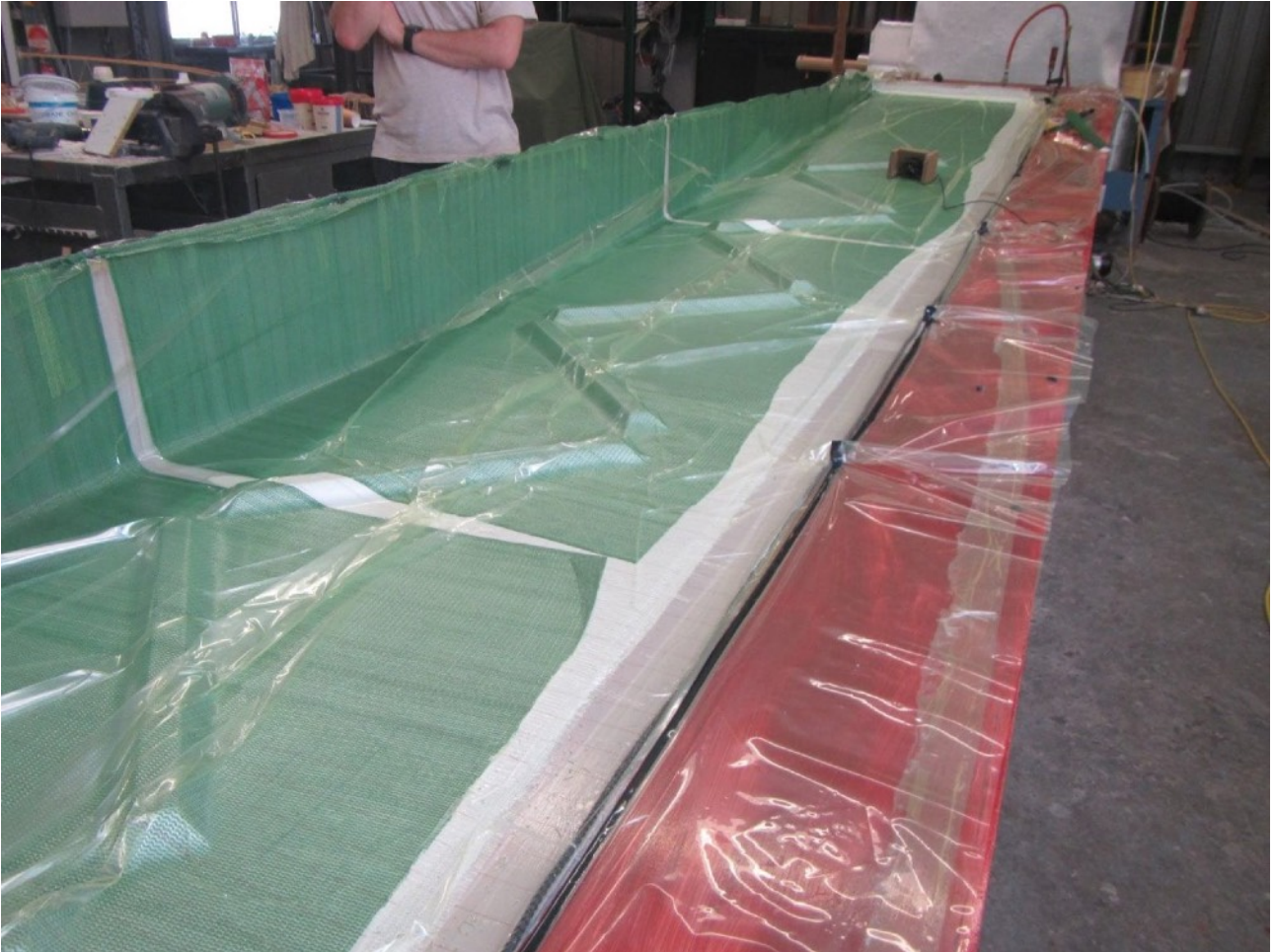


Cargo Proa Prototype

Building Blog



OCTOBER 2020#1

Demoulded the 2nd beam web, looks good. Rob R added the side webs to the test beam, will add the top web and we'll test it in house this week.

I cut and shut one of the topsides panels (simpler than expected), bonded a couple of ring frames in the hull, glassed the tender bows and trowelled on some bog to make it a bit more presentable.

The sample test rod exceeded the 1 tonne limit (surprise to the technicians, not to us) on the test machine, they will test it on the 5 tonne machine this week.

