

## Hanging S5

The repair of S5 went a lot smoother than P5, much of it due to the experience gained in hanging P5. The fit between S5 and S4 was very good. I only needed one iteration to get an acceptable fit. Here are some pics to showing the location and size of the gaps. All seam locations not highlighted in the pics have gaps less than .030”.



This area is just forward of where the ballast terminates. The region of the seam marked by the pieces of tape is slightly longer than the frame spacing. The gap is about .030” at either end of the region and increases to about .063” at the midpoint. This the largest gap for this plank. Fortunately this region of the seam is backed up by the keel rabbet and so a wider gap is tolerable (caulking cannot be inadvertently driven into the interior of the boat). Note that this is an area where I have not made any modifications, so this gap was probably the same before I removed the plank.



This is a very short region at frame 17 having a maximum gap of .030”.



This region is just forward of the notch for the nib end of S4. The length of the region is just over the frame spacing and has a maximum gap of .030".



This region is between frames 31 and 32 with a maximum gap of .030”.



This is the hood end aft having a maximum gap of .030”.

Here is a summary of the steps involved in hanging S5:

First step is to remove S5 from the boat. While removing S5, I had numerous occurrences of chip-out while removing the screws. I suspect that the problem is that in some cases the centerline of the screw is not concentric with the hole for the bung. So on removal, as the head of the screw approaches the outside face of the plank it catches on the side of the bung hole and causes chip-out. To reduce chip-out in the future when removing a plank, I may try to back the screws out a bit at a time, so that the screw heads do not reach the surface until the plank is off of the boat.

When it's time to hang S5, I'll need to make room for the clamps. So I removed S6. I then cleaned the wood behind S6 by scraping and followed by a wipe down with lacquer thinner. I then plugged the old screw holes with H. Mahogany bungs. Recently I had Mike Powell from the PSU Forestry Department identify the frame material as H. Mahogany. (Actually, I gave him one of the lower end shims, but I believe the material is the same.) I bought a special bit from Germany for making the bungs. The bit can make 6 mm (.236”) bungs 1.5” long.



This allows me to fill each hole with one bung. So I enlarged the screw holes to the diameter of the bungs to a depth equal to the thread length of the screw. I then used a pipe cleaner to coat the inside of the hole with epoxy (105/205) and then set the bungs in the G-flex blend. When the epoxy cured I trimmed the bungs flush with a chisel and cabinet

scraper. I then painted the contact surface with two coats of Primocon (1<sup>st</sup> coat thinned 10% with Xylene).

