Laminated Spoon Blade Oars

Source

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USA

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Introduction

I'm going to have another try at making laminated blade oars, this time all in wood (my last pair used fiberglass shafts).

This set is for a sliding seat boat, planning for fairly traditional Macon shaped blades.

Figure 1- Rick Thompson, maker of lightweight wooden spoon blade oars

Oar Specification

The oars are 9'6" / 289.5 cms long, and they weigh 1.62 kgs each.

The laminated loom has a length of 8'3" / 252 cm, and a diameter of 1.5" / 38 mm at the handle end, a diameter of 1.75" / 44.5 mm between 2' / 61 cm, and 3.6' / 110 cm from the grip end, and an oval shape of 0.85" x 1.2" / 22 x 30 mm at the neck of the blade.

The laminated blades have a width of 7.9" / 200 mm, and a length of 20" / 508 mm.
They are 0.3" / 7.5 mm thick in the middle and 0.2" / 5 mm at the edges.

Conventional round grips have a length of about 6" / 150 mm, and an outer diameter of 1.25" / 32 mm.

Rick uses ergonomic mountain bike handles mounted on a round tube glued into the loom end. The tube has a grip length of 6" / 152 mm, a total length of about 10" / 254 mm, and an outer diameter of 7/8" / 22.2 mm. Finished weight is 3.6 lb / 1.62 kg each with D-sleeves, collars and temporary mountain bike grips installed.

Weight to balance at the handles is 2.7 lb / 1.2 kg.
This can be reduced by inserting a steel or a plumb rod of a certain weight into the hole inside of the grip.

Downloads

I draw templates for the blades, and I created a drawing for the shaft as well.

This document, and all the drawings can be downloaded for free from here

https://biber-boote.ch/?page_id=1950

This Document

http://biber-boote.ch/wp-content/uploads/Laminated-Spoon-Blade-Oars.pdf

Blade Templates – Scale 1:1

See https://biber-boote.ch/?page_id=1950

Loom Drawing

See https://biber-boote.ch/?page_id=1950

Editor's Remark

I used all information as given on the webpages in the forum. This means that all comments made to Rick's presentation by visitors are contained in this document too. For better visibility and to separate such test from the author's text these *comments are formatted as italic text*.

Besides this I added metric values for most of the imperial values given in the text.

Enjoy the build, and please send me a picture of the result to info@biber-boote.ch.
Thank you.

And last but not least:

If you find an error, you are allowed to keep it ☺.

Blades

Some people prefer long narrow blades. The question is whether it is it because of the the looks or for some aspect of performance.

Steever's calculations show short fat blades are more efficient. This is why why racing oars are all fairly short fat blades, especially the newer designs (e.g. Concept 2's newest is 18" x 9" / 457 x 229 mm).

I thought that longer blades were a tradeoff to make rowing in waves easier, but even that is not really an issue if you feather.

Shafts

It looks like it is important to match the blade design with the oar loom / shaft flexibility.

The hatchet oars I have now are about 19" x 8.3" / 483 x 211 mm (bigger) blades, and they are on very soft fiberglass shafts. That seemed too flexible at first but now they are my favorites.

Now I'm going to try to make wood shafts that are thin, light and soft but don't break. Not quite sure how yet, but as a first try I will laminate a strong wood to a light wood.

Making the Jig

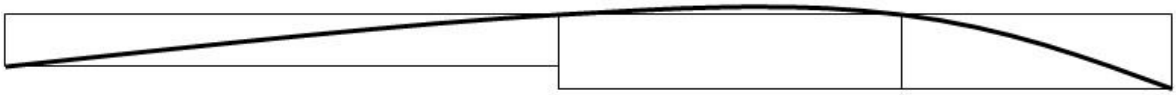


Figure 2 - Blade Curve

The blade curve was eyeballed from the shape of typical racing blades and sketched onto a pattern. Two pieces 2” x 6” / 51 x 153 mm were cut into the curve.

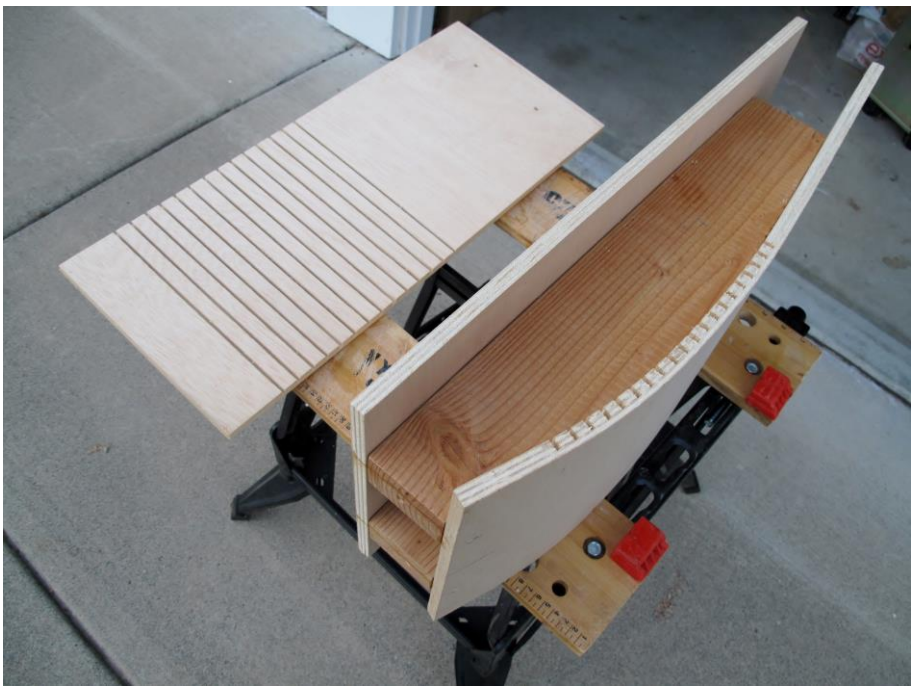


Figure 3 - Jig for laminating the blades

Some cheap plywood was glued on to make up the main part of the jig, and also the flexible top clamp piece.

Making the Blades

Figure 4 - Raw material for the blades: Oak veneer and Okoume plywood.

The core is 4 mm okoume marine ply (3 layer), leftover from the boat.

For the outer skins, I found 1/16" / 1.6 mm white oak veneer from Certainly Wood. Most veneer is too thin, but they have a selection of thicker material. 11 pieces size 11" x 50" / 280 x 1270 mm were $3 each if I bought the lot, so I did (enough for 5 pairs of oars). This is nice material, very straight along the grain and uniform thickness. It looks to be knife cut, I'd have no way to make sheets like this even if I had a band saw. Plus it is not expensive.

John DeLapp builds his oar blades with two 1/8” / 3.2 mm thick wood pieces. The result is a 6.5 mm thin blade, that is rather fragile. It has only one glue layer between its two parts. Because of this there is some spring back - means loss of bend - when removing the laminated blade from the jig.

Figure 5 – Raw cut material for two bladess: Oak - Okoume Plywood – Oak

I used a pullsaw to cut the raws for two blades. Trying to do the whole job without power tools.

Figure 6 - The jig ready to start gluing

Wax paper is used to separate the two blade assemblies, and to keep the blades from gluing together or to the jig.

Note the patented "towels on a clamp", which goes wherever I'm making a mess in the shop.

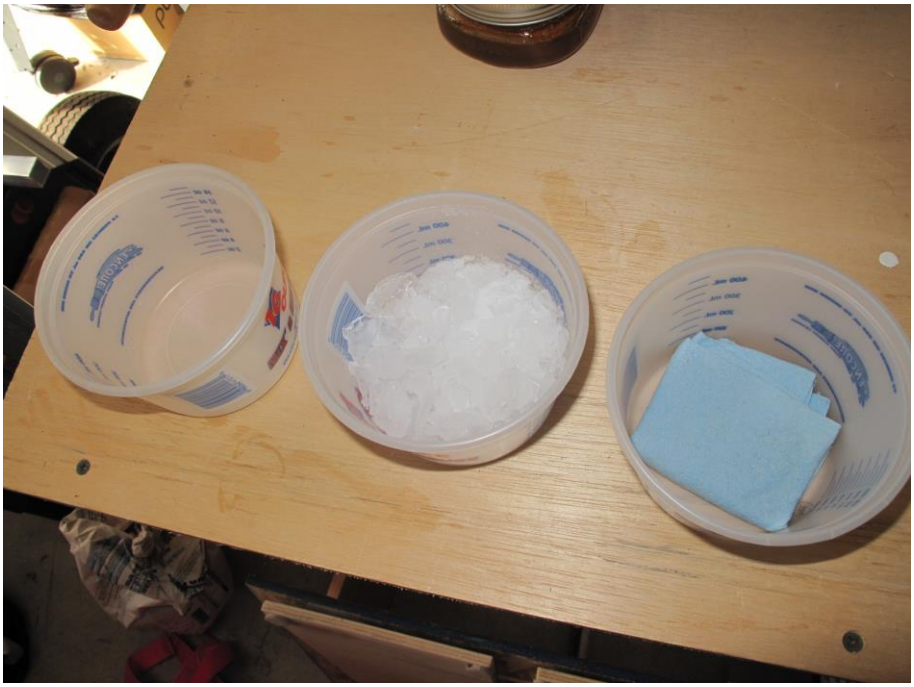


Figure 7 - 3 tub system for epoxy work

Tub 1 holds the epoxy, it goes into tub 2 which is half full of crushed ice. Tub 3 catches condensation so it does not drip water on the job. I use slow hardener, and it's not hot today, but a tub of epoxy can still kick off faster than you want it to if it starts to self heat.

Figure 8 - Two blades in the jig with glue applied

The 2 screws at the far end go through the jig and the layers, holding the whole slippery stack together and aligned ready for clamps.

The okoume ply was aligned with the outer grain lengthwise, same as the skins. So only the inner ply is crosswise.

I'm laminating two blades at the same time. The blades are separated with wax paper to not become one blade at the end. And yes, I did think of getting two blades with slightly different curves. One will have a radius of curvature .29" / 7.4 mm longer than the other. The tightest part of the curve is around 8" / 203 mm radius, so the difference is a few percent. I was not going to worry about it ...

Figure 9 - Two blades in jig - closed and clamped jig

Figure 10 - Blade blanks out of the jig, test fit the pattern

After removing the laminated blades from the jig, there's no significant springback.

There is a slight noticeable difference in curvature between the two blades, as expected. But that can be compensated by offsetting the blanks slightly when placing the pattern.

Some epoxy squeezed through pores in the veneers and wetted the outer surfaces. Hope this is not a problem, I should be able to sand back to wood (gently).

These raw blades feel light compared to my last ones made with thicker maple skins, and they are very stiff too. So far so good.

Thorne's comment:

Perhaps you should roughly trim and finish the edges of the blades, then try them with the new oar shafts / looms. That would allow you to tweak the "loading profile" by resizing the blades to better match the flex of the new oars.

From the Concept2 site:

"A blade's loading profile can be impacted by shaft choice. In fact, the Skinny shaft was designed to offer an overall softer loading profile with the Fat2 blade, while maintaining the blade's efficiency. The graphic at the bottom of this page shows the loading profiles of different Concept2 blades."

Good idea, Thorne. I was thinking the 18" x 7.7" / 457 x 196 mm was still a bit too big, but will leave it as is for testing.

Figure 11 - Blade cut from blank

Going with Thorne's advice, I went up to 20" x 7.9" / 508 x 201 mm. They can always be cut back.

The off-cut pieces are plenty strong along the grain. They break much easier across the outer grain, but I am sure the blades will be strong enough without any fiberglass needed. I may glass just the tips, for abrasion.

Blade weight is 12 ounces / 340 grams.

