. **Now is the time to coat and seal with straight epoxy, all the inside faces and their mating surfaces.** Do this before its too late. You may want to fiberglass the inside of the daggerboard trunk too. I recommend this for wear protection. If you glass the inside of the trunk, attach the two upper $\frac{3}{4}$ " by $\frac{3}{4}$ " daggerboard trunk to seat rails, with stainless screws from the inside of the trunk. Wet the mating surfaces with epoxy and attach the two daggerboard trunk spacers to one of the side panels with stainless screws from the outside. Using 6oz fiberglass, coat and wet out the side panel and up the two end pieces on the inside and just to the top to their inside edges. Making sure to keep the glass pressed into the corners. Epoxy coat, glass, and wet out a layer of 6oz glass on the other (flat) side panel. Let cure overnight and then fill the weave with another coating of epoxy and let cure. Trim all edges after everything has cured.
3. Mix up some GelMagic and butter the upper edges of the daggerboard trunk spacers. Place the other panel on top, square up, weight, and let cure over night. Coat with mixed epoxy, all plywood panel sides and edges of the assembled daggerboard trunk, especially the bottom edges. Let it cure overnight.
4. Add the side panel attachment rails to the forward and aft daggerboard case bulkheads. Look at the plan drawing to find their measurements and locations.
5. Align, clamp, and screw tight, the two daggerboard case bulkheads to the daggerboard case. Making sure everything looks in alignment. Place the assembly in the boat on the centerline, making sure it's vertical and square. Use the centerline cord to find the centerline of the boat and all the bulkheads and various parts that make up the whole daggerboard case. Mark all locations.
6. Put plenty of marks on all the parts of the daggerboard case to identify their centerline locations, so that you can realign them again. Disassemble the case and apply GelMagic to all the mating faces. Coat well and reassemble the parts making sure to match everything up again. Add stainless screws as needed to hold the assembly in position. Do not over tighten. Let cure overnight.
7. Realign the daggerboard case in the hull. Once you are happy that the daggerboard case assembly is true and square, its time to mark it's location so that the daggerboard opening can be made in the hull.. Mark the location with a pencil, by drawing a line around the outside base of the daggerboard case.
8. Remove the daggerboard case assembly and mark the actual cut line, $\frac{1}{4}$ " inside the perimeter marks of the side panels and 1" inside the perimeter of the end pieces. **Remember, the end pieces are $\frac{3}{4}$ " thick, don't make the slot too long now.** Cut the hole in the bottom to the "inside" of the cut line. Give yourself some wiggle room and stay $\frac{1}{8}$ " inside this inner cut line. You will hand shape this to the inside of the daggerboard trunk when you turn the hull over to fiberglass and finish the bottom.
9. Reinstall the daggerboard trunk to it's marked position. Use weights and scrap sticks clamped to the sides, to hold it in position. Place some jump stitches around bulkheads and case corners, to hold the assembly in position and let cure overnight. Check for alignment again before you walk away. Adjust if needed before the epoxy cures. Let cure overnight.

10. Do a check to make sure that nothing has moved or slipped in the night. If all is still correct, wet out all the joints and seams between the trunk, bulkheads, and the bottom of the boat with straight epoxy. Mix up some wood filled epoxy and fillet all the case and bulkhead to hull seams and edges. When the fillets "green up" wet the area with epoxy and lay in 2" glass tape on all fillets and wet out. Let cure overnight.
11. Coat all surfaces around the daggerboard case area with two coats of epoxy to seal them off.
12. Finish out the bottom interior of the daggerboard slot when the boat is upside down and you are finishing the bottom. *See the details in the following section , "Finishing and Taping the Seams".*

The Center Seat Panels and Mast Location

Fitting the Side Panels

1. Study the plan drawings for the dimensions of the two side panels. Both will start out the same, but will have to be shaped to "their" locations and final fit. Be sure to mark which is port and starboard for future reference.
2. Measure, cut, and epoxy to the side panels, the rail material that supports the top seat panel. These can be screwed to the side panels, as well. Take your adjustable angle gage and set it to the edge angles at the top of the daggerboard case bulkhead's. Use this to set your tablesaw to make the "top" cut. Remember which side is "up" and which side is "glued". Mark if needed. *(see the plan drawings for the details)*
3. To start the shaping process; clamp one of the side panels to the two vertical 3/4" x 3/4" support rails attached to the ends of the daggerboard case bulkhead's. Take a pencil and lay it flat against the hull and pull it along the side panel to hull seam. The pencil will make marks where the side panel is high, and miss when there is a gap in the fit. Do Not Cut To That Mark. Stay outside and rasp down close, but not to the line; and only those areas that "have" a pencil mark. Reinstall the side panel and use the pencil to remark the seam again.
4. Repeat this until the side panel fits nice and snug, and the top edge of the side panel aligns with the top of the daggerboard case. Repeat all the steps for the other side panel.
5. While the two side panels are still clamped to the daggerboard case, locate the areas where the 1/4 turn hatch backing plates will be mounted. Measure, cut, and epoxy in place all backing plates that your hull will use. Also the backing plate in the top seat at the bow used to support the mast tube assembly. Let them cure in place overnight.
6. Center the hatch frames over the side panels and mark. Be careful when you make the opening cuts, that you keep them tight. Make the cuts and smooth any rough edges.
7. Now would be a good time to give the side panels two good coats of epoxy on all sides, and especially the edges.

Fitting the Top Seat Panel

1. Clamp the side panels back into place. You will have to use some screws now to hold them in

position; as the clamps will be in the way when trying to fit the top seat panel. If you make them part of the assembly, use #6 or #8 x 3/4" stainless screws, and check for placement. The screws are aligned and centered over the bulkhead stiffeners.

2. Check the "width" measurement between the side panels at the bow to make sure it matches the width at the daggerboard case.

Note: Use a piece of scrap to "hold, and set" the correct width of the side panels at the bow. Drill holes and use two screws to set this width, so you can use this scrap piece again when you jump stitch the side panels to the hull.

