

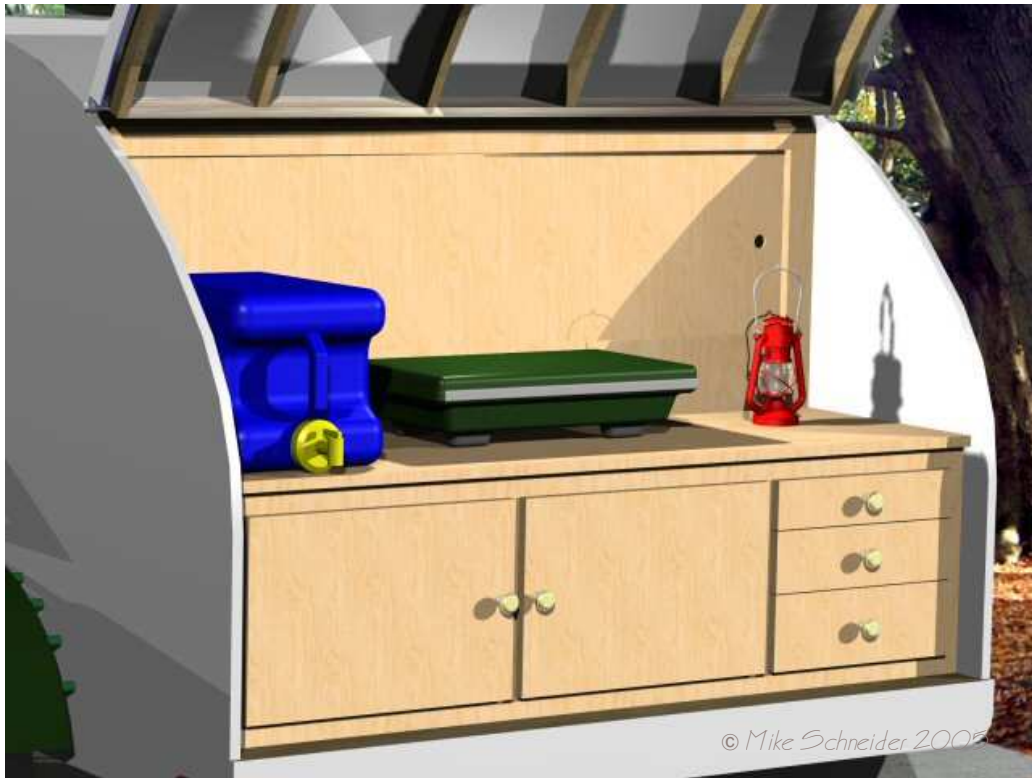
Generic Benroy Plans



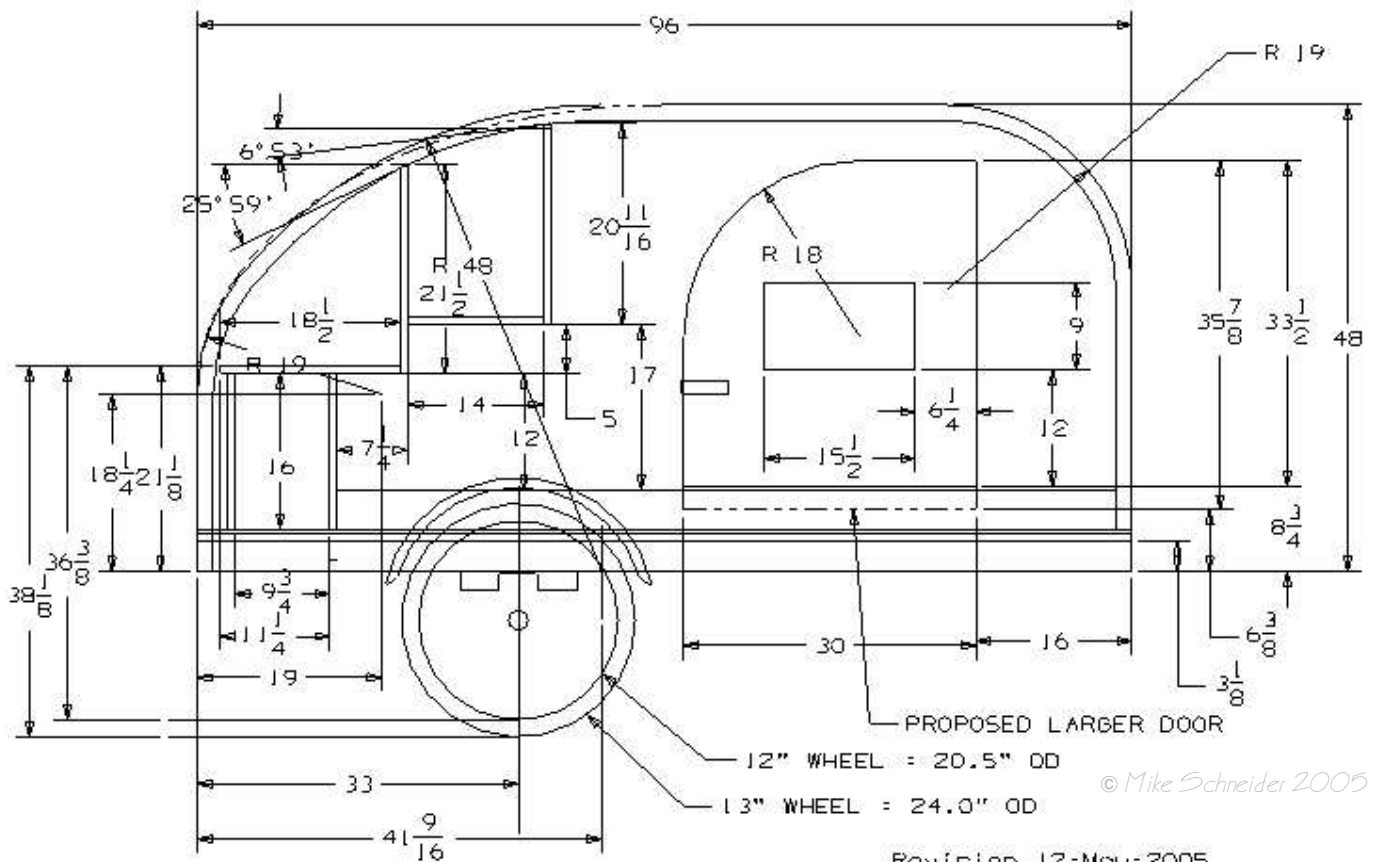








NEW PROPOSED GENERIC BENROY PROFILE



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Revision 12-May-2005
 Walls cover 3 1/8" siderails

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Step 1: Planning the design.

The plan is to come up with a design that anyone with a reasonable amount of skill and a reasonable amount of tools can build.

After conducting a poll of users here, it seems the two most popular profiles are the Benroy and the Kenskill. While the Benroy profile seems to fit well behind Jeep Wranglers and other sporty vehicles, the Kenskill seems to fit better behind a more vintage looking vehicle.

So let's review all the options before we make a final decision... Here's what the teardrop should have...

A 48" height. 48" is a common size at all the orange box type stores

A length long enough for a true queen sized bed... 80"

A width comfortable enough to sleep in, including rolling over without rolling over your partner. As a minimum I would like to suggest a queen sized bed 60" wide.

A robust trailer design that is easy to procure, whether you are a welder or not. A 5x8 bolt together red trailer seems to fit that category.

A door that is easy to make and use. Easy to trim, whether it's a woodie or a clad/skinned design. (The door center should be about 40" from the head of the mattress to the center of your body when you sit up and swing your legs over the side of the mattress.

A door that is tall enough to not hit your head on it when climbing in or out.

A cabin that gives you adequate storage without making you feel claustrophobic.

A generic design that lets you adjust the profile from Kenskill to Benroy to your own custom design, and still use the same basic directions.

A choice of skinning... either aluminum, filon, paint or varnish.

A galley design that doesn't bruise your shins... per Amy

A basic galley that consists of stove, and fridge/icebox or cooler and storage. (We couldn't fit the ice box in the 8' long design.)

A tongue that lets you have a propane tank and a battery.

A roof vent to keep you cool

An easily accessible raceway for electrical wiring

Easily obtainable parts

A shoreline connection for campground campers

A solar panel for rustic campers

Gas struts to make it easy to open the hatch

A total dry weight of less than 1000# which allows almost any car to tow it.

A tongue weight of less than 150# which most car hitches can handle

The basic teardrop should be affordable... (it's the options that add cost)

Here's what we are ruling out right from the get go...

4' trailers... A 4' teardrop, which seems to be a bargain, is not bargain if you find it's too small for you. Who wants to sell it and start over again? Not me.

A crappy looking design. No one wants to be seen with something that looks crappy. We want classic and classy designs only, something you'll be proud to be seen in. While there are many classy designs, we will only focus on one or two of them.

Step 2: Build your chassis 5x8 red trailer

The 5x8 red trailer design has been modified for use with the Generic Benroy.
(Thanks to Tom Swenson for letting me use his photos and the information on modifying his trailer.
<http://www.tomswenson.com/teardrop>)

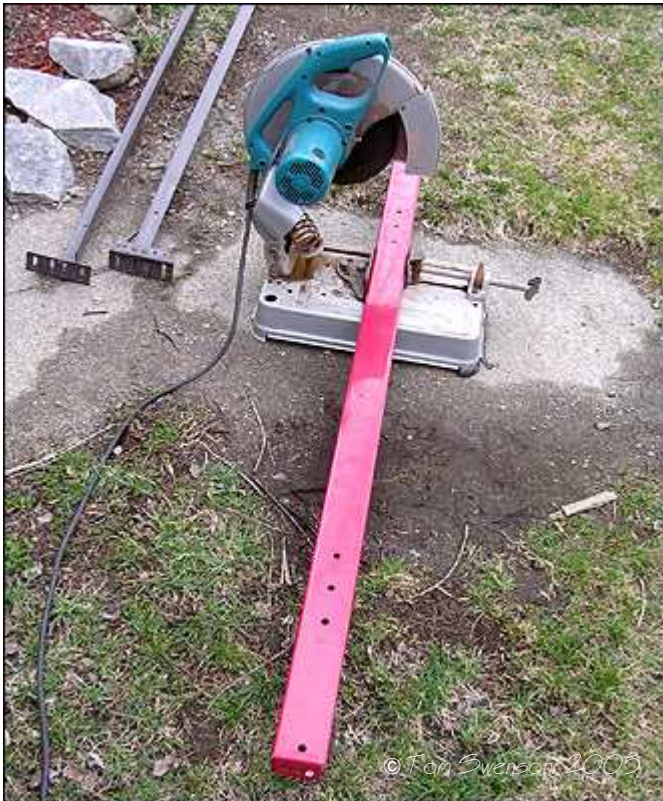
The first modification is to change the width of the trailer from 60" to 58". This will allow the side walls to hang over the frame, thus hiding the frame.

The second modification is to notch the frame and mount the axle above the springs instead of under the springs. This allows the trailer to sit lower, albeit not quite as low as the original. For that you would need a torsion axle, with adjustable arms.

And finally, do not install the fenders or any of the electrical components

The trailer will be assembled as per the directions that came with it, except for the following.

Using a metal chop saw, cut each of the (4) cross members exactly 2" shorter. Drill new holes in the end, of each cross member.



Instead of being fitted in their intended place, the two cross members from the centre of the trailer are fitted longitudinally, inside the main side rails. One inside each siderail. This converts the folding trailer into a rigid trailer.

Install a pine cross member in place of the channel cross members.



Cut off **1.4"** from the **45°** tongue members. Drill new holes on the trimmed ends.



Notch out the angle iron **spring mount** to give the axle travel clearance.



Tom found that the spring hanger was interfering with a bolt that secured a cross member. The fix was to notch out the spring hanger in the area of the bolt.



Finish assembling per the directions.

There are a number of ways to add stabilizer jacks to a trailer. Tom welded a piece of angle across the width of the frame, and welded the stabilizers to that.

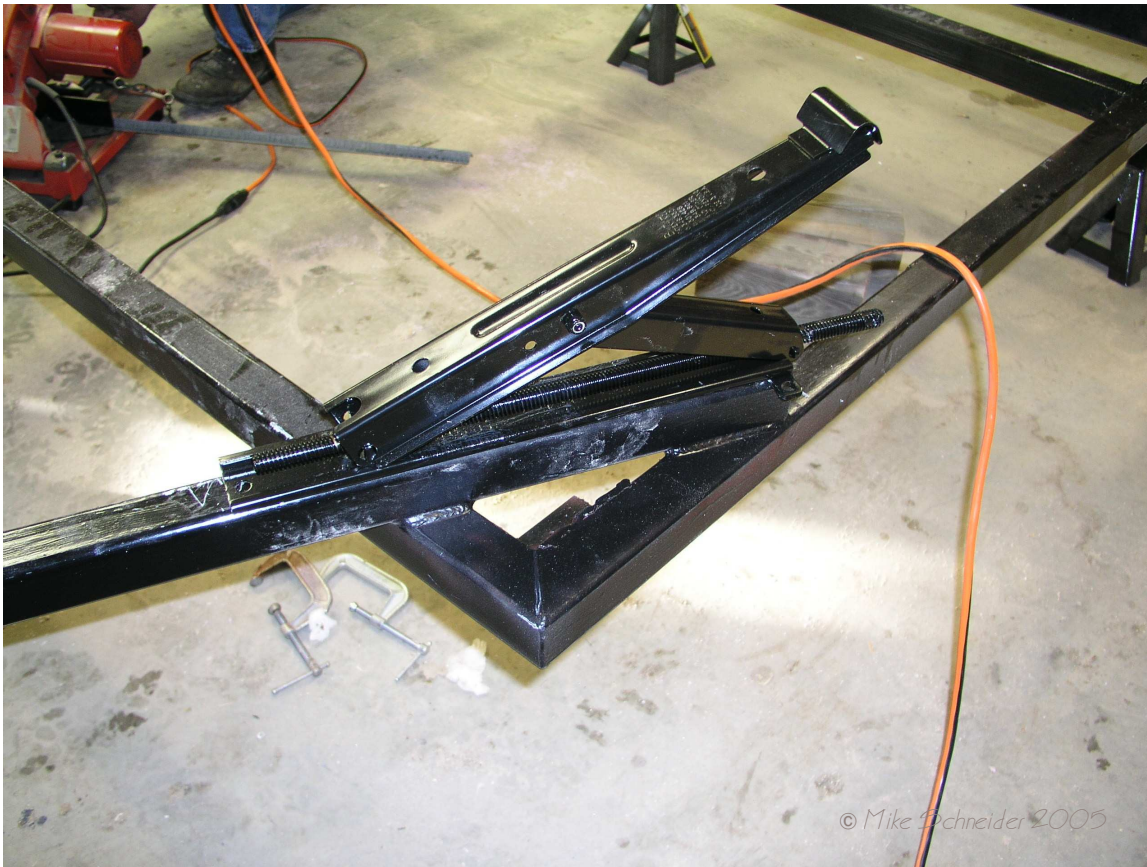




I welded on little tabs, and bolted my stabilizers to that...



The front stabilizers went under the tongue.



The rear stabilizers went on the rear cross member.



In retrospect, I think only rear levelers are needed. I really like the way Tom did his!

This would also be a good time to prime the wood and paint the trailer.

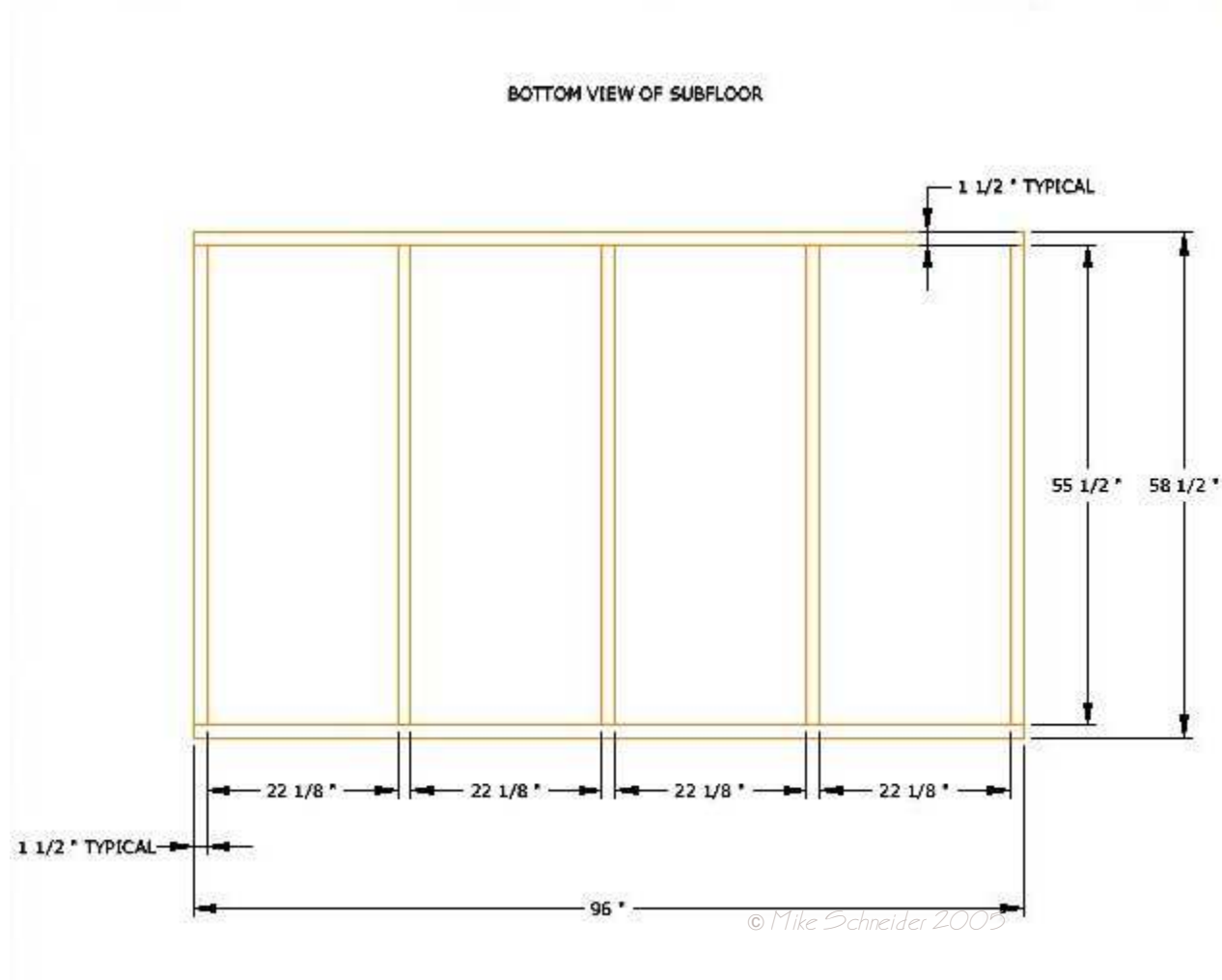


Step 3: Build your floor 1/2" fir plywood

The floor is built from 2 sheets of 5'x5'x1/2" Baltic birch., and xx 1x2s. Cut both sheets of Baltic birch to 48" x 58 1/2". Place the two sheets together on a flat surface, so that you end up with a rectangle 96"x58 1/2". (The trailer is 58" x 96". The floor should hang over the trailer by about 1/4" on each side.

Using Gorilla glue /polyurethane glue, and 1 1/4" stainless steel screws, glue and screw the first 8' long piece of 1x2 to the long edge of the floor.

Glue and screw the (5) 55 1/2" subfloor studs to the plywood as shown in the drawing below.



