

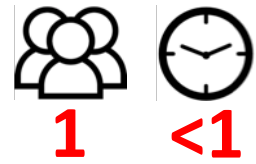


# Puur 17 Assembly Manual

## Chapter 2 Jig, Skeleton, and Hull Panels



## 2.1 ASSEMBLE THE JIG



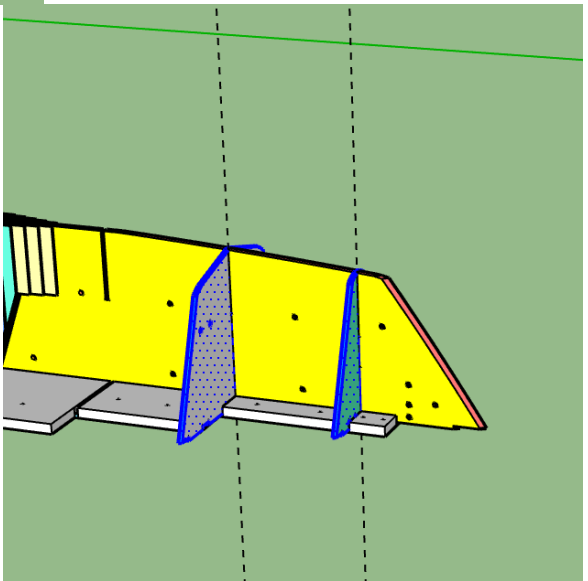
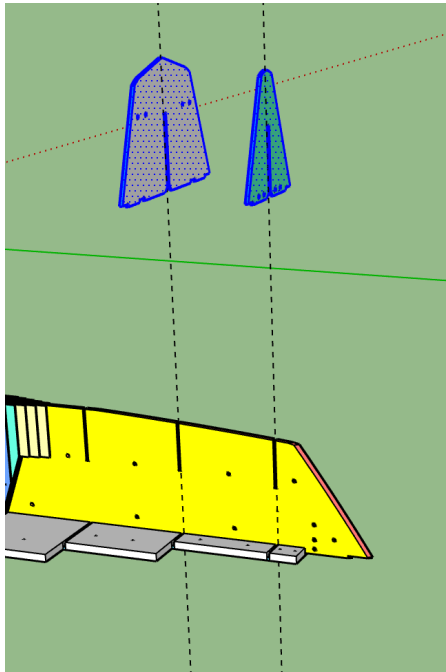
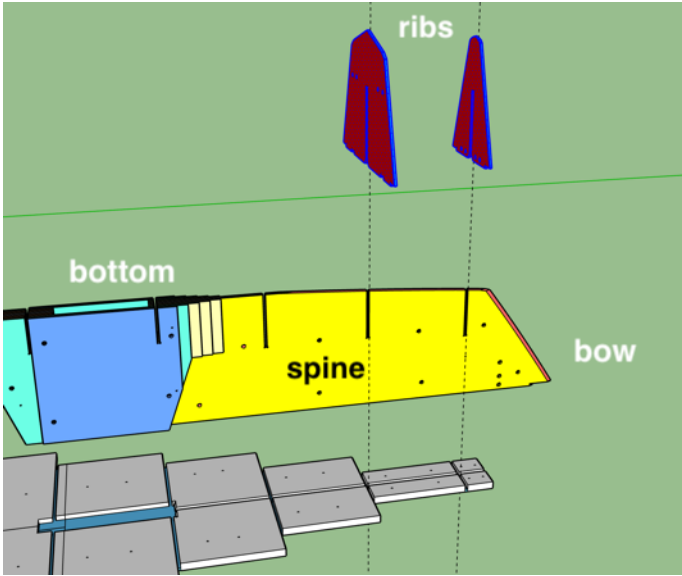
### Background

The SnapTrue Jig from Puur is precision-manufactured to hold the skeleton of your boat true in all three dimensions while you attach the hull panels to the skeleton. From that point, the hull and skeleton will be a self-supporting rigid structure which will be true in all three planes. You will have a true, fair, and symmetrical boat.

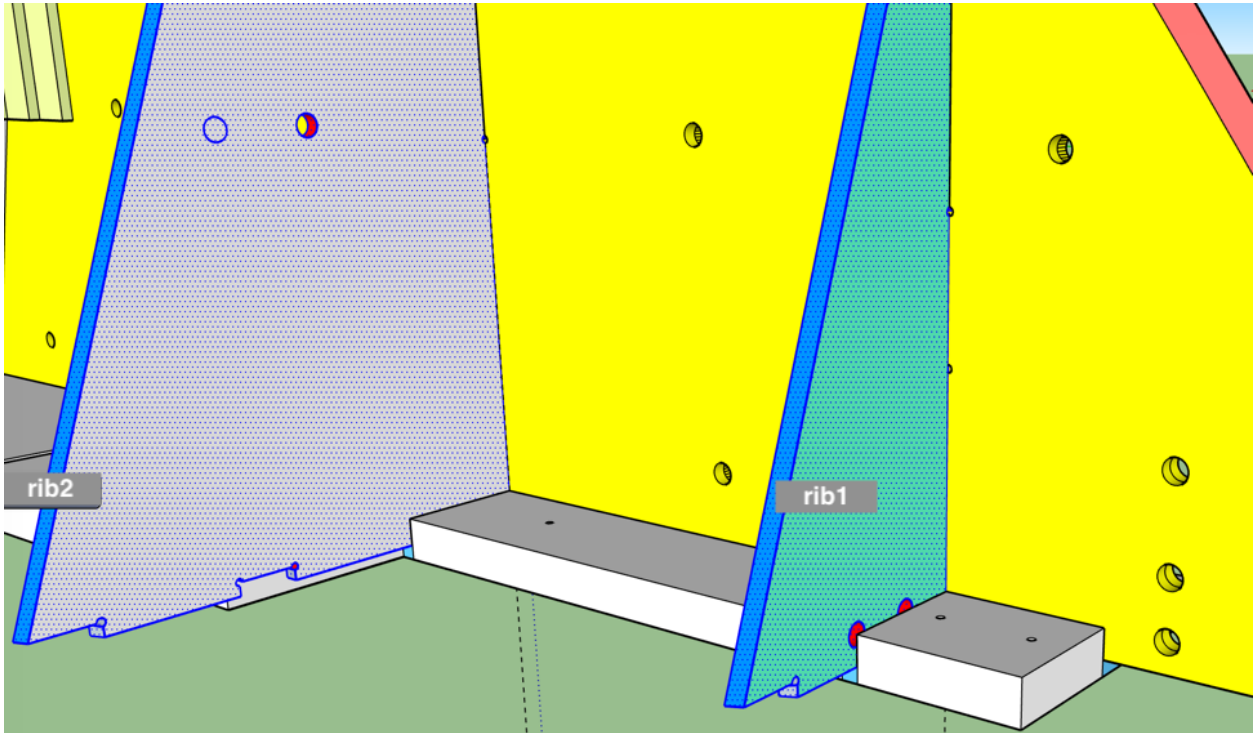
The SnapTrue Jig is a set of 3 MDF sheets that have deep longitudinal and lateral slots milled into them, slots which have been precision-milled at the perfect locations for the ribs and spine of your boat.

With the SnapTrue Jig installed on a planar table, you simply insert the spine assembly (upside down) into the longitudinal slot, and the jig will hold it perfectly aligned while you then insert the ribs into (a) slots in the spine and (b) transverse slots in the jig.

The following images illustrate how this process works. Detailed instructions will follow this overview.







## Procedure

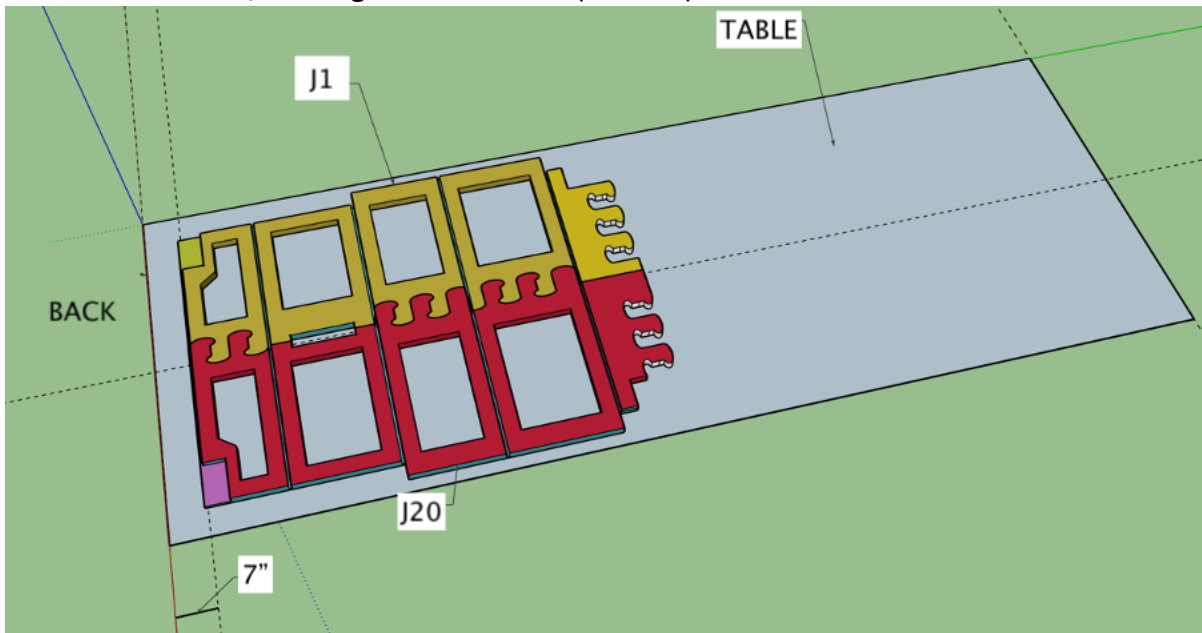
1. Prepare the Table
  - a) Since the table was used already during the pre-lamination steps, take time to clean it up well now.
  - b) Inspect the table for anything (glops of epoxy, screws, splinters, etc.) protruding from the top surface where the jig will be attached. Remove any such protrusions.
  - c) Re-check that the top surface of the table is still level, and correct it if not.
2. Measure for Jig Location on Table
  - a) Select the end of the table toward which you want the bow of the boat to face during constructions. This is generally the end with the most space beyond the table, because the bow of the boat will hang off the table by about 6" (150mm) when the hull is finished.

For reference, we'll call the end of the table where you want the bow the FRONT of the table and jig. The opposite end will be called the BACK. If you stand at the back and face the front of the table, the left side of the table/jig we will call LEFT, and the opposite of that will be called the RIGHT. Later, when we're referring to the hull in the jig, we will always refer to the PORT or STARBOARD side of the hull. But, tables are not boats, so it's FRONT/BACK/LEFT/RIGHT for the table and jig.

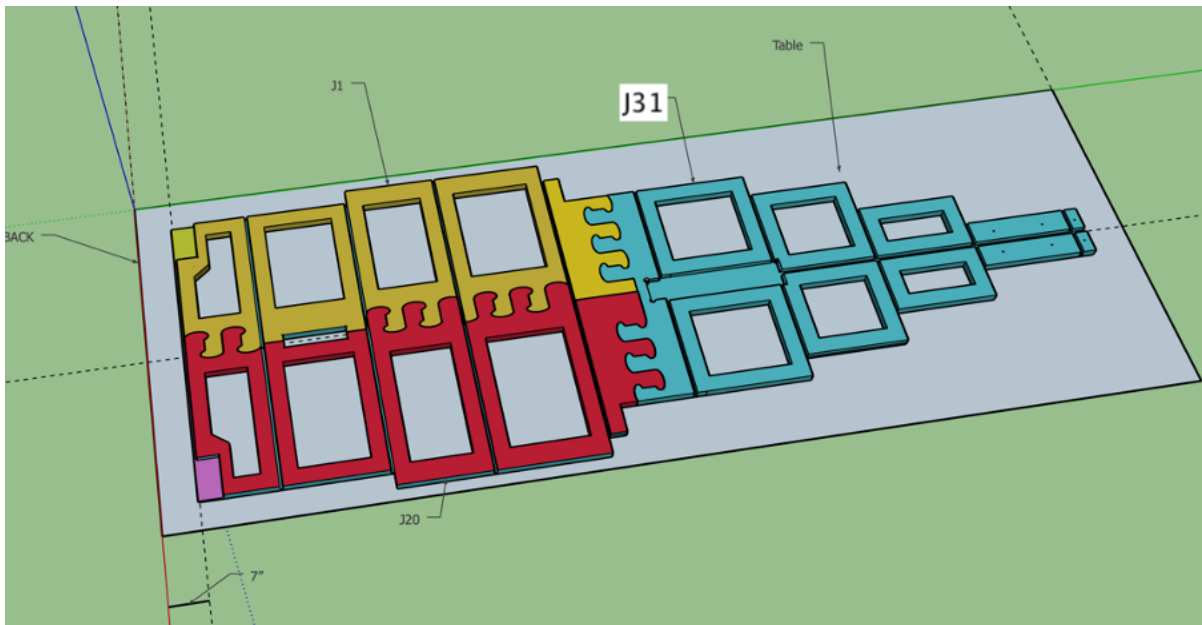
- b) Go to the back of the table, and use a sharpie to mark a line 7" (170mm) from the end of the table. This is the guideline for the back edge of the jig. When the jig is placed on the table, be sure the back edge of the jig is aligned with this guideline. This will ensure that you have enough room to move around the hull after the hull is complete.

3. Assemble the Jig

- a) The Jig is composed of three parts: left, right, and forward.
  - i. The part numbers are J-1, J-20, and J-31. Locate these parts now.
- b) Standing at the back of the table looking toward the front (where you want the bow of the hull, J-1 and J-20 should be oriented with the as shown in the diagram below. Lay J-1 on the table, then press J-20 into J-1 like jigsaw puzzle pieces.
- c) Then move the two-part assembly to the desired location: on the longitudinal centerline of the table, and aligned with the 7" (170mm) offset from the back of the table.



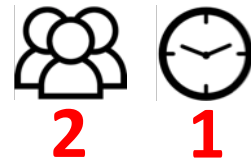
- d) With the first two pieces of the jig in position, insert J31 simultaneously into the first two, as shown below.



- e) Use a long level to check that the jig is planar, both longitudinally and laterally at each slot. The level should not rock back and forth, and there should not be a gap under the center of the level.
  - i. If it is not level, there are two possible causes. First, the table is not level. So, remove the jig, and recheck the table for level. Adjust as needed.
  - ii. Otherwise, it is also possible that the jig material has gotten warped slightly. This is rare, but in most cases the weight of the skeleton is sufficient to press the jig back into planar connection with the table. Place something weighing approximately 10# on the jig in any locations where it is elevated off the table, then recheck the level of the jig. If this does not remedy any warping, you will have to use screws to pull the jig down to planar connection with the tabletop. If you must use screws, be sure to re-check that the jig is planar AFTER inserting the screws.
- f) As a final step, recheck the alignment of the jig vs. the table – centered left-to-right, and aligned with the 7" (170mm) offset at the back side of the table.

That's it. You're done. The jig is ready to go.

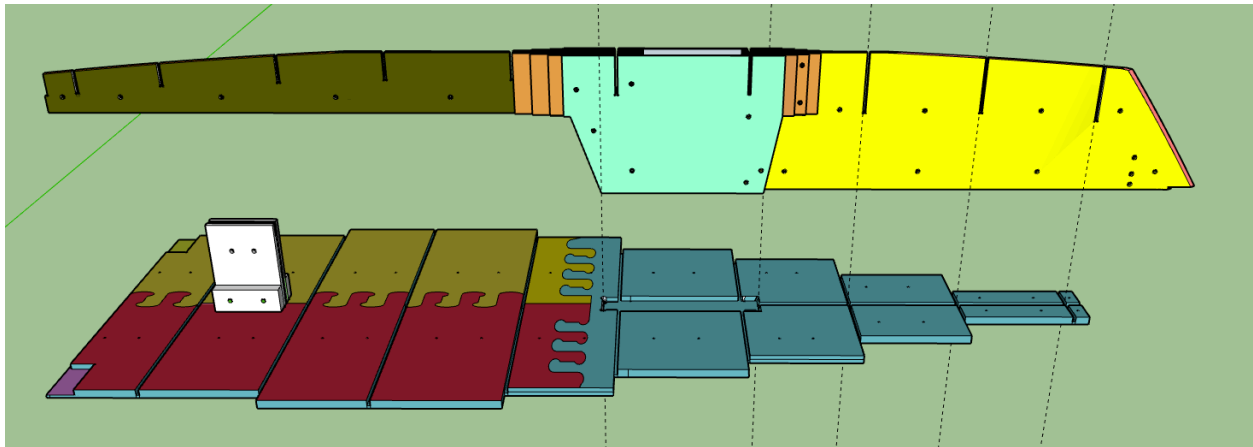
## 2.2 INSTALL SPINE INTO JIG



### Background

***Do not attempt this step alone.  
You will likely damage the jig and may hurt yourself as well.***

It is essential that the spine sit fully inserted into the longitudinal slot in the jig. That is, the spine must rest flat in the bottom of the jig without rocking longitudinally OR laterally. This section will walk you through the process of properly installing the spine into the jig.



