

RED BARN BOATS



redbarnboats@netscape.com

9.5 ft Laura Bay

Plan build — V.1.0.4 — 2-20-2007

LOA:	9' 6"
Beam:	52"
Transom Width:	42"
Transom Height:	17"
Draft:	2"
Weight:	xx lbs.
Maximum Outboard:	3 HP
Maximum Load:	500 lbs.
Maximum Weight:	450 lbs.
Maximum Persons:	3 Adults
Oar Length:	7.5-8 ft
Sail Area	36 sqft.

The 9.5 ft Laura Bay

To the Builder:

Thank you for choosing to build the Laura Bay. The Laura Bay is the first of a series of multi-chine boats that I will be posting at Duckworks in my section of the Designers Group. The design came about as the result of work I had spent developing a plywood based boat that could compete with the Lazer, and be a whole lot cheaper to build. That boat will be called the "Plyzar", and be out later.

When I was designing this boat I knew that it had to be longer than my Nuthatch pram to get the volume I wanted to carry any kind of load. You don't gain that much extra interior hull volume going from a pram to a "Vee" bowed boat. You just fill in the gap ahead of the bow of a pram if the gunnels and keel line continue on and come to a point. You get a longer boat without that much of a gain in area, but you do gain some wave splitting abilities.

The hull had started out as a twelve footer, and several rounds of model making resulted in my No. 11 hull which hangs by a string in my kitchen. At twelve feet it was a very graceful hull as it was, but I wanted just a bit more freeboard so I raised it up a bit on the upper hull panel and made the No. 12 hull, which also hangs in my kitchen. While doing a Google search on small boats, I came across a discussion board where a very well known Seattle yacht designer was asking for opinions on what was a good hard-shell dingy design. I gave him a call and we talked about dingy designs for a yacht he was designing for a customer. I told him I thought I might have something that might interest him. I then took the No. 11 and No. 12 hulls and scaled them back to fit on a 10 foot sheet of plywood (or scarfed pair) and after many, many, many models later, I had four different versions going. I finally settled on a version from the No. 12 family, and model No.6 of that line became the Laura Bay.

The first hull was fun and easy to build and had very few changes that needed to be made to the original drawings. Everything from the instructions to the drawings have been updated for this current set of plans. This is also one of my sailing designs and those instructions and drawings are included too.

This series of boats will be named after women that I should have formed a serious relationship with, but then when we're young we all make wrong choices. Right? I received the most memorable kiss in my life from a certain young woman, and the Laura Bay is my tribute to that wonderful event.

Check out the plans section at www.duckworksmagazine.com for more of my designs.

Thank you again.

Warren D. Messer

CONSTRUCTION DESCRIPTION INDEX

Materials List:.....	4
Work Platform:.....	6
Scarfig:.....	6
Lofting the Lines:.....	11
Cutting out the Panels:.....	13
Marking and Drilling the Stitch Holes:.....	14
Wiring it all Together:.....	14
Laying out the Stern Panel.....	17
Squaring Up the Hull:.....	17
Gluing the Stitched Hull:.....	18
..... The Jump Stitch:.....	18
..... Fillets and Taping the Seams:.....	19
Fitting Out the Interior:.....	21
..... Putting in the Bulkheads:.....	21
..... Seat Support Rails:.....	23
..... Daggerboard Trunk:.....	24
..... Movable Center Seat Option.....	25
..... Cutting Corners:.....	27
..... Fitting the Rails:.....	30
..... Oarlock Brackets:.....	34
..... Shaping the Rails:.....	34
..... Filling the Holes:.....	34
Interior Finish:.....	34
Exterior Hull Finish:.....	35
..... Finishing and Taping the Seams:.....	35
..... Fiberglass the Hull:.....	35
..... Painting the Hull:.....	37
The Sailing Option:.....	41
..... Rudders:.....	41
..... Daggerboard:.....	42
..... Mast, Partner, and Supports:.....	44
..... Tillers, Pintles, and Gudgeons:.....	47
..... Mast, Boom, Sprit, and Sails:.....	48
..... Internet Contacts and Phone Numbers:.....	48
Tools: Used, Have and Wished For:.....	50
Revisions - Numbers, Dates, Items, and Notes:.....	51
Plan Drawings:.....	
..... Printable Model:.....	D1
..... Plywood Layout:.....	D3
..... Scarfig Details:.....	D4-5
..... Lofting Measurements:.....	D7
..... Bulkheads, Seats, Daggerboard Trunk:.....	D8-12
..... Construction Details:.....	D13-15
..... Plan & Profile:.....	D16
..... Sailing Rig:.....	D17-18
..... Daggerboard Layout:.....	D19-21
..... Rudder Layout:.....	D22-25

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:

..... 4ft x 8ft x ¼" (6mm).....	3 Sheets
OR..... 5ft x 10ft x ¼" (6mm).....	2 Sheets
..... 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.....	2 Boards
----------------------------	----------

Softwoods and Scrap plywood:

..... 2"x 2"x 8 ft.....	1 Board
..... 3-4" x 48" scraps of ½" plywood (if you have to scarf).....	8-10 pieces

Stainless Screws:

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

Stainless ¼" U-Bolt w/nuts, washers, and backing plate..... One set

Pan Head Bolts, ¼" x ¾", with nuts and (2X) washers:..... 100 sets

Steel Tie Wire:..... Roll

Gorilla Glue:..... 12oz bottle

Plastic Sheeting: (epoxy protection)..... 10ft x 10ft

Stain (water base)..... ½ pint

Used Toothbrushes..... 8-10

Sand Paper: (60 grit, 80 grit, 100 grit, 150 grit)..... 5 sheets each

Epoxy Materials From:

www.systemthree.com or www.duckworksmagazine.com

..... 2" and 3" tape – 9oz. From System Three (cheaper with 50ft roll)...	50/25 yards each
..... (OR) 3" and 4" tape – 4oz. From Duckworks.....	50/25 yards each
..... 60"- 4oz or 6oz fiberglass cloth.....	3 1/3 yards
..... Silvertip Resin.....	1 Gallon
..... Silvertip Hardener (fast-below 80°; slow-over 80°).....	½ Gallon
..... 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:

..... WR-155 primer.....	1 quart
..... WR-LPU two part linear polyurethane.....	2 quarts
..... (OR) Marine Enamel paint.....	2 quarts
..... Marine Grade Varnish (for bright work).....	1 quart
..... 14oz grad paper cups 12 pk.....	1
..... 7" foam rollers (yellow).....	2
..... 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 your help? 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 3hp 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.

Scarfing Theory

1. If the boat you are building is longer that a single 8 foot sheet of plywood, and you can not find 10 foot sheets in your area, you are going to have to make a scarf joint. This ties together two or more sheets and pieces of plywood to make the continuous sheet needed to construct the boat you are building. The scarf joint is a low angle, matching bevel you cut into the plywood sheets you are trying to join. The ratios of the bevel are from 8:1 to 12:1. Which means that for every unit of plywood thickness, you bevel/ramp out 8 to 12 units of thickness from the edge. You are making matching ramps that will mate up when one sheet is flipped over. For a 1/4"(6mm) sheet, the bevel distance will be 3" from the edge for a 12:1 scarf. With 3/8"(9mm) plywood a 4" bevel/ramp is cut into the sheet from the edge for the same 12:1 scarf. Thicker plywoods will require longer bevels to maintain the 12:1 ratio. Go with the wider 12:1 ratio for a longer and stronger joint. A smaller ratio, like 8:1 or 10:1, will not have the surface area to spread the tensions and will have less area to apply the epoxy, resulting in a weaker joint. Especially if you are working with thicker plywood.