3. Follow the plan drawings, and measure, cut, and shape the bow end of the top seat panel. Do several "dry fits" as you mark and shape the radius at the bow end. Try to maintain the centerline of the top panel and that it still fits at the bow end of the side panels and hasn't shifted off to one side or the other. You don't want any twisted noses here. Make sure you have your centerline cord pulled tight and attached at the bow and stern of the hull. Hang two pencil bobs on the cord; one over the stern end of the daggerboard case and one over and just behind the radius cut at the bow. Use these to make sure the top seat panel is fitted correctly. Some give and take can be given here, but try to stay less than 1/4" off of center.
4. With the top panel aligned, shaped, and fit to the seat assembly; place a couple of screws at the bow end of the top panel, and into the side panel rails to hold them at the correct width, and a couple add at the stern end, and into the daggerboard case to maintain alignment.
5. If all is good, disassemble the top and side panels. Mix up some epoxy, or GelMagic and coat all the surfaces used to hold the side panels to the daggerboard case assembly. Attach the side panels with their locator screws and tighten just enough to hold in place, but not squeeze out all the epoxy. Use the "scrap from the above note" to hold the bow end of the side panels to their correct width. Let cure overnight.
5. Remove the "scrap" spacer and reinstall the top seat panel. If everything is still in alignment, mix up some EZ-Fillet and jump stitch the side panels to the hull. Make sure everything is still lined up before you walk away. Let cure overnight.
6. After the jump stitches have cured, you can complete the filleting process on any seams along the bottom edges of the center seat assembly. You can add the 2" or 3" glass tape now or later. I do the final fillet now, but like to wait until everything is ready for the glass tape (after the top seat panel is fitted) and do it at one time.
7. Measure, cut, and epoxy/screw to the side seat panels, the two top seat panel cross supports shown in the plan drawings. Fit snug, but not distorting the tops of the side seat panels.

Fitting the Mast Step

1. With the centerline cord and pencil bobs still in place, its time to locate the hole in the top seat panel. Easier said than done. Remove the screws and set the top seat panel aside for the time being.
2. Slide the pencil bob at the bow to a spot on the centerline cord where it is over and about 1" behind the seam where the two bottom panels meet. (*see the plan drawings*) That is where the

mast step will be located. Take a 1 1/2"H x 2 1/2"W x 3"L block of wood, and shape the bottom and leading edge to fit the hull. Take your time here and rasp off only small amounts between fit checks. Remember to keep checking the fit of the block to it's centered position under the pencil bob, as you rasp.

3. Once you are happy with the fit, and the block is "level" with the hull and centered. Establish the block's "fitted" location with marks on all sides that can be used to recenter it. Now mix up some EZ-Fillet and butter the bottom of the block with enough fillet material that it will squeeze out around the edges when placed back in it's "marked" location. Check for "level" and "centered". Let the block cure in place, but check it's position occasionally before you leave for the day, to make sure it has not "slid" downhill and out of alignment. Let cure overnight.
4. After the block has cured in place, sand any rough edges and apply at least two coats of epoxy to seal off all the exposed edges.

Locating the Mast Tube Support Assembly

1. Check the plan drawings for the pipe size and fittings used for the assembly. Drill a hole in the "center" of the 2" pipe plug. The plug will be used to hold the lower end of the mast tube support assembly to the hull. You will be using a #12 x 1 1/4" stainless screw and a 1" stainless "fender" washer, so size the drill bit accordingly, but do not make it too big. Tight is best.
2. Use a drill bit sized to be a pilot for a #12 screw. Check on a piece of scrap wood that you have the correct drill bit for the job. Now check again that the boat is still as "level" as it was when you set the Mast step in EZ-Fillet. If all checks out, drill the pilot hole in the mast step for the screw.
3. Insert the screw in the 2" pipe plug and loosely tighten the plug in place. This will be used to "dry fit" the actual pipe later.
4. Take some scrap plywood strips that are long enough to span the hull from side to side, and clamp them to the outer rails where you first think the mast will be at that height above the hull's bottom. You will be moving this around, so don't make it too perminate yet. Take another piece of scrap plywood that's big enough to have a hole 2 3/8" in diameter cut in it; mark and cut such a hole. Use the 2" ID mast support pipe to check for a good fit. Make sure the scrap with the hole for the pipe, is big enough to be clamped to the "spanning" scrap strips.
5. Clamp the scrap with the hole in it, to the two strips spanning the hull at the rails. Re-string your centerline cord if it's not now being used. *(The cord will probably be below the "scrap jig".)* Reattach the pencil bob to the centerline cord, and move it along the cord until the point is over the stainless screw holding the 2" plug in place. Lets hope it still is.
6. Now move the piece of scrap with the 2 3/8" hole in it, around on the two scrap strips clamped to the rails, until it looks centered around the pencil bob's string. Look from all sides. Now clamp the "hole scrap" to the "rail scrap". Check for being centered again. If everything went as planned, you have just established the true "upper" location of the mast support tube. Protect this "upper jig", and the centerline cord from being knocked around as you proceed to the next step.
7. Now reinstall the main seat top panel to it's "fitted" location. Use the pilot screws to hold this position. Now shorten the pencil bob's string so it rests just above the top seat panel. Make sure

the pencil bob is still centered in the "upper jig". Now mark the masts centerline (fore and aft, side to side) location on the top seat panel. Check everything again for "level" and square.

8. If everything is still ok with the "marked" location on the top seat panel, remove it from the hull. You now need to take a compass or a (1/4" high ring) section of the pipe to lay out the circle for the cut. Make sure everything looks good before you cut the hole. Keep the opening "round" and tight. This will help seal the edges later when you apply just straight epoxy (tight hole) or GelMagic (loose hole) to make the opening waterproof. (we hope).

Checking the Mast Tube Assembly

1. Remove the 2" pipe plug mast base, and apply a good layer of sealant or thickened epoxy to the bottom, replace and screw in tight. Coat the interior of the pipe union with pipe cement and slide over the plug **and let cure for a few minutes.** Insert the plastic pipe into the pipe union, not too tight and do not glue. A 12" length of pipe should be enough for the job as shown in the plan drawings.
- Note: If you want to extend the pipe up to the height of the rails and install an upper mast partner, (fixed or removable) running from side to side and attached to the rails, you may do so.
2. Slide the top seat panel over the pipe and use the pilot screws to hold it in it's, final position.
 3. On this hull I am using a 2" "pipe cap" to keep out water from getting inside the mast support tube. Leave only enough pipe above the surface of the top seat panel to let the "pipe cap" fit tight and still have 1/2" of clearance between the top of the seat panel and the bottom of the cap. Mark this maximum height so it can be used as a cut line later.
 3. Recheck everything for correct alignment! If all is well, pull out the pipe and remove the top seat panel.