### Procedure

1. If the Aft Spine Stand is in the jig, remove it from the jig now.
2. Double-check that the top of the spine is flat, without any globs of epoxy remaining from the pre-lamination stage. If you forgot to do this cleanup earlier, take care of it now. The top of the spine assembly should be flat and at a 90 degree angle from the sides of the spine assembly.
3. As shown in the illustration above, invert the spine and insert it into the jig (without the spine stand in the jig). The middle of the jig has a large rectangular depression running along the longitudinal centerline; this indentation is designed to accept the wide keel box area of the spine. Align the spine to this keel box indentation in the jig.
4. The spine should rest completely flat in the bottom of the jig, from the keel box all the way forward through the tip of the nose. The spine should not rock forward/aft in the jig. Use a square to validate a 90 degree angle between the jig surface and the spine.
5. If the spine is binding on the sides of the jig slots at any points, the solution is to identify the binding points and carefully sand the walls of the jig (and/or the sides of the spine assembly) at the binding points.
6. When the spine is resting flush in the bottom of the jig along the full length of the spine from keel box to nose, the first part of the Test Fit is successful. Do not proceed until you accomplish this result. Precision here will yield great returns in the finished product.

7. Once you are satisfied with the first part of the Test Fit, remove the spine and replace the Aft Spine Stand into the jig.
8. Re-test the fit of the spine in the complete jig assembly. The spine should sit flush in the bottom of the jig from the keel box forward, AND it should sit flush in the bottom of the fork of the Aft Spine Stand as well.

***Do not proceed until the spine rests flush in the bottom of the jig and in the Aft Spine Stand. This is a critical alignment.***

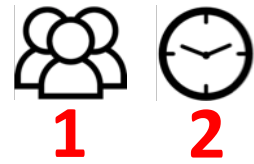
9. Remove the spine from the jig.
10. It is likely that some epoxy will drip down the spine during assembly, so we need to take precautions to prevent bonding between the spine to the jig.

Cut a piece of plastic sheet roughly 10' (3m) long and roughly 5" (125mm) wider than the widest part of the longitudinal jig slot into which you've been inserting the spine. Place this plastic sheathing over the jig slot from the forward edge of the jig to the middle of the jig.

Cut a 1' x 1' (0.3m x 0.3m) square piece of plastic and insert it into the upward facing fork of the Aft Spine Stand, to prevent accidental bonding here, too.

11. Re-install the spine into the jig and Aft Spine Stand, over the plastic sheets.
12. Double-check that no wrinkles in the plastic are preventing the spine from sitting flush in the bottom of the jig and Spine Stand.
13. Trim the left and right sides of the longitudinal plastic, such that the plastic only extends about 1" (25mm) beyond the top of the jig.

## 2.3 DRY FIT RIBS TO SPINE AND JIG



### Background

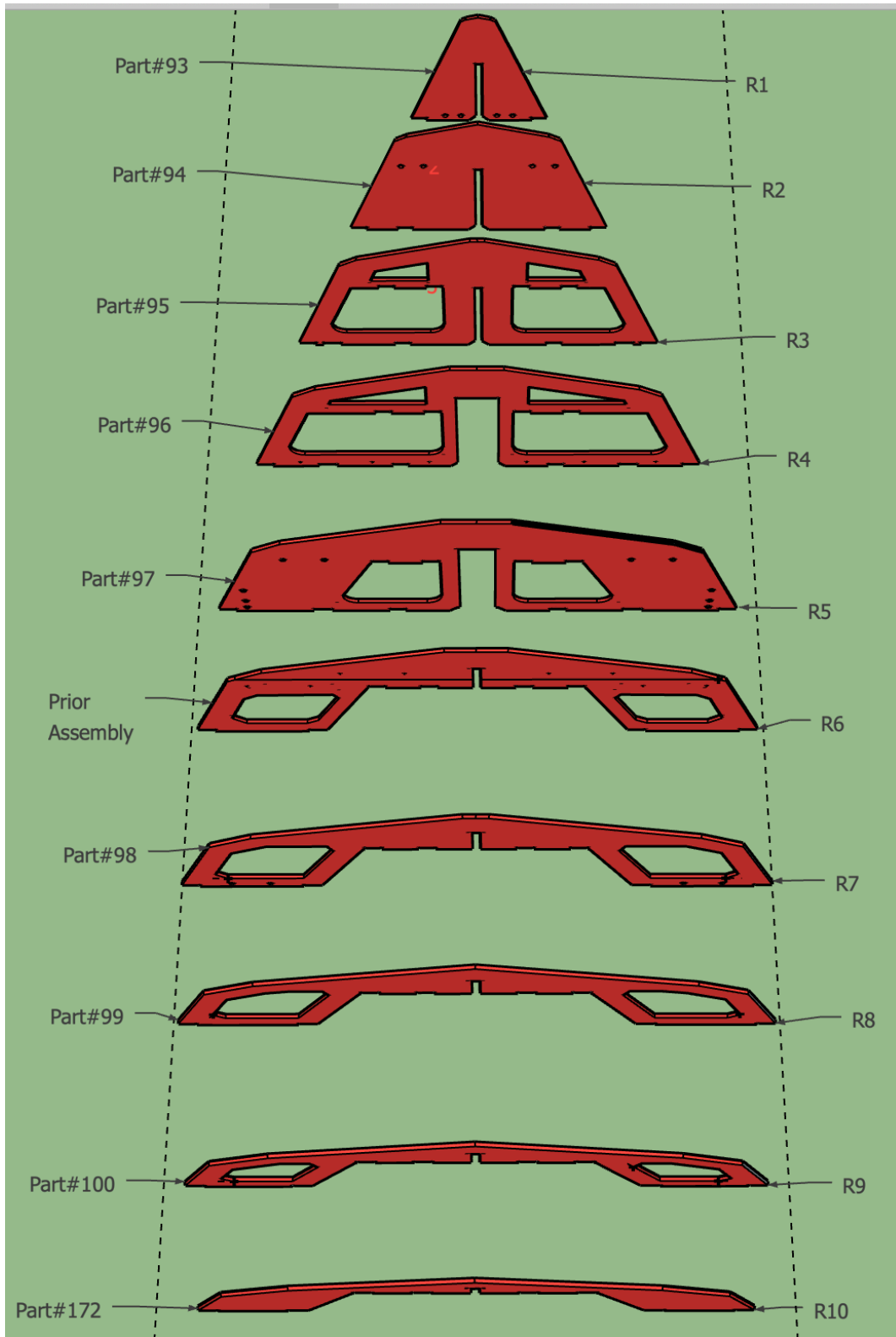
Each of the 10 ribs has a central notch that will mate precisely with a notch in the spine.

The ribs are beveled to match the curvature of the hull, and this means that it is essential to orient each rib properly. For Ribs 1-5, the part number is written on the FORWARD face of the rib, so be sure that you always face the part number on Ribs 1-5 toward the front of the hull. To avoid mistakes, we recommend you now use a sharpie to mark the word “FORWARD” next to the part number on Ribs 1-5.

For Ribs 7-10, the part number is written on the AFT face of the rib, so be sure that you always face the part number on Ribs 7-10 toward the back of the hull. To avoid mistakes, we recommend you now use a sharpie to mark the word “AFT” next to the part number on Ribs 7-10.



1. Locate all the ribs. The part numbers and order are shown in the diagram below.





2. With the spine already in the jig atop its plastic protection, invert Rib3 and insert it into the third spine slot from the front of the spine. Be sure the Rib3 part number is facing the FRONT of the spine.

The rib should slide firmly but smoothly into the spine slot. When the flat top surface of the rib reaches the jig, you may have to guide the edges of the rib gently into the slot, since the rib may have slight natural warping. Gently guide the flat surface of the rib into the lateral slot while pushing the rib down into the spine slot. You will feel the rib bottom-out in the jig slot, and you will see that the bevels on the rib match perfectly the bevels on the spine at their intersection, as shown in the image below.



### **Problems and Resolutions**

- a) If the rib is inserted completely into the spine but does not bottom-out in the jig it will rock from side to side. This means one of the following:
  - i. You may have not gotten the spine properly inserted into the jig. Remove the rib, and recheck to ensure that the spine is fully flush with the bottom of its jig slot across the entire length from the keel box to the nose. Adjust plastic, deburr the mating surface of the spine, etc.
  - ii. You may have some extraneous material (splinter, epoxy, etc) inside either/both the slot in Rib 3 or inside the matching slot in the spine. Remove the rib, inspect, and remove any material impeding the slots from fully inserting into each other.

- iii. Your jig installation is not planar. Remove the spine from the jig. Place a level laterally across the jig at the position of Rib 3, and observe if it rocks side to side – which indicates the center of the jig is higher than one or both sides of the jig at this location. Return to the jig installation/adjustment section until you have a completely planar jig.
- b) If the rib bottoms-out in the jig slot but its bevels protrude above those in the spine where the rib bevels meet the spine bevels, that means one of the following:
- i. You may have some extraneous material (splinter, epoxy, etc) on the top flat surfaces of the rib's wings. Remove the rib and clean off any extraneous material.
  - ii. You may have some extraneous material inside the lateral slot in the jig. Remove the rib and vacuum out the slot.
  - iii. Your jig installation is not planar. Remove the spine from the jig. Place a level laterally across the jig at the position of Rib 3, and observe if there is a gap under the center of the level – which indicates the center of the jig is lower than one or both sides of the jig at this location. Return to the jig installation/adjustment section until you have a completely planar jig.
- c) If the rib aligns with the spine where their bevels intersect, and if the rib bottoms-out on one side at a time but not both simultaneously (that is, if the rib rocks laterally slightly), that means one of the following:
- i. You may have not gotten the spine properly inserted into the jig. So, remove the rib, and recheck to ensure that the spine is fully flush with the bottom of its jig slot across the entire length from the keel box to the nose and that the walls of the spine are square to the horizontal surface of the jig.
  - ii. Your jig installation is not planar. Remove the spine from the jig. Place a level laterally across the jig at the position of Rib 3, and observe if there is a gap under the center of the level – which indicates the center of the jig is lower than one or both sides of the jig at this location. Return to the jig installation/adjustment section until you have a completely planar jig.

3. Once you have Rib3 fit properly – the rib bevels match the spine bevels, the tops of the rib are firmly flush against the bottoms of the lateral jig slots, and the rib does not rock side to side – repeat the rib-to-spine/jig insertion process for each of the remaining ribs.

**REMINDER:** For Ribs 1-5, the part number must always face FORWARD. For Ribs 7-10, the part number must always face AFT. You will have already marked the word “forward” on the forward surface of Rib 6. It is essential that you fit the ribs in the proper orientation.

***Take your time. Precision here will yield great returns later. Do not proceed until you have excellent fit between spine, jig, and all ribs.***

4. Remove the ribs from the spine.
5. Insert plastic strips into the lateral jig slots for each rib on each side of the table, to prevent bonding the ribs to the jig during epoxy work. Each strip should be approximately 2” (50mm) wider than the slot itself, and each should be long enough to cover the full length of the jig slot from the spine to the outside edge of the jig. Use 2 separate pieces for each rib, one on each side of the spine.

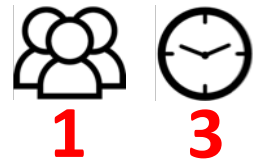


6. Re-install the ribs, on top of the plastic in their slots. Work out any wrinkles that prevent them from sitting flush in their slots and aligned with the spine. Double check that the rib plastic overlaps slightly the spine plastic.
7. Re-check all rib alignments – rib tops bottomed out in jig slots, no rib rocking from side to side, and rib bevels aligned with spine bevels.
8. Now remove all the ribs from the spine again.

**NOTE:**

We recommend you use FAST hardener for all the epoxy procedures to follow in this chapter.

## 2.4 EPOXY RIBS TO SPINE



### Background

Do not do this step for ANY ribs until ALL ribs are properly dry fit in the previous step.

Read this entire section prior to beginning work. You should be familiar with the entire process before starting the first step. You should view two related videos in Chapter 2 of the user forum Assembly Techniques library: Installing Ribs into Spine, and Epoxying Half-Lap Joints.

It is essential that you orient each rib properly before epoxying it to the spine in this step. Failure on this point will result in **complete failure of the kit**. Check the orientation of each rib twice before bonding.

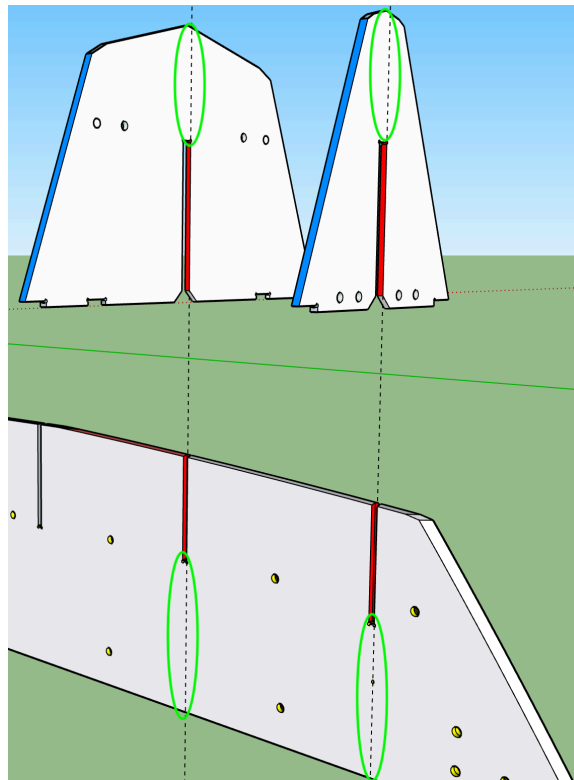
For Ribs 1-5, the part number faces FORWARD.

For Ribs 7-10, the part number faces AFT.

For Rib 6, the word “forward” faces FORWARD.

When it is time to epoxy each rib (not now), you will apply epoxy on two types of surfaces:

- a) **Notches:** You will apply epoxy to all the interior surfaces of the rib notches and spine notches, which are shown in red for Ribs 1&2 (for examples) in the diagram below. **Note that you will also apply epoxy to the small horizontal surface inside each notch, which is hard to see in the diagram below.**
- b) **Faces Where Notches Mate:** You will also need to apply epoxy to the mating surfaces that will be inserted into the slots. These mating surfaces for Rib2 1&2 (for examples) are circled in GREEN in the diagram below. **Note that the reverse sides of each panel will also be mating surfaces. You will apply epoxy on the reverse sides also.**





You must complete each rib's installation completely before proceeding to the next rib. Do not attempt to work on multiple ribs simultaneously.

However, it is not necessary to complete the installation of all ribs in the same work session. You can divide the 10-rib job across several days, to maintain your focus. **Failure to follow instructions during this work will result in a total loss of the hull skeleton.**

### Procedure

- 1) Begin with Rib 5, which is part number 97.
  - a) Brush a light coat of unthickened epoxy inside the rib notches, inside the associated spine notch (fifth from the front), and on the mating surfaces of both the rib and the spine.  
Take your time, and count carefully. **Installation of a rib in the wrong slot will result in complete failure of the kit.**
  - b) After a few minutes, repeat the first step with a second coat of unthickened epoxy.
  - c) After a few minutes, mix a small batch of epoxy thickened with 405 filleting blend. Use a piping bag or stir stick to spread a thick coating on the surfaces and edges you previously coated with unthickened epoxy.
  - d) Double-check the orientation of the rib.

**For Ribs1-5, the part number faces forward. Installation of a rib in the wrong orientation will result in complete loss of the skeleton.**

- e) Insert the rib into the associated slot in the spine, and guide it carefully into the bottom of the slot in the jig. Remove wrinkles from the plastic in the jig notches for this rib, so the rib can sit flush in the bottom of the slot.

**Be sure the plastic covers all potential mating surfaces between the jig and the rib, on both sides of the spine. If the ribs are bonded to the jig, the skeleton may be lost.**

- f) Make sure the rib is properly seated flush in the bottom of the jig slot and flush in the bottom of the spine slot, just as during your dry fit procedure. The bevels on the rib should align perfectly with the bevels on the spine.
- g) Use a gloved finger or a rounded mixing stick to smooth out the thickened epoxy that bleeds out of the notches into the angle between the rib and the spine. Make a small fillet in the corner, roughly  $\frac{1}{2}$ " (12mm) radius. See the image at right.

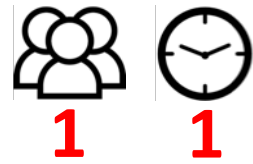


- h) Use a clean spreader to scrape off excess epoxy from the panels adjacent to the fillets above.
- 2) Repeat the above process for Ribs 4, 3, 2, and 1. For each of these ribs, the part number faces FORWARD.
- 3) Repeat the above process for Rib6, being careful that to orient the rib such that the word "FORWARD" faces forward.
- 4) Repeat the above process for Ribs7-10, EXCEPT that for Ribs7-10 the part number faces AFT.
- 5) Allow all the rib-spine installations to cure for at least 12 hours before proceeding.