2. The telling how to do it is a lot easier than the actual doing it. This is a learned experience and each scarf you make will be better than the last. The strength and beauty of the boat will depend on how well you do this one task. It is not a big or expensive tool thing. This is a skill that takes practice and patience. Before you buy the expensive wood for the boat, take any scrap plywood you or your friends may have laying around and practice, practice, practice. Start small and work your way up to longer scarf joint widths using the 12:1 ratios. It's a good time to practice mixing and using epoxy, but you can use normal glues on the practice scarfs. If using epoxy, think small batches and don't squeeze it out of the joint with too much pressure.
3. The most favored technique for scarfing several joints is to lay the sheets one on top of the other and with their edges staggered back from each other the width of the scarf joint. Check the drawing in the plans section on how to layout and stack the sheets of plywood, arrange the support scrap, mount the "guides" for the "router rails", and screw it all together on the work platform.
4. We will make a scarf with two full sheets and two partial sheets of 1/4" (6mm) plywood with a 12:1 ratio. Square everything up with the end of your work platform. Or if you have an extra sheet of cheap (relative to marine grade) 1/2" plywood laying around; use it as a level and square base to line everything up with, and use a couple of screws to anchor it to the platform. You will chop up the surface of that good sheet where the router feathers in the bevel of the lowest sheet of 1/4" ply to be scarfed. If you have a level and square platform you only need to add enough full width pieces of scrap [(1/2" x 3-4" x 48") see the exceptions in the scarf drawing] to fully support the first 8 foot sheet of plywood that will be scarfed.

Note: On a scarfed hull, the "thin" side of the scarf on the long sheets point to the stern! This makes it necessary to think about which side of the sheet is up or down while stacking the plywood for cutting the scarf joint. You might want to write on the ends to be cut, which is the up or scarfed side. On the "long" sheets if you want the "good sides" to be on the outside of the hull, the "bad sides" need to be "UP" in the stack. On the "partial" sheets this is reversed. The "good sides" need to be "UP" In the stack: Long (bad and up) Partial (good and up).

Scarfing Practice

1. The very first thing to do is to check to be sure that the end of your platform is square. If it's not, square it up so it is, or take that first piece of 1/2" scrap (the plans show two layers of 1/4" plywood) and square it up with one of the platform's outside 2x6's. It is critical that you have a 90°, square angle between the side of the platform and the end of the plywood. Whether you use the double layer of 1/4" or single layer of 1/2", or any other wood you have available, is up to you. **Just make sure that the "upper support" is of the same thickness as the "bottom lift" wood.**
2. Lay the first full sheet of ply (bad side up) on top of your squared up work surface, and set it back 3" from the edge of the scrap("bottom lift") that is square with the platform. I hate to be redundant, but this is important. Make sure it is square to the exposed edge of the "bottom lift" piece and flush with the side of the platform. One thing I do is to sit a straight 2x4x8ft, on it's edge, on the exposed ends of the cross beams, and clamp it (underneath) to the outside 2x6 that I have used to square up the "bottom lift" with. Then I have something to uniformly press all the sheets in the scarf stack up against.

3. Position the second full sheet (bad side up) on top of this and set it back 3" from the edge of the one underneath it. Make sure its square! Take your sliding combination square and set it to 3" and check both ends to make sure it's even from side to side. If everything is good, use some clamps to hold the sheets together. Now look at the to be scarfed edges of the first and second sheets. Are they flat? Probably not; way not if you just had them leaning up against the wall.
4. You can see in the plan drawings that there are no screws at the end of the first sheet, because it gets beveled. The first row of screws is on the second sheet. We will see if that row of screws will bring down the high spots in the first sheet too. On the second sheet, measure and mark a line at 3 ½" from it's edge. It will be the centerline for that row of screws, and they will be set flush with the surface. Use flat head screws and as close to ½" in length as you can get. Don't go shorter, but don't go much longer, or you will have a lot of holes to fill. Use a drill/counter sink bit with a stop gage if you have one. Otherwise just drill a seperate pilot hole and countersink with a bit sized to the head of the screw. **Remember, just flush!** Drive in the screws tight enough to pull the head's just below the surface of the plywood. If you still have waves in the edge of the first sheet, you may have to place some screws along it's edge too. Just remember to remove them when you get to that area with the router. If the edge still wants to lift after you have routed that area; use some ¼" scrap as backing and screw the edge back down.
5. Two plywood layers are now in place and it's time for the first partial (short-good side up) sheet. It is set back 3" like the one below it and set flust to the common side. Check with the sliding combination square to make sure it is. Measure, mark, and drill the 3 ½" screw set back line and place any screws needed to make the sheet lay flat.
6. Repeat with the second partial (short-good side up) sheet. Measure, mark, and drill the 3 ½" screw set back line and place any screws needed to make the sheet lay flat.
7. Time to place the "upper support guide" for the router "guide rail" to rest on. You can see in the profile drawing with the router on the guide rail, that what you used for the "bottom lift" doesn't matter. BUT, the "upper support" set back wood is directly related to it's thickness. With a ½" thick "upper support", it is set back 6" from the edge of the top partial (short) sheet. With a ¾" thick "upper support", it is set back 9" from the edge. Use screws long enough to do the job without putting holes in everything under it, and only enough to hold it in place. Two should do the job.
8. There should now be a stack of plywood sheets set true and square, with the first sheet 3" back from the edge of the "lower support", and each succeeding sheet set back from the one below it. The "upper support" is set back in relation to it's thickness. Check the plan drawings for details. Only place enough screws to hold the sheets flat, in position, and deep enough to keep from whacking up the edge of the router bit.
9. Now is the moment of truth, or how to ruin \$100 worth of plywood. If everything is flat and square you will not have generated any problems at this stage. The removing of all that wood is now the main focus of out discussion. Like everything in life, everyone has a method or a specialized tool for cutting the bevel. Hand planes, routers, electric planes, grinders, belt sanders, circular saws, and combinations of all the above. I'm still fleshing out the best way and my style changes as I purchase new tools. I have a plate that I attach to the bottom of my router and run it up and down the "guide rail frame", supported by and attached to, the "upper and lower supports". With a straight cut bit just barely sticking out from under the guide rail frame, I run the router up and down the guide rail frame until I have cleaned out that area and then move the

rail frame to the area next to the one I just finished. Make the rail frame wide and strong enough so it can cantilever over the edges of both sides when you get there. I make several small passes at each depth until I get close to the final cut, then switch to 60 grit on the orbital sander until I'm close, then 80 grit to finish. **This is not a speed contest, don't hog it out in one pass!**

10. I try not to let any of the thin edges in the stack get close to a "feather edge". I would rather have the thin edge of the plywood's scarf stay as straight and true as I started with. I go for a final edge "thickness or thinness" of around 1/16" and make sure the edges of the individual lamination layers (ply's) of each sheet of plywood form semi-straight ribbons/lines from side to side. If things are going well, the bevel as it comes out of the top partial sheet, will be on or close to the 3" set back line. Whatever way you do this, stop every so often and check that you are not making depressions in the bevels by compressing the rails as you hold the router down. You can grind down a high spot, but a hole has to be filled and it weakens the wood. Run a long straight edge over the bevel surface in several directions to check for this. If you do "rag up" an edge, don't worry, I'm going to have you put a layer of glass tape over the seam anyway if this is your first boat. It takes a lot of skill to get to the point where you can make a strong and clean scarf joint without ragged edges. Most of the "pre-cut" kit boats you can buy are all cut with CNC machines that can shave a knats butt, some are scarfed, some are not. Or the design calls for butt blocks because the plywood is so thin.
11. You should now have four sheets of plywood with beveled rows of semi-straight ribbons of differing colors of wood plys from the top of the stack to the bottom. All finished off with 80 grit and ready for the next step. Remove all the chunks, chips, and dust from the scarfs and get ready to glue. Remove all the screws. **Leave them in if you do not have the time this day for the next step.**

Checking the Fit

1. The 3" set back lines should probably still be marked on the plywood. To save a lot of dust and work later, take some 2" shipping tape and run a piece from side to side on the back side of the "thin" edge and a piece from side to side at the top of the bevel, behind and next to the 3" set back line, but not in the scarf itself. This will keep the squeezed out epoxy from getting onto everything along the edges later. Set aside all the scarfed plywood (scarfed edges up) from the platform and lay down a 1-2 foot wide piece of plastic sheeting under where the scarf joint will be. Lay down the first long sheet of plywood and it's partial sheet mate. Make sure the surfaces are free of dust and such.