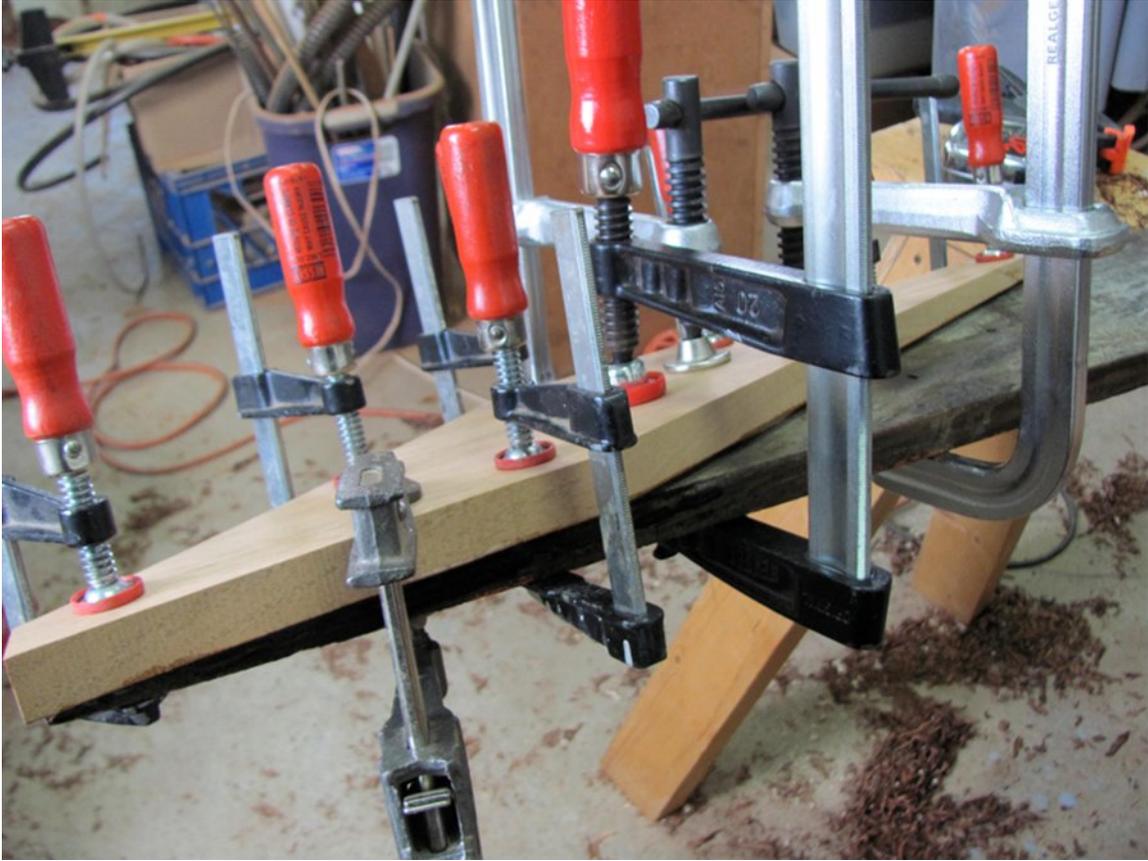
The previous step is really prep work for S6 and not strictly necessary for hanging S5, but it's easy to do it with S6 off the boat.

With S5 off the boat, I started the repairs, which consisted of several parts. The most difficult of which was the plank end.

For some reason, the hood end aft did not fit snugly to the rabbet in the stern post. I didn't notice this when I removed S5, so I'm not sure how this occurred. In any case, I spliced in a repair using what is called single finger joint or a cloths-pin splice similar to the repair of P5. Unfortunately, the repair didn't go well.

The problem was that the plank twists a lot and I didn't immediately recognize the impact of this in making the repair. In attempting to plane a flat surface for the splice, the twisting plank caused the splice to extend forever! I finally recognized the problem and had to settle for a surface that was not flat over its entire length. This caused a nasty fitting problem, as you can imagine. After considerable trial and error, I got a good fit. I was more careful in choosing the cutting plane on the bottom half of the splice. The two pics below show the top half of the splice during glue up.





As with P5, there was a semicircular hole in the edge of the plank, which if filled with another cloths-pin splice.



The remaining repairs were minor by comparison, so I decided to fit the plank before finishing the repairs.



The pic above shows the plank clamped in place on the boat with wedges to hold it down against S4. Fitting the hood end to the stern-post rabbet was the tricky part. First, I made a template capturing the shape of the hood end. I could then trace this shape onto the plank end. The problem was in determining how much to trim to make the plank length and the bevel correct. I started by making the end a bit too long and used a radiused spoke shave to trim the end to fit. Rather than remove the plank on each iteration, I just removed the clamps and wedges aft, which allowed the plank to swing out away from the boat. Then using some blocking and a long clamp, I was able to stabilize the plank end while I worked the spoke shave. I used the template to guide the curvature and judged the bevel by eye. After numerous iterations I achieved the desired fit – notch in S5 firmly seated against the nib end of S4, lower edge of S5 in contact with top edge of S4, and hood end seated against the stern-post rabbet – or almost that good!

