

Leveling Shapeoko 3 XXL Spoilboard

This is a discussion about leveling a replacement spoilboard for my Shapeoko XXL. I had created 3 spoilboards at the same time. Over time I have replaced the spoilboard a total of three times. This being the third. I originally used the Myers spoilboard to create the spoilboard with 2" spacing using 1/4-20 3/16" Tee nuts. This gives me plenty of room to surface the spoilboard before having to replace the spoilboard. My second one had been surfaced several times and recently I had an incident where I was cutting a 1.5" lathe steady rest. The material became loose and the bit went crazy and cut into my spoilboard fairly deep. Plus it was just time to replace it. Earlier I had developed a Spoilboard Considerations document that is posted on the C3D Community Forum.

<https://community.carbide3d.com/t/spoil-board-considerations-draft-how-to/31162>

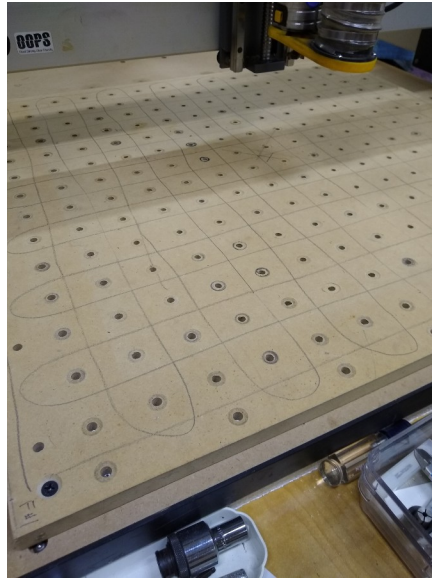
So the original spoilboards I made were larger than my Shapeoko XXL could cut completely during flattening. So using my document above I cut the original design down on the table saw.

During my replacement I took the old spoilboard off and knocked out the Tee Nuts and reused them. About half way through I was finding that some of the Tee Nuts were not seating all the way. I used a 1/4-20 3/4" bolt and two washers and a Dewalt impact driver to full seat them. Some of the Tee Nuts would rebound back out. I removed those and found that some of the ears on the Tee Nuts were bent. About half way through I had some new ones and got those out and starting using those instead of the used Tee Nuts. I still used the bolt to seat the tee nuts all the way and that left some indentations on the surface of the new spoilboard. It is very important that the Tee Nuts are fully seated to avoid your spoilboard from being uneven. So during the install I checked every location to feel if they were seated all the way. There were 240 Tee Nuts to drive in, tighten with driver and check for their depth on the bottom of the spoilboard. This took several nights of work due to the fatigue of this repetitive task.

I have 1/4-20 brass threaded inserts installed on the factory base board. I used the old spoilboard to mark and drill the flat head screws that hold my spoilboard down in place. I used a hand reamer to make the flat head recess deep enough that during flattening my cutter never hit the bolt heads. I have a total of 4 of these threaded inserts in the 4 corners of the spoilboard. On the next iteration I will likely increase it to 6 or 7 with one in the middle of the spoilboard.

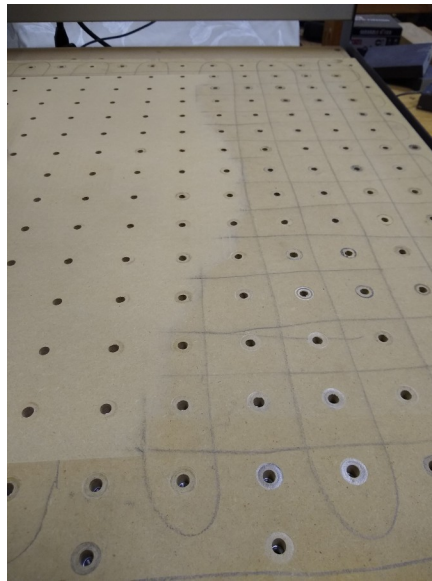
To start the flattening process I created a Carbide Create project that was a rectangle 1/2" larger than my actual spoilboard. That created a 1/4" of space to get the whole spoilboard flattened. This is so all the

edges get trimmed and do not leave a small ledge around the outside of the spoilboard. I then created a pocket tool path that was with a Whiteside 6210 fly bit and cut 0.010" deep. The custom tool for the fly cutter was created for 0.010" depth of cut. This way I get a single pass on the flattening. Additionally I drew pencil lines zig zagging vertically and horizontally on the spoilboard. With the pencil marks I have a visual reference when the whole spoilboard is flat.

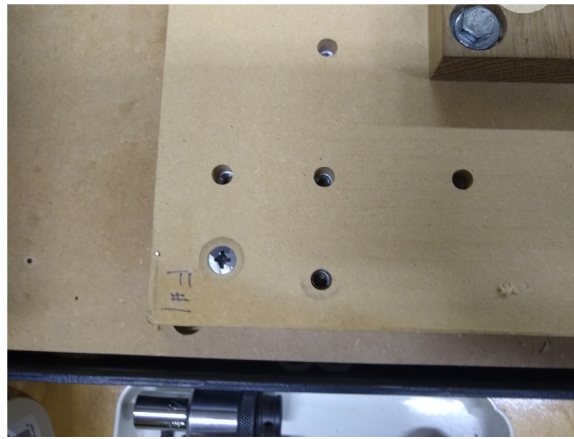


I powered up the Shapeoko and went into settings before initializing and disabled my BitSetter. This is for two reasons. First is the Whiteside 6210 has a hollow center and is not compatible with the BitSetter. Second I did not want the fly bit to hit the BitSetter when making the final run around the front of the spoilboard. After disabling the BitSetter I initialized. In the CC project I had used the center as my origin. I installed a 60 degree vee bit and set the X and Y Zero by lining up the X in the middle of the new spoilboard I had created by using a 4 foot ruler used across the corners of the project. After zeroing the X and Y I used the paper method to set the Z zero. I could have used the BitZero but I was in an old school mood.

