

S19 – outer plank

December 9-16:

Well the inner plank at S19 is done, so it's on to the outer plank.

The first step is to mark the location of the bottom edge of S19-outer onto S19-inner. This provides a reference for making the scrubbing templates and for measuring the bevel angles.

Next we make the scrubbing templates. Because I had to plane the top face of S19-inner to match the existing inner plank (which was too thin), the templates have somewhat of an odd shape – flat towards the top and curved at the bottom. This doesn't matter, however, since you need to scrub the inside face to fit the inner plank regardless of the shape.

What does matter, and what is different, is the shape of the outside of the plank. This must match the curvature of the hull. So I can't use the same template shape for both the inside and outside faces of the plank. What I'll do is just leave the outside face of the plank flat and proud of the existing planking and fair it in later. Note that I've allowed .100" extra thickness for scrubbing, but the existing planking is about 1/16" shy of 5/8". So the new planking extends above the old by as much as 0.150" in some places.

When the planking lies against the frames, like the inner plank or a Carvel plank, you can easily extract the shape of the template by tracing the shape of the frames. Not so for the outer plank, since the frames are obscured by the inner plank. So making the scrubbing templates for the outer plank involves a bit of trial and error.

I've collected quite a few templates from previous planks, so I look for one that is a close fit. Holding the template against the inner plank, I use a short pencil laying flat on the inner plank to transfer the curvature of the plank to the template. This technique is not precise but is satisfactory for these templates. I've also used a contour gage to accomplish the same thing.



With the templates done, it's time to measure the bevel angles; i.e., the angle between the edge of the new plank and the edge of the existing plank above it. Over the years, I've tried a variety of techniques for measure bevels. The best approach depends on the situation. For example, if the frame is fairly flat, a small bevel gage works well, except when the edge is narrow. So for the 5/8" thick outer plank, it works fine, but not for the 3/8" inner plank. But when the edge is this narrow, bevel errors are less noticeable. One of these days I'll work on a special tool for this case, or maybe just a collection of bevel gages at varying angles around 90 degrees.

If the frame has substantial curvature, the bevel gage doesn't work very well. Since you're scrubbing the plank to fit (not bending it), the angle you want is relative to cord of the curvature not tangent to the curve, which is what you get with a bevel gage. In this case, I find it best to measure the angle from the scrubbing templates. See my previous publications (e.g.; *Planking a Carvel Planked Boat*) for details on measure bevels.

Ultimately, however, small differences in bevel angle are not significant. The idea is to have the plank edge tight at the outside. A small gap on the inside is acceptable, since (1) it will be filled with sealant, and (2) it's not visible. So if the bevel angles don't vary much, just chose the smaller (more acute) for all the bevels.

The next step is to make the spiling batten. We can reuse the one used for the inner plank. We first break it down into its sections, make adjustments to the sections at the hood ends, sand the sections, and paint them white. Then clamp the sections to the boat and glue on the butt blocks. This batten is about 4-6" longer than the previous one, but it's easy enough to make up this distance but allowing some gap between sections. While the glue is drying, you can spile for the top and bottom edges of S19-outer.

Removing the spiling batten from the boat is a bit tricky. It's almost 40' long and limber as a wet noodle. In fact, I cracked one the butt blocks in the process. Now I've got a clamp on it.

Using the spiling batten, I laid out three plank sections; one 17 footer forward, one 17 footer aft, and about an 8 footer to fill in the middle. I then rough cut the planks $\frac{1}{2}$ " oversize to allow for any stress relaxation. Then I planed them to final thickness – $\frac{5}{8}$ " plus 0.100" allowance for scrubbing.

The planks didn't turn out as well as I would have liked – too many knots and squirrely grain, but they should work ok.

Starting with the middle plank, I reverse spiled the top edge and cut close to the line with my circular saw. I did the same for the other two sections. Then I planed the middle section to the line.

Next I scrubbed the inside face of the middle section concave using my scrubbing templates.

I then started to cut the top-edge bevels. Unfortunately, I started to cut the bevels the wrong way, so I had to square up the edges and start over. This messed up the shape of the top edge. Consequently, the fitting process took a lot longer than normal. On first fit, the maximum gap was probably $\frac{1}{8}$ " or more. Eventually (maybe 7 or 8 iterations), the fit was very good. I'm just glad that I left the bottom edge full or the plank would have been too narrow.

Having fitted the center section, I moved on to the forward section. I began by planing the top edge to the line. Then I cut the bevel, which was about the same for the length of the plank. This made planing the bevel fairly easy – no bevel limit line, just set the bevel gage and start planing. After awhile you get the feel for feel for it, and you only have to make an occasional check with the gage.

With the bevels done, I scrubbed the inside face. This plank ranges from the hood end forward to frame 19, but frames 1 through 14 are flat, so very little scrubbing was needed.