**IMPORTANT:** Pay careful attention to the FORWARD/AFT orientation of each rib.  
Installation of a rib in the wrong orientation will result in complete failure of the kit.

**IMPORTANT:** Pay careful attention to the part numbers.  
Installation of a rib in the wrong spine slot will result in complete failure of the kit.

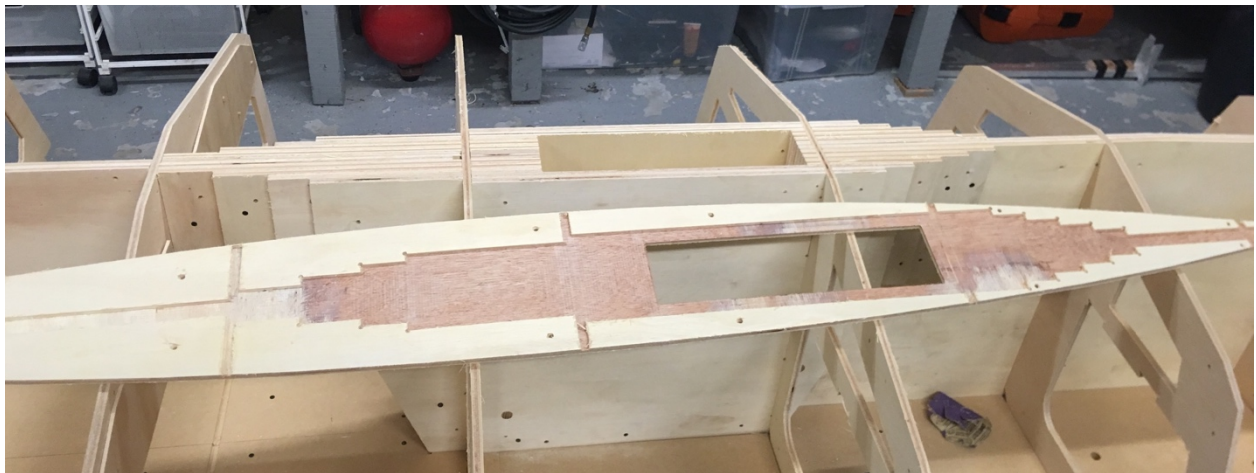
## 2.5 THE "FOOTBALL"



### Background

The Puur17 has a small flat section at the bottom of the hull, directly under the spine. We call this part the football because of its shape. There are four purposes of this section:

- a.) It serves as an upper jig aligning the spine and ribs. There are slots and intrusions carved into the football to allow it to fit tightly over the spine and ribs, holding them in proper relative position to each other.
- b.) It serves as a guide to ensure proper alignment of the curved hull panels that will be attached later adjacent to the football.
- c.) It provides a stable base for the hull when flipped upright for deck assembly.
- d.) It provides a strong and stable base for the hull to rest on a horizontal trailer bunk, transferring trailering loads directly up into the spine, rather than through the hull panels.



### Procedure

- 1) First, dry fit the football onto the skeleton. The football contains slots that will allow you to press the football down firmly onto the vertical terminations of the spine and ribs. The fit is firm, but it must go all the way down to fit flush.



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- 2) If the slots in the football do not fit completely flush onto the spine and ribs, there may be some extraneous material on the spine surfaces, the rib surfaces, or inside the slots on the football. Clean all these areas again, and refit the part.
- 3) You may need to use a rubber mallet to tap the football into place. When it fits properly, it will be flush to the spine along the entire length of the football, and it will fit flush the full width of each rib it intersects.

Do not use a hammer directly on the panel, as you will damage it. If you must use a hammer instead of a rubber mallet, place a spare piece of plywood over the panel, and hammer the spare piece rather than the panel itself.

Take your time and get it right. Proper installation of the football is critical to the alignment of the hull panels that will be installed later.

- 4) Once you have the football fitted properly, mark its perimeter outline on the ribs and spine. These marks are the outer boundaries for epoxy application in the next steps.
- 5) Remove the football.
- 6) Brush a coating of unthickened epoxy onto the mating surfaces of the football – all the inset areas where the spine and ribs fit – as well as the mating surfaces of the ribs and spine inside the perimeter outline you marked.

Be sure to coat  $\frac{1}{2}$ " (12mm) of the vertical surfaces of the ribs and spine, in addition to the horizontal surfaces, because the notches in the football will wrap and cover some of the rib/spine vertical surfaces.

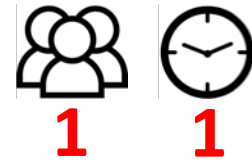
- 7) After a few minutes, repeat the previous step.
- 8) After a few minutes, mix a batch of 403-thickened epoxy. Spread it evenly on the previously-coated areas of the football.

- 9) Press the football into position over the spine and ribs. Tap it firmly into place with a rubber mallet to tap very firmly to ensure complete seating. Check the full perimeter of the football to ensure that it is uniformly seated and level longitudinally and laterally.
- 10) Use a nail gun and  $\frac{3}{4}$ " (19mm) composite nails to nail the football to the spine every 6" (150mm) along its length, as well as to the mating sections of Ribs 3, 4, and 5. Be sure to insert nails on both the port and starboard sides of the keel slot opening.



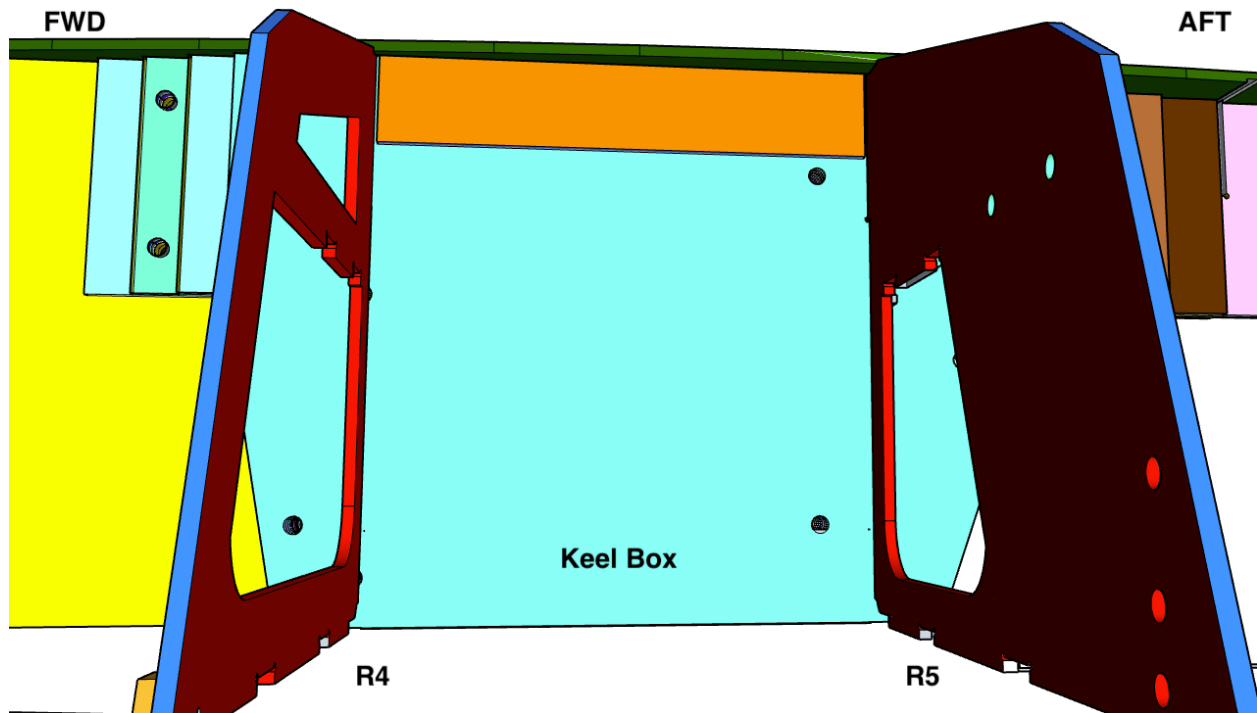
- 11) Use a gloved finger or a rounded mixing stick to smooth out the thickened epoxy that bleeds out into the 90-degree angles between the football and the spine or ribs. Make a small fillet in the corners, approximately  $\frac{1}{4}$ " to  $\frac{1}{2}$ " (6-12mm) radius.
- 12) Use a clean spreader to scrape off excess epoxy from the panels adjacent to the fillets above. Wiping the spreader off with an acetone-wetted rag between each pass will help produce a tidier result.
- 13) Allow this installation to cure for at least 12 hours before proceeding.

## 2.6 INSTALL LOWER KEEL BLOX BLOCKS



### Background

The keel box will be reinforced with 2 blocks on each side, one at the hull bottom where the box meets the football, and one where the box meets the deck (this side is currently in the jig). In the current procedure, you are going to install the bottom block only, which is shown in orange in the diagram below. It will fit in the gap between R4, R5 and the Football (green in the diagram)



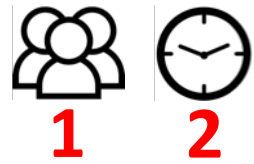
The deck-level blocks will be installed later. Do not install them yet.

### Procedure

1. Locate parts 111 and 188, which are the lower box blocks for port and starboard, respectively.
2. Dry fit the blocks into position, to verify nothing interferes with a flush fit against the wall of the keel box and the surface of the football. Remove any extraneous epoxy clumps from the faces.
  - a. If your fillets were very large, you will need to sand bevels into the corners of the box blocks to clear the fillets.
  - b. Do this for port and starboard installations.
3. Mix a batch of unthickened epoxy.

4. Brush a light coating of epoxy on all mating surfaces and all joints in the area of the installation, including parts of ...
  - a. Rib4
  - b. Rib 5
  - c. Football
  - d. Keel Box
  - e. Box blocks
    - i. Be sure to coat all of the end-grain edges of the box blocks
5. Wait 2 minutes, and repeat the coating of all the surfaces and edges
6. Mix a batch of epoxy, and add 403 adhesive to create a mixture that will not run down the side of the mixing cup.
7. Use a piping bag to lay a bead of the 403 mixture in the joints where the blocks will be installed.
8. Use a spreader to spread a thin layer of the 403 mixture on the mating surface of the blocks.
9. Position the port block flush against the keel box and football. Press the block firmly against both surfaces, and use the nail gun to nail the block in place with polymer nails.
10. Repeat the nailing process for the starboard block.
11. Use your finger or a mixing stick to shape small fillets from the excess epoxy the oozes from the edges of the installation.

## 2.7 INSTALL CHAINPLATE BLOCKS



Do not start this section unless the Rib10/Spine installation has cured for at least 24 hours.

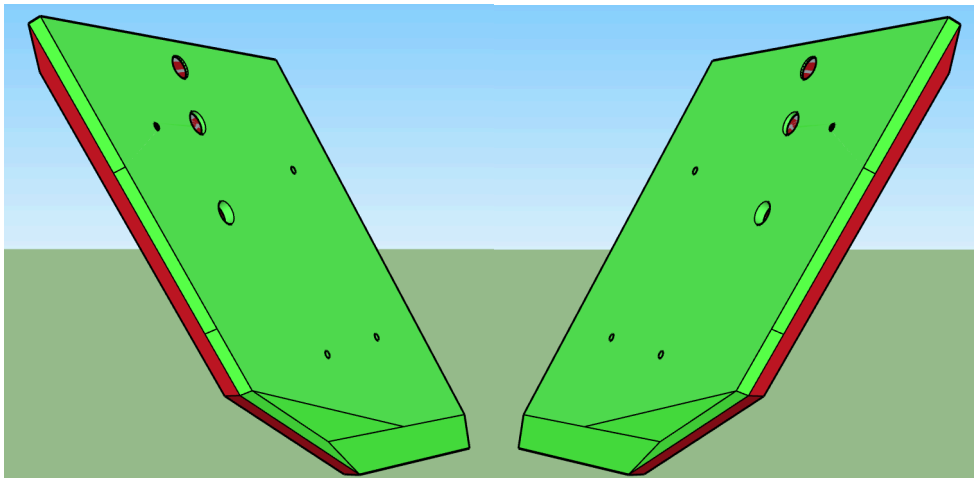
### Background

During the pre-laminations phase, you assembled 7 components that will be used now, in combination with Rib 10 (which has already been installed in the spine).

a.) Three transom panel components:

### **Transom Wings**

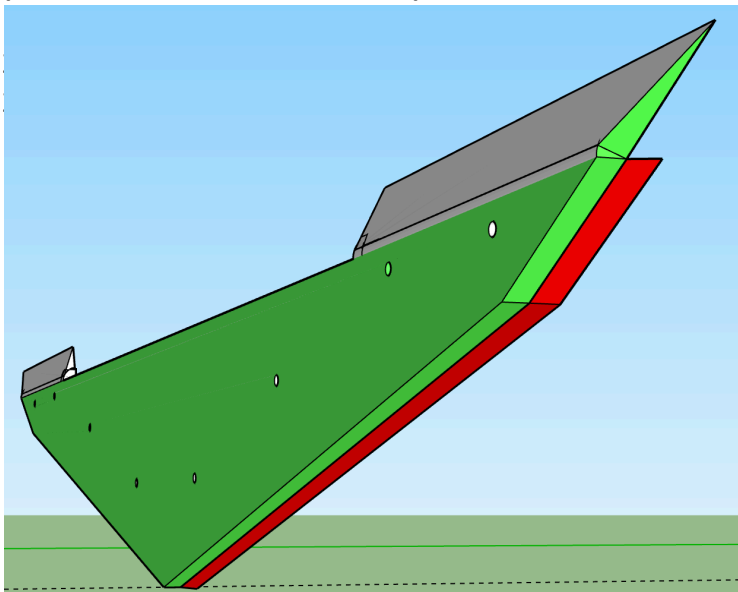
**Port (170 AFT/Green, 168 FWD/Red)**



**Starboard (171 AFT/Green, 169 FWD/Red)**

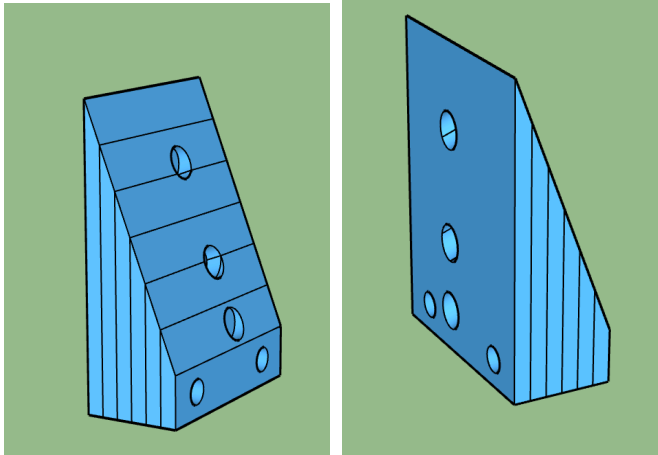
### **Transom Center**

**(167 AFT/Green, 166 FWD/Red)**

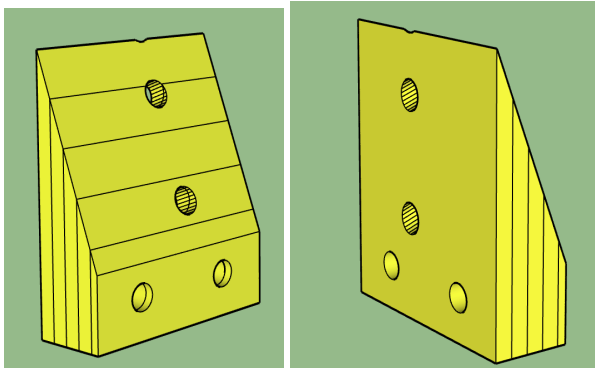


b.) Four backstay chainplate blocks:

Forward Blocks



Aft Blocks



To reiterate, the part numbers composing each of the four assemblies are as follows:

	Port	Starboard
Backstay Chainplate Blocks FWD	152-157	158-163
Backstay Chainplate Blocks AFT	142-146	147-151

