
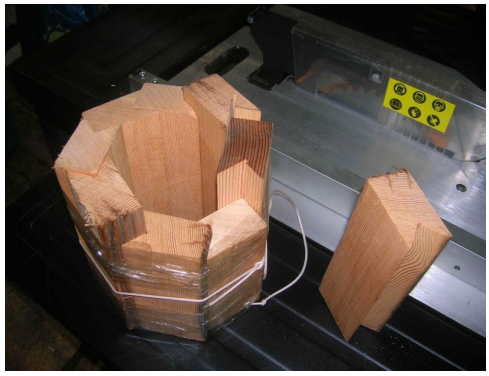

How to build an 8 Staved Birdsmouth Mast.

By Gary Pick
bambooman@netspace.net.au

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To build a birdsmouth mast is not hard to do, there's a good bit of work in it but it's not rocket science. So here we go. I'm going to deal with an 8 stave mast because I consider 8 staves to be the ideal and it's what I built.

Design:

To design your mast you need to know the finished dimensions. I will assume we are talking about a hollow free standing mast. Pages 130-31 of Practical Junk Rig will give you your recommended mast diameter at the partners (where mast passes through the deck). You will of course need to know how long your mast will need to be. PJR will also give this information.
The wall thickness of your mast should be around 20%, so for a mast 200mm in diameter the wall thickness would be 40mm. There is a basic ratio for calculating the width to depth cross section of the stave . The outside diameter is defined as 2.5 times the stave width. However that solution is not entirely accurate. In fact, both the width and thickness of the staves have an effect on the resulting diameter. But I recommended this site, in my book it is the ants pants.
http://www.duckworksmagazine.com/04/s/articles/birdsmouth/index.cfm
You will find a wealth of information as well as calculators to work out your ideal dimensions.

Timber:

I used recycled Oregon (Douglas Fir) because I couldn't afford to buy new timber, it added to the work load as I had to rip the timber into the required stave dimensions and I had to join sections together to get my stave lengths.

Parts:

The mast itself is one but from the heel of the mast to a little way above the partners the mast needs to have a solid or near solid plug because this is where the major stresses will be. I made my plug using the birdsmouth technique because I thought it would be good practice for the real thing.

Tools:

basic woodworking skills are needed for this job, you need to know which side of the line to cut. As for tools you will need access to the following, a chunky electric drill, planer, circular saw, router and ideally a tablesaw/sawbench. For the latter I bought a Chinese tablesaw for $AU349 and I used that to cut my birdsmouths.

Process:

This can be broken down into a number of steps and we will use my dimensions.

1. Cut the stave timber to the correct dimensions, mine were 82mm x 40mm.

2. Set your table saw to 45 degrees and the fence to 40mm. Using scrap timber adjust the height of the blade till the cut finishes on the centreline...20mm in from the edge. Once you get that right it is then a simple matter to run your stave through the saw then flip it end for end and run it through again. If you have done it right a triangular scrap of timber should result.

3. If you were like me and had to buy odd lengths then you will now need to scarf sections together to get you full stave lengths. This requires careful thinking because you need to stagger the joins to ensure the maximum strength of your mast. I used an 8:1 ratio for mine and used a Router with a simple timber jig to cut them.

4. Glue your stave sections together. I used epoxy thickened with a little wood flour, I get mine from the dustbag on my sander.
5. Tapering the mast. My mast is around 220mm at the deck but tapers to 100mm at the top. I used the calculators on the website above to calculate my taper. The taper comes off the back 40mm face not the birdsmouthed face. Pick your straightest stave and using a stringline and cramps or nails driven into your mast bench get it perfectly straight. Now mark up your taper.
   I cut my taper using a powersaw and it does work but it is hard to keep the tapered face square, that is 90 degrees to the 82mm face. If you don't keep it square you will have gaps when you come to glue up the mast. I cut and glued in thin splines to fix mine.
   Note: Don't try too big a taper on the bottom section of the mast. I tapered mine down to 150mm and made the tenon for the mast step part of the mast plug.
6. Now you should have all your staves. My mast bench consisted of 44 gallon drums with a plank on top. To assemble your mast you will need to make up some simple plywood or wooden jigs to hold the first 3 staves in place. Once you have set those up dry assemble your mast, this is easy to do as the staves slot into each other and are self aligning. Set up a few Spanish windlasses and pull the staves in tight. Admire your work for a moment...now make sure it all fits together neatly. You may have to fine tune here and there.