Note: Working with epoxy is not difficult, but the manufactures mix ratios must be followed. Read and follow all the safety information given with the product. The strength of the joint depends on the fit, the correct epoxy mix, and the temperature of the work area. Read the following instructions several times before you start.

2. The next moment of truth is the fitting of the pieces. Take your time and don't rush yourself. Start with the 1-2 foot plastic sheeting on the work platform. **If you forget the plastic sheeting the work platform will become part of the boat!** Lay down the first long sheet with the bevel up. You should have the 2" shipping tape on the underside of this piece already on. If not do it now. Make sure that this sheet and the partial sheet are taped both sides. Do a dry fit of the two sheets. Align the long sheet's edge, flush to the 2x4x8ft board still clamped to the platform's edge. This will give you a reference to start with and come back to later. If you are happy with this, place a couple of 1/2" sheet rock screws along the 3 1/2" set back line in the old screw holes or

new ones if needed, to keep the edge flat and the sheet from moving around. Place the short sheet, bevel down, on top and aligned with the platform's edge too. Slide the short sheet's "feather edge" up close to the 3" set back line, and make sure it all looks square. Try to get everything to line up in all directions and for at least one straight long edge. You need to have something consistent and straight to measure off of, to get the boat's lines on the plywood.

3. Run a straight edge down the scarf at right angles to see if the tops of the sheets are flat. Move the short sheet in or out to get the two top surfaces to line up flat. Measure the "overall length" of the two long edges to see if they are the same and especially that the joined panels will be long enough for the boat you are building. Whoops! There will be a small gap along the seam where the edge is not quite a "feather edge", and that's ok. Some of the excess epoxy from the joint will fill this up. If you have to put a couple of sheet rock screws in the short sheet to hold it down flush, go ahead.
4. There is still one more task before you start mixing epoxy. You want to be able to get back to this "alignment" after you've smeared on the epoxy. You already have the 3 ½" set back line on the long sheet, and now you want to put some marks on the top of the short sheet to have something to measure to later. With the sheets still lined up, measure from the 3 ½" line, back to the top of the short sheet, say 6" and make a (readable) mark on both sides. This will give you a true reference to the correct fit later when you are worrying about correctly measuring, mixing, and smearing epoxy on everything. But don't mix it up yet! You want to make sure all the pieces are fitted and marked before you get out the epoxy.

Applying the Epoxy

1. For a first time or occasional builder, I would recommend epoxing up one scarf joint at a time. Epoxy set times in very warm weather can make building the second layer on top of the first a real rush and you don't need that here. If it's hot out, just do one non-rushed joint at a time.
2. Go ahead and remove the short sheet and flip it over so the beveled edge is on the plastic sheeting, and toe to toe with the long sheet. You may as well put some more plastic down and set the next scarf pair on top (scarfs up) and each piece back from the bevels of the lower pair and pre-coat both sets. **(See the following NOTE!)**
3. It's time to use **the "handy mans" secret weapon**. The common used toothbrush! I have found nothing better to use with epoxy. Nothing! One brush will last for hours, even longer if you drag it every so often over a cloth draped over a hard edge to squeeze out the excess. I also use it for fiberglass tape work. One side is a fantastic brush and the other side is a first rate squeegee for helping to wet out the cloth and move the excess epoxy to dry areas along the tape. The new "hightech" (\$\$\$) brushes may not work as well as the old styles. You can get six for a buck at the dollar stores.
4. The beveled edges have a lot of "end grain" surface area that needs to be coated with mixed straight epoxy so the wood can "suck in" as much as it can hold and not "starve" the scarf later of all the epoxy, and make a weak joint. It doesn't take a lot, so only mix up small batches, say 2-3 ounces to start with. Most epoxy's are 2:1, so mix up 2oz of A and 1oz of B. Mix well and follow the manufacturers instructions. Now you need to spread the mix on the beveled surfaces. If the scarfed face looks dull or dry after you have smeared it with epoxy, coat it again. Don't put on so much that it starts running down the face of the bevel. Let it soak in what it needs to fill the pores of the end grain, and still have a semi-rough surface after the epoxy has set for a while.

Leave some "bite" on the surface for the actual joint.

Note: You might want to wait until the next day to apply the second coat of epoxy and assemble the panels into one sheet. This will let the first coat fully cure and stop any epoxy joint starvation. With System Three Silverback Epoxy, you can skip the sanding between coats if the reapplication time is less than a couple of days.

5. Now decide whether or not you will assemble both sets of panels and epoxy the stacked pairs together at one time. For the first timer I would recommend doing one set at a time. Less things going on and if you make a boo boo, you only have one set to fix or replace. By doing it one at a time, the second set benefits from the learning experience you had with the first set.
6. Place the second set of panels somewhere flat so they don't take on any warps. Make sure the long sheet of the first set is either still screwed or clamped to in position; with a plastic sheet under the scarfed edge to keep the platform from being a part of the boat. Set the scarfed edge of the short panel on the plastic and get ready to apply the thickened epoxy to both faces.
7. Now mix up some more epoxy, but this time we want to add some "thickener" to it, to keep it from being too runny and flow out of the joint when you flip over the short sheet and match up the bevels. Go get (borrow) one of those **mesh** drains your significant uses to drain pasta. You want to sift out some of the sawdust you've already made and save the little bitty pieces that fall through. Or you can buy a small bag of wood flour when you get your other epoxy supplies. Handsome or Handy? After you have mixed up the A&B parts of the epoxy, add some wood flour until the mix is like thick honey. Spread a little bit on the short sheet to give it a thin coat, but save the majority of the mix for the face up long sheet. Give it a good coating, but not so much that it's all over the place. Let both sheets set face up for a couple of minutes to give yourself a chance to catch your wits. Flip over the short sheet and line it up with the long sheet. Measure both sides to your predetermined marks and place the sheet rock screws back in their holes on the short sheet to keep everything aligned. Look for gaps along the scarf edge and add some more sheet rock screws where needed. Screw through a piece of scrap wood over some sheet plastic to spread out the pressure **Do Not Over Tighten the Screws** and squeeze out the epoxy. Just enough to hold the edge down flat. Most of the excess will squeeze out the top and bottom, and fill the low spots along the seam edges.
8. Another way to join the two panels is to line up the sheets with your marks as before, but clamp or screw, the short sheet to the work platform, back and away from the scarf seam. Then place a 1 ft wide piece of plastic sheeting over the joint, place a four foot long (straight) 2x8 over the joint and put on 50-60 pounds of weight evenly spread along it's length. That will produce a more uniform pressure along the scarf. Don't clamp the ends of the 2x6 to the platform or you may make it lift in the middle.
9. Another trick I use is to place a 4 foot length of 2" wide "**plastic mesh**, sheet rock joint tape", across the bottom of the long sheet bevel to keep the wood flour thickened epoxy from flowing out. It's only a couple of thousandths thick, but it helps keep the bevel faces from actually touching and squeezing out all the epoxy. Your call.

Note: Read the previous section several times and practice with some scrap wood everything we've talked about. Do a couple of practice runs with the real panel sets before you mix up the epoxy. Just remember, it's somewhat like golf. Every time you step up of the ball, it's a first time. Think it through. Birdie or Bogie.

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 sections, 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 $\frac{1}{2}$ of a full sheet, can be scarfed together. On a $\frac{1}{4}$ " (6mm) plywood boat with a 3" scarf, the full sheet remains the same, but the short sheet loses 3". So on a 12 design the joined panels are actually 11ft 9 inches 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. Do not forget to measure and mark any side panel "baselines" for seat heights listed in the plans. They are there to help you find the locations for the seat rails and other things that need to be "level" after the hull has been assembled. 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.

3. 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 your 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 $\frac{3}{4}$ " x $\frac{3}{4}$ " 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 where the lines 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 where they will be fully supported and remain straight and not take on a warp. Lay the batten on the plywood and bend it to the outline shape of the nails and on the "panels outside", 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. 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 it 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. **Keep the plywood sheets clamped together until all trimming, edging, and drilling are finished.!**

The Stern Panel

1. **This panel will 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" of the eight hull panel ends. 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 its surface as needs be. You can then trim the ends and make the long cuts in the middle of the sheets through the gaps. It's 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 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.