Final Placement of the Mast tube and Top Seat Panel

1. Mix up and smear on a thick coat of GelMagic epoxy to the top's of all the rail material stiffeners used to support and attach the top seat panel to the full assembly. Enough to fill any gaps along the top surfaces.
2. Install the top seat panel and any pilot screws you have used to hold it in alignment. Add just enough weight to hold the panel down without squeezing out all the GelMagic. Let cure overnight.
3. Trim the pipe to the mark you made for the amount that sticks above the top of the seat panel. Smooth the cut edges. Sand the area of the pipe that goes through the top seat panel and the backing plate. This will help the epoxy stick and keep the pipe from rotating.
4. Coat the lower end of the pipe with pipe cement if you want (I didn't), and shove it down through the hole in the top seat panel until it slides "home" in the 2" union. If you didn't glue the lower end of the pipe into the pipe union, you can still take it out if you change your mind about how you want "your" boat.
5. You will fill in the small gap around the pipe with extra epoxy when you finish off all the seam

edges with glass tape. Or GelMagic if the gaps are "larger". ;)

Taping all the Seams (Seat Edges and Seat to Hull)

1. Mix up and "bag" some EZ-Fillet and fill in all the gaps along the seat seams and the edges between the seat panels and the hull (if you haven't done the seat to hull seams yet). Let cure overnight.
2. Mix up some straight epoxy and pre-wet the seam area out as wide as the tape you are using. Cut and place the tape in a logical order so the different layers fit in the corners smoothly. Think ahead and place some masking tape along the boundary's where a tape or several tapes meet along the hull. Then you can come back after the epoxy has turned "green" and trim to the inside of the taped line. Remove the tape and you have nice, even, corners and edges; and a better looking finish.
3. Wet out all the tapes and let cure. After curing, check for rough tape ends at the corners, and remove all the selvage along the edges of the glass tape. Re coat with a layer of epoxy to smooth and seal.

Note: I cut a 2-3" length from a cheap foam paint roller, and use this to even out excess epoxy along the tape and edges to minimize runs. Also to re coat any "cured and sanded" areas prior to painting. I roll the excess into any adjacent, or dry areas that I haven't coated yet.

4. Give the interior of the hull two coats of epoxy if you haven't done so already. Use the foam paint roller technique described in the previous note.

Interior Hull Finish

Natural

1. If you are going for a "natural wood" look, you will have needed to have masked off everything that was not filleted or taped from the very start of the project. All the pencil lines will need to be erased and sanded off. Any wood stains from doing the rails need to be sanded off, if its even possible. No fairing compounds can be used. Any rough edges have to be sanded smooth and coated with straight epoxy. It's hard to keep the boat drip free during construction. Mask everything off just beyond the edges of the taped seams.

Painted

1. Grind off any selvage along the fiberglass tape edges of the hull seams and any bulkhead seams that were installed in this boat. The taped edges can be faired in with fairing compound if you so desire. Block sand to a smooth finish.
2. Rough sand the interior with 100 grit paper. Use a finer grit if the plywood panels are still in a smooth condition. Final sand with 150 grit paper.
3. Vacuum up all the dust and such. Wipe the interior clean a couple of times with a damp cloth to remove any dust left behind. Rotate and change the cloth often to pick it all up.

4. There are several ways to final finish the hull. Epoxy, varnish, primer, paint, color pigmented epoxy, and combinations of all of them. The kicker is to make sure that any primer and paint you use is compatible **with epoxy and will dry when applied**. Before you use any paint, contact the epoxy manufacturer and see what they do or don't recommend. Sometimes they will be non-committal about what to use and recommend their product only. That is ok, but the price point may be higher than what you want to spend, and may involve too much work to redo the floors of your boat every two years or so. Other paints may work but you have to try them out on samples treated the same way your hull was prepped.
5. The following options may work for you.
 - a. One to two coats of epoxy, covered by varnish for UV protection.
 - b. "X" coats of epoxy, primed and painted with products that stick.
 - c. "X" coats of pigmented epoxy for wear ability and UV protection.
6. Color pigments can be added on some brands of epoxy. It does not effect the cure of the epoxy. Check to see if its possible with your epoxy; then follow the manufacturers instructions for mixing pigments to their epoxy products. A little goes a long way. The pigmented epoxies can be brushed, spread with a squeegee and rolled like regular epoxy. They make an excellent interior coating and come in several standard and custom colors.

Outside Hull Finish

Finishing and Taping the Seams

1. Apply straight epoxy on the edges of all the panels, to fill and coat the plywood edges to seal off and make them water resistant. This may be done after the hull sections have been cut out and prior to the wiring up of the hull. Mix only a small amount of epoxy! 1 1/2 to 3 oz's max.
2. Use "wood filled epoxy" to fill the gaps of all the outside seams using the "syringe or plastic bag method".
3. Or use a fairing compound such as **System Three's, Quick Fair** ®, to fill any small (non-structural) voids and gaps. The faring material can be worked 3 to 4 hours after applying, following the manufactures instructions.
4. Apply straight epoxy along the edges to 1 1/2" on either side on the hull seams for the 3" tape. Do instruction #5 before the epoxy is "green/tacky". You want to be able to slide the tape around and not have it be pulled out of shape. This will not require a lot of mixed epoxy, so make small batches.
5. Apply the 3" tape to the epoxy and wet out the cloth until it turns clear. Remember to minimize the runs. Use the 3" cheap foam roller trick to stop the runs. **Remember, big runs will have to be scraped off and sanded.** Let cure overnight.
6. Grind, scrape, or sand the selvage off the edges of the taped seams. Cut out and sand any bubbles or lifted edges in the tape where it did not stick to the hull. If it is a large area, cut out, sand and reapply tape to fit. Apply fairing compound to the edges and small voids in the tape. Extend the fairing compound out at least 3/4" from the edges to feather them in. Block sand after

3 to 4 hours to smooth the seams. Check for high and low spots. **Good work here pays off in the end.**

Finishing the Daggerboard Trunk

1. Rasp out the opening flush with the inside of the trunk taking care not to rough up the layer of fiberglass lining the inside of the case. There will be a small gap between the hull and the bottom of the daggerboard trunk where they meet. Fill this with a bead of epoxy fillet material and smooth. While applying the 3" glass tape to the outside centerline seam, let the epoxy turn "green" and then either trim to the edges or roll a bit of the side and end cloth into the opening. While applying the glass cloth to the bottom, trim it so one half of the opening cut rolls into the trunk from each side and is the full fore and aft length of the slot opening. Make sure to "wet" the inside of the trunk with epoxy before rolling in the 3" tape or bottom cloth.

Fiberglassing the Hull

I have pre-coated the taped (with faired edges) and sanded hull with a thin layer of epoxy and sanded the hull again before applying the glass cloth. I have also just spread the glass cloth over a taped (with faired edges) and sanded hull and applied epoxy to that. I have had good short term(boat life) results with both and have not had any problems with the glass cloth lifting either way. You will need to determine which way works best for you.

1. Apply a coat of straight epoxy to the bottom panels to seal the grain and keep from starving the glass to wood interface in the next step. Make sure to coat the areas covered with fairing compound on all the seams for the same reason. Again, try to minimize or eliminate any runs on the side panels. Roll out the excess wet epoxy with a 3" length of foam paint roller. You may want to mask off the area just below the fairing compound on the side panels with old newspapers or such. You will need this when you glass the bottom. Let cure overnight.