Making the Shafts

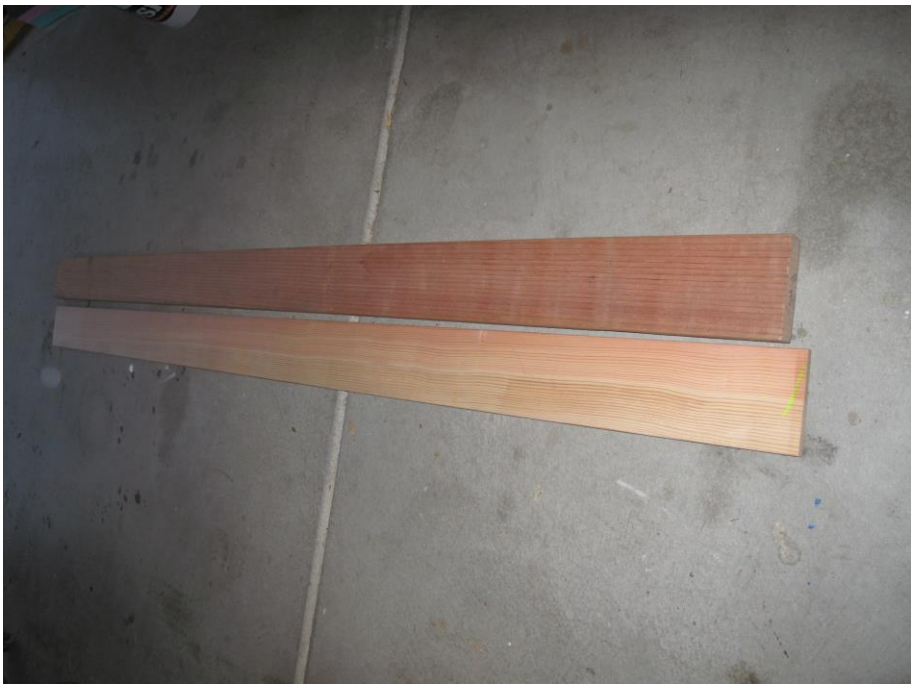


Figure 12 - Raw material for shafts

I make the shafts from 2” x 6” / 51 x 153 mm Redwood and 1” x 6” / 25.4 x 153 mm Douglas Fir, each 8’ / 2.44 meters long.

Yes I know: Use Sitka Spruce for oars, but I don't have any.

The Redwood is almost certainly too easy to fracture under tension, so I'm going to try laminating the pieces and use the Douglas fir on the tension side.

Weighing and measuring the planks, the Douglas Fir is 34 lb/ft3 / 480-600 kg/m3 and the Redwood is 18.6 lb/ft3 / 370-420 kg/m3.

For a shaft 1.75" / 44.5 mm diameter by 8' / 2.44 m long, the weight would be 4.5 lb / 2.02 kg made from all Douglas Fir but only 2.5 lb / 1.125 kg made from all Redwood. If the lamination is 60/40 Redwood to Douglas Fir, the weight would come out around 3.3 lb / 1.485 kg.

Just looked up sitka spruce. At 27 lb/ft3 / 430 kg/m3 it would be slightly heavier than the 60/40 lamination as described above.

Tapering the shafts to 1.5" x 1.25" / 38 x 32 mm at the blade will reduce weight some.

If these come out around 4 lb / 1.8 kg finished with blade I will be happy.

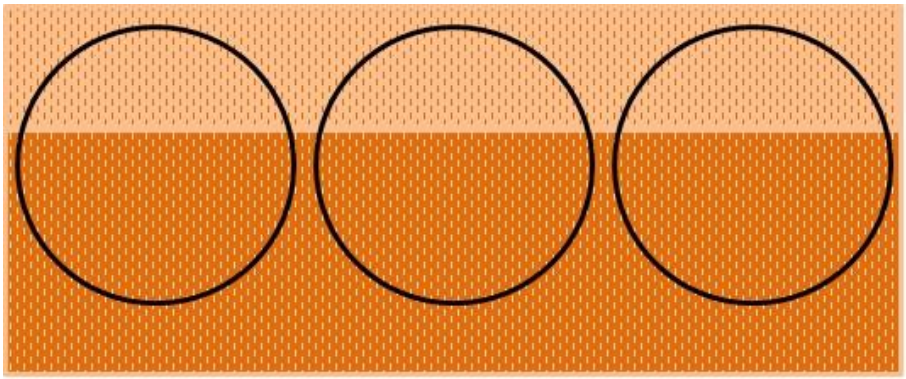


Figure 13 - I should be able to get 3 shafts from these planks, like this

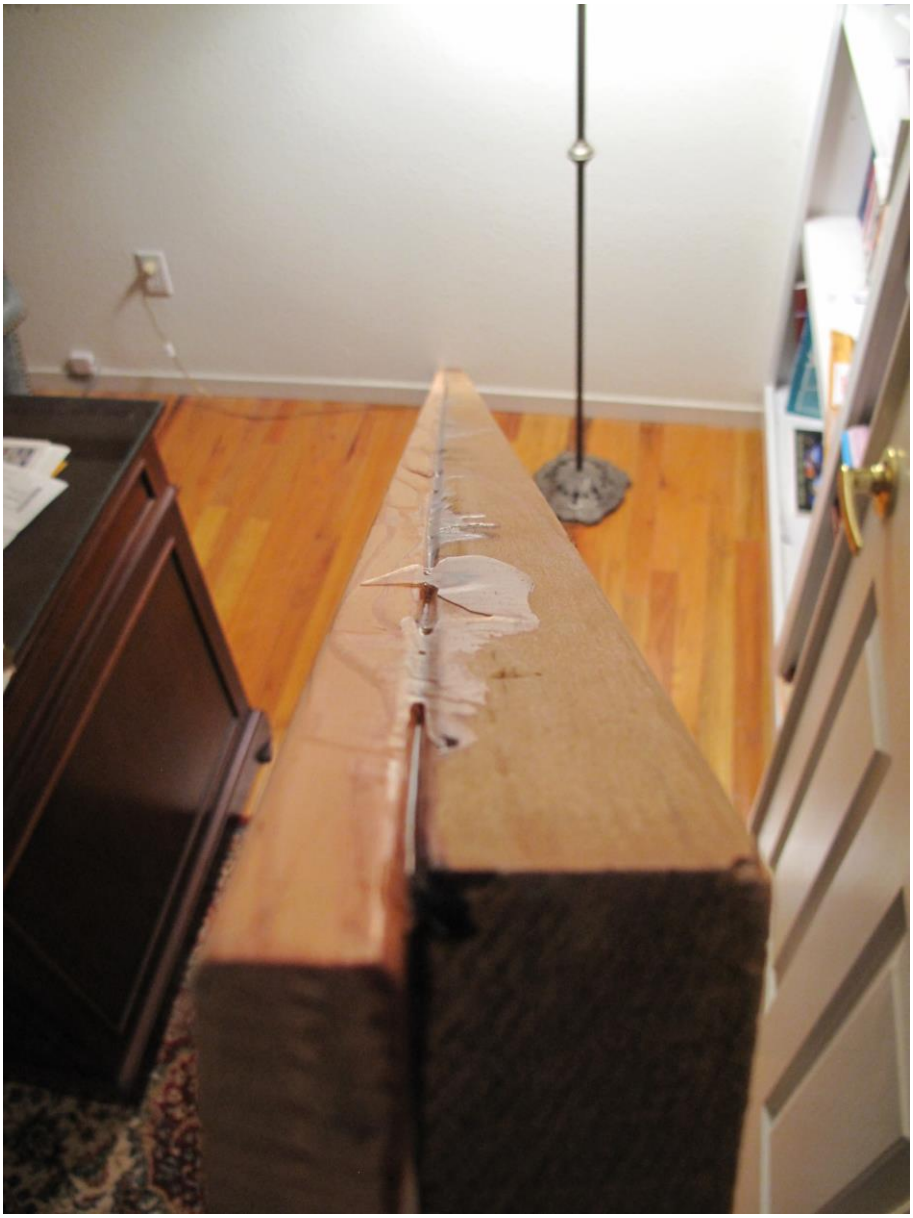


Figure 14 - Planks glued up, nice and straight after weighting with bricks on a flat part of the garage floor

I will wait a few days before cutting, to be sure the epoxy is fully set.

Woxbox's comment:

Often two pieces glued up will tend to take a curve, especially two different species. The expansion from moisture, etc., won't be identical for both halves. Hope it works ok for you.

Thanks, I was hoping someone would point out the flaws in this experiment.

Pocock used laminated shafts for some of his sculls, we still use them racing Mike Huntsinger's gig. His had a thin wood (cherry?) laminated to mostly spruce, so not quite what I am trying. These planks are dry and have been stored in a warehouse for years, and the finished oars will be varnished, so moisture levels should be stable. I will let you know if they bend over time.

Thorne's comment:

We will watch with interest! I'm also unsure about the mix of Redwood and Douglas Fir == as you can see on this chart, the bending strength is vastly different.

That is really the point of this test, using the stronger (but heavier) Douglas Fir on the tension side of the shaft where it's bending strength is useful. Wood near the center has little stress (which is why hollow shafts work well), and the wood on the other side is under compression. Redwood does have lower compression strength, but the primary failure in bending is going to be rupture of the tension side.

Figure 15 - Shaft blanks cut from the glued planks

Each 8’ / 2.44 m blank is 1.9" 48.3 mm square and weighs 4.9 lb / 2.2 kg. Reducing to 1.75” / 44.5 mm round and tapering should finish up near 3.5 lb / 1.575 kg.

My intention of not using power tools is shot, the table saw was far easier than cutting these by hand.

Now I need to sharpen some planes ...

Figure 16 - left an off-cut out in the rain, it did indeed take a curve

The Redwood expands more than the Douglas Fir when wet. This is really soaked, though, hoping the varnished oars are stable.

AndyG's comment:

I'd be tempted to slice the Redwood in half and glue the remnant onto the fir side.

I see your point on balancing the expansion, but then they won't have the stronger Douglas Fir on the tension side. I'm going to go ahead the way they are and see if curvature becomes a problem. This is an experiment, I can always cut the shafts off the blades and try again.

Woxbox's comment:

You might ask yourself if heavily painted doors expand and jam in the summer, or if musical instruments, no matter how well coated, go out of tune with changes in humidity. I've always been surprised how rapidly guitars change with the humidity, even small changes are registered well within 24 hours.

Why not sandwich the Redwood inside the fir?

Upchurchmr's comment:

Are you going to epoxy these - they won't bend much if you do.
Even varnish will stop expansion due to moisture - mostly.
Oil? Might as well prebend them.
But then again - the blades are bent, why not the shafts?
(I really wanted the one with the big ears and the tongue sticking out, why can't we have that one)?

So even if the shafts do bend as much as the soaked off-cut, will this cause a problem using the oars? The blade angle would be slightly greater, and that was an eyeball estimate anyway.

I'm still going ahead with these, you guys all get to say "I told you so" when I have to make new shafts .

That would be good to try if this test fails. I could imagine an even lighter wood in the center (balsa?), almost like hollow shafts but somewhat easier to make.

Upchurchmr's comment:

Wood in the center still has to be able to take load, its just called shear, instead of tension or compression. If you ever want to see what happens with a real low strength inside material, make up a shaft with styrofoam on the inside. The shaft will bend dramatically more before it breaks.

I agree with you about using the material you have made up. The offcuts soaked in water might have bent, but I assume the shaft material that was still dry did not bend enough to notice. Correct?
Just coat them to keep the wood dry when they are shaped.

Figure 17 - Tapered the shafts to 1.5" x 1.2" / 38 x 30.5 mm at the blade end

The tapered shafts still seem quite strong and stiff, should I go smaller?
Rounding will take more material off, maybe safest to try this first.

Douglas Fir is easy to plane, but Redwood is like butter. Still, making oars seems harder work than using

oars ...

I wish I had a good woodworking bench and vise, but by holding the blanks with my knees and sitting on the bench vise this went fine.

The blanks are now 4 lb / 41.8 kg each, tapering took off more weight than I expected.

Planes are a Stanley 605 "Bed Rock" with a Lie Nielsen blade, and an unknown brand adjustable throat low angle with a replacement Japanese bi-metal blade. I got that blade from Japan Woodworker, back when they still had the store in Alameda.

Ah, one person on my side 😊. Yes, the dry shaft blanks are still straight.

For bending in one axis only (oars but not masts), an I-beam should be the lightest weight section for the beam. Not sure I'd want to go that far:

Figure 18 - Laminated wood I-Beam

Gib Etheridge's comment:

Bow makers learned long ago that increasing the tensile strength on one side (called the back) increased the compression on the other side (the belly). The 2 had to be equally matched for optimum draw weight and durability. It won't surprise me if the "bellies" on your oars fail due to too much compression. Bowyers call the crushed area "chrysals". They look washboardy. You may actually find that they work better with the Redwood in tension, but you probably won't because they're spoon oars and not reversible.

I would have used the Redwood as neutral wood (another bowyer's term) and equal amounts of fir for the back and the belly. Actually, for the lightest weight using mostly wood I would have used only Redwood and glassed the looms with that cloth tubing that you slip over it then stretch to get it to fit tightly. Unidirectional would be best.

http://duckworksbbs.com/supplies/clo...ving/index.htm

Best of luck to you though, it's by experimentation that we learn and make improvements. I'm enjoying the thread.

