

RED BARN BOATS

The 12ft Grandville Bay



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12ft Granville Bay

Plan build — V.1.0.0 — 12-25-2010

LOA: 11' 11.5"

Beam: 56"

Weight: 132 lbs.

Maximum Outboard: 3.0 HP

Maximum Load: 575 lbs.

Maximum Persons: 3 or 575 lbs.

Oar Length: 8-8.5 ft

The 12 Ft Granville Bay

This hull was named after my best friend of 38 years. I had been working on the 12ft Padilla Bay skiff, and showed Nick the finished model. He liked the hull, but was more partial to the rounder bottoms of boats like my Laura Bay and PUD-g design. Ok, I'll see what I can do and started working on this new design.

I had been working on a model with a wineglass transom, but was having a hard time getting the bottom two panels to twist enough to come together at the stern. I have since found a way to do this, but not for this hull. This one will use a "keel strip" that starts from about the last 1/3 of the hull, and extends to the bottom of the stern panel to give it a straight keel to sit on. I was impressed on launch day as to how effective the keel strip was in making the hull track straight as I rowed around Lake Wilderness. I was able to spin the hull in place by counter strokes with the oars, but it was more work than on my other hull designs, and this is another indicator that the keel strip along with the hull shape, keeps the boat on track.

I didn't have a GPS with me to tell what the rowing speed was, but it moved along with less effort than the O&P Pod, which has been the easiest rowing hull of my designs so far. It also has a very long "glide" after you stop rowing from a sustained cruising speed. Again I was impressed by how the hull moves through the water, and the smooth surface of the water in the hull's wake.

I tried to keep all the volume in the stern area that I could, and still have enough "up sweep" to give the hull some style. The beam is 56" (including the rails), and there should be plenty of freeboard when loaded. Maximum people weight is 2 ½ persons, and with an optimal weight for two adults. Like the O&P Pod, the Granville Bay has less flotation/support in the bow and stern (unlike the Nuthatches which have a much wider foot print), so the seats are moved inward to keep weight out of the ends. On the O&P, I got the depth of the foot well correct on the first design, but I need to move the foot well back a few more inches in the plans on the GB12. You might want to copy the dual tanks used under the middle seat (keep the foot well open) with a set under the stern seat too, and add small hatches on the inside faces. At a streamlined 12 feet, this is not a weekend cruiser for carrying a lot of camping gear, but is a great day tripper for going out on the water and rowing or sailing around all day.

The maximum outboard by U.S. Coast Guard calculations, based on the ratio of beam width to stern width, is 3hp. I would only use an outboard with two people on board, as the bow rises too far out of the water with one person sitting in the stern. I never really considered the use of an outboard with this hull, except for using the Electric Paddle. It was designed as a mainly single person rowing and sailing hull.

This hull will also be CE/CLR balanced to use my 64sq ft sprit sail, and should have more than enough power to make you grin. While I had the hull next to the dock, I used one finger to push on the calculated CLR position on the hull, and it moved sideways with absolutely no turning as it should have based on my paper tests. The boat should sail very well, but I will have to test this first and make a video for my www.youtube.com/redbarnboats site.

I like all my designs, but have to admit that this hull is my favorite so far. Let me know what you think of the 12ft Granville Bay.

Warren Messer
Red Barn Boats

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Materials List

Platform:

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

Plywood:

..... 4ft x 8ft x ¼" (6mm).....	4-5 Sheets
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Hardwood: Philippine Mahogany

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

..... 1" x 6" x 14 ft.....	2 Boards
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Softwoods:

..... 2"x 2"x 8 ft.....	6-8 Boards
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Stainless Screws: *Sheet Metal, not Wood Screws*

..... #6 x 5/8".....	Box of 100
..... #6 x 1".....	Box of 100
..... #8 x ?? Various places need them, but I can't remember where.....	
..... #10 x ¾".....	8 for oarlock sockets
..... Note: Some longer ones will be needed if you do the fancy stern ...	

Pan Head Bolts, ¼" x ¾", with nuts and washers:.....	100 sets
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Steel Tie Wire:.....	Roll
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Plastic Sheeting: (epoxy protection).....	10ft x 10ft
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Stain (water base/oil base).....	½ pint
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Used Toothbrushes.....	15-20
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Sand Paper: (60 grit, 80 grit, 100 grit).....	5-8 sheets each
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Epoxy Materials From:

www.systemthree.com or www.duckworksmagazine.com

..... 2" and 3" tape – 9oz. From System Three.....	50/60 yards each
..... (OR) 3" and 4" tape – 4oz. From Duckworks.....	50/60 yards each
..... 60" 6oz fiberglass cloth.....	4yards
..... Silvertip Resin.....	2 quarts
..... Silvertip Hardener (fast-below 70°; slow-over 70°).....	2 pints
..... 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: small, large.....	1 each
..... Cheap foam rollers (evening out epoxy coats after squeegeeing on).6	

Paint Materials:

..... WR-155 primer (one coat interior, one coat exterior).....	1 quart
..... Marine Enamel (interior).....	1 quart
..... WR-LPU two part linear polyurethane (exterior).....	1 quart
..... WR-LPU (between side trim).....	½ pint
..... 9" foam rollers (the cheap ones work fine).....	6
..... 3" brush (good quality for tipping).....	1
..... 1" masking tape (green or blue- the good stuff).....	1 to 2 rolls

Note: This is not a complete list, and the stainless screw sizes may be off, from what I actually used. Get what you need when you need it, and I would advise against one big order for all parts and supplies.

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 too 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. There's time enough for it on the beach or at home; if you don't have to drive there. Don't become a segment on America's Funniest Home Videos, Youtube, 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. The boat will perform best under the "best rowing weight" limits. 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 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 through 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 maybe 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 using a building frame (even with a frame, things are never the same from hull to hull); the 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 interior panels, 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.

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 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 applying epoxy to 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 (overview only)

1. If the boat you are building is longer than 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 plywood's 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.

Note: I have gone to scarfing each sheet by itself, and not in a stack as I describe in the following directions. Watch my videos on www.youtube.com/redbarnboats to see how I do this now.

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, 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.
2. Lay the first full sheet of ply (long, 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 (long, 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 separate 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 flush 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 \$200 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 our 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 gnats 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 layers 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 its 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 ½" sheet rock screws along the 3 ½" 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 epoxying 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 its 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 sides 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 "high-tech" (\$\$\$) 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 3 ounces to start with. Most epoxy is 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 "bight" 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 SilverTip Epoxy, you can skip the sanding between coats if the reapplication time is less than 72 hours.

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.

Note: You can use System Three's GelMagic for the scarf joint instead of regular straight mixed epoxy. This is my preferred epoxy for this step, and you get a better outcome the first time you do this.

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. *It's easier and better to use GelMagic for this.*

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 boogie.

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 Sides

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 side panels. 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 losses 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 side panels and the measurements start and stop at the very ends.

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 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. 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.

Note: You can jump ahead and read the section on "Fitting the Rails" for another source of batten material.

4. Try to find material that is fairly straight, same with the pipe, and keep them stored somewhere 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 down towards the ends. 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 battens not touching at a couple of the nails, don't worry about it. Move any nails that are not touching or place a weight on the batten to hold in place until you mark the line. You should now have a "fair" line from bow to stern. Place your pencil along the batten and mark this curving line between the nails. Remove the batten and pull the nails, the sides panels are completed. **Keep the panels clamped together!**

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. *I used a Saber Saw on this hull; just too much wood to cut.*
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 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 pair so it's 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 lines" of the sides, and the top 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.