Finally, I cut the hood end to size and cut the (obtuse) bevel. Then it was time for a trial fit.

All in all the first fit was pretty good. The hood end wasn't right, so I had to spend some time trimming the end with the plank on the boat. I probably should have made a better template for the hood end. Once the hood end was right, the maximum gap for the top edge was only a bit over .030", so one fitting cycle was all that was need to get a very good fit (<.022" and mostly <.010" needing only two light wedges).

I could start on the aft plank section, but I think I'll work on scarfing the two sections that I've already fitted.

First I'll mark the location of the frames on the two sections so that I can eventually position the fasteners. I also need to mark where there are any bolts in the frames, so that I can avoid them.

Next, I need to relocate the bottom-edge data points, especially for the middle section. Due to fitting problems, these points are displaced 1/8" or more. I'll then draw a fair line through the points and cut/plane to the line.

I need to position the two sections on the boat and make reference marks at frames 17-19 for accurate registration during scarfing.

December 17:

I decided to fit the aft section after all. It just made sense to fit all the sections before scarfing so that I can define and cut the bottom edges at the same time. Besides, to limit the dust in the shop, I like to make long cuts outside, and today it rained all day.

So I planed the top edge of the aft section to the line. I then cut the bevels. The bevels were shallow and fairly uniform along the length of the plank, so it didn't take very long.

Scrubbing the inside face was next. This took some time. The amount of shaping varied substantially from one end of the plank to the other. At the hood end, the plank is flat, whereas at the inboard end, the cord depth is about 0.1". I needed about 6 templates to cover the range of shapes. It's a seemingly endless cycle of checking the plank against the templates, marking the high spots, planing the high spots, and then rechecking. When you achieve the right shape, sanding with coarse paper removes the ridges left by the plane.

Lastly, I cut the hood end to size with the appropriate bevel. Again, I should have made an accurate template of the hood ends. This would have reduced the amount of (awkward) on-boat planing to get the hoods ends to fit.

I clamped the aft plank section to the boat to check the fit. This section has substantial twist and curvature, so at first glance the fit was not encouraging. A little edge set here and there resulted in a vast improvement. There were still some areas that needed attention, but after two fitting cycles the fit was very good.

I realize that edge setting a plank is to be avoided, but with a plank section like this one – lots of curvature, twist, and scrubbing, I suspect that it's inevitable. One can't expect a spiling batten made of 1/4" plywood to flex like the plank it represents.

Finally, I relocated the bottom-edge data points, and drew a fair curve through the points.

In preparation for scarfing, I clamped each section to the boat and did the following:

- Marked the location of each frame to help with locating the fasteners. I will also need to mark where any frame fasteners might interfere with planking screws.
- Made reference marks on frames 17, 18, and 19. Also marked the forward and middle sections at the same location as the frames.
- Do the same for frames 25, 26, 27 for the aft and middle sections.
- Made a reference mark at the balance point of each section to aid in initially positioning the section.
- Where the plank sections overlap, checked that the width of the sections are equal (as determined by the line defining the lower edge). No adjustments were needed.

Before scarfing, I need to cut caulking bevels at the hood ends.

December 18-20:

Caulking bevels cut (goal: 1/16" gap at front face; tapered the full width of the plank).

Scarfed the middle section to the forward section.

Also plugged a small hole in the plank (sap pocket or worm hole). I drilled out the defect with a .240" drill and plugged the hole with a 6mm Wana plug set in G/flex epoxy.



Scarfed the aft section.

I need to mention something about scarfing ...

Scarving this plank presented a problem not previously encountered. The problem arises because the inside face of this plank is concave not flat. The way I cut the scarf joints is to lay one section on top of the other so that I can cut both bevels simultaneously.



This method (normally) results in perfectly matching bevels right to a feather edge. When the face of the lower section is concave, however, the feather edge of the section on top is not supported across the width of the plank. Consequently, instead of being cut by the plane, the wood deflects. The result is a “thick” feather edge that doesn’t match the mating bevel.

To correct this problem, I found that once the wood starts to deflect, I could reverse the plane, planing against the grain. In that case, the plane is support by the lower bevel and so the top bevel is not deflected. Of course the edge is quite fragile and one must exercise great care so as not to damage the edge. I use a small plane set very shallow with a slicing motion.

The plank is now ready to be clamped to the boat to check the fit. Assuming the fit is ok, I’ll trace the bottom edge onto the inner plank to indicate where to apply primer. I’ll then prime both surfaces, apply sealant to the plank, and clamp the plank in place.

I need to mark the location of any frame fasteners, mark the plank for fastener locations, and screw the plank to the frames/backbone. Insert bungs. Eventually, I’ll back-fasten the inner plank to the outer and fasten the hull strap.

December 21:

Checked the fit using 3 ropes to lift the plank into place.