Check the manufacturers instructions to see whether or not you will need to lightly sand the hull before the next step. If it has been less than 12 hours since you did the pre-coat, you may skip sanding the hull before you put on the cloth. If you did the pre-coating early in the day, it may have cured enough by the afternoon to go on to the next step. It **has to be tack free** so you can move the glass cloth around on the hull. You be the judge.

2. Unfold and spread out the 4 or 6oz cloth on the boat. Hand smooth the cloth from the center outwards in all directions. Be careful not to destroy the glass weaving with too much hand pressure, or snag the cloth on any rough spots on the hull. Try to keep the weave of the glass strands square with the boat. I like to let the cloth sit on the hull for a couple of days to get rid of any fold marks. I will lightly hand smooth the cloth to conform to the hull, going in one direction and then another. It is possible to smooth the cloth to where there will be no need to cut and overlap seams at the bow. Just keep lightly brushing the cloth with your hand around on the hull as you smooth out any distortions. The cloth weave will spread and tighten as you do this and will conform to the hull with no wrinkles or folds.
3. On the PUD-g, 50" cloth will cover the "upper" seam joint to 1/2" above the panels seam; 60" cloth will let you have a full 1" overlap beyond the upper edge of the 3" seam tape. See the drawings for the masking tape trick to make a clean edge for trimming. The extra glass cloth covering the tape will be trimmed off.

4. Wet out the fiberglass cloth starting near the middle, and on both sides of the keel line and work outwards, and towards the bow and stern. After the glass has "wetted out" in those areas and turned clear, squeegee the excess epoxy to the dry areas of the cloth, outwards and away. Be careful when you squeegee to the edges, that you do not move so much epoxy that it will run down the sides. On the sides, wet out the cloth to only $\frac{1}{2}$ the width of the tape you placed for your cutting edge. Once you start the process, it will become obvious what to do.
5. If you have a daggerboard slot in the hull, you will want to wet the cloth that covers the hole and let it turn "green". You will come back later with a razor blade and cut it down the middle to 1" from the ends and then make 45's to the corners. Fold the glass into the slot opening and press down. Apply more epoxy to hold them down if needed.

Note: If using the "fast" hardener in hot weather, pour the mixed epoxy out in big "S's" and get it out of the cup so the concentrated epoxy doesn't go "off" in the cup.

6. The thinner you can first spread it out, the longer the working time you will have to squeegee it around. Squeegee the "foam" to the dry cloth areas as you work. If the boat will not be painted, wipe the "foam" off the squeegee with a cloth. After three (3) hours the epoxy will be "green" and it is time to trim off the excess fiberglass with a very sharp knife. This will be easy if you used the taped edge method explained earlier. Take a very sharp knife/razor blade, and cut along the upper edge of the tape that was used to mark the lower edge of the 6oz bottom cloth. *See plan drawing.* Push down the fiberglass with a gloved finger if an edge lifts while cutting. Remove the tape and paper and let the hull cure over night.
7. Roll out and around on the hull, any excess epoxy, with a 3" length of cheap foam paint roller on a 3" cage. This will give you an even coat and reduce the chance of runs that will have to be scraped or sanded off. Let cure overnight.
8. Block sand the rough edges of the 6oz bottom cloth. Feather the edges out $\frac{3}{4}$ " with fairing compound. Then add more coats of straight epoxy to fill the weave of the cloth and protect the glass fibers that are still proud. To really help in the weave filling process and to locate any "bad" spots in the glass cloth, add some pigmented paste to the epoxy. It doesn't take much, and any flaws in your work will show up now, and not after you have painted it.

Note: Find and fix any humps, bumps, or voids in the hull's surface now, as you add layers of epoxy to fill the weave. If you bought two colors of pigment paste, you can change the colors slightly as you add another layer of weave filling epoxy. It doesn't take much, and 3oz of epoxy will give the PUD-g a complete coating if you use the foam roller to even it out.

9. Sand the bottom, sides and ends. Make it smooth. A dollars worth of sandpaper and a couple hours of labor here will make all the difference in the world. Fill and sand any remaining low spots. Use a bright handheld light held at an angle, to check the surface for flaws.
10. Now take a minute, stand back, and admire your work. At this point you have some decisions to make. This is a beautiful design and if you have followed the instructions and taken your time, a beautiful boat now sits before you. If you are just going to use it to bang around in for some fishing or for the kids to play with, just put on a couple of coats of paint thats compatible with epoxy, on the outside and be done with it.

Note: Be forewarned that some primers and paints will not dry or adhere well to epoxy finishes!

Check with the manufacturer of the paint, and the manufacturer of the epoxy before you use the product!

Painting the Hull with Two Part Polyethylene

1. Now is the time to put on that expensive epoxy primer listed in the materials list. Follow the directions on the can, but more importantly follow the how to apply directions contained in the information sheets from the manufacturer or on their web site. Follow the sanding directions and give it time to cure.

Note: A well finished and lightly sanded epoxy surface can also work for the polyethylene paints.

2. The two part, water based linear polyethylene paints do not bite. It is not that difficult to get good results if you take your time and learn from my mistakes. Try to do it indoors, out of the sun and in less that 80 degree weather. A rainy day is perfect. Indoor and dust free only!
3. The first thing is to have a good clean surface, so wipe it down a couple of times with a clean damp cloth.
4. Have a good quality, natural bristle brush for the "tipping", and a good quality foam or "woven" cloth roller brush. Money here is well spent. One of the cheap plastic "roller pan" liners will be good enough for this job. The **System Three LPU** paint is easy to clean up in soapy water. Real easy, but have a couple of buckets of water nearby before you start. Also a bottle of clean water to mix with the cross linker.
5. The most important thing to know now is how much to mix up for the first coat. On an 8 foot boat a 7oz mix (6oz paint + 1oz clean water mixed with 48 drops of cross linker) will give you 4 coats. The last coat will probably be an 8oz mix (7oz paint + 1oz clean water with 64 drops of cross linker). If the last mix is short a few drops of cross linker, don't worry.
6. Pour 6oz of LPU paint into a cup. Mix the cross linker with 1oz of water in a separate cup and then stir the cross linked mixture into the paint. Mix well and pour in roller pan.
7. The paint will seem fine in the pan, but will seem "runny" when you roll it onto the hull. Roll it on at all angles, moving from wet to dry areas, until there is an even coat over the entire hull, and watch for excessive runs. As you roll it on, bubbles will form on the surface, making it look like tapioca pudding. Not to fear; this is where the good quality natural bristle brush comes in. Put the roller and roller pan in a bucket of water and pick up your brush. Use at least a 3" wide brush and lightly drag it along the surface in long strokes. On this boat you can walk along the side and make one stroke from end to end. Streaks will appear, but do not worry. The paint will flatten out and fill them in. Clean the tip of the brush with water a couple of times while "tipping" to keep the finish smooth. Just dip the tip of the brush in water and wipe with a clean cloth. Do the whole hull. Watch for runs. Check with a hand held light. Clean rollers, brushes and pan in soapy water.