Note: It is imperative that before you un-clamp the "top set" of panels, that you take a thin kerf saw, and make "cut marks" on the "top edge" (un-beveled edge) of the panel set, at each of the 1ft station lines you lofted on the panels. You will USE/NEED those locations for the layout of the rails, and interior parts of this hull. **MAKE THEM NOW!**

Marking and Drilling the Stitch Holes

1. Now we will mark the perimeter of the panel sections for drilling the stitch holes. For 1/4" (6mm) panels, this will be 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 3/8" is the rule of "the thickness of the plywood plus 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 bottom panel edges and on the ends and bottom of the side panel edges. Also the side and bottom edges of the bow and stern panels.
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 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 the **still clamped pair** of panels along their bottom edges, and ends. 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 grid lines and you will need to mark the opposite panel for bulkhead locations and such, drill holes at all the spots where the 1 foot grid lines cross the 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 and last 1 ½ feet from the ends, and halfway between the grid lines in the middle. On the chine edge set back line of the bottom panel, repeat the drilling process. At the bow and stern ends of the bottom panel, drill holes 1" from the edges on both ends again and drill one hole halfway between on the bow set back line and drill two equally spaced holes between on the stern set back line. **The other panel edges will be drilled when assembled.** The reason is that when the side panels are being bent/curved while you wire them to the bottom panels, the relationship of the "edge length" changes. You will see this as you wire the side panels on, by the offset of the grid line marks between the bottom and side panels. The edge of the bottom panel is the same length as the edge of the next panel, but as you look at the drawings 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 top edge of the side 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 100 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 lineman'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 3 ft long, going from side to side, above one of the tie wires near the 5

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 "Whoa" 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 joint, about an inch from one of the wires. Have on hand about 100 sets of (¼" x ¾") pan head bolts, nuts and washers. Install the bolt 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 along the curves and at two foot intervals on the straighter sections. 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 the panels come together. *See the diagram in the plans section.*

2. Next is the first bottom side panel and it doesn't matter which side you start with. Now is when you may need a helper. Someone needs to hold up the other end, level with the end you are working on and at an angle that keeps the holes being wired one over the other. As you move along from hole to hole, the helper is pulling the side panel in, and towards the bottom. Line up the lower bow or stern (depending which way you start) end of the side panel with the bottom panel. Drill a hole to match on the 3/8" line, on the side panel that you have already marked earlier. Make sure that the holes are in line. Drill the hole and wire them together with a "snug" twist. I have found that if you bend the wire over a finger and form a long "U" shape it will be easier to start the wire in the holes. You do not want the panels to start "walking apart" as you drill and wire toward the stern. 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 stern or bow. Make sure the panels are lined up evenly at the start and maintain that relationship to the end.

Note: Before you drill any of the holes for the ¼" bolts; attach the panel with 4-5 wires (spread along the seam bow to stern) first to see if the "edge lengths" of the two panels match. Move the panel fore or aft, and drill new wire holes for this "correct location"; then drill and use the ¼" bolts to hold the seams in position.

3. Continue on drilling and wiring to the stern/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. 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 on the outside by the bolts, washers and nuts. If the stern ends of all the panels are off **more than 3/16"** from each other, use the saw and even them up, but be careful when you do this and don't un-square the hull. 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 "edge" lengths of the already wired up bottom and 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 bow and stern panels 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.

Note: If you want a single piece stern panel, and the ends of the side panels don't line up right; you can wire in "your" stern panel (jump stitch and fillet in place on the inside) and adjust/cut any of the ends when you fair and tape the outside seams on the stern. Just make sure that the single piece stern panel is level and square to the hull.

2. For the stern panel you will need a piece of plywood large enough for the job. Make sure the grain runs horizontal (long direction) on the panels. Follow the dimensions in the plan sheets and layout the panels. Use the factory edge of the plywood sheet as the "top" edge of the stern panel. Mark off the width of the panels and their centerlines 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 match the lengths of the side panels on the wired hull.
3. Cut the stern panel. 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. *See the following note.* 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.

Note: Do everything you can now to make sure the upper panel edges are as close to flush with each other as possible. Or that the stern panel is at least 1/4" taller than it should be. 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 (or worse yet, shaping the rails) to get everything square and the lines fair and smooth.

4. You may also need to use **1" fender washers inside and out, and longer bolts** when bolting together the side panels at the bow, because the gaps may be bigger. 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. 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 alignment, you can add another bolt. You will probably wind up having them about 6" apart up front where the curves are more severe.
2. Before you give the wires their final snugging up, you need to square and level the hull panels. With all this work, and money, the last thing you need is a boat with a twist.
3. 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. Then after the epoxy "jump stitch fillets" have been placed and cured the cords can come off. **DO NOT OVER TIGHTEN, AND DISTORT THE HULL.**

Note: It is a good idea to keep the cords on to make sure the hull is always level and square all the way through construction, and to periodically use your big level to be sure it still is.

4. Center the hull on the platform and cut some cord to hold down the hull. To make four points, you will use the two stern corners, and two points on either side back from the bow at the 9ft station cut mark lines. 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 one of the sawhorse "end" supports. Tie a loop in the middle of the cord and run the other "bitter" end through the loop and loosely tie off. Do this to all four corners. Run another cord through the same wire in the stern "port" corner and then up to the bow, through a wire at the top, and back to a loop in the cord. Do the same from the stern "starboard" corner to the same bow wire, and loosely tie them off.
5. 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 cords at the 9ft station cut marks and repeat with those cords. Now take a tape measure and check the diagonal distance from the bow and the two 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 bow 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.

Note: On the prototype hull I used a set of cords P&S at the beam too. For a total of six cords.

6. The boat is now square and level, but you now have to check that the angle between the side and bottom panels are equal and opposite. On a hull design with a "V" bottom or is "Multi-chined", you have to make sure that the hull is symmetrical.
7. On the plans there is a 2"x2" (*purple in the drawings*) called out that is used to set and hold the beam measurement while the hull is being epoxied together. Measure from the station cut mark listed and mark that location. Cut a 2"x2" piece of wood to the length listed in the plans and mark on one side "Top". 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 length" to be correct. Put a sheet rock screw through the side and into the end of the 2x2, so the 2x2 is below the top of the side panel at the measurement listed in the plans. Go to the other side and either pull out or push in the side panel to fit the 2x2 and screw it in place. Use a bit of scrap under the head of the screw to keep from making a large divot in the surface of the plywood. You will fair it later when you finish the exterior of the hull.

Gluing the Stitched Boat

Safety, Safety, Safety, Wear your disposable gloves, face masks and eye protection equipment. No exceptions. Read all the manufacturers instructions and warnings. 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. I prefer to

use System Three's GelMagic®. For first time builders the slight extra cost is more than offset by the ease of use. Just put the mixing nozzle on the tube and go. Watch my videos at www.youtube.com/redbarnboats for how I use the product.

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! One toothbrush will last from start to finish on a fillet and tape job for a 10 foot boat.

2. Mix up a small batch of "straight" mixed epoxy (A+B) 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: If you want to use your own wood filled epoxy for this, 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. 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.

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

day (three days with System Three products) between applications, 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.

Note: Now is a good time to locate and mark a line 2" off the centerline of the hull (*at least 2ft long in the area where the DB trunk will go*) to help locate the position of the daggerboard trunk later.

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 four corner 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! Firm, but not overly tight.

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. Check the drawing in the plans section. *The upper panel seams will not be as thick as the lower ones, because of the different panel shape angles as they bend from stem to stern.* Do not worry, with all the glass tape inside and out, it will still be a strong hull.

Note: I have changed the way I do things now from the following instructions. I now let the fillets cure before I add the glass tape, as I can then sand/shape them after it cures for a smoother finish. I found that I was making dimples in the fillet material as I applied the tape, and it didn't look as good as letting it cure first. Plus it was easier to focus on just one thing at a time.

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 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 scrapped 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.

Note: If the workspace is warm to hot and the fillets are firming up, mix up some straight epoxy and paint the fillet material before laying the tape.

7. Start at one of the hull corners, center the tape and start rolling it out, lightly pressing 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 epoxying 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 65-70 degrees, do the filleting, then the 2" tape, then the 3" tape.

Note: Let the boat cure for 1-2 days before you remove the leveling and squaring cords. It's also ok to just leave them in place. I usually do.

9. With the level and square cords removed (or not), 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 rasp, or what ever you have and remove the "selvage", but do not rip up the surrounding wood or tape while you do it.

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

Fitting out the Interior

The Daggerboard Trunk

Note: To install the daggerboard trunk, you will need to re-level the hull and use a tight centerline string to hang the "pencil bobs" on.

1. Cut out the pieces following the plan sheets. Make sure the opening is wide enough to accept the daggerboard that you are making. 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.
2. **Now is the time to coat and seal with straight mixed epoxy, all the inside faces and their mating surfaces.** Do this before its too late. You may want to fiberglass the inside too. I recommend this for wear protection. If you glass the inside of the trunk; first attach the two upper 2x2's (*to support the middle seat top*) to the outside of the daggerboard trunk with stainless screws from the inside of the trunk.
3. Wet the mating surface (*under the spacer 2x2's*) with epoxy and attach the two 2x2 end pieces to one of the side panels with stainless screws from the outside. Using 4 or 6oz fiberglass, coat and wet out the side panel and up the "width" of the two end pieces on the inside. Pressing the glass into the corners. Let it cure to the "green or full" stage and trim off the excess glass on the "upper" edge of the 2x2 pieces. Trim all sides when cured. Epoxy coat, glass, and wet out a layer of 4 or 6oz glass on the other (flat) side panel. Trim all four sides after it cures. Coat the mating sides of the first and second panels with epoxy (I use GelMagic here) on the 2x2 pieces and fasten together with screws. Coat all exposed plywood edges with epoxy, especially the bottom edge. Make sure everything is square and don't over tighten the screws. Let it cure overnight.

Note: Be sure all four sides are square to each other; especially the top and bottom edges.

Note: You will use the "line" now that you earlier marked 2" off the centerline of the hull before you added the fillets and glass tape. This will "make certain" that the Daggerboard Trunk is square to the hull.

4. Set the cured and trimmed daggerboard trunk in the boat on the centerline, making sure it's vertical and square, then clamp it tight to the "beam spreading 2x2" (*purple in the plan drawings*) with scrap wood. Mark it's location on the bottom with a pencil, by drawing a line around the outside base of the daggerboard trunk.

Note: It helps (mandatory) to have a centerline string (tight) from the stern to the bow to locate the actual CL of the hull. You also have to have the hull tied down and level at this stage of construction! Use "pencil bobs" off the centerline string to help locate the center of the hull.

5. Remove the daggerboard trunk and mark the actual cut line, $\frac{1}{4}$ " inside the perimeter marks of the

side panels and 1 ¼ " inside the perimeter of the end pieces. **Remember, the end 2x2 pieces are 1 1/2" thick, don't make the slot too long.** Cut the hole in the bottom to the "inside" of the cut line. Give yourself some extra wiggle room and stay 1/4" further 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.

6. Reinstall the daggerboard trunk to it's marked position. "Jump Stitch" the trunk to the hull with epoxy (I use GelMagic) making sure it is square, vertical and true. Let this cure overnight
7. If the daggerboard is still true with the hull, it's time to wet out the joint between the trunk and the bottom of the boat. Mix up some wood filled epoxy (EZ-Fillet) and epoxy/fillet the trunk to the bottom of the boat.

Note: On the prototype hull, I just used an "extra thick" fillet, and no glass cloth, but you can add the cloth if you like. With a thick fillet, I do not think the glass tape adds that much extra strength to the joint.

8. When the fillet "greens up" or you can let it cure and sand later. Wet the area with epoxy and lay in 3" glass tape and wet out. Let cure overnight.
9. **When the hull is upside down.** 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 protective layer of glass cloth on the inside. While applying the 2 or 3" 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 into the trunk opening and that it stays down and in place. Keep an eye on this before you leave the shop for the day.

Mounting the Gunnel Rails to the Hull

Note: I install the inside/outside gunnel's now; to set the "curve of the hull" before I mount any of the interior seat supports, or panels. That way I know that the rails set the shearline curve of the hull, and not any of the interior parts, or because of any miss measurement of those parts that will distort the overall form of the hull if you install the rails later.

The Inside/Outside Fore and Aft 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 (no spacer blocks), a single outer rail, or an inner and outer rail with spacer blocks 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 more work fitting them in the stern 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 by others on the beauty of the boat.
2. I will give details on making and installing the latter, inner and outer rail (with spacer blocks)

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. For an 8-10 foot boat, rails that are 5/8" thick and 3/4" wide look right at this size. On a 10-12 foot boat 3/4" by 1" looks good. The prototype hull used 5/8" x 1 1/8" stock. 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 14-18 feet. 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 (*around the 3ft station line cut marks*) and the longer section's "end point" on the outside and pointing 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 you are now short one piece, and all the other pieces are too short.

Note: A finished 3/4" x 4" (really 3 1/2") board, using a 3/16" thick saw blade, you get 4.3 rail strips, 5/8" wide. If you have rail material longer than the boat, rip out the rails before you start construction. The 0.3 " waste strip will be a really nice batten to use when you fair the marks during layout.

- 5 Remember that the "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 12 foot long sheet of plywood will have 12 foot rails. Trim two of the long strips to the length of the boat plus 2", and mark them as "outside rails" and set aside.

Note: If the boat plans show a lot of arc to the shearline, measure it to see if you need more than 2" extra for the rail length. Tape a cord along the edge of the shearline from bow to stern and mark it's length at the bow and stern. Remove the cord and measure it's length from the bow and stern marks you made. Add 2" to this length.

6. Trim two more of the long strips to the length of the cord, and mark them as "inside rails" and set aside. They will be shortened to fit later.
7. 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 hull (sanding the underside of the rail) 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/beveling 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.
8. 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 5/8". Clamp the rail to the side panel at the bow. Slowly bend the rail down and in as you add more clamps working towards the stern. Stay close and just below/even with 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. 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 3/4" sticking out past the stern and hope that it is ahead of the bow by 1/8".

9. 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 it's entire length, and that all is still 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, and never to the plywood.

Note: 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.

10. 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. 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.

Note: I will sometimes "pre-bend" the rails after they have been cut into strips (by me or the lumberyard) to take on a set ahead of time. Usually a couple of weeks before I mount them. Use some cord tied at the ends, and pre-bent to look like a bow (bow and arrow bow).

Mounting the Outside Stern Rail

1. Take a piece of rail material and pre-sand any sides that need it, and put the bevel in the lower inside edge stated earlier.

Note: Mounting this first rail is a critical part of the construction of the hull. It needs to be level side to side, and "even and level" with the top ends of the upper two side panels. Hopefully you made the stern panel 1/4" taller than needed, so there is "room to trim" to fit the hull on both ends.

2. Apply GelMagic/epoxy to the inside edge of the outside rail. Clamp the "outside" rail to the stern panel, even on each end with the upper edges of the port/stbd top panels.

Note: It helps to clamp some short bits of rail stock to the outside of the top panels as a gage for final placement height.

3. Drill from the inside and countersink flush using #6 x 5/8" stainless screws. The first holes are 1" inside the corners on both sides. Drill two more holes equally spaced inside the first two. Try to place them where they will be hidden by the spacer blocks you add next. Mark their locations on the top of the rail (*and on the plywood panel just under the rail for insurance. I've forgotten in the past and wished I had remembered to do this simple step*).
4. The next day after the epoxy and any squeeze out has cured (you don't want epoxy on your saw blade), use a "no set" to the teeth hand saw and hold the blade tight along the outside of the hull

as you trim off the excess outside rail ends. Do a good job here to keep from having to use a lot of filler in any gaps later!

Mount the Outside Gunnel Rails

1. Check again for any sanding that should be done and get the gunnel rails ready to glue/epoxy and screw in place.

Note: I used to apply glue to the rails and fair/clamp them into place and then drill/drive the stainless sheet metal screws into final position. Now I pre-mount the rails using lots of clamps to check for "fairness of line" and adjust the rail to fit/flow with the hull. The rail tops are "always below" the top of the plywood panels! Then I drill/countersink and install the screws for a pre-fitting.

2. The first screw is as close to the bow on the inside that you can get it. Use some clamps to hold the rail to the hull at the bow until the epoxy/glue cures. Make sure there are no gaps between the rail and hull at the bow. You will add longer screws from the outside later that screw into the breasthook block in the bow. Drill/countersink for #6 x 5/8" stainless screws at each of the "station line cut marks" as you work your way to the stern. Add a screw close to the stern panel.

Note: Mark the location of ALL the screws on the top of the rail, and under the outside rail on the hull panel. If you forget now, you will find one or two later when you drill into them.

Note: Try to locate and drill the holes for the screws in what will be the center of the outside rail after you have made them "fair to the hull", and before the top of the plywood has been trimmed to the correct height. Hopefully there is a bit of plywood above the tops of the outside/inside rails to trim down flush later. If things look good, I remove the fitted outside rails for gluing.

3. You can either apply glue to the rail or to the hull. I have done both ways, and I now apply GelMagic to the hull, and re-attach the rail with the already pre-drilled holes for the #6 x 5/8" stainless sheet metal screws.

Note: Make sure you add a good bit of epoxy to the trimmed ends of the outside stern rail. This will fill any gaps between the two rails when the outside rail is screwed/clamped into place.

4. If you glue/epoxy the rail off the hull; 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. Use a longer than needed screw for the first hole at the bow; so you will have some clearance to move the rail into position. Start adding more of the SS screws to the preexisting holes, and add clamps as you go. You will need more clamps near the curved part of the bow and midsection than the straighter stern area.

Note: Make sure that there are no gaps between the rail and the plywood. Use more clamps if there are! The screws will not keep the plywood tight to the rails without using extra clamps between.

6. If you have enough clamps, do the other outside rail. Be observant to how the first rail was attached. The other rail should follow the same ups and downs since the tops of both side panels were cut and shaped as a unit and have the same "fairness of curve" you 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.

7. After the epoxy has cured, use your "no set to the teeth" saw and trim the over hanging stern ends of the port and starboard outside rails flush with the aft edge of the sterns outside rail. Be careful and don't "chip out" the rail ends around the saw cuts. They will be rounded over, but not a lot!

Installing the Spacer Rail Blocks

Note: You can make up the spacer blocks from laminations of different types of wood to contrast with the wood used for the rails, and corner blocks. You can add a lot of WOW doing this.

1. Measure, cut, and mark the locations for the spacer blocks, and epoxy and screw to the hull. Use stainless screws long enough to go into the outer rails by $\frac{1}{4}$ ", after countersinking.

Note: The plan drawing shows a linear layout for placement of the spacer blocks. The critical one's are the oar lock spacer blocks, and the mast partner spacer blocks. The ends are set from measurements taken off the "station line cut marks" listed. *All the other spacer blocks are fitted and spaced between the critical ones, and the measurements listed are to be used as guides only.*

2. The spacer blocks are mounted with their tops even with the top of the outside rails, and not the top of the upper plywood panel. There is no shaping of any of the rails to be "level with the waterline". The finished rail system tips to the outside, and follows the vertical angle of the top plywood panel as it changes along the way from the bow to the stern.

Note: It is critical that you follow the build plan drawings while installing the spacer blocks, and later the inside rails. The location and placement of the screws has to be followed to keep from installing a screw where another screw will later need to be installed, or where the openings for the Oarlock Sockets and their mounting screws will be located.

3. Be sure you make all the small cuts (on the hull panel sided) on the longer spacer blocks that are indicated in the plans, or they will not conform to the hull, and will create "flat spots" along the curve of the hull. The smaller spacer blocks can be placed along the hull; coated with epoxy and just clamped into place until cured. Then no screws will have to be marked or worried about later, and the longer inner rail screws will pass through them and into the outer rail. *MARK all screw locations on the top of the rail, and underneath on the side of the hull panel.*

Note: Locate the stern spacer blocks "even" with the top of the outside stern rail, and not the stern panel. There will be an angle to the outside rail, and you will match the top of the spacer rail to follow that same angle. The top of the plywood stern panel should be higher than either rail at this point, and you will trim the plywood to the tops of the rails when they are all installed.

Note: *Trimming the ends of the spacer rail blocks that meet in the stern corners can be handled in several ways.*

4. You can just butt them up where they meet in the corners, and later fill (push in as much as is needed) any gaps with EZ-Fillet wood filled epoxy. You can rasp, sand, and finish the corner blocks when you do the final shaping of all the rails as one group.
5. You can tightly fit each of the spacer blocks to each other where they meet using your table or band saw. The blocks are small and can be easily worked, but only cut the fitted blocks to their

final length after you have done all the trimming to make them fit. Then measure and cut the other ends (away from the fitted corners) to their proper lengths and install.

6. You can leave a gap (half the angle between panels) in the corners like the prototype hull, and later trim and fit other types of wood to fill the gap. You can also add more blocks in the corners as I did on the prototype hull.

Installing the Inside Rails

1. Follow the build plans for the locations of the screws used to attach the inner rails to the hull.

Note: You can either leave the heads of the screws exposed and slightly countersink the holes; or you can fill the holes with EZ-Fillet and fair them in with the rail. If you fill, you will have to countersink the holes a bit deeper. Say 3/16" from the tops of the screw heads to the surface of the rails.

2. Dry fit the inside rails to the hull, and trim for length. Trim the ends of the inside rails to whatever type of corner or bow blocks you have or will later install.
3. Apply glue to the faces of the spacer blocks only. Clamp the inside rail in place, and even with the tops of the spacer blocks and the outside rails. Use lots of clamps to hold the inside rails tight to the spacer blocks.

Note: I usually let the epoxy cure before I drill any of the holes for the screws used to attach the inside rails to the rest of the rail system. Use lots of clamps to do this, and especially around the long oarlock socket spacer rails (no gaps), and near the ends of the hull at the bow and stern.

4. With the inside rail glued in place, it is time to mark the locations of the long stainless screws used to finish the installation of the rails. Use a guide/gage to mark the "centerline" of the rails at the location of each screw shown on the plans. Try to be accurate when drilling and countersinking these holes along the centerline of the rail. You don't want the screw heads to look like they wobble up and down from bow to stern.

Note: You might wait on drilling/countersinking the screws until you finish installing the Bow Block (next item). Then you will know where the "true center" of the inside rails are from bow to stern.

Shaping the Bow Block

1. This is an area where I could write a whole book on the installation of this wooden block. This is probably the most difficult part of the boat to make, and to make well. You have several angles coming together from the sides, and the top; plus you have to "dap" in the spacer blocks and inside rails to fit tight. It also has to be thick enough to rise above the rails and then be shaped back down to their tops again.

Note: EZ-Fillet will fix a lot of problems with gaps. If you don't want to make the side cut angles in your bow block, you can go ahead and mount it and fill in any gaps or open spots with EZ-Fillet, and shape that to fit after it has cured. If the gaps are even, it will just look like a different wood.

2. You can also "jump stitch" a piece of 1/4" plywood, 3/4" below the tops of the plywood panels as they meet at the bow, and place multiple strips of wood across the top. I did this when I

constructed the prototype hull for the double ended 12ft O&P Pod. You can cut and trim the smaller pieces to fit any gap, and epoxy them side by side across the surface of the plywood. Then finish off the top surface to form a pleasing arc to match the shape of the other rails as they meet at the bow. This works structurally and is visually pleasing. Try to use woods that match up with any colors you use on the stern corners, or spacer rails.

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 on most styles. The other option and the strongest is the "insert" type, that needs a hole bored into the rail/spacer block, and is screwed in from the top.

Note: Item #2 is an alternate way of adding rails to a hull if you "do not" use the spaced rail system. I have done this on earlier hulls, but have gone to the "spaced" rail system for all my boats. It makes it easier to drain any water out by just rolling the hull over onto it's side. With the other style, you have to bail and sponge out the last bits of water.

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 hole for the oarlock socket will clear the inside of the hull panel and still have enough rail material for strength. A 5" piece of rail material is let into the inside rail by 3/16", and is glued and screwed in place. The exposed ends of this piece is 45'd on each end to blend into the inside rail and is shaped to match. Position the clearance hole so that the outer edge/diameter of the "oarlock socket" 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 for a drawing of this add on block.*

Note: On the "spaced" rail system, I have to make sure that there are no gaps where the oarlocks will be mounted. This is part of the design process, and has to be done after the model water tank float tests; to determine the placement of the seats. Once I know where the seats go, I then know where the oarlocks have to go. Everything else is fitted after the oarlock blocks are located. The plans will show the oarlock location measurements I have used in the prototype hull, and will work for all weights of users.

Note: If you are "really tall", you may have to move the oarlock socket blocks aft some, and re-fit all the little blocks between. The mast partner block does not/can not be moved from it's location. *Plus the foot well in the aft seat will need to be deeper.*

3. Use these measurements to determine the oarlock locations for your boat, regardless of the type of rail system, or bracket you want to use.

Note: If you move the locations of the seats, all bets are off on the balance of the hull.

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 a foot 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 the high spots of the plywood that were standing proud if you followed the directions.

Note: 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.

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.
3. 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 grit paper. BY HAND ONLY! Use no machines on this task.
4. 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

(alternate to leaving the screws exposed)

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 be filling the countersunk screw holes now too 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 (with a big exit tube). 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.

Note: 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 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.

Note: I usually stain the rails before I install the interior parts. It is better to have the rails stained before you do any of the interior work and inadvertently drip epoxy on the wood and then have to sand it off later to apply the stain.

4. Stain the rails with a penetrating stain, either oil or water based. Again check with your epoxy manufacturer to see what they recommend. I have had good luck with both. I would not recommend staining any wood edges that will be glued or epoxied together. Do the gluing before the staining. Make sure that whatever type of stain you use has been wiped down, cured, hardened and ready. Wait a few days between the staining and any varnishing or epoxy coating to make sure it's cured.
5. 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, sand and put on a couple more coats.

Installing the Seat Support Rails

Note: Make sure the hull is level and tied down again. You need the hull level again to be sure that the interior parts do not have a lean of any kind! The hull does not have to be level on its waterline, as the daggerboard trunk sets square to the hull if constructed and mounted correctly. See the next note!

1. Now we will begin installing the 2x2 seat support rails in the hull. The first set of seat support rails to be installed will be the ones on the fore and aft sides of the daggerboard trunk.

Note: Hopefully you installed the daggerboard trunk vertical in the hull, and that the bottom side of the trunk is square with the fore and aft edges so it sets level in the hull, and does not have any angle fore or aft.

2. Take your time installing these two 2x2's, as everything in the hull depends on their being so. The 2x2's have to be level fore and aft, and side to side. They have to be notched to fit around the cutouts made in the daggerboard trunk, and that can become problematic in making sure the notches are in the middle of the 2x2s.
3. The sides of the hull are fairly parallel where the aft 2x2 goes, and I would start with that one. Cut and fit the 2x2 to the length needed and slide it close to the daggerboard trunk to mark where the notch is cut. There will be some fiddling around to get this 2x2 in place.

Note: If one end of the 2x2 comes up "short" after fitting the notch around the daggerboard trunk, just fill in the gap between it and the hull with EZ-Fillet or GelMagic. If the 2x2 has the correct length, but there is a gap on one or both sides of the notch around the daggerboard trunk; again just fill in any gaps with EZ-Fillet or GelMagic.

4. To hold the aft 2x2 in place while the epoxy cures; you can either place a level on top of the 2x2 and use nails through the sides of the hull to hold in place until cured, or place a board across the gunnel's (clamped down) on the "leveled hull", and use wood scraps from this board down to the

2x2, and clamped on both ends. Place another level on the 2x2 to make sure it is still level.

Note: If the 2x2's fit close (+/- 1/8") use GelMagic to epoxy to the hull and around the daggerboard trunk cutouts. If the gap next to the hull is really big; fill the opening on the end with wood scrap to fit, and trim to the outlines of the 2x2. The plywood seat panels will eventually carry most of the weight placed on the seats.

5. Cut the forward center seat support 2x2 and fit it to the hull, making sure that it is level side to side and level with the aft seat support 2x2. This is a must!
6. Now you will clamp onto the top of the epoxy cured middle seat support 2x2's, two 2x2x8ft support boards. Study the plan drawings to see what you are trying to do here. Make sure that the 8ft 2x2's are straight.
7. Measure, cut, and fit the remaining seat support 2x2's to the hull. Use the measurements off the drawings to locate where the forward and aft supports go.

Note: I use the tight centerline string to hang pencil bobs to mark where the "leading and aft" faces of the 2x2's are to be mounted. Just take a tape measurement off the top of the stern panel along the centerline string to find the locations for the pencil bobs. A block of wood clamped to the top of the stern rail helps here, as the angle keeps a measuring tape from "hooking" over the end.

8. Don't worry if your seat support rails are mounted a bit wider or narrower than called out in the plans, or that they may be off a bit fore and aft in the hull. The only thing you want to be sure of, is that they are level side to side with the other seats and level to the hull; and that they are all the same height in the hull. There can be a bit of (1/4" +/-) variation in seat heights.
9. Remove the 8ft 2x2's. The hull doesn't have to be held level any more, but the cords do help to keep the hull from moving around as you work.

Fitting the Seat Top Support Bars in the 2x2 Rails

Note: These are the "orange" parts in the drawings; fitted in notches between the seat support 2x2's.

1. Mark the locations of the support bars, on the seat support 2x2's as shown in the plan drawings. You will need a hand saw, and a small chisel to remove the wood from the notches you are making.

Note: The support bars that support the hatch panels on the middle seat, and the support bars that support the sides of the aft seat foot cutout, are the most critical and need to be accurate in their locations.

2. Cut and fit each of the support bars to "it's" location and mark it for that location. You will find that there are little variations in the interior widths between the seat support 2x2's, so don't make all of them the same at one time. Trim them to fit each notch they will eventually go in.

Note: Do not worry, if some of them come up a bit short, and when fitted, are lower than the tops of the seat support 2x2's. The next instruction will solve that problem.

3. With all the support bars cut and fitted in their locations, its time to epoxy them in place. Move

them off to the side of their notch, and apply GelMagic to the gap. Place the support bar back in the epoxy, and take 2" wide strips of plastic long enough to go around the seat support 2x2 (open side) and cover the epoxy area. Then take clamps (my scrap wood adjustable screw clamps work good here) and place them over the seat support 2x2, so the clamping ends fit over the support bars. Adjust the clamps screws, so they are parallel, and hold the support bars even with the top and bottom of the seat support 2x2. *See the building plans for details of this procedure*

Fitting the Middle Seat Hatch Panels

1. The first panels to be measured, cut, and mounted will be the two middle seat hatch panels on either side of the daggerboard trunk. There is an opening between the daggerboard trunk and the faces of the two hatch panels. This opening is for the feet of anyone sitting on the forward seat. Whether it is for a passenger or for the rower who has to move to that position when someone is setting in the aft seat.
2. The height of the hatch panels, will be from the bottom of the hull, to the top of it's seat support bar, and measured on the daggerboard trunk side of the support bar. There will be notches placed in the upper corners to fit around the seat support 2x2's. *Read the following note!*

Note: The width of the hatch panels on the underside of the seat support 2x2's will actually be wider than the outside distance between the fore and aft seat support 2x2's. This is because of the angle of the vertical side panels that fit against the tops of the seat support 2x2's. There will be a gap at the bottom of the seat support 2x2's, and this is where the hatch panels will have to be made wider. It seems confusing, but you will see what I mean when you measure up the hatch panel. Make it out of cardboard to fit first.

3. Once you have the hatch panels on both side cut to fit; it is time to add the stiffening back plates for the hatches. Check the build plans for dimensions, cut, and epoxy them to the "inside" of the hatch panels and let cure overnight.
4. Measure the outside dimensions of the hatch insert opening that you will use. I used 6" (ID) hatches here. Transfer that diameter to the hatch panel, and cutout with a jig saw. Try to have a snug fit, but not too tight. Rasp and sand the opening to fit the hatch frame.

Note: If using a ¼ turn or threaded hatch; a too tight of fit will make it hard to install the hatch frame correctly and then make removing and installing the hatch cover almost impossible.

5. Coat the inside face, all exposed plywood edges, and the hatch opening with two coats of epoxy to seal off the wood surfaces.
6. Install the hatch panels vertical in the hull and clamp to the "inside/daggerboard side" of the seat support bar.

Note: At this time, you may want to find some scrap plywood that will fit the "underside" of the seat support 2x2's between the daggerboard trunk and your newly installed hatch panels. This will finish off the underside of the seat, and make it a lot easier to paint out. I wish I had done this. Just put a coat of epoxy on all the 2x2", and plywood faces that will be covered up (for all time) by this panel. Add a fillet or glass tape to the seams under this panel and between the daggerboard trunk and the hatch panel. Do this again if using the alternate method for the aft seat foot pass through.

Fitting the Aft Seat Foot Well

Note: After rowing the prototype hull, I found that I need to move the foot well farther aft than it is now. By at least 4" more. I have changed the drawings to reflect this change in the plans for your hull. I have also added an extra section on a different method, that follows this one.

Note: The forward angle of the two foot well side panels will set the angle of the seat support panels on either side of the foot opening. How long the plywood panel you place your feet on will set the angles of the side panels, so play around with the fitting of the foot panel first.

1. Place a clamp (one of my screw clamps works good here too) on the middle seat support bar of the aft seat. This will be used as a backstop for the foot panel. The width of the foot panel should be the width to the outside faces of the two support bars on either side of the middle one. You also have to add a "V" in the bottom edge to fit the bottom of the hull.

Note: The foot well assembly is easier to make outside of the hull and then fitted later.

2. Now use cardboard to layout the panels on either side of the foot panel. The tops of the foot well side panels will be even with the bottoms of the seat support bars. The front top edges will be even with the front of the seat support 2x2. The lower edges of the foot well side panels will be even with the "bottom" side edges of the foot panel. The side panels overlap the foot panel by 1/4". Transfer the fitted cardboard templates to plywood and cut out the pieces.

Note: It helps to use GelMagic and jump stitch the side panels to the foot panel on their inside seams to hold things in place. Remember, the foot panel fits between the inside faces of the foot well side panels!

3. Measure and cut a top panel to fit inside the foot well side panels and even with their tops, and snug against the top edge of the foot panel. Use a GelMagic jump stitch, or a few pin nails to hold this top panel in place. Check the fit of this subassembly before you continue.
4. If the subassembly fits; round over the outside corners and apply a layer of 2" glass tape, or scraps of glass cloth to the outside seams and wet out. On the inside seams, apply a bead/fillet of GelMagic, or EZ-Fillet.

Note: It helps now to coat (two coats) all the inside faces of the foot panel assembly with epoxy, and all the surfaces of the seat support 2x2's and all the seat support bars in the hull. Plus all the panel areas on the bottom and sides of the hull that will be covered up by the seat panels. [This is important!](#)

5. Check the fit again, line up the subassembly and clamp to the seat support 2x2. Apply a bead of GelMagic or EZ-Fillet along the edges where the top panel touches the seat support 2x2 and the support bars.

Aft Seat Foot Pass Through

Note: I have added this section as an alternative to having a flat panel to place your feet on. The opening between the two tanks would be needed for taller (6ft+) users. You may want to make a bar to place your feet on while rowing, if you this "gap" method between the aft seat air tanks.

1. You will cut out cardboard templates to fit between the "outside" faces of the two seat support bars (the two on either side of the middle one) and the bottom of the hull below them. They will be tapered the same way you made the hatch panels for the middle seat side tanks.

Note: Remember to make them just a bit wider (1/8") on the underside of the seat support 2x2's so the seat support panels will fit against them and reduce any gap that may form if you don't allow for this extra width. There will be a slight gap under the seat support panels next to the bottom edge of the 2x2 when they lay against the top edge of the 2x2 if you don't

2. Determine how big of a backing plate you will need for the hatch you use, and epoxy it to the back side of the hatch panel.

Note: You should be able to get a 6" hatch to fit here, but I can't say that for sure. The overall width of a standard 6" hatch on it's outer ring is 8". You could use a 4" hatch, but the opening would limit what you could store in the side tanks.

Note: As an alternative, you could place the 6" hatches in the top seat panel on either side, and above the two side air tanks. You could line the two tanks with dense cell foam and make coolers out of them. See the plan drawings for a view of this alternate way of installing the hatches.

3. Remove the hatch cover, and place the hatch frame on the aft seat hatch panels and mark the locations of the circle cuts you will need to make to fit the outer frames. Keep the opening tight, but not where you have to pound the hatch ring into the hole. Sand any rough surfaces and coat all faces and edges with two coats of epoxy.

Aft Seat Support Side Panels (taking the measurements)

Note: I am using the aft seat support side panels as a starting point. All the seat support panels will be measured in the same way, and marked on cardboard the same way to make a template for each panel in the hull. Once you have done this set, the rest are measured and cut in the same process.

Note: On this hull I have not given any dimensions to the seat support side panels. No two hulls will ever be alike, and any measurements that I could give you would not fit your hull. So I will give directions to using a Spieling Stick.

Note: The prototype hull has the seat support side panels installed at a slight angle. About 1/2" off from vertical at their bases. This gives a more pleasing look, but you can make them 90 degrees to the seat tops if you prefer.

1. With either the [aft seat foot support well](#), or the [aft seat foot pass through](#) in place, we will add the seat support panels on either side.
2. Clamp a long nail to the top of the forward seat support 2x2. You want the "working side" of the nail to be centered over the inside edge of the foot well side panel. The seat support panel will be the one to "overlap" the foot well side panel. Use a stick long enough to reach from the nail to the farthest hull panel seam.

Note: All pencil marks made on the stick and on the seat support 2x2's; are made on the "nail" side of

the stick.

3. Place the stick against the centerline side of the nail, and even (vertical) with the inside edge of the foot well side panel. Mark the height of the stick by the nail, and place a line on the seat support 2x2 along the stick.
4. Move the point of the stick to the center of the first hull seam (this is a best guess). Mark the length of the stick by the nail (you will extend this measurement later), and place a line on the 2x2 along the lower (nail) edge of the stick. *Read the following note!*

Note: See the build plans for the drawing on why you add extra length to the stick when you are measuring to the top of an already "filleted joint".

5. Repeat the above steps with all the hull seams that will be along the edge of that seat support panel. Place the stick on the top of the seat support 2x2 and mark the length from the nail to the end of the support 2x2. This is for the panel top width measurement.

Lofting the Stick Marks (to cardboard templates)

Note: The smaller ($\frac{1}{4}$ ") panels, all overlap the panels they fit next too. The middle seat support panels overlap the edges of the hatch panels. The seat support side panels overlap the side panels of the foot well assembly. Read this next section with the plan drawings on this subject next to you.

Note: If you want the seat support panels to have a slight angle to them, add a $\frac{1}{4}$ " of height along the "top edges" of the cardboard templates. The plywood can be trimmed back to the top of the 2x2's after the panels are set at their angles and attached to the seat support 2x2's and hull bottom with epoxy.

Note: Have plenty of cardboard sheets big enough to layout the panels on. The bigger full width seat support panel templates can be used again on the smaller full width panels too; and cut down again to work on the foot well and middle seat panels. Be aware that you may need to make a separate template for each of the smaller panels. I needed to this on the prototype hull because of the slight variations in measurements accumulated in the construction process. Nobody is perfect, and you will never see the differences anyway. It's easier to cut another template than to have a big gap along a seam and have to use more EZ-Fillet.

1. Use a straight edge long enough to draw a line the full width of the panel you are lofting up on to this cardboard template. Then use a good square and mark another line at a right angle to the full width line. This 90 degree line will be on the edge of one of the smaller panels, or in the middle of one of the full width panels.
2. Aline the stick you marked up in the proceeding instructions with the 90 degree line. Place the mark on the stick that represents the hull centerline (for full width panels) or the edge (smaller $\frac{1}{4}$ panels) height from the top of the panel to the keel or to the deepest part of the smaller panel you measured. This will be the deepest measurement for this template. Use a pencil and draw a line along the edge of the stick to mark either the centerline of the full width panel or the edge of one of the $\frac{1}{4}$ panels.
3. Use an adjustable sliding gage to find the angle between the top edge of the seat support 2x2, and

the first angle on the face of the 2x2 that you marked earlier for the angle and distance to the first hull joint.

4. Move the adjustable gage with it's new angle, and hold it next to the point where the 90 degree line intersects the long top line. This is the location of the imaginary nail now, and where all the gage angles are measured from. Use a pencil to mark this line. You will have to use a straight edge to extend the line to and beyond where the hull seam may be.
5. Place the stick along this new line, and move it until the mark you made on the stick for the distance from the point of the stick at the hull seam, and back to the nail was. Draw a line along the stick, and make a mark to show where the end of the point on the stick is on this line. Add a bit more to the length past the end of the stick. *See the following note, and review the build drawings for the solution to this problem.*

Note: The plan drawings show a cross section of what happens if you do not add what you think the thickness of the fillet is on that seam.

6. Repeat the above instructions until you have all the angles and distances marked up on the cardboard template. Remember to add the mark for the width of the panel at the top edge of the seat support 2x2.
7. Use a straight edge and tie together all the marks you made at the ends of the stick measurements. This will be the outline of the seat support panel, and should be fairly accurate if you took your time on the lofting. Use a knife or scissors to cutout the cardboard template,
8. Hold the template in position (you can use a couple clamps to hold it to the 2x2) and see if it fits well. If the overall shape is correct, but you have one or two edges that are too wide or too short, you can trim back on the cardboard, or add some extra strips of cardboard (taped to the original template) along the gaps. Use this "finalized" shape as your template to transfer to plywood.

Note: Flip the cardboard template over and see if it fits correctly on the other side of the hull. It may or may not. If not, write it's location name on it and make a new template for the other side.

9. You can now cut out the plywood and test it's fit to the hull. Make any adjustments to it, and mark it's location, and set aside.

Note: Locate the panels that have hatches installed in them, and be sure to fit the backing plates shown in the build plans to their inside surfaces. Make the cutouts, and smooth the cut edges.

10. Once you have all the panels measured, templates made, transferred to plywood, and cut out with their locations marked on them; you can give them all two coats of epoxy on their inside surfaces, and along all edges.

Installing the Seat Support Panels

Note: Before you attach any of the seat support panels, you need to coat all the seat support 2x2's, seat support bars, and any area on the hull bottom that will be enclosed by the fitted seat panels.

1. Place each of the seat support panels in it's position and take one last look at the fit of each of them. If you are happy; start installing the panels.

Note: The plan drawings show narrow "filler" panels that fit between the smaller side panels, and cover the faces of the seat support 2x2's. The are located on the front of the stern seat, and front and back of the middle seat.

2. Apply a line of GelMagic along the seat support 2x2 (close to the top) and along any other edges; like the middle seat hatch panels, or the side panels on the foot well assembly. Remember, they get overlapped by the seat support panels.
3. Clamp lightly at the top to the seat support 2x2, and apply any temporary or permanent brads or pin nails along the overlapped edges to hold them in place.

Note: I usually apply GelMagic mixed in a cup, and applied with a stick. If you are using the "slow set" GelMagic with the mixing tip; you can move from panel to panel setting them each in place. At the same time you can also place some "jump stitches" along the panel to hull edges. Do not poke to hard along the hull to panel edge and move it out of place. I usually come back after the GelMagic has cured.

4. After all the seat support panels to 2x2 epoxy has cured, it is time to apply a "jump stitch" around the perimeter of all the panels. It doesn't take too many; just enough to keep the panel edges from moving around when you apply the fillets later. Or you can do a 100% GelMagic fillet too.

Installing the Seat Top Panels

Note: The plan drawings show how to use the left over waste from cutting out the hull panels from the scarfed together sheets of plywood. Trim any "curved" sides to "straight sides" and test fit in the hull.

Note: Check in the drawings for the two views on using plywood, or fillet material to fill in the edges of the seat top panels. "Over topping" the side seat support panels with the plywood seat top panels is the better option.

1. You should have enough of the "saved" plywood to make all the seat tops. They will not be wide enough, but you can fill in the edges with other scrap. Trim and mark the locations of the "fitted" seat top parts. *See the next note, and be careful with the cuts and don't make them "too short".*

Note: Use more cardboard to make templates for lofting the curve of the hull to the ends of the seat top plywood panels. Use the "flat pencil" (held flat against the hull) method to mark/cut the template to the outline of the hulls curve. Transfer this curve to the end of the plywood seat top and cut.

2. Clamp the fitted seat tops to their locations, and determine the widths of the extra pieces needed on both sides, to make up the final seat top width.

Note: The edges of the "saved wood" should overlap by at least half the width, the full length of the seat support 2x2's if you stayed close to the lofted keel line on the scarfed panel pair. You can "scab" in some extra wood on the outside of the 2x2's (flush with the top edge) if your saved wood is not wide enough. If you add the extra cover panel between the daggerboard trunk and the hatch panels (on the underside), no one will be the wiser. They will all be hidden.

3. Give all the wider seat top panels two coats of epoxy on their bottom sides. You do not need to

coat the "widening strips", as they will be attached with epoxy to the 2x2's when installed.

4. After all the seat top panel epoxy coatings have cured; you can install them in the boat. Use GelMagic and apply a good coat to the tops (full width for the extra widening pieces) of the 2x2's and to the tops of the seat support bars. Install and clamp in place. Or use stainless brads or pin nails. Use a "small toothed" squeegee to spread an even layer of GelMagic.

Note: If you are using clamps, be sure to cover the area under the clamps with plastic sheeting to protect them from the epoxy.

Prepping the Panel seams for Glass Tape

Note: I apply the glass tape along the top edges (only) of the seat tops before I fillet the rest of the hull panel seams. That way the fillets cover the ends of the glass tape and make a smoother finish.

1. Use a good quality medium rasp to round over, and touch up all the seat top edges. The seat top edges need a good radius for the glass tape to roll over and stick tight without gaps or bubbles.
2. Fill and smooth any gaps in the seams with fairing compound. Use a straight edge along the seat tops (fore and aft) to be sure that the "side strips" are the same height as the wider seat top plywood. Fair in as needed. The glass tape will cover any fairing compound on this seam.

Note: On this hull, I only added glass tape to the seat top edges and the four vertical edges on the middle seat hatch to side panel seams.

3. Use a guide to mark a line 1½" (half the width of 3" glass tape) back from the edges of the seat tops. This will give you a reference were to place the tape when you wet it out. *If you have a scrap of 3" glass tape, use it as a check, and move the reference line to fit.*

Note: The "rolled over" width of the tape should be long enough to reach the bottom of the filler strips you added between the smaller seat support side panels. Keep this in mind as you apply the 3" glass tape to the seat top seams. This will hide any fairing compound you used to smooth the seam between the filler strip and side panels.

4. Wet out the area where the 3" glass tape will go first, then place the tape over the seams. Use your toothbrush to move the tape into position, and remember the previous note. Wet out any dry areas, and finish roll all the seams with a 3" foam roller to get an even coat, and let cure over night.
5. Sand the glass tape edges to remove the raised selvage edge. I usually do not fair in the edges of the glass tape. The primer and paint finish them off as needed for safety and appearance.

Filleting the Seat Panels to Hull Seams

Note: As previously stated, I only fillet these seams and do not apply any fiberglass tape to them.

1. Mix up and bag as much EZ-Fillet as you think you can use, place, and smooth in a timely fashion. Better to error on the side of caution and mix smaller batches than you think you can use. You always get bogged down at some point, and there's no use in wasting good epoxy.

2. A fillet depth of 1/4" works well, and a "fair out/taper" width of 3/4" on either side will be strong enough without adding glass tape. On my "open interior" fly fishing hulls, I glass tape (2" & 3") all the interior fillets for extra resistance to twisting, and the possibility of opening a seam.

Note: You can do this in two passes if you like. The bulk of the fillet on the first pass, and a smoothing pass on the second.

3. Sand the cured fillets to a smooth finish. I usually give the sanded fillets an extra "smoothing" layer of mixed straight epoxy to the face and edges of the fillets with a toothbrush. The epoxy tends to fill in the little pin holes in the surface and along the edges of the fillets that show up when you paint the interior.

Interior Finish

Natural

Note: The "natural" look may be achieved, but at a big cost in time and materials, and I don't think it's even possible on this hull.

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 Sand off any selvage along the taped edges of the hull and seat assembly 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.
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.

Note: I now only give the interior a good sanding (especially the epoxy areas to ruff up the surfaces) on my prototype hulls and just paint them.

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. 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 most brands of epoxy. It does not effect the cure of the epoxy. 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.
- Note: I used pigmented epoxy on this hull to make the interior stripe below the rails. I did this because I knew that it would cure overnight, and I could apply masking tape over it the next day and continue painting the interior of the hull.

Exterior Hull Finish

Finishing and Taping the Seams

1. Use a toothbrush to 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 Mix only a small amount of epoxy at a time! 1 to 2 oz's max.
2. Use EZ-Fillet to fill the gaps of all the outside seams using the "plastic bag method".
3. Or use a fairing compound such as System Three's, *Quick Fair*®, to fill all the voids and gaps. The faring material can be worked 3 to 4 hours after applying, if you are in a hurry to finish this hull. Block sand by hand, all the seams so as to maintain the sharp edges of the design. Keep most of the block away from the seam so you don't create any rounded over spots.
4. Apply straight epoxy along the edges to 1 ½" on either side of the hull seams. This will not require a lot of mixed epoxy, so make small batches.

Note: It helps to have watched me do this on my www.youtube.com/redbarnboats site before you do.

5. Apply the 3" glass tape and wet out the cloth until it turns clear. Remember to minimize the runs. Roll all the seams after you do them with a foam roller to even out the wet and dry areas. 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.
7. 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 when cured to smooth the seams. Check for high and low spots. *Good work here pays off in the end.*
8. If you have to come back for a second coat of fairing compound (I usually have to), it helps to mix in one of the color pigmented pastes to the next coat. By adding the pigmented paste to the

fairing compound, you make it stand out from the first coat, and you know where you were low or high on the first pass.

9. Repeat with as many coats and colors of fairing compound as it takes to make all the hull seams as fair as possible for the next step.

Fiberglassing the Hull

1. Give the hull a good final sanding with 120 grit. Look for any holes in the plywood surface, or bits of hardened epoxy on the surface that will snag the fiberglass cloth in the next step. Fill and sand any flaws in the hull. Wipe clean the bottom of the hull with a damp cloth to remove any dust and particles on the surface. Rotate the cloth often.
2. Unfold and spread out the 4oz or 6oz (your choice, I used 6oz on the prototype) cloth on the boat. The width of the cloth will depend on what you can get. I was able to get 60" wide cloth. Hand smooth the cloth from the center outwards in all directions. Be careful not to destroy the glass weaving with too much pressure. Try to keep the weave of the glass strands square with the boat.

Note: Once I have the glass cloth spread out and centered on the hull, I then know how far up the sides of the hull the cloth will reach. On this hull, the 60" wide cloth reached just to the "upper edge" (boat sitting upright) of the 3" glass tape on the outside of the upper hull seam at the beam. I use this as the location on the hull where I place a layer of masking tape that will be the "cut line" for excess glass cloth.

3. Place the masking tape around the hull along the "upper edge" (hull sitting upright) of the 3" glass tape already applied. Follow this curve along the hull sides to the bow, and straight across on the stern panel.
4. Re-smooth the fiberglass cloth to conform to the hull. Take scissors and remove the excess glass cloth 1" past the lower side (hull upside down) of the masking tape. This helps when chasing to the edges of the cloth, all ridges and folds. Take your time, and hand smooth the cloth over several days until it is flat to the hull, and all excess folds have been chased to the ruff cut edges of the glass cloth.

Note: Use the area between the thumbs and fingers to conform the glass cloth to the bow and stern corners. Make multiple passes in a downward motion to smooth out any folds, and ridges. It helps to watch the videos on how I do this.

5. After the glass cloth is smooth to the hull, and all folds and ridges have been removed, it is time to wet out the fiberglass cloth. Start at the centerline near the middle of the hull and work outwards and towards the bow and stern on the bottom panels first. After the glass has "wetted out" and turned clear in this first area, squeegee the excess epoxy to the dry areas of the cloth, outwards and to the ends.

Note: Be careful when you squeegee epoxy to the edges; so that you do not move so much epoxy that it will run down the sides before you get a chance to spread it out. Once you start the process, it will become obvious what to do.

6. While working down the sides, be careful how much epoxy you use to wet out the cloth. Just pour on enough in one area to wet it out, and not so much that you waste a lot of time chasing

down the runs. Stop using a scrapper to move the epoxy when you get close to the masking tape used for the cut line. Switch to a toothbrush to wet out the last bit, and stop at ½ the width of the tape you placed for your cutting edge.

Note: Be sure to follow along behind as you go with a foam roller to even out the coat, and stop any runs before they have a chance to cure. A 3" roller is big enough to do this with.

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

7. 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 the very sharp knife 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 tape/paper and let cure over night.
8. After the epoxy has cured, block sand the rough edges of the 6oz bottom cloth. Feather the edges out ¾" to 1" with fairing compound. Smooth the edge with more fairing compound until the seam cannot felt.

Note: You can add different colored pigmented pastes to each of the fairing compound layers to differentiate each one from the other.

9. With the edge of the glass cloth faired to the hull, you can finish with more coats of epoxy to "fill the weave" of the cloth. Two coats spread and rolled with a foam roller should be enough to fill the weave of the cloth and give you a smooth bottom on the hull.

Note: Check the bottom of the hull with a strong light to be sure that you don't still have a few rough spots left from filling the weave. Mix up small batches of epoxy to fix, and roll smooth into the surrounding areas. Fix them now before you paint!

10. 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 hand held light held at an angle, to check the surface for flaws.

Painting the Hull

Note: If you are going to add the wooden trim strips below the gunnel rails, and two tone paint the hull; use ¾" to 1" masking tape to cover the area were you will apply GelMagic later to attach the strips. You will save a lot of work and time, if you install the "finished" trim strips after you have painted the hull. I wish I had. :(

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. The one quart (1qt) can should give you three to four coats on this hull. Give it time to cure and follow the sanding directions if

the hull needs it.

Note: If you did a good job on the weave filling coats, the two part epoxy primer will smooth out most flaws, and you can start painting when the primer cures.

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 than 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 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 this hull 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.

Note: If you are building this hull in the colder winter months; study the next "note" and see if your shop is warm enough to follow these instructions. If you can maintain 70 degrees in your shop for a full 8 hours, you can add at least 4 coats of LPU paint if you have some help with the mixing, applying, tipping, and clean up of the brushes between coats.

Note: For each layer of crosslinked LPU paint to be truly "crosslinked"; each succeeding coat needs to be applied with no more than 8 hours between coats. The previous coat does not have to be cured, but it can not be "tacky". If you can touch the previous coat and not leave a fingerprint, you can apply the next coat.

6. Pour 6oz of LPU paint into a cup. Mix the cross linker with 1oz of water in a separate cup and then stir the cross linked mixture into the paint. Mix well and pour in roller pan.
7. The paint will seem fine in the pan, but will seem "runny" when you roll it onto the hull. Roll it on at all angles, moving from wet to dry areas, until there is an even coat over the entire hull, and watch for excessive runs. As you roll it on, bubbles will form on the surface, making it look like tapioca pudding. Not to fear, this is where the good quality natural bristle brush comes in. Put the roller and roller pan in a bucket of water and pick up your brush. Use at least a 3" wide brush and lightly drag it along the surface in long strokes. On this boat you can walk along the side and make one stroke from end to end. Streaks will appear, but do not worry. The paint will flatten out and fill them in. Clean the tip of the brush with water a couple of times while "tipping" to keep the finish smooth. Just dip the tip 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 (or sooner; check with a finger tip along the bottom near the keel).
9. 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.
10. 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.

Note: Don't mix up a small batch without adding the necessary water. If you roll on a "thin coat" in warm weather or a heated shop, the paint will dry too quickly, and leave streaks when you tip the surface. This happened to me twice, and until I mixed up a batch big enough to put down a layer thick enough to tip and thick enough to not dry out before I was finished with the tipping.

The Sailing Option

Rudders, Daggerboards, Tillers, and Towing Eyes

Rudders

1. There is more than one way to make the rudder, 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 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 center line on both edges and sides. You may have to build a jig for your adjustable table saw 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" table saw. 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. 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), or a combination of 3mm and 6mm (1/4") 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. 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 daggerboards 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, or a combination of 3mm and 6mm plywood, and shaped to a NACA 00XX 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. 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, or a combination of 3mm and 6mm (1/4"). 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 X strips of various widths and lengths to make a daggerboard with a NACA 00XX 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 strips and the edges 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 1/2" 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 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. Cut out, shape, and finish the 1/4" block used to keep the daggerboard from sliding through the hole. Attach the handle and block to the daggerboard with a layer of GelMagic and some stainless screws.
11. Finish sand with 100 grit, remove any dust from the surface, and apply at least three coats of epoxy to the daggerboard.
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.
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.

Sailing Hardware

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 1/4" stainless steel bolt and washers to attach it to the rudder.
2. Use pintles and gudgeon's that are heavy enough to do the job. Use the "long and short" pin pintles to make it easy to attach and remove the rudder, and the long pintle goes on the bottom. Make sure you epoxy "backing blocks" of adequate size, to the inside or outside of the stern hull panel to spread the loads in case of a grounding. Use stainless bolts and backing washers to attach the gudgeon's and bed with sealant to keep the water out. A good supply of sizes can be found at www.duckworksmagazine.com. I used the "medium kit" on this hull. But I did have to reshape the lower gudgeon to fit around the keel strip.

Towing Eyes

1. Consult the plans for location, and use at least a 3/16" 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 wench eye and tie down while being carried on a trailer.
2. 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. The U-bolt can be used to hold the backing plate in place on the hull while the epoxy cures. Run a standard stainless nut up both legs of the U-bolt, followed by a small stainless washer, loosely tighten the interior nuts until the epoxy cures.
3. Remove stainless hardware after curing. Reinstall the U-bolt with sealant after finish coating the interior and exterior of the hull.

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 this design.

Note: Mast, boom and sprit tubing can be found at www.onlinemetals.com or calling 1-800-704-2157. The tubing is T6-6061 seamless, and is non-anodized.

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 can be used for the design.

Note: A good and inexpensive sail for this hull (I helped with the design) can be found at www.neilprydesails.com or by calling 203-375-1626. It is called the "Pram 64" sail. Call for availability.

Standing and Running Rigging

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

Note: Line, blocks, fittings and such can be ordered at www.duckworksmagazine.com Good quality fittings and at a very good price.

Revision Updates:

1/20/11	Changed yardage of 2"&3" or 3"&4" glass tape from 50yards to 50/60 each.
1/20/11	Double checked USCG calculations on HP of OB. 3hp max.
1/28/11	Added pages to drawings for deeper footwell in aft seat.
1/30/11	Changed max weight rating for hull.