The fit looks good, just my caulking bevels are not open enough. Marked the plank for fastener locations. No frame fasteners were found to be in the way of planking screws.

Lowered the plank with ends resting on saw horses. Recut the caulking bevels to provide 1/16" opening.

Removed dirt from the faying surfaces of the inner and outer plank with a tack cloth and coated with primer.

Made 100+ bungs.

December 22:

Coated inside plank face with sealant. Took almost 2 tubes of sealant (one was about 5 months out of date!), which was a surprise. I think the last plank took just under 1 tube. Maybe I applied it too heavily. The application guide says to use a 2mm notched trowel but I only have a 1mm and 3mm. (After 3 days it appears that the out-of-date sealant has cured, which was the one concern.)

Positioning a 40' plank covered with sealant is no picnic, especially short handed. My most recent approach was to use 3 ropes extending down from the deck to lift the plank. Where the ropes touched the plank, I temporarily eliminated the sealant. The goal was to lift the plank high enough to clamp the hood end forward and then add clamps working aft. This almost worked! In practice, the plank rubbed against the inner plank below its proper location, making a mess. Fortunately, this was limited to about three spots, which I could clean up with putty knife, rag, and mineral spirits. The second problem was adjusting the position of the hood end once the plank was in contact with the inner plank (hard to move due to the sealant). Ultimately, I clamped a block of wood to the plank

near the midpoint (no sealant due to rope), and pounded it with a hammer. Once I got the plank approximately in position, I added sealant where the ropes had been and finished clamping. Applying the sealant and clamping the plank in place took about 3 hours. It's a race against time before the sealant starts to cure. I should have more clamps so that I don't have to rush to install the fasteners.

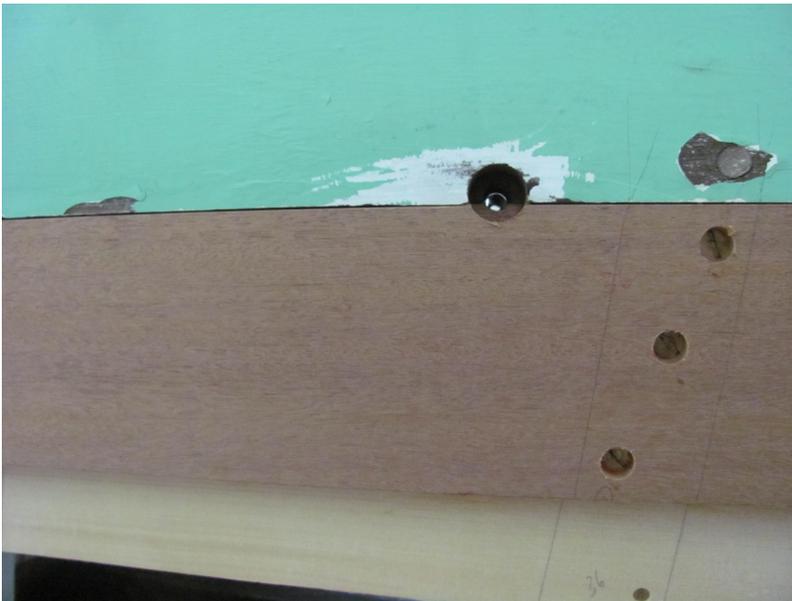
Installed the fasteners (well over 100), which took about 6 hours. Here are some pics of the fastened plank.



I still need to install the bungs, back fasteners, hull strap screws, and the two mizzen chain plate bolts. I had removed these because they fell on the plank seam. I was going to relocate them but decided against it.

December 25:

Installed the two mizzen chain plate bolts. The one aft was 3/8" diameter and I reused the original. The one forward was 5/16" diameter. I replaced it with a new one. In both cases I drilled from inside the boat with a sacrificial block outside to prevent break out though the new plank. I then counterbored from the outside to 3/4" for the bung. I started the counterbore with a counterbore cutter attached to a 5/16" drill bit. I finished the cut with a Forstner bit to remove the center left by the counterbore. The initial drilling was all 5/16". Then after counterboring, I enlarged the aft hole to 3/8". I cut a screwdriver slot in the top of both bolts to prevent spinning when I tightened them. I also tied a strand of cotton wicking under the head as a stop-water.





Unfortunately, the counterbored hole ended up a bit oversize, so I don't know if the bung set in red lead will stay put. If not I'll insert a new one set in adhesive.

I then installed all the bungs set in red lead, including the one screw left over from my laminated frame repairs. After the paint dries, I'll trim the bungs flush with the plank.

I still have to install the back fasteners and the hull-strap screws. I have to deal with a problem with the previous back-fastener holes in the existing inner plank. Some of them lie on a crack. I think I should plug these (clean up hole with counter sink and fill with epoxy) and drill for new. This will complete the installation of plank S19. Of course I still have to plane the S19-outer to match the shape of the hull, but this has to wait as least until I finish S18.