Thanks Gib, that's good info. I have not found any references to oars made with laminated shafts, except to notice that the Pocock oars we use for racing have two woods (one is thin). Is the wood in bows under more

stress than in oars? Bows look like they undergo much more bending.

The glass tube would work, but I'm hoping these can be all wood (well, wood and epoxy).

Gib Etheridge's comment:

Bows are certainly under a different sort of stress than oars. They bend much further for one thing, and then there's the shock when the string goes straight (that's why one should never dry shoot a bow, the arrow absorbs a lot of the energy), but one can only stress a bow to it's draw weight, a function of stiffness and draw length, commonly about 50 lbs / 22.5 kg. One can put a lot more than 50 lbs / 22.5 kg of tension on an oar using your whole body. I would say that the 2 are not very comparable, but the principles are the same.

If you find that you are developing chrysals in the Redwood you may be able to save them by planing the chrysals off of the bellies and adding fir if you get it in time, meaning before they get too deep and the loom fractures. The problem with that though would be that since your fir is already so thick and you would want to match it there would be very little Redwood left. Still, my favorite pair of spoon oars is fir, so I think it would be worth doing, and a nice little accent stripe of Redwood would look nice.

Anyway, lets hope it works just as it is. Good experiment.

IanHowick's comment:

You've got this around the wrong way.

Wood is a lot stronger in tension than in compression, it will always fail first on the compression side. It seems at though it's breaking on the tension side as the start of failure on the compression side is less obvious but transfers the load across to the other side and thats where it breaks. You'd be better off with the stronger / more of the stronger wood on the compression side, or balanced stronger wood on both sides of the lighter core. Lighter /weaker wood on the compression side with the the stronger wood on the tension side is going to be particularly weak.

I'll try and post a reference from my engineering books if you like.

Hmmm, that changes things. Thanks Ian, you caught this in time. It was an assumption of mine that the failure would be on the tension side, broken sticks look like that but I understand how compression failure would then transfer stress. I was also starting to worry that crushing at the oarlock would start a failure.

A reference would be good, but I need to do some tests. I don't have any good off-cuts from the shaft blanks, but do have more Douglas Fir and Redwood. I will glue up some test pieces and bend them to failure both ways, measuring the force at failure.

Peerie Ma's (aka Nick) comment:

Run a Google search on compression strength US timber, should bring up lots. There may be articles in Wooden Boat back issues. Redwood sounds like a generic name, you may have to look for a species name. The timber that is strong in compression needs to be on the forward face of the oar.

David Lesser's comment:

So the Redwood side of the shaft will be pressing against the oarlock on the stroke? The Redwood is softer than the Douglas Fir and more likely to be dented by the oarlocks. Another reason to consider a Douglas Fir sandwich with Redwood in the center.

Woxbox's comment:

Ian, I won't disagree that the Redwood would be highly stressed at the oarlock and could start a chain reaction that leads to failure, but that statement is a bit too general. Wood is strongest in compression when the load is parallel to the grain. If the load is at right angles to the grain, then you can have issues, to be sure. How much, I believe, depends on the species. But trees stand for a hundred years and more because that's the way wood carries loads (here it's own weight) the best -- counteracting gravity right down the length of the trunk. In all other directions, the strength of wood is somewhat less.

The sandwich is sounding better and better. Next set, which will also get hatchet blades.

Peerie Ma's (aka Nick) comment:

The oars that I used in the '60s when I rowed competitively were spruce, either hollow or with lightening grooves routered in, with ash on the compression face. Ash being stronger in compression along the grain than spruce.

Mike Huntsinger just advised me that his Pocock oars have the stronger wood on the compression side. I should have taken the time to look at those again. The Pococks are spruce with ironbark (ironbark? not the lightest construction).

Peerie Ma's (aka Nick) comment:

The lamination of ash was only about 1/2" thick.

I think the ironbark may be thinner. Mike is going to weigh the Pococks.

Timo4352's comment:

Maybe just cutting out a section of the Redwood from just below the oarlock area and up to the handle, and gluing in a more durable wood in its place?

Seedy's comment:

Can you pin the blades and try one of each? Rowing and breaking might have differences.

I like that, one of each. If the boat turns circles then the oar pulling hardest is the better design .

I will have to taper each shaft end to fit the blade, so once done I could not switch without shortening the loom.

IanHowick's comment:

Here is a reference from The Mechanical Properties Of Wood | by Samuel J. Record, the whole book is available online:

http://chestofbooks.com/home-improve...ber-Beams.html

"Since the tensile strength of wood is on the average about three times as great as the compressive strength, a beam should, therefore, be expected to fail by the formation in the first place of a fold on the compression

side due to the crushing action, followed by failure on the tension side. This is usually the case in green or moist wood. In dry material the first visible failure is not infrequently on the lower or tension side, and various attempts have been made to explain why such is the case."

Two other books you should have on the shelf are by J. E. Gordon:

Structures: Or Why Things Don't Fall Down
http://www.amazon.com/Structures-Thi.../dp/0306812835

and

The New Science of Strong Materials or Why You Don't Fall through the Floor.
http://www.amazon.com/Science-Materi...72MXY1A04PJ28H

Very readable, he was involved in building / designing the wooden Mosquito fighter bombers and wooden gliders in WWII, and both books are still in print which says something about their value.

I think you would be best to slice the stronger laminate in half and then glue it on the other side of the Redwood so you have a Douglas Fir - Redwood - Douglas Fir sandwich. That or add some Douglas Fir on the other side so it is balanced.

I'd rather have 10mm Douglas Fir - 30mm Redwood - 10mm Douglas Fir than 20 mm Douglas Fir and 30 mm of Redwood.

I made a set of hollow shaft oars with the radiata pine on either side and paulownia on the inside. Started with a box of two pine slabs and Paulownia sides then rounded it. They came out plenty stiff and strong enough, there's no way they'd work with Paulownia on one side and stronger timber on the other.

Here is a link to a PDouglas Fir I scanned of a couple of pages out of Gordon's Structures that are relevant. See the picture of a wooden glider wing, the heavier beam of the main box girder is on top, which is the side that is under compression. Having said that, I think you are better off with a fairly symmetrical structure with the stronger timber on the outside of the sandwich.

https://dl.dropboxusercontent.com/u/...ompression.pdf

Woxbox's comment:

Ian, I'm not the engineer, just reporting here what I've read elsewhere. I can't seem to find the book you reference in that link. But here's another source.

And from it, if you scroll down to page 4-8, you'll find these properties listed for old growth Redwood:

- *Compression parallel to grain: 29,000 kPa*
- *Compression perpendicular to grain: 2,900 kPa*
- *Tension perpendicular to grain: 1,800 kPa*

Other species show similar ratios. Am I missing something? Not to suggest this engineering is simple, this book lists nine different ways to measure the "strength" of a piece of wood. To be sure, one number will never answer.

IanHowick's comment:

Yes, wood is strongest along the grain both in compression and in tension, but it's along grain tension strength is still about three times it's along grain compression strength. Have a look at the PDouglas Fir I linked to from J.E. Gordon Structures, the table of compressive and tensile strengths on the first page and how a living tree manages to most efficiently carry the loads it is subjected to. The heart wood is under compression which puts the outer sapwood under tension to minimise the compressive forces when it is

resisting bending.

https://dl.dropboxusercontent.com/u/...ompression.pdf

A mast cut from a clean, straight sapling would be able to bend twice as far before it breaks as an equivalent mast made from wood cut from a tree or laminated from timber.

Thanks, Ian. So I should throw out my engineered composite pieces and go out and harvest a couple of Douglas Fir saplings .

This is the wood data from Thorne's reference:

Wood Species	Specific Gravity	Compressive Strength (psi)	Bending Strength (psi)	Stiffness (Mpsi)	Hardnes
Fir, Douglas	0.49	7,230	12,400	1.95	710
Spruce, Sitka	0.4	5,610	10,200	1.57	510
Redwood	0.35	5,220	7,900	1.1	420

Not sure if the compressive strength is along the grain or not, but this shows relative strengths of the 3 woods.

If Sitka Spruce makes good oars, then putting the Douglas Fir on the compression side means these should be stronger in bending, before compression failure, than all spruce. As long as the Redwood tension strength is good enough they won't fail in tension. Redwood is weaker than spruce, but not 3 times weaker.

I still want to try this on test pieces.

Woxbox's comment:

And at the end of the day, how hard can you pull on those oars? Enough to reach more than 2 tons per square inch pressure at the oarlocks? Better beef up the oarlocks while you're at it. That's the thing with the way we build wooden boats -- we usually break long before the boats do.

Upchurchmr's comment:

Not to be obnoxious (but I will be) how stiff do you want the oars?

I read lots about guys wanting an amount of bend, to get more energy at the end of the stroke when they return to straight.

This is a complex trade off of strength, but not so much that you have added too much weight and don't actually use the strength, and stiffness. If you want a given deflection of the blade with a given load, when you add stiffer/ stronger material, the deflection is going to be lower. The way to get the deflection the same, and use the "good" material to its limit, is to now reduce the diameter of the loom.

You can ignore all that if you want as stiff as possible.

Of course if they are really stiff, they will probably be a lot stronger than you need, so now they are heavier than necessary.

Woxbox's comment:

To add to the confusion, there's another argument: Some flex cushions the action and is easier on the joints, shoulders in particular.

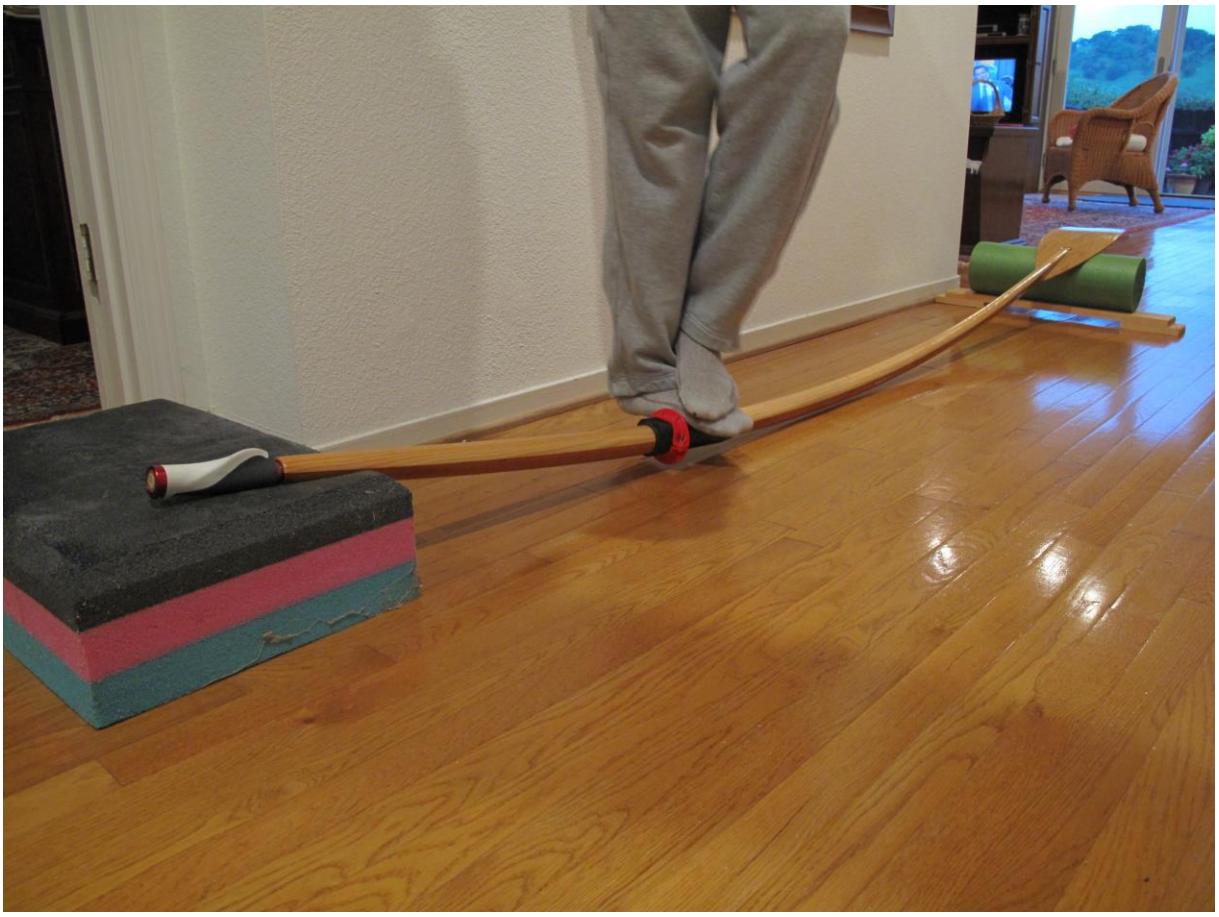


Figure 19 - A strength (and bending) test

Supported at the handle and blade ends, with me (200+ lb / > 90 kg) on the oarlock location.
Douglas Fir on the compression side.