A bit of a summary so far:

In 56 days we have built moulds for and infused 4 x 12m/40' (2 more next week), 6 x 9m/30' and 6 x 4m/13' hull/deck panels, 4 by 3m/10' rudder halves and many samples and test pieces for various items. We have 3 vacuum pumps, sometimes all of them are on at once. I work 10-12 hours per day (a fair bit of it looking, thinking and drinking tea), Rob R 8 hours and the volunteers

about 20 hours a week. We have tried a bunch of new things, including flax instead of f'glass and stringers instead of foam (hopeless and great, respectively), sundry panel joins, minimising consumables and recycling/reusing those we do use. Generating about a household bin of rubbish per week. So far, a couple of minor repairs, but no throw away panels and mostly perfect laminates with half the resin and none of the suiting up, gloves, mess, fairing and waste needed for hand laminating. So far I have spent \$AUS19,000 on materials, consumables and the mould table for the 8.4m/28' tender, rudders, windward hull and beams. If the tests work out, the lee hull, beams and rig materials will cost about the same amount but there will be a fair bit left over from what I have. We are using my crappy hardware store power tools and a couple of medium size vac pumps borrowed from UQ.

In case anyone is interested, I will be placing

another order from China in a couple of weeks. The bigger the order, the lower the pro rata costs (handling, freight, customs, etc), so anyone who wants materials at about half the Aus costs, please let me know.

Day 54

Diagonals almost as good as they looked, got the 2nd set laid up. Infused the topsides (perfectly) once Brad had found all the leaks.

I used to test for vacuum by listening for air and pulling up the plastic folds. Worked OK, but I was never sure what was going on. The bat detector, catch pot (not required, but good to know it was there), multiple pumps and no core allow for a much more relaxed approach to the layout, bag sealing and infusion.

Joined the 2 half hulls. Not quite as unenjoyable (applying wet resin on my hands and knees) as I thought it would be thanks to Teguh doing all the running around for me.

Lunch time was the usual chatting about boats and building them, when Rob R suggested a really clever way to build the lee hull so that it could be easily transported. Model starts next week to see what is involved.

Day 53

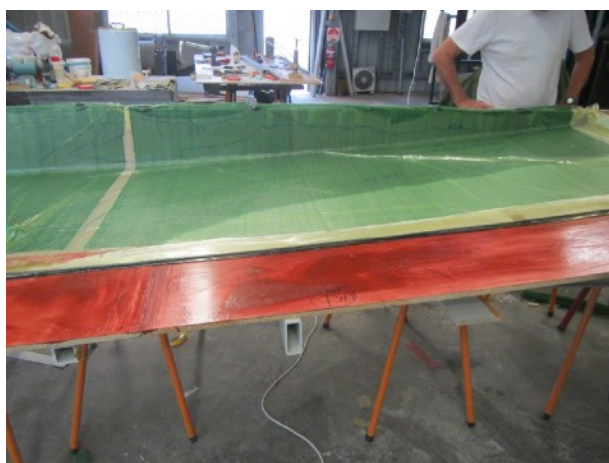
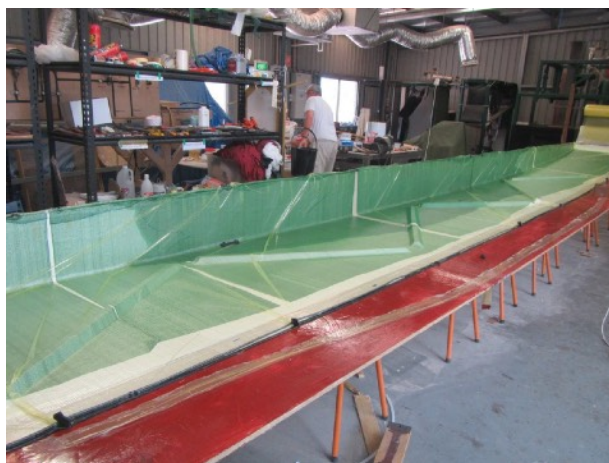
Finished the 2nd topsides, Roan learnt the joys of filleting and coving on the tender, then we made the first diagonals for the beam model. Looks good. I made a couple of catch pots for the Uni vac pumps.

Day 52

Late start, but Nakul and Teguh turned up to help Roan, Rob R and I. Rob R is in the last stages of a cunning truss construction method, Roan did some stringer installation and glassing on the tender and Teguh and Nakul demoulded the 2nd hull half section and started laying up the 2nd topsides.

The hull half is excellent, the greater angles on the stringers are a little less stiff (I think, it is difficult to tell until they are assembled) but certainly good enough. Then all of them helped me get the halves ready for joining.

There were a few lessons learnt, one of which is not to cut tacky tape with a rotary cutter. The stuff melts, sticks to and burns skin. Organising is hard work, but the things that get done with no physical effort from me makes it well worth while. Helped enormously by all of them being sensible and competent.