Note: To have someone follow behind tipping a completed section as you roll on the paint is a big plus. But good results can be obtained with just one person. You just have to have things ready when you need them.

8. The paint should be dry enough to re-coat in about 2 to 3 hours. Repeat step "7" again for the next three coats. If you start around 8 O'clock in the morning, you should have the whole boat painted by early evening. Pull off all the masking tape and clean up any wayward drops.
9. That's it. Now let it set for a couple of weeks for a full cure and you have a hard shell finish that will last a long, long time.

Using Marine Enamels

1. There are several good brands of marine enamel paints on the market. Try to use the water based brands, as the clean up is a lot easier and the fumes are nil. Follow the manufacturers directions and use good quality rollers and brushes for applying the paint.
2. Some of the brands have curing times of several days to reach a hard shell finish. Let the boat set for the time called out to achieve best results. Paint the inside first, flip the hull and complete the bottom.
3. Do your final coat of bright work varnish after the hull has cured. I like to put two coats of varnish over two coats of epoxy, each layer lightly sanded before the next coat goes on. I sand the second coat of varnish and leave it that way until I finish painting the hull. Then I clean up any splatters and apply the final coat of varnish to the bright work.
4. Install any remaining hardware to the hull at this time; like the bow stainless towing eye. Add in any type of foam flotation you want to the bow and stern seat cavities. Install any hatches you may have added with with a good bead of sealant and stainless fasteners.
5. Grab the oars and sail rig, head to the water and enjoy.

The Sailing Option

Rudders, Daggerboards, Tillers, and Mast Partners

Rudders

1. The plans will show more than one way to make the rudder, using the material of your choice. It can be cut and shaped from a single piece of plywood. Cut, glued, and shaped out of several blocks of cedar. Or laid up from several pieces of 1/8" (3mm) plywood, and shaped to a NACA 0010 or NACA 0012 section. Read instruction #13 in the Layered Plywood Daggerboard section.

Plywood

1. If you are going to use a single blank of plywood for the rudder, use at least 3/4" thick material. Try to use a marine grade blank with multiple ply's for stiffness. Round the leading edge and taper the trailing edge to 1/4" thick, while maintaining a straight vertical bevel line on both edges and sides. You may have to build a jig for your adjustable tablesaw guide to hold the rudder as you slide it past the angled saw blade. You should be able to get a 2" bevel from a 10" tablesaw. Sand to a fair shape, then coat the daggerboard and especially the exposed laminations and edges, with several layers of epoxy. Then finish with 2-3 coats of paint or varnish to reduce water penetration.

Solid Wood

1. A solid wood rudder can be made with 5/4's (1" thick) cedar. The cedar that's on the market now a days, is from very young trees, with very large ring widths. The boards will be prone to warping and cupping if left as one section. To get around this problem; rip the board into 1"x1" strips, and to the length you will need. Reverse the tops with the bottoms and leap frog the strips around so that none of their long edges remain adjacent. If the board was rough cut on one side, rotate the two strips on the ends of the stack 90 degrees so the rough edges face outwards. That should mix up the grain pattern enough to reduce any tendency for the laminated strips to warp. Use a good waterproof glue or epoxy, to join the strips together to form a new blank. Use dowels if you want too.
2. Follow the plans of how to make the many lengthwise rip cuts to form the cross section. Make all the rip cuts before you do any shaping. Do this before you make any of the "tapering" cuts to form the outline of the rudder. Use a colored grease pen to mark the "master" rip cuts. These will be high points used for shaping the cross section. Plane, rasp, and sand the blank to the final, fair shape. Mark and cut the final outlines of the rudder stock. Keep an eye on both sides as you shape the blank, and make sure they are even and symmetrical to each other. Fill any low spots with fairing compound and finish sand to a smooth surface. Coat the blank with several layers of epoxy, then paint or varnish for wear and UV protection.

Layered Plywood (my choice)

1. A rudder without all the hand cutting, shaping and sanding can be made from 1/8" (3mm)

plywood strips. Try to get marine grade plywood if you can, but regular grades will work. Just add at least three coats of epoxy. Follow the plans for the size of each of the matched pairs of strips. Note the arrows on each of the strips showing the direction of the grain of the top ply. This will ensure that the finished rudder will have the greatest resistance to bending and twisting. There will be 8 strips of various widths and lengths to make a rudder with a NACA 0012-8 cross section. Use the rudder plans for all layout and cutting details. Remember to check the ply orientation (direction) when laying out the individual strip layers prior to cutting. Look twice, cut once. Go to the following "Layered Plywood" section on centerboards to read the how to instructions, since the rudder is constructed in the same manor.

Note: The strip stacks are mirror images of each other. Do not arrange both stacks in the same order with the same nail guide holes. Drill a set of new guide holes for the "other" strip stack. Do a preliminary setup of the separate strip stacks to see what I mean. Then keep the stacks marked and apart from each other until final assembly.

Daggerboards

1. The plans will show more than one way to make the daggerboard, and using the material of your choice. It can be cut and shaped from a single piece of plywood. Cut, glued, and shaped out of several blocks of cedar. Or laid up from several pieces of 1/8" (3mm) plywood, and shaped to a NACA 0010 section. Read paragraph 13 in the Layered Plywood section before you begin.

Plywood

1. If you are going to use a single blank of plywood for the daggerboard, use at least 3/4" thick material. Daggerboards do not have to have a thick cross section to be efficient, but must be thick enough to resist bending moments. Try to use a marine grade blank with multiple ply's for stiffness. Round the leading edge and taper the trailing edge, while maintaining a straight center line on both edges and sides. Sand to a fair shape, then coat the daggerboard and especially the edges, with several layers of epoxy. Then finish with coats of paint or varnish to reduce water penetration.

Solid Wood

1. A solid wood daggerboard can be made with 5/4's (1" thick) cedar. The cedar that's on the market now a days, is from very young trees, with very large ring widths. The boards will be prone to warping and cupping if left as one section. To get around this problem; rip the board into 1"x1" strips, and to the length you will need. Reverse the tops with the bottoms and move the strips around so that none of their long edges remain adjacent. If the board was rough cut on one side, rotate the two strips on the ends of the stack 90 degrees. That should mix up the grain pattern enough to reduce any tendency for the laminated strips to warp. Use a good waterproof glue or epoxy, to join the strips together to form a new blank.
2. Follow the plans of how to make the many lengthwise rip cuts to form the cross section. Make all the rip cuts before you do any shaping. Use a colored grease pen to mark the "master" rip cuts. These will be high points used for shaping the cross section. Plane, rasp, and sand the blank to the finial, fair shape. Keep an eye on both sides as you shape the blank, to make sure they are even and symmetrical to each other. Fill any low spots with fairing compound and finish sand to a smooth surface. Coat the blank with several layers of epoxy, then paint or varnish for wear and UV protection.