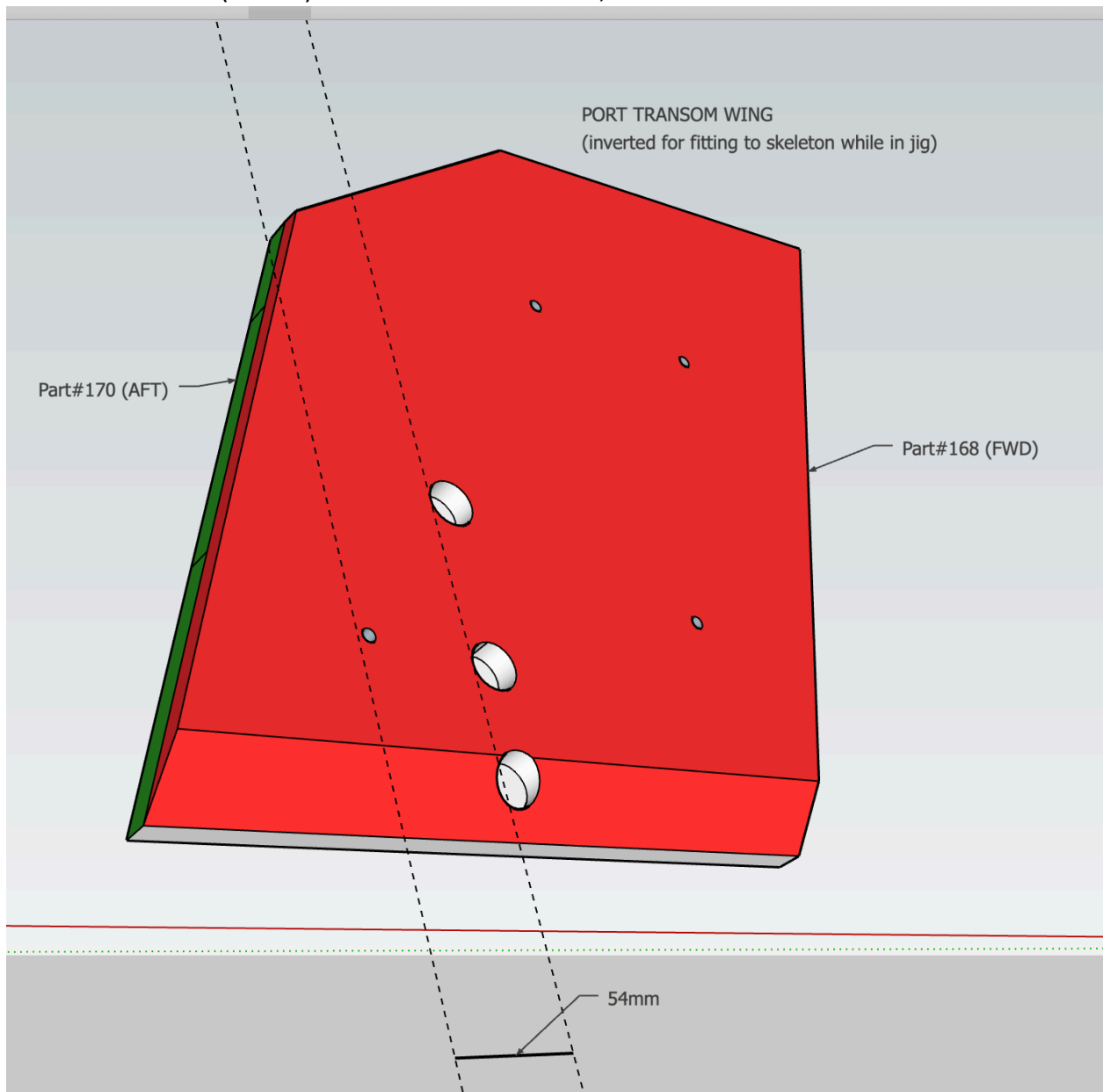
**IMPORTANT:** These parts are NOT interchangeable. Check part numbers carefully, and write "AFT", "FORWARD", "PORT", and "STBD" on the parts so that you do not confuse them during assembly.

### Aft Blocks to Transom Wings

- 1) Locate the Port Transom Wing (parts 168 and 170) and the Port Aft Block (142-146).

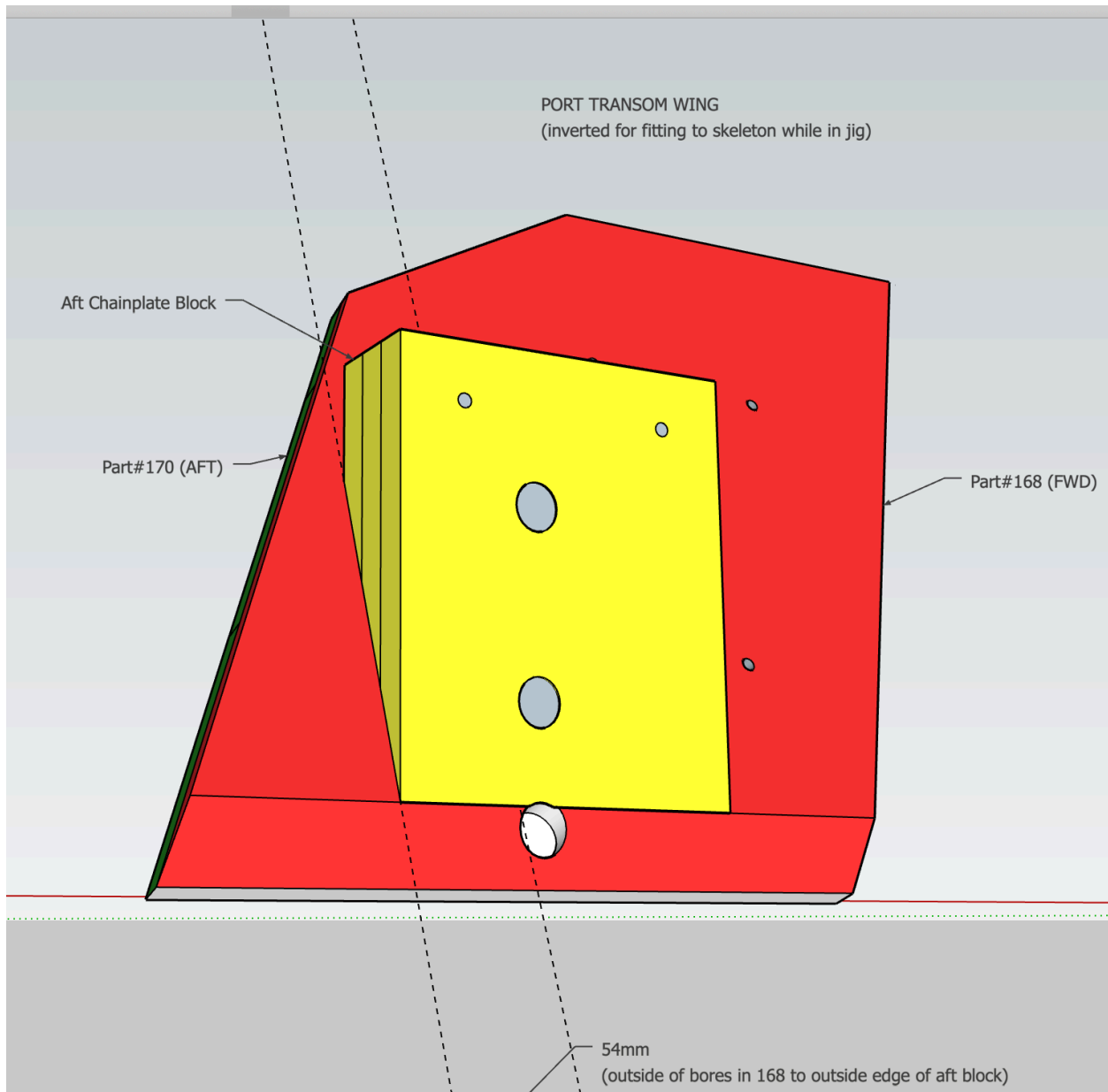
**Note: because the hull is currently inverted, PORT parts will be on the RIGHT side of the skeleton when viewed from the back of the table facing forward.**

- 2) Place the wing on the ground over a piece of plastic sheathing, with Part 170 facing down. To verify correct orientation, check that the upward facing surface contains a large bevel with a large bore drilled through it.
- 3) With a ruler, mark a line tangent to the two bores NOT in the bevel, tangent on the outermost apex of the circles, as shown in the diagram below. Then mark a parallel line a further 54 mm (2.125") outboard of the first line, also as shown below.



- 4) Turn the Port Aft Block upside down, such that the non-beveled side is facing up. Place the beveled side down on the top of the transom wing, such that
  - a) The sharp edge of the block's wedge is aligned along the transom wing's bevel
  - b) The outside corner of pointed end of the Aft Block is located at the intersection of the second marked line and the bevel on the transom wing, as shown in the diagram below.

**NOTE: Don't be confused. The Aft block is attached to the Forward face of the wing.**



The bores in the block should align with the bores in the wing, such that you can see all the way through. The inner surface of the bores will be stepped, due to milling, but there should be a clear  $\frac{3}{4}$ " (19mm) diameter path through the center of the entire assembly, such that you can see all the way through.



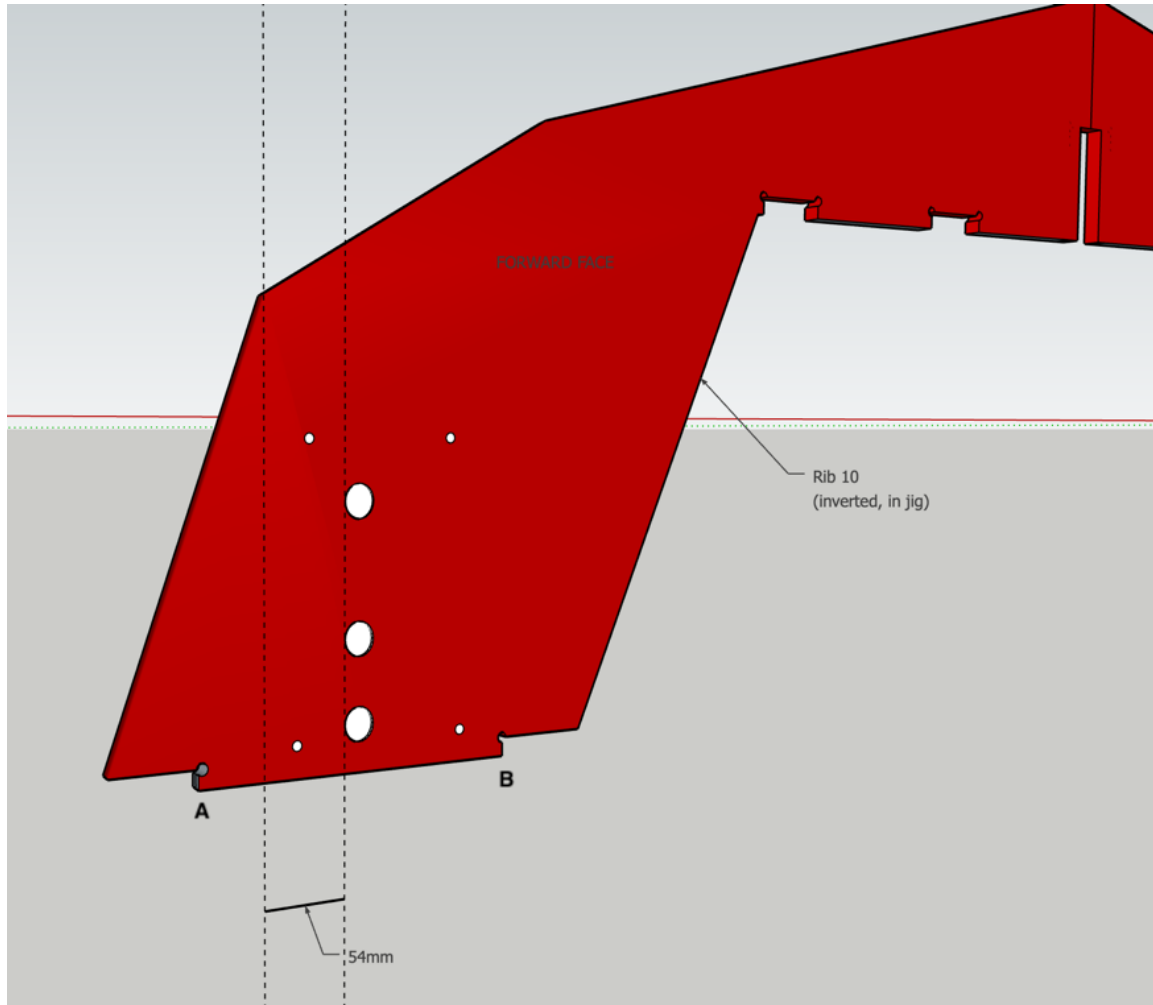
- 5) When you are satisfied with the positioning of the block relative to (a) the guidelines, (b) the bevel on the wing, and (c) the bores, you should use a sharpie to mark the outline of the block on the face of the transom wing.
- 6) Follow the standard procedure for laminating: clean off all mating surfaces of extraneous material or splinters; all mating surfaces receive two light coats of unthickened epoxy, followed by one thin coat of 403 adhesive-thickened epoxy; then place the block on the transom wing in the outlined location.
- 7) While a partner holds the block in place, insert four long wood screws first through the block and then into the wing until tight, to hold the assembly together during bonding.

Verify that the block has not moved during screw-down. If it moved, unscrew it and repeat the process until the block is screwed down in the proper position.

- 8) Clean ALL epoxy off the bevel of the transom wing.
- 9) Use a gloved finger to create a fillet around the remaining perimeter of the block where it meets the wing.
- 10) Leave the assembly flat on the plastic to cure for 12 hours.
- 11) Repeat the process for the Starboard wing and block, being sure that Part 171 is face-down on the plastic.
- 12) After 12 hours of cure, remove wood screws, tape the bottom of the screw holes, and fill screw holes with unthickened epoxy using a syringe.
- 13) Allow the fills to cure for another 12 hours, then remove the tape. Sand off extraneous epoxy around the fills, to leave a flat surface.

### Forward Blocks to Rib10

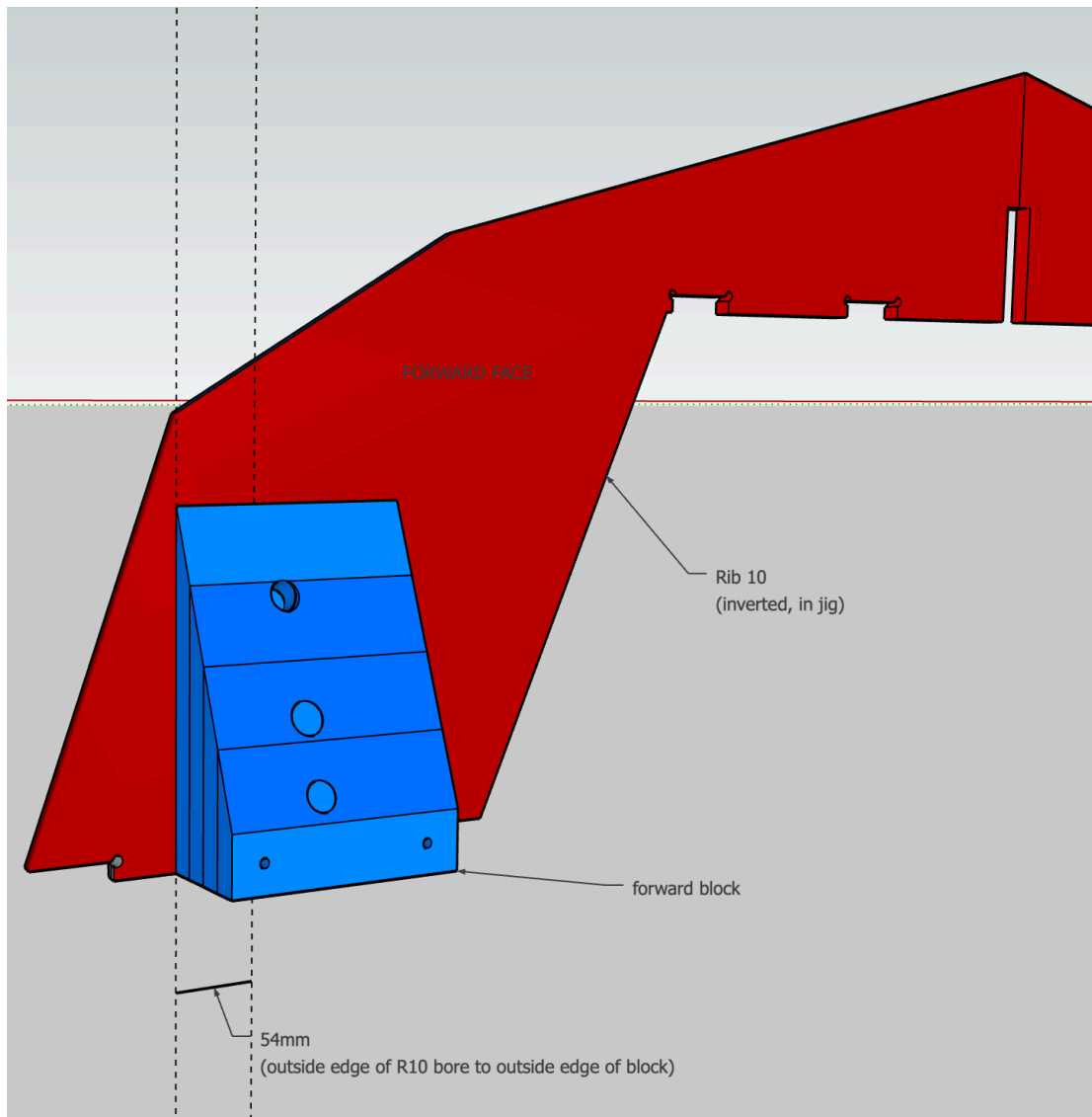
14) Begin on the port side of Rib10, on the forward face. Use a rule to mark a line tangent to the outer edges of the three bores. Measure from the first line and mark a second parallel line 54mm (2.125") outboard from the first, as shown in the diagram below.