Separate the hull panels from the excess main plywood sheet by cutting along the keel line first. Transfer any seat rail or bulkhead "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.**
5. With all the edges of a panel 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 ½" 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. Since only one panel has the 1 foot gridlines and you will need to mark the opposite panel for bulkhead locations and such, 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 2" spacing along the set back line for the first 1 ½ 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 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, to 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.

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 bow. Insert the first wire, center it and pull both sides back and put a twist

in them. Do this all the way to the stern. 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 bolt, 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 near the top, near the middle and in the lower corners, where 3 panels join, and at the bow 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, and start wiring from the stern. Now is when you 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 inline. 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. To minimize that chance you will put in a "cross wire" at the second bolt from the stern. You will need longer wires, 6" will do. Drill four holes around the bolt and insert the wires to form an "X", and tighten them. Check to make sure that the stern ends of the two panels still match up. Snug these wires down a little tighter.
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. 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. **Cut 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, 1" from the bottom and two evenly spaced in the middle. Do the same for the stern to bottom 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, one where the three corners meet, one in the middle, and one near the top.

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.

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. On all the plans there is one or two 2x2's called out that are used to set and hold the beam measurements while the hull is being epoxied together. The plans call out where they will be mounted in relation to the "sawn notches" you made in the upper edge of the top panels. These 2x2's will be used to set the maximum width of the boat and the cuts cannot be erased or lost. 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 is flush with the sides**. Put a sheet rock screw through the side and into the end of the 2x2, about ½" from the top. Go to the other side and either pull out or push in the side panel to fit the 2x2 aft of the cut line, and screw it in place. The gunnels will cover the screw holes.

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 out of alinement, you can add another bolt. You will probably wind up having them about 6" apart up front where the curves are more serviere.
3. Before you give the wires their finial 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 too, so do a good job of installing them.
5. Center the hull on the platform and cut some cord to hold down the stern corners and the cross braces in the middle and near the bow. It helps to have some bits of rolled up carpet to jam under 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 ends. 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 same 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 boat, using a wood filled epoxy mixture. You can also use the "five minute" epoxy glues that "Mix" in the nozzle. If it doesn't "Mix" in the nozzle, don't use it. I prefer to use a wood filled fillet mixture like System Three's EZ-fillet ®. For first time builders the slight extra cost is more than offset by the ease of use. You don't waste limited

"pot life" mixing in all the added stuff of some secret formula you found in a book or magazine.

Mix according to the manufacturers directions. The first time I mixed up a batch, I made 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.

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!

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 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 out side 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 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 alinement. Its handy to lay some old newspaper on the bottom of the boat to catch spills and 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 use the end of a small screwdriver to test again. It should be hard as a rock. If the shop temperature is 60 degrees or higher, there should be no soft fillet material on the boat after a nights 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 when he/she sees your finished creation. By removing the bolts first you can see what happens to the higher stressed places like the panel corners. They shouldn't move. Start removing the wires in the less stressed places along the straighter seams, then finally the corners. I like to leave the top wires in the corners just for insurance. The stitch fillets should be more than able to hold it all together.

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 to 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.

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.
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 squeegee or plastic lid to move and shape the fillet material. Add more material from the bag as needed, while trying not to move too much material and creating edges along the sides that will have to be scraped off.

Note: If it is over 80 degrees in the workspace, do a complete process of fillet, 2"tape, 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.

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.

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.

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 other two so they butt up in the middle and lay flat on top of the bottom tape.

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

8. 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.

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

9. 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.

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.

Fitting out the Interior

Fitting the Bulkheads

1. Whether you use bulkheads or not will be determined by the boat you want to build. The bulkheads add extra strength to the hull and with the seats create an area where foam flotation material can be placed. You can dispense with the bulkheads by using 1" x12" stock for the seats and using inflatable bags for the extra flotation support. The boat will float without the foam or inflatable bags, but lower in the water and with less help in supporting any of the occupants or gear.
2. Depending on the design, you can make the interior bulkheads from the plywood leftover from cutting out the bottom and side panels. Which bulkheads you need will be determined by which version of boat you are building. See the plan sheets for the details. The layout of the bulkhead cut lines will be done in the same manor as the stern panel, so reread those instructions.
3. Consult your set of boat plans for the dimensions to locate the bulkheads in the hull. All the measurements will use the "saw cuts" on the upper edges of the side panels as the starting point. I have found that running a tight string between the center of the stern panel and the center of the bow, helps in locating positions in the hull. Measure along the string and down to the centerline of the bottom.
4. Before you cut out any of the bulkheads you have laid out from the plan measurements, make sure you check the boat to see if everything matches. It helps to make a large pair of dividers from some scrap hardwood. It's much easier that trying to bend a tape measure to get an accurate reading. Make the two legs at least 3ft long, with a finishing nail driven in "backwards" on the outer ends. Use a ¼" bolt with a "Nylock" nut and two washers, as the pivot point on the other end. Use this tool to check all the widths, heights and "edge lengths" on the boat, where the bulkheads will be mounted and at any other difficult locations.
5. Make sure the boat is symmetrical, with equal measurements on both sides. It should be if the boat was level and square when the seam taping was done. If it is not, it could be that one side has just "sagged off" a little if the boat is out of square now. I have pulled in a stray boat by drilling a hole ½" inside the tip of the bulkhead's chine "corner", and drilled two holes in the hull's chine "seam". Then I can pass a tie wire though the bulkhead corners and the chine seam holes and pull the two together by twisting the wire on the outside of the hull. The holes will be covered by the bulkhead taping on the inside and the chine seam tape on the outside. You can do this to the "keel" seam too, You can also do this to the upper corners of the bulkheads, but will have to fill and finish the holes.
6. Make any adjustments to the dimensions of the bulkheads before you cut them out. Make a

cardboard mockup if you have the material. Remember to radius the chine corners to fit the filleted and glassed hull seams. Check the newly cut bulkhead by temporarily installing and then reversing it's position to see how it fits. Small areas of "gaplittlebitus", and "gapmorethanyoulikeus" can be dealt with by the fillet material and glass tape, so don't fret over an exact fit. Well constructed yachts (\$) will have foam between the hull and the outside edge of the bulkhead to reduce hard spots.

7. Cut some $\frac{3}{4}$ " x 1" stock to use as stiffener material along the upper edge of the bulkheads, this also gives you a place to screw the seats into. Glue and screw the square stock flush to the edge of the bulkheads and trim the ends to match the angle of the plywood side panels. You may need to notch one corner of the stiffener, so the plywood seat will be flush with the top edge. See the plan details. Now is a good time to seal the flat surfaces and edges with epoxy. So mix up a small batch and coat the flat surfaces and all the edges, and let cure overnight. Try to have other things ready so you don't waste excess epoxy.
8. Making the bulkhead "vertical and square" will be part eye ball and part tool. Since the boat may or may not be sitting on it's lines, vertical with a bubble level is a relative term. Place a long straight edge on the "saw cut" marks you measured from the plans. Hang a couple of plumb bobs off the straight edge to line up the top edge of the bulkhead. Use a combination square since it's short side length will create a right angle over a smaller distance along the hull's bottom curve for checking the bottom edge. Position the bulkhead to rest against the long side of the combination square and at right angles to the hull's centerline. Mark the location of the bulkhead's chine points on the hull's chine seams. Does it look right? Adjust the bulkhead as needed. You're going to the lake, not the moon. Only on the racing classes do the measurements need to be really close.
9. Once you are happy with the bulkhead's location, use the drill and stitch wire technique through the chine seams, or clamp some scrap to the upper edges of the side panels, and on either side of the bulkhead to hold it in place. Hang a weight over the top of the bulkhead to hold it down, or clamp the bulkhead between the scrap pieces that are holding it in place. Back up any gaps with scrap wood wrapped in plastic and held down by weights. If everything still looks good, glass it to the hull. **Is the bulkhead level with the leveled hull?**
10. If everything is correct, use some jump stitches along the edges to hold in place and let cure over night.
10. Mix up some epoxy to pre-coat the bulkhead and hull, 1" on either side of the seam area. Then mix fillet material, squeeze it out and radius the bead, and then wet out one layer of 2" fiberglass tape. Let it cure overnight and finish the other side later if the plans call it out.