I wanted soft looms so this cross section may be too big. Plenty strong, though.

Does anyone know how much bend to expect before failure? I could set up the end blocks to limit the possible bend, then thin them down for more flex.

Upchurchmr's comment:

The guys who make composite oars have a flex test to classify their oars as stiff or soft.
I saw it once. The oar is simply supported at the handgrip, and the oarlock. If I recall, a 50# weight just above the blade, with the deflection taken at the tip of the blade.

The picture was supposedly taken from the Concept 2 web site.

Now you just need something you are trying to compare against for the first measurement.

Actually I really like my Concept 2 composite blades - ever think about a thin veneer over composite?

Perhaps a simpler test would be to substitute an oar for the "step on" test?? With someone else's oars???
You might actually get useful information if you substituted a smaller weight (not making a comment about your weight).

Figure 20 - These are the oars I built earlier (almost 4 years ago now, wow)

Heavier blades using maple veneers (from a skateboard kit), fiberglass shafts let into ash dowels, brass rod counterweights. They weighed 5.5 lb / 2.475 kg without the counterweights. I like the soft fiberglass shafts, very easy on the shoulders and a good kick at the end. I will try to copy the flex of these.

Upchurchmr's comment:

Nice looking, I remember seeing them.

Asloth's (aka Steve C.) comment:

Thanks, Ian. So I should throw out my engineered composite pieces and go out and harvest a couple of Douglas Fir saplings .

Rick, I like this idea, of using saplings as looms. Now to find a few, let dry slowly and shape. My last pair of oars were single pieces of Douglas Fir, for looms and ply blades, and are the lightest I've built. Beside being strong enough for my use. Thanks for the idea.

I put a scale under the blade end of the shaft. With me standing at the oarlock there was 53 lb / 23.85 kg at the blade. I need to do what you say with the shaft cantilevered, and measure the deflection.

Are you in Pt. Hadlock? There should be plenty of Douglas Fir saplings nearby ...

MN Dave's comment:

Saplings will dry and split because of the difference in shrinkage in the radial and tangential directions.

Post # 69: Not sure if the compressive strength is along the grain or not, but this shows relative strengths of the 3 woods.
Post # 67: But here's another source.
The compressive strength was parallel to the grain. Douglas Fir parallel 7230 psi; perpendicular 800. Table 4-3b, page 4-12.

Chrysals:
A transverse line of crushed fibers in the belly of an archery bow beginning as a pinch - called also fret.
Good advice - don't fret? Thanks Gib, always something interesting.

No one has mentioned the relative stiffness of the woods. The table in the Wood Handbook (But here's another source.) indicates that Redwood is about half as stiff as stiff as Douglas Fir. So when you bend the 2 layer beam, the Redwood will compress about twice as much as the Douglas Fir stretches and vice versa. The consequence, without doing the math, may be that the stress will be distributed across a thicker layer of Redwood and hence lower than the outer fibers of the Douglas Fir. The bending test in Post #78 might show different deflection if you turn the shaft over, and is faster than the math.

One way or another, a balanced structure is best as has been said above. You might salvage the shaft by adding a layer of Douglas Fir on the other side and trimming the other side back to size. If you will run out of Douglas Fir when you taper the shaft, you could taper the Redwood before laminating the second layer of Douglas Fir.

Asloth's comment*:*

Came back, after a week, from PH Monday as there was a very short break in rain. Yes plenty of Douglas Fir saplings around there, plus WRC (?) and AYC (?), so I'll have a big supply, even though they might check/split as above.
Steve C.

Figure 21 - Glued up another two-wood pieces from Douglas Fir and Redwood 1 x 6s

I don't have usable off-cuts from the oar blanks, so I glued up another two-wood piece from Douglas Fir and Redwood 1” x 6” / 25.4 x 152 mm. Ripped into equal 1" / 25.4 mm wide test samples.

Figure 22 - I plan to test bending strength on this setup

I will press down on the cross piece (held with the clamp). The big dowel gives a smooth consistent edge to bend on, and the scale will measure the force. I will bend a piece to breaking each way:

Douglas Fir in tension and Douglas Fir in compression.

Anyone see a better way to measure which is strongest? Any bets as to which way will take the highest force, and whether the failure will be tension or compression side?

The pieces will be marked off before starting to ensure equal locations of dowel and ends.

Upchurchmr's comment:

My bet is that you pry the cabinet (or whatever is "grounding" your test sample) off the floor.
Listen carefully for the first crack. You shouldn't be looking for complete failure. Have fun. I've suggested tests like this for about 5 years, this is the first time I know of someone doing one as a result of the thread.

Congratulations! you are first!

OK, three point bend tests done on video. I did not get a good number for each piece because the scale limited out at 400 lbs (it shows kg, so 180 kg max). It seems clear which is strongest, though.

Figure 23 - Figure 23 - This is Douglas Fir on the compression side

I could not get this to break with all my weight and bouncing on the piece, way over 400 lb / 180 kg at the dowel.

The dowel was 7" / 178 mm to the bench and 15" / 381 mm to the push bar. With my 200+ lb / > 90 kg on the push bar that's about 650 lb / 292.5 kg static at the dowel.

I am going with Ian's recommendation and putting the Douglas Fir on the compression side, the opposite of what I first thought.

Figure 24 - This is Douglas Fir on the tension side

This is Douglas Fir on the tension side, rupture at somewhat over 400+ lb / 181 kg.
The rupture happened in the Douglas Fir.
If Ian is right this is because the Redwood was compressing.

Figure 25 - Rounded off to 1.3" x 1.1" oval

One more, this time rounded off to 1.3" x 1.1" / 33 x 27.9 mm oval to see how much strength is lost.
Finally ruptured the Redwood tension side, but at well over 400 lb / 180 kg.

Upchurchmr's comment:

Do you have enough wood to cut the specimen in half? Possibly that will get you in the range of the scale.

Using the dowel contacting on the round specimen may introduce a new (undesirable) failure mode. Like the dowel denting your specimen well before it starts to break. Testing is really tough to get accurate reproduction of the way it will be used.

I guess I lost the bet that the cabinet will move?!

I think this is enough testing - my takeaway is that this Douglas Fir/Redwood lamination is stronger than I expected. I knew these were not going to break over my knee, but was sure 400 lbs / 180 kg would do it. The 1.3" x 1.1" / 33 x 27.9 mm section is smaller than originally planned for the smallest neck of the shafts. Bending the oval over the dowel is close to bending at the oarlock, which would compress and dent, but that section will be thicker.

That workbench is solidly mounted to the wall. It did move some in the video, wasn't sure it would hold ...

Ian Howick's comment:

Just back from a few days away. Good to see the testing and confirmation that it's stronger with the stiffer Douglas Fir on the compression side. Interesting to see if the shafts stay straight with that unbalanced laminate or will they end up with a curve?

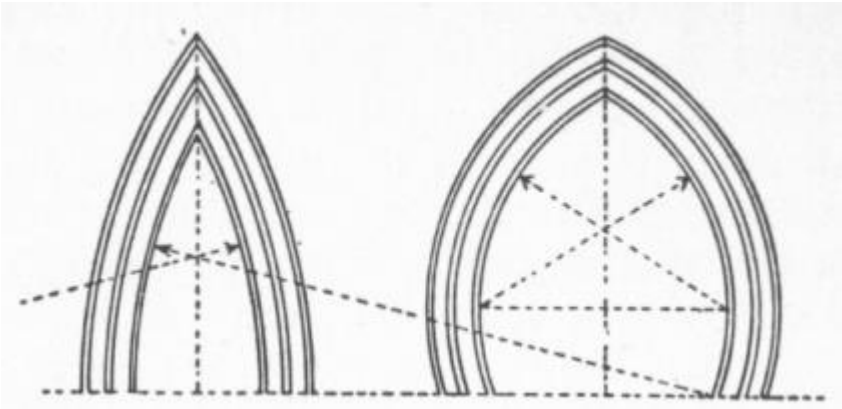


Figure 26 - Pocock's loom shape: Cross section it is a gothic arch shape with rounded sides

Mike Huntsinger has loaned me one of his Pocock sculls to make some measurements (if any harm comes to this I'd better leave the country...). The first thing to note is the loom. In cross section it is a gothic arch shape with rounded sides, like the image on the right here.

Figure 27 - Pocock Scull

Construction is a light wood (spruce) with a strip of heavy dark wood (ironbark). The stronger wood is, as Ian would expect, used on the compression side. The ironbark is only 1/16" / 1.6 mm thick.

I don't think they would have done this just for decoration, it must be adding strength.

Figure 28 - Pocock Scull Blade

The Pocock blades are laminated from spruce, but across the width of the blade. They have been carved out in a spoon on both axes. There is no fiberglass, just a strip of hardwood let into the tip.

This helps, but they are more fragile than I would like. If you were to use one rowing on the Napa River, say, and were to catch the blade on a shallow spot, the tip would break and you would feel pretty bad.

DAMHIKT, as Thorne says.

Figure 29 - Comparing the Pocock blade to the laminated ones I made

The blade area is almost the same.

Figure 30 - Pocock scull blade curve

The curve of the Pocock blade is a little steeper. I'm calling mine good enough, not going to re-make the blades.

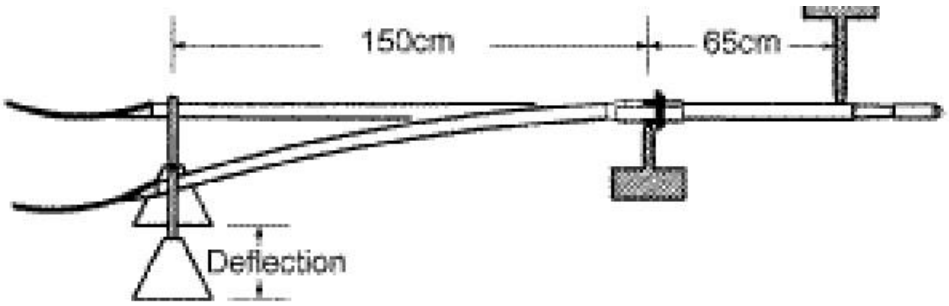


Figure 31 - deflection measurement for stiffness from the C2 website

I found the deflection measurement for stiffness from the C2 website. This is the diagram for sculls. The weight is 10 kg. Deflections are 4 cm for "Stiff", 4.5 cm for "Medium", 5.5 cm for "Soft", and 6.5 cm for "Extra Soft".

The Pocock loom measures 1.9" x 1.8" / 48.3 x 45.7 mm at the oarlock, tapering to 1.5" x 1.0" / 38.1 x 25.4 mm at the neck.

I'm going to taper my looms more, to match the Pocock at the neck. The Pocock is 9' 10" / 2.997 m length and weighs 4.6 lb / 2.07 kg.

Mine will be 9' 6" / 2.895 m, now hoping to be under 4 lb / 1.8 kg (before any counterweights are added). Mine will be round shaft. I use the Pococks racing, but prefer round looms in oval oarlocks (with shaped grips) for cruising - quieter and easier on the wrists when feathering.

Figure 32 - My deflection measuring set-up

From Right to Left: Pocock scull, my homemade oar with 1.1" / 27.9 mm fiberglass shaft, and Douglas Fir/Redwood blank. The weight is a bucket filled right at 10 kg.

If this thread suddenly goes dark it is either that my wife has seen what I am doing in her kitchen, or that Mike has seen what I am doing to his oar 😜.

Here are the measurements:

- Pocock scull
  4.8 cm - medium stiff

- Laminated blank
  5.4 cm with Douglas Fir down, 5.5 cm with Douglas Fir up - soft
  This will only get softer as I thin and round the blanks.

- And here's the surprise
  My favorite homemade fiberglass loom oars measured 17.2 cm - way, way off the scale at "super soft".

I don't think the laminated shafts will get this soft, something less will be fine.

Upchurchmgr's comment:

OK, when are you going to reveal the deflection of the Pocock and your homemade hatchet? Sorry you were answering while I was writing. When you finish this scull concept, do you want to go for minimum weight? If you look at the I beam in your post #47, you would be almost there.