Glue and screw the last 8' long piece of 1x2. Let the glue dry overnight.

The floor can be uninsulated for 3 seasons camping, or insulated for 4 seasons camping. If you decide to insulate, cut the 3/4" extruded polystyrene on the table saw to fit into the floor recesses. Have all 4 pieces prepared before coating the floor with roof tar.

Use roof tar to coat the underside of the floor, making sure not to get any tar on the sides where the walls will be attached.

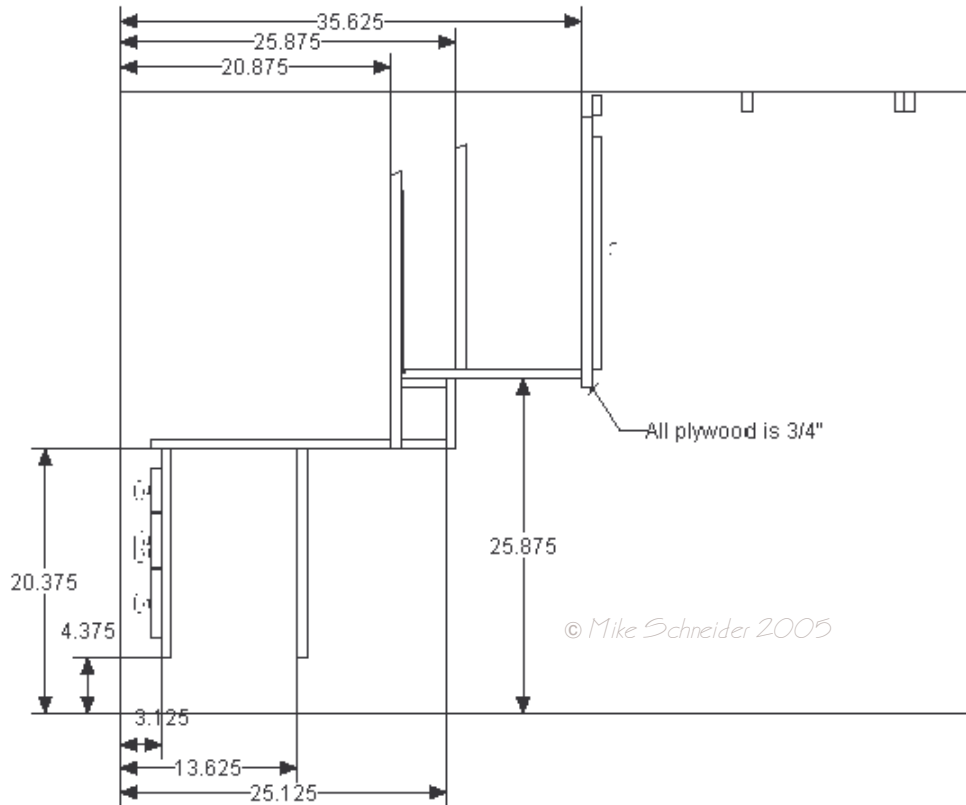
Press the EPS into the wet tar and screw the EPS into the recesses with 1 1/4" stainless steel panhead screws and fender washers. Use about 12 screws per panel. Let dry. Drying could take several days or more, depending on the temperature.

The stainless steel hardware is used because it has a fine thread and a controlled length, to help prevent you from breaking thru the floor. (If you break thru the floor, remove that screw, grind off the tip, and screw it back in.)

Bolt the floor to the trailer with 3/8" bolts, (5) bolts per side. Use flat washers and nylock nuts.

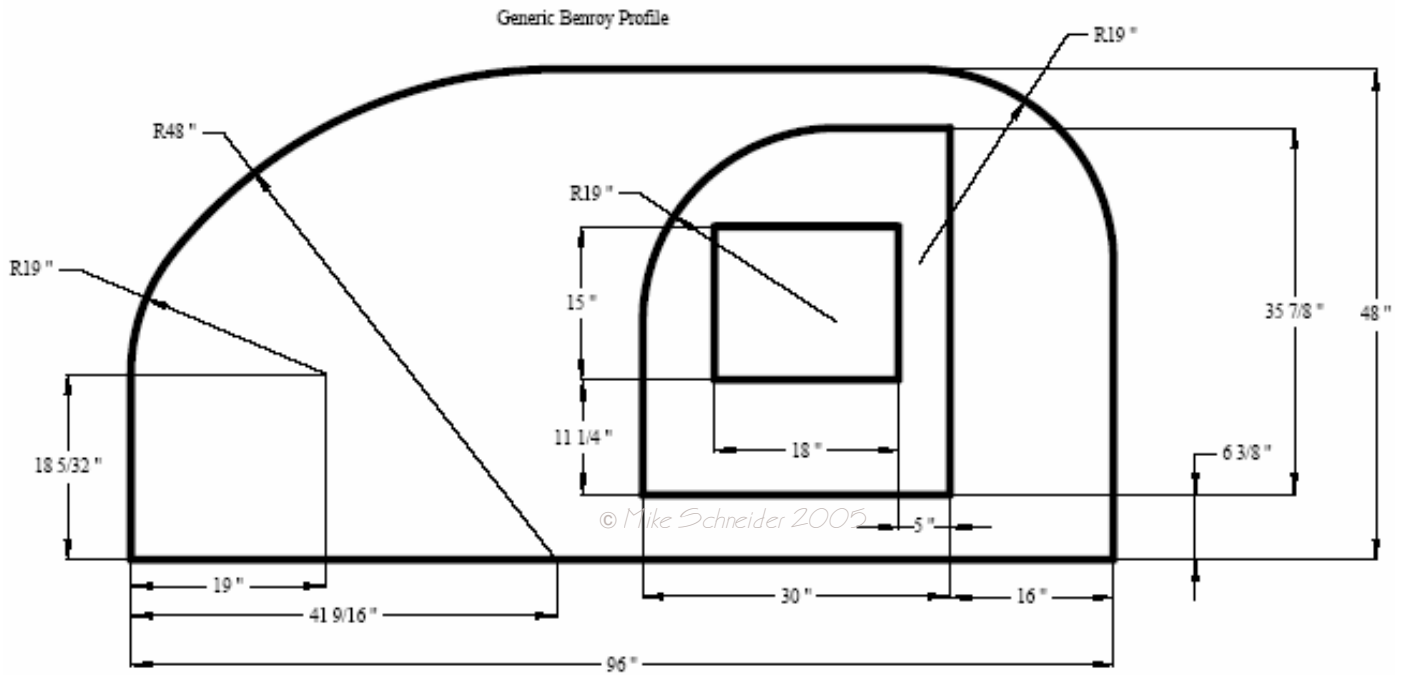
Step 4: Cut out the walls

The walls are 4'x8'x 3/4" Birch plywood. The good surface will be the inside of the teardrop.
Layout the position of the bulkheads and cabinets on both inside walls, using a 4' t-square. Refer to the drawing below...



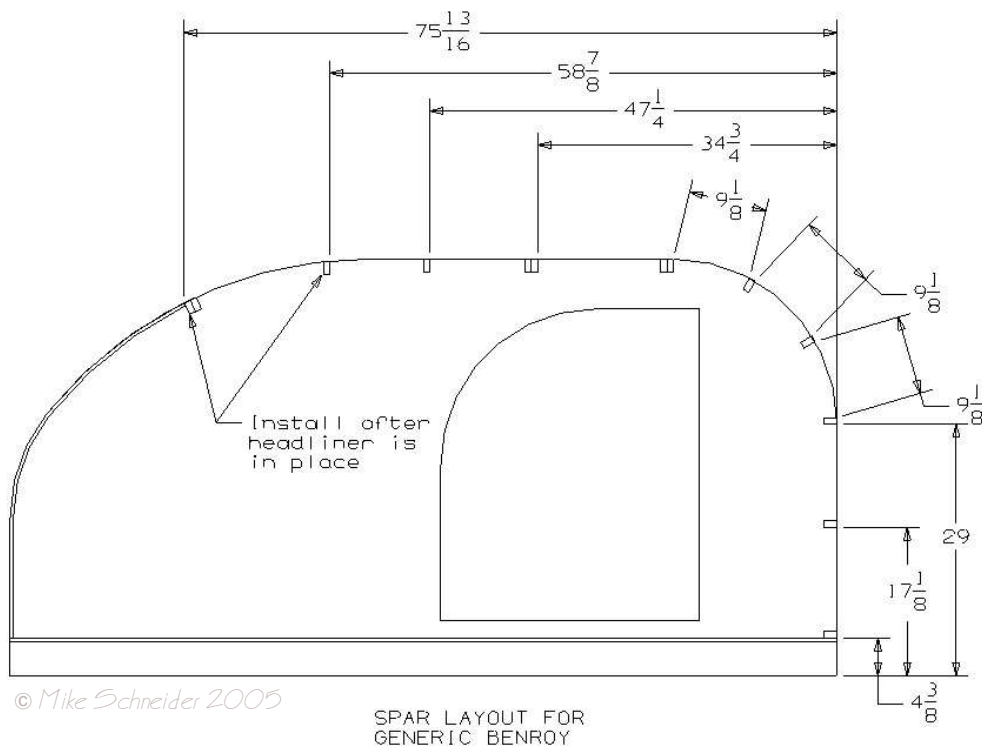
Step4fig1

Then place the first sheet of plywood, good side down, and layout the Benroy profile using 2 homemade beam compasses. A beam compass is just a length of wood with a nail in one end, and a hole for a pencil in the other end. The short compass will have a 19" radius, and the long compass will have a 48" radius. At this time you'll also want to layout the door, and the window.



Step4fig3

Next, layout the positions of the spars.



Step4fig2

Using a jigsaw, cut out the profile and the doors Use a belt sander to sand the profile and the door openings smooth.

Now let's layout the other wall. Remove the first wall. Set the second piece of plywood good face down on the saw bench. Layout the door and window. Now place the first wall on top of the plywood, good side up. Using this as a template to trace the wall profile on the plywood. Remove the template and cut the profile and the door opening. Use a belt sander to sand the profile and door openings smooth

Tip: Initially the plan was to cut both pieces of plywood at the same time. But when I tried that using $\frac{3}{4}$ " plywood, the blade angled, making the underneath piece quite a bit smaller than the top piece. So even though it sounds like more work, you'll end up with a better quality teardrop if you cut each piece separately!

Drill and countersink holes **xxx"** from the bottom edge of the wall, every 8" as shown on the drawing. (The countersink should be on the outside of the wall.) The **xxx"** should be equal to the height of the trailer side rail, plus $\frac{3}{8}$ ".

Drill and countersink a hole at one of the spar locations towards the center of the wall. Drill and countersink a hole at the final spar location where the hatch will start. These will be used for temporary spars in the next step.

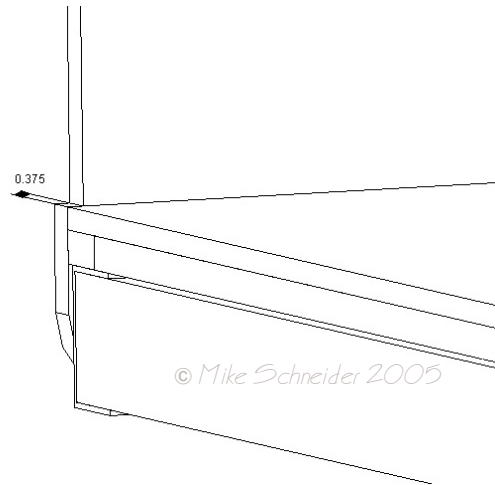
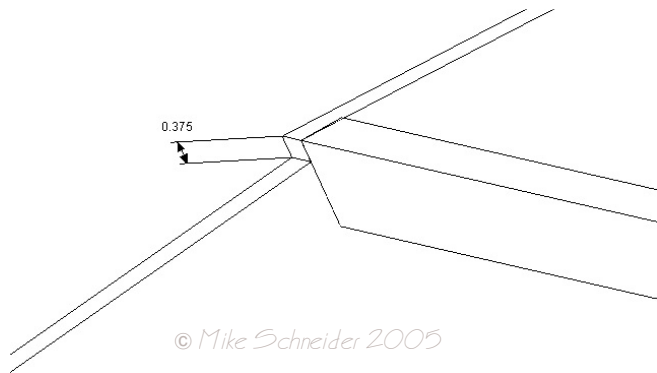
Step 5: Dryfit the walls.

Cut two temporary spars. These are 1x2 pieces of pine, 58 1/2" long. Cut this using a miter saw. You want your spars to be as square and perpendicular as possible.

Position the walls so that the bottom of the wall is flush with the bottom edge of the trailer. A partner would be helpful for this step. The back edge of the wall should be flush with the back edge of the trailer. It might helpful to use a piece of scrap wood as a straight edge against the bottom edge of the frame and wall. Once you've got the wall positioned, install a 1 5/8" drywall screw at each end of the sidewall. Repeat for the other wall. Then, quickly install your temporary spars putting in a 1 5/8" drywall screw in each end. One spar should be in the middle on the teardrop, near the ceiling vent. The other should be positioned where the hatch starts. Grab a framing square and check to see if your walls are perpendicular to the floor.



The sidewalls now need a notch for the hatch. This is a 3/8" offset cut all the way from the poplar spar to the floor. Use a marking tool or a t-square set at 3/8". Strike a line offset from the outside profile of the teardrop 3/8", from the spar to the floor. Also mark the floor and spar locations on the sidewall in the offset area.



Disassemble everything.

With your walls back on the saw horses, cut out the 3/8" notch with a jig saw. Save the cutouts, you will be using it as a template to make your hatch. Sand the notch smooth with a belt sander.

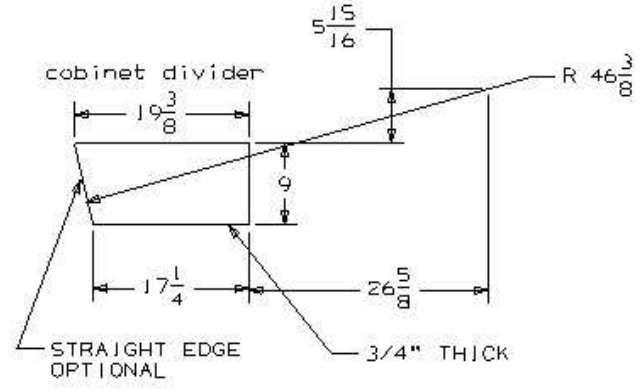
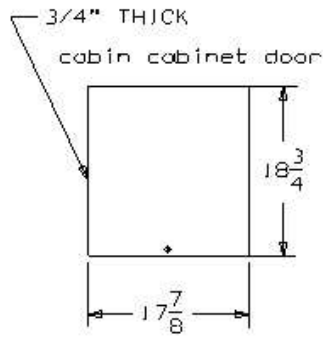
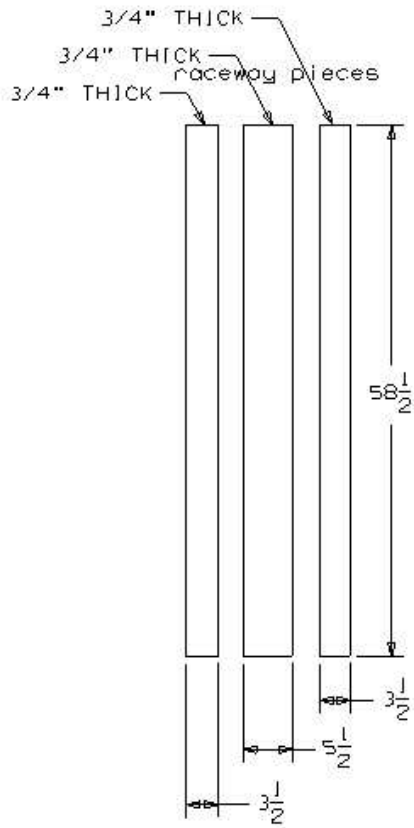
Tip: *If you forget to cut the notch at this point, you can cut it after the walls are installed. But it is so much easier while laying on the bench!*

Put roofing tar on the bottom edge, and on the inside edge of the wall that will be facing the frame. You'll only do about the first 2". Do not coat the part of the wall that will be receiving the glue.

Step 6: Build your interior cabinets – basic cabinets

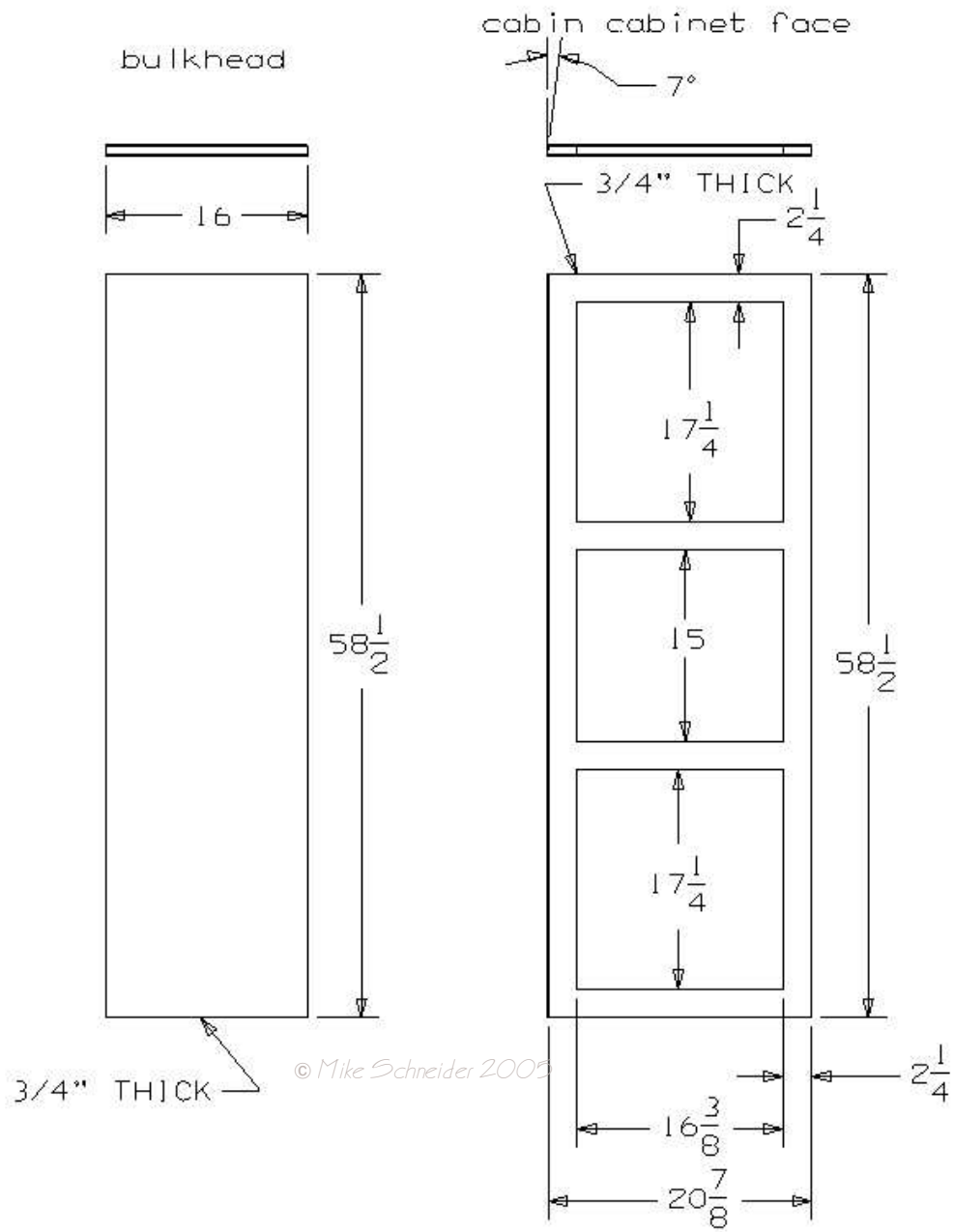


The cabinets are all built from good grade $\frac{3}{4}$ " plywood. You could use birch, cherry, oak, or any other flavor that you like. Cut out your pieces based on these drawings...