Layered Plywood (my choice)

1. A daggerboard without all the hand cutting, shaping and sanding can be made from 1/8" (3mm) plywood strips. Try to get marine grade plywood if you can. Follow the plans for the size of each of the matched pairs of strips. Note the arrows on each of the strips showing the direction of the grain of the top ply. This will ensure that the finished daggerboard will have the greatest resistance to bending and twisting. There will be 6 strips of various widths and lengths to make a daggerboard with a NACA 0010-8 cross section. The 0010-8 designation means that the board has a cross section of about 3/4" and a cord length of 8" and is a "lifting foil". To make it easier to assemble the strips, do only one half of the daggerboard at a time.

Note: The strip stacks are mirror images of each other. Do not arrange both stacks in the same order with the same nail guide holes. Drill a set of new guide holes for the "other" strip stack. Do a preliminary setup of the separate strip stacks and join them together to see what I mean. Then keep the stacks marked and apart from each other until final assembly.

2. Take one each of the cut pieces and stack them in position according to the dimensions in the plans, and on a solid, flat surface. To keep the strips from moving about while you epoxy them together, drill three holes on the lengthwise centerline of the 2" strip and equally spaced down it's length, and drilling into the flat surface you are using. You might want to do this on a separate piece of 2x12 or thick piece of plywood. Use a drill that is the same diameter as any small finishing nail you have laying around the shop. Push a nail into each of the drill holes and remove any clamps.
3. You need to shape the bottom end of each strip of the daggerboard to maintain the NACA 0010 cross section. To do that, each of the strips needs to be separately marked and cut. Follow the plan measurements to layout and cut each of the plywood layers. Rough cut all the strips of one set and re-stack in the nailed pile to check that everything is correct. Un-stack the strips and place in separate piles. Line up the leading, long edges of each strip with it's equal and opposite mate and cut the ends to match. Smooth the ends of the matched pairs enough to make them even. There will be a final shaping and sanding later. Mark each strip for top, leading edge, and outward face. Place them back in their own separate "mirror image" stacks.
4. Rebuild one stack of the strips and line up with the nails . Take a pencil and mark the outline of each strip on the one below it. This will give you a reference of how far to spread the laminating epoxy. You will coat the rest of the strip and the edges later before you put on the "fillet" epoxy. If you don't coat it, you won't have to sand it later for the next step! Repeat with the other stack.
5. Pull the nails and set the top three strips aside. You will want to place some plastic sheeting under the first strip to protect your work area. Coat the "top" of the first layer with epoxy, and the bottom of the second layer. Stack them on the plastic protected work area and use two of the guide nails to center everything up. Coat the top of the second layer and the bottom of the third and place in the stack. Only coat the bottom of the last strip. Check to see that the strips are all laying flat, with no warps. Cover with some plastic sheeting and with just enough weight to keep everything flat. If you have an edge that wants to lift, just use a short sheet rock screw to hold it down. The fillet material will cover the holes. Another way to do this is to replace the nails with screws and just snug them tight. Then take scraps of the 1/8" plywood and build up the stair steps (on top of plastic sheeting) to a flat upper surface, cover with a something big enough to cover everything and top with some weight. Let cure overnight. Repeat the process with the

other set of strips.

Note: Remember the second stack is a Mirror Image, is laid out backwards and requires it's own set of nail guide holes.

6. Coat the bottoms of the two stacks with epoxy, line them up with the nails or screws, and lightly clamp the edges all around. Let cure overnight.
7. Block up the daggerboard blank so it doesn't wobble around. Use a plane or rasp to slightly bevel the leading and trailing long edges of the "top", 2" strip so it matches the cross section view in the plans. Sand the bevels even and smooth. Clean off all dust. It's ok to skip this instruction and just use the unbeveled strip edges as the guides for leveling the fillet material. This is not for a 12 meter America's cup contender.
8. Coat all the surfaces with epoxy, and especially the edges, and let the epoxy soak in. Mix up and bag, some "fillet material" as you have done earlier. Squeeze out a bead along one of the "stair steps" and use a small straight edge to fair the material into the gap between adjoining edges. After you have filled all the stair steps; take a longer and more flexible straight edge and pull the full width. Be careful on the curves. **If the material is pulling up, stop and let it cure.** Limit creating any high spots you may have to sand later. You can come back after it has cured and fill any low spots with "fairing compound". Let cure overnight.
9. Rough sand with 60 grit to smooth and find any high or low spots. **Wear A Dust Mask!** Sand down the high spots and fill any low spots with fairing compound
10. Layout the "lifting hole". Use a 1" drill to make the end cuts and a keyhole saw to open up the center. Round and smooth all edges. Drill the hole for the 3" circle made from scrap 1/4" plywood. Round and true all edges.
11. Finish sand with 100 grit, remove any dust from the surface, and apply at least three coats of epoxy to the daggerboard. Make sure to coat the interior of the handle.
12. Whether or not you fiberglass the daggerboard is up to you.
13. Only a good sailor will know the difference between the above instructions and a plain old 1"x10" board stuck down the daggerboard trunk. Be realistic in your sailing abilities.

Tillers, Pintles and Gudgeons

1. Check the plan details for size and shape. The tiller can be made out of anything that has the strength to handle the job and is pleasing to the eye. The only thing it has to do is be the right length and fit the head of the rudder. You can make it round, square, or tapered; from solid wood or laminated. Use at least a #10 stainless steel bolt, washers, and nut to attach it to the rudder.
2. Use pintles and gudgeon's that are heavy enough to do the job. Use the "long and short" pin pintles to make it easy to attach and remove the rudder, and the long pintle goes on the bottom. Make sure you epoxy "backing blocks" of adequate size, to the inside of the stern hull panel to spread the loads in case of a grounding. Use stainless bolts and backing washers to attach the gudgeon's and bed with sealant to keep the water out. A good supply of sizes can be found at www.duckworksmagazine.com. **See the note below for an alternate way to mount the**

gudgeon's and pintles.