I built a cross beam for a catamaran row boat several years ago. The initial build of a 2.25" / 57 mm square beam weighed about 6 lb / 2.7 kg each, which was clearly too heavy. The beam was 5' / 1.525 m long. As just a trial I made up solid wood caps (cedar) 1/2" / 12.7 mm thick, and 1/8" / 3.2 mm marine plywood for the sides, cut on a 45 degree angle to the direction of the sheet (best angle for shear on the side). My wife stood in the center of the beam (125 lb / 56 kg) and it had little deflection, so I tried it (250 lb / 112.5 kg). Again very little deflection. So we both got on and then she started jumping - to make sure. The beam was about 1 lb / 0.45 kg before I put a ply of 6oz/square foot / 185 g/m2 on it.

A square beam with the fibers on the sides at +/- 45 degrees needs very little material. I really believe the caps could have been reduced even more since I had about 3x the normal loading and then had a glass ply.

There would be adaptation required at the oarlock to get a round shape, at the grips and at the blade, but the best way to build this beam is to taper away from the oarlocks in both directions. I bet you could 1/2 the weight for the loom.

You could even do the kayak trick of making a thinner wood form and using glass for the actual strength. The glass essentially disappears in epoxy, leaving the image of wood oars. Use unidirectional glass on the caps.

The box beam has the same benefits as the I beam you showed, but it more difficult to build (and you can't go quite as thin on the side plies).

Sorry - you haven't finished, but I thought you needed the next challenge in the back of your mind.

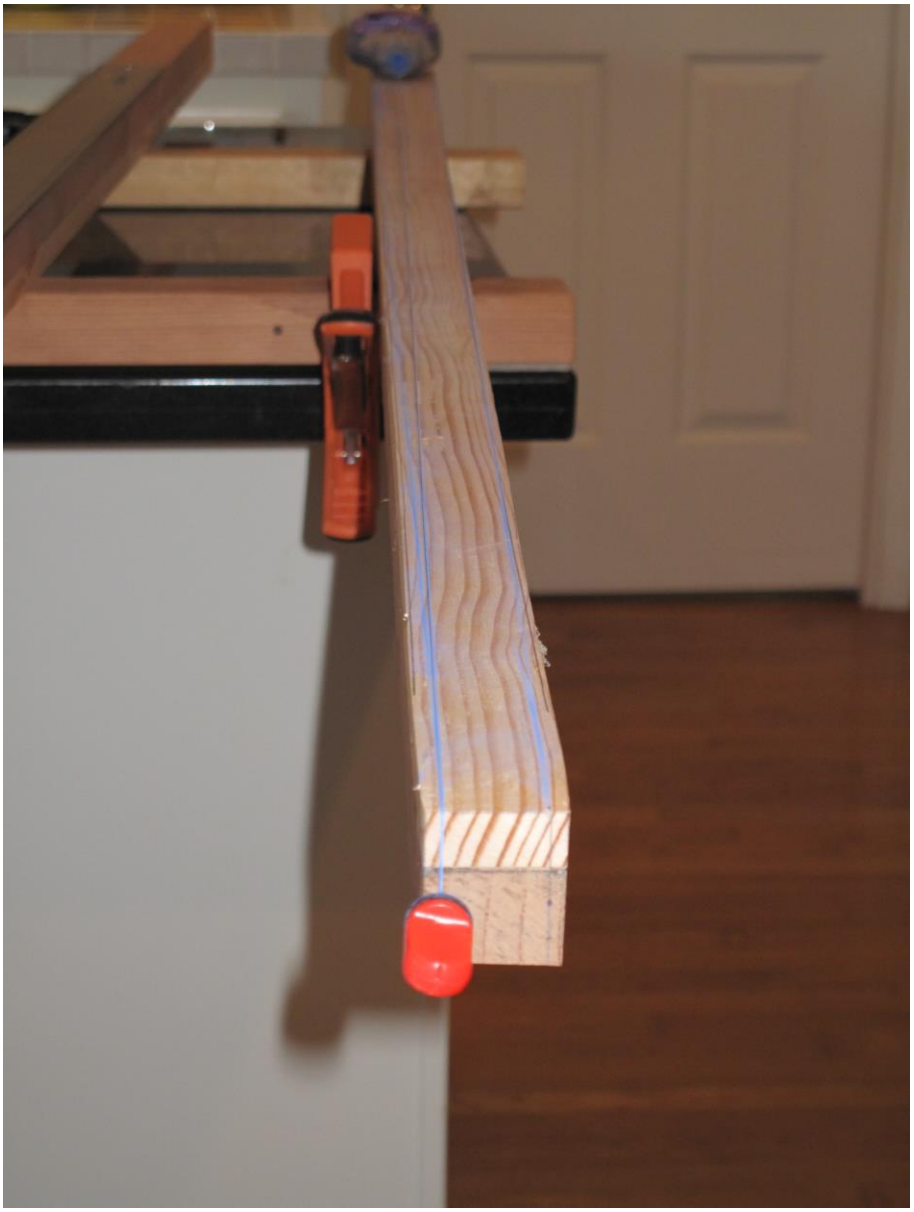


Figure 33 - Marking with a chalk line, to trim the looms down to 1.5" x 1" / 38 x 25.4 mm

I'm just posting this because it worked well.
I was trying to think of a way to mark off the slight additional taper needed, then remembered the chalk line ...

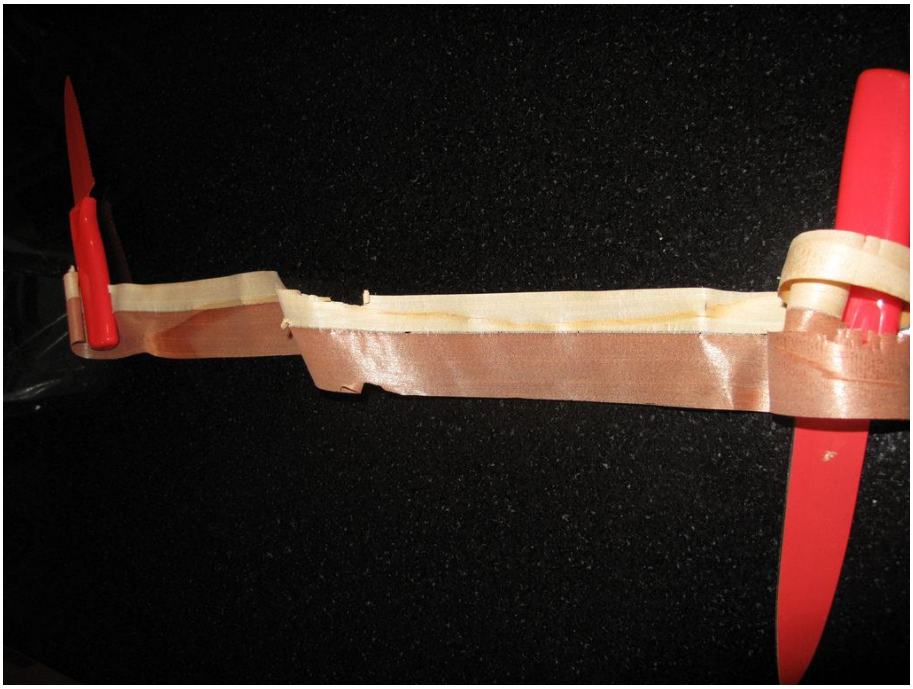


Figure 34 - Tapering the loom blanks to the Pocock dimensions

The loom blanks are tapered to the Pocock dimensions, now weighing 3.8 lb / 1.71 kg each. At least this makes cool bi-color shavings. The box section sounds like it would be very light. I think it might be too stiff - going for soft flex.

Still going to resist using any fiberglass, to see what can be done in wood. The carbon fiber hatchet sculls are around 3.5 lb, / 1.575 kg that may be the lower limit of what works.

MN Dave's comment:

I can't disagree. That is enough testing. But like pictures, we will always want more. Greedy little ingrates when you're online.

So next time, if you center the scale, you will have to add some to the applied load, but it will reduce the load on the scale. Longer sample is always better. I checked to see what the strength of wood in the lamination looked like. Since there are two materials with different stiffness, the answer is wrong, but in the ballpark. I also backed ou the load for centering the sample on the scale. It does get the load closer to the scale capacity.

Equations from the Wikipedia link. I see that the symbols don't paste:

7" to the bench and 15" to the push bar. With my 200+ lb on the push bar that's about 650 lb static at the dowel. The 1.3 x 1.1 section

distance	*load*	*scale*	*force on cabinet*	*distance*	*ef =*	
15	*200*	*629*	*428.57*	*7*		*no equation for off center loading*
15	*200*	*400*	*200*	*15*	*9683*	*=3*400*30 / (2*1.1*1.3*1.3)*

7	*429*	*857.14*	*429*	*7*	*9683*	*=3*857.14*14 / (2*1.1*1.3*1.3)*
11	*273*	*545.45*	*273*	*11*	*9683*	*=3*545.45*22 / (2*1.1*1.3*1.3)*

sf = 3FL/2bd2 for a rectangular cross section
sf = L3m/4bd3 for a circular cross section
ef = 3FL/2bd2 Calculation of the flexural strain
Ef = L3m/4bd3 Calculation of flexural modulus

sf = Stress in outer fibers at midpoint, (psi)
ef = Strain in the outer surface, (in/in)
Ef = flexural Modulus of elasticity,
F = load at a given point on the load deflection curve
L = Support span, (in)
b = Width of test beam, (in)
d = Depth of tested beam, (in)
D = maximum deflection of the center of the beam, (in)
m = the gradient (i.e., slope) of the initial straight-line portion of the load deflection curve,(P/D), (lb/in?)
R = the radius of the beam, (mm)

Thanks Dave. Looking this over quickly before the pub crawl (yes I am still sober), doesn't the scale measure the bending force applied to the beam, independent of the two ends?
If the beam breaks at 650 lb / 292.5 kg, the scale needs to be able to measure that. Moving the distance to each end point changes the force at each end (cabinet and me), but the sum of forces at the ends totals 650 lb / 292 kg. Also, the length of the beam does not change the force, as long as the beam is long enough to be in bending (length many times the beam thickness).

To use this scale, I could either make thinner beams OR change the setup so the scale is measuring one of the ends, and set the lever ratio so this end is less than 400 lb / 180 kg.

MN Dave's comment:

You can hang a lot more weight at the center of a short pole than a long one. You can also break the end off of a stick stuck in a vise more easily if the stick is longer. The breaking strength of the outer fibers doesn't change, but you get better leverage on the longer end.

[Edit: clear as mud? would an ASCI picture help?
Original test, 200lb applied at 15" from scale, 1.1" wide, 1.3" deep, Modulus of rupture (tensile strength) 9683 psi.

Longer sample, centered at 15" from scale, same strength, breaks at 200lb applied load.

Shorter sample, centered at 7" from scale, same strength, breaks at 429lb applied load.

Original 22" sample, centered at 11" from scale, same strength, breaks at 273lb applied load.

*The calculation of the breaking stress in the outer fibers depends on the length of the beam between the load and the fulcrum. By locating the scale off center, you demonstrated the difference in a sort of complicated way. That is why I calculated the breaking stress, ef, for a 30" sample and a 14" sample with your loads. (I calculated 629 where you got 650: 200*15 = 7*429). When I got the same number, for ef, I figured that the off center test was equivalent to a centered test, but the calculation had to be based on one end or the other, so the math is doable either way. The last line is where I worked backwards to the load that it would take to break the 22" sample with the load centered.*

Back to sober again, and yes you are right. I should have made equal levers on both sides, easier to calculate. With unequal levers the max stress is not at the scale, as it was clearly seen that both samples broke away from the dowel, well into the longer section.

Figure 35 – Oars made by John DeLapp

Tom Kremer was at the pub crawl and brought his DeLapp oars.
They were built by John DeLapp himself, and are the nicest I've seen.

Figure 36 – Oars made by John DeLapp

The blades are laminated from 4 layers of thin light wood, total blade thickness only 5/32" / 4 mm. I don't know where John found this veneer material, have to remember to ask him next time I see him. The shaft is spruce, neck dimension only 1.5" x .75" / 38 x 44.5 mm. This is very light construction, but Tom is a strong rower and has not broken them yet. I don't think the blades will take much abuse from the rip-rap, so mine are staying at .29" / 7.4 mm thick.