Seat Support Rails

1. Make the seat support rails from 1" x $\frac{3}{4}$ " stock. The bow and stern seat support rails do not have to meet in the corners. You can cut them an inch shy of the corners to avoid the fillets.

You need to check the panel angles on your boat before you continue with these instructions. Place a straight board (a 1x4 is fine) long enough to span the full width of the stern or bow, to use as a temporary "side" for measuring the bow, stern; side panel angles. Measure the angle between the bottom of the board and the bow, stern, and side panels. The side rail angles for any seats not at the bow or stern will need to be measured using the 1x4, as the angles

are different. Use these degree angle measurements to set the blade on your saw to cut the "top", $\frac{3}{4}$ " side of the rails, so they are level with their matching partner.

2. Use the measurements given in the plan details, for the rail lengths and locations. Use the rail cut angles you have measured on your boat and mark on each rail it's cut angle and which is the "top" cut side. That way there will be less confusion when making the cuts at the table saw. Remember that the cut angles for the bow set and it's sides will be different by a few degrees from the stern seat and it's rails. The stern seat's stern rail will have a different cut angle than the two side rails. Cut the rails to length, measure the angles and mark the "top" cut sides, set the saw and fence (see plan details), and cut them out. Then lay them in their proper locations on the hull bottom. Check the plans for the rail lengths and approximate cut angles.
3. Hold the top of each of the rails on the lines marked on the hull and mark the lengths of the rails on their lines. Pencil a line along the bottom of each rail to mark it's lower limit. The shorter rails will have one screw 1" from each end. The longer rails will have the 1" end screws, plus 2-3 more equally spaced along their length. **The rails that fall on curved sections of the hull will need to be shaped on the glued surface to fit the curvature.** Check for level and square.
4. Measure in 1" from the end marks and drill from the inside out, halfway between the upper and lower edge lines. These are the pilot holes for the screws. Hold the rails to their lines and drill from outside the hull and into the rails just deep enough to mark the screw locations. Place the rails on a flat surface and finish drilling the holes to their proper depths. Switch to a "countersinking" drill bit and countersink on the outside of the hull, with just enough depth to cover the screw head with filler and still have enough plywood thickness to keep the screw from pulling through. If you don't want or need to fill the holes, just countersink flush and use brass or stainless screws. You can paint or leave them bright. If you have long enough clamps, you can just glue the rails in place.
5. When installing the bow or stern seat rails, I like to have the seats precut and fit to their matching bulkheads. On the stern seat, I mount the stern seat rail according to the plans. I then use the seat as a spacer to attach the bulkhead with jump stitches and then a final fillet and tape. I then use scrap cut to match the side angles of the seat, to fit the stern seat side rails. I know that they will be square with everything by doing it that way. The bow seat is the same process.

Note: Dry fit all the rail pieces before you glue them to the hull to see that everything fits and that none of the corners are misaligned. Make any adjustments and re-cut/re-drill any rails that may be off. Check for level and square.

Daggerboard Trunk

1. Cut out the pieces following the plan sheets. 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 too loose or too tight. Make the daggerboard opening at least $\frac{1}{4}$ " more than the thickness of the daggerboard you 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 if you choose. Add the side panel attachment rails to the main and partial bulkheads.
2. **Now is the time to coat and seal with straight epoxy, all the inside faces and their mating surfaces.** Do this before it's too late. You may want to fiberglass the inside 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 CB 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 over the top to their 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 side panel. Trim all edges after everything has cured. Mix up some fillet material and butter the upper edges of the daggerboard spacers. Place the other panel on top, square up, weight, and let cure over night. Coat all plywood panel sides and edges of the assembled daggerboard trunk, especially the bottom edges. Let it cure overnight.

3. Set the cured and trimmed CB trunk in the boat on the centerline, making sure it's vertical and square, then clamp or screw it tight to the bulkhead. Align, clamp or screw the partial aft bulkhead to the CB trunk. Use the centerline cord to find the centerline of the boat and all the bulkheads and various parts that make up the whole CB case. Once you are happy that the CB case assembly is true and square, its time to mark it's location. Mark the location with a pencil, by drawing a line around the outside base of the daggerboard trunk.
4. Remove the daggerboard trunk 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.** 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.
5. Reinstall the daggerboard trunk to it's marked position. Glue/epoxy the trunk to the bulkhead and tighten the stainless screws making sure it is square, vertical and true. Use weights and scrap sticks clamped to the sides, to hold it in position. Place some jump stitches to hold the assembly in position and let cure overnight. Check for alignment again and if correct, wet out all the joints and seams between the trunk, bulkheads, and the bottom of the boat. Mix up some wood filled epoxy and fillet all the trunk 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.
6. Coat all surfaces around the CB trunk with two coats of epoxy to seal them off. Epoxy the top and side panels to the CB trunk, round all edges well, fillet and tape to each other and the hull. Be sure to coat the top and side panels on the inside with two coats of epoxy to seal them off. They will never see the light of day again, hopefully. Coat the outside of everything that hasn't been coated, with one coat of epoxy.
7. Finish out the trunk slot when the boat is upside down and you are finishing the bottom. Rasp out the opening flush with the inside of the trunk taking care not to rough up the layer of fiberglass on the inside. 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 2" glass tape to the outside centerline seam; trim it so 1" extra rolls into the trunk area from each end. 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 2" tape or bottom cloth.

The Movable Center Seat Option

1. The Laura Bay is the first hull with the movable center seat option of any of the boats I have designed. Measure and cut out the parts as listed in the plan set. The two assemblies are called the "seat wings", and will be referred as such in the instructions. Hull #1 has seat wings made from plywood to use up some of the scrap from cutting out the curving hull panels. Another option is to make the seat wings out of solid $\frac{3}{4}$ " material and blend it in with the rails, seat trim, and mast partner supports. This would make for a very nice looking boat.
2. For the plywood option, follow the plans and cut out the mirror image plywood seat wings and mark them as to which side they go to. Make sure when you cut them out, that you have the **same side of the plywood sheet scraps "up"**, and not have mismatched "faces".
3. Take one of the seat wings and hold it up along the edge of the hull on a pencil line marked between the two measurements given that are below the top edge of the hull and at or measured from the "station line cut marks". If the fit is close, drag a pencil along the hull to mark the true curve of the hull and fit the seat wing to that curve. Remember that any width adjustments you make to one side, you have to make to the other side too. Bevel the lower, outside edge of the wing to match the angle of the hull. Repeat with the opposite side seat wing.
4. Cut out the rail material following the directions in the plans and fit the rail corners as shown in the details. The rail material is standard $\frac{3}{4}$ " x 1" with the $\frac{1}{4}$ " x $\frac{1}{2}$ " notch cut in one side. Glue the rail pieces to the "fitted" plywood seat wings. Do a rough shaping of the edges and sanding after the glue has cured. Make sure the seat wing assemblies are on their lines, sitting on the middle bulkhead, and level with each other side to side. It may help to clamp a 1x4 spanning the hull to the two seat wings to help keep them level side to side, and have the same fore and aft angle.
5. The two seat wing "support" brackets are $\frac{1}{4}$ " plywood, and measured and cut according to the plans. They are glued to the aft end rails of the seat wings. At the forward end of each seat wing, a $\frac{3}{4}$ " x $\frac{3}{4}$ " x 3" piece of rail material is glued to the underside of the seat wings and beveled to the angle of the hull panel where it is attached. Finish sand, shape, and final fit the assemblies to the hull. The seat wing assemblies should be coated all round with a layer of epoxy to seal all sides and edges and allowed to cure.
6. The seat wing assemblies should be clamped in position with the 1x4 again and rechecked for level and square. A #6 x 1 $\frac{1}{4}$ " stainless screw can be placed through the seat wing rail and into the stiffening rail in the center bulkhead on both sides. This will help hold the seat wings in position. Add any supports that are needed to keep the aft end of the seat wings on their marks. A drop of glue on the edge of the seat wing supports the night before will also work.
7. Sand the hull and along the edge of the seat wing where the epoxy fillet will go. Also on the hull where the seat wing support edges meet. Mix up a small batch of fillet material, place in a bag, and squeeze out a bead along where the seat wings, and seat wing supports meet the hull. Smooth in the fillet beads with a gloved finger. Clean up any excess with a putty knife.
8. Final sand, stain, and finish according to your desires.
9. On the solid wood option, I would extend the forward end of the seat wing so it would blend end to the hull. On the stern end, I would extend it aft 4-5" in a smooth arc. Fit the seat wings to the