Installing the Tiller Hardware

(do this before any interior or exterior painting)

The Gudgeons

1. Find the stern panel centerline that you used to layout the panel with. Check that it is the true centerline of the hull. If not, establish a new one.
2. Measure down from the "underside" of the stern rail and make two marks on the stern panel centerline. One at 2" and one at 9". These marks will establish the "top edge" of the gudgeon brackets. Use something that will give you a true 90 degree angle to the centerline, and widen the marks.
3. Use a 1/8" drill bit to drill one pilot hole for a #8 screw to hold the top gudgeon to the hull. Align the gudgeon to the mark and drill. Place the screw and check for alignment with the mark. Switch bits and drill a 3/16" hole on the opposite side of the pintle pin opening, and insert a 3/16" stainless machine screw in the opening. Check for level.
4. Add a nut to the first machine screw and tighten. If all is well, drill the next two holes and insert those machine screws too. Remove the #8 screw and drill that hole as well.
5. I have a 3/8" x 12" bolt (bolt head down) that I use to line up the lower gudgeon with the upper one that we just installed. Place the lower gudgeon on the bolt and insert the threaded end into the upper gudgeon. Add a nut to the bolt and let everything rest on the upper gudgeon.
6. Move the lower gudgeon up to it's mark and check for level with the 9" line. Check to see if it is "square" with the upper gudgeon, by seeing if the bolt will move up and down easily. Move it around until it does. Hold the lower gudgeon in this "free zone" and drill a 1/8" pilot hole for the #8 screw again.
7. Repeat steps 3&4 again. Always checking that the 3/8" bolt still moves smoothly up, down, and around. Tighten all the machine screws.

The Pintles

1. Now that the gudgeon's are installed. Its time to mount the pintles on the rudder. But first you will have to shorten the pins. Your other choice is to lower the height of the upper gudgeon. I like to shorten the pins so I can have the upper gudgeon higher on the hull and have greater strength.
2. Trim the upper pintle pin to 1" below the arms and the lower pintle pin to 1 1/4". That still gives you 1/4" of pin below the bottom of the upper gudgeon. File a slight bevel to the cut ends. You do not have to file them to a point to still work correctly!
3. Put the pintles into the correct gudgeon's (short pin on top) and slip the rudder into the "pintle arms". Raise or lower the rudder to the correct height *(the top of the "shaped" leading edge of the rudder, should be even with the keel seam at the stern)* and clamp it in place. See the plan

drawings for the details.

Note: I find it handy and makes a better fit, if I place a 1/2" dowel between the aft facing "V" of the two pintle arms and the front of the rudder blanks leading edge. Then clamp everything together.

4. Now is the fun part. ;) It's not. Trying to keep the rudder free swinging as you drill the holes, and install the machine screws that hold everything together. Be really careful here! You don't want to drill over sized or misaligned holes that will let the pintles move around and make the rudder "growl" as you steer the boat.
5. Move the "clamped" rudder back and forth to make sure that it still swings free, and the pins wiggle around a bit in the gudgeon's. Check to see if the pintle arms still look like they are 90 degrees to the stern panel and gudgeon's.
6. Drill the first hole in the upper pintle and in the forward hole. Do not try to go all the way through from one side to the other. Drill only in about 1/4" and stop. Go to the other side and drill back through. A smiling God will let the bit go through on the first pass. By doing it this way, you reduce the chance of hollowing out a big hole on the other side as you try to drill your way through in one pass.
7. Check everything again and drill the first hole through the rudder in the lower pintle. Add the machine screw and tighten. Check to see that it still swings freely.

Note: It helps to let the upper pintle carry the weight of the rudder. Try to leave a small gap between the bottom of the lower pintle and the top of the lower gudgeon. This is one thing that helps keep from having a sticky rudder after the installation process. Also lots of patience during installation.

8. Do everything again to drill and install the outer (aft set) of machine screws. Take your time. I didn't get a freely swinging rudder until the fourth hull. The first three growl at me, but I don't need a rudder retainer to keep it in. I just yank up hard to remove it. ;)
9. Remove, and set aside all the hardware. Complete the finish work on the rudder and hull.

Note: The machine bolt and nut sizes I used to install the prototype hull's rudder. Gudgeons to hull: (8) 10-24 x 3/4" round head machine screws with (8) 10-24 nylock nuts. Pintles to rudder: (4) 10/24 x 1 1/4" round head machine screws with (4) 10-24 nylock nuts.

Towing Eyes

1. Consult the plans for location, and use at least a 1/4 " stainless U-bolt with stainless nuts and washers for the towing eye. Make sure it is low enough on the bow to give it a "lifting force" as it is pulled. It will also be used as a winch eye and tie down while being carried on a trailer. Make sure to add a backing block of sufficient size and thickness to spread the loads imposed on the hull. Add a stainless backing plate or large stainless washers to spread the forces and not compress the wood backing block. Coat the wood backing plate on all sides and edges with a good layer of epoxy. Use a screw or tape to hold the block in place while the epoxy cures. The holes for the U-bolt will be drilled later after the bottom has been glassed, but before it is painted.

Note: You could also pre-drill the holes in the bow seam from the outside; before the outside seam tape

is added. The holes will show through the wetted out glass tape and cloth and be easy to find and drill through the glass and interior backing block. This will be the easiest way to find the centerline and keep the holes centered.

Main Sheet Attachment

1. I haven't decided which method is the best for the PUD-g. I like the mid-boom attachment that I have used on the Nuthatch and Laura Bay, but I think that an "end boom" setup would be better for the PUD-g.
2. For the end boom system, you will need to drill a hole in each of the stern corner blocks. The holes are for the "bridle" line that a traveler block will run back and forth on. One end of the line is lead through the hole from the top and a stopper knot is tied in the end. The other end is fed into one of the pulleys in the traveler block and down the other hole. To hold the line after adjustment, mount a cleat on the underside of the rail near the corner block; or just tie a stopper knot in the end. Leave about 6-8" of slack in the line; measured above and in the middle of the stern rail. *See the plan details.*
3. About 6-8" from the end of the boom, attach an eye for the upper block (a single block w/becket) of the main sheet. Attach the main sheet line to the becket with a bowline knot, down to the upper block of the travel, back up to the upper block and forward to a single block in the middle of the boom.
4. To finish the line off, you can either hold the main sheet in your hand and play it in and out, or add another block mounted on the center seat and use that as a turning block. Maybe use a block with a cam cleat. After sailing my hull, just hold the line in your hand.
5. Another way is to use a double block shackled to a single block on the traveler line. The main sheet goes down from the becket, through the upper half of the lower block, back to the upper block, and back down and through the lower half of the lower block. *See the plans for alternate methods.*

Drilling the Hole for the Snotter Hook

1. In the plan drawings for the mast hardware details, a warning box tells you to go read the instructions before drilling the hole/mounting a stainless eye bracket in/on the mast for the snotter line block. This is because I drilled my first hole in the wrong place. Seemed like the right spot, but when I set the sail the first time, the sprit pole did not hold the sail correctly and I had a big crease in the top of the sail.
2. To find the correct height for "your" sail, temporarily half hitch a line (keep it short and tight so the block is next to the mast) around the mast to hold the snotter line turning block. Set the sail and then adjust the half hitch line up or down on the mast, until the sprit pole sets the sail with no creases.
3. The turning block should be "next to" and aligned at the same angle as the sprit pole when things are correct. By moving the attachment point of the turning block up or down the mast with the sail set; you will see what I mean as the sail develops creases or sets smoothly.