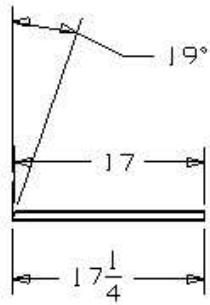
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Step6fig2

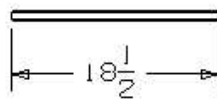


Step 6 fig 3

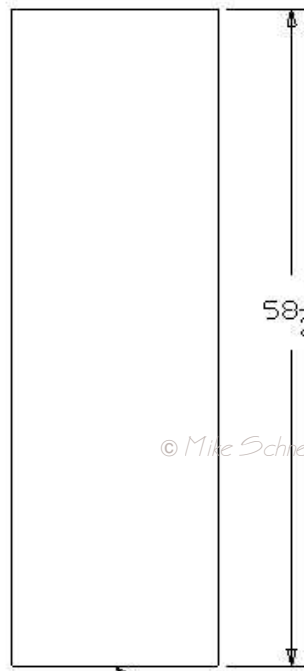
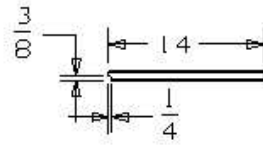
Middle partition



counter



cabinet bottom



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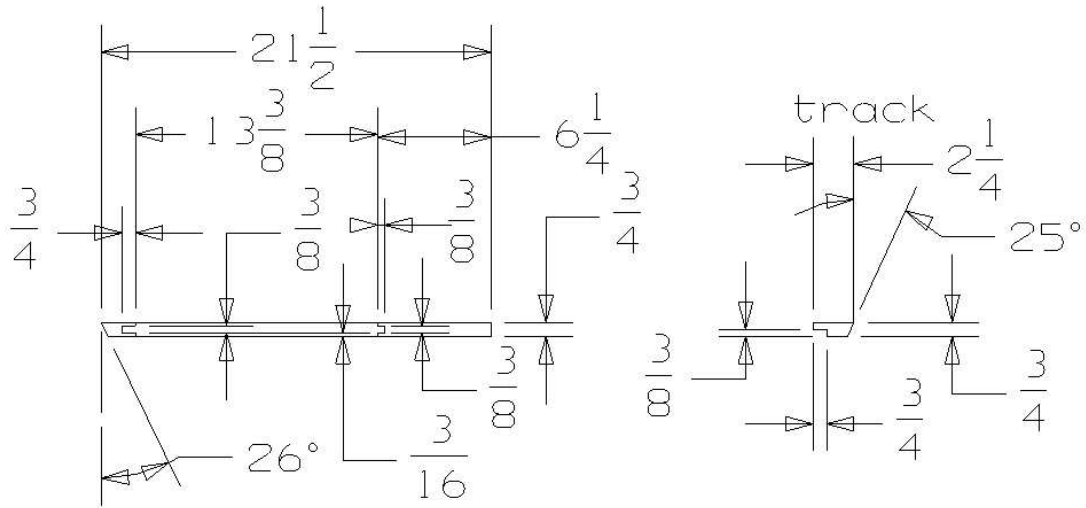
3/4" THICK

3/4" THICK

3/4" THICK

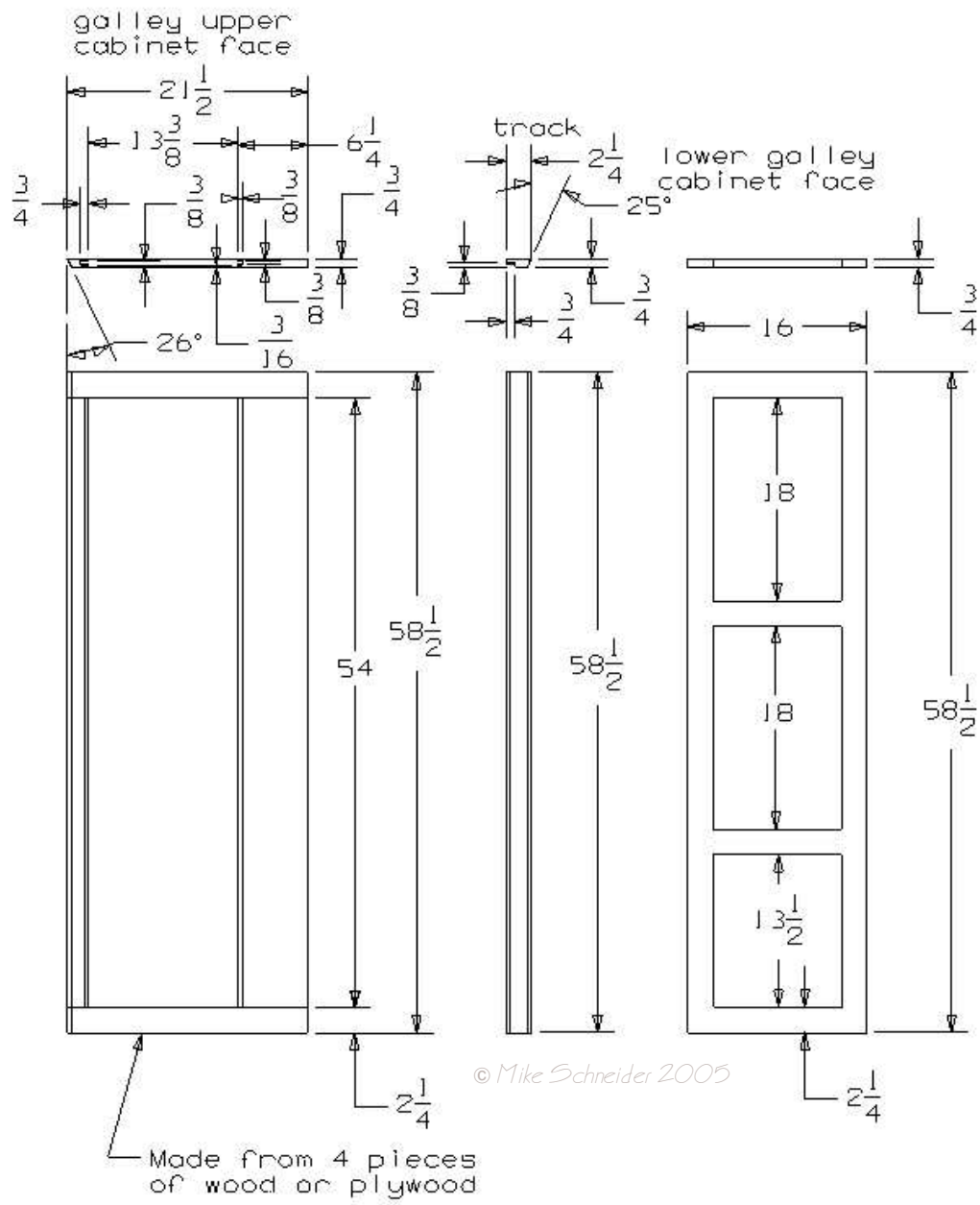
Step 6 fig 4

galley upper
cabinet face

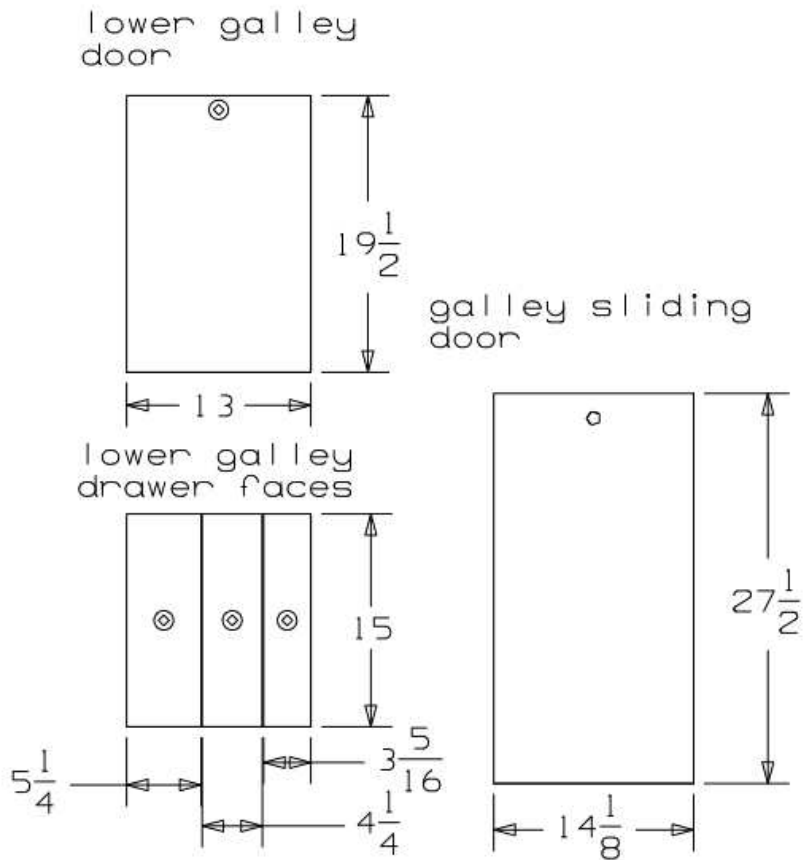


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Close up view of Step 6 fig 5.



Step 6 fig 5



Step 6 fig 6

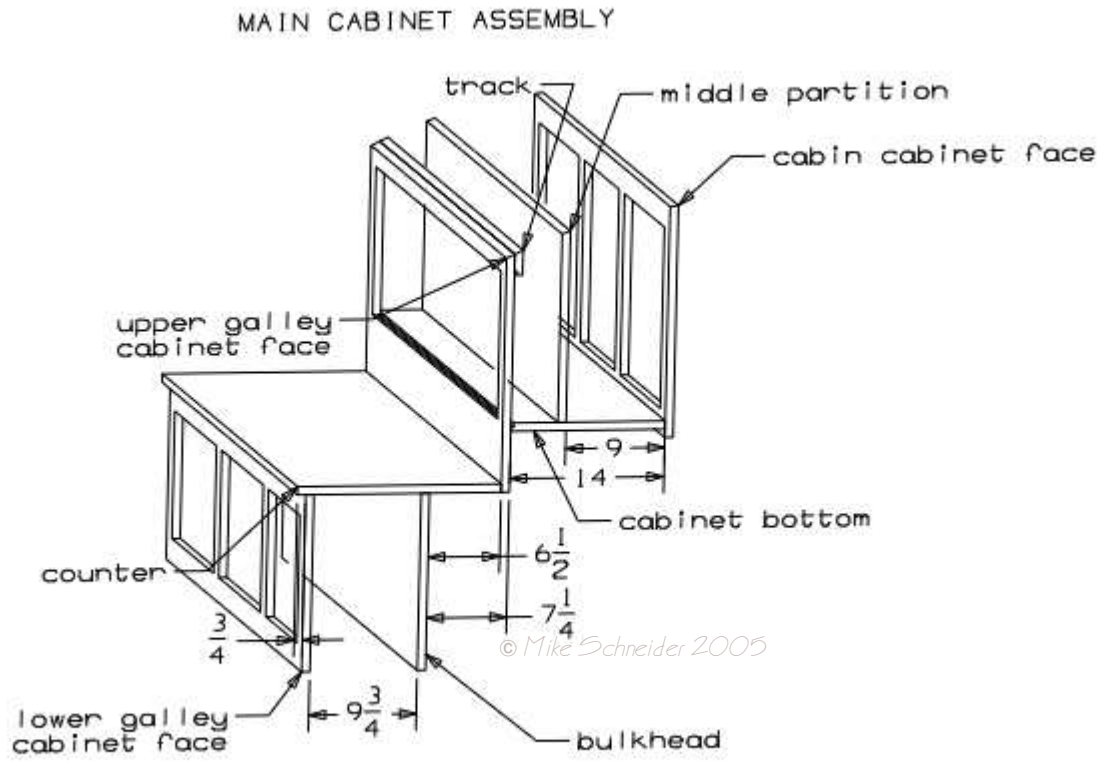
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You'll assemble the cabinets separate from the teardrop, and then add it, as an assembly to the teardrop. The cabinet assembly will also serve as a method to keep the sides perpendicular to the floor.

You'll use a combination bit to drill the holes, counter sink and counterbore the holes at the same time. You'll come back later with some wooden plugs that you will fill the counterbored holes in with, and then cut and sand flush.

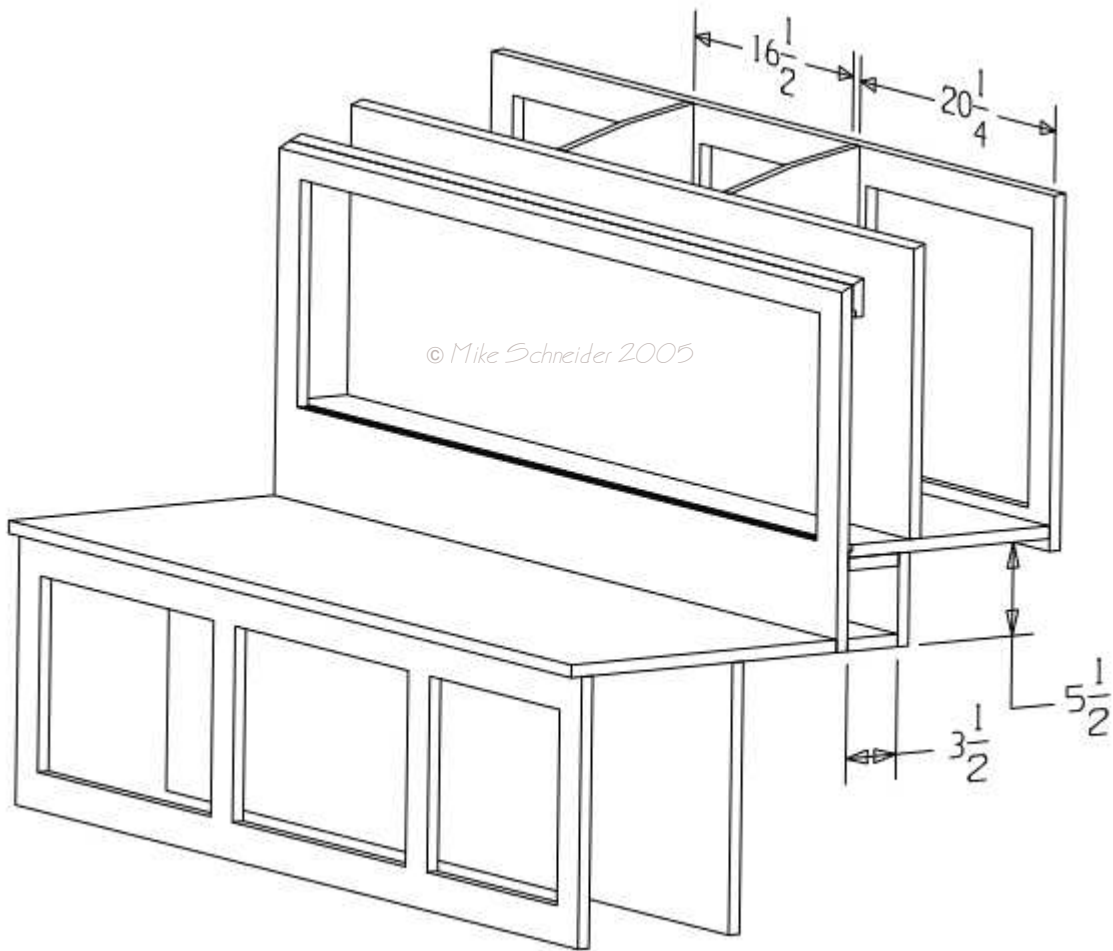
The screws should be 6" from each end (approx) and about a foot apart. You'll assemble the panels with the side edge sitting on the ground. Use an exterior wood glue for the cabinets, something like Tightbond III.

The first step is to assemble the main portion of the cabinet, as shown in this picture...



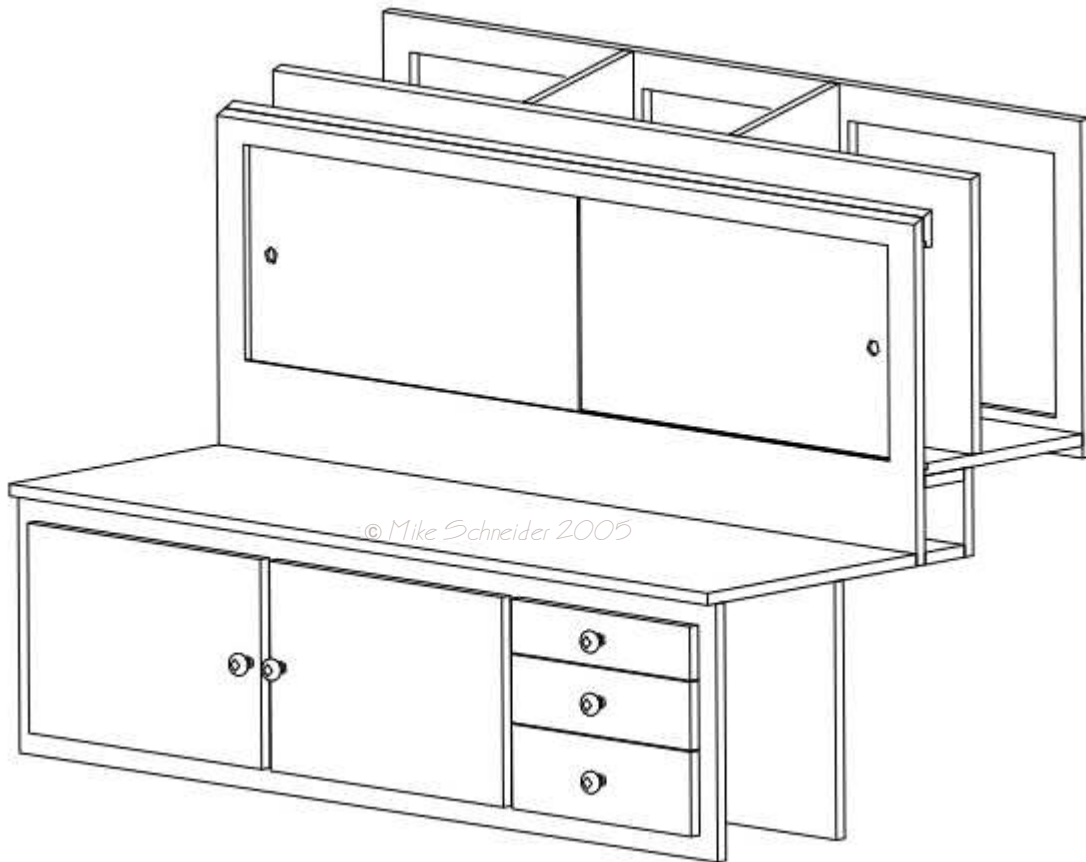
Step 6 fig 7

Then you'll come back and add the electrical raceway, and the cabin cabinet divider partions...