The next step was to eliminate (or at least reduce) the gaps in the seam between the bottom edge of S5 and the top edge of S4. So with S5 clamped in place and wedged down, I used my set of feeler gages to measure the gaps in the seam. I recorded the gaps with pieces of masking tape on S5, then removed the plank and planed down the high spots – two passes with a finely set apron plane takes about .010". Because this was an existing plank not a new one, it only took one iteration to achieve an acceptable fit.

Now it was back to the final repairs.

I decided (as I did for P5) to plug all of the old fastener holes with bungs set in an epoxy blend consisting of 50/50 (approx.) of G-flex and 105/205 or 206. To do so, I first cleaned out the holes by running a 7/16" counterbore into the holes, using an oversize pilot bit. Some of the holes on the inboard face of the plank exhibited checks radiating from the holes. I decided to repair these checks first. Using a Fein multitool, I enlarged the checks slightly to make room for epoxy filler. In doing so, I discovered that the checks were only superficial, but I decided to fill them anyway. Because the checks extended into the fastener holes, I was concerned that the epoxy would run out of the check into the hole, so I first plug the holes with 6 mm bungs.

After filling the checks, I bunged the fastener holes. For those pilot holes not already plugged by 6 mm bungs, I used duct tape on the inside face of the plank to cover the holes so that the epoxy would not run out. Using the epoxy blend and a syringe, I filled the holes up to the bottom of the bungs. Then coated the inside of the bung hole and the outside of the bung with epoxy and seated the bung to the bottom of the hole with a hammer, being careful to keep the grain aligned.

If the bung hole had chip-out, I used the syringe to fill the void and covered the area with a small piece of 5 mil poly (with a 7/16" hole punched in it to fit over the bung), which helps to keep the epoxy in place. The following pic shows a typical example.



The final repair was a minor split in the plank edge, which I fixed by opening the split with my Fein tool and filling the gap with epoxy blend.

With repairs complete, I measured (as you can see in the pic above, I painted the edge gray so that my pencil line would be visible) and cut a 1/16" caulking bevel on the bottom edge and clamped S5 on the boat for fastening. In all, it took about 90 #12 bronze screws (2" in the frames and 2.5" in the backbone) and 10 hours over 3 days to finish fastening.

I should mention that the gaps in the seam almost always "grow" a bit during fastening. This is because it's very difficult to clamp the plank firmly against the frames – the fasteners inevitable draw the plank in a bit. This can rotate the plank slightly making the gap bigger.

I would also like to reflect on how I proceeded to eliminate the gaps in the seam. I used feeler gages to assess the size of the gaps along the edge of the plank and then trimmed down the high spots. When employing the feeler gages, I did not differentiate between tight spots at the inside or outside edge of the plank. In principle, it's important to remove wood from the correct edge. If you're not careful, you can end up with a tight seam only at the outside edge (larger gap at the inside edge). Then when you cut the caulking bevel, this inside gap will appear! As it turned out, it didn't matter for S5 as very little wood had to be removed. In the future, I'll try to remember to correct this omission.

On a related note ... knowing the gap at the outside edge can be important in cutting the caulking seam. The goal is to have a uniform seam with a gap at the outside edge of 1/16" and a tight seam on the inside edge. If you don't take into account the size of the gap before you measure for the caulking bevel, you make the gap too large.

Finally, if I ever have to remove this plank in the future, the following sequence of pics shows the bungs that cover screws.



At the center is frame 33 with a diamond bund pattern. Note that the bung on the right plugs an unused hole.



This is the hood end. At the center, we have two bungs close together. The right one of the pair covers an empty hole. The drill hit something in that hole.



The bung under and near the center of the repair area is a dead hole.



The bung nearest the nib end covers a broken fastener. It would not have to be removed to remove the plank.



This area is near the forward strap. The two bungs that are isolated and flush with the face of the plank cover dead holes. These were previously occupied by fasteners into the top of the keel plank, but I felt that they were too close to the top of the keel to drill the holes without breaking out.



Nib end of S4. The flush bung top center covers a dead hole.