Jpatrick's (aka Jeff) comment:

Thin veneer like that used for the DeLapp blades is common in the furniture making trade. It can be sourced from numerous suppliers. I've used Certainly Wood for many years (http://www.certainlywood.com). They are very reputable and knowledgeable. I know they have 1/16" / 1.6 mm douglas fir veneer because I used it for some bathroom cabinets in my house.

The veneer thickness in the DeLapp blades is very close to 1/28" which used to be a standard thickness. Most furniture grade veneer has gotten thinner over the years so one must ask what the actual thickness is when buying. Softwoods are commonly cut thicker than hardwoods.

Thanks Jeff. Certainly Wood is where I got the 1/16" / 1.6 mm white oak for the skins, on sale in their "Special Thickness" selection.

Timo4352's comment:

Whenever I get around to building my own set of oars I think they we be these DeLapp oars.

Here is a link to DeLapp's plans: http://www.tsca.net/puget/resources/..._oar_plans.jpg

Note that his plans call out 4 to 5 mm ply for the blades, but when John builds them himself they are much nicer laminated veneers 😊.

Timo4352's comment:

Thank you. I have studied the plans on and off for a while now. Just haven't set my mind to starting them yet. I do like the veneers and may just go that way when the time comes.

Laminating with the veneers has a lot of possibilities. You could order soft and hard woods in one shipment, use the softwood as the core and hardwood for the outer skins. It would not be too expensive to have mahogany or cherry blades - then you'd have some very striking oars, fairly easy to make, that are also light and good performance.

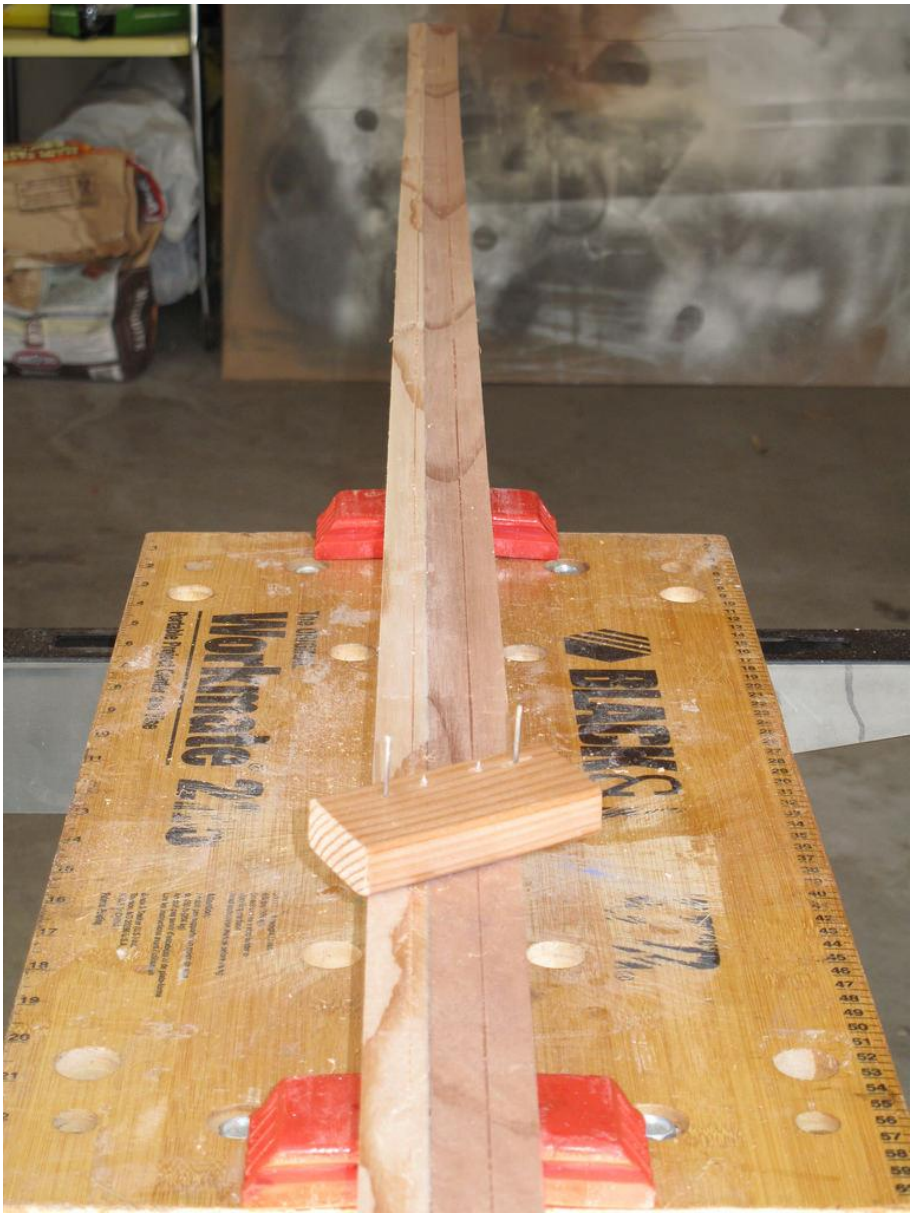


Figure 37 - My first spar gauge, from info on the forum. 7-10-7 spacing

Finally got a few hours today to make some progress.
I tapered the necks a little more, to 0.8" / 20 mm at the end.

Figure 38 - The gauge works well, planed to 8 sides

Now 2.9 lbs / 1.305 kg per loom. The Redwood is so soft and cuts so easily that I would be worried whether these were strong enough if you guys hadn't goaded me into doing the tests 😊.

Figure 39 - spar sander made from a piece of ABS tube slightly larger than the looms

I used a spar sander made from a piece of ABS tube slightly larger than the looms (2" / 50 mm inner diameter tube for the 1.75" / 44.5 mm outer diameter looms).

60 grit sand paper held inside with double sided carpet tape.

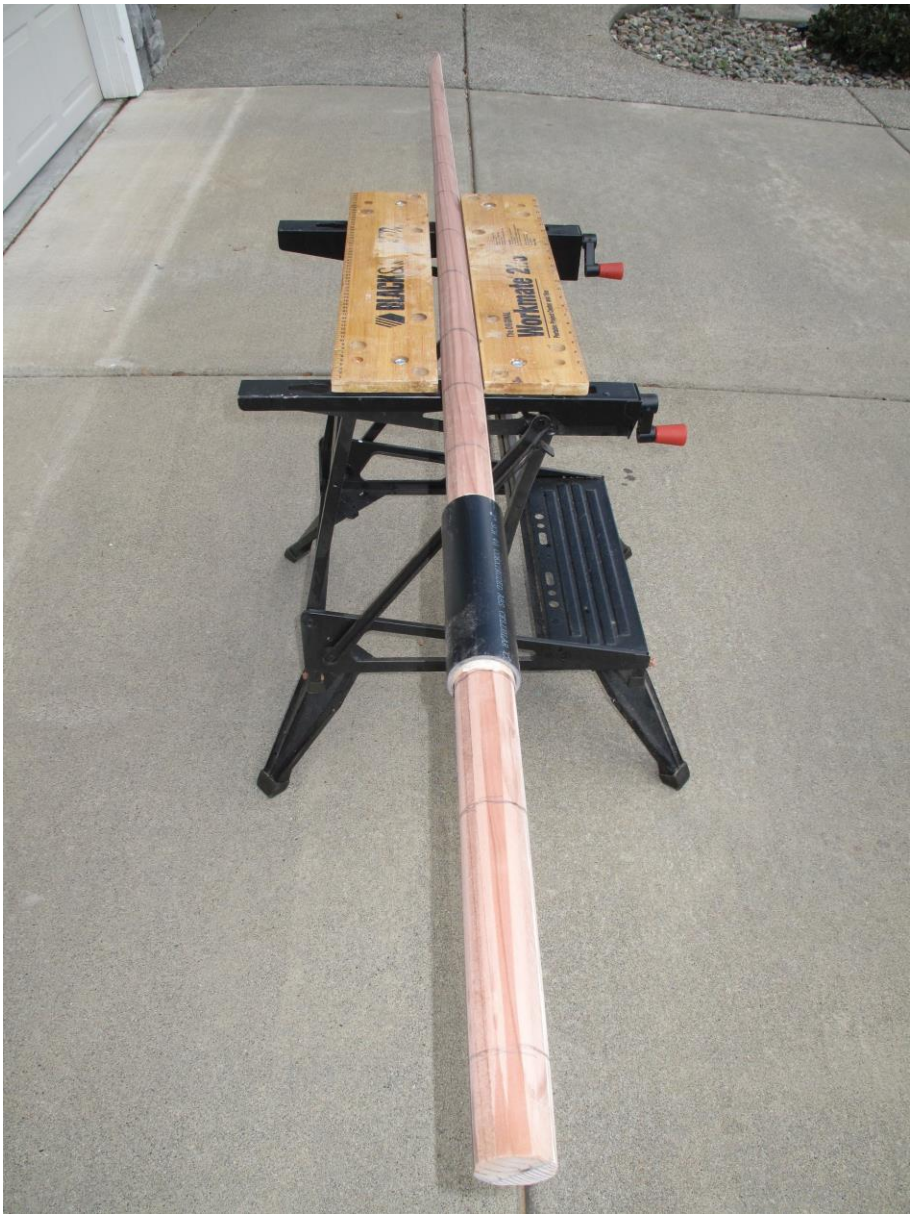


Figure 40 - Marked pencil lines around the loom at regular intervals

I used marked pencil lines around the loom at regular intervals, and sanded until the marks were gone.

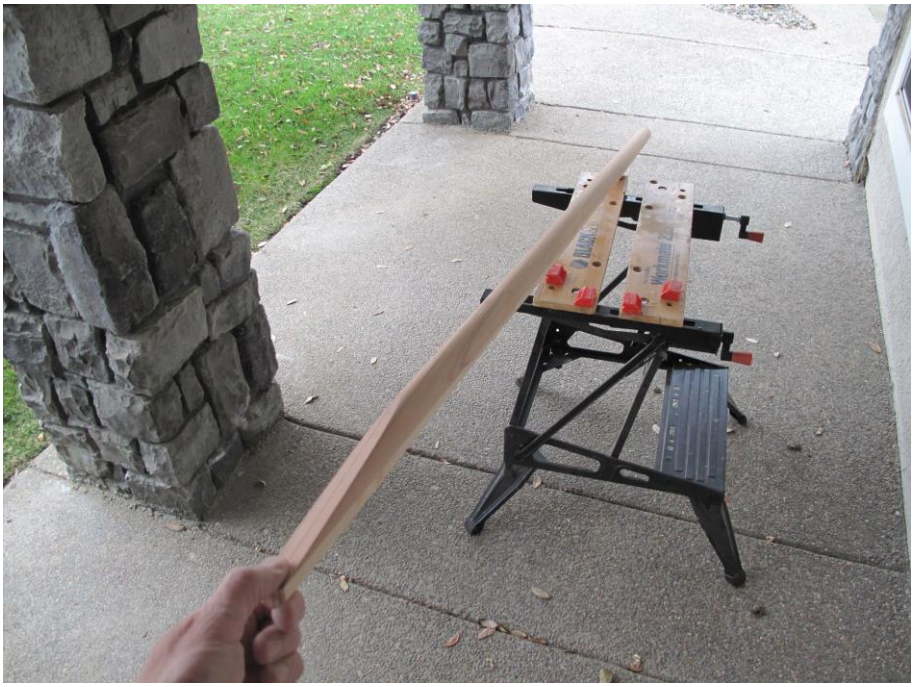


Figure 41 - Sanded loom

Sanding one loom took less than an hour, most of the time spent on the Douglas Fir. The Redwood again was very easy to shape. I'm sure anyone who has made spars knows how well this works, but I'm amazed at how the rough looking blank has suddenly become a nice tapered spar.

Figure 42 - Second loom being planed

This is just the second loom being planed, I'm only posting to show off the new tool. My wife took pity on me constantly trying to repair the mechanism on the old Workmate bench, so she bought me a new (using the best monster truck voice) "Rockwell Jawhorse Sheetmaster". 50 lbs / 22.5 kg of stable 3 point clamping, it makes spar planing so much easier.

Now if I just had a second one ...

Figure 43 - Tools for drilling the looms

My tools:

- 7/8" / 22 mm wood boring bit
- 7/8" / 22 mm drill bushing stepped up to 1.75" / 44.5 mm by press fitting into cheap bronze bushings
- ABS pipe slotted out, with hose clamp

My other oars have shaped, ergo style mountain bike grips, which work well but are awfully non-trad. This time I'm going to try to make ergo shaped wooden grips. This may take some experimenting, so I'm not going to just carve them out of the oar looms as is usually done. The looms get holes drilled in the end so grips can be made and tested.