7. For the final glue up you will need help if it's a big mast. I rounded up 7 friends and made sure I had plenty of munchies and beer for later.

Assembly:

1. Have everything organised and set up to go on the day, before your helpers arrive.
2. Tell your helpers to wear old clothes and have a good supply of latex gloves handy.
3. If you are running cabling now is the time to fasten it to the inside face of the first stave. Make sure it doesn't get in the way of the staves that will be either side.

4. Explain to your helpers what the process is. I had one person mixing epoxy and wood flour and also plain epoxy mixes. I also had one person taking photos.
5. One person will be using the plain epoxy mix to wet out the birdsmouth and the back edge of each stave.
6. I had 3 people applying thickened epoxy to the birdsmouth of each stave and as each one was done it was placed in the jig.

7. As you coat each stave place it either side of the bottom stave in the jig. The last stave will go in like the keystone in an arch.

8. Once the the mast is assembled you will need to pull the staves in tight, the staves will align themselves so some form of strapping is fine. I used fencing wire because I have a lot of it. Don't worry if the wire cuts into the raised corners as you will be planing those bits off anyway.

9. Clean up and drink beer.

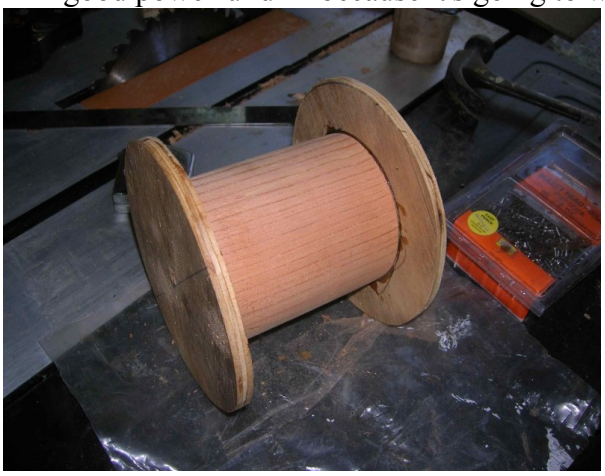
Finish:

1. leave the mast at least 24 hours before you remove the strapping.
2. The mast is all sharp corners and glue runs and it has to be made round. Using a chalkline or a string line mark line down the center of each stave from top to bottom. This is the line you will round off your mast to.
3. Now plane off all the corners till the mast is roughly round. In my opinion a power planer rules here, it's a lot of work. My mast is 9 metres so I got to do a lot of walking.

4. I made myself a set of plywood calipers and marked off one metre stations along the mast so I could check the diameter as I went.

5. At this point I made up two sets of rollers from old shopping trolley wheels to mount the mast on. It's easier to rotate the mast them manually lifting and turning...you'll need them later anyway.

6. The mast is still going to be a bit on the lumpy side and I used a good sharp hand plane to get rid of the obvious high points.
7. It's really starting to look like a mast but it now needs to be sanded. I made up a wooden drum to fit my drill and bought some sanding belts. It works like this, turn the belt inside out and slide it over the mast. The drum has a shaft on one side that fits the drill chuck and a dowel handle on the other side , put a short length of plastic tubing over this to hold onto. Place the belt on the drum and tension it up. Pull the trigger on the drill and the belt spins around the mast and sands it smooth. Having someone to rotate the mast really helps. I coated the drum with silicon to stop the belt slipping on the drum. Make sure you have a good powerful drill because it's going to work very hard, I burnt out one of mine.



8. Your mast is now done. I fibreglassed mine with a lightweight cloth to give the mast a good abrasion resistant surface.

My mast weighs in at 87 kgs., which is around 5 kgs more than me.

Further Information:

Arne Kverneland's article The Mast was an excellent starting point for me.
Practical Junk Rig will give you all the information you need on calculating the amount of bury and LAP (length above partners).
Gaetan Jette's article on calculating the stave dimensions for your mast is worth it's weight in gold.
http://www.duckworksmagazine.com/04/s/articles/birdsmouth/index.cfm#manual-calc

For more information on my boat and the building of my mast check out my thread here:
http://forum.woodenboat.com/showthread.php?88318-Redwing-update