15) Locate the Port Forward Backstay Chainplate Block, orient it as shown below, and align its outboard edge with the second line on Rib 10. There are three alignment checkpoints for positioning the block.

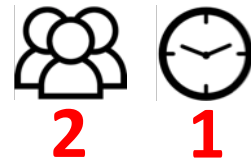
- a) The bores should be aligned through the rib and the block, with a clear  $\frac{1}{2}$ " (12mm) diameter pathway visible through the entire assembly.
- b) The sides of the block should not overlap points A or B; rather, the block should fit entirely within the space between A and B.
- c) At the jig, the edge of the rib and the edge of the block should be aligned.

If you cannot achieve this alignment, double-check that you have the correct block. **The blocks look similar, but they are not interchangeable.**



- 16) Check the above assembly for a completely flush fit between the block and the rib, and remove any extraneous material that prevents a flush fit.
- 17) With the block aligned to the guidelines and satisfying the alignment criteria, use a sharpie to trace the outline of the block onto the rib surface.
- 18) Remove the block, and insert protective plastic beneath the rib and covering the entire area beneath where the block will sit on the jig, such that no overflow epoxy can bond the jig to either the rib or the block.
- 19) Follow the standard procedure for laminating: all mating surfaces receive two light coats of unthickened epoxy, followed by one coat of 403 adhesive-thickened epoxy.
- 20) Immediately after applying the epoxy and placing the block into position against the rib, have a partner hold the block in place, while you use a drill to insert four 1 ½" (38mm) wood screws first through the rib and then into the block until tight, to hold the block-rib assembly together during bonding.
- 21) Double-check that the block's alignment is still correct vs. the traced outline on the rib. IF the block has moved, remove the screws and reposition the block correctly. Then reinsert the screws while holding the block tightly in the proper location.
- 22) Use a gloved finger to create a small fillet around the remaining perimeter of the block where it meets the rib.
- 23) Repeat the process for the Starboard side.
- 24) Allow these assemblies to cure for a full 12 hours.
- 25) Remove the wood screws.
- 26) Use a syringe to fill each screw hole with unthickened epoxy. Some epoxy will run out; use a paper towel to soak it up.
- 27) Mix 405 into the remaining epoxy in the cup, to create a paste thick enough that it will not run down the side of the cup. Use this thickened mixture to fill the screw holes flush to the top, then apply foil tape over the top to prevent any oozing during cure.
- 28) Allow these fills to cure for 12 hours. Remove tape, and sand off any excess epoxy so that the face of the rib is flat and smooth.

## 2.8 INSTALL TRANSOM WINGS



**Do not attempt this section before the forward-block-to-Rib10 epoxy has cured for at least 24 hours, the wood screws have been removed, the screw holes filled with epoxy, those fills have cured for 12 hours, and the fills sanded flush.**

### Procedure

- 1) Begin on the port side. On the aft face of Rib 10, remove any extraneous material (epoxy, splinters, tape, etc) from the wing area.
- 2) Mark a line tangent to the outboard edges of all three chainplate bores. Measure 54 mm (2.125") further outboard from this first line, and mark a second parallel line. Use a square to mark a third line at a 90 degree angle from the second line, such that the third line is tangent to the upper edge of the upper bore (as the rib sits in the jig inverted).
- 3) Measure 58 mm (2.25") further upward from the third line, and mark a fourth line parallel to the third line.

The upper/outer corner (circled below in yellow) is the locating target for the next step.



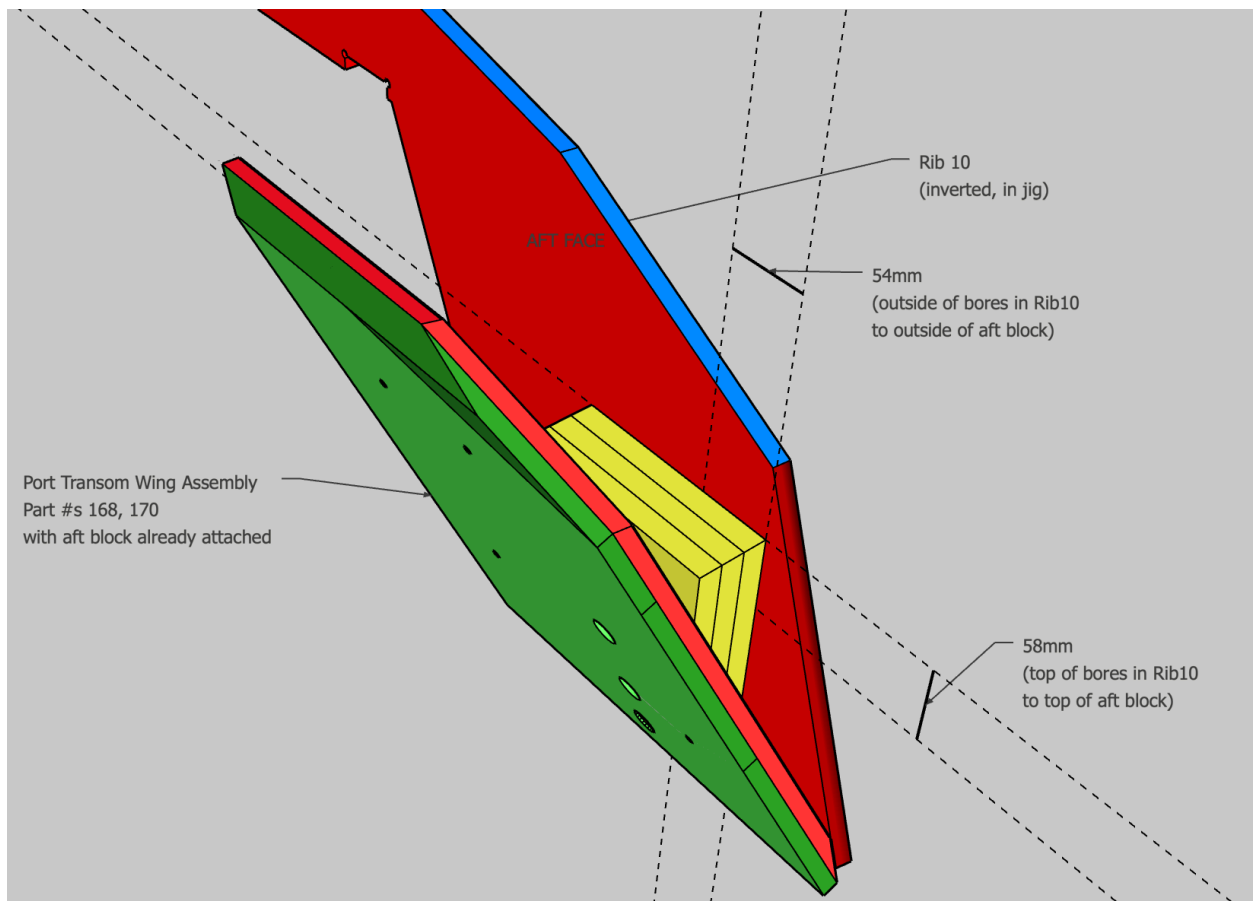
- 4) Locate the Port Transom Wing Assembly, which now has an Aft Chainplate Block attached to it. Be sure all extraneous material (epoxy, splinters, tape, etc) is removed from this assembly.
- 5) Orient the assembly as shown below relative to the aft face of the port side of Rib10.

Position the assembly such that the upper/outer corner of the Aft Chainplate Block is at the upper/outer intersection of the lines on the aft face of Rib10 (as circled in the previous diagram).

Verify that the assembly will sit flush against the rib with the block aligned squarely along the outer marked lines (both horizontally and vertically). If it does not, remove extraneous material until it sits flush and square.

Verify that the upper edge of the block is aligned along the horizontal guide line. Verify that the outside edge of the wing is aligned with the outside edge of the rib at the point where they meet.

**Note: The assembly touches the rib surface on two faces: the block touches the face of the rib, AND the beveled forward surface of the wing assembly also touches the face of the rib. BOTH these connection areas must be epoxied in the current procedure.**



- 6) Verify that the chainplate bore holes are aligned through the entire assembly.

Note: The image below is taken from the forward side of Rib10 on the starboard side of the boat, looking aft. But, it illustrates the bore alignment you need. You can see all the way through the forward block, Rib10, the aft block, and the transom.

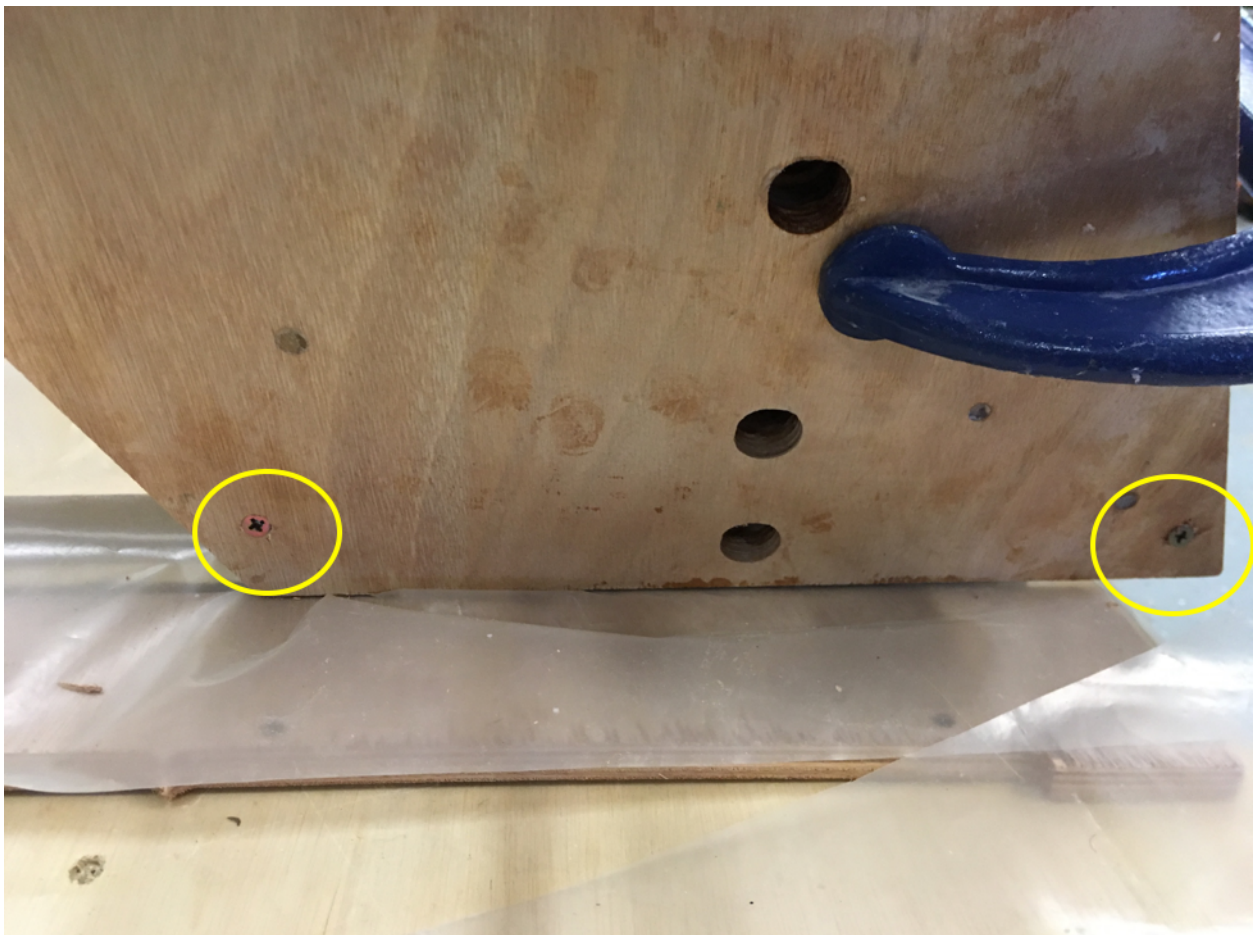


- 7) Use a sharpie to mark the outline of the three exposed sides of the block along the aft face of Rib10.
- 8) Remove the assembly.
- 9) Place plastic under Rib 10 and under the area beneath where the assembly will sit when epoxied to Rib 10.



### Epoxy the Assembly

- 10) Use the standard epoxy process to bond the assembly to the rib: two light coats of unthickened epoxy on mating surfaces, followed by one thin coat of 403 adhesive-thickened epoxy on one side of the mating surfaces.
- 11) Have a partner hold the assembly firmly in position: at the corner of the marked lines, and square with BOTH the horizontal and vertical guide lines.
- 12) Approximately 1-2" (25-50mm) above the jig surface, insert two 3" wood screws through the port transom wing assembly and into/through Rib10, pulling them together tightly for bonding. These screws should be inserted in the locations shown in the image below, where they will not have to go through the block – just through the wing and Rib 10. This will make the insertion easier. The purpose of these screws is to pull the beveled edge of the transom wings flush with mating surfaces on Rib10.

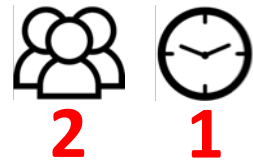


- 13) Double-check that the block is still properly aligned relative to the guide lines. If not, back up and repeat the screw-in process, ensuring that the block does not move off the guidelines. **This alignment is critical.**
- 14) Once the screws are inserted in the bottom of the wing, use a clamp to pull the upper edge of the wing toward Rib10, so that the upper edge of the aft block is flush against the aft face of Rib10 to facilitate a good epoxy bonding between the block and the rib.



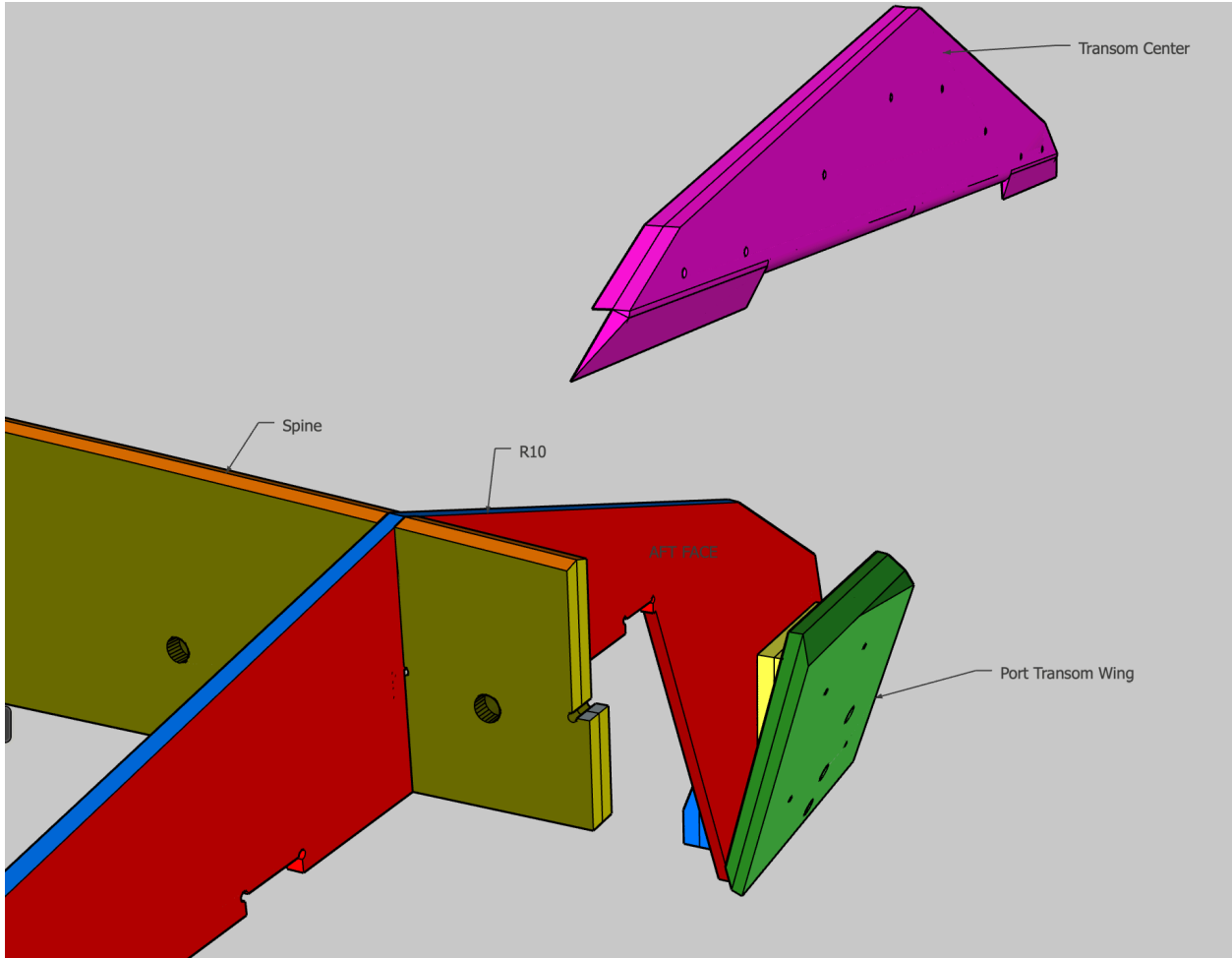
- 15) Use a gloved finger or a rounded mixing stick to make a fillet around the perimeter of the block-to-Rib10 joint.
- 16) Repeat the process for the Starboard side.
- 17) After 12 hours of cure, remove the wood screws.
- 18) Use a syringe to fill each screw hole with unthickened epoxy. Some epoxy will run out; use a paper towel to soak it up.
- 19) Mix 405 into the remaining epoxy in the cup, to create a paste thick enough that it will not run down the side of the cup. Use this thickened mixture to fill the screw holes flush to the top, then apply foil tape over the top to prevent any oozing during cure.
- 20) Allow these fills to cure for 12 hours before proceeding. Remove tape, and sand off any excess epoxy so that the faces of the rib and the transom are flat and smooth.