Figure 44 - Drilling the looms

Figure 45 - Test fit a blade

The looms are down to 2.6 lb / 1.17 kg each after sanding.

The blades are at 12 oz / 340 g, I think they are too big and too heavy. I might reduce the width from 7.9” / 200 mm to 7.0” / 178 mm, and thin the hardwood skins some by sanding.

Loom dimensions:

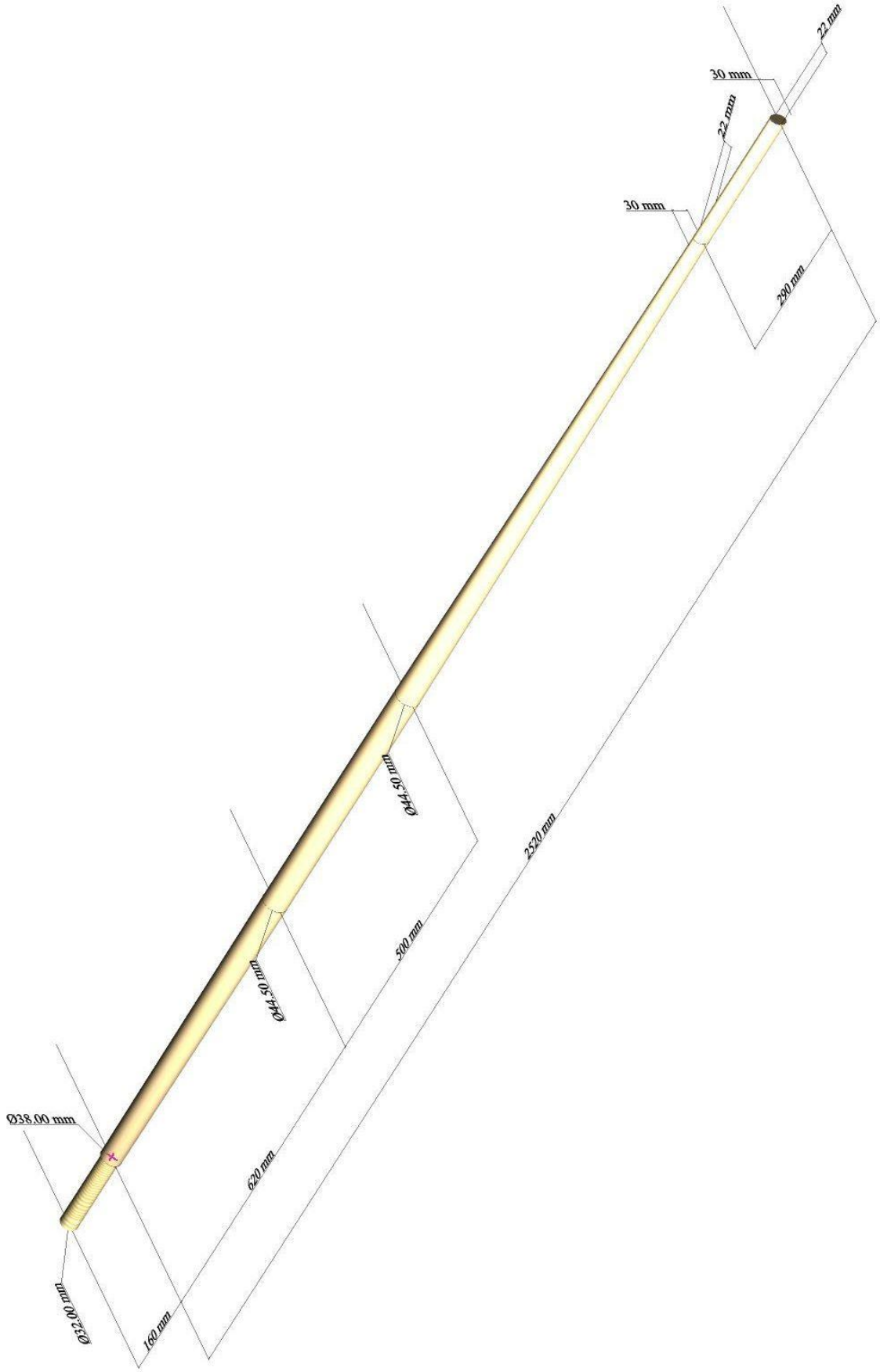
This is what I don't really understand about hollow birdsmouth oars. My looms (and the Pococks) taper to 1.5" / 38 mm by about 1" at the neck. When making hollow oars, do you keep them hollow all the way to the neck, or do they go solid at some point? Don't you also need solid core at the oarlocks? How about glue squeeze out inside the shaft, that's un-needed weight that would be hard to remove.

After this experiment, I'm just not convinced that hollow shafts are going to save any weight compared to composite wood laminates. And it's a whole lot more work to make them.

I've got Sam at Edensaw on the lookout for a few Sitka planks 1" x 6" x 8' / 25.4 x 153 x 2440 mm.

My plan for the next oars is the sandwich - .75" / 19 mm Redwood center (18 lb/ft3) with Sitka each side (27 lb/ft3). I bet that would be lighter than hollow, stronger, and much easier to make.

Drawing of the Loom



Sleeves and Oarlocks

Figure 46 - A Pocock grip, 1.4" / 35 mm diameter

I race with these, they are a comfortable size and work well. They are cylindrical, the D-shafts and oarlocks provide blade angle control.

For sleeves and oarlocks, everyone has their personal preferences but I use two types:

1. Plastic D-sleeves with bronze Douglas oarlocks
   These are more precise blade angle control, racing type configuration

   D-sleeves
   http://www.duckworksbbs.com/product-p/dur-martinoli-parent.htm

   Douglas oarlocks
   http://www.duckworksbbs.com/product-p/rs-do.htm

2. Rope wrap on the oars with bronze oval oarlocks
   This is my preference for touring, the oars are easy to feather and rotate quietly, but blade angle control is by wrist only

   Bronze oval oarlocks
   https://www.fisheriessupply.com/thomas-machine-and-foundry-oval-bronze-oar-locks

Figure 47 - Martinoli D-Sleeve

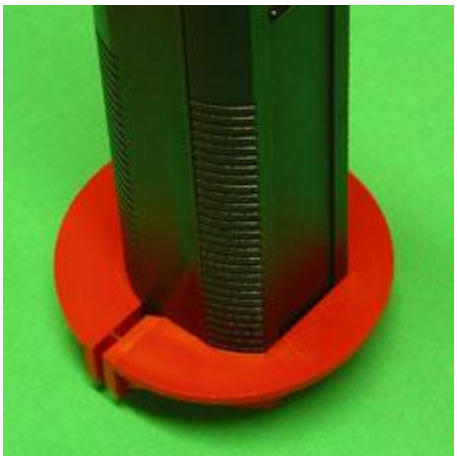


Figure 48- Martinoli D-Sleeve with collar

Figure 49 - Douglas bronze oarlock

Figure 50 - Martinoli sleeve, Martinoli collar, and Douglas bronze oarlock

Both of the oarlocks that I use have well made, precisely machined shafts, so they are not loose and noisy.

I have been experimenting with homemade oar sockets built with oil impregnated Oilite bushings. These are self lubricating, so far are working well.

Pictures of the experimental sockets posted to Flickr:
https://www.flickr.com/photos/ricks_boats/albums/72157624205867790

Figure 51 - Self-made oar socket – Parts

Figure 52 - Self-made oar socket - Parts pressed together

Figure 53 - Self-made oar socket - Raw wood with drill bit

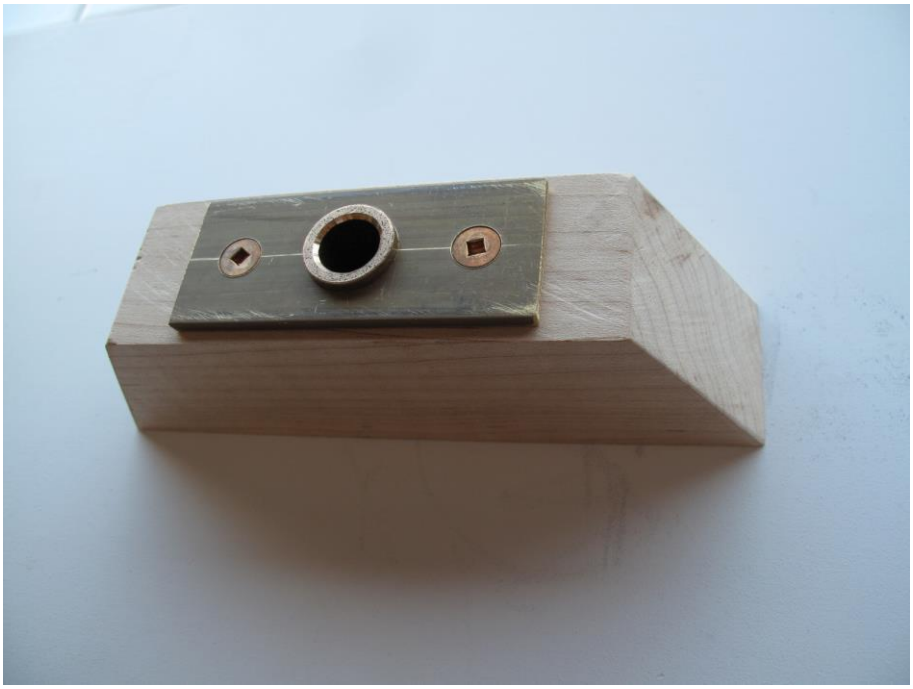


Figure 54 - Self-made oar socket - Parts put together

Figure 55 - Self-made oar socket with rope-sleeved oar

Grips

Figure 56 - Mountain bike ergo grips as used on my other oars

After trying these originally, I found that the shaped grip provided great blade angle control for round looms.

You can feather, return with very loose grip, then just close fingers at the catch to rotate the blade back. The angle is not held as well as the D type, but for cruising it is fine and I much prefer easy rotating round looms on long cruises.

Figure 57 - The start of a shaped wooden grip

I will try to whittle this into the ergo shape.

Timo4352 comment:

Is that phenolic tubing used for the insert?
Could just fill that with lead shot for balance then?
Is that the plan?

Yes to all.
The canvas phenolic tubing was leftover from making the tent. It's 5/8" / 16 mm inner diameter, could take lead shot or maybe just a metal rod. The end will be slotted for a taper to tap in and hold the grip orientation.

Figure 58 - Looms tapered at the handle end, blades attached with temporary screws, handle tubes slotted

Slightly more progress. I left the blades at 20” x 7.9” / 508 x 200 mm but sanded the skins a bit thinner. This shaved maybe an ounce ...

Weight is now 3.3 lb / 1.485 kg each. I have to glue on the blades and handle tubes, varnish, and add rope wrap and shaped handles. Should still come in under the 4 lb / 1.8 kg goal.

MN Dave's comment:

The oars are looking good, and a coat of varnish will bring out the color.

I will never understand birdsmouth oars except an exercise in complexity with some unfathomable desire to do all that work just t have the grain look the same all the way around.

As pedant in residence:
I think that you might have meant Pawlownia when you said Redwood has a density of 18 lb/ft3. Redwood averages 26 lb/ft3. http://www.wood-database.com/lumber-...ods/paulownia/
And while I'm at it, having done the spreadsheet some time ago, a mix of lead shot in epoxy would have about the same density as solid steel if you could pack the shot to the theoretical maximum of 65% by volume. Slightly lower actually. Wikipedia said that spheres can pack up to 65%, and I have no incentive to try the calculation myself. Anyway, a solid steel bar might be easier than lead shot if the tube inner diameter is close to the available bar at the hardware store.
I have a book on paddle making which may be the place that I read that you should endeavor to match the shrinkage when laminating wood so that the lamination won't want to bend as the humidity changes. Once varnished, I wonder how much this really matters. When I made my oars, I paid a lot more attention to appearance.

Interesting you mention Paulownia, I had noticed the combination of low density yet other good properties. It's hard to find in the US as most goes to Japanese furniture makers. This place in GA sells plantation grown, but not longer than 5' / 152 cm and expensive:
http://www.worldpaulownia.com/html/p...warehouse.html

Redwood is listed at 26 lb/ft3, but there is a big variation. By picking the lighter boards, I measured 18 lb/ft3 for the one I used for these oars.

The off-cut of the laminate pictured earlier with the curve has been left outside through several storms, and I keep checking it. It is curved when soaked but straightens out when dry. Varnish should keep curving under control (I hope).