curvature of the hull and shape or use a band saw to cut the hull side angle so the seat wings mount flat. The seat wings would be held up by the middle bulkhead and a series of #6 x 1 1/4" stainless screws along the hull. A small 3/4" x X x X seat wing support would be made, fitted, and placed in the same location. You could also make the seat wings wider and longer so the moveable middle seat would have a greater range of placement. Be aware that the forward limit will be the width of the moveable seat. You decide.

Moveable Center Seat

1. Follow the plans for the dimensions of the plywood seat and rails. Standard 3/4" x 1" rail material with knotted edges to set the plywood in is again used. If you have the material, 3/4" x 1 1/4" - 1 1/2" rail material can also be used and knotted in the same way. Solid wood can also be used if you would like. On the plywood seat, a large left over piece of scrap ply may be trimmed, fitted, and epoxied to the underside of, and inside the rails to stiffen it. Shape and final sand all sides and edges.
2. Make sure to cover all sides and edges of the seat with epoxy to seal them off. Let the epoxy cure over night.
3. In the middle of the ends of the seats and in the center of the end rails, drill a 5/16" hole, 3/4" deep. Here you will fit and glue, a 5/16" x 1 3/4" dowel in each end of the seat. Marking the matching holes in the seat wings will be easier if you have the "dowel centering" plugs that fit in the holes and mark the center point of the hole to be drilled.
4. Fit the plugs if you have them and line up the aft edge of the seat with the aft edge of the seat wings and press. If not just be careful when you layout the seat wing holes. Seat wing holes a little oversize will not hurt, and will keep the pins from ripping up the plywood surface during use. For the forward position, make sure the seat is square with the hull; then press, mark, and drill or measure and drill if you don't have the plugs. Coat the holes with epoxy to seal off. You can do this later when you are working with the rails.

I like to place a bit of green masking tape next to small places that need to have epoxy applied. Then later I can do them as I am doing something else and not have to make up a tiny batch of epoxy and get the mix wrong.

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. The text in the following section will deal mainly with the four corners needed for a pram style boat. Exceptions for a hull with a "Vee" bow will be noted.
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. The same for the gunnels.
3. Which corner type will you use? I have made them out of 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. The parts are small enough that unfinished wood can be used; then shaped and sanded to a smooth surface. You can make them as big, fancy and with as much scroll work, covered in carvings, and whalebone inlays as you wish.

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 corners, you will find those five angles are completely different. That all depends if the hull is exactly symmetrical, or the four corners will all 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 of wood for your corners in the size and type of wood you want to use; mark the separate corner locations on each of the two blocks. 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 (bow and stern,) 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. We will start with the "stern" block. Take your "bevel gage" and measure the angle between the port side and transom panels. 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 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 table gage to the combined measured angles. The blade is set to cut the vertical side angle bevel, and the table 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.

You should now have a single block of wood with an angle cut and beveled edge, equal and opposite, in each end of the block. Now is the time to "square" the edge where the inter 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.

7. Repeat this sequence with the bow block.
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 gunnels 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 four 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 panels of the plywood and shape after everything is installed. This is where you wanted to make sure that the upper edges of all the panels were within 1/8" of each other.

12. Glue and screw the corner pieces to the heights you have just established. Mark on the hull somewhere that doesn't get covered up, the locations of the corner block screws. That way you won't drill into them when attaching the outer rails, making extra holes that have to be filled and hidden.
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 aft end to fit the rails. 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 mockups to check the fit and maybe a scrap block to test your methods. On hull #1, I had the center lamination extend behind the bow to help attach the outside rails. I had a hard time cutting out the side bevels and not end up cutting off the extension. One side I cut too deep and had to fill with fillet material. Making the block is not an impossible task; though at times it seems that way. Try to do it, because it makes the boat look great. 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 did!

Fitting the Rails

1. Some of what's already been said will depend on what style of rail system you put on your hull. The rails give shape and strength to the hull and can be installed in several different ways. You can have a matched pair of inner and outer rails, a single outer rail, or an inner and outer rail with spacers between the plywood and inner rail. The last style mentioned can have lots of fancy trim, various colors of wood and use thinner rail sections for the same strength. But involving a lot more trimming, fitting, and finishing work, and will require different sized corners. The rails 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.
2. I will give details on making and installing the inner and outer rail system. The other types are just less or more of the same.
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.
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 be at least 2" longer than the boat. You should be able to find rail wood in lengths up to 14 feet or more. If you can't find suitable wood in those lengths in your area, you can scarf shorter pieces together. Use at least a 12:1 ratio when scarfing the rails and put the scarfs near the straighter stern area and the longer section's point outside and aft. 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.

If you have rail material longer than the boat, rip out the rails before you start construction. The waste strip will make a really nice batten to use when you fair the marks during layout.

- 5 Remember that the total "edge length" of the shearline is longer than the plywood you used to make the boat. So don't think that a boat cut out of a 10 foot long sheet of plywood will have 10 foot rails. Cut them out of the 12ft stock and trim them when you fit them. The end pieces can be used for other things.
6. Now is a good time to give the rail pieces a light sanding while they are off the boat and to round over "three" of the edges. You can do this after the rails are installed, but you end up with sanding marks in the plywood if you do it later. The upper edge next to the plywood is not rounded; it has to remain square with the upper edge of the ply. The upper and lower outside edges get rounded and the lower inner edge is optional. (see plan details). Rounding the lower inside edge gives you a gap that helps in scraping out the excess glue. Plus it lets you roll the edge of the masking tape into a "valley" to help keep a straight edge and keep the paint from "wicking" under the tape's edge. This is optional, but helps with the detailing. Mark each of the pieces "inside", "top", and "bow" for orientation.

The Stern Rails

1. Take the rails you marked "stern" and fit them to the stern panel. Shape, sand and trim them 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 rails are cut off flush with the aft edge of the outside stern rail after they are attached.
2. Apply glue to 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**). Drill from the inside and countersink flush using #6 x 3/4" 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 1/4" stainless screws, a hole 1" in from the inside edge of the outer rail. Screw the ends of the outer stern rail into the corner blocks on both sides.
3. 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 1/4" 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. Drill two more holes equally spaced inside these holes and clearing the outside rail screws.
4. Trim the outer rail ends flush to the outside edge of the hull. Finish sand later.

The Side Rails

1. Now you will need lots of clamps. Take one of the "outside" rails and place the "bow" end towards the bow and at the shearline, and overhang the end by 1". Clamp the rail to the side panel at the bow next to the breasthook. Because of the size of the breasthook on the Laura Bay, there is nowhere close to the bow end of the rail to clamp to the hull. 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 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 1¼" 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 stern. If the rail at the bow still looks good and in it's proper place, go back to the bow end and drill two more equally spaced holes. 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.
2. Stay close and below the shearline as you proceed. At the midpoint you will have to start lifting the rail to follow the shearline. Place a clamp at the midpoint and continue. Clamp the rail at the stern and there should now be at least 1" sticking beyond the stern; or 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. If it is less than 5/8" you have too much sticking out at the bow or you cut the strips too short. Re-adjust the rail until there is at least ¾" sticking out past the stern and hope that it is ahead of the bow by 1/8"..

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 and not be noticed. Its a boat not a rocket.