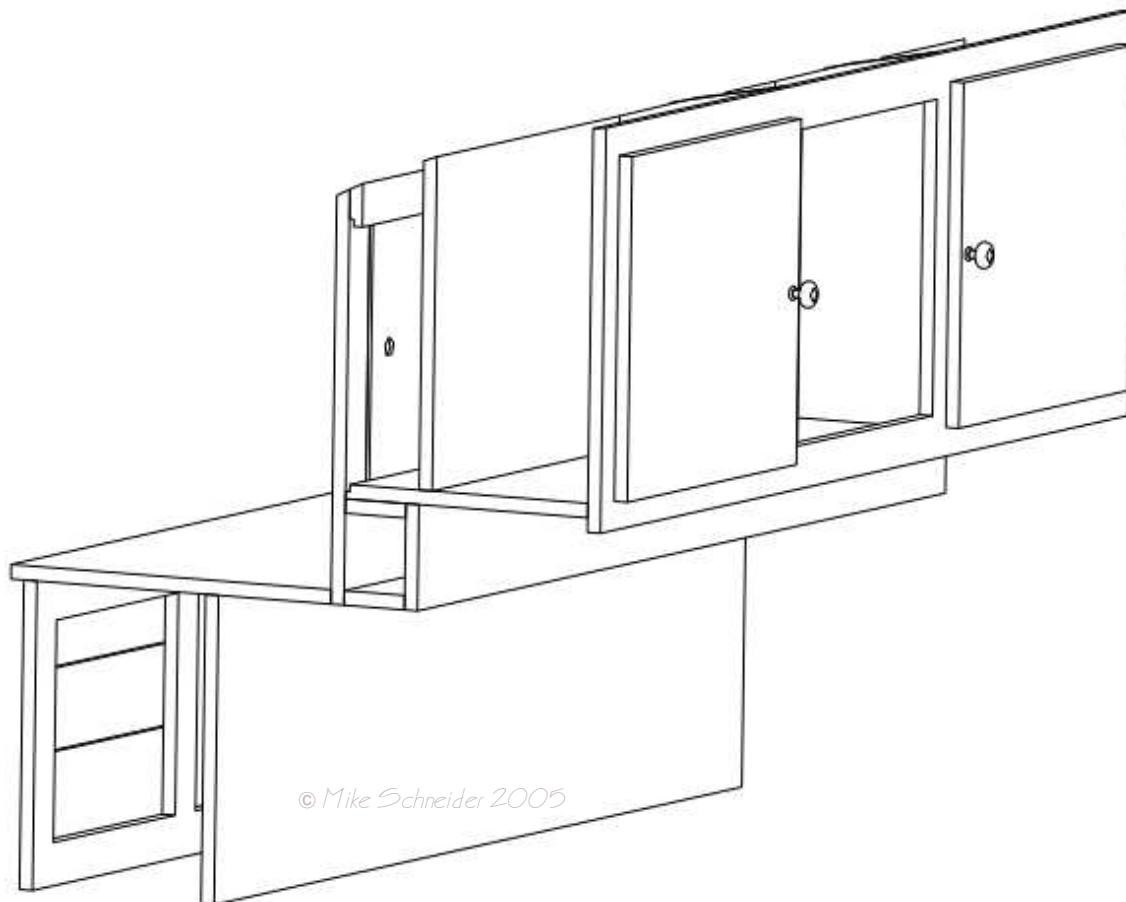


Step 6 fig 8

Last but not least, you'll add the cabinet doors and sliding doors...



Step 6 fig 9



Step 6 fig 10

Build the drawers for the galley:

First you'll need to glue and screw in two side panels (shown in yellow) into your cabinet. The inside edge should line up exactly with the opening in the face frame, which is $13\frac{1}{2}$ " wide. These side panels must be perpendicular to the floor and perpendicular to the face frame, and held as close to $13\frac{1}{2}$ " as possible.

The drawers are simple boxes made from $\frac{1}{2}$ " thick wood. Pine or aspen work fine.

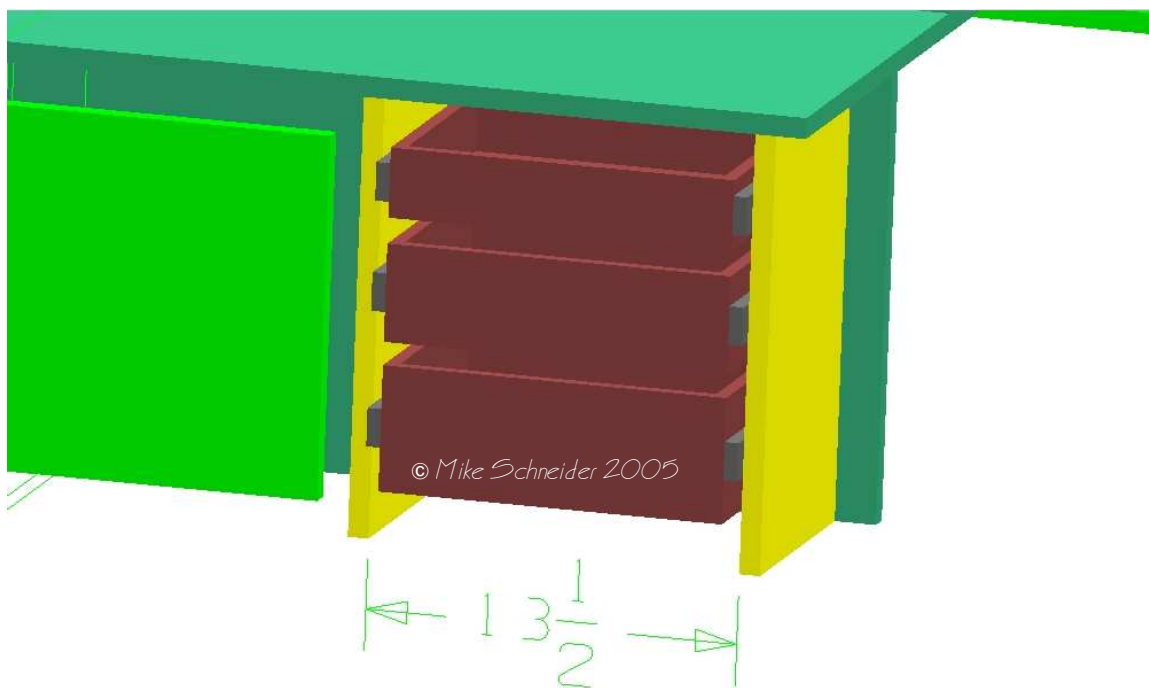
First you'll build 3 boxes, with $\frac{1}{2}$ " sides and $\frac{1}{4}$ " plywood bottoms. I cut a dado using my table saw for the plywood bottoms. Then I glue and nail the boxes together.

The drawer box sizes are as follows.

Top drawer $2\frac{1}{2}$ " high x $12\frac{1}{2}$ " wide x 10" deep

Middle drawer $3\frac{1}{2}$ " high x $12\frac{1}{2}$ " wide x 10" deep

Bottom drawer $4\frac{1}{2}$ " high x $12\frac{1}{2}$ " wide x 10" deep



Mount 10" long drawer glides on each side of the drawer

Mount the mating piece of the drawer glides to the side walls of the cabinet

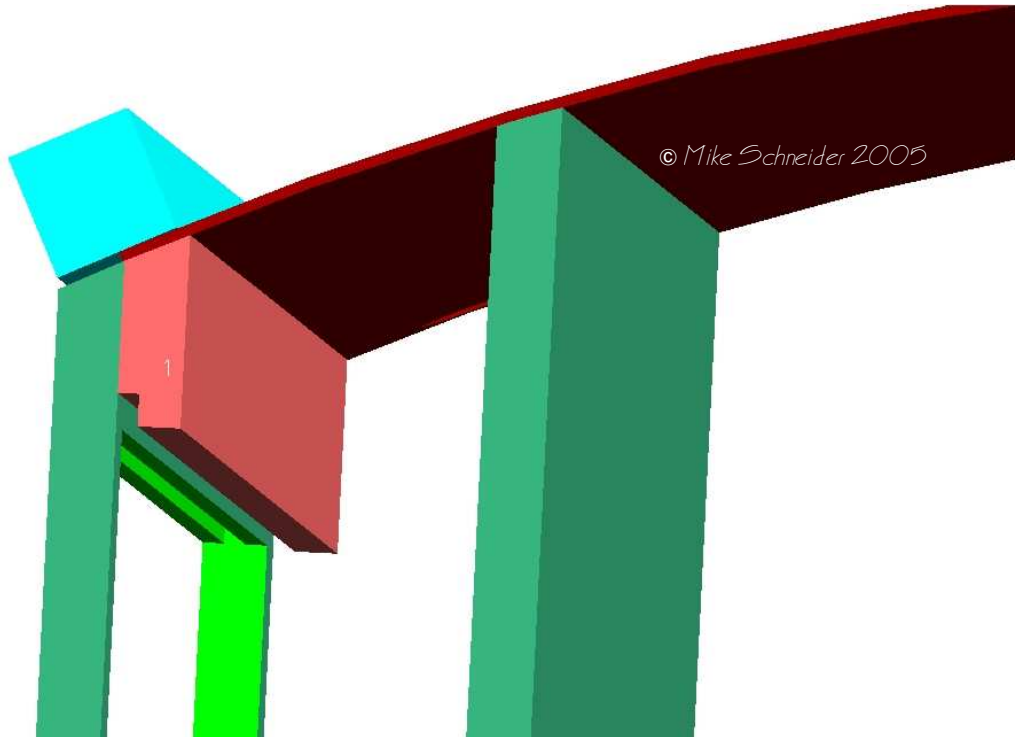
Add the drawer fronts to the drawer boxes. The drawer fronts should be $\frac{3}{8}$ " above and $\frac{3}{8}$ " below the drawer boxes, and centered horizontally.



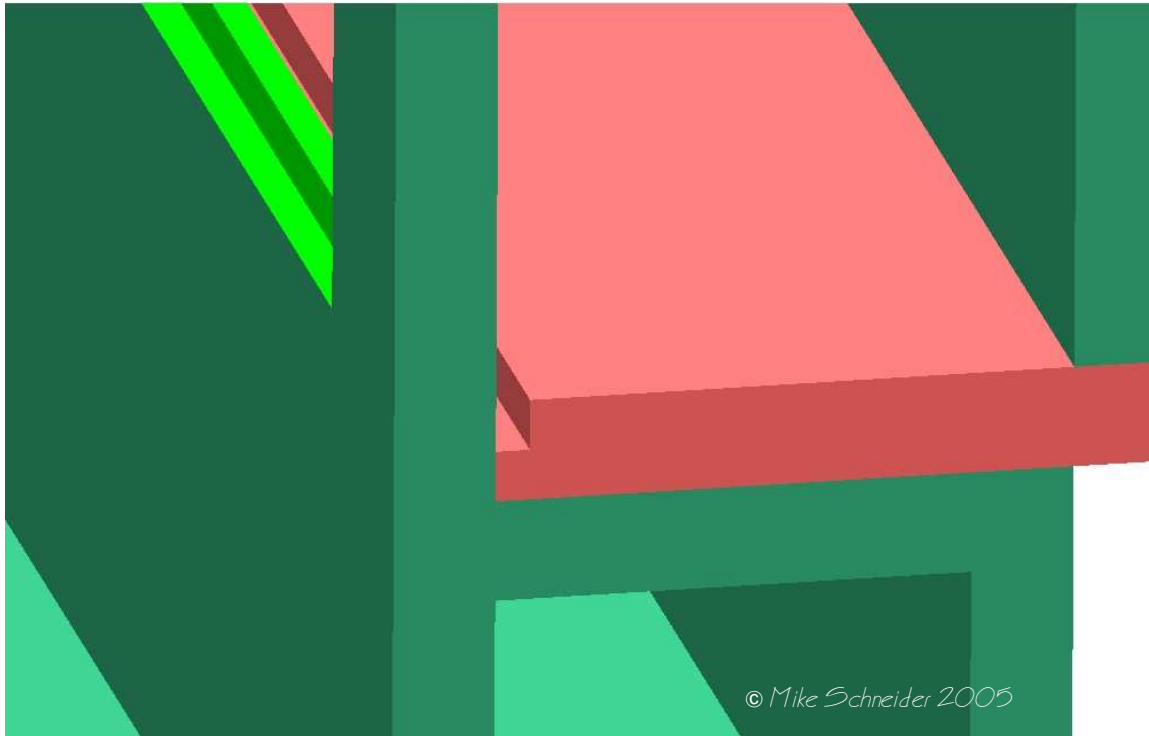
Add your drawer knobs.

The sliding doors

The pieces of wood that you cut for the cabinets included several $\frac{3}{8}$ " x $\frac{3}{8}$ " grooves. This is for your sliding doors. Installing the "track" on the top creates the back groove for one of the sliding doors. The front groove was created when you built the face frame.



The bottom back groove is created by installing the cabinet bottom. The bottom front groove was created when you built the face frame.



Now all that is left is to slip the sliding doors into the groove. The doors start out at 14 1/8" high. You should be able to slip the door into the 3/4" deep track at the top, then into the groove at the bottom. If the doors are too tight to fit into the bottom groove, cut off 1/16" and try again. Repeat until the doors slip in.

7: Dryfit the cabinet assembly

The main purpose of dryfitting the cabinet assembly is to ensure that you have adequate clearance for the hatch, and to locate your holes for assembly to the walls.

Locate your cabinet as per the lines that you drew in step 4. Check to see that you have at least 1 5/8" clearance between the back edge of the wall and the counter edge. If you do, then trace the profile of the cabinet on both walls.

Remove the cabinet assembly, and drill 1/8" pilot hole every place you will have a screw. You will drill the pilot holes from the inside out, centered in between the two lines you drew for each piece of plywood. From the outside, drill and countersink all the holes.

Put your cabinet assembly back into position. Then drill two pilot holes and put two screws in on each side. Does everything fit? Is everything square? Are you happy with everything? Now is the time to make any adjustments.

Finally drill all your pilot holes into the cabinet assembly to get ready for the next step.

Step 8: Glue up the walls and the cabinets

This is a major step. Make sure you have all your help lined up, and all your pieces handy.

- 1- Remove temporary spar
- 2- Remove the first wall
- 3- Put polyurethane glue on the wall where it will touch the floor and the floor framing
- 4- Put wood glue on the edges of the cabinet assembly
- 5- Reinstall the wall, and put in all the floor screws
- 6- Put in all the cabinet screws
- 7- Repeat on the other side
- 8- Put your temporary spar back on
- 9- Take a break, you've earned it!

Step 9: Install spars 1x2 pine

You should now prepare (11) pine spars and (2) poplar spars. These spars are dimensional lumber 1x2". Actual measured dimensions are $\frac{3}{4}$ " x 1 $\frac{1}{2}$ ". If you are not having any luck finding dimensional lumber that is straight, then buy some 1x4s or 1x6s and rip off a bunch of strips 1 $\frac{1}{2}$ " wide. Then cut them all to 58 $\frac{1}{2}$ " long. It helps to have a mechanical stop on your miter saw to ensure that all your spars are truly the same length.

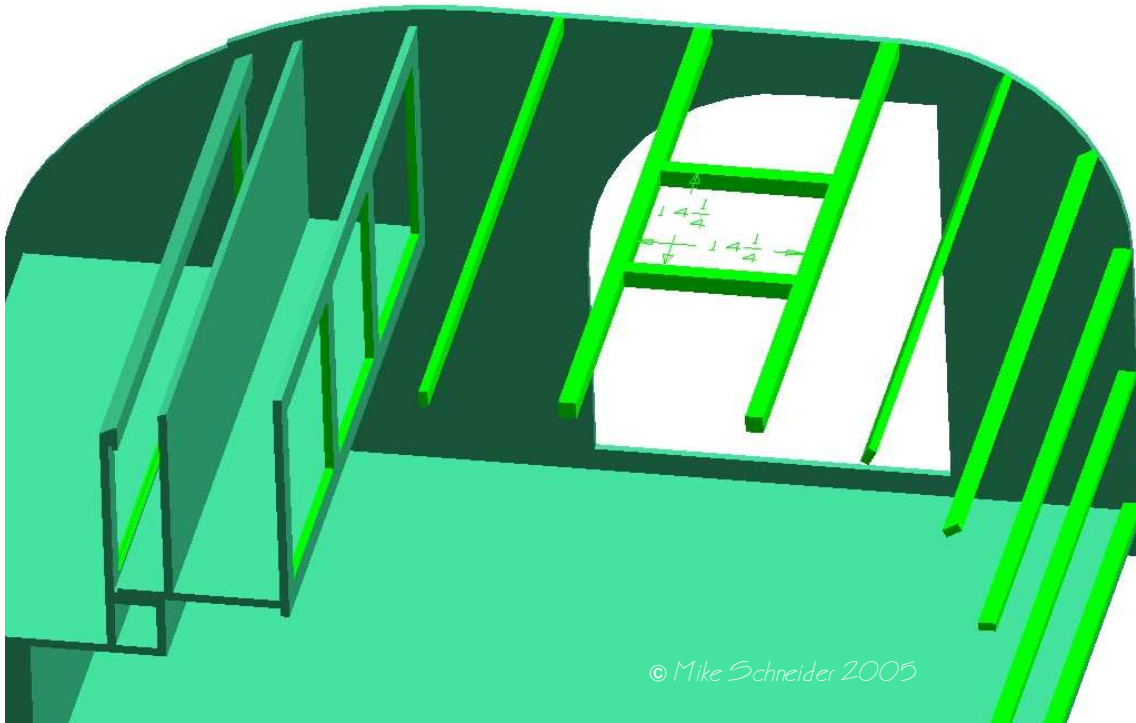
The final spar, the one that the hurricane hinge gets screwed into is a double spar, made by gluing the two poplar spars together. That'll give the screws something to bite into!

Also the spars on each side of the roof vent are double pine spars, made by gluing two pine spars together.

You marked the locations of the spars in step 4. Now you are going to drill $\frac{3}{16}$ " clearance holes for spars. Drill 2 holes per location from the inside. Then come back on the outside and countersink the holes.

Finally, using polyurethane glue, glue in all the spars except for the ones above the cabinet, and put 2 screws in each end.

Now you need (2) 2x2s 14 $\frac{1}{4}$ " long. The actual measured dimensions of 2x2s are 1 $\frac{1}{2}$ x 1 $\frac{1}{2}$ ". You will use these pieces to frame in the roof vent. The rough opening of the roof vent should be 14 $\frac{1}{4}$ x 14 $\frac{1}{4}$ ".



Also notice in this picture, the spars are not installed above the cabinets. That's so you can install the headliner. See step 11 for the installation of the remaining spars.

Step 10: Stain/Paint the interior

In the past I have painted or stained the interior after the headliner was already in position. In retrospect I realize that it would have been so much easier to do the finishing work prior to installing the headliner.

You might want to make the headliner panel, as per the directions in step 11, and finish the headliner at the same time that you finish the interior.

Finishing the interior is mostly a matter of personal taste. Some folks like to finish it with a dark stain and a high gloss polyurethane. Others prefer the light look and just brush the polyurethane directly onto the wood.

One could also paint the interior, hiding a cheap looking woodgrain, or in the case of my first teardrop, hiding a huge mistake. More about that later. Others use moisture resistant paneling, forgoing the need to paint at all.

Here's some things to think about as you choose your interior finish.

- 1) A teardrop is small already, a dark finish will make it feel even smaller.
- 2) Finishing all sides in paint or polyurethane will tend to make your voice echo. The bedding and curtains dampens that echo quite a bit. But you might want to consider something soft and textured for either the walls or ceiling. How about a white carpet on the ceiling?
- 3) Water based stains go on blotchy. Remember that BIG mistake I made? I tried water based stain on my interior, without testing it first. I assumed it would go on just as nice as oil based stain. It doesn't. It's blotchy. Really really blotchy. At that point I was ready to drag my teardrop to the curb for trash pickup! The next day I regained my senses, and painted the walls purple and the ceiling white. And I never thought about that mistake again. But the lesson here is test on a piece of scrap wood first. And if you want to keep it easy on yourself, use the oil based stains.
- 4) I've used oil based polyurethane as long as I can remember, so I was hesitant to try the new water based polyurethane. I was finally convinced to try it because of the short drying times. Now I use water based polyurethane for everything. It goes on with a foam brush and dries in about 15 minutes. I'm usually applying the next coat of poly within the hour. Depending on what I'm doing, I'll usually apply 3 to 5 coats of poly. Once the poly has cured, it's very hard and very durable. And poly can be sanded between the 3, 4 and 5th coats for a nice smooth finish. Use a fine sandpaper though, don't use steelwool, as that will put rust in your finish.
- 5) If you don't like painting, staining etc, you can always get a moisture resistant paneling for the walls or ceiling. Just glue into place instead of a plywood headliner or inside wall skins. I have never tried wallpaper, but I imagine that if you used a moisture resistant adhesive and a moisture resistant wallpaper, it should work. I'd be more inclined to get preprinted paneling.

After you have finished your interior and allowed the paint or polyurethane to cure then proceed to the next step.

Step 11: Install headliner 1/8" birch plywood

You are going to prefabricate the entire ceiling panel on the floor.

Cut 2 strips of birch plywood to 3" x 58 1/2".

You'll need 3 pieces of birch plywood. It's best to start with 5' x 5' x 1/8" Baltic birch plywood to come up with these 3 pieces.

Piece 1 = 48" x 58 1/2"

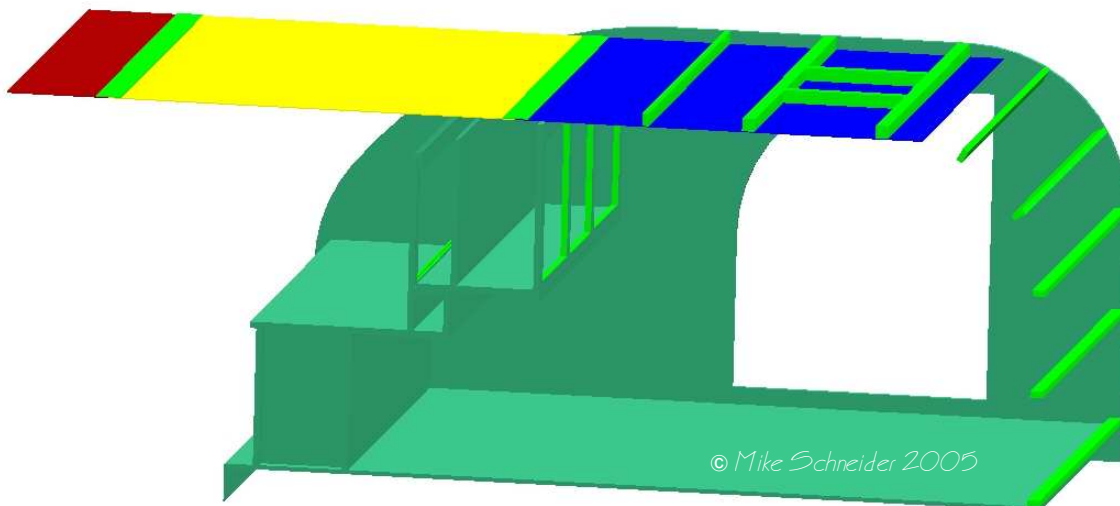
Piece 2 = 48" x 58 1/2"

Piece 3 = 12" x 58 1/2"

Set the plywood panels (good side down) on a clean flat surface, so they form 1 large panel, 109" x 58 1/2". Glue the 2 strips of 3" plywood so that they straddle the joints. Place something heavy on the 3" strips and let dry. 1 gallon jugs of water are good for weights.

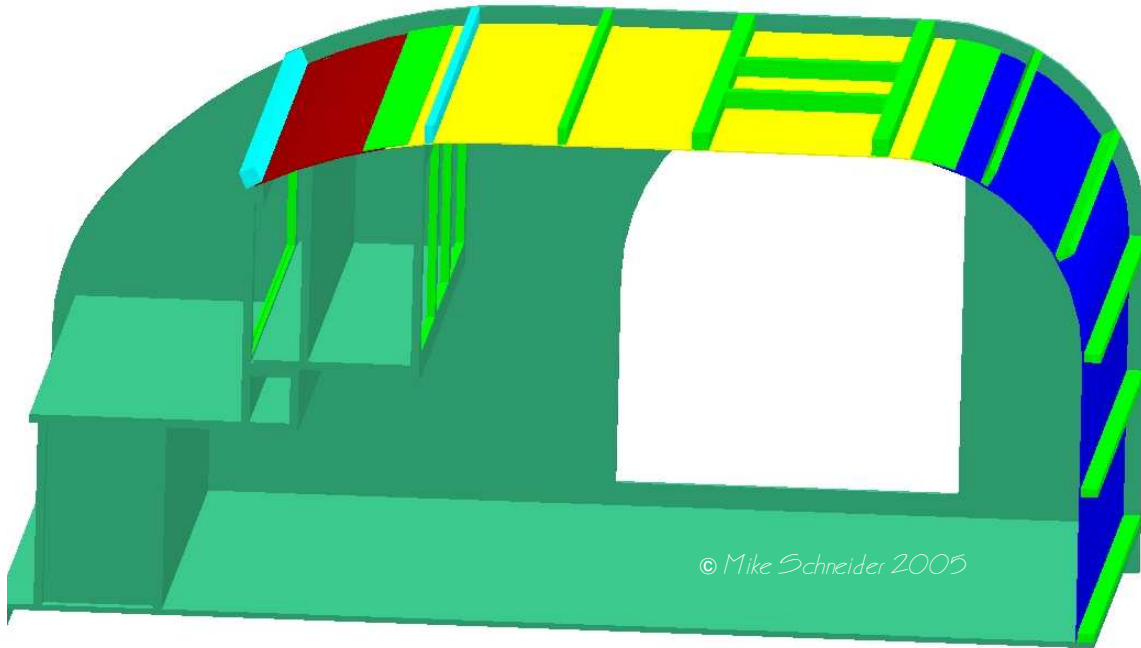
The next day; this would be a good time to flip the assembly over and stain and polyurethane it. See step 10 for details.

After the headliner panel is finished and dry; Slide the panel in from the rear, above the cabinet assembly and below the spars. Apply glue to the spars, one at a time, and press the ceiling panel into position.



Tack into position with a pneumatic stapler. If you prefer not to see staples on the inside, then prop the ceiling in position with a series of sticks of various lengths wedged into position. Let dry.

Install the remaining spars, shown in light blue.



Using a small drill, drill a hole in each corner of the framing where the vent fan will go. Connect the holes with a line using a black magic marker. From the inside, cut out the hole for the vent fan with a jigsaw and a fine tooth blade. You could also use a laminate trim bit to cut the hole out.

Step 12: Run 12v Wiring – security cable

Wiring. The mere sound of the word scares some people. But it's really not that hard. Lets look at an overview of the inside wiring first.

Just like in the first Benroy I built, this design has an electrical raceway under the cabinets in the cabin. This raceway is nothing more than a box to hide all your wires and plugs in. The electrical comes in once side of the raceway, and there are 12V plugs and 110V plugs on both the cabin side and the galley side of the raceway. The first plug on the 110v side is a GFI plug, which acts as your fuse. The 12v side has a fuse for every circuit. Finally, there is a 12v converter that turns your 110v power into 12 v power for lights, vents, fans, mattress warmers, tvs, etc.

Here's the parts you need:

- 110v Inlet
- 12 gauge wire for 110v circuit
- Electrical box for every 110v plug you want
- Electrical outlets
- One GFI electrical outlet
- 12 v converter
- 12 gauge wire for 12v circuit
- 12 volt plugs
- 12 v fuse box
- Bus bar
- Sound cable 16-2
- ¾" pvc conduit

Make the electrical raceway by screwing a piece of 1x4 underneath the cabinet and another 1x4 5 ½" below that. The front of the raceway will be a piece of 1x6 either screwed on or hinged. Michael W did a beautiful hinged version of the raceway.



At the end of the raceway, on the drivers side, drill a hole for the 110v inlet, and install.



Cut out your rectangular holes for your 110v plugs in the bulkhead wall and also in the raceway front.



Drill your holes for your 12v plugs in both the bulkhead walls and the raceway front.

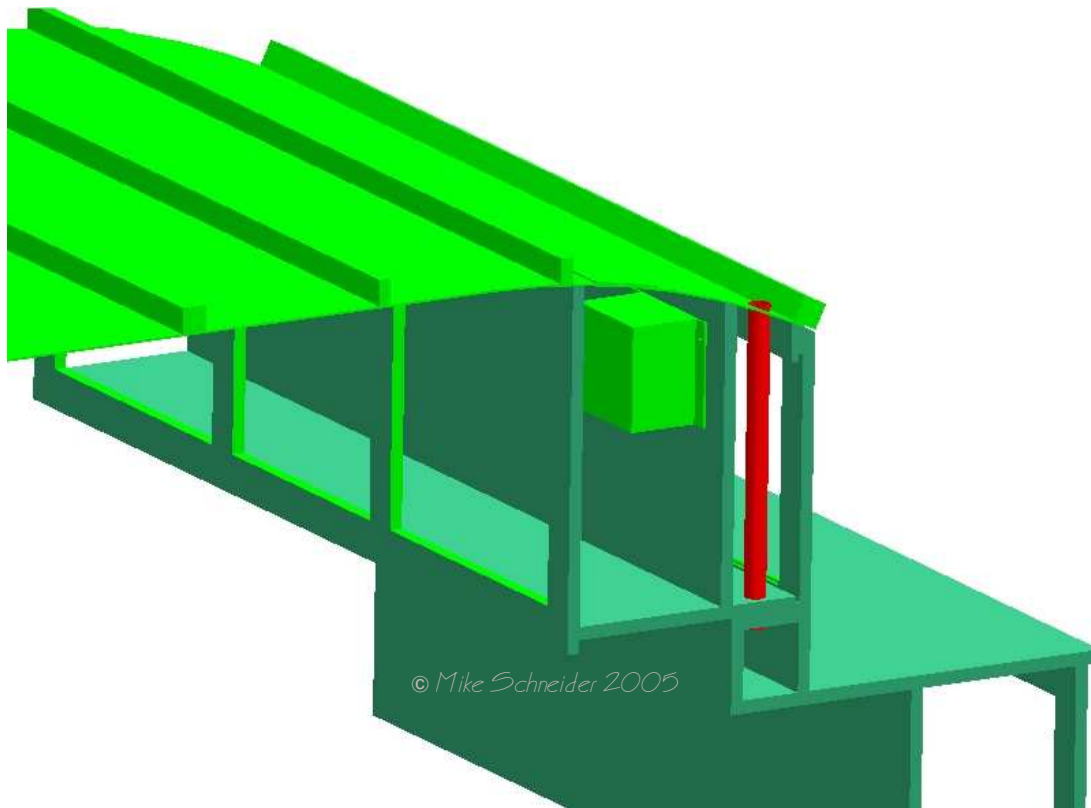
Mount the 12v converter on the bulkhead wall, either the cabin side or the galley side.



Run the wires from the 12v converter to the fuse block and the busbar. If you really want to get fancy, you could add a double pole double throw switch that will let you switch your power source from battery to power supply, depending on if you are camping in the wild or at a campground with electricity.

Run wires to any 12v plugs you installed in the raceway.
(Wiring diagram required)

Drill a hole through the ceiling skin of the cabinet, through the bottom of the cabinet and thru the raceway for a piece of conduit. Press fit the conduit into the hole, so that it's flush with the top and bottom of the cabinet. See conduit in red in the next picture. I am also showing the power supply mounted inside the cabinet. The wires can be pulled up thru the ceiling, and down thru the conduit to make your connection.



Pull 16-2 wires from all the lights locations, vent fan location, and 12v plug locations down through the conduit in the cabinet to the fuseblock and busbar. You'll be drilling holes thru the roof spars to pull your wires. Try to place the wires exactly 6" from each edge. Later when you attach your roof, you'll avoid the area 6" from the edge, so that you don't accidentally put a nail or screw into your wiring, causing a short.



As you attach each light, you'll connect the other end to the fuseblock and bus bar as shown in the photo below.



Pull the 110v wiring as shown in the photo above. The first plug should be a GFI plug. The remaining plugs can be standard household plugs. Wire the plugs in parallel.

(Wiring diagram required)

Test the 110v circuit with a tester similar to this one.



<http://www.electrical-online.com/howtoarticles/voltagetesters.htm>

Turn on the power converter. Test the 12v circuit with a tester similar to this one.

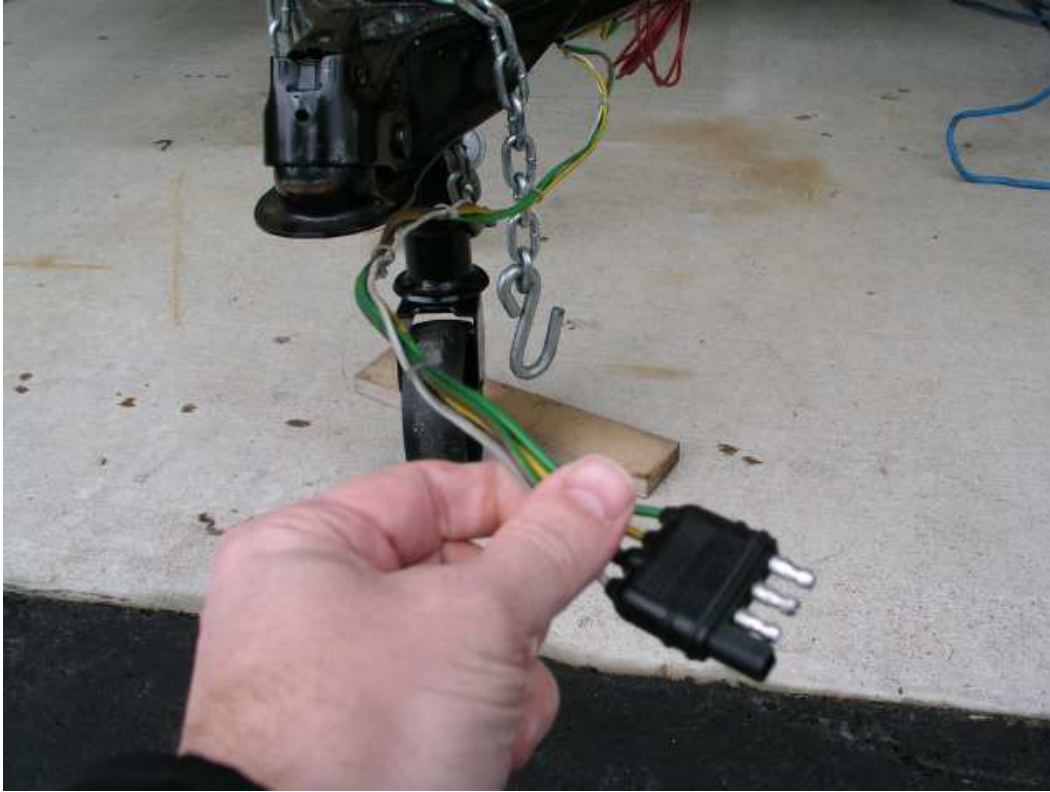


http://www.pilotstore.com/store/item.asp?ITEM_ID=1544

Later when we install the hatch we'll be pulling some more wire into the electrical raceway.

Step 13: Trailer Light Wiring:

1. Position the 4-Flat trailer wiring connector near the trailer coupler, leaving approximately 18" of wire to extend toward the tow vehicle.



2. Attach the White wire (ground) to the small hole in the trailer tongue using a self tapping screw. Purchase enough white wire to extend to the rear of the trailer and connect the front and rear right side marker assemblies for ground. Attach one end to the ground screw with the existing white wire.

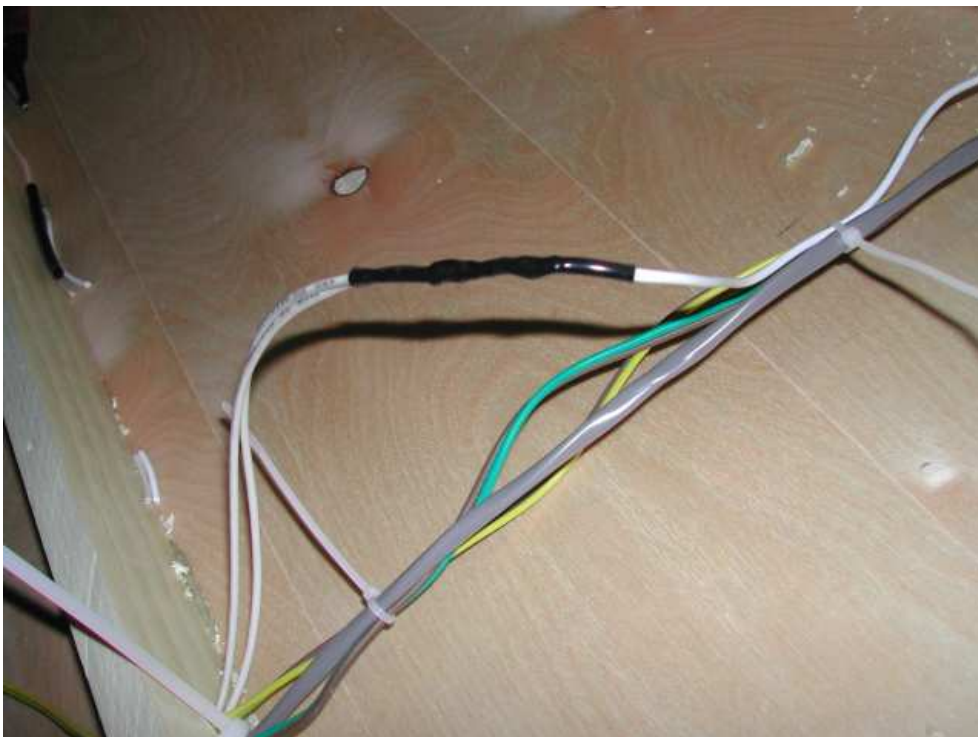


3. Route all of the wires (including the additional white wire) through the trailer tongue and down the left connecting rail. On a Harbor Freight or Red trailer you'll tuck the wires inside the side rails and attach with nylon clamps or cable ties. If you are using a custom fabricated trailer made from 2x2 tube, you can run the wires underneath the tube, along the inside edge of the tube, or even inside the tube as illustrated in this picture.



4. Separate the Yellow/Brown and Green/Brown wire pairs for approx 6" at the location of the front left side marker assembly.

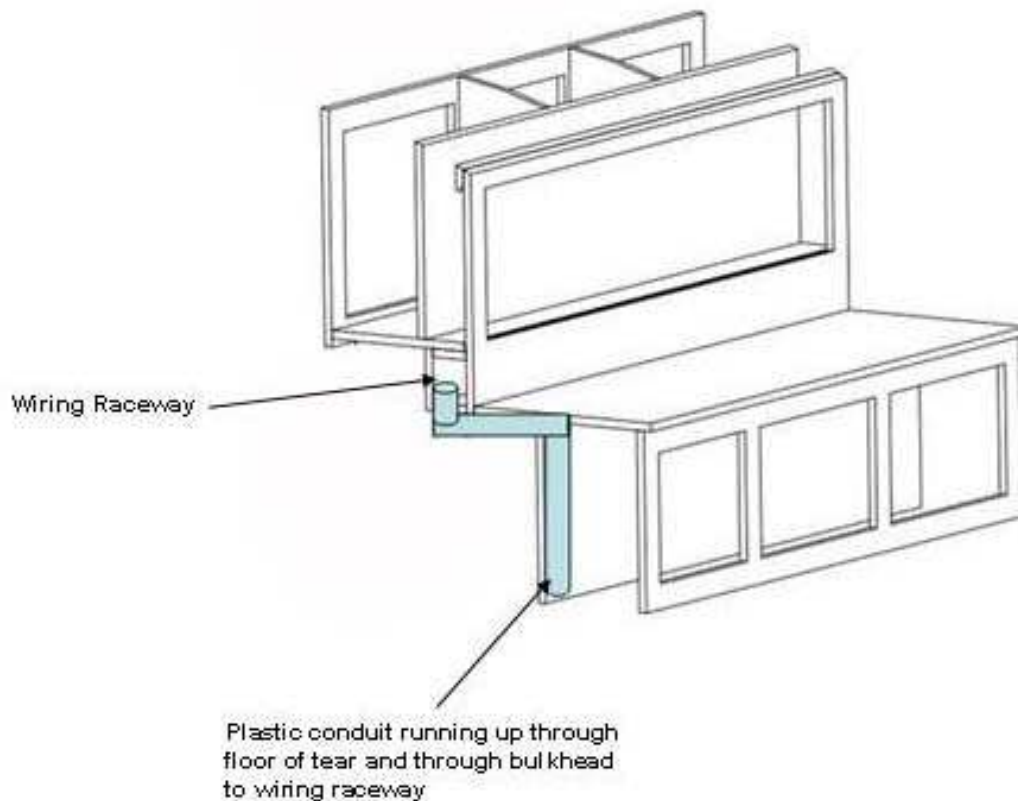
5. Connect the wire lead from each marker light to the Brown harness wire by soldering and shrinkwrapping as illustrated here:



(You will need approximately 60" additional wire to connect the right side marker. Attach to a crossmember to reach the right side) Connect the white wire to the ground side a each marker light.

6. Continue to route the wires down the left frame channel to the left tail light assembly location, using wire clips (provided) to hold the wire in place. Separate the Yellow/Brown and Green/Brown wire pairs for approx 6" and repeat Step 5 above. (*you will need additional splices.*)

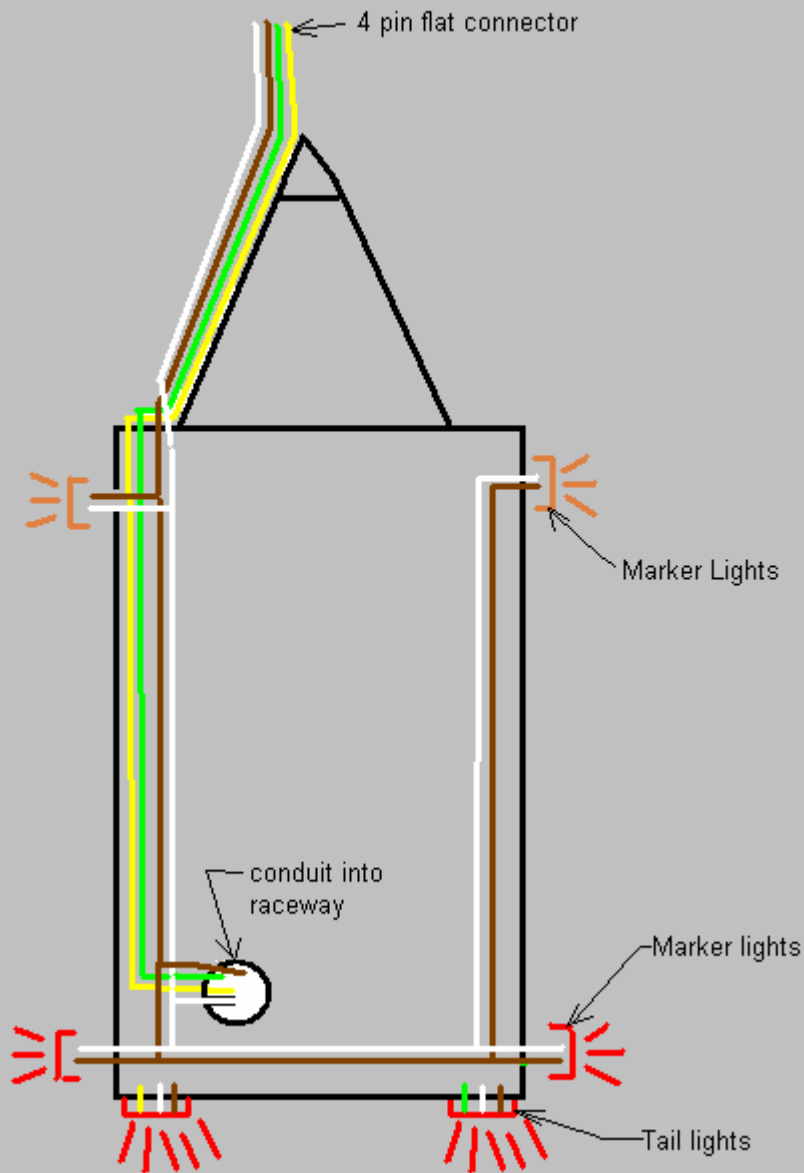
7. There are a couple ways to get from the trailer into the hatch with your wiring. You can run the wires inside the wall before you skin them, so that they come out into the electrical raceway. You could run gray plastic conduit thru the floor into the galley cabinet and then horizontally and up again into the electrical raceway. Which ever method you choose, you'll want to end up with all 4 wires in the electrical raceway so you can make the connection to the hatch wiring there.



8. Connect the wire leads to the tail light assemblies as indicated in the chart below.

- Brown** - Tail Lights
- Yellow** - Left Turn/Brake
- Green** - Right Turn/Brake
- White** - Ground (To all lights)

Simplified Wiring Diagram



Step 14: Insulate roof R-tech & EPS

It's time to insulate the roof. You've got a couple of options...

- 1) You can use Extruded Polystyrene Insulation (EPS) in the entire roof. You'll have to kerf the EPS to bend it around the curves
- 2) You can use R-tech insulation which bends around curves easily, but costs a little more
- 3) You can use both of the above.

If you decide to kerf the EPS to bend it around the curves, you'll want to kerf it about 3/8" deep every 1/2" or so. You can do this easily on the table saw.



Step14 Fig 1

Test your insulation for fit. It should fit snugly. Once you got it fitting well, glue it in place with some titebond or some polyurethane glue. For the pieces that you bend around the curve, you can shoot some brads into the spars thru the insulation to keep it in place, or use some duct tape to keep it in place. You'll have to remove the duct tape once the glue is dry.

Using a combination of EPS and R-tech, your insulated Generic Benroy will look something like this...



Step 14 fig 2

Don't forget to notch out your insulation for your wiring!

Step 15: Skin the exterior- Uniflex255



Step15 Fig 0

There are a number of different ways to skin the exterior, aluminum, filon, pvc and more. I chose to paint the exterior with Uniflex255, a boat hull paint from the rot doctor. I figured if it was good enough for boat hulls, it was good enough for the teardrop.

The rot doctor recommends treating all surfaces with CPES before patching or painting. The CPES is a thinned out epoxy that penetrates into the grain of the wood, and hardening, creating a tough, durable seal, and will prevent the wood from rotting.



Step 15 Fig 1

Once the CPES is dry (at least several hours), the next step is to patch all holes and defects with Fill it Epoxy Filler.



Step 15 Fig 2

Let the Fill-It Epoxy filler cure overnight.

The next day use a combination of belt sander and random orbital sander to sand all that Filler smooth.



Step 15 Fig 3

Finally mix up your Uniflex 255 and apply with a solvent resistant roller.

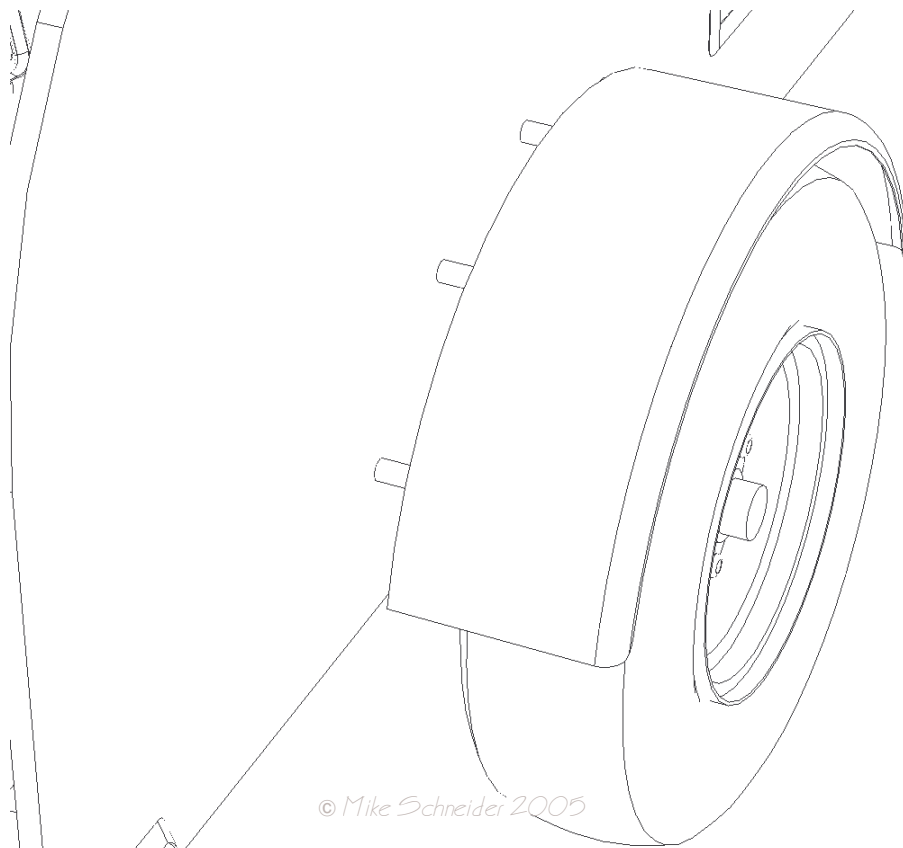


Step 15 Fig 5



Step 15 Fig 4

Step 16: Install the fenders – round or 1940s style



Step 16 Fig 1

The fenders are part number 126701 from Northern Tool. You will fasten them to the body using spacers and bolts.

Determine the length of the spacer by centering the fender on the tire, and measuring the distance between the body and the fender. I measured $1 \frac{7}{16}$ ". Cut 5 pieces of tubing to length for each side.

Drill clearance holes in the fenders for the bolts. Using the fender as a template, drill 5 pilot holes in the body.

Fasten the fender to the body by running the bolt thru a flat washer, the fender, and the spacer.

Step 17: Build the hatch

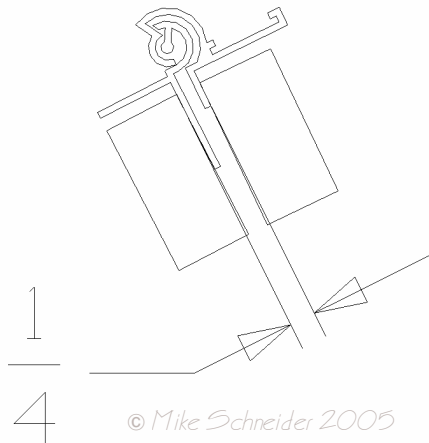
Building the hatch is not nearly as hard as some people make it out to be. The biggest problem building the hatch is springback. Springback is where the hatch tries to straighten back out. This can be caused by not using enough ribs, or by using a skin that is too thick or heavy.

I've built two hatches for two different teardrops, and never had a problem with springback. I'll share that design with you now!

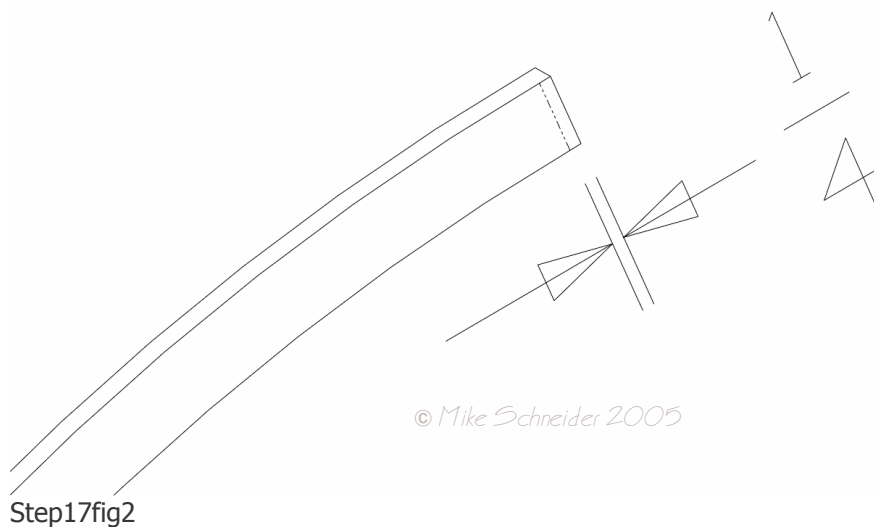
It's time to layout one of the ribs. Grab that notch template that you created in step 5. Trace the outer profile of the notch on a piece of $\frac{3}{4}$ " Baltic birch plywood. Using a jig saw, cut the outside radius and the two ends, making sure to cut away the waste so you can create an offset in the next step.

Using a marking tool, or an adjustable square, offset a line $1\frac{1}{2}$ " from the outside radius to the inside. Finish cutting out the rib. This will be your template for the remaining ribs. Using your new rib, mark and cut 5 more ribs. You should now have 6 identical ribs.

The two outside ribs need to be cut back $\frac{1}{4}$ " at the top and $\frac{1}{8}$ " at the bottom to allow for the hurricane hinge.

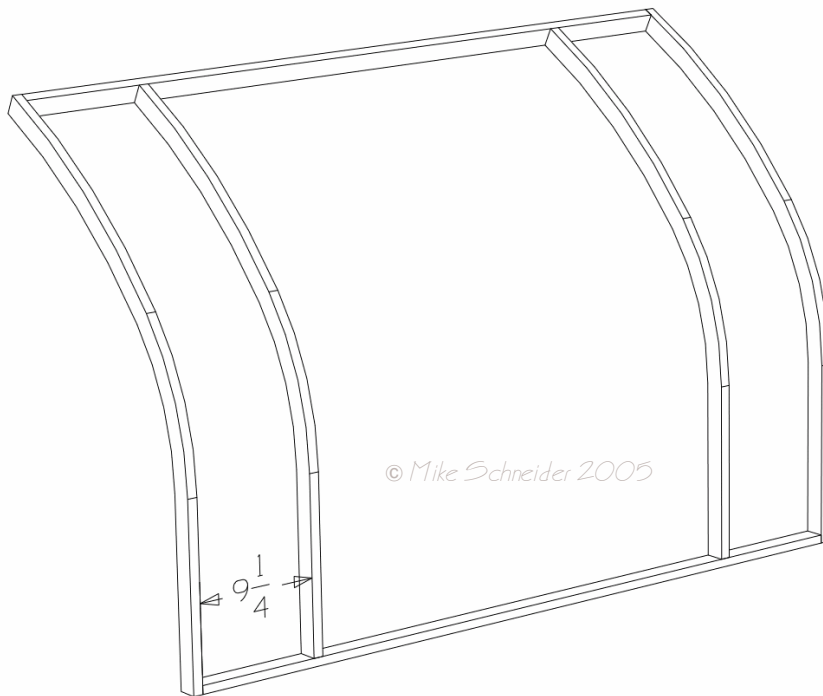


Step17fig1



Step17fig2

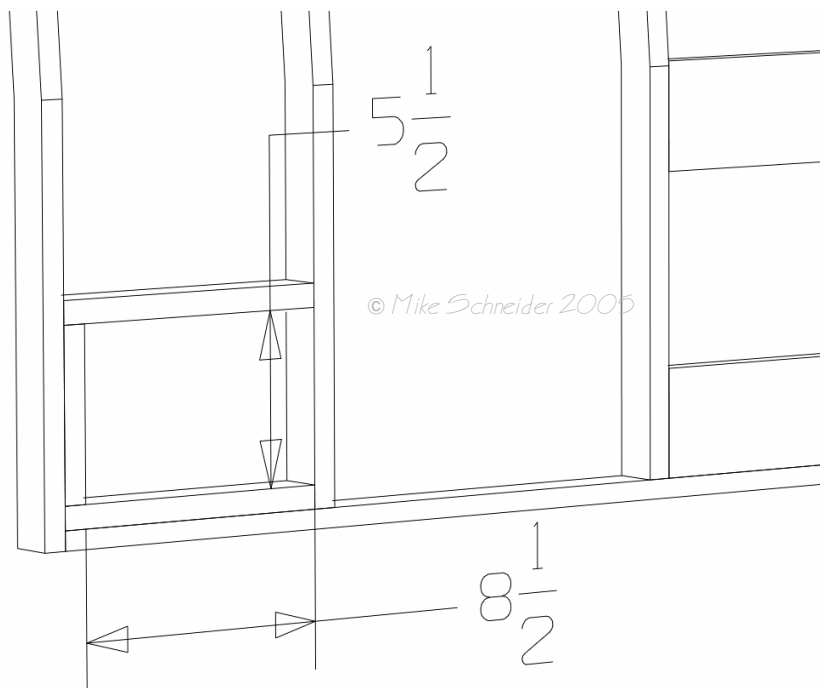
The 4 inside ribs need to be cut back 1" at the top and 7/8" at the bottom, because they will fit inside the main frame.



Step17fig3

Create the main frame. Cut 2 spars, $1\frac{1}{2}$ " wide x $56\frac{1}{2}$ " long. Glue and screw the ribs to the ends of the spars. Your main frame will be 58" wide. That will leave a $\frac{1}{4}$ " gap on each side. If you insulated your walls or built a different width teardrop, adjust the size of your main frame accordingly. The key is to leave a $\frac{1}{4}$ " gap to the inside of the walls on each side.

The next two ribs are positioned so that they can be used to mount your tail lights. I positioned the next rib so that I had an opening of $9\frac{1}{4}$ ". I later came back and added another $\frac{3}{4}$ " piece against the outer rib so that my finished opening was $8\frac{1}{2}$ " wide. Adjust this dimension to suit your tail lights.



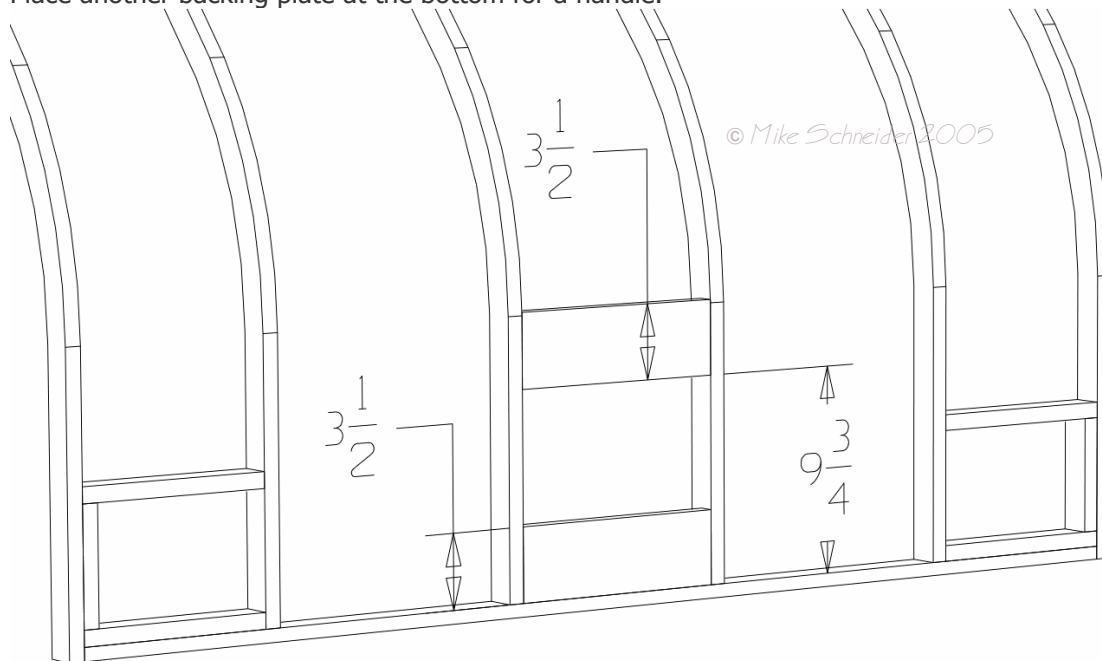
Step17fig4

Finish framing in your tail lights with pieces of 1 1/2" spars. My finished opening height was 5 1/2", but again, adjust this to fit your tail lights.

Space the remaining 2 ribs equally as shown.

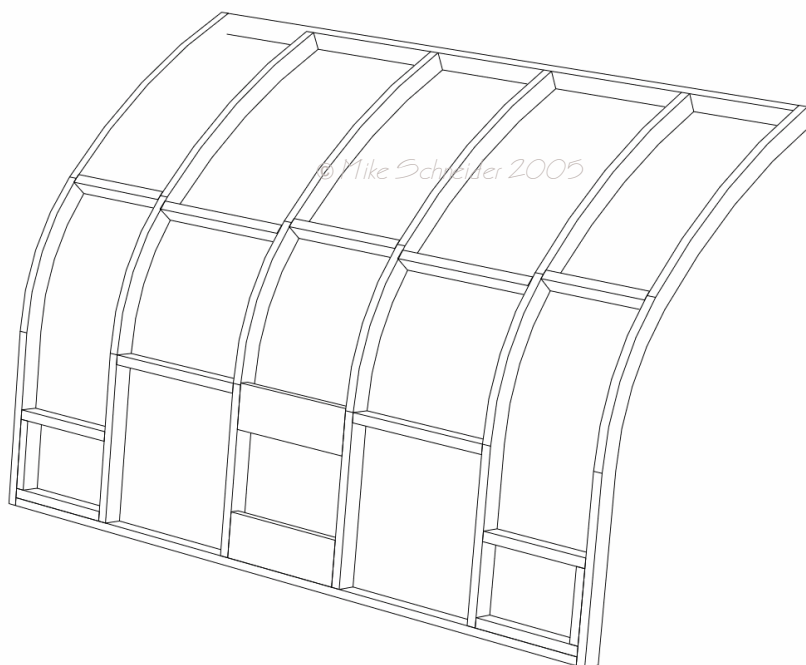
Place a backing plate for your license plate light and holder in between the two center ribs as shown.

Place another backing plate at the bottom for a handle.



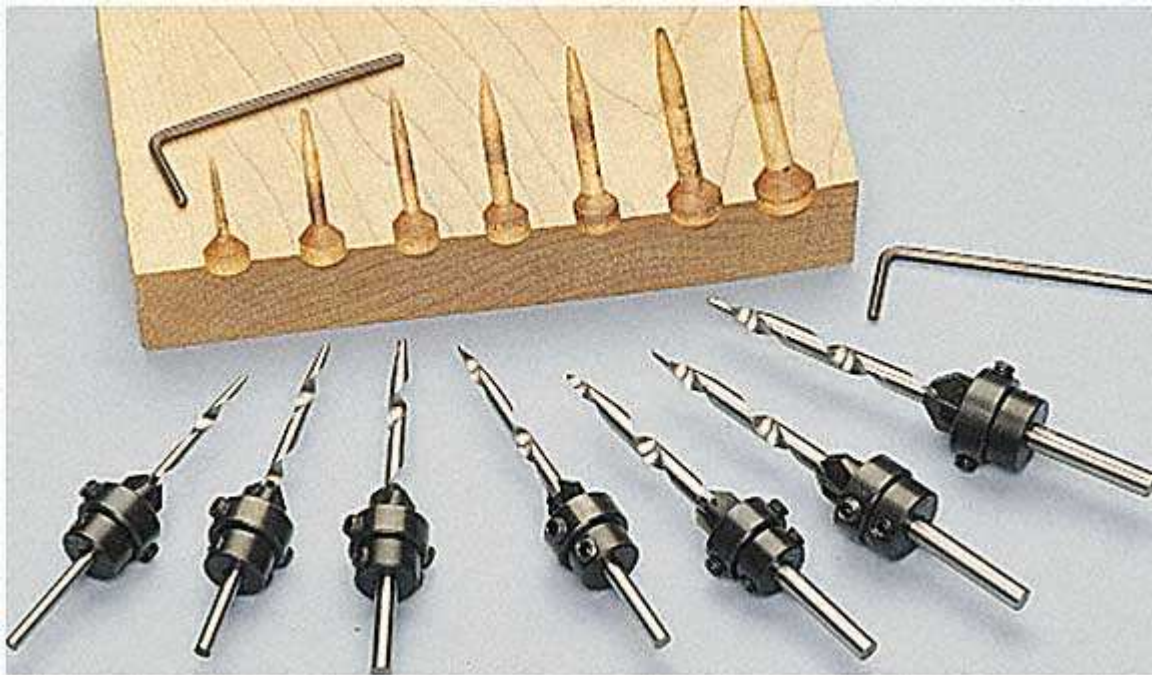
Step17fig5

Glue a bunch of 1 1/2" wide spars across the width of the hatch. The placement doesn't need to be exact, just do it roughly as shown. This creates a torsion box effect, which helps prevent the hatch from twisting.

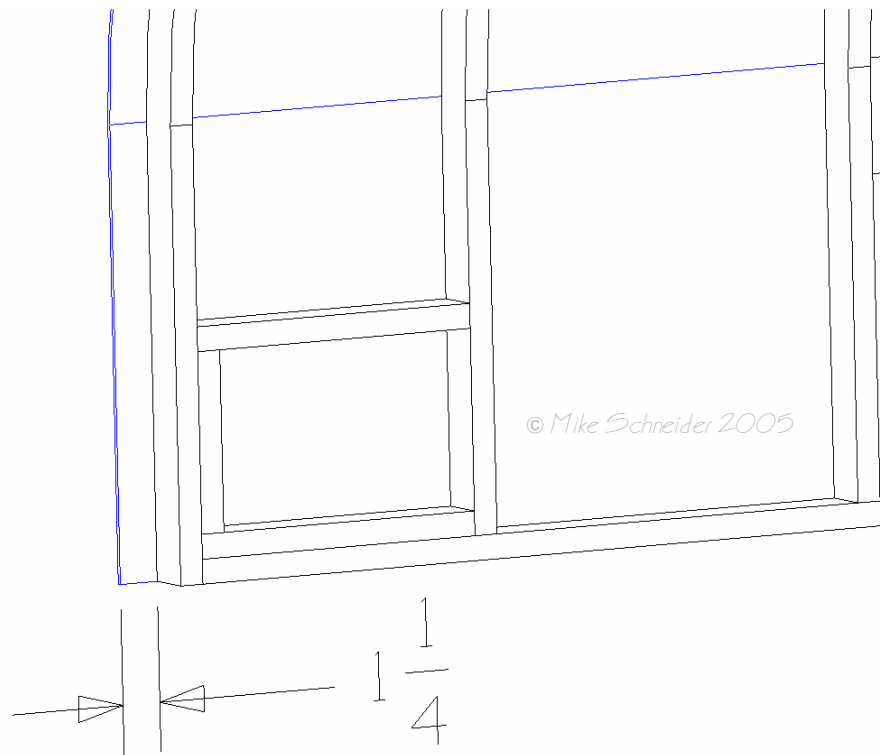


Step17fig6

All the joints are held together with water resistant glue like Titebond III and galvanized drywall screws. Drill and countersink with a bit like this to keep the wood from splitting.

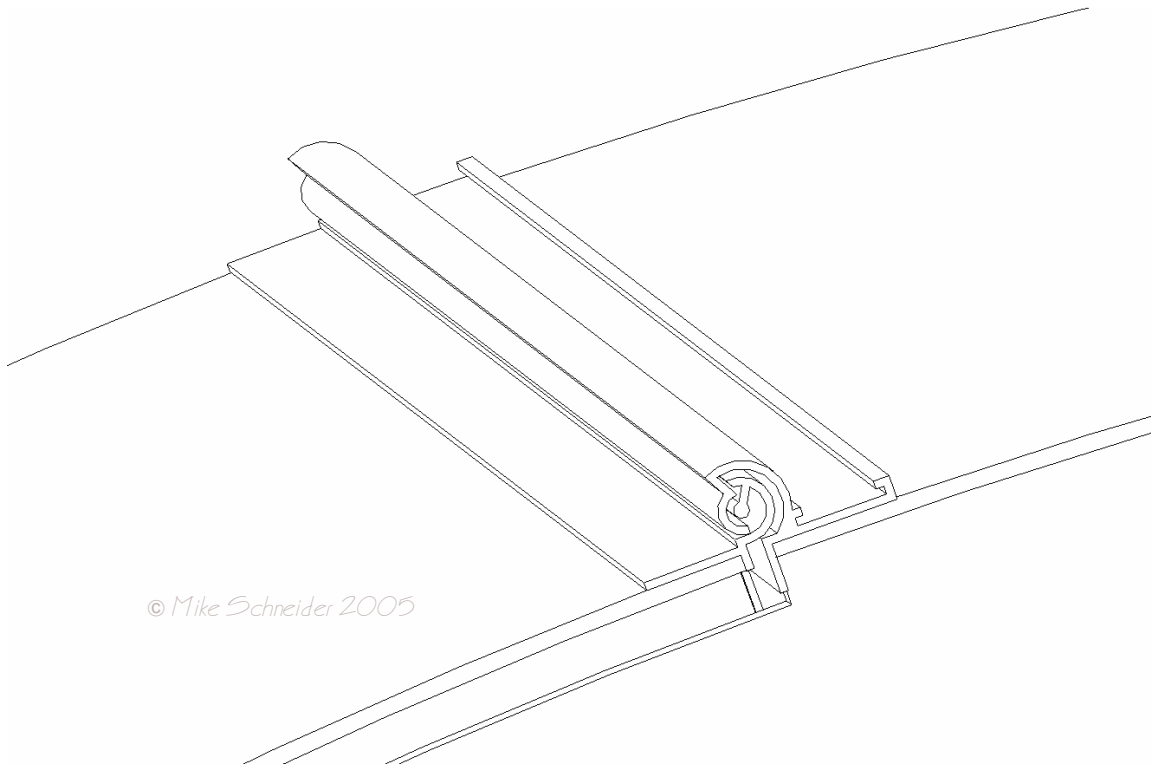


Skin the hatch with 1 layer of 1/8" Baltic birch plywood, or two layers of 1/8" luan. Allow 1 1/4" overhang on each side. Glue and fasten the skin to the ribs with staples or nails. Be sure to set the heads below the surface of the skin. You will come back later to patch the holes with a fiberglass putty.



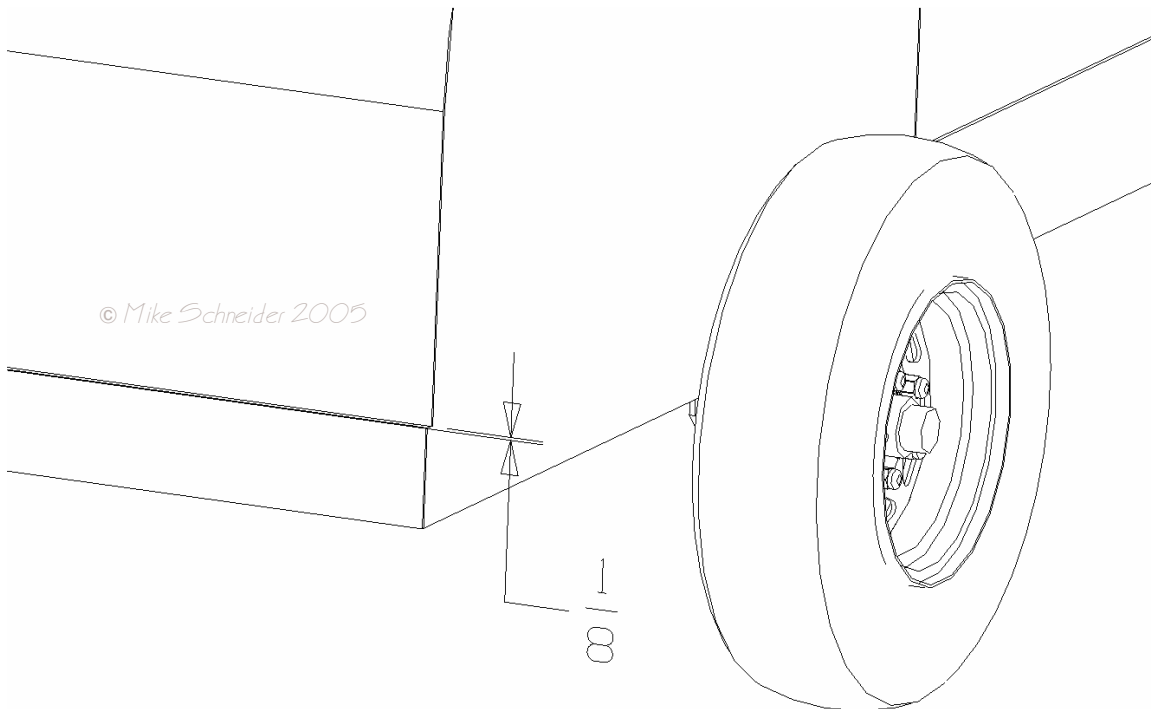
Step17fig7

The aluminum trim will be added later after the hatch is painted. Right now lets temporarily install the hurricane hinge and see how things fit. Install the hurricane hinge to the hatch with 3 screws; one on each end and one in the middle. The hinge should hang over the body by $\frac{3}{8}$ ", and over the hatch skin by $\frac{1}{8}$ ". Then install the hurricane hinge with the hatch to the roof with 3 screws.



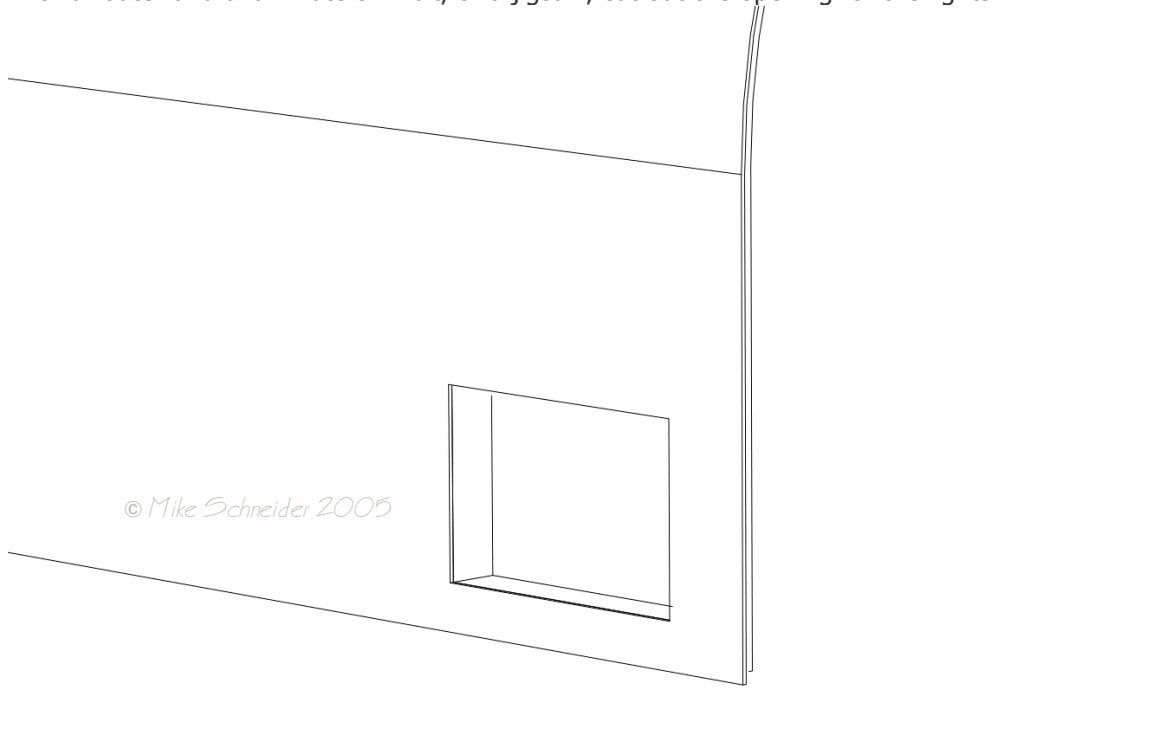
Step17fig8

Check the fit. The bottom of the hatch should have $\frac{1}{8}$ " to $\frac{1}{4}$ " clearance with the floor. If necessary, clamp a guide board on the hatch and trim off $\frac{1}{8}$ ". Check the fit again. Repeat until you have $\frac{1}{8}$ " clearance.



Step17fig9

With a router and a laminate trim bit, or a jigsaw, cut out the opening for the lights.



Step17fig10

Congratulations on successfully building your hatch. That wasn't so bad, was it?

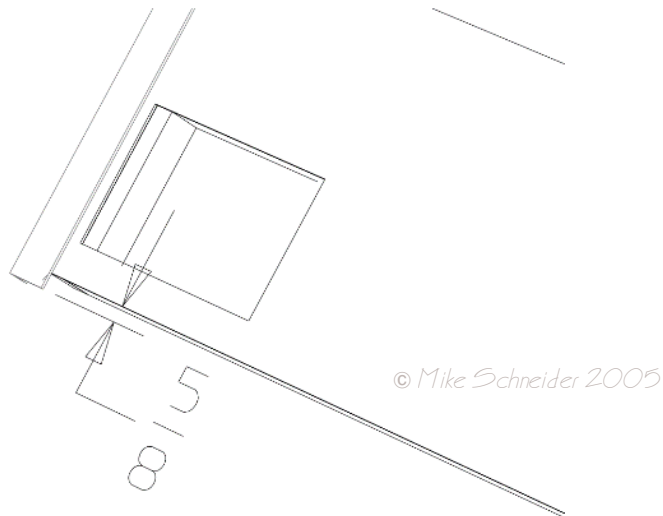
Step 18: Painting the hatch

You'll be sealing and painting the outside skin and all the edges that have a possibility of getting exposed to the elements. You could paint the inside surfaces of the hatch too if you like, but it's not necessary. Use the same painting procedure as you used on the body, including putty, sanding, CPES and Uniflex 255.