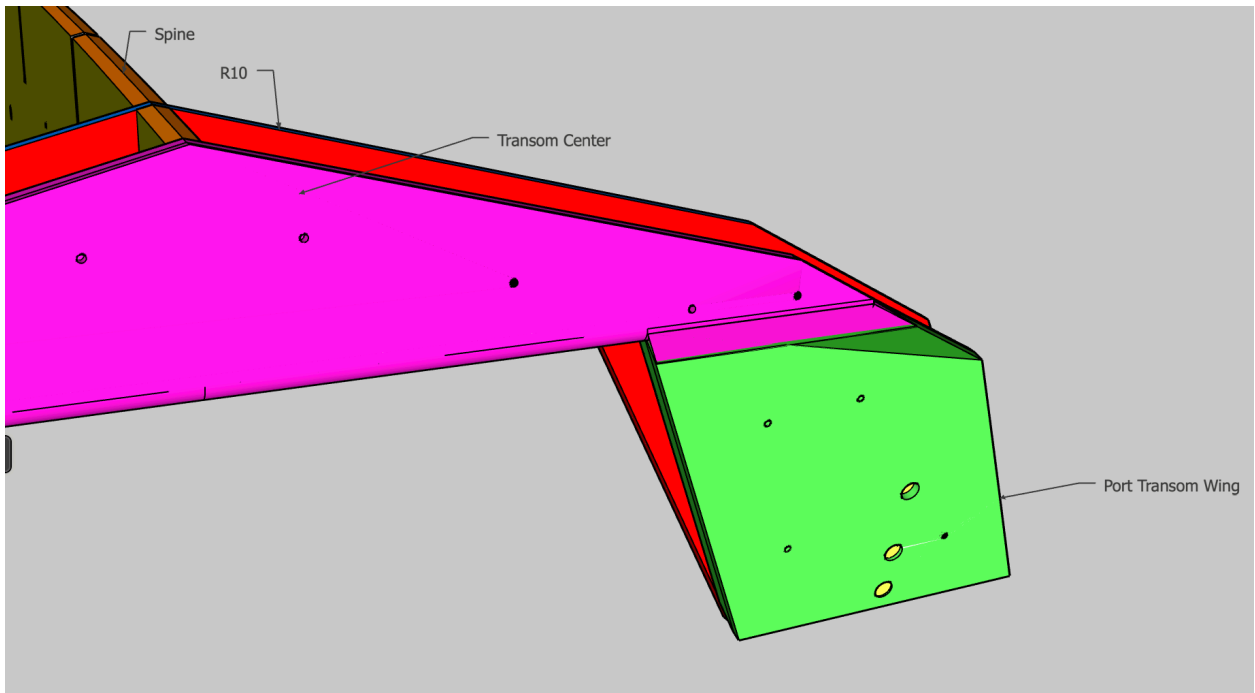
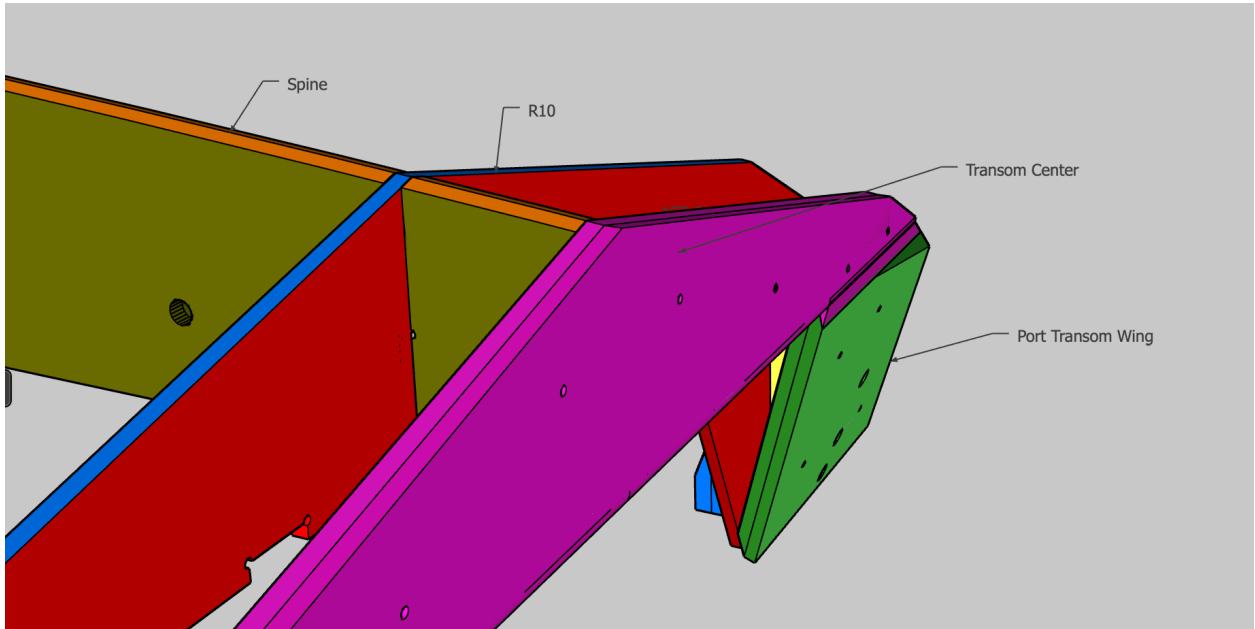
## 2.9 INSTALL TRANSOM CENTER PANEL



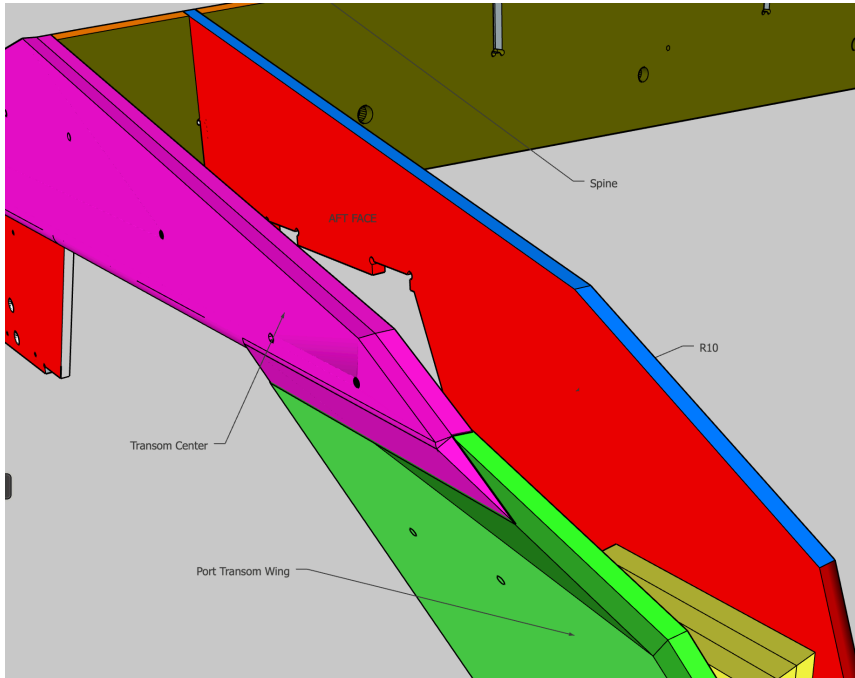
### Procedure

- 1) Locate the transom center assembly. Dry fit it onto the notch on the end of the spine as well as onto the Port/Starboard Transom Wings as shown in the four diagrams below.



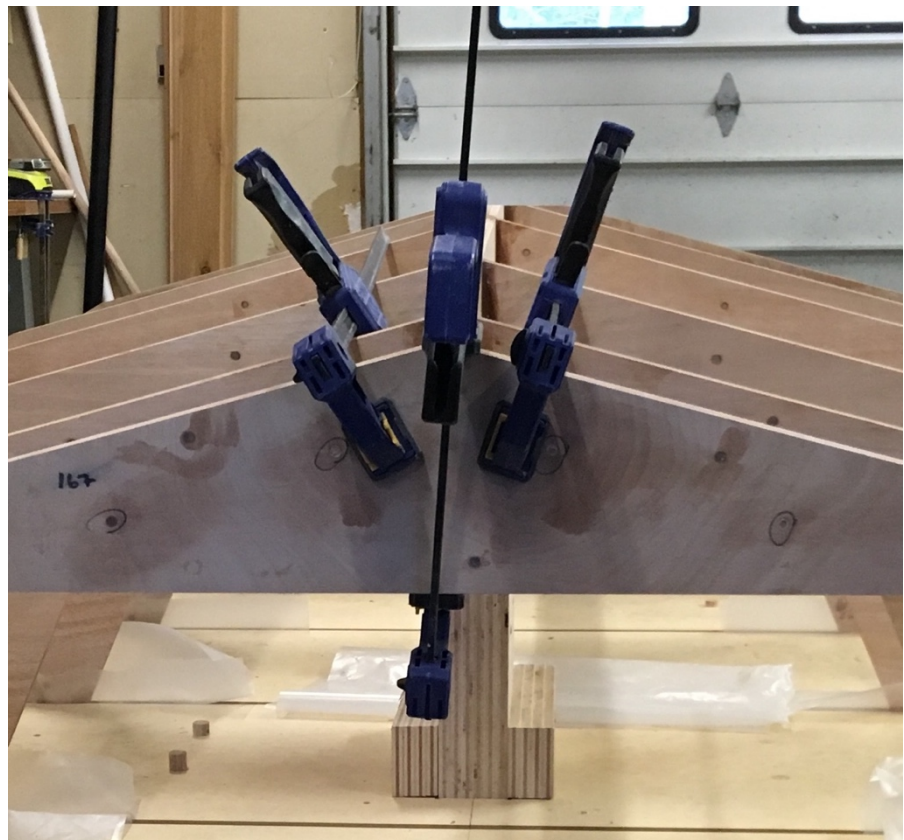


Note that the aft bevel on the CENTER TRANSOM is AFT of the wing. The mating surface is the notch on the FORWARD side of the CENTER TRANSOM, as shown in the next image.



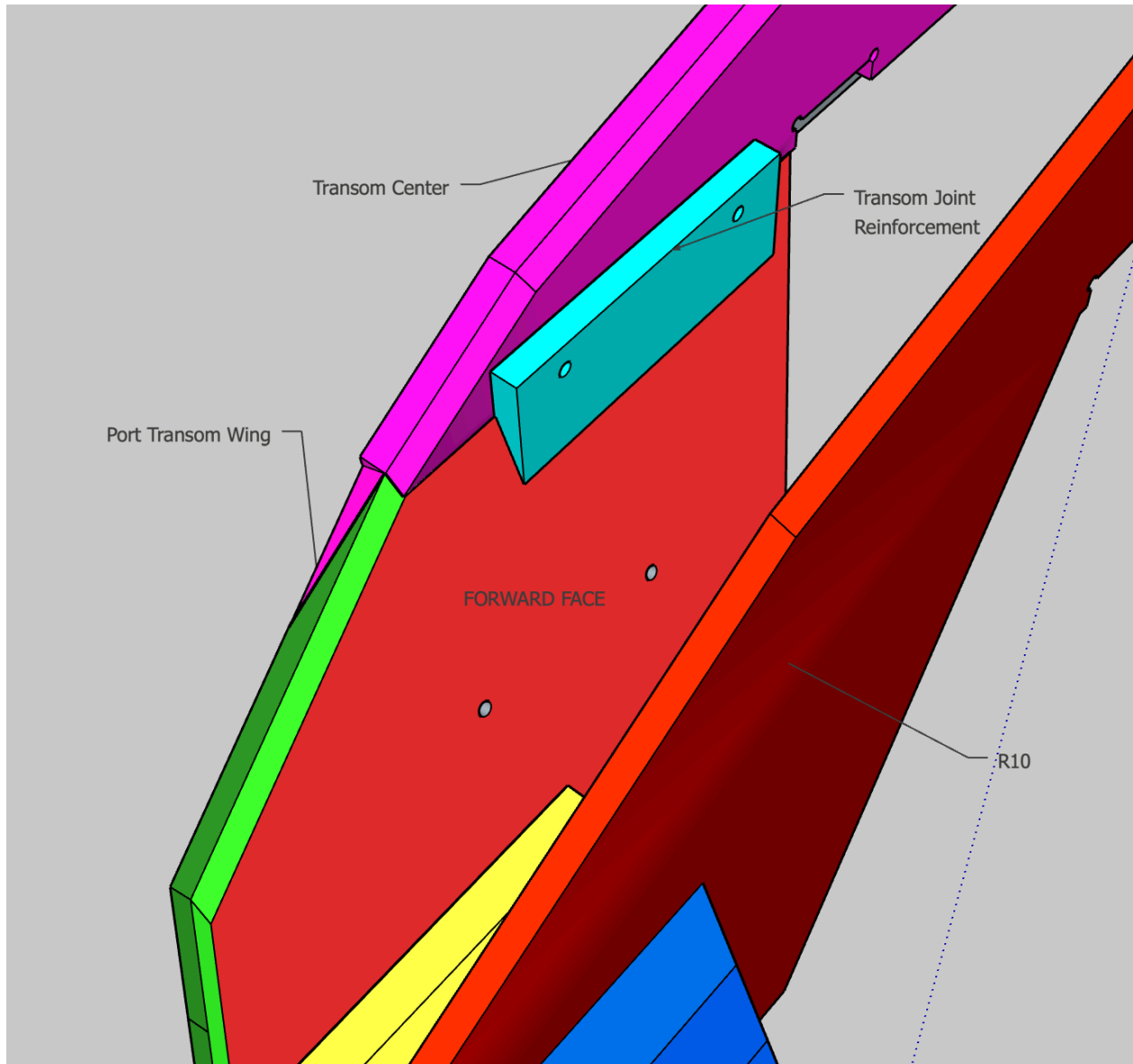
- 2) Use two clamps – one on either side of the spine – to clamp between (a) the middle of the transom center to (b) Rib 10, so that the transom center will stay in the aft spine notch without anyone holding it.

Position the center assembly on the spine notch, such that it is fit properly at the same time to both port and starboard wings. Have a partner hold the center assembly in place, while you use clamps to hold the center assembly (a) horizontally clamped to R10 on both sides of the spine and (b) vertically to the underside of the spine.



- 3) Locate the port and starboard Transom Joint Reinforcements (part numbers 164 and 165). Check the fit and positioning of these blocks as shown in the following diagram.

**Note:** The outer corner of the reinforcement must not extend to the edge of the transom center assembly or it will interfere with the attachment of hull panels in a later step.



- 4) Clamp the transom wing/reinforcement block/transom center assembly on both port and starboard sides, verifying the alignment checkpoints below:

The middle “V” bevel on the transom center assembly should align perfectly with the “V” bevel in the spine, and the outer bevels of the transom center should align perfectly with the transom wings on port and starboard.



- 5) With all the parts clamped in place and alignments verified, use a sharpie to outline the mating surfaces of the wings, transom center, and spine.

Remove all the clamps and remove the transom center part from the skeleton.

Use the sharpie to complete the notation of all the mating surfaces to which you will need to apply epoxy.

Because you are working with bevels, it is easy to get confused if you do not make these notations directly on the parts while they are assembled or as soon as you unclamp the assembly.