3. You don't have to clamp the rail down in that many places, five should do. You are trying to make sure the rail is long enough and give it a pre-bend to let the side panel and rail adjust to each other. You will have to add enough clamps to close any gaps that form in the joint to find the true length of the rail when you glue it on later. This is doubly important when you size the inside rail. Mark it as to which side it is. If you have enough clamps, do the other outside rail too and keep them clamped overnight to take on a set. Wet the rails with some water to help the wood fibers slide to their new shape.

The best way to pre-bend the rails is to cut them out ahead of time and stack them in the proper order. Outside rail on the bottom; inside rail on top. Stack the two sets next to each other and loosely tie the ends together. Support the ends off the floor with a couple of supports at least a foot high, and place weights in the middle and a little bit ahead of that. Let the rails pre-bend for a couple of weeks or more while you work on the rest of the boat.

4. The next day mark the "overhang" of the rails at the bow and stern for reference and remove

them from the hull. Check again for any sanding that should be done and get them ready to glue. The rail has a curve to it now and doesn't want to lay with it's glue side up. So clamp the rail at one end, to your work bench or the work platform and apply glue to the "inner" side.

5. 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. 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.
6. Line up the bow "overhang" mark; install the first screw, and start clamping towards the stern, bending and following the shearline. Come back to the bow after the first few clamps and place the rest of the stainless screws. You will need more clamps near the curved part of the bow than the straighter stern area. Clamp and adjust the rail to the correct height before you start drilling and placing stainless screws to make it perminate. 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" they 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 3/4" 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.
7. On the outside, drill and countersink by 3/16", a hole measured 1" forward of the stern's plywood edge, (not the overhang excess). Use a #6 x 1 1/4" stainless screw to anchor the outer rail to the stern corner block. **Let the glue cure overnight.**
8. If you have enough clamps, do the other outside rail. Be observant to how the first rail was attached. The 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" 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 outside rail after the clamps come off. Keep it square! You should not be removing any material from the tops of the rails. Finish sand later.
10. Remove the clamps and set aside. 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. Make sure the the top edge is flush to the plywood and the outer rail. 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!** 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" beyond the forward edge of the stern corner block. Remove the clamps and the rail, cut outside the mark, and apply the glue.

11. 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 or slide 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 and the outside rail. Add enough clamps to remove any gaps between the rail and plywood.
12. Drill and countersink all holes 3/16" and use #6 x 1 1/4" stainless screws. These holes will be filled with "fillet material". The first hole in the inside rail is 1" behind the bow corner block. This will clear the screw you placed in the outer rail at 2" behind the corner block. (You marked this right?) The inside rail screws will be drilled and placed halfway between the outside rail screws. The last hole at the stern end of the rail; is 1" ahead of the stern corner block. **Do not shape the ends of the rails, breasthook, or stern corner blocks yet! This will be done later.**

OarLock Brackets

1. The type of oarlock bracket you install on the boat will be determined by the style of rail you chose. The "angle iron" style that screws into the rail from the top and side, will work best on the outer rail only style. The other option and the strongest is the "insert" type, that needs a hole bored into the rail, and is screwed to the rail from the top. This works on both the inner/outer rail system and the "spaced" rail system.
2. The insert option will need an extra section of rail added to the inside rail. It is needed to widen the rail so the bracket's oarlock hole will clear the inside of the hull and still have enough rail material for strength. A 5" long piece of rail material is glued and screwed in place at locations given in the plan set. The exposed corners of each piece is 45'd on the ends to blend into the inside rail and is shaped to match. Position the clearance hole so that the outer edge of the "insert" just clears the inside edge of the hull. This will give enough room for the end of the oarlock to clear the sides and still have enough room to tie a lanyard to the end of it. **See the plan details.**
3. On the "spaced" rail system, you have to make sure that there are no gaps where the oarlock will be mounted. The plans will show the "generic" oarlock location measurements. Use these measurements to determine the oarlock locations for your boat, regardless of the type of rail system, or bracket you want to use. If using the "spaced" rail system, remember or have marked, all the previous screw locations so you don't try to drill on top of another screw.

Shaping the Rails

1. Do a rough shaping using the tool of your choice. I like to use a wood rasp, and the one I use is about 16" long. Use one with a "medium" tooth to it. 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.

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 12" 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.
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 in the plywood, 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. 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. Or you could use one of the cheap plastic throw away syringes. 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. You have to hurry along before the fillet material "kicks" in the bag/syringe. 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.
2. After the fillet material has set, take 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.
3. Once the fillet areas are scraped flush with the surrounding wood, rough and finish sand for your final smooth surface.
4. The finishing of the rails can be done before or after the interior and exterior of the boat has been done. I would recommend finishing the rails after the interior finish has been done, but before the exterior has been finished. If you use the LPU paints on the exterior, they need to cure undisturbed for a week or more bottoms up. You don't want to drip epoxy and varnish on that beautiful work. Use a good quality masking tape and lots of old newspapers for which ever way you go about doing it.

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 what ever 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 have evaporated.
6. Once the stain has cured, you can either apply a straight varnish or epoxy/varnish coating to the rails. The first coat of epoxy will give the wood some protection against rot, but will need the 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.

Interior 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. 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 120 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 finial 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 to 2 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, 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. **Block sand by hand**, all the seams so as to maintain the sharp edges of the design.
4. Apply straight epoxy along the edges to 1 ½" on either side on the hull seams for the 2" 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 2" tape to the epoxy and wet out the cloth until it turns clear. Remember to minimize the runs. **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 ¾" 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.**

Fiberglassing the Hull

I have pre-coated the taped 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 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. 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. *See the*

drawing for details. 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 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 with your hand, the cloth 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. Check the drawing for the amount of cloth that will overlap the seam tape. On the 9.5 Laura Bay, 50" cloth will just cover the "upper" seam joint by $\frac{1}{4}$ "; 60" cloth will let you have a full 1" overlap behind the upper edge of the 2" 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.

5. 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 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.
6. Block sand the rough edges of the 6oz bottom cloth. Feather the edges out $\frac{3}{4}$ " with fairing compound. If the boat will not be painted, then more coats of straight epoxy will be needed to fill the weave of the cloth and protect the glass fibers that are still proud. If the boat is to be

painted, you can save epoxy by spreading a thin layer of fairing compound over the bottom of the boat to fill in the weave of the cloth. Or add a small amount of mixed epoxy to your mixed fairing compound to thin it out. I like this last method, and two coats fills the weave.

7. 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.
8. 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 compatable with epoxy, on the outside and be done with it.

Be forewarned that a lot of 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

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.
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 and 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 floatation you want to the bow and stern seat cavities. Install the seats and screw in place with #6 x 3/4" 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 8 strips of various widths and lengths to make a daggerboard with a NACA 0010-10 cross section. The 0010-10 designation means that the board has a cross section of 1" @30% and a cord length of 10" 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 un-beveled 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 ½" dowel. Cut and smooth the elastic cord notch. 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 and dowel holes.
12. Whether or not you fiberglass the daggerboard is up to you. It will give it more strength, but will be a real bear to lay in smoothly around the edges. Use 4oz cloth if you do. Most of the damage will be on the leading edge, so a layer of 2" tape here will help if you don't glass the whole board. There is another way to go about this, and it entails a lot of words to describe it. The short version is that you whack off, ½" of the bottom and trailing edges and fill back up with fillet material and reshape to a knife edge. Then glass and trim to the new bottom and trailing edges. The fiberglass will stick better to the fillet material than to the wood.
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.

Mast Partners and Supports

Side Support Blocks

1. The supports will be centered and mounted at the 7 foot "station cut marks" on both sides of the

hull. You can either use solid $\frac{3}{4}$ " material or laminate up some of the $\frac{1}{4}$ " scrap laying around. I used $\frac{3}{4}$ " mahogany I saved from the rail material. Follow the measurements in the plans to layout and cut the two support blocks. Trim, round, and sand all exposed sides and edges.