OCTOBER 2020#2

Day 57, 58, 59, 60

Another short week. I spent Tuesday, Wednesday and Thursday tidying up loose ends, decanting resin (not unpleasant, sitting in the sun contemplating progress in the late afternoon) and tedious boat building (filleting, tabbing, grinding, filling, sanding) installing a couple more ring frames and a gunwhale on the windward hull, building wing battens and an hour a day getting the tender ready to paint. Assembling the ww hull is going to

require some thought as we need to keep access easy and everything supported.

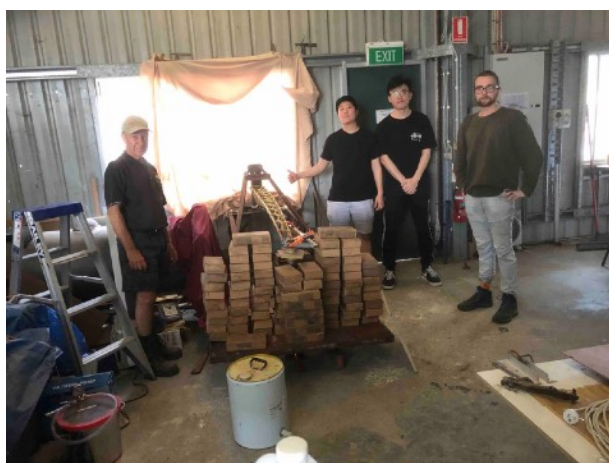
Amy, Teguh, Nakul and Sai got the ww hull cabin roof ready to infuse, Roan finished the Opti size wing rig battens and mast (2 tops of windsurfer masts) and is making the first sail panel this weekend.

The tedium ended when Rob R appeared Friday morning with the test rig for the 1/5th model beam which he had spent 2 days building from the scrap metal in the first photo. We spent the day setting it up and could not resist testing it. The rig worked perfectly.

This beam is a test of 3 build techniques (one excellent, one that can be streamlined and one that 'needs more work') and one of several possible truss layouts. Trusses have been around for hundreds of years, so you would think the optimum design would be established by now. Apparently not, and nor are the stresses when it is subject to bending in 2 directions and twisting. Something called static indeterminateness. The same applies to compression and buckling loads on covered unidirectional fibreglass rods. There is some theoretical work, but not many practical examples. Testing for new data is much more interesting than testing to establish fudge factors between known theory and practice.

The laminate on this beam is a mix of what we had available and what we thought would work. The joints are all experiments to check out their potential. Some are good, some not so much. The next one, and the scale model of the lee hull, will be built differently, take a lot less time with more control and reliability.

Estimates of breaking load varied from 100-200 kgs, so we were pretty chuffed when it got to 274 kgs and we ran out of pavers to use as weights. Someone commented that as it hadn't broken, we were none the wiser. I replied that I was pretty happy it had got to 275 and would rather be happy than wise! Thanks Yvon and Dong for measuring and recording, Roan and Rob R for the photos and making sure it all went according to plan.



OCTOBER 2020#3

Rob R says it better than I can: The second beam test again surprised us when we were still unable to break it. This time it was supporting in excess of 500Kg before the load tray started to bottom on the runners supporting the test bed. The test more or less started after we had stacked on the 274Kg achieved the previous test and checked the deflection compared to the last test. It was just a bit less than the first test so the new top web was a bit stronger and a bit neater. Both Rob and I were gaining confidence in the little beams structural integrity and were guessing 400Kg before failure and thinking 500Kg would be a magic unobtainable number. With the extreme load came extreme bending with 200mm of deflection proving the forgiving nature of composite materials. Having proven the material strength the design will now be tweaked for more rigidity. So more testing to come.

Meanwhile work is continuing on the tender and windward hull while I have started on an internal model truss for the leeward hull, which of course we will be testing. Mostly just Rob and I working this week as it is exam time for the student volunteers. Rob has been going from job to job on the WW hull all the while trying to work out the best assembly procedure. A similar thing is also



happening with the truss development as we try to come up with a plan for the actual truss beam build. Meanwhile the truss model experimentation continues with the building of a one fifth scale truss to go between the masts in the leeward hull. The truss building ideas continue to change and evolve leaving behind some cool ideas that seemed like winners at the time only to be replaced by more practical, efficient and less sexy concepts. I've lost count of how many tow wet out methods have been tested, with the best wet out so far being done by hand. Needless to say that won't be practical for a full sized truss where the tow numbers will be in the hundreds, instead of the 30 or 50 we have been using for the test beams.

Amy and Teguh spent a day on the boat, graduated from cutting fibreglass to laminating it. Quick learners. Roan built a fibreglass axle for the anchor roller and installed it in the tender. Unfortunately, the cat sat on his 3d printer so the Opti rig is on hold for the moment. The solar panels for the tender moved several steps closer, and we have started talking with the Power and Drive people at UQ about motors and installation.