I started the project in Carbide Motion. I had used my custom tool for the Whiteside 6210 and I could see about 75% of the way through the front of my spoilboard was not getting surfaced. I could have stopped the job and reset the zero on the low spot but I did not know if the rear of the spoilboard would have been higher and caused cutting problems. When the job completed I simply jogged the router to the front and set the Z Zero in a low spot and started the job again. You see in this picture taken from the side that the front of the spoilboard is lower than the rear that was surfaced on the first pass.

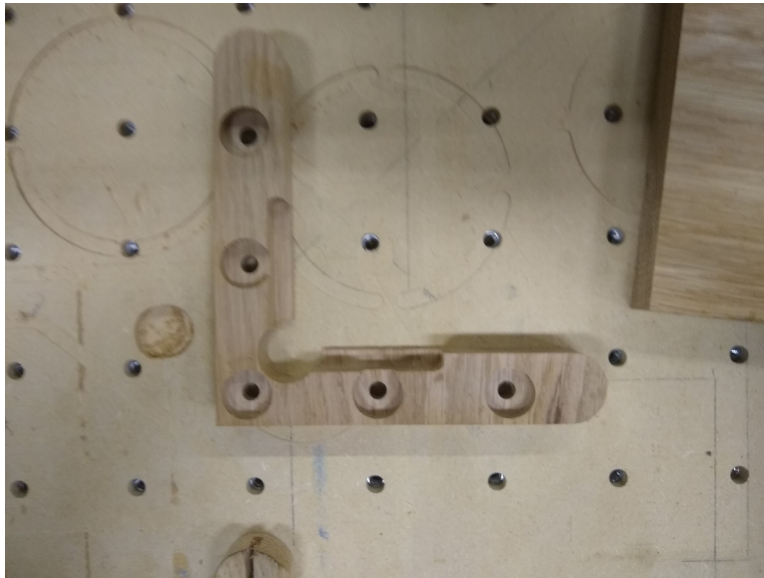


I started the job again with the new Z zero and the surfacing removed all but just the front corner of the spoilboard material. At this point I decided rather than run the whole job again I would just live with the front corner being a little low because I never really use that part of the spoilboard. I could have rezeroed in the corner and ran the job again but it was late and I had several projects lined up and after taking several days to complete the new spoilboard installation I was satisfied. I should have ran the job again but I was tired.



With the 1/4-20 Tee Nuts I use an L bracket and cam clamps to secure projects to the spoilboard. I am using the painters tape and super glue more and more and especially for small projects. I use the L bracket for the initial gluing and then remove it. It is important to replace the L bracket before removing the project because I use the router with a bit in it to initially square the L bracket.

Here is the L bracket I created and use to square up projects. You can see that I made a relief cut so the BitZero can still be used on the lower left corner. However the minimum material thickness is $\frac{1}{2}$ " to use the BitZero . I wanted the corner to still be in place to help square up projects. I use 1/4-20 bolts with washers to secure the L bracket. You must carefully measure your spoilboard thickness and the recess in the L bracket so the bolts do not penetrate all the way to the base board. This would hike the spoilboard and make your project not cut properly due to the height issues. My new spoilboard is .75" and all my L bracket and cam clamps regardless of thickness have $\frac{1}{2}$ " distance from the bottom of the L bracket/cam clamp to the top of the recess for the washer. I like to use oak for the L bracket and the cam clamps.



Here are some of the cam clamps I have made. I started with the Myers cam clamp design and in the picture I redesigned the cam clamps and made them my own. The advantage of the cam clamp is you make half in one direction and mirror and make the other half face the other way. This is so when clamping a project the bolts moves clockwise during tightening. This is an mechanical advantage to keep the clamp from being loosened during tightening. On one side the clamps face the way to help with tightening and on the other side the mirror image is used and the same mechanical advantage of tightening the bolt keeps the clamp from being loosened against the project material.

As time goes by and the spoilboard is surfaced I just add a washer to keep my bolts from bottoming out on the base board. The original Myers clamp plans had the large cam clamps pictured below and some smaller ones. I made both but primarily use the large clamps. You can see at the top the spacing between the material and the top clamp I had to use a spacer to get a good clamp because the 1/4-20 holes for the bolts were too close to the material to get the large cam clamp in place. The same is true on the right side. You can also see the opposing clamps on the side. The top clamp on the right side is tightened further when tightening the bolt. The lower clamp on the right side can loosen its grip on the project when tightening so be sure to hold the clamp tight when tightening the bolts. I keep lots of spares of the cam clamps because occasionally I cut into one making a cut near the edge of a project. I reuse the bolts and washers and replace the clamp. I just throw the abused clamp in the trash. Notice the orientation of the grain. This is for strength.