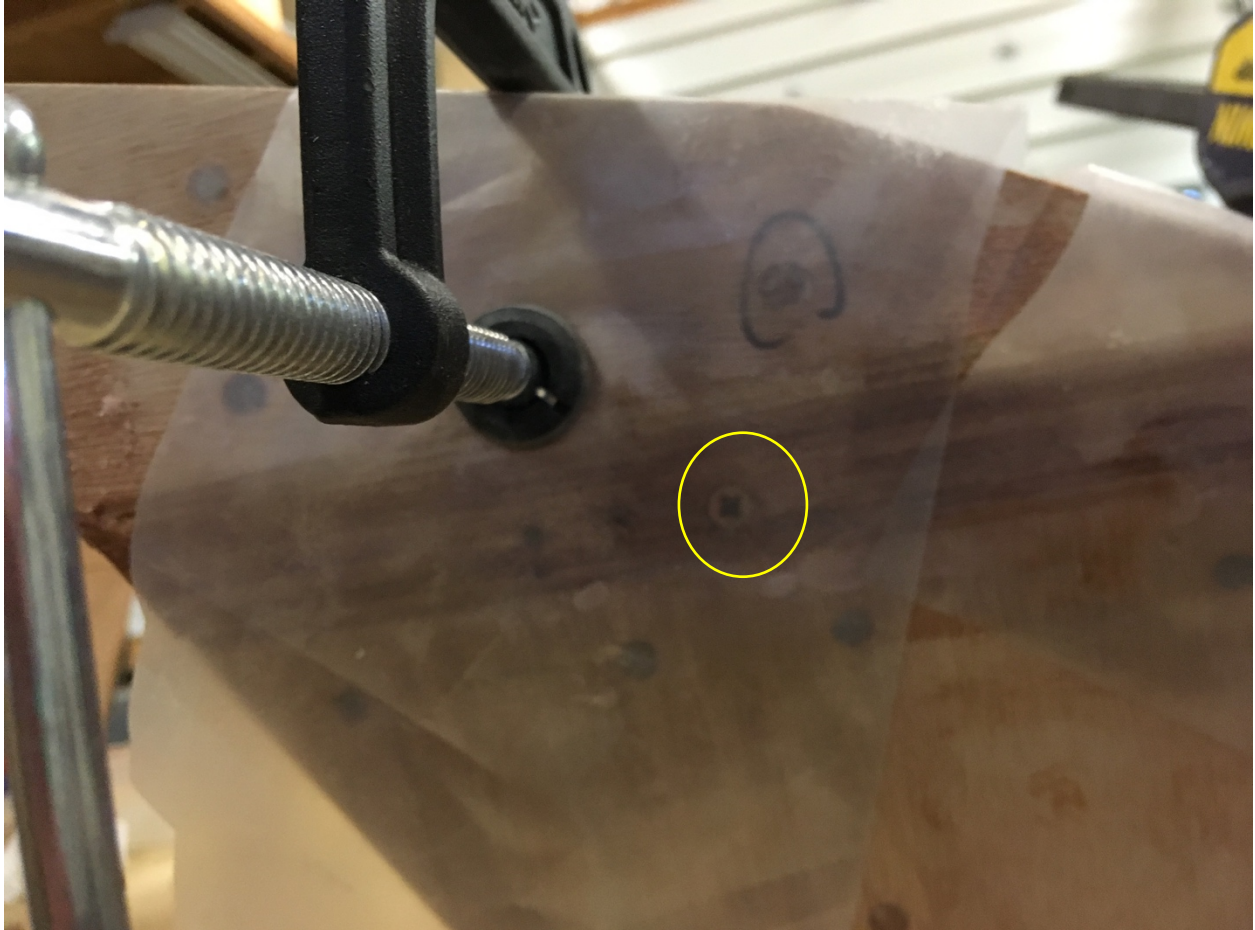
- 6) Only when you are satisfied that all the parts are fitting appropriately, remove the parts and prepare for epoxy.

### **Epoxy the Assembly**

- 8) Lay a piece of plastic on the ground where you will apply epoxy to all the parts before installing them. Also, cut small pieces of plastic to place under all the clamps, to prevent them being bonded to the skeleton.
- 9) Coat all the mating surfaces of all the parts involved in this section, using a light coat of unthickened epoxy.
- 10) Repeat the coating process after a few minutes.
- 11) After a few more minutes, apply a coating of 403 adhesive-thickened epoxy to one side of all the mating pairs – spine/transom center, center/wing, wing/block, center/block.
- 12) Position the transom center in place, and clamp it as you did during the dry fit. Be sure to put plastic under your clamps. Do not use too much clamping force yet – just enough to hold everything in proper position.
- 13) Double-check all the alignments, per the diagrams earlier in this section.
  - a) The transom center piece should be fully seated in the notch in the spine. There should be no gap between the transom and the spine.
  - b) The inner and outer edges of the transom wings should align with the corollary edges of the center piece.
  - c) The mating surfaces of the wings and center pieces should be completely flush on both the port and starboard sides of the skeleton.



- 14) With a partner holding the assembly stable, insert a 1 ½" (38mm) wood screw through the aft face of the bevel between the center transom and the transom wing on the port side, as shown below. If necessary to maintain alignment, you can use two screws. Repeat for the port side.



- 15) Re-check the alignment of all parts in the transom assembly. If anything is out of alignment, back up and do it again.
- 16) With a partner observing any shifting in the assembly, slowly increase the pressure on all the clamps. There should be no shifting. If anything shifts, loosen the clamps, reposition, and clamp again.
- 17) Use a gloved finger to shape fillets from the excess adhesive-thickened epoxy oozing out of the following joints:
- a) Transom center to spine
  - b) Joint Reinforcements to transom center and transom wings

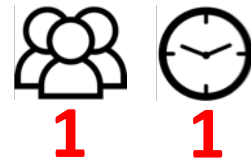
You can also use any of the mixture left in the pot if necessary, or mix another small batch.

- 18) After 30 minutes, check all alignment points to ensure that the center piece has not shifted under clamping pressure. If it is shifting, reposition the piece as instructed, re-clamp, and check again after another 30 minutes. If it has shifted again, reposition the piece, and insert two small wood screws through the transom center piece and into the spine.
- 19) After 12 hours of cure, remove the wood screws, clamps and plastic.
- 20) Use a syringe to fill each screw hole with unthickened epoxy, immediately taping over the opening with foil tape to prevent the epoxy from running out.

Also fill the  $\frac{1}{4}$ " (6.4mm) holes in the Transom Joint Reinforcement blocks.

- 21) Allow these fills to cure for 12 hours before proceeding. Remove tape, and sand off any excess epoxy so that the faces of the rib and the transom are flat and smooth.

## 2.10 COAT TRANSOM-RIB10 INTERIOR SURFACES



### Background

Several interior areas around the transom and R10 are going to be difficult to access after the hull panels are attached. So, you need to make sure they are well-coated with epoxy now, before the panels are attached.

### Procedure

Mix a batch of unthickened epoxy.

- 1) Use a brush to apply three light coats (a few minutes apart) of unthickened epoxy to all interior surfaces between the aft face of Rib10 and the forward face of the Transom on both port and starboard sides. Coat all exposed surfaces of the blocks and reinforcements, as well as the soon-hard-to-reach areas on the aft face of R10 and the forward face of the transom.

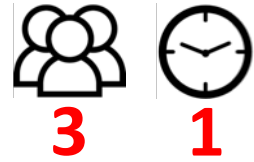
**Do not get epoxy on the rib edges or transom edges, where the hull panels will be connected later.**

- 2) Use a brush to apply three light coats (a few minutes apart) of unthickened epoxy to the port and starboard wings on the forward surface of Rib10. Coat also the exposed surfaces of the forward chainplate blocks forward of Rib10.

**Do not get epoxy inside the chainplate bores.**

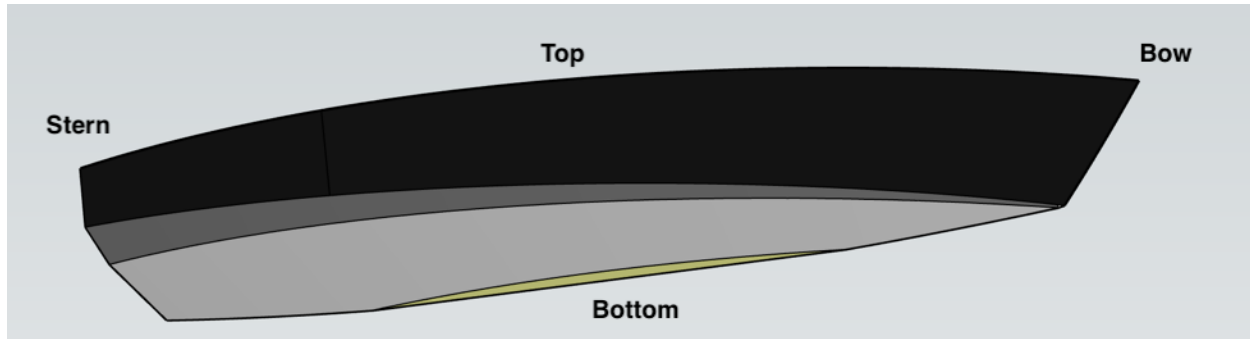
- 3) Wait a few minutes, then repeat steps 1 and 2 for a second coating.
- 4) Wait a few minutes, then repeat steps 1 and 2 for a third coating.
- 5) Allow this epoxy to cure for 12 hours before proceeding.

## 2.11 DRY-FIT HULL PANELS TO SKELETON



### Background

The hull is composed of 3 panels on each side, plus the football on the bottom.



The 3 panels on each side are mirrors of the panels on the other side. So, you will make two passes through these instructions, one for the port panels and another for the starboard panels.

The Upper Hull Panel is black in the image above.

The Middle Hull Panel is medium gray in the image above.

The Lower Hull Panel is light gray in the image above.

**Note:** the image above shows the hull right-side-up, whereas you are currently working with the skeleton upside down in the jig. When you install the hull panels to the inverted skeleton, the hull will be inverted from the image above.

Each hull panel is designed such that when bent around the ribs of the boat, it will form a continuous arc – with no undulations or warping. Each panel should fit flush with the precision bevels on each rib as it passes that rib, indicating that the arc is as-designed.

**Take your time getting the panel alignment just-right in this section, as extra care now will save you many hours of fairing and sanding later.**

## Procedure

### **Clean-up**

- 1) Check for excess epoxy or other material on the following surfaces:
  - Upward-facing spine bevels
  - Spine bevels at the nose
  - Bevels on ribs
  - Bevels on transom
  - Outside edges of the football
  
- 2) Use 80-grit sandpaper wrapped around a small sanding block approx. 1"x4" (25mmx100mm) to remove any excess epoxy or other material that you find on the edges listed above, but be careful you do not alter the shape of the bevel itself.

The bevels on all parts are precision-machined to match the arcs of the panels bent over them. Be careful not to alter the shape of the bevels when you are removing extraneous material.

- 3) Check all six hull panels for extraneous material (epoxy, splinters, tape, etc) on the surfaces that will prevent them from sitting flush on the rib/spine bevels, and remove such material.
- 4) Do the same check and sanding for extraneous material on the edges of the panels, where such material might interfere with the mating of the edges of two adjacent panels during installation.

## Dry Fit Hull Panels

To accomplish this step well, you will need help from at least one person – preferably two. Do not attempt to accomplish this step alone; it is not possible for a single person to do it correctly.

### *Lower Hull Panel*

- 5) Begin with the lower hull panel, which is the one that fits adjacent to the football, on the part of the ribs furthest from the table surface.
- 6) Begin on the port side of the boat.
- 7) With one person holding the front of the panel and one holding the back of the panel, position the panel atop the ribs and flush with the outside edge of the football.

Together, move the panel forward or aft until the following alignment points are verified:

- a) The center edge of the panel is touching the football along the entire outer edge of the football.
- b) The center edge of the panel is aligned with the peak of the spine (the centerline) both forward of the football and aft of the football.
- c) The outer edge of the panel is aligned with the first elbow on the rib bevels for ribs 1-10 and the transom.
- d) The aft edge of the panel is parallel with the transom and terminates between the two 12mm layers of the transom. That is, the hull panel should terminate 12mm forward of the stern of the boat.

Once the alignment points are ALL SIMULTANEOUSLY satisfied, the panel is properly aligned.

- 8) With your helper(s) holding the panel in position, now check the fit of the bent panel over the rib bevels. Be sure your helpers do NOT push BETWEEN the ribs, as this will cause the panel to deflect abnormally. Always press on the panel directly atop a rib to maintain the natural arc of the panel. The panel should mate perfectly with the bevels on the ribs, as shown in the image below.



- 9) To check the fit at a particular rib (which we will refer to as the Target rib), press the panel against the +2 and -2 ribs (the ribs that are 2 stations away from the target rib, so that the panel forms an arc naturally over the Target rib. That is, to check the fit at Rib 3, press the panel at Ribs 1 & 5. The panel should lay down flush against the bevel at the Target rib without you pressing the panel at the Target rib itself.
- 10) Repeat the same arc test for the same target rib, this time pressing atop the +1 and -1 ribs. The panel should lay down flush against the bevel at the Target rib without you pressing the panel at the Target rib itself.
- 11) Repeat the fit-check steps for all ribs for this panel.

- 12) If you find that the panel does not touch a rib, the first thing to do is double-check that the panel is properly positioned and that you are pressing only atop ribs to prevent unnatural deflection. If you are satisfied that you are doing the arc fit check correctly, yet you still have a rib-panel intersection that is not touching, then there has been a problem in a prior step – either with the rib installation into the spine/jig or with the panel lamination itself.
  - a) Note the rib where the problem is observed. Locate the other panel of the same shape as the one you have been using, in this case the other Lower Hull Panel. Dry fit the second panel on the same side that you've been working, and repeat the alignment and arc-fit checks. If the previously-observed problem remains, the problem is in the skeleton. If the problem is not replicated with the second panel, the problem is with the first panel.
  - b) If the problem is with the panel, try the first panel on the opposite side of the hull and check it for fit. Often the panel will fit better on the other side because it is bending in a different direction.
  - c) If after these steps, you still have any panel-rib gap of more than 2mm, contact Puur Customer Support for diagnostic assistance.
- 13) Repeat the fit process for the lower hull panel on the starboard side.
- 14) Use a sharpie to mark "PORT" and "STARBOARD" on the lower hull panels, according to where you fit them to the skeleton.



### *Upper Hull Panel*

- 15) Once you've finished fitting the lower hull panels on port and starboard, remove those panels from the skeleton.
- 16) Skip the middle hull panel for now.
- 17) Position the upper hull panel on the port side. This is the panel that fits almost vertically around the widest part of the hull.

**If you do not have a third worker to hold the center of the panel, this panel will not remain in place without clamps. You will have to clamp and unclamp the panel repeatedly as you move it into final position.**

The photo below shows how to use the clamps during fit-check of this panel; on the backside, the clamps are on the inside of the rib openings.



With your partner(s), lift the panel roughly into place, and together move the panel forward or aft until the following alignment points are verified:

- a) The forward edge of the panel is parallel with the nose of the spine and terminates between the two layers of the 2x12mm spine.
- b) The aft edge of the panel is parallel with the transom and terminates between the two 12mm layers of the transom. That is, the hull panel should terminate 12mm forward of the stern of the boat.
- c) The upper edge of the panel is aligned with the third elbow on the rib bevels for ribs 1-10 and the transom, as shown in the photo below.

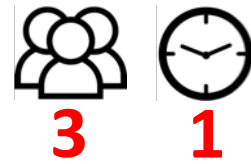


- 18) Perform the same +2/-2Rib and +1/-1Rib pressure tests that you did on the lower hull panel, to verify that the upper hull panel is fitting properly to each rib along its arc from stern to bow.
- 19) Leave the panel clamped to the skeleton.
- 20) Repeat this process for the Upper Hull Panel on the starboard side, and leave the panel clamped to the skeleton when done.
- 21) Mark "PORT" and "STARBOARD" on each panel, according to where you fit it.

*Middle Hull Panel*

- 22) Repeat the dry-fitting process for the middle panels, aligning the edges of these panels with the angles in the shoulders of the ribs.
- 23) Mark "PORT" and "STARBOARD" on each panel, according to where you fit it.

## 2.12 MARK EPOXY ZONES AND NAILING GUIDES ON PANELS



Do not proceed to this step until you are satisfied that ALL panels meet the alignment criteria during the dry fit process.

### Background

You will be making two sets of marks on each panel, to assist in a later step.

#### ***Mark 1: mating zones***

To attach hull panels to the skeleton, you will be applying epoxy to the mating surfaces between the ribs and the panels: specifically, the edges of the 10 ribs and to 10 similar zones on the interior of each panel. To coat these mating zones accurately, you will need to trace the mating zones on the inside of the panels while they are dry fit on the ribs.

#### ***Mark 2: nailing guide***

In the same step that you use epoxy later to attach the panels to the ribs, you will use a nail gun to secure the panels to the ribs. Since the panel will obscure your view of the underlying rib, you need to mark nailing guidelines on the outside of the panel, showing where the underlying rib is located. These guidelines will allow you to hit the rib with the nails, even though you will not be able to see the rib itself.

The epoxy mating zones and the nailing guidelines must be marked with a sharpie while the panel is being held in the proper position according to the dry-fit process recently completed. So, you will now repeat the dry fit process for all panels.

### Procedure

1. Position the Lower Hull Panels (the ones that align to the football) as in the dry-fit process, and have your helpers hold the panels in place.
2. Use a sharpie to trace on the underside of the panel, along the forward and aft edges of each rib, where that rib touches the panel.
3. Use a sharpie to trace on the underside of the panel, where that panel touches the spine (central, aft, and bow sections – including the nose) and the transom.

The photo below shows an example of the interior markings for mating zones:



4. With the panels still held in proper alignment against the skeleton, use a sharpie to mark the locations at the edges of the panel where the rib intersection terminates. Each location is shown in the photo below with a red "X."

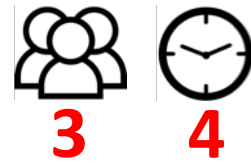


5. After marking the ends of the rib locations, use a straight edge and sharpie to draw a line across the width of the panel, connecting the two end-marks. This mark is shown in black in the photo above.

Note: the photo above was taken after the panel was nailed to the rib in a later step, and you can see the nail holes along the guideline.

6. Remove the Lower Hull Panels from the skeleton.
7. Complete the re-fit/marketing process for Upper Hull Panels, then for the Middle Hull Panels, removing each panel from the skeleton when done.

## 2.13 ATTACH HULL PANELS TO SKELETON



**Do not attempt this section without TWO HELPERS.**

**This section cannot be accomplished correctly with less than THREE WORKERS.**

**Do not start the work in this section unless you have enough time to complete THIS SECTION AND THE FOLLOWING TWO SECTIONS IN THE SAME WORK SESSION. These three sections should be completed in immediate succession.**

**Review all instructions in all three sections multiple times BEFORE beginning the process.**

**Walk through the process in a dry-run rehearsal with all workers. Repeat the rehearsal until everyone is comfortable with the process.**

### Procedure

1. Cut a large piece of plastic, approximately 6'x20' (2m x 6m), and lay it on the ground in an area away from the hull construction table.
2. Be sure you have adequate supplies of 3/4" (19mm) polymer nails within easy reach.
3. Be sure you know how to reload polymer nails into the nail gun.
4. Charge the compressor tank, apply 90 psi to the gun, and make sure your nail gun is functioning properly.
5. Begin with the 3 hull panels for the PORT side. Place them on the plastic with the rib mating outlines facing upward.
6. Begin with the LOWER HULL PANEL, the one that fits adjacent to the football.

**Do not attempt to install all the panels simultaneously.**

7. Mix a batch of unthickened epoxy, and split it into two pots: one for each of two workers.



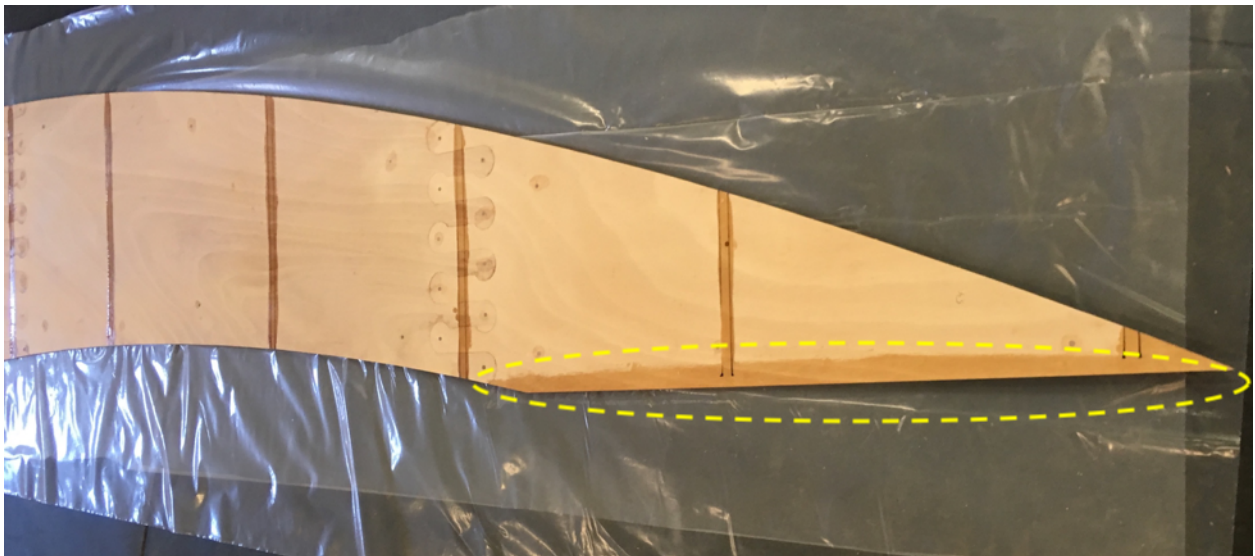
### Worker 1

8. Brush a light coat of epoxy between the outlines for all the contact zones marked on the interior of the lower hull panel – zones for the ribs, spine, transom, nose.

Do not brush epoxy on the 8mm edges of the panels.

Be careful to include all the mating areas and to brush 1” outside the lines.

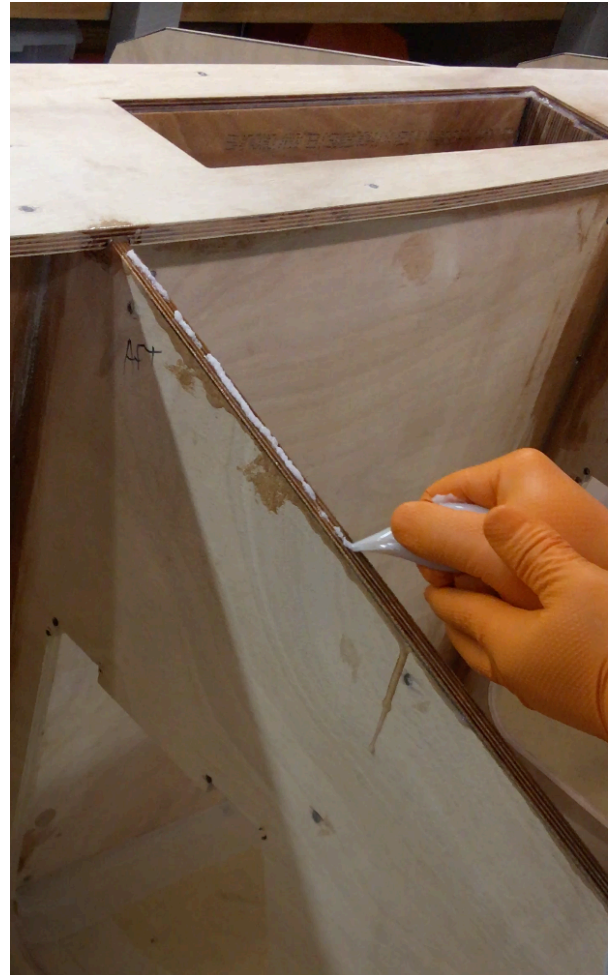
Coat all the mating zones, even if you missed outlining some. Note in the image below, that the forward spine mating zone was not outlined – but it has still been brushed with unthickened epoxy.



9. Wait a few minutes, and repeat this application.

### Workers 2 and 3

10. At the same time, a second worker will brush unthickened epoxy on all the contact edges of ribs, spine, nose, and transom where the lower panel will mate.
11. Repeat this application after a few minutes.
12. Mix a batch of 403 adhesive-thickened epoxy that is very thick, such that it does not flow down the side of the mixing cup.
13. Scrape this final mixture into a piping bag, and cut an opening in the tip that is less than ½" (12mm) wide.
14. Using the piping bag, apply this thickened epoxy onto all the contact edges of ribs, spine, nose, and transom that were previously coated by your partner in preparation for this panel. See photo at right for example.
15. As one worker is piping the thickened solution onto the ribs, another worker is following with a spreader to distribute the epoxy into a uniform layer over the entire surface area of the rib edges. The objective is a very thin layer – less than 1 mm thick after spreading.



## All Workers

16. Once all the panel and rib surfaces are coated with epoxy, place the panel onto the skeleton in accordance with the alignment criteria previously used in the dry-fit procedure.
17. Position one worker at the front and one at the aft of the boat, to hold the panel in place. The third worker, who will do the nailing, should be positioned at Rib 5.

As you are positioning the panel, verify that the nailing guide lines are in fact directly atop the ribs. If not, either your alignment is incorrect or you will have to adjust your nailing slightly to one side or the other from your guide line, because the guide line is incorrect.

It is vital that no one press on the panel anywhere other than directly atop a rib. Pressing between ribs will cause the panel to deform, which will prevent it from creating a true arc across the skeleton. During nailing, it will be tempting for the worker using the nail gun to press a hand on the panel between ribs. Do not.

**NOTE:** You will run out of nails frequently during this process. Check constantly to ensure that you know when you need to reload, as there is no indication when the gun is firing dry. The nail gun will make a very similar indentation in the panel, so you cannot tell whether a nail was shot simply from looking at the panel. Check the nail gun's magazine often, and keep additional nails handy.

18. With the panel positioned in correct alignment, use the nail gun to nail the panel to Rib5, beginning at the football and ending at the outer edge of the panel.

Nail in sequence along the guideline at roughly 2" (50mm) intervals; do not jump around.

Press the tip of the nail gun very firmly against the panel while nailing. This pressure will push the panel firmly against the underlying rib.

19. Repeat the nailing process for Rib 4, then Rib 3.
20. Once you have finished Rib3, you will note that between Rib 3 and Rib2 the panel is mating directly with the spine at the centerline of the hull.

Nail progressively along this spine-mating area, moving from Rib 3 to Rib 2.

21. Then complete the nailing for Rib 2.
22. Nail along the spine from Rib 2 to Rib 1.
23. Complete the nailing for Rib 1.
24. Afterwards continue the nailing sequence along the spine, to the forward termination of the panel.
25. Return to Rib 6 and repeat the nailing process.
26. Repeat the nailing process for Rib 7.

27. You will note that between Ribs 7 and 8, the panel will again mate directly to the spine. Follow the same panel-to-spine procedure as previously, but this time nail progressively along the spine connection from mid-ship toward the stern.
28. Continue the process working aft, nailing along each rib, then nailing along the spine between that rib and the next.
29. Nail the panel to the transom in the same manner as you nailed the panel to each rib.

#### *Middle Hull Panel*

30. Repeat the epoxy-and-nailing process for the MIDDLE HULL PANEL, ensuring that the edge of the panel is parallel to and closely butted against the edge of the LOWER HULL PANEL already installed. You do not need to force a super-tight fit, just allow the panels to touch gently.

#### *Upper Hull Panel*

31. Next, you will repeat the above process for the Upper Hull Panel, with a few modifications as discussed below.
32. After coating the Upper Hull Panel's mating zones and the rib edges where it will be installed, lift it into position and have two workers hold it – one at the bow and one at the stern -- in the approximate position desired.
33. Position one worker at the front and one at the aft of the boat, to hold the firmly in tension against the nose of the spine and against the transom.
34. The third worker ensures the edge of the panel is butted to the edge of the middle panel. This is very important.
35. The third worker, who will do the nailing, should be positioned at Rib 5.
36. Verify that the nailing guide lines are in fact directly atop the ribs. If not, either your alignment is incorrect or you will have to adjust your nailing slightly to one side or the other from your guide line, because the guide line is incorrect.

**TIP: It is vital that no one press on the panel anywhere other than directly atop a rib. Pressing between ribs will cause the panel to deform, which will prevent it from creating a true arc across the skeleton. During nailing, it will be tempting for the worker using the nail gun to press a hand on the panel between ribs. Do not.**

37. With the panel positioned in correct alignment, use the nail gun to nail along the guideline at Rib5.

Nail continuously along the rib at roughly 2" (50mm) intervals; do not jump around.

Press the nail gun very firmly into the panel during nailing, to seat the panel firmly against the underlying rib.

38. Repeat this nailing process for Rib 4, then Rib 3, then Rib 2, then Rib 1.
39. Then, continue the nailing process where the panel meets the spine at the nose of the boat.
40. Return to Rib 6, remove the clamp, and repeat the nailing process for Rib 6.

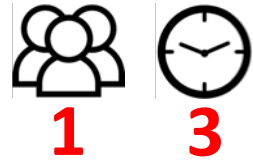
41. Repeat the process for Rib 7.
42. Remove the clamp at Rib 8 and repeat the process for Rib 8, Rib 9, Rib 10, and the Transom.

*Starboard Side*

43. Once all three panels are attached on the port side, repeat the entire process for the three panels on the starboard side of the hull.

***NOTE: After attaching all six panels, proceed immediately to the work described in the following section. Do not stop here.***

## 2.14 FILL SPINE SEAMS



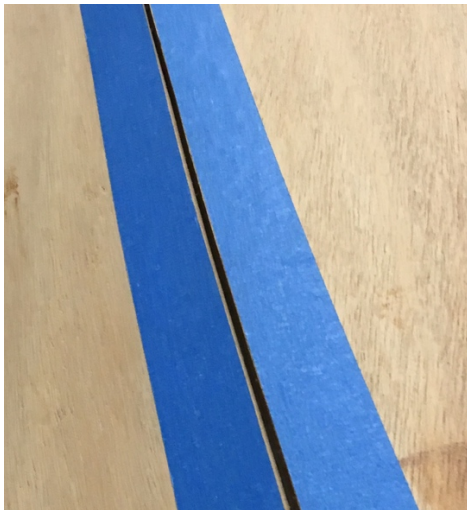
### Background

Forward and aft of the football region, the Lower Hull Panels on both sides meet at the central ridge in the hull, over the spine. Where these panels meet in this location, you will notice a gap directly over the spine, where indicated in the photo below. You need to fill the gaps in these regions, to make these joints as strong as possible.



### Procedure

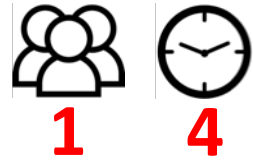
1. Apply blue tape on both sides of these seams, to minimize mess and clean-up time.



2. Mix a batch of unthickened epoxy, and brush it inside these seams.
3. Wait a few minutes, and repeat.
4. Mix a batch of 403 adhesive-thickened epoxy, to a consistency that easily flows down the side of the mixing cup.
5. Fill a syringe with this mixture, and fill the seams with the mixture. Be sure to fill the seams completely, even overfilling slightly. It may take several passes to complete the fill. Use a spreader to clean up any excess.



## 2.15 FILL BOW JOINT AND TRANSOM-HULL JOINTS



### Background

You will notice that an elbow-shaped void exists where the hull panels terminate at the transom, because their aft edges are 12mm (1/2") from the vertical surface of the transom. You will notice similar gap at the bow, where the port hull panels meet the starboard hull panels.

These areas are circled in the photo below.



These gaps are intentional. You will fill these gaps with 403 adhesive-thickened epoxy that will cure to form very durable corners, protecting the hull from impacts.



### *Transom*

1. Use foil tape to create a form extending vertically from the transom, as shown in the photo below, left.
2. Mix a batch of unthickened epoxy, and brush a coating onto both sides of the elbow within the tape form.
3. Mix a batch of 403 adhesive-thickened epoxy that is thick enough not to run down the walls of the mixing pot. Transfer this mixture to a piping bag, cut the tip to create an opening 3/8" in diameter. Use the piping bag to run a heavy bead of the mixture into the form, filling the void completely.
4. Use a mixing stick to pack the filling densely and to smooth the filling flush with the hull.



Tip: See the image at right. The builder here is using his left hand to brace the foil while working the mixture into shape. A better solution is to hold a small piece of scrap plywood on the outside of the foil form while you are pressing the mixture in with the stick. This will hold the foil mold square and prevent it from deforming under the pressure of the stick.

The post-cure objective is a nearly-square epoxy plug at the corner of the transom, as shown in the photos below. This squared plug will be bull-nosed in a later step.





#### *Bow Joint*

5. Repeat the Transom void filling process for the joint at the nose of the boat where the port hull panels meet their starboard counterparts. This joint will be sanded into a bullnose later, but for now what we need is to project the port panels forward into a point.
6. Use foil tape on both sides of the nose gap to create a mold. You will also need to place a piece of foil tape under the nose, just above the table.
7. After painting the gap with unthickened epoxy, mix a batch of 403 adhesive-thickened epoxy that is so thick it will not run down the walls of the mixing cup.
8. Mix a batch of 403 adhesive-thickened epoxy that is thick enough not to run down the walls of the mixing pot. Transfer this mixture to a piping bag, cut the tip to create an opening 3/8" in diameter. Use the piping bag to run a heavy bead of the mixture into the tape form, filling the void completely.
9. Use a mixing stick to pack the filling densely. You want the epoxy to project approximately 1" forward of the full panels, so that you have plenty of material to work with during shaping later.
  - a. See the photo above for how the nose fill should look after curing and removing the foil border forms. (before sanding the bullnose, of course)
10. After the thickened epoxy in the transom and bow joints has cured 6 hours, you can remove the foil tape.

**WAIT 24 HOURS BEFORE LIFTING THE HULL OUT OF THE JIG IN THE NEXT STEP.**