Step 19: Trim the hatch

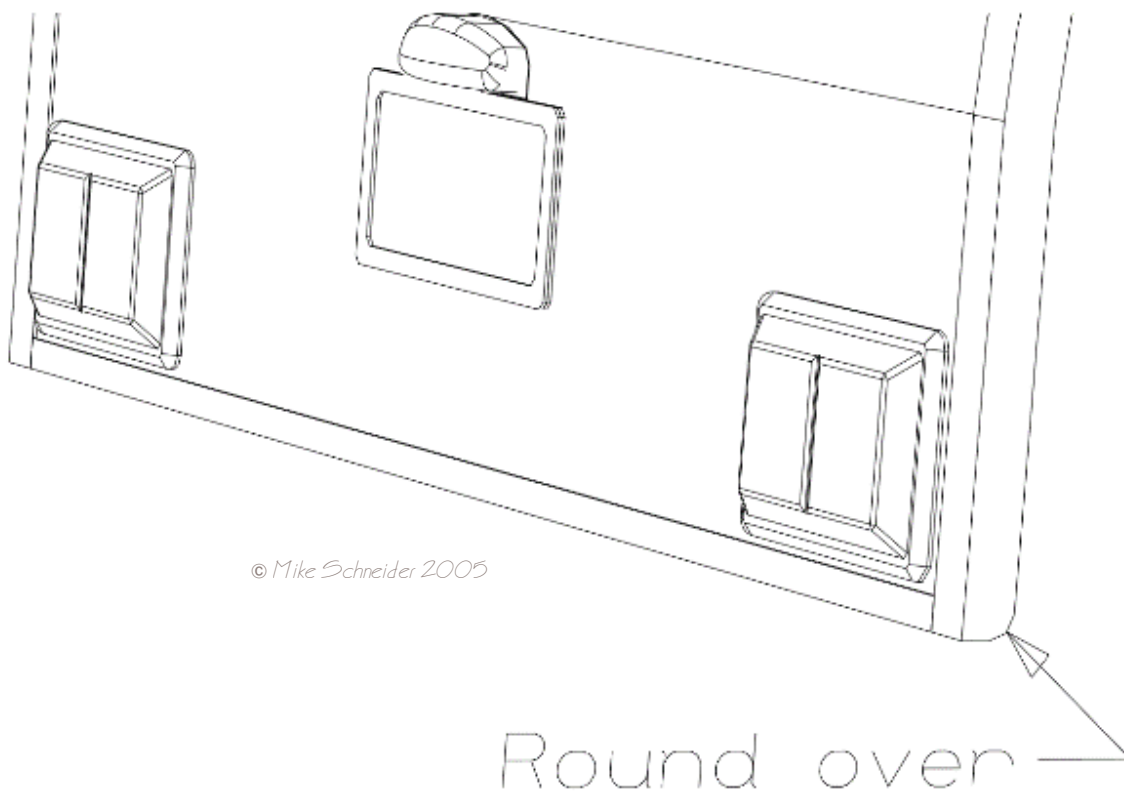
Bend some deadsoft 1 1/2" aluminum angle around the side profile of the hatch. If you purchased your angle from a hardware store or a home depot type store, you'll have to soften it first before you can bend it. You'll anneal (soften) the angle with a propane torch. Heat a small section of angle up until the flame coming off the aluminum is orange, then move on to the next section. Wear gloves, the aluminum gets hot!

Fasten the aluminum angle to the skin with pop rivets. It should extend beyond the bottom skin by 5/8".



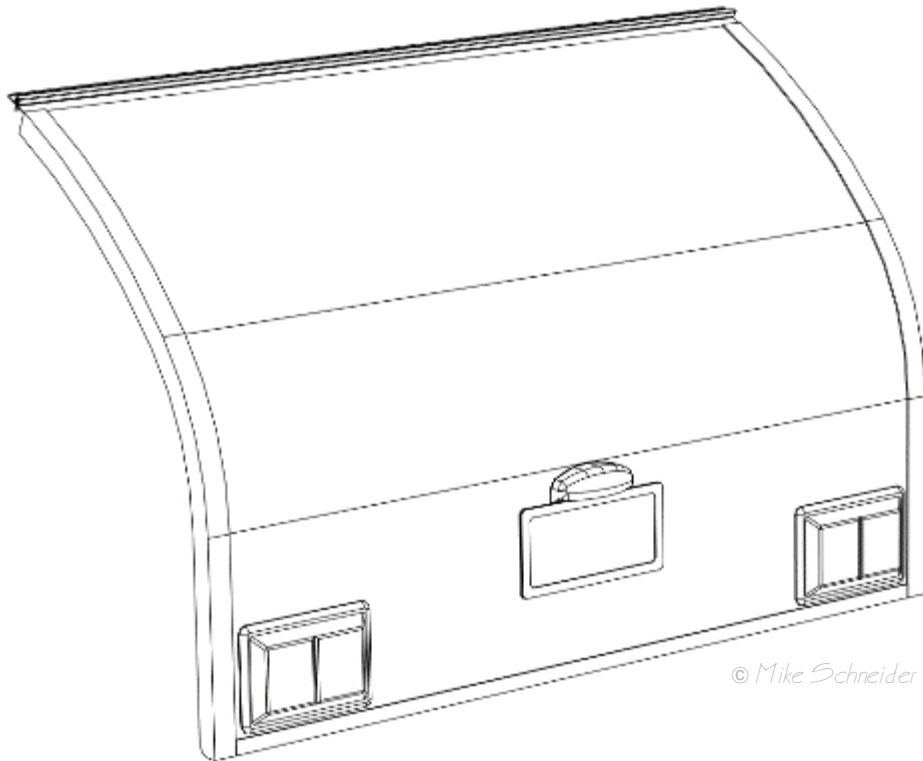
Step19fig1

Install a piece of 1/8" x 1" flat aluminum bar on the bottom edge of the hatch flush with the end of the angle. Fasten with stainless steel flat head screws. Then add your taillights, and license plate light. Round over the bottom corner of your aluminum angle.



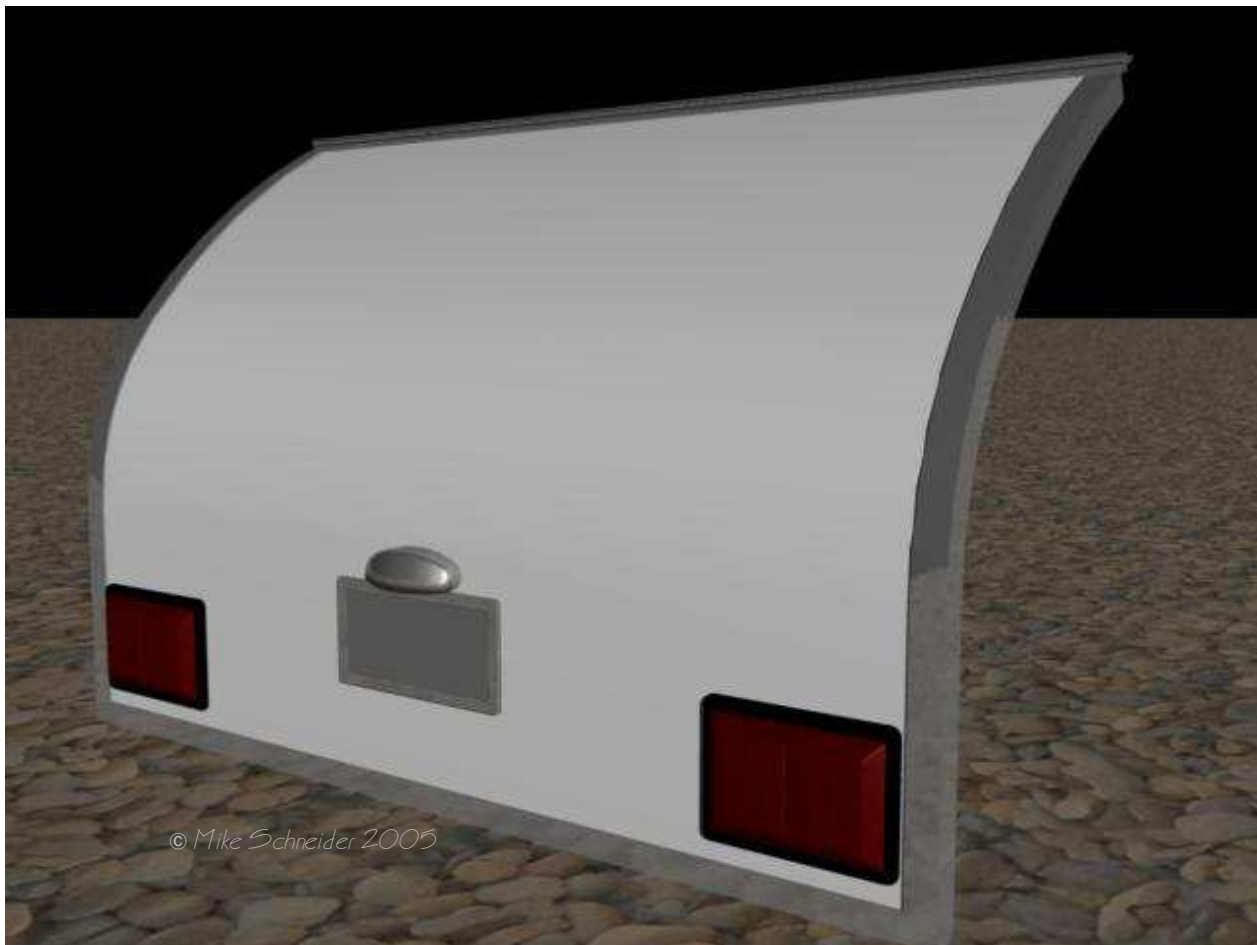
Step19fig2

This is how your completed hatch should look.



© Mike Schneider 2005

Step19fig3



© Mike Schneider 2005

Step 20: Wire the hatch

At this time the hatch is still open on the inside. This will make it easy to wire the hatch. If you plan on skinning the inside of this hatch, you'll do this at the same time as you do the wiring.



You'll be pulling two sets of wire thru the ribs in your hatch. A set for the dome lights that you'll install in your hatch, and a set of 4 strand auto wire that you'll be feeding your tail lights and license plate lights with.

First the dome light. Decide on the placement of your domelight. Drill holes through the ribs and run wire from the domelight to the vicinity of the hinge.

Next run your 4 strand auto wire to the tail lights and license plate light.
Here's where the wires go...

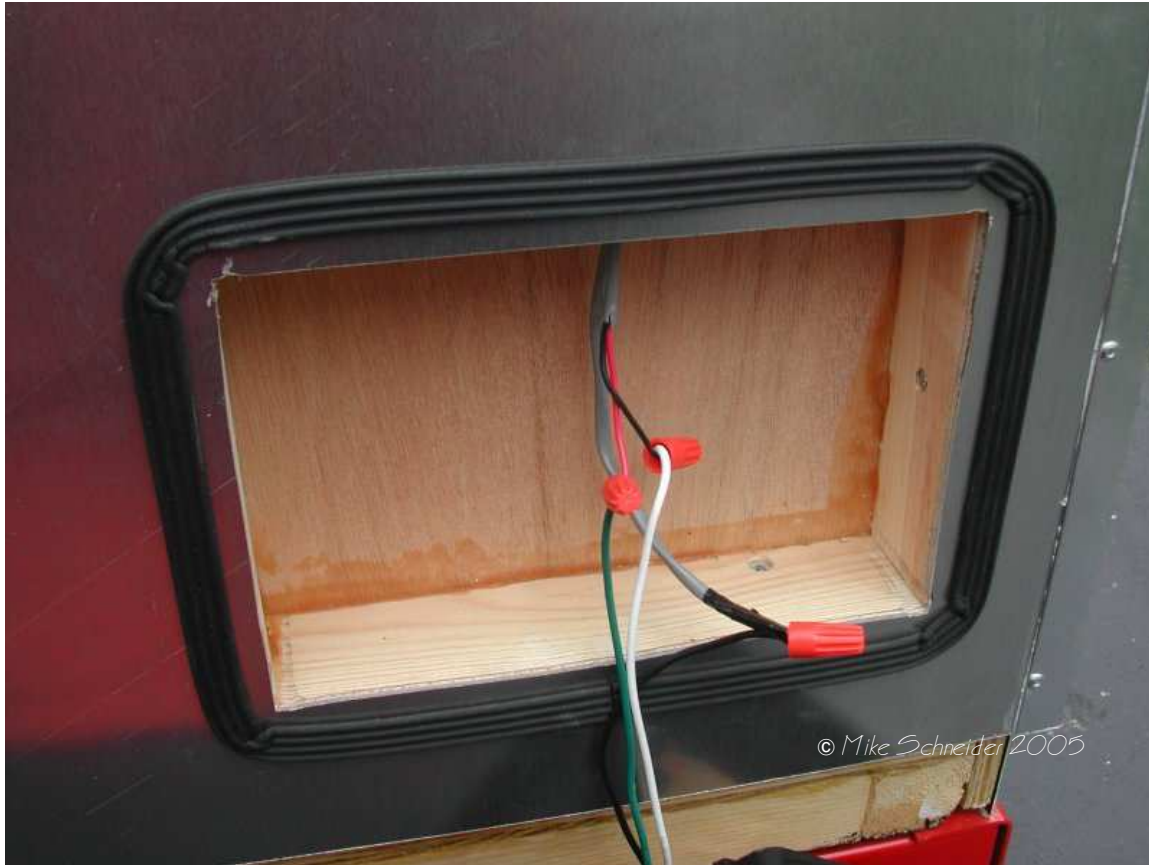
Wire Function	Wire Color
RIGHT TURN & BRAKE LIGHTS	GREEN
LEFT TURN & BRAKE LIGHTS	YELLOW
TAIL LIGHTS	BROWN
GROUND	WHITE
BACKUP LIGHTS (OPTIONAL)	RED (6 PIN PLUG REQD)

Don't forget to run a brown and white wire to your license plate light.

Finally, skin the inside of the hatch, pulling your wires thru before gluing your skin down.



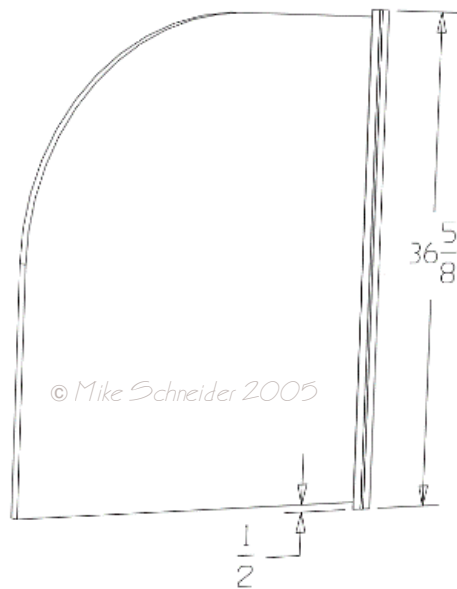
On the other side, connect your tail lights. Put some weatherstripping around the opening, and attach your tail lights. (I ignored the backup light portion of the taillight, but if you are running a 6 pin plug from your tow vehicle, you could hook that up as well.)



Step 21: Build the doors – 3/4" birch plywood

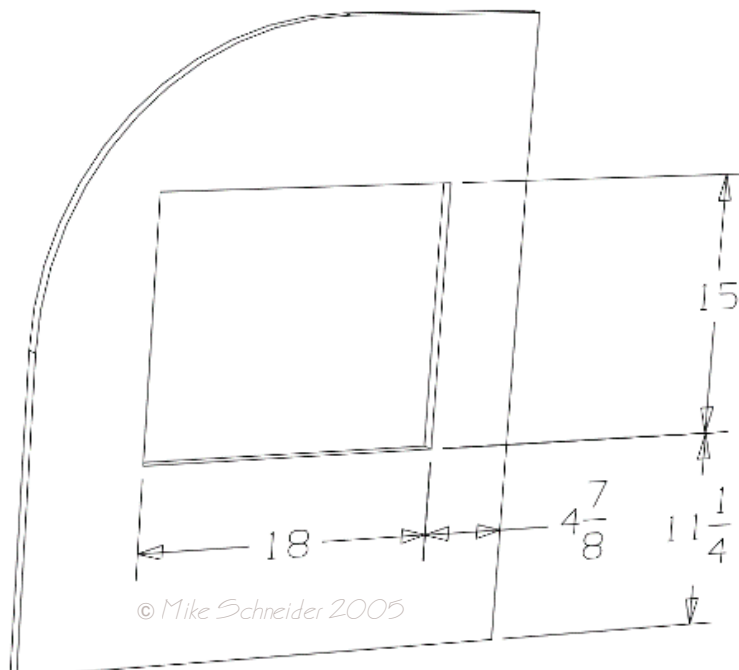
You cut out the doors already in step 4. Now it's time to finish them.

You want to end up with a 1/8" gap all around the door, after the T-molding has been installed. So your finished door size needs to be 3/8" less than the opening size, both vertically and horizontally. The easiest way to get your door to size is to rip off the appropriate amount off of the straight edges using your table saw. Hang the door with your stainless steel hinge and test for fit. The hinge should extend beyond the top and bottom of the door by 1/2".



Step21fig1

With your doors properly sized, cut out the opening for the window.

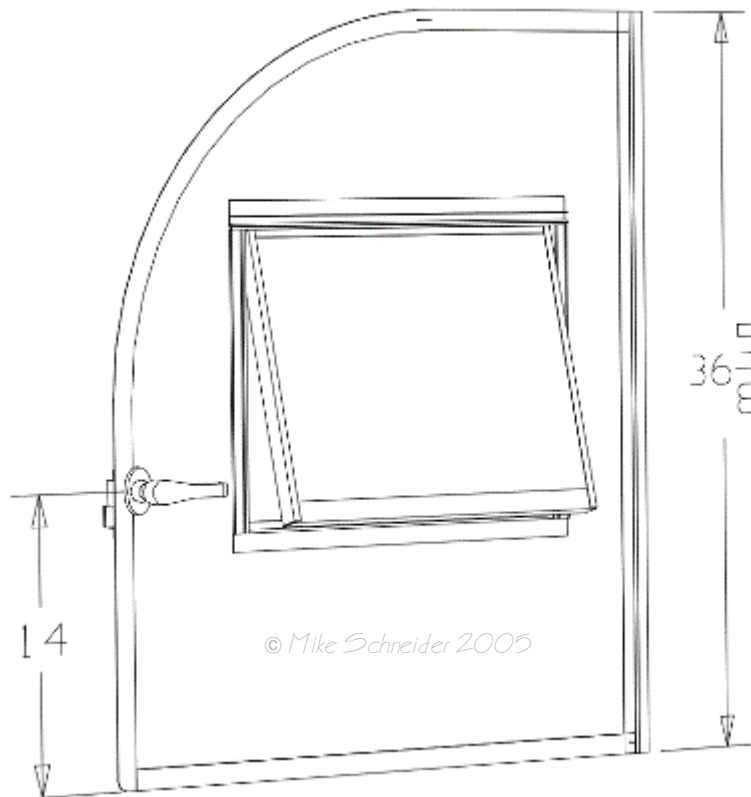


Step21fig2

Stain and polyurethane the inside surface of the door to match the cabin. Paint the outside and the edges with CPES and Uniflex.

Bend some deadsoft T-molding around the edge and fasten it with stainless steel flat head screws. Also fasten a straight length along the bottom edge. Attach a stainless steel hinge along the long vertical edge. Install your door handle. I notched out the T-molding with a grinding wheel for the door handle. Finally, install a window in the opening, with a good bead of silicone caulk for water proofing.

Your door should now look like this.



Step21fig3

Hang the door on the body with stainless steel flat head screws. Pick a length that won't break through the inside of the wall

- Install hatch latches
- Install roof vent
- Install interior lights
- Install porch lights
- Install running lights
- Install rain diverters
- Install aluminum backsplash
- Install gas struts
- Install stove
- Install propane
- Install battery
- Install tongue chest