2. You need to determine if you are going to use a straight or arched partner for your boat before you mount the support blocks. **The edge that attaches to the hull needs to be beveled to match the angle and curve of the side panel, and the upper outside edge needs to be tapered to fit tight under the inner rail if you use a straight partner.** If you use the arched partner, the support blocks only need to be trimmed to fit the curve of the side panel. They will be attached square to the hull and parallel to the inner rail, but will look like they are angled up. This angle will match the ends of the arched mast partner, we hope.
3. If you use the straight mast partner, the support blocks will be cut with the side panel angle and trimmed to fit the curve of the hull. The top outside edge of the support blocks will then need to be beveled to fit tight and level with the hull and the support block on the opposite side.
4. Line up and clamp or hold, the support block to the hull and drill three equally spaced holes into the block. Use #6 x 1" stainless screws and countersink the heads deep enough for the fillet material to hold, but not so deep that the screws pull through the plywood.
5. If everything looks good, apply glue or epoxy to all the mating edges and sides of the blocks and screw in tight. Add clamps if you can get them to fit. Let cure overnight.

Mast Partners

Straight - Solid or Laminated

1. You can make a straight mast partner from either solid or laminated material. The only thing to remember is to bevel the support block edge next to the hull to match that angle, and bevel the top $\frac{3}{4}$ " inch along the upper edge that touches the bottom of the inner rail for a tight fit.

Laminated Arch

1. You can use some of the $\frac{1}{4}$ " (6mm) scrap left over from the construction of the hull. The partner is made from three pieces, 36 inches long and 5 inches wide. The ends are tapered from 5 inches in the middle, to 4 inches at the ends. Measure in from the edges, $\frac{1}{2}$ " on each side at the ends and use a batten to fair in, and mark the curve.
2. Use some scrap 2x6 as the frame to make the laminations on. Drill a hole in the 2x6 for what ever sized bolt you have laying around that will do the job. I had an old 5/16" x 4" carriage bolt laying around that I used. Measure 18" from either side of the hole and use your square to mark a line. This will be where you place the "risers" that hold the plywood in the arc for laminating. Place the "risers" on the inside of the marks. You can nail in a couple of scraps of 2x2 to the 2x6 to clamp the "risers" to. The risers should be 4" high. See the drawing set for a diagram of this.
3. Butter up the top side of the bottom ply, both sides of the middle ply, and the bottom side of the top ply. Let the epoxy soak in for a while and then re-coat. Stack the ply's in order and line up the ends, then hold the stack down tight to the 2x6 with a nut and washer on the bolt. Make sure you have plastic sheeting covering everything. Add clamps along the edges if the plywood

laminations have any gaps. Let cure overnight.

4. Remove the laminated ply's. Even up, smooth, and shape the sides and edges. Line up the partner lamination so it's square; side to side and fore and aft on the centerline. Mark and trim the ends to fit on top of the partner supports and between the inner side rails. There is some room for adjustments here as it is a tapered fit. Make small cuts until it lines up.
5. Once you are happy that everything is aligned and square, drill a hole for the mounting bolts on each side. Place the bolts temporarily and snug up (do not over tighten). Check the boat for level again and pull a plumb bob string through the bolt hole in the mast partner. Make sure it touches the fore and aft cord stretched along the centerline of the boat. If everything looks good, mark and cut the opening for the mast in the partner. **If the plumb bob string is off the centerline**, adjust the "center" of the hole for the mast. This will be either 1 3/4" if you have a "true Optimist mast" or 2" if you get your mast tubing from Online Metals listed later, or your own supplier. If you build a wooden mast, size the mast partner width, and mast hole according to your needs.
6. Shape, smooth, and sand all ends, edges, and openings in the partner. Make sure the mast has room to rotate, but not too loose. Seal with two coats of epoxy all seams, edges, and openings, and let cure.
7. Let the epoxy surfaces on all the "bright" wooden areas cure for a full 14 days; before you sand with 150grit. Then apply several coats of varnish to all areas exposed to the sun to protect the epoxy from being degraded by UV rays. Follow the manufacturers directions for applying the varnish and check to be sure it is compatible with an epoxy substrate.

Mast Step Block

1. The mast step uses a single piece of 3" diameter round stock cut from scrap 1/4" plywood. If you read the stories in Duckworks Magazine, you saw that I used an old "Pert" shampoo bottle to make the plastic ring. Any plastic bottle you have that is between 2 3/4" and 3 1/2" will work. The plastic ring section you cut from the bottle should be about 1" high.
2. Insert the single plywood circle in the mast step ring and push to the bottom.
3. Hold the ply and plastic blanks level in the bottom of the hull on the center line and at the point called out in the plans. Take a marking pen held flat to the bottom and draw a line around the plastic ring. This will be the line you will cut with scissors to fit the plastic ring to the shape of the hull. Cut along the line and check the fit again, making sure the ring is level (looks correct) to the hull. Make any adjustments to the fit. Mark the ring when fitted to orientation with the keel line.
4. Mix up some fillet material and fill the ring. Shape the fillet material to the outlines of the ring with a scrap piece of wood drawn across the bottom. Fill any holes and remove any high points. Let cure overnight.
5. For final alignment, you need to make sure the boat is level again. Lightly sand the hull in the area where the ring will go before you align it. Run a cord down the centerline of the boat and attach "pencil bobs". Place the ply-fillet ring in position and check for alignment. On the mast step, I like to have the mast partner bolted in place so it is the actual center. I wrap the "bob's" cord around the centerline cord and through the hole in the partner and center it. Mark the

position with a pencil.

6. Sand the bottom of the ring. Mix up some thickened epoxy or use System Three's GelMagic to coat the bottom of the ring. Apply a thick coat. Line up the ring on it's mark and place. Check for fit and either leave alone or place a small weight on the ring. Smooth around the edges with a gloved finger. Let cure overnight.
7. Remove the plastic ring and sand the top and around the side. Stain the plywood if you so desire and coat with epoxy when the stain has cured. Two coats of epoxy will do fine.
8. Use the pencil bob to find the center of the mast step. Mark and drill to accept a #10 x 1" stainless screw. The mast step "cup" is a white PVC plastic plug; used to fit "inside" 2 ½" PVC pipe.

Mainsheet Attachment

1. A wooden attachment bracket for the lower mainsheet block, is attached to the hull just behind and ¼" below the top of the daggerboard trunk. A rounded piece of ¾" material is cut to fit the width of the daggerboard trunk, with a ¾" wood gusset support piece attached under it to help support the vertical loads imposed on the stainless attachment "eye" bracket. The two pieces are doweled and glued to the daggerboard trunk with epoxy.
2. The wood pieces finish sanded, stained, and coated with epoxy to match the rest of the trim.
3. A stainless "eye" is screwed to the top plate with at least ¾" x #12 stainless screws. This will hold the snap swivel on the bottom of the lower mainsheet block. See the plan details for more information.

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 gudgeons 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 gudgeons 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 gudgeons and pintles.**

Towing Eyes

1. Consult the plans for location, and use at least a ¼" 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 keep the holes centered.

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 9.5 Laura Bay Sailing Option

Any International Optimist sail and mast setup will work on the Laura Bay. 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 manufacture 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.

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 have for my own Laura Bay and I was 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. They should all nest inside each other and will ship UPS in a heavy cardboard tube. 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.

Line, blocks, fittings and such can be ordered at www.duckworksmagazine.com Good quality fittings and at a very good price. Ask chuck for the "Laura Bay" rigging kit.

Tools Used

The following tools were used in the construction of the 9.5 Laura Bay. 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 (1/2" chuck)
- Electric 3 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:

7-31-2006	Reshaped outside arc and dimensions of bottom panel to eliminate a flat section.
8-12-2006	Added alternate method to make the seat wings from $\frac{3}{4}$ " solid material.
8-24-2006	Changed mounting position for mainsheet attachment in hull.
9-05-2006	Added "Tools Used" page to plan set.
9-13-2006	Added 4x8x1/8" plywood sheet to materials list for DB and Rudder construction.
9-14-2006	Added information blocks to Plan Drawings.
10-08-2006	Changed measurement in Daggerboard drawing.
2-20-2007	Changed text instructions on mainsheet attachment.