4. Once you have found this point, you can either drill a hole for a plan block with hook, or pop rivet a stainless eye to the mast to hold the top loop of the turning block. An error of 1/2" up or down should not matter.

Masts, Booms, and Sails

Masts and Booms

1. The mast and boom diameters and lengths will be called out in the building instructions. References to suppliers will be noted in the building instructions. Every effort will be made by the designer to see that standard mast and boom sections will be used for that particular design.

Sails

1. The sail type and size will be called out on the plan set and in the building instructions. Every effort will be made by the designer to see that readily available sails from existing boat classes can be used for this design.

Standing and Running Rigging

1. Readily available blocks, pulleys, line, and fittings will be called out in the plan and building instructions sheets.

The Pud-g Sailing Option

Any International Optimist sail and mast setup will work on the Pud-g. It may seem over sized for the hull, but PUD-g gets up and hauls keel in a breeze. The first hour I sailed the boat, I thought I had a CLR/CE balance problem with handling and steering. After I got my body out of the stern area, and moved crossway's just behind the daggerboard housing and hung my feet over the side, the problems when away. Just slouch down in the bottom and enjoy. The kids will have a blast; "if" the Captain gives up the helm. ;)

Check your local sailing clubs and sail lofts for locating new and used equipment. Several dealers and manufacturers can also be found with a "Goggle" search for "Optimist sails".

Complete rigs can be found at: www.optiparts.com or www.pyacht.com or www.optistuff.com. From inexpensive "Club and Training" sails and rigs, to very expensive "Racing" sails and rigs.

Another method and a little cheaper is to go ala cart. That way you can build your rig as you go, but you may have to manufacturer or adapt some of your own mast, boom, and sprit end fittings. Check the web at www.winners-marine.com and download a PDF file for how to rig optimist sails. www.flickr.com/photos/redbarnboats.

A good and inexpensive Optimist sail can be found at www.neilprydesails.com or calling 203-375-1626. The 2006 price was \$95.00, plus shipping and any taxes for your area. Call for availability. This is the sail I use for the Laura Bay, 8ft Nuthatch and the Pud-g, and I have been very happy with the quality of the fit and finish. The sail sets smoothly, with no creases.

Mast, boom and sprit tubing can be found and ordered online at www.onlinemetals.com or by calling 1-800-704-2157. The tubing is T6-6061 seamless, and is non-anodized. Order one 8ft length of 1" OD x 0.065" wall thickness for the sprit. One 7ft length of 1.375" OD x 0.065" wall thickness for the boom and one 8ft length of 2" OD x 0.065" wall thickness for the mast. You can fly a sprit sail without a boom, but if you chose to use a boom, it will need to be trimmed to fit the sail you do use, and need a "Y" yoke where it rides on the mast. My mast, sprit, and boom rigging solutions are shown in the plan set and seen in the photos online in my series of stories on the construction of the Laura Bay at <http://www.flickr.com/photos/redbarnboats>

Screws, hatches, blocks, fittings, and such can be ordered at www.duckworksmagazine.com
Good quality fittings and at a very good price.

Tools Used

The following tools were used in the construction of the Pud-g. I use a lot of hand tools when I build a boat, but the old standby power tools have their uses too. The tablesaw was the only electric tool that I couldn't do without, unless I had someone else rip out the rail stock. A good bandsaw with guides could also do that and the corner pieces too.

Hand Tools:

Small Hammer	Lineman's Pliers (cutting and twisting tie wire)
Phillips screwdrivers	Wire Cutters (for removing tie wires)
26" Handsaw (cutting out the panels)	Small Wrench Set (assembly bolts and nuts)
Coping Saw	Levels (12 or 24" and 48")
Dowel Cutting Saw	Adjustable Sliding Bevel Angle Tool
12" Hand Rasp (medium cut)	Framing Square (bulkhead, etc. layout)
Cabinet Scraper (+file to sharpen)	Lofting Batten (at least 12 feet long)
Hand Brace and Bits (set - 1/4" to 3/4")	Epoxy Squeegees (at least one 5" rubber edged)
Countersinking Set (small, med, large)	Hand Sanding Blocks
Poprivet Gun (5/32" and 3/16" rivets)	Paint Brushes, Rollers, Frame, and Pan
Drill Bit Set	Good Portable Shop Light
Hand files (various sizes and cuts)	Good Quality Sawhorse Brackets (work platform)
Clamps: (lots)	
C (small)	
pipe (12" to 48" ranges)	
hand (open to at least 2" for rails)	

Electric Tools:

Have:

- 10" Tablesaw
- Electric Drill (1/4") and (3/8")
- Quarter Sheet Sander (I like the Porter Cable 340)
- Shop Vac (with hoses that fit the sander)
- Wood Lathe and Tools (for fancy tillers and such – but not needed otherwise)
- Screwdriver (small)
- Router (for scarf joints)

Wish For:

Bandsaw (14")
Floor Drill Press ($\frac{1}{2}$ " chuck)
Electric $3\frac{1}{4}$ " Planer Hand held (alternate for scarfing)

Side note on mounting the snotter block: Not all sails will be constructed the same, and the angle the sprit makes with the mast will determine the shape of the sail. Before you drill any holes for either a hook or eye pad, bend the sail to the mast and boom and check the sprit angle. Then wrap a line around the mast where the instructions in the plans say the hook or eye pad will be mounted. This will be where you temporarily mount the snotter block. Attach the sprit to the sail and tighten the snotter line. Look for creases in the sail along the sprit. Move the snotter block and mast wrapped line up or down until the crease disappears. This is where you want the snotter block to be located. The block should now be inline with the sprit. Mount the block in this location and determine the height of either the hook or eye pad.

Side note on mounting the gudgeons and pintles: If you don't/won't add wood blocks under the gudgeons so the upper pintle clears the aft stern panel rail, you may have to shorten the upper and lower pintle pins so the rudder can be removed. If you don't, the upper gudgeon may get mounted too low and close to the lower gudgeon. The lower gudgeon is centered and mounted on a line between the chines and should go no lower. You may have to indent the lower edge of the stern rail for the upper pintle to clear. If the gudgeon is $\frac{3}{4}$ " wide, the upper pintle pin can be trimmed to $1\frac{1}{4}$ " long, and still function properly and still have the upper gudgeon mounted high. The lower pintle pin then needs to be shortened to $1\frac{1}{2}$ ". This is the way hull #1 is constructed. Don't forget to place a "spring style stop" above the lower pintle so you don't lose your rudder some day.

Revision Updates: