



### A SIMPLE 15'-3" ALL-WEATHER SAILOR

By Rob Marean

“Slipper” is:

**Simpler:** Because of the building material and relatively few components. Ditto for: **Faster Easier** and **Cheaper: to Build.** It is also **Safer** Because all sailing, **motoring**, docking, & anchoring functions are conducted within the safety of the deep cockpit. **Superior:** comfort and camp-aboard amenities for its size.

**Dual wheel steering stations** for inside or outside helm.

**Superior:** visibility inside or out.

**Centerboard trunk** has minimal intrusion into the cabin, and is easily worked around in the cockpit.

**Length of W.L. is 97% of L.O.D.** for maximum Hull Speed

**Centerboard** can be winched to cabin-top level resulting in a draft of aprox. 15" or lowered to produce 3'6" draft contributing to stiffer and more weatherly performance.

When heeled, the hull presents a ‘V’ to the water, reducing drag and pounding. The aft cabin tends to point the bow into the wind whether sailing or anchored as opposed to conventional designs.

LOA= 17'-3" plus rudder

LOD= 15'-3"

Max Beam= 7', W.L. Bm= 5'-3"

Draft= 1.5' to 3'-6"

Ballast= 3-400#'s

MT Displacement est. 1500#'s

Sail area, w/100% foretriangle = 180 sq. ft.

Mast= 17'-6", Boom=8'-6"

## **TABLE OF CONTENTS**

Glossary...3	Install Centerboard Trunk...23
Bill of Materials...3	Lead Slug...23
Note...4	Steering Shaft...24
Begin Building...11	Interior...25
Hull Sides...12	Bunk & Interior Helm Seat...26
Stem...12	Seat Back...27
Mark Sides for Frames...13	P & S Cabin Sides...27
Hull Sides to Stem...13	Cabin Roof...28
Building the Frames...13	Main Hatch...29
Bow Locker...14	Winch Mount...31
Knock-Out Frames...15	O.B. Well & Mast post...32
Main Bulkhead.....16	Sliding motor mount...33-4
Mid-Cabin Frame...17	Tabernacle...35
Transom...18	Bow Locker...36
Hull Bottom...18	Mooring Bitt...36
Centerboard Slot...19	Bow-Sprit Backing Plate...37
Painting the Hull...19	Bow Locker Deck...37
Turn the Hull...20	Bow-Sprit ...38
Stl. Centerboard...20	Chain Plates...39
C.B. Trunk...20	Mast...39
Chine Logs...21	Sheeting Tackle...39
Cabin Side Stringers...22	Main Sheet Traveler...40
Cabin, Rear Panel...39	Rudder ...40

## GLOSSARY for this design.

**Bobstay**, a cable or chain connecting the bowsprit to the stem, allowing the forestay to be tensioned.

**Chainplate**, metal strap attached to hull to anchor mast shroud.

**Chine**, sharp corner of the hull where the side joins the bottom.

**Chock**, fairlead for line, reducing chafe.

**Companionway**, passageway into the cabin.

**Kerf**, a slit cut all or partway through a timber.

**LOA.**, Length Over All

**LWL**, Length, Water Line.

**LOD**. Length On Deck.

**Rocker**, the fore & aft curve of the bottom

**Sheer**, or gunnel, top edge of hull side.

**Stem**, the timber that connects the hull sides and bottom together at the bow.

**Stringer**, long members which run fore & aft to support decking.

**Transom**, the panel that joins the hull sides and bottom at the stern.

**Tack**, forward lower corner of a sail.

**Clue**, lower aft corner of a sail

**Gudgeon & Pintle**, hingeware to connect rudder to transom. Pintles are hinge axis inserted into gudgeons

**Sheets**, lines attached to the sails to facilitate trimming.

**Roach**, The area of sail aft of a straight line from the head to the clew.

**Rake**, to incline from perpendicular.

## BILL OF MATERIALS (estimated)

(I recommend un-perforated, treated deck material for all the dimensional material. The brand my local lumberyard stocks is “*Elite*.” It is Douglas fir, has tight knots and is highly rot resistant. Check to see if you would be allowed to hand select knot-free pieces.)

Framing, 2x4 x 16’ (usually ripped in two).....8 each

Hull sides, bottom, transom, cabin roof & lockers, O.B. well, bunk & galley counter tops...14 sheets 3/8” or ½” ply (Bottom to be ½” or 5/8”)

All plywood that isn’t marine grade is A-B Exterior grade

Cabin, galley, and locker sides.....3 sheets 3/8” ply

Main Bulkhead & centerboard trunk, OB Well.....	2 sheets 5/8" ply Rudder, stem backing.....	1 sheet A-B ext. 1" ply
Bunk top/helm seat, O.B. well, 3/4" ply.....	1 sheet	
Stem .....	One 2x12, 6 feet	
2 x 6 - 8' Bow sprit, motor mount, bow backing beam .....	one ea.	
Mooring bitt & Mast post, and 8" of 3/4" aluminum bar....	4"x 4"x 8'	
1-3/4" stainless steel (ss) #10 flat head wood screws, Phillips, star or square drive.		
Approximately.....	30	
Ditto for 1" ss screws for hull butt joint & cabinetry.....	100	
3/8" stainless eyebolts, various lengths (see text).....	6	
1/4" x 3" ss bolts, nylock nuts & flat washers.....	6	
Gudgeons and pintles to hinge rudder.....	two pairs	
Adhesive caulk, <i>LEXEL, Beats the Nail</i> , or 3M 5200, ...	Approximately 20 tubes	
1/8" X 1&1/2" stainless steel bar, C.B. stops, chainplates, bow spirit. ....	2'	
3/16" ss turnbuckle.....	3 each	
Bob stay turnbuckle W/hook for quick disconnect.....	3/8" galv. 1 ea.	
A variety of galvanized <i>Simpson Strong-Ties</i> to make various connections. (See a selection at: <a href="http://www.dhcsupplies.com/simpson_strong_tie.htm?pi=2">http://www.dhcsupplies.com/simpson_strong_tie.htm?pi=2</a>		
Three feet of 4" I.D. steel pipe.		
Miscellaneous blocks, cleats & rigging hardware.		

My intent was to get the maximum single-handed cruising accommodations in a minimum vessel. The entire exterior hull and cabin are made up from just ten assemblies butt or edge glued to form a modified dory hull. The hull sides are just two pieces of 4 X 8 plywood ripped to 3' wide, then butt joined. Since I am neither a designer or draftsman, the plans are amateurish and may require using one's intuition and/or innovation.

## NOTES

The whole idea behind this design is to produce a vessel that is safer and more comfortable and convenient to use as well as being as simple, inexpensive, and as easy as I know how to build.

On page 31 under the title "Hull Bottom" are instructions to connect together the two panels that will be the bottom of the vessel. If you are using LEXEL as the adhesive, allow this joint to cure for a minimum of 72 hours before installing. Ditto for the 3'X 8' sheets for the hull sides. This process can be done ahead of time so it doesn't hold up construction.

**Ports:** I recommend using  $\frac{1}{4}$ " LEXAN for all the windows, sealed and screwed to the external surface. It is almost bullet proof, but it scratches easily so either install them after all else is complete or leave the protective covering on. There is a danger of any plastic being overheated and cracking when cutting with a power tool. Use a sharp fine-tooth blade and go slowly. Kerosene makes a good lube but, of course, it is a mess to clean up especially since using solvents on polymers is a no-no. Screws can crack the plastic if they bind it. Test your fastening system on a remnant to make sure it works.

**Balancing the rig:** I highly recommend that your original sails be purchased used and cheap. Because this design has only been built as a model the balance of the sail plan is only theoretical. If the vessel will not sail, or sails backwards under mainsail alone, the sail area is too far aft. To move the sail area forward, reduce the size of the main and/or increase the size of the jib. If she refuses to point to weather, move the sail area aft. The rig is balanced when the rudder is 2-3 degrees to leeward while beating to weather.

**Think it through:** Because I've had a lot of experience building things I've built this model from a few simple line drawings as I believe many home-builders could. But since I have only built this design as a model, the dimensions and especially the angles given are not going to be 100% accurate, but they should be close enough that you will be able to make minor adjustments to make things fit. Also there are almost certain to be mistakes and/or oversights. So try to think at least one or two steps ahead to make sure what you are building will result in a sound vessel.

**"Bilge" pump:** Since the cockpit can't be made self-bailing, bilge pumps should be installed P&S as close to the main bulkhead as possible.

**The "gaff"** in the mainsail contributes to *Slippers salty* looks but is actually an oversize batten much like the current mainsails of highly competitive designs, maximizing sail area while keeping the center of effort low, contributing to stability.

**Positive foam flotation** is always a good idea. There should be room in the stowage lockers, galley and bunk to do the job. Be sure to use a non-hygroscopic (won't absorb water) type, which won't rot the wood. If you use pour or foam-in-place without lining all areas with plastic sheeting, it will stick to the hull (stiffing it) but be a bear to remove if you need to make repairs.

**Scale:** At 2" equals one foot, the model is 32" long. The figure in the model is 6 feet tall to scale. His name is "Pike". He is a former starship commander and doesn't know Dink about boat design or construction, so any problems you find are all his fault, it's hard to get good help these days :o) Bear in mind that these

“instructions” are only a guide as to how I would go about building *Slipper*, if you come up with a better method, by all means go for it.

I’ve tried to write up the directions for this project so that individuals with less experience can follow along. Consequently it may sound like I’m talking down to those of you who are well experienced. I apologize and ask your understanding.

Assuming you have your building site ready, the next thing to do is gather materials. In my experience if you are going to take all the time and trouble to build something, it’s worth using good quality materials. Marine grade plywood (ply) is going to require more effort to bend than the lower grades, so have a look at it first to make sure you have the means to bend it. If not, then consider substituting 3/8” or a lower grade.

Here’s a couple shots to give you some idea of what you are going to be building.

clip



The forward 18" panel of the bunk lifts out creating a foot well. The panel is then installed in supports to form the back of the helmsman's seat. A narrow shelf supported by the CB trunk and hull sides should be installed under the forward window for compass, VHF etc.

Kickin' back on the six-foot bunk.



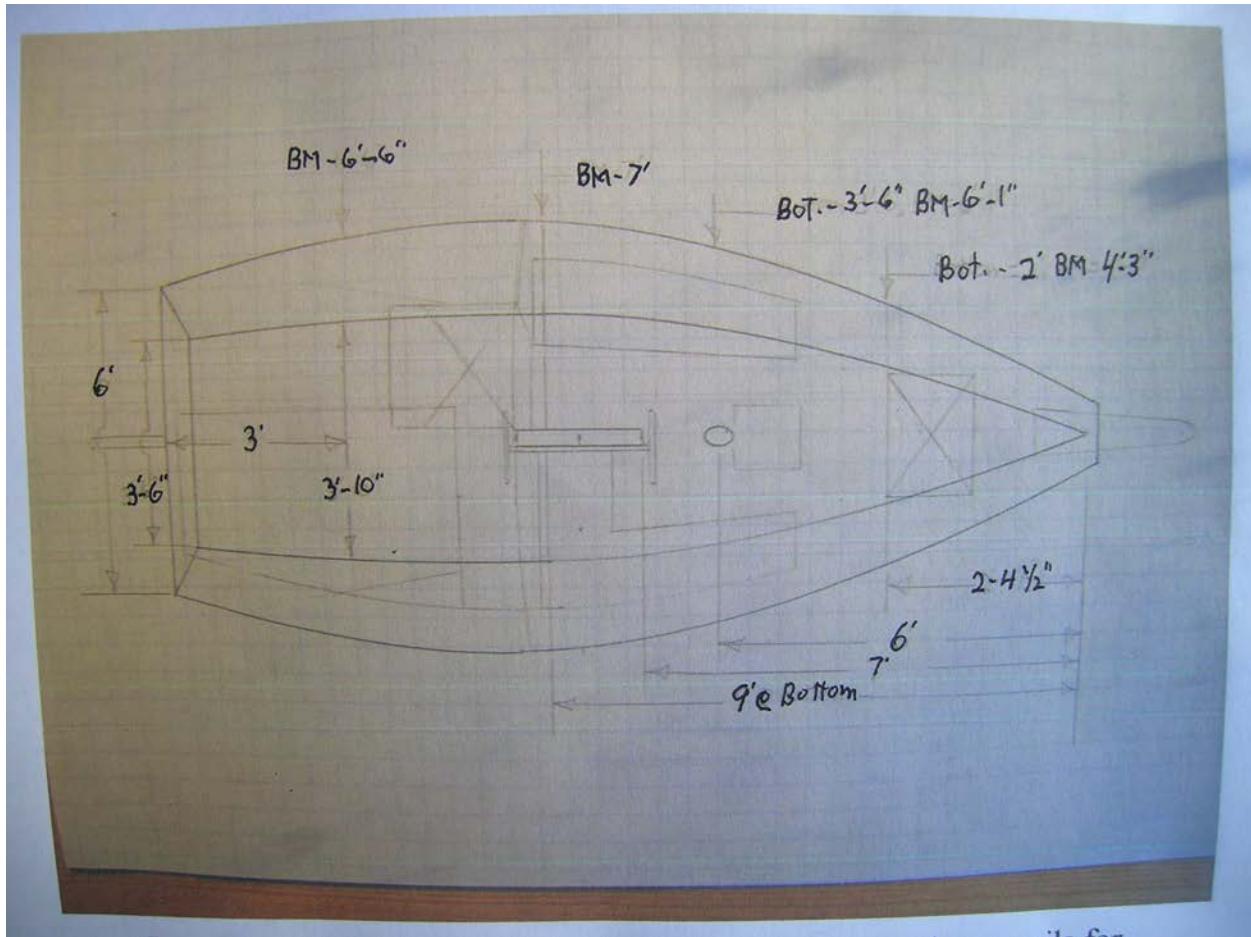
By installing oar locks, the vessel can be rowed by sitting on the bow locker and using the outboard well for a foot rest.





Above is a shot of the interior layout I used, but the interior is entirely up to you. Just make sure you have sitting headroom where you need it. I show a solid fuel heat stove aft of the galley, but you may prefer to put a portable toilet there.

This shot is a drawing giving some of the basic dimensions.



### **READ EACH PARAGRAPH COMPLETELY BEFORE CUTTING.**

For that matter you would be wise to read the entire directions before starting. With the 2018 price at about \$2/tube *Beats the Nail* construction adhesive or equivalent is by far the cheapest option. Pieces must be mated in FIVE minutes or less as it sets up fairly quickly. The down side is that it loses its flexibility over time. *LEXEL* (my choice) is around \$8/tube. It is water clear or white, adheres to almost anything and stays very flexible, *BUT IS SLOW TO CURE!* (like 2-3 days is preferable.) 3M 5200 has been the standard marine adhesive for years, but at about \$20/tube it gets expensive. Whatever you choose, check with your supplier to see if you can get a price for a case. Go online and read the description of these products before making your decision. I'm sure there will be additional miscellaneous materials, but this will get you in the ball park.

## **BEGIN BUILDING**

ALL JOINTS – except the temporary (KO) frames- THROUGHOUT THE BUILDING PROCESS ARE GLUED/BEDDED AND FASTENED.

The hull is going to be built upside down and then turned over to add the interior and cabin, so make allowances for how you will do that before you start. THE BOTTOM PLY WILL OVERLAP THE HULL SIDES AT ALL POINTS.

## **HULL SIDES**

Rip four sheets of 3/8" or 1/2" ply to a width of three feet. On all four of the sheets scribe a perpendicular line across the 3' dimension 3&1/2" from the end. These are the guide lines for the 7" butt joint plate. LATER, these will butt join the two pieces of each side together.

Transom cut: On two of the four 3' wide pieces, starting at the top aft corner, scribe a line on the end opposite of the joint guide lines at an angle of 15 degrees across the 3' dimension. This cut should intersect the opposite side about 10 & 1/2" in from its aft corner.

Butt joint plate: Using a remnant of the 3/8" or 1/2" side panels, cut two pieces 2'-10&1/2" long and 7" wide. The two long sides and one short side of the plate are beveled /ripped to a 45 degree angle so that they better blend in with the hull sides. The 45 on the short side will mate to the top edge (gunnel) of the hull side. They are cut 1&1/2" short of the bottom to allow room for the 1&1/2" chine log that joins the sides to the bottom.

**Joining the sides together:** Select one panel that hasn't had the transom cut to be the forward half of one side. Select the second panel that HAS had the transom angle cut for the stern half. The two ends with the joint guide lines are butted together to form a hull side that is 16' on the long side and approx. 15'-1½" on the short side. The sides of the panels that are facing up will be the INBOARD side of the hull. Glue and fasten the 7" wide butt plate to both halves of the hull side using the guide lines to align the sides and center the plate. Stagger two rows of 1" screws (for 1/2" ply) or ¾" (for 3/8" ply ) about 6" apart on EACH side of the joint. EACH half of the butt plate screw pattern should resemble this . . . . etc. The 45 degree end should be even with the LONG edge of the hull side. This will be the sheer or gunnel. If you are using LEXEL or equivalent, make it a practice to smear the excess adhesive on to the raw end grain of the 45 degree bevel and all raw cuts to help seal them. Mineral spirits will dissolve LEXEL for the first 15 minutes or so. Making two identical panels that only fit on one side obviously

won't work, so repeat the process for side #2 making SURE it is the mirror image of side #1,

**STEM (B0W)**. *General directions:* Back 3'-2" " of a 4'-6" long 2x12 with 1" ply, glued and screwed to the aft side of the 2x12, making sure that you do not have any screws on the cut line described below. With your saw set at a 24 degree angle cut it to a 'V' shape 2" wide at the bottom center of the 'V' and with 3' sides with the ply side being 24 degrees wider on both 3' sides. The crown of the bow locker deck will be scribed and cut later.

**MARK SIDES FOR FRAMES.** Lay the hull sides flat with the inboard side facing up. Measuring from the bottom (chine) of the panel what will be the bow, mark and label the following distances on Both hull sides: [chalk is easily removed and works well to label marks]

Bow locker chine (B.L.c..) 3'-1&1/2".

Knock Out frame chine (KO.c) 6'-1&1/8".

Main Bulkhead chine (M.B.c) 9'-1&1/8"

Mid Cabin chine (M.C.c) 12'-7&7/8"

Gunnel and chine measurements will differ slightly because of the flair of the sides and rocker of the bottom. Beginning at the top of what will be the bow, mark the following dimensions on the gunnel:

Bow locker gunnel (B.L.g) 3'

Knock Out gunnel (K.O.g) 6'

Main bulkhd. gunnel (M.B.g) 9'-6 & 3/4" [M.B. is tilted aft ten degrees]

Mid Cabin gunnel (M.C.g) 12'-9 & 3/8"

Now draw lines from the gunnel to the chine connecting their respective marks. These lines will locate the stern side of the frames that will shape the hull.

### **HULL SIDES TO STEM.**

On the interior sides of both 3' side pieces, using half of a ripped 2x4, install a length along the **aft side** of the main bulkhead guide line from the sheer to within 1&3/4" of the bottom (to leave room for the chine log that connects the side to the bottom.) The upper end cut at 30 degrees horizontally (to mate with a similar member that attaches to the aft side of the main bulkhead to attach the forward end of the cabin sides.) These pieces can be cut square on their long dimension because they are installed at the widest part of the hull. Block the stem up more or less

vertically with the pointed end up. Glue and fasten the bow ends (square cut) of the hull sides, flush to both sides of the stem with the chine side on the pointed end of the stem and the inboard sides facing each other and the 2x12 side of the stem facing outward or forward.

**BUILDING THE FRAMES.** As the label implies, the Knock Out (KO) frames are temporary and will be removed once the hull is complete so they can be made of any material if you don't want to use decking. The bow locker, main bulkhead, mid cabin and transom frames are permanent. Since you will be assembling the hull upside down extend the sides of the frames, (or use scrap pieces,) to allow clearance for the 4'- 4" main bulkhead and mid-cabin frames. To allow approximately 15 inches of space, extend the frame sides MEASURED VERTICALLY (plumb) FROM THE SHEER as follows:

Bow locker (P1) 1'-7&3/4"

(KO-1) 1'-10&3/4"

Main Bulk Hd. (from sheer) 2'-2&1/2"

Transom (T) 1'-4".

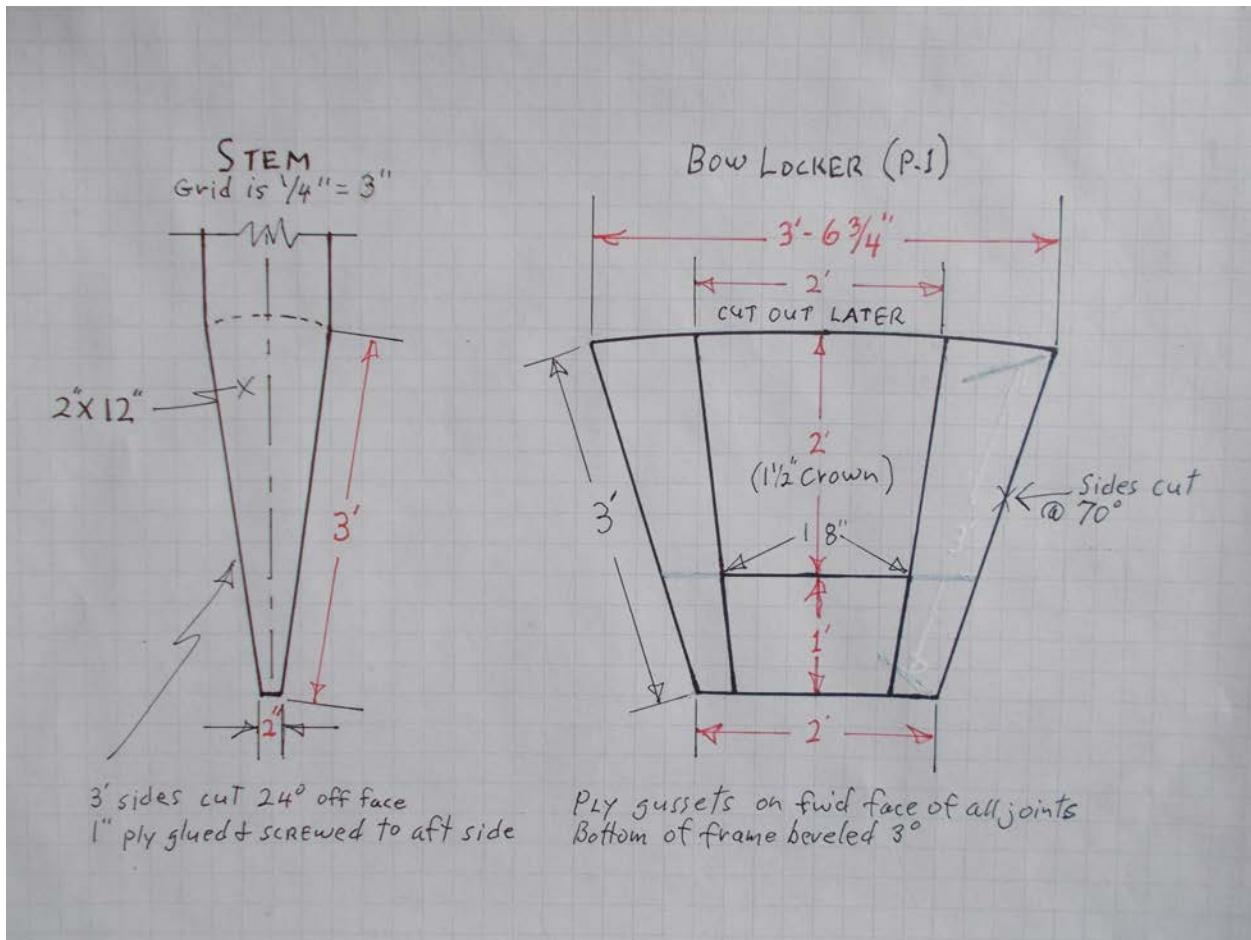
This space will put the bottom of the hull about six feet above the floor. For a space less than 15" subtract a constant from each of the above dimensions, but leave room for the 4'- 4" frames.

### **BOW LOCKER (Frame BL-1)**

Top cross member is cut from a full 2x4, with 20 degrees on both the vertical and fore and aft plains of the aft side of the **ends** to an overall length AT THE SHEER of 3'-6&3/4", allowing 1&1/2" ABOVE THE SHEER for the crown of the locker deck. Scribe in and cut the crown before assembling.

Bottom cross member ends are also cut at 20 degrees on both vertical and fore & aft plains to an overall length of 2' on the aft side. Rip a 6' length of 2x4 in equal halves at an angle of 20 degrees for the two side pieces, to be cut at 20 degrees fore and aft and 13 degrees vertically to produce a 3' side when the cross members are in place. Once the outside of the frame is assembled with 3/8" ply gussets glued and fastened on the forward face of all joints, the frame for the the locker door can be fitted per the drawing and installed. The top opening of the locker doorway will NOT be cut out until AFTER the hull is assembled and the rest of the

framework for the locker hatch and bow sprit have been installed.



### KNOCK OUT FRAMES (KO-1)

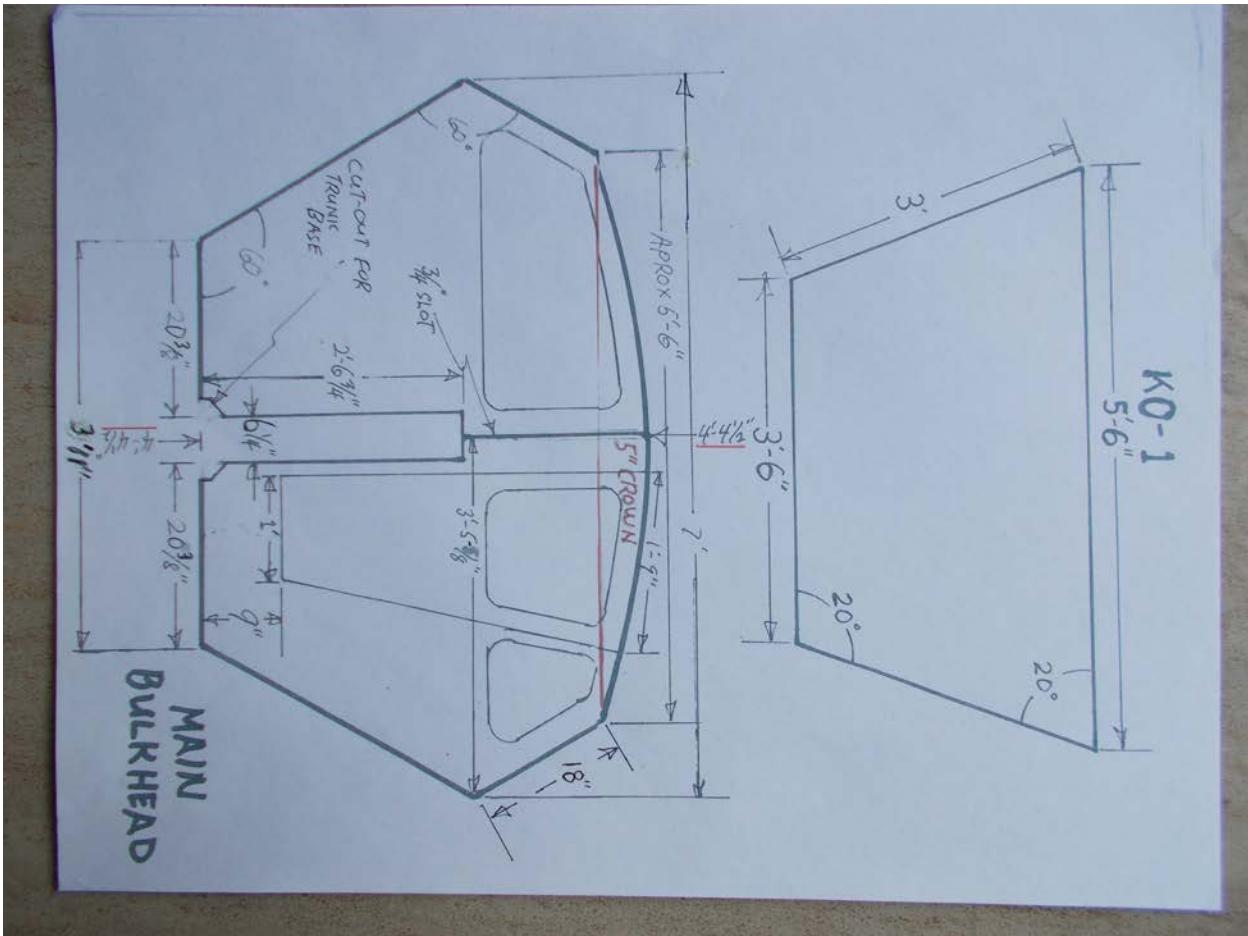
Rip a 6' length of 2x4 in equal halves @ 20 degrees for the side pieces. KO-1 is a simple trapezoid with a perimeter dimension of 5'-6" on the long side, (deck) and 3'-6" (sole) on the opposite side connected by pieces resulting in 3' sides. The bottom cross member ends are cut ~~at 20°~~ degrees both vertically and fore and aft, and an overall length of 3'-6". Ends of the top cross member are also cut to 20 degrees both vertically and fore and aft, to a length of 5'-6". Side piece ends are cut to fit between these two members to produce a side length of 3'. Don't glue, so you can disassemble , but screw 3/8" ply gussets on all joints.

## **MAIN BULKHEAD**

The main bulkhead is cut from 2 sheets of 5/8" ply to the dimensions given in the Main Bulkhead drawing. Window pattern is suggestion only, but window and companionway door openings should be easier to cut out before installing the bulkhead. Keep window cutouts at least 3" from the roof and 2" from the sides. I would use a 2 inch radius at the window corners and the bottom of the doorway. Screw temporary ply plate or pieces to connect the two halves together to the dimensions shown. Make it strong, as this joint will be under significant compression stress because it is the widest point in the hull. The top of the arch should be cut at about 82 degrees fore and aft to land the roof.

*Consider installing the framing on the aft side of the main bulkhead before cutting it to shape. Sides will be square, roof and floor angles will be ten degrees.*

With the two halves of the bulkhead connected to the dimensions given, a 6' length of 2x8 is used as a cross beam for the arch. Center the 2x8 on the arch and scribe in the arch contour and P&S side slopes. The arch will also be cut at about 82 degrees fore and aft to mate with the cabin roof. The P&S ends of the arch will be cut square.



Cut out 1&1/2" wide and 1&11/16" deep notches in the arch flush on the outside of both sides of the companionway doorway. These notches will support the forward end of the 1&1/2" by 1&11/16" roof supports that frame the companionway hatch. Trim the vertical width of the 2x8 to a width of 3" so it doesn't interfere with the window cutouts. Glue and fasten in place except the doorway opening which will be cut out later. After the main bulkhead is installed, rip an 18" 2x4 in half and cut to length as necessary to fit under the arch and the P&S hull sides to accept the cabin side panels.

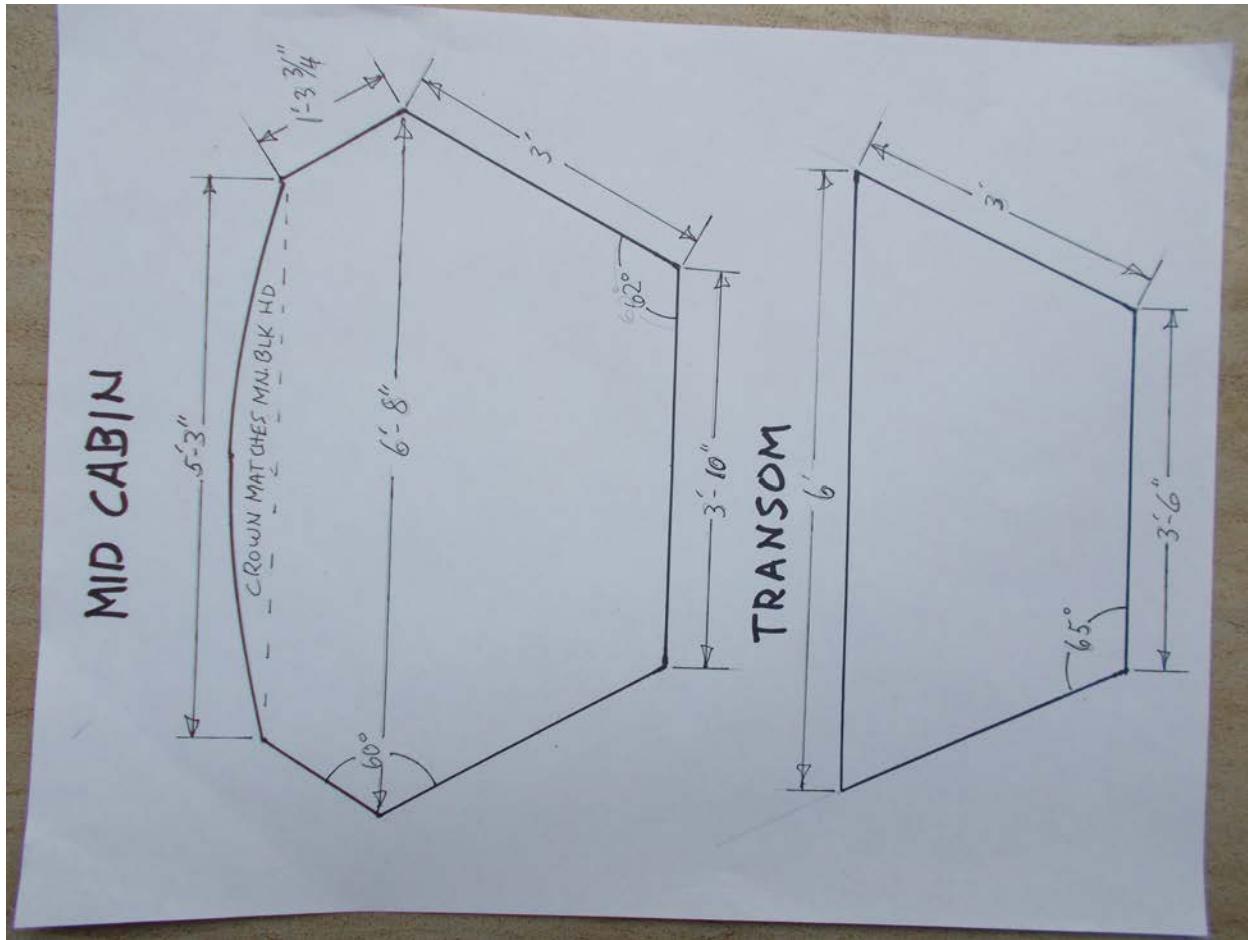
The cut-out for the CB trunk through the main bulkhead will be  $\frac{3}{4}$ " higher than the trunk to allow the trunk to be lifted and passed through the main bulkhead without scraping off the sealant on the bottom of the trunk. This  $\frac{3}{4}$ " gap will be filled with a C.B. cap after the C.B. is installed. **After the hull is assembled and turned**, the trunk is slid into place with no sealant so the bottom of the trunk can be scribed for placement and planed to fit the curvature (rocker) of the bottom if necessary. Then sealant is applied and the trunk is lifted through the bulkhead and

lowered into position over the C.B. slot cut in the bottom of the hull using guide lines scribed on the hull floor (sole) per above.

The gaps above the side pieces on the bottom of the trunk are then filled with short pieces fit and bedded in place. The gap through the main bulkhead at the top of the C.B. trunk is filled with a horizontal trim cap –slotted for the C.B., covering the full length of the C. B. trunk.

## **MID-CABIN FRAME**

Because the dimensions will be determined later, do not build or attach the top half of the Mid-Cabin frame. For now install a 6'-8" temporary cross member from sheer to sheer to shape the hull. The configuration of the top half of the Mid Cabin frame will be determined by the dimensions of the aft cabin panel described later. I'd suggest that you visit your local lumber yard or go on line to select what *Simpson Ties* (see: [http://www.dhcsupplies.com/simpson\\_strong\\_tie.htm](http://www.dhcsupplies.com/simpson_strong_tie.htm)) would be most useful to reinforce the cabin-side to hull joint at the main bulkhead and the cabin side to roof beam. For the roof beam to cabin-side joint *Simpson "T"* straps. These are galvanized steel components that can be: screwed, cut, bent once (only) to conform, drilled and, if etched in muriatic acid, can be painted if desired. Do Not glue the bottom cross member of the Mid-Cabin frame. It will be removed after the chine logs are installed. The 3' sides of the Mid-Cabin frame should be beveled to aprox. 83 degrees and the bottom to aprox. 88 degrees. When completed, the modified hexagon shape makes it inherently strong.



## TRANSOM

Cut the transom from  $\frac{1}{2}$ " ply to the dimensions shown in the above drawing. Glue and fasten two each one foot square backing plates on the vertical center two inches from the bottom and top edges to avoid the connecting stringers. These will reinforce the gudgeon attachment points for the rudder. A 6' cross member cut from a full 2x4 should be chamfered at an angle of 48 degrees by ripping 24 degrees from the center of one  $3\frac{1}{2}$ " side then another 24 degrees off the other half of the same side to produce a 48 degree angel and installed across the top of the transom frame. The lower 24 degrees will be glued and fastened to the  $\frac{1}{2}$ " transom, the upper 24 degrees will extend above the transom panel to be glued and fastened to the aft panel of the cabin top. While the angle will be different – about 60 degrees - *this same configuration of connecting member will be used to connect the cabin sides to the hull side.*

## **HULL BOTTOM**

Assuming you have attached the hull sides to all the frames and transom using the guide lines described in “Mark Sides for Frames” it is time to attach the  $\frac{1}{2}$ ” or  $5/8$ ” bottom panels. Measuring 8’ forward from the transom, determine where the two bottom panels are going to butt together. Then measure the beam at that point so you can determine how long the  $\frac{1}{2}$ ” or  $5/8$ ” by 7” wide joint plate should be not to interfere with the chine logs that connect the hull sides to the bottom. (allow aprox. 1&1/2” on both ends) Bevel the long edges of the joint plate to 45 degrees to make them less obtrusive, because you will be walking on them. Mark a guide line 3&1/2” from the 4’ end of one of the 4’x 8’ panels. Using the guide line and centering the joint plate on the aligned panels, glue and fasten the panels together. If you are using LEXAN for adhesive, allow this joint to cure for a minimum of 48-72 hours before installing on hull.

Hoist the bottom panels onto the hull with the joint plate facing down (the inside of the cockpit.) The bottom should overlap the hull in all areas. Align the aft end overlapping and flush with the aft side of the transom. Align the sides at the Main Bulkhead. Glue and fasten the bottom to the Transom. Working your way forward in sequence, glue and fasten the bottom to each of the frames EXCEPT the temporary frame KO-1 and the bottom cross piece of the Mid Cabin frame. Now the Bottom can be cut to match the hull sides and angles.

## **CENTERBOARD SLOT**

Once the bottom has been installed and cut to fit, starting at the bow, measure 7 feet down the centerline of the bottom and mark the forward end of the centerboard slot. Continuing down the centerline, make a second mark 9'-1/2" from the bow to locate the aft end of the centerboard slot. If you are using a  $\frac{1}{2}$ ” plate for the C.B., drill a  $\frac{3}{4}$ ” hole tangent to the fore and aft marks. For a  $3/8$ ” C.B. drill a  $5/8$ ” hole tangent to the fore and aft marks. Cut the slot  $\frac{3}{4}$ ” wide for a  $\frac{1}{2}$ ” C.B. For a  $3/8$ ” C.B. cut the slot  $5/8$ ” wide, straddling the centerline of the bottom in either case.

## **PAINTING THE HULL**

You may want to wait until the hull is right side up, but consider if you want to install a grounding shoe or shoes on the bottom of the hull. For beaching, consider putting a second layer of  $\frac{1}{2}$ ” ply on the first 3’ of the bow, tapering the trailing edge to reduce turbulence. Consider if you want to install grounding skegs

amidships near the chines to transfer the load to the hull sides, to keep the hull level when beached. These skegs should protrude from the hull about the same distance as the lead slug on the bottom of the CB, probably 2x4's on edge.

At this point I would suggest you seal the hull bottom butt joint and the raw edges of the hull bottom and C.B. slot with LEXEL or equivalent. While that is curing, use a water level (clear tubing or hose with 3' or so of clear tubing attached to both ends.) or laser, to level the hull fore & aft and side to side. Then strike a waterline all around the hull 4" above the bottom at the bow and stern. This may be a little high, but that's preferred as it will keep splash from soiling the hull. It can be lowered later by covering the top 2" or more with a boot-top stripe of contrasting color.

(OPTION) After the sealant is fully cured, to prevent the plywood from checking give the hull a coat of GLUVIT or similar product available from West Marine and others. After the GLUVIT is fully cured, you can paint the hull. Be sure that whatever finish you use below the waterline is intended to be used below the waterline.

## **TURN THE HULL**

After the finish is thoroughly dry, you are ready to turn the hull right side up. Make sure to leave room under the hull to install the fasteners for the OB well and CB trunk. Level the hull fore and aft and side to side and support it. A laser level is very handy for projecting the water line onto the hull.

## **(Galv?) STEEL CENTERBOARD (C.B.)**

**WARNING** ! Welding galvanized material produces ***toxic fumes*** (Check the Web.) If you galvanize, weld before galvanizing. If you don't galvanize, check the Web on how to epoxy paint steel.

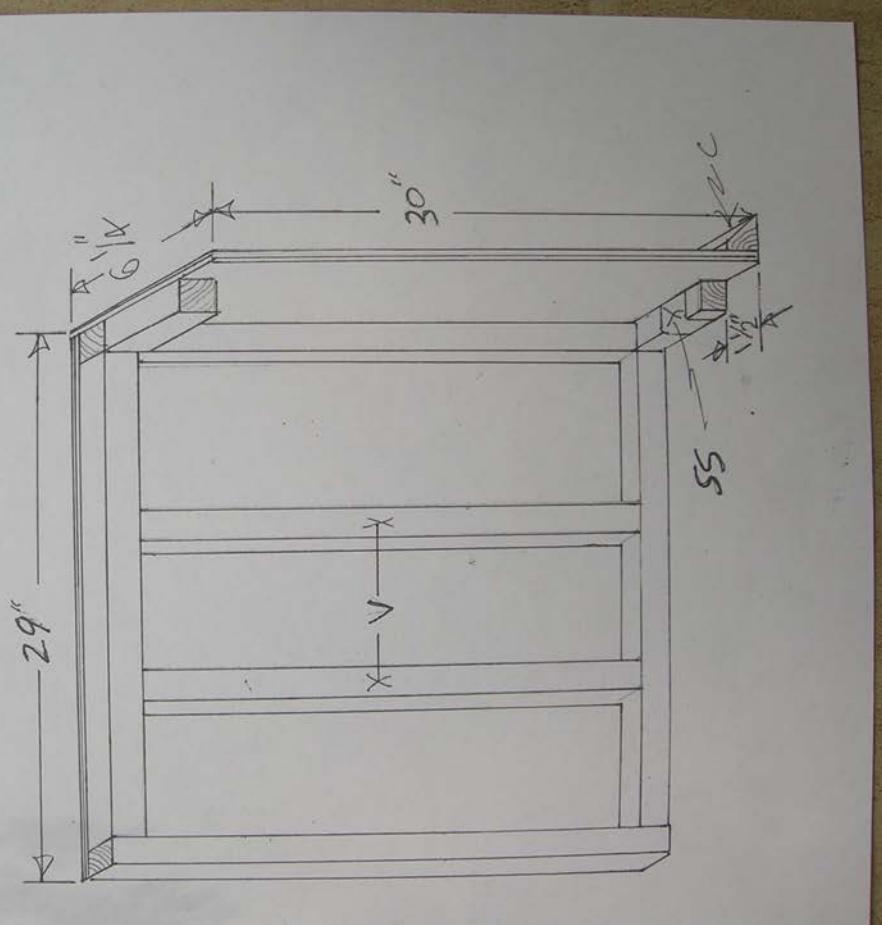
The centerboard is cut from 3/8" (130#) or 1/2" (174#) steel plate and measures 4&1/2' high by 2' wide. Weld 1&1/2" x 1&1/2" tabs (cut or grind 1/2" radii on the protruding corners to discourage jamming) on to the fore and aft edges with the lower edge of the tabs 8 &1/2" from the top – *leaving a minimum of 10" of board in the trunk*. These tabs will land on stainless stops inside the C.B. trunk which support the keel in the fully lowered position and prevent the keel from falling off in the event the hoist cable fails. **Make sure** these tabs will clear the top framing of the CB trunk so that the board can be raised completely, because I'm not sure I allowed for that in my instructions.

## CENTERBOARD TRUNK

General description: Bear in mind that you want to end up with a CB trunk that will have  $\frac{3}{4}$ " clearance for a  $\frac{1}{2}$ " centerboard or  $\frac{1}{2}$ " clearance for a  $\frac{3}{8}$ " board, AND clearance for the C.B. stops. The trunk is made from  $\frac{5}{8}$ " ply. It is 2'-6" high, 2'-5" long and 6 &  $\frac{1}{4}$ " wide. It is built in right hand and left hand halves so that the interior parts can be added, then the halves joined together. In a "knock down," the CB trunk will have to support 1600# or more of transverse load, so it has to be "Hell for stout" as the old carpenter used to say. The two 1& $\frac{1}{2}$ " vertical members on the P&S (port and starboard) sides (marked with "V's on the drawing) will mount  $\frac{1}{2}$ " round (or ripped 1" dowel) capped with a split length of 1" heavy wall vinyl tubing to reduce CB friction. The fore and aft ends of the trunk will have a 1/8" stainless pieces bent 90 degrees (marked "SS" on the drawing) bedded & screwed to the upper surface of the lower cross pieces to stop the CB tabs in the fully down position and protect the hull if/when the keel runs aground. Curb around the base of the outside of the trunk (marked "C") is chamfered @ 45 degrees to prevent water, and hence rot, from accumulating. Later, the trunk base and curb will be fastened *from* the bottom w/1& $\frac{3}{4}$ " fasteners. The starboard cockpit seat supports and stabilizes the CB trunk, so again it has to be "hell for stout."

### **CENTERBOARD TRUNK**

The centerboard trunk is built in left -hand and right-hand halves so that the interior components can be installed. The two 1 &  $\frac{1}{2}$ " vertical members on the P&S sides (marked with "V's on the drawing) will mount  $\frac{1}{2}$ " round, capped with a split length of 1" heavy wall vinyl tubing to reduce CB friction. Each end will have a 1/8" stainless piece (marked "SS" on the drawing) to stop the CB in the down position and protect the hull if/when the keel runs aground. Curb around the base of the outside of the trunk (marked "C") is chamfered @ 45 degrees. Trunk is fastened *from* the bottom w/1& $\frac{3}{4}$ " fasteners.



## **CHINE LOGS**

The chine logs will be one half of a 2x4 that has been ripped to the widest angle of the section where they will be installed, and then planed to fit the narrower angles. Ideally, the chine logs should be triangular so that they don't trap water against the hull. It may be necessary to cut kerfs in the stringers every 6" or so to bend them. The kerfs should be cut from the inboard side of the stringers so you don't have kerf voids at the side/bottom joint. Lay in a bead of caulking in the joint and cut, glue and fasten chine logs along the **entire** hull to bottom joints. The temporary frame (KO-1) can be removed to facilitate this step but, leaving room for you to remove it, install chine logs fore and aft of the frame before removing it so the chine will be fixed in place.

The bottom cross member of the Mid-Cabin frame can also be removed once the chine logs are installed.

## **CABIN SIDE STRINGERS**

Using the method similar to that described for the transom, the 2 x 4 stringers connecting the cabin side to hull side pieces will be chamfered at an angle of 60 degrees by ripping 30 degrees from the center of one 3&1/2" side then another 30 degrees off the other half of the same side to produce the 60 degree angel. (120 degrees included angle.) The lower 30 degrees will be glued and fastened flush with the upper edge of the hull sides, the upper 30 degrees will extend above the hull sides to be glued and fastened to the cabin sides. These stringers have to bend to conform to the curve of the hull. Using a 1/8" wide blade, cut kerfs 4" to 6" apart across the uncut 3&1/2" side to within about 1/2"-3/8" of the 60 degree side. This should permit you to bend the stringer. Cutting the stringers to fit between the frames, glue, clamp in place and fasten to the hull side with the apex of the 60 degree angle flush with the top edge of the hull side.

## **CABIN, REAR PANEL**

With the hull right side up and level fore and aft and side to side, select a light weight straight board. Put one end on the center of the crown of the main bulkhead, support the opposite end from the top of the transom panel to produce a two inch slope from fore to aft. This will be the fore and aft slope of the cabin roof. To achieve this slope, you may have to make some adjustment to some of the following dimensions for the back panel of the cabin:

Using 3/8" plywood, the bottom of the cabin rear panel matches the width of the transom at six feet. The P&S sides of the back panel are just one foot long, the 5' wide arch between these two sides matches the arch of the main bulkhead, which produces an angle at the P&S ends of the panel of about 64 degrees. The bottom of the panel joins the transom at an angle of 48 degrees as described in "TRANSOM" above. Cut the port (window) opening in the middle of the panel but don't exceed a width of 18" or it will interfere with the steering cables. Glue and fasten the panel into place at the bottom.

Using a 6' length of 2x8, scribe the contour of the roof arch by centering it on the main bulkhead. The top of this arch will be cut at about 56 degrees to mate with the roof panels. You can measure the angle by bridging the gap between the main bulkhead and the cabin stern panel with a straight board. Once this arch is cut, center the narrower side of the arch flush with the top of the rear cabin panel and, using the panel as a guide, scribe lines to trim the ends to conform to the P&S slope of the panel sides. The slope cuts will be at 90 degrees. Glue, clamp and fasten the arch flush with the top of the rear cabin panel. Ripping a one foot length of 2x4 in two, cut, fit, glue and fasten vertical supports between the ends of the arch and the hull sides.

## **INSTALL CENTERBOARD TRUNK**

The cut-out for the CB trunk through the main bulkhead will be  $\frac{3}{4}$ " higher than the trunk to allow the trunk to be lifted and passed through the main bulkhead without scraping off the sealant on the bottom of the trunk. The trunk is slid into place with no sealant so the bottom of the trunk can be scribed for placement and to fit the curvature (rocker) of the bottom if necessary. Then sealant is applied and the trunk is lifted through the bulkhead and lowered into position over the CB slot cut in the bottom of the hull using guide lines scribed on the hull floor (sole) per above. Inch and a half curbing can then be installed at the base of the trunk securing it to the floor, chamfered at 45 degrees forward of the main bulkhead in order to shed water and fastened thru the hull bottom from underneath the hull bottom.

The gaps above the curbing on the bottom of the trunk are then filled with short pieces fit and bedded in place. The gap through the main bulkhead at the top of the C.B. trunk is filled with a horizontal trim cap –slotted for the C.B. - covering the full length of the C. B. trunk. On the aft bottom side of the main

bulkhead, caulk and install 2"x2" members ripped to fit snugly to secure the bulkhead to the hull floor.

## **LEAD SLUG**

Virgin lead weighs 712 pounds per cubic foot, scrap lead will be slightly less than that. Lead is toxic and melts at 622 degrees Fahrenheit or 328 degrees Centigrade so you will have to use (rent?) a good sized propane burner to melt the lead. A cast iron pot would be ideal if available. In any case *the UTMOST IN CAUTION IS REQUIRED* in dealing with molten metal. There are lots of instructions and hardware on line, be sure to check them out.

<http://www.preparedsociety.com/forum/f81/melting-lead-safely-10078/>

I have never melted or molded lead so I am just shootin' in the dark here. If you have a better idea by all means use it. But if it were me, I'd use a 3' length of steel pipe (the galvanizing would likely melt on galvanized pipe and may produce toxic fumes). with a cap screwed on one end Build a sturdy jig to hold the pipe vertical, you definitely don't want anything going wrong when you are dealing with molten metal. A three foot length of 4" I.D. steel pipe filled with lead will weigh about 200 pounds including the pipe. A wood plug about 2" long can be *secured* (so it won't float) in the capped end of the pipe (bottom). Once the lead has cooled the plug is removed to permit a wooden fish tail fairing to be inserted and glued in place. The wood plug may char, but once it is completely covered by the molten lead, the oxygen supply will be cut off and the wood unable to burn. Leave a similar gap at the upper end of the pipe to accept a wooden hemispherical bull nose. Since the molten lead will be contained inside the pipe, it can be filled in small batches. The advantage of using steel pipe for the mold is that once the C.B. is complete with stop tabs and a top center slot for both the hoist cable attachment and to insert a pin to lock the C.B. in the fully retracted position, the C.B. can then be installed in the trunk and then the completed slug can be welded onto the C.B. Determine the balance point of the slug and center that point on the center of the C.B. so that the weight of the slug doesn't cause the C.B. to be off balance and jam in the trunk.

## **STEERING SHAFT** – Read the entire directions before starting.

After installation, the fore & aft vertical ends of the CB trunk will be covered with 1" ply that extends above the trunk to mount the bearings that support

the steering shaft. Be sure to have the steering shaft in place when the supporting end caps are installed to make certain the shaft turns freely.

There are a number of on-line sites from Amazon to e-Bay that sell ships wheels at reasonable costs. Because of the limits of standard size wheels, the exterior wheel will be 18" and the inside wheel 12". You will need to acquire these wheels so that they can be adapted to the steering shaft which probably will require some custom machine work. Leave as much room as possible between the outside wheel and the mast to permit the helmsman to pass between the two when tacking.

You may have to redesign my idea for the steering mechanism because it may be too funky, but I would try it because it is so simple and inexpensive. The 1" ply end-caps on the centerboard trunk need to be the full width of the CB trunk so that the offset bores supporting the steering shaft – and hence the shaft – do not interfere with the centerboard, and still leave plenty of stock on the starboard side of the cap to accept the side thrust of the wheel under high loads. Bore the 1&1/4" shaft support holes to support the shaft on the starboard side of the CB trunk to minimize the wheels interfering with the passageway in and out of the cabin. Select a length of 1" O.D., ( $\frac{3}{4}$ " I.D.) thick wall aluminum tubing that will slide easily through a 6" length of 1" I.D. thick wall vinyl tubing. Temporally fit the fore and aft end caps on the CB trunk to determine where the 1&1/4" bore for the vinyl tubing should be to avoid interfering with the centerboard, and where to drill and tap a 10-32 stainless flat head machine screw with ss flat washer, to attach the steering cable to the aft end of the steering shaft. (Coat the screw and hole with anti-oxidation compound (electrical hardware item) to reduce galvanic corrosion.) With that accomplished, cut a length of vinyl tubing 2&1/2" long (it will pass through the end-cap bore and protrude about  $\frac{3}{4}$ " on both sides.) Using a thin blade, (band saw, hacksaw, coping saw,) cut 4 each  $\frac{3}{4}$ " deep slots in both ends of the vinyl tubing to divide the tubing ends into 8 equal tabs. Bending the tabs slightly outward, cut off every other one on the first side and the offset tab on the second side such that the tabs – and subsequently the fasteners - do not line up with each other. Insert the vinyl segments into their respective end caps. Using as little heat as possible so you don't distort the bearing surface, bend the tabs to the end caps, drill and screw each tab to hold them securely in place.

The thick wall aluminum tubing will have to be long enough to extend through the exterior and interior shaft supports and still leave room to mount the wheels and have a minimum 3" space between the interior wheel and the inner

shaft support to accept 4-6 complete turns of 1/8" stainless cable between the shaft support and the wheel. Measure and acquire sufficient 1/8" stainless cable the middle of which is attached to the steering shaft by the 10-32 ss screw and washer. Put the middle of the cable under the forward side of the washer of the 10-32 retaining screw. Taking the cable on the port side of the shaft, pass it under the shaft and wrap it around the shaft 3 full turns and tape it in place. It has to be wound this direction so that turning the wheel to starboard turns the vessel to starboard. Wrap the other end of the cable around the steering shaft and under the aft side of the retaining screw washer and snug the screw, bearing in mind that aluminum strips easily. (If that happens, use a thru bolt) Then wrap the cable three full turns around the steering shaft in the opposite direction such that when the shaft is turned one cable feeds out while the other takes in. Tape in place with vinyl tape. Run the ends of both cables to blocks mounted on the main arch. Consider running the cables through steel fairleads mounted on the underside of the mid-cabin arch for extra support and lubricity.

Run the cables in as straight a line as possible to a pair of spring-tensioning turning blocks mounted on wood blocks on the aft panel of the cabin. (see:

<http://www.velasailingsupply.com/Ronstan-Steering-Cable-Tension-Spring-p/ronrf149.htm>) The cables are separated 18" by the turning blocks installed to guide the cables through slots in the aft wall of the cabin and toward the stern end of the rudder head where they will be attached later, – another 3' minimum for both cables.

The exit point for the cables is a little tricky because the cables are going to pass through an exit slot in the rear cabin panel and turn toward the rudder at about 45 degrees. The exit slot will need a rain-cap on the outer surface that doesn't interfere. I've had good luck cutting various sizes of 45 or 90 degree pvc elbows as caps or vents then gluing them in place.

## **INTERIOR**

Once the chine logs have been installed and the adhesive cured the temporary spreader at the mid-cabin frame can be removed and the interior cabinetry installed. The configuration is entirely up to you of course, but here are a few things to bear in mind. On the galley side, do you want the sink or the cook stove under the hatch area so you can stand up to wash dishes or cook? Buy the cooler you intend to use on the boat and then build an drawer away from the heat stove (if installed.) an inch larger than the cooler all around. Roll-out drawer

hardware would be handy on this drawer because the cooler is heavy. But it – and all the drawers - need to have a positive latch on them to prevent them from opening when the vessel is heeled. Install a minimum of 1" ridged foam in the bottom of the drawer. Put the cooler in a plastic garbage bag and center it in the drawer. Using pour-in-place foam (or easier) canned foam from your hardware store, foam all around the cooler outside the bag. Urethane foam sticks to almost everything, but the garbage bag allows you to remove the cooler to take it home to fill it which is very handy. Only foam about halfway up the sides of the cooler because the foam will continue to expand for 10 -15 minutes or so, keep an eye on it. Consider using a 1" piece of ridged plank foam (styrene crumbles too much) or a batt of polyester to cover the top of the cooler.

The countertop should be level on both axis and near the height of the sheer because that is the widest part of the hull. In any case make sure there is ample space above the cook top and anything else that might catch fire. (A fire at sea can spoil your whole day!) Most lumberyards stock 1x2 and 2x2 fir strips. Frame your galley with either or both of these and *Simpson Ties*. Be sure to leave adequate clearance for the doorway and heat stove if installed. 1" by 1" aluminum angle (hardware store) can be mounted on the frame sides to support the drawers. To prevent the drawers from sliding open when heeling, consider child-proof latches, they are inexpensive and effective. Using *Melamine* for your countertop, available at most lumberyards, will save you from having to fit and glue on a sheet of laminate. Consider cutting out the sink hole from the back side before installing. Make sure to leave room under the sink to run the drain. (Most areas and federal regulations now require a holding tank for both black and grey water.) Consider adding a shelf from the C.B. trunk to the starboard hull for nav. equip.

## **BUNK & INTERIOR HELM SEAT**

The forward 18" of the bunk is simply a piece of  $\frac{3}{4}$ " ply the forward end of which is supported by cleats on the CB trunk, main bulkhead and hull side. The aft end rests on the bunk frame. The space under this piece is left vacant to provide foot-room for the interior helm. Measuring aft on the floor 18" from the main bulkhead scribe a line perpendicular to the centerline of the hull to locate the forward end of the bunk frame. Determine the maximum height you can make the bunk and still have sitting headroom (including bedding or cushion?) where you need it. Using ripped 2x4's and *Simpson Ties* frame a platform that will be level on both axis and as wide as possible without interfering with opening the galley

drawers, doors or constricting access to the heat stove if installed. If you will have a portable toilet on board consider its dimensions and where it will be placed. Build the frame strong enough so that fasteners thru the hull sides and transom will hold it in place without need to fasten below the waterline. Cut the sheet of  $\frac{3}{4}$ " ply to cover the main portion of the bunk. Any hatches in this piece should be cut before installing. If the hatches are to be hinged, cut the outboard side of the hatch openings first and install a continuous hinge (stainless or brass) over the cut line before completing the cut out. This will insure the hatches fit perfectly. On the backside of the cutouts, glue and fasten 2" wide  $\frac{3}{4}$ " ply stops to support the hatch on the three sides without the hinge. Drill a couple 1" holes, 4" apart near the inboard center of each hatch. Cut out the slot between the holes and rout the corners to produce a comfortable grab handle. Glue and fasten the bunk top to the bunk frame, leaving room on the forward end to land the removable 18" section.

## **SEAT BACK**

Glue and fasten blocking on the inside of the hull to mount the seatback at about a 10 degree angle sloping aft. Using two  $\frac{1}{4}$ " ss carriage bolts, through-bolt a 24" length of 1&1/2" PVC conduit to the upper inboard surface of the seat with 8" of the pipe extending beyond what will be the lower edge of the seat back. With the square portion of the bolt heads let into the PVC, and the nuts on the bottom side, neither should chafe bedding or comfort. Slip the seat back into the blocking on the hull side and mark where two conduit clamps should be mounted to support the seat back. Glue and fasten backing blocks to mount the conduit clamps.

The bunk framework should be a box in with 3/8" ply to provide rigidity. Cut out access/vent openings in the inboard side of the ply to contain contents but still allow you to retrieve smaller items without having to open the hatches.

## **P&S CABIN SIDES**

Most of the rest of the assembly is going to be a scribe in place and cut to fit process. Rip one full 3/8" ply sheet to a width of 20". Extend the panel forward to or slightly beyond the main bulkhead where it joins the hull side. Holding the top of the panel nearly horizontal fore and aft, clamp the forward end to the main bulkhead. Now clamp the aft end of the panel to the rear cabin panel. This will allow you to scribe in the fore and aft cut off angles of the cabin side as well as the contour on the lower edge of the panel where it meets the hull. Scribe a straight line from the upper outboard corner of the main bulkhead to the upper outboard

corner of the aft cabin roof frame. After cutting to the scribed lines, lay out and cut out the openings for the windows bearing in mind where the mid-cabin frame will be and staying 3" away from all the edges of the panel. Glue, clamp and fasten the panel fore, aft and bottom. Repeat the process for the opposite side.

Using a 6' length of 2x8 scribe on the arch of the main bulkhead. Since this frame is plumb, the cut on the top of the arch will only slope 2-3 degrees downward front to back. Using the 2x8 to bridge the gap from side to side at the mid-cabin frame, you can determine the length of the arch where it meets the upper edge of the cabin sides. Using an adjustable square, you can measure from the bottom of the 2x8 to the cabin sides to determine the angle to cut off the ends of the 2x8 from the upper corner where it meets the cabin side panel. Glue and fasten the arch in place then fill in ripped 2x4 supports under the arch to the lower part of the mid-cabin frame.

The stringers that connect the roof to the cabin sides are cut using the same method described in "Cabin Side Stringers" p.52 above. These pieces will be predominately straight but their angle will vary in the 42-48 degree range. Using an adjustable square you can measure the angles at the rear, middle and front of the cabin. The total angle is divided in two with one half of the angle ripped into the lower half of a 2x4 and the other half into the same side of the upper half of a 2x4. Cut the stringers to fit between the frames at the cabin side/roof joint, then glue, clamp and fasten in place with the apex of the angle flush with the upper edge of the cabin sides.

## **CABIN ROOF**

Cutting it flush with the doorway opening, carefully cut out the portion of the 2x8 main bulkhead arch that spans the doorway. Then, using a length of 2x4 long enough to extend from the main bulkhead at the doorway arch to the mid-cabin arch, rip it in two and install the forward ends in the notches in the main bulkhead arch with the wider dimension vertical and the milled corners down. These members must be flush with the tops of the main and mid-cabin arches. Attach the aft ends to the mid-cabin arch at exactly the same width apart as the forward ends to allow the hatch to slide freely. Use galvanized steel *Simpson Ties* or equivalent available from lumberyards to reinforce these attachments. Plane the outboard edge of the port hatch frame to conform to the slope of the roof. I know of no reason why the hatch opening cannot extend all the way from the main

bulkhead to the mid-cabin arch, a distance of about 2&1/2'. With the hatch open, this would allow one to stand up to cook or do the dishes etc.

## **INSTALLING THE ROOF**

To help center the roof once it is cut to shape, scribe a fore and aft line at the exact middle of the mid-cabin arch. Extend this line down the fore and aft sides of the arch. Using a full sheet of  $\frac{1}{2}$ " ply, lay the 8' dimension across the aft half of the cabin roof. Clamp the forward edge to the mid-cabin arch with enough forward overlap that you can scribe in the contour – if any – of the mid-cabin arch. Now roughly scribe in the P&S and stern sides leaving about 2" of overhang all around. Make a mark on the underside of the sheet that matches the centerline mark on the arch. (Transfer the centerline mark to the upper side of both fore and aft sheets in turn.) Remove the sheet and cut it to exact shape on the forward edge and rough shape on the other three sides. Set it aside so it will be out of your way to go through a similar process for the forward half of the roof.

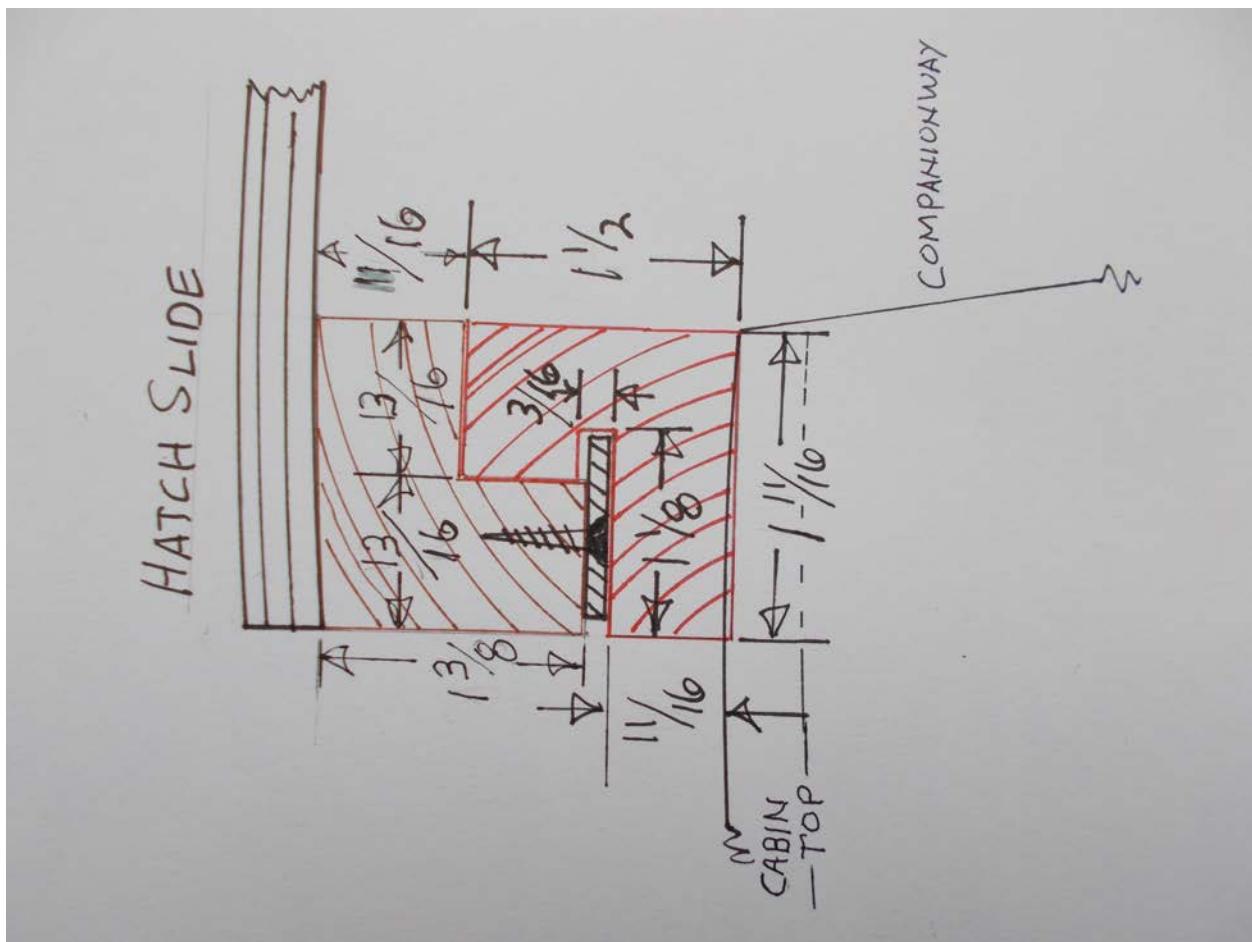
Using another full sheet of  $\frac{1}{2}$ " ply, place the sheet across the forward half of the roof, overhanging the mid-cabin arch slightly. Clamp the P&S ends of the sheet to the mid-cabin arch and scribe in the contour (if any) of the arch. Make a mark on the underside of the sheet that matches the centerline of the arch. Roughly scribe in the other three sides of the cabin allowing about a 2" overhang on all three sides. Remove the sheet and carefully cut the mid-cabin line and rough cut the other three sides. Apply adhesive to all the members you will be fastening to, but only the forward half of the mid-cabin arch. (the aft half will have to land the rear portion of the roof.) Center the sheet and clamp the P&S sides to the **forward half only** of the mid-cabin arch. Starting in the middle of the mid-cabin arch, fasten the sheet to the arch alternating fasteners P&S side to side about every 8-10 inches. Going to the main bulkhead arch, start in the middle and fasten the sheet alternating P&S side to side. Fasten the sheet to the hatch frame, then to the cabin sides. Once the adhesive has cured, the hatch opening can be carefully cut out and the overhanging edges of the roof trimmed flush.

Returning to the sheet for the rear half of the cabin, center the sheet back on the roof and install one screw in the middle. Then screw the forward P&S corners down temporarily to check that the two sheets butt each other with no gap. Remove the sheet and trim as necessary for a snug fit. Apply adhesive to all mating surfaces and again center the sheet. Starting in the middle of the mid-cabin arch, work your way to the edges fastening the sheet alternating P&S side to side. Moving to the

stern of the cabin, starting in the middle, and moving alternately P&S, fasten the sheet to the aft-cabin arch, then – starting in the middle - fasten the sides. Now the P&S and stern roof overhang can be carefully trimmed flush with the surface it mates to. This cut can be either square or match the slope of the surface it's mated to.

## **MAIN HATCH**

The following is a detail drawing of the hatch slide looking at the forward end of the inboard side. The outboard side will be a mirror image of this view. The upper and lower pieces (brown & red) are the two half's of a ripped 2x4, and extended at least 15" aft of the hatch opening.



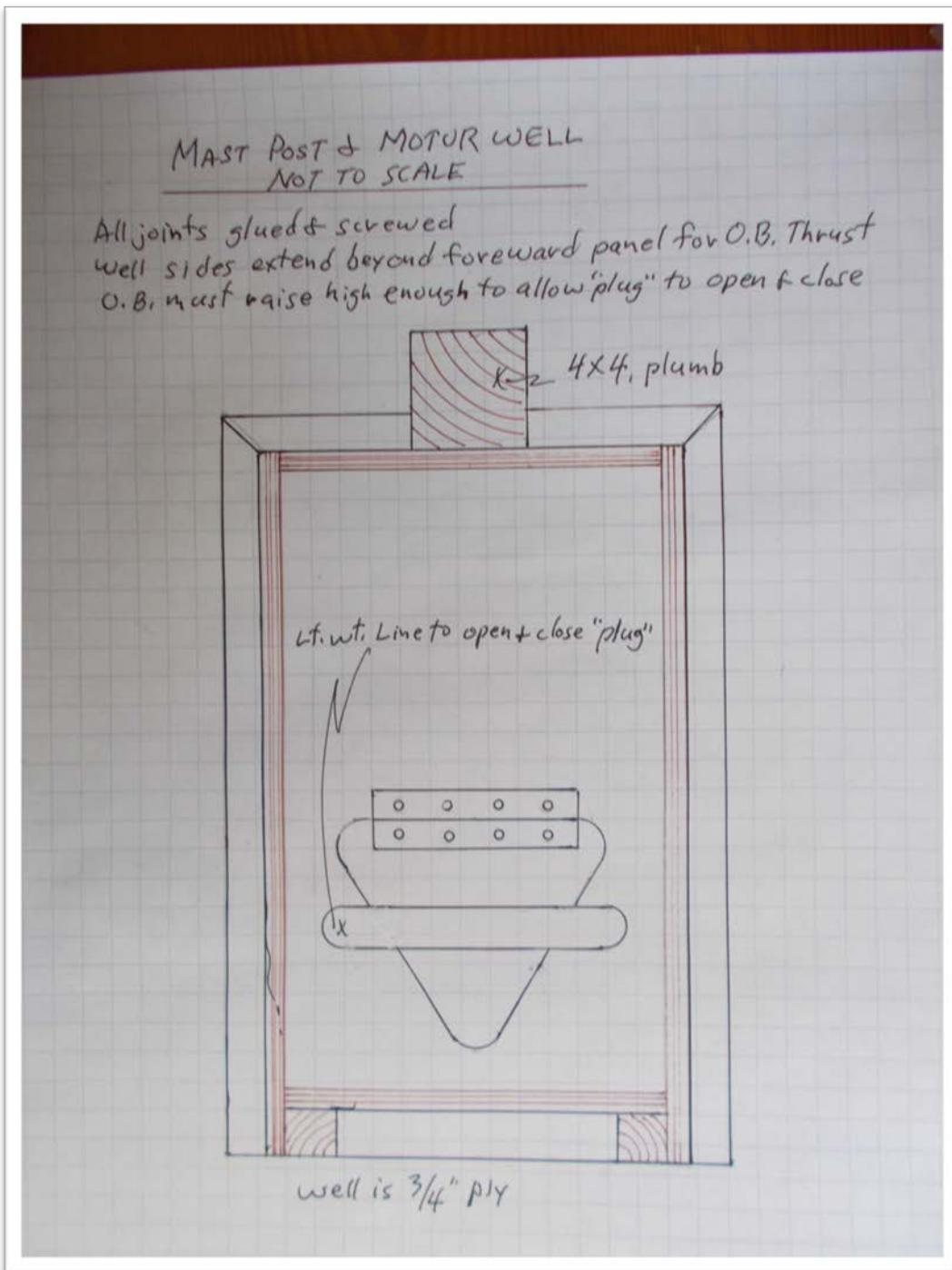
The metal component that is screwed on is a length of 1" by 1/8" aluminum strap (available at most hardware stores) that prevents the hatch from blowing off. While one could use this same interlocking configuration on the aft end of the hatch, I don't think it would be necessary except in the most extreme of weather conditions. The aft end of the hatch frame can just butt up against curbing installed between the hatch guides at the aft end of the hatch opening in the roof. Lubricate the aluminum and the slide surface. Teflon is expensive but when dry won't collect grime. Silicon lube or candle wax will work but will collect grime. Since the dimensions are tight, you may well have to try and fit a couple times to make sure it works freely. The hatch is then slid in place from the rear. With the hatched closed a face piece can be fitted on the forward end to close and cover the gap between the hatch and the companionway drop-boards. This piece will butt against the aft curb to prevent the hatch from being opened too far and coming out of its track. As you do this, consider installing an indoor/outdoor grab handle on the face piece and how you will install a hasp to lock the door/hatch.

## **WINCH MOUNT**

On the centerline of the cabin roof, mount a 2x4 underneath the cabin roof between the main bulkhead and the mid-cabin arch. This will be the backing plate for both the C.B. winch and a sheet winch if desired. (Always good to have a winch on board to retrieve a stubborn anchor, raise the mast etc. Remember that the lead to the winch must be below the base-plane of the winch to avoid an override that in extreme cases may require cutting the line.) On the centerline of the top of the cabin roof, mount a length of 2x4 that extends from aft of the mid cabin frame and projects one foot forward of the main bulkhead. Round the fore & aft ends slightly. Screw or lag into the cabin frames. Using 3/8" ss carriage bolts, inserted from the bottom (so you don't tear up your head) through-bolt to the two 2x4s together with at least 3 bolts. Using a ripped 2x4, or one-inch dowel, install a diagonal brace from underneath the protruding 2x4 winch mount to the point on the port side of the C.B. slot where the C.B. trunk joins the main bulkhead. Sand and round the rip cut slightly, then cut the lower end so that it is in contact with both the bulkhead and the CB trunk. The upper end of the brace should be as close to the forward end of the 2x4 as possible without interfering with the bolts that will mount the CB winch, and – of course – it cannot interfere with raising/lowering the CB. Drill 1/4" holes in each end of the brace so you don't split it, then fasten in place with 1/4" ss lag bolts.

## **OUTBOARD WELL & MAST POST-(4X4 treated decking)**

The mast post will be about 3&1/2 feet tall to clear the bow locker. Admittedly it would be handier if the mast could be lowered to the cabin top but the mast post would have to abt. 5 feet tall which is too high. The following is a drawing giving general construction details that will have to be adjusted to accommodate your motor and motor storing preference.

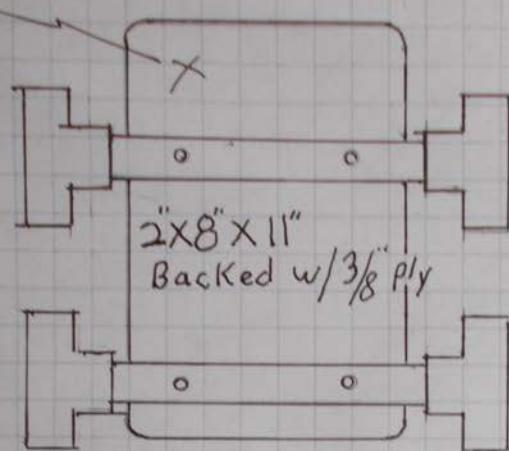


The Well is made from  $\frac{3}{4}$ " ply because it has to endure the thrust and vibration of the outboard. Framing is 1&1/2" treated decking ripped from 2X4's. Dimensions of the well and sliding motor mount will depend on your motor, so you need to have acquired your outboard motor or have complete specifications of its dimensions. The simplest setup for sailing would be to remove the motor from the well and hang it outside on the front of the well. But I would Recommend drawing a triangular outline to be cut out of the bottom of the hull to allow lowering the prop into the water, then temporarily installing SS continuous hinge or two smaller SS hinges, straddling the aft cut line before you cut. Then remove the hinge and complete the cut. Then by installing a cross piece on the upper surface of the "plug" and reinstalling the hinge(s,) the "plug" can be held in place by lowering the outboard down on top of it, thus reducing turbulence, improving performance and eliminating backwash into the well. (Highly recommended.) If you store the motor in this configuration in salt water, make sure the lower unit has a submerged zinc. Be sure you can raise the O.B. enough to open & close the "plug." Fix a light-weight line to the cross piece to open and close the "plug". If you don't want to relocate the motor and choose a fixed motor mount, meaning the lower unit drags in the water all the time, the lower unit will also require sacrificial zincks in salt water. Consider a sliding motor mount that will allow the motor to be lifted out of the water. Here's a sample you can make from 1" PVC pipe and 3/4" galv. pipe. Bolting each flange to the well with two thru- bolts will be adequate.

## SLIDING MOTOR MOTOR MOUNT

SLIDING O.B. MOTOR MOUNT 1/4" = 1 inch

Leave room for motor mount

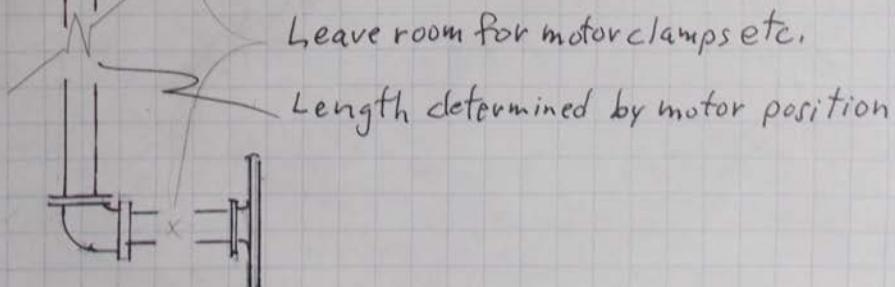


1" PVC Thru bolted To  
mounting pad. Fill cross  
pipes w/ 1" dowel

Assemble onto 3/4" Galv.  
pipe slides before attaching  
To mounting pad to  
assure alignment

All 3/4" Galv. steel

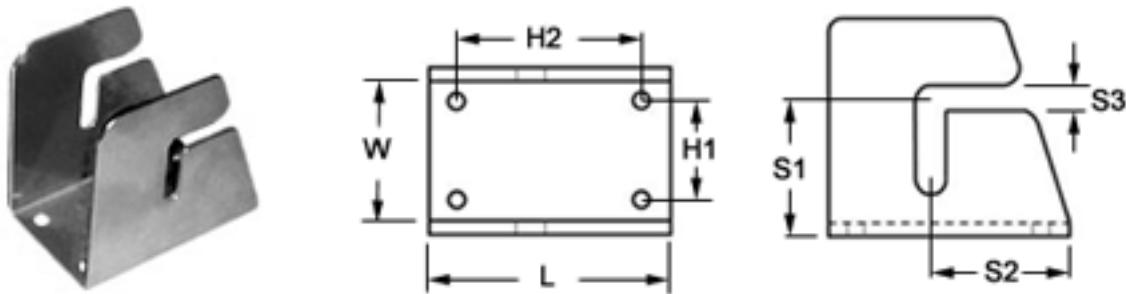
Pipe flanges thru bolted to well



An OB well 12" P&S and 14" fore and aft on the inside should accommodate most fixed mount outboards to 5 H.P. But if you are going to incorporate a movable motor mount you will need to extend the dimension to accommodate it. Use a long shaft outboard. The cavitation plate on the lower unit must be below the lower surface of the hull bottom. Build the well as a free-standing unit. Plane the well bottom to fit snugly all around the vessel bottom, then mark the hull floor all around the inside of the well. Set the well aside and scribe a triangle that will clear the prop & lower unit inside your marks with the apex forward and the base aft. Using a compass or round container, scribe in 2" radii in all three corners. If you are going to hinge a door in the bottom, cut the aft base of the triangle first and install a stainless continuous hinge or two smaller hinges over the straight portion of the cut line, then complete the cutout. Apply glue/sealant all around the base of the well, center it and butt it against the mast post outline (next page) and fasten in place. Use 1&1/2" ss screws to fasten from the bottom of the hull into the 2x2's outside the base of the well.

With the hull level fore & aft & P&S, the 4X4 mast step post is to be **six feet** from the forward face of the stem at its lowest point. You can measure this from inside the hull if you subtract the thickness of the stem, the backing plate and anything else that may be in your way. Determine the center of the hull and make a mark to indicate the center of the 4X4 mast support post. Now measure from that mark to the centerboard trunk and record that distance so you can double check the location of the mast step at installation.

The mast step must be plumb all around, locates the OB well and is an integral part of the OB well. Here's a link to a simple mast base from the Dwyer Mast Company



<https://www.dwyermast.com>

In order to lower the mast, the top of the mast support post must be high enough that the mast clears the highest obstacle (like the mooring bitt) on the bow locker, about 3'-6" above the cockpit floor. Plan on a removable mast yoke with pins that fit into stainless eye screws attached to the front face of the stem. A "V" block on the aft cabin roof would complete the support for trailering the mast. Trim the bottom of the mast post so that it is plumb and snug to the hull floor. Bed the post in sealant, then glue and screw it to the outboard well.

## **BOW LOCKER**

Find the fore & aft mid point of the bow locker by measuring from the front of the stem to the aft of the bow locker frame. Trace the 1&1/2" arc of the bow locker arch onto a length of 2x4 and cut it to shape. Centering the arc, cut it to fit athwart ship at the fore & aft mid point of the bow locker. To support the arch, fit 2x2 supports under it that run from the arch, attached to the hull sides, and down to the chine log. Glue and fasten in place. Using 2x4s ripped in two, frame in an 18" wide hatch opening centered between the mid and aft arches. Install ripped 2x4 supports under the BL-1 arch and its joint with the hatch frame, maintaining the same width as the deck opening on the upper end and tapered at the lower end per the drawing on page 25. Attach support blocks to the two interior sides of these vertical pieces to support a horizontal sill between these two vertical members 12" above the hull floor. Carefully cut out the mid section of the BL-1 arch between the fore & aft hatch members. As always, use Simpson ties to reinforce the joints where necessary. To keep rain from entering the hatch, using 1x3 material, glue and fasten curbing on the inner surface of the deck hatch opening that extends 1&1/2" above the hatch frame, and 3/8" into the cockpit to be flush with the finished aft wall of the locker. Seal all the joints. I would hinge the hatch lid on its port side so it can be opened to allow headsail changes, anchoring etc., without fear of losing it.

## **MOORING BITT (4X4 treated decking)**

The mooring bitt is a 4x4 that should extend about 5" above the bow sprit, (mounted on top of the finished deck) which should make it about 43" in length. Round all the corners of the upper 5" to a 3/4" radius (including the top) to reduce binding and chafe. Measure down 1&1/2" from the upper end and center a 3/4" hole through the 4x4.

Place the 4x4 upright, centered and plumb, on the forward side of the mid-locker frame with the thru-hole athwart ship. (There should be a minimum of 1&1/2" space between the mooring bitt and the 1x3 curbing around the inside of the hatch to leave room for the hatch lid.) Trim the lower end flush with the hull floor if necessary. Using two 3/8" by 5" ss lag bolts, or one 3/8" thru bolt, fasten the 4x4 through the mid-locker frame. Install 2x2 curbing all around the base of the 4x4.

### **BOW SPRIT BACKING PLATE**

Using the ruminant from the BL-1 arch that was cut out, trace the arc on a piece of cereal-box cardboard or equivalent. Cut out the arc and centering it on the aft side of the stem, use it as a template to shape the upper end of the stem from hull side to hull side. Using a length of 2x6 long enough to extend from the hatch frame to the stem, cut it to butt against the bow locker hatch frame, straddling the mooring bitt (to land the decking) and butting against the stem on the forward end. Plane the outer edges of the 2x6 to conform to the deck arc, it won't take much. The 2x6 deck beam will fork the mooring bitt and run from the hatch frame to the stem. Glue and fasten support blocks on the fore & aft sides of the mooring bitt and the aft side of the stem to support the 2x6 deck beam flush with the arch of both the stem and the bow locker hatch. Glue and fasten the deck beam in place. To secure the deck to the sides of the hull, rip stringers that will be glued and fastened to the sheer then planed to match the arch of the deck. If necessary, cut kerfs in the stringers so they can be bent to match the curvature of the hull

### **BOW LOCKER DECK**

The bow locker deck can be applied in either one piece or three pieces. Because of the precision required to do it all in one piece, three pieces should be easier, but will leave a seam on the transverse forward locker frame that will have to be carefully waterproofed.

Description for three piece decking: Using a piece of 3/8" ply large enough to cover the forward half of the bow locker, butt it against the mooring bitt. Mark the width of the bitt on the ply and measure the depth of cut needed to butt against the forward side of the locker curb, but only on the forward half of the remaining transverse deck beam. Allowing an inch or more overlap, roughly trace the outline where the decking meets the hull sides. Cut the ply to shape. Apply adhesive to the

upper surfaces of the backing plate, hull stringers and the forward half of the transverse locker beam, slide the ply into place. First, fasten the ply to the 2x6 backing plate, then fasten from the bitt to the hull sides and on to the bow. The remaining P&S 3/8" deck pieces are butted against the forward decking and the hatch curbing and cut to extend 3/8" beyond the aft locker frame so as to overlap the 3/8" aft sides of the locker. Trim off the overhang on the hull sides. Complete the enclosure of the bow locker by gluing and fastening 3/8" ply to the aft vertical surfaces of the locker. After the deck is in place, sand/file or turn a 3/16th" bevel on both ends of a 6" length of 3/4" aluminum bar, apply adhesive to the 3" center section and drive it through the 4x4 with a rubber mallet or wood block so as not to deform the equally protruding ends.

The simplest companionway door is a 1/2" ply "drop board" that fits into slots cut into 1&1/2" material secured to the P&S sides of the doorway. It should overlap the locker siding P&S and lower end such that rain/spray can't enter. A 6" length of 1x1 attached to the inside, top center makes a handy grip to remove the board.

Unless you opt for a free standing hatch cover, it will have to be hinged on one of the three sides with decking. The forward side probably has enough backing to accept hinges, but the mooring bitt will interfere with opening the hatch more than vertical. Furthermore, with the hatch vertical, access to the jib tack and ground tackle are substantially restricted. If necessary to accept hinge fasteners, install additional backing under the deck. In any event make sure that the hatch extends far enough to prevent rain/spray from entering the joint between the companionway door and the locker. The perimeter of the hatch will need 3/4" material edge glued/fastened and sized to slip over the hatch curbing and meet the curve of the deck.

### **BOWSPRIT** (2X6 treated decking)

The bowsprit and deck **must** be completely finished (painted) before the bowsprit is installed. Using the remaining portion of the 2x6, the bowsprit should extend a minimum of two feet beyond the bow to leave it long enough to mount a combination navigation light in front of any fittings. It can always be shortened later if desired. When the time comes to install the nav light, run the wire through 1/2"pvc underneath the sprit and through the stem and secure with clamps. The portion of the sprit extending beyond the stem can be tapered to 3" wide and fully rounded at its forward end. The corners on the aft end of the bowsprit should be cut

to 1&1/2" radii and all the upper edges of the sprit routed to a 3/4" radius. Center the aft end of the bow spirit far enough forward of the mooring bit so as not to interfere with anchor rode or dock lines etc. Starting as near the inboard side of the stem as practical, fasten the sprit to the deck with a temporary screw. Moving to the aft end, center the sprit and attach another temp screw where you will install a thru bolt. Half-way between these two screws, drill a thru hole for a 3/8" stainless eyebolt. To stop water from leaking around the eyebolt, first slip a 3/8" ss flat washer on it followed by a ss fender washer, followed by a neoprene washer, or one cut from an inner tube or similar material. The hole in the tube/neoprene should fit snugly around the body of the bolt to stop moisture. Insert the bolt (no nut) to keep the sprit in place while you remove and replace the temp screws one at a time with additional 3/8" ss eyebolts and washers. Remove the sprit from the deck and fit neoprene or tube washers to the bolts on the underside of the sprit. Replace the sprit and install the same washer combinations on the bottom ends as used on the eye end and tighten the nuts with the bolt eyes aligned with the long dimension fore and aft and the unconnected end of the eye facing forward (for greatest strength.) Thoroughly caulk the sprit/deck joint to prevent water getting under the sprit.

Assuming that the bow spirit has been painted, cut two pieces of 1/8" X 1&1/2" SS bar, 2&1/2" long. (Aluminum can be substituted) Stack the two pieces together and drill two 3/8" holes, centered and 1&1/2" apart, equally spaced from the ends. Using one as a template, center it on the forward end of the bow spirit, leaving room forward of it for the navigation light. Drill through one of the holes and insert a 3/8" ss eyebolt (no nut) to hold it in place while you drill through the second hole. One of the ss plates will go on top of the sprit, the other underneath but **both** will have to bedded or fitted with a neoprene gasket. The forestay will attach to the forward eyebolt, the aft eyebolt will accept the bobstay that connects to a 3/8" ss eyebolt 4" above the waterline at the lower end of the stem. A 3/16" galvanized shackle and chain tensioned by a 3/8" galvanized turnbuckle at the upper end (so it can be easily removed for trailing) should be adequate. The eyebolts connecting the plates to the sprit should be fitted with the same flat washer/fender washer/neoprene washer combinations used on the sprit.

## **CHAIN PLATES**

Using the 1&1/2" x 1/8" SS bar, cut two pieces 8" long. Center a 3/8" hole 1/2" from one end and round that end with a full radius. This will accept the turnbuckle that tensions the 1/8" shroud to the masthead. Measuring from the opposite end, center 1/4" holes at, 1/2", 2&3/4" and 5". Centering the plates on the frame that supports the main bulkhead, position the plates to extend 2" above the P&S hull sides. Using a 1/4" bitt, drill through the hull and frame support and insert a 1/4" ss bolt to hold the plate into position while you drill the other two holes. Remove the plates and either bed them or fit the bolts with neoprene washers or a gasket between the plate and the hull, and reinstall using fender washer/flat washers combinations under the nylock nuts on the interior frame side.

## **MAST**

The mast extends approximately 21' above the cockpit sole. The mast step will be approximately 3&1/2' above the sole, (so it can be let down over the bow without hitting the mooring bitt) netting a mast length of approximately 17&1/2'. The boom should be aprox. 8&1/2' long and mounted high enough on the mast to clear one's head while seated,(!) as well as the C.B. winch. There are a number of on-line sites that sell used aluminum masts and booms. The mast is supported by P&S masthead shrouds fitted with 3/16" SS turnbuckles on the lower ends to allow the mast to be plumbed and shrouds tensioned. A masthead forestay that runs to the foremost eyebolt on the upper side of the bowsprit is also fitted with a 3/16" SS turnbuckle to tension the forestay.

## **SHEETING TACKLE**

As a rule of thumb, working jibs should not be sheeted closer than 8 degrees off the centerline of the hull and Genoas, not closer than 10 degrees measured from the tack of the respective sails. I prefer to have the jib tack a couple feet above the deck so I can see under them, a collision at sea can spoil your whole day! Also as a starting point, place a piece of electrical tape 40% up the luff of the jib. Hoist the sail and project a line from that point down thru the clue to determine where to place the jib sheet block. This point will change with sailing experience and with each sail, so it would be advantageous to install a track that allows you to move the sheet block fore and aft to get the proper sail trim. Failing that, I have been known to use a length of 1/4" or 5/16<sup>th</sup> Dacron line with loops tied into it every 6", anchored at both ends such that I could clip in the sheet block shackle. Install P&S

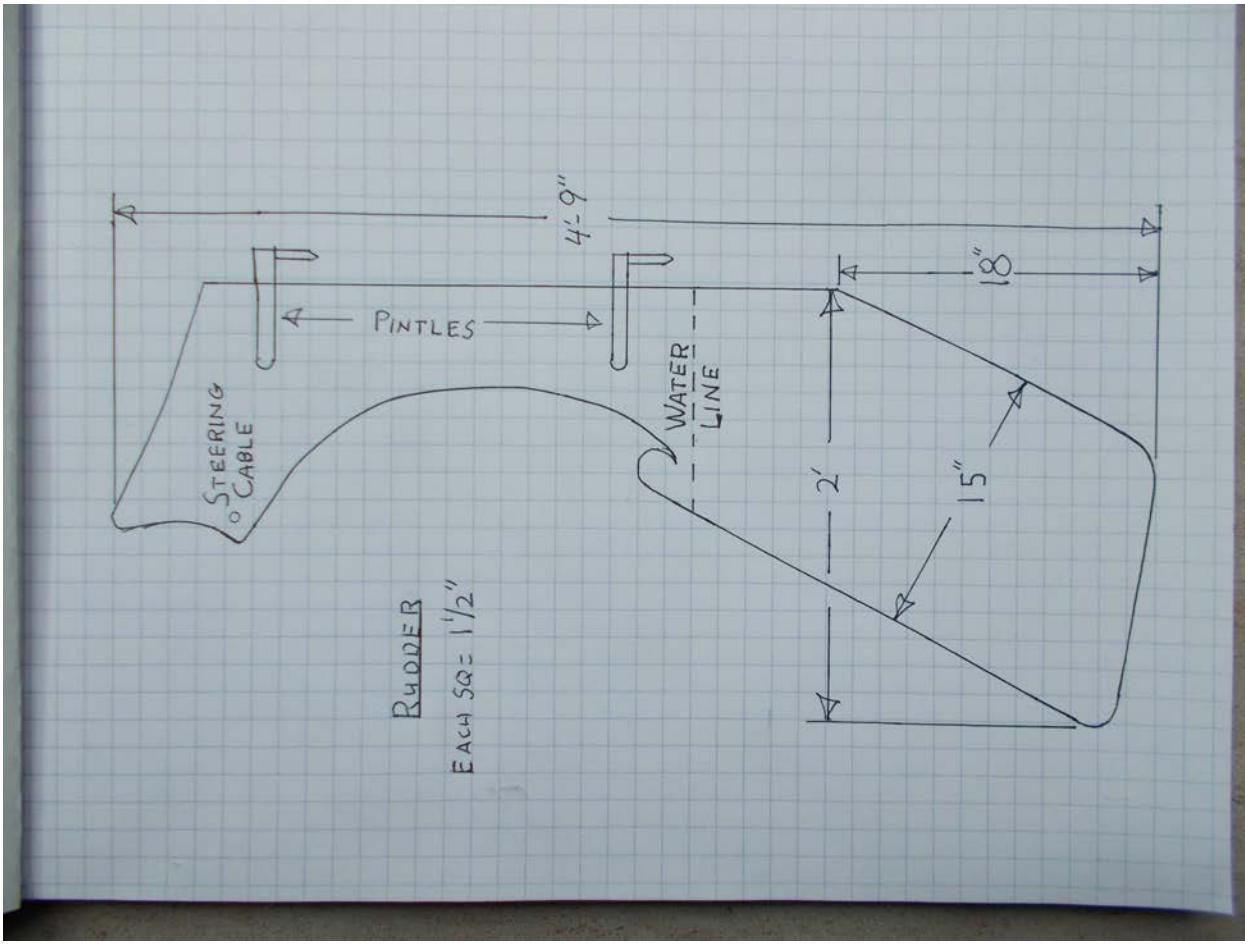
quick release type cleats in locations that are easy to access so you can release the sheet quickly if necessary.

## **MAIN SHEET TRAVELER**

The main sheet traveler is installed on the cabin roof at the mid-cabin frame. You can buy a traveler track if you prefer, but it will have to be on a bridge to span the main hatch slide. It can be as simple as a couple of  $\frac{1}{4}$ " eye bolts two feet either side of the centerline. Thread a block onto a 7' length of  $\frac{5}{16}$ " or  $\frac{3}{8}$ " line and thread the ends through the eye bolts. Secure the line with figure-eight stop knots, leaving approximately two feet free on one end so that you can adjust the tension if needed. Install a boom hoop (you can bend one out of aluminum strap) on the boom directly above the mid-cabin frame. The main sheet will require a two-part block and tackle. Attach a double block with becket to this hoop and a second double block to the single block on the traveler line. Attach the main sheet to the becket and lead it through one of the blocks on the traveler, then back up to a boom block, then back down to the second traveler block, then back up to the second boom block such that the lead comes out running forward. Install P&S quick release cleats on the front corners of the cabin roof to accept the main sheet. Leading the mainsheet from the boom to the cleat will act like a boom vang to some extent, preventing the boom from lifting excessively when sailing downwind.

## **RUDDER**

The Rudder is cut from quality one inch ply per the following diagram. The rudder is hung such that the upper forward corner is even with the joint between the transom and the cabin. The pintles are located to hang on to the gudgeons that are bolted thru the transom and interior backing plates. (Each square below = 1 &  $\frac{1}{2}$ ")



That's about a wrap! However I'd consider capping the raw edges of the hull sides in the cockpit. A durable and 'quick and dirty' method would be to split one side only of  $\frac{3}{4}$ " vinyl tubing, lay a small dollop of Lexel (little else will stick to vinyl) on the inside of the tubing every 4-6 inches and force the split tubing over the raw edge using a little heat from a hair drier if necessary. Fasten from the side or upper surface with #6 or #8 ss screws depending which seems to work best. You may have to cut out the tubing for the butt joint plate.

Screw a couple SS eye screws into the forward face of the stem to accept pintels or similar fitting to accept a yoke to support the mast while trailering. A wood 'V' block on the cabin roof should support the trailing end.