Tom Hoffman's comment:

Perhaps I can explain. Indeed there are 3 sections where a core is inserted in the hollow shaft for strength and rigidity. Of course the loom handle. It is inserted in a good 6-8" also at the oar lock position 4-6" above and below. And at the blade end a long flat piece at least as long as the contact curve of the oar and up into the shaft as far as the flat part of the oar shaft extends. Essentially by a adding these 3 solid pieces, you create a truss effect.

As to doing it for an exercise in complexity, in reality it couldn't be simpler. After reading all the post in this thread and all the gauges and shaping and hand work to get to a pleasing looking oar.

The Birds Mouth Oar is a very fast way to make a very inexpensive pair of oars using just a normal set of shop tools mostly a router table and a table saw. Since I have all the jigs made for tapering the staves and for holding the birds mouth versicle so I can squirt epoxy into the "V" before clamping, I can probably turn out a set of shafts in an hour or so. The blades take a bit longer as they have to stay clamped in the jig till set.

Regarding the weight issue to help balance the oar at the lock, it is very easy to pour epoxy/lead shot into the loom end and insert the handle and you would have a weighted and much better balanced oar. My first set I did not do this on subsequent sets I did. On my second and later sets I used much thinner veneer for the

blade. My first blades were 3 layers of 1/8" / 3.2 mm later were 3 layers 1/32" / 0.8 mm I did insert 2 layers of .56 oz fiberglass cloth. Not sure if it helped or not. The blades were good and strong and thin. It did reduce the weight a good bit.

I am not a racing rower and I do not row in conditions where an oar failure would be a catastrophe. I just row with SWAMBO on a pleasant Sunday afternoon on a quiet lake or float down a river here in Iowa.

Anyone one wanting a set of plans free for how to make these oars, Please email me direct.

Figure 59 - Tom Hoffman's oar with birdsmouth loom

Tom,

The birdsmouth still sounds more complicated to me, but I have never made any spar before these so am a complete novice . Could you please mail me a set of the plans you are offering, so I can understand what is involved?

I am expecting it takes many shaped pieces (8 staves plus 3 solid sections plus the blade), also jigging to make the staves and to secure the shaft in alignment while gluing.

You mention a router table. I do have a router, but it has been years since I switched on that screaming noisemaker and hopefully never will again. While I quickly failed at the no-power-tools goal when using the table saw to cut the loom blanks and the hand drill for the handle holes, I still prefer pull-saws, planes and hand sanding to most other power tools.

Rick

By the way, if these pass the initial tests they will get used for racing. The first big race comes up in April with the Open Ocean, 8 miles of rough water out the Golden Gate. Yes, I will carry spare oars ...

MN Dave's comment :

Those are nice looking oars.

Hmm, tapered shafts, so I'll need a jig for ripping tapered staves on my table saw, a router, router table, bits, jig to feed the staves through the router. Sounds like the second set of oars can go pretty quickly, once I buy the router, router table and bits and make the tooling. It's all about the learning curve, once you get past that, the bird's mouth might be quicker. A square inner loom could be a different story, but can still be made either way.

An 8 siding gauge is a stick with 4 carefully measured holes and four nails. A draw knife can make a lot of wood disappear in a hurry. Either way, a lot depends on how much you like the particular process.

The density of lead shot set in epoxy is at best slightly lower than solid steel. There is a trade off between conveniently sized steel bar and lead shot. If you have a piece of steel the right size, lead shot doesn't buy

anything. If the steel has to be reshaped, the shot is much easier to work with.

Regarding tapering:
My looms are straight for about 20" at the oarlocks, then taper evenly toward the handles and taper to an oval at the blades. Can that be done with hollow bird's mouth?

Tom Hoffman's comment:

Yes, that's what really makes these neat because they start out octagonal transition to round (2") or so at the lock and then keep tapering to just above the blade where the transition to and elliptical wing shape for stiffness perpendicular to the face of the blade.

OK, Tom sent the plans by Joel Herzel for his hollow shaft spoon blade oars, 40 pages of instruction and build photos. Thanks Tom.

I have read through pretty carefully, but need to read several more times to understand all the fine points of advice by Joel. Here are some of my first thoughts:

1. Yes you can make tapered elliptical shafts by making the staves properly tapered

2. The hollow would be lighter, Joel says a scull made with Port Orford Cedar came in just under 3 lb / 1250 g

3. It looks like more work!
   Sorry Tom, but you have to make 8 staves of varying tapers, carefully machine a birdsmouth into each one, and after gluing you still need to plane off the points and sand the loom

4. Joel uses a laminating jig for the blades very much like mine.

Tom - Could we put these plans up on the forum somewhere so all can see them?

Upchurchmr's comment:

Lead is really easy to melt and cast. Then you get 100% density.
Just use a pan your wife is not going to use again.

Tom, I don't do Skype, would you please mail me also with the oar plans?
I've made several bird's mouth shafts just to see how it works. Seems very simple to me.
Jigging is an almost non existant requirement. It would be necessary for a mast of larger size and weight.

Tom Hoffman's comment:

I don't skype either, can't remember how I put that on my data page, now I can't get rid of it.

There is only one jig to taper the staves, You cut the bird mouths on all 8 staves, then you taper all staves the same, stopping short on two of them and finish the wide end using a plane or jig saw or what have you to blend the two cuts down at the blade end.
Yes the plans are a re print of Joel Herzel's original article, he graciously gave them to me for free, His pictures didn't make the trip well, so I shot new pics and added them where I thought they would be informative.

Haven't heard from him in a long time, haven't seen any post on here either for a long time.

MN Dave's comment:

You have something there. bottom left, page 308 American Gas-light Journal and Chemical Repertory, Volume 103 November 15, 1915:
Tthe density of packed lead wool was about 97% of poured lead. You might want to put some tight hose clamps around the wood to prevent splitting while you pound the wool.

Figure 60 - A pair of hollow oars from douglas fir made by Biber-Boote Schweiz from the plans created by Colin Angus

As another option, Colin Angus has plans for hollow shaft spoon blade oars: http://www.angusrowboats.com/woodenoars.html.

Angus' oars are made box section, not bird's mouth. Much as I admire Colin's exploits, I chose not to build his oars for several reasons:

The build method is labor intensive, he estimates 30 - 50 hours for a pair of oars. The finished weight is around 4.5 lb - both laminated shaft and bird's mouth come out lighter.

His blades are made from wood blocks laminated together and carved out into spoons, then fiberglassed both sides. I think using thin wood sheets laminated in a form is a stronger and lighter method. Colin's are very nice looking, though I would think about thinning the edges for a less chunky appearance.

Thinking about Tom's bird's mouth looms again, they are probably 1/2 lb / 250 g lighter than the solid laminations and fairly straightforward to build if you have the power tools. First you need something to make the thin stock, a planer would be good. Then a router, router table and bird's mouth cutter. A table saw to cut the tapers. Gluing up should be OK if the staves self align and don't need a jig to keep straight. It looks like a messier glue job than just flat gluing two planks, but not too bad.

I'm going to take a pass on this method for now and keep trying to improve the laminate. One thought is to go with the sandwich, but start by gluing just two pieces. Then use the table saw with dado to cut out a slot in the center lam, leaving a hollow when the last layer is glued.

Tom Hoffman's comment:

If you want to go to really thin stock, just order plain or fancy veneer from any veneer supplier it comes close to or right on about 1/32". My first pair had 3 - 1/8" veneers I made by resawing on my band saw and then running through my planer. My planer stops planing at 1/8" and even then you are likely to have a couple explode on you while you are planing.

My first blades were heavy and clunky looking like the ones shown above. If I were ever to do the 1/8" veneers again I would I would thin the inside of the spoon from the shaft to the blade edge leaving it 3/8" at the blade and thinning to 1/8" edges that would reduce the weight some, I never weighed my oars they seemed light until the were in the locks, then having nearly 6' sticking out overboard and only 30" or so inboard, then they seemed heavy and I caught more than my share of crabs
(in Iowa they were probably crawdads).

The space in the loom from handle to oar lock stiffener block is pretty big and you can get a good bit of weight in there.

Upchurch's comment:

In making birds mouth you don't need a planer - a table saw works perfectly well.
What is a bird's mouth cutter? I used a wobble dado (and got soundly criticised for it - but it worked easily) and many use the table saw set at 45 degrees. What would you use a router for? Nothing to my mind.

A tapering jig for the table saw would be necessary to build.

Tom Hoffman's comment

It is a specialized router bit to cut the 45 degree groove (birds mouth in the side of thin stock). You are only dealing with stock 1/4" or 3/8" thick and 2" wide or so. You put the bit in the router with a fence and make a tunnel to push your strips through and pull out the back side, safe easy and fast.

Here is the one for Octagonal.
http://www.ebay.com/itm/Birds-Mouth-...3D221882457555

Shave Horse

Figure 61 - A saw horse

My choice of tools I'd like to acquire next are a draw knife and a shave horse

Ulav8r's comment:

A shave horse does not have to be acquired, it can be built if you can work wood.

Hugh MacD's comment:

What ulav8r said. If you don't want to take up the space of a full sized shave horse, I'll send some sketches for a "shave clamp" that a friend of mine worked up to clamp into a Workmate. We're using it for making bows (arrow flinging self bows, that is) but they seem to work OK for that light duty work. Bot as "ergo" as a real shave horse, but they take up a lot less space when they're not in use.

I'm actually finding that the Jawhorse is pretty good, using a piece of slitted ABS tubing to hold the looms, but a shave clamp sounds better. With the Jawhorse you have to stand at the side to operate the clamp.

Hugh MacD's comment:

*That's a really nice shave horse! If you want something smaller you might cobble up something like this. Made it from a single 10' / 305 cm 2" x 6" / 50 x 150 mm and a chunk of 5/16 / 8 mm bar stock. Well & some odds * ends. Works pretty good. If you need more clamping force stick a jug of water on the treadle.*


2½
3"

Tom Hoffman's comment:

This is probably the most flexible vise/clamping system I have ever seen. Swiss Zyliss Vice. I have several, all my work benches are made so I can clamp these on, on any side. They are only limited by your length that you lay out and have a secure connection between the vise and tail point.

They are for sale on ebay for around this $$$ New, the were around $250 at wood working shows.

http://www.ebay.com/itm/Zyliss-Swiss...sAAOSwuAVWu-oP

Thanks, I can work up something like this. It will clamp in the Jawhorse just fine.

Looking on Ebay and Amazon for draw knives, lots of choices. Does anyone have recommended favorites? I was first thinking curved blade for oars, but actually straight would be better to cut to the spar gauge lines.

Drawknives

Tom Hoffman's comment:

I would think a spoke shave would be preferable for the looms and shafts also draw knives were primarily a green wood tool, they don't works well on dry wood, a spoke shave is a finishing tool toward the end of the wheel making process. I use to make English Long Bows and the spoke shave and scraper worked great.

MN Dave's comment:

Drawknives work well on any wood, not just green. Once you get the feel, you can remove a lot of wood in a hurry and still come out with a decent finish that will clean up easily with a spoke shave or travisher. I knocked out a serviceable canoe paddle in 15 minutes with a drawknife once. The wood was a yellow pine 1x8, which is fairly hard and brittle. It wasn't pretty, but I was heading up a creek and short a paddle. You can split out large chunks and do a lot of damage too, so go easy until you get used to them.

My favorite is a 5 1/2" Fuchs that I bought from Woodcraft in 1975. They show up on ebay as antiques. I may be an antique too, come to think of it. Anyway, it is very similar to http://www.traditionalwoodworker.com...info/500-1350/ They were rather less expensive when I bought mine, but I was making $1.60 per hour then, so they are more affordable now.

For hollowing spoon blades, I rough out with a scorp, or inshave https://arivinghome.wordpress.com/tag/inshave/ The blog has a drawknife page too. My inshave is an antique I picked up at the Maine Boat Builders Show. It is like a heavy duty curved version of the Fuchs drawknife, with a 5 inch blade and only 3/4 inch depth of curve. [edit: It is a L.&I.J. White #5 coopers drawknife Similar to this:

???? no img available ????

The blade depth is 1 7/8" on the inshave and 1 1/2" on the drawknife. The [edt: Arno set pf 3] with the ball shaped handles that used to be sold by the Woodenboat store are nice, but I prefer the handles on the Fuchs or 2 Cherries. I have used narrower blades that work well too, but I prefer the wider one. [see also Proper draw knife for spar making?]

Skuthorp's comment:

I'm making and repairing wooden carriage wheels at the moment, and a draw knife and a concave spokeshave are the main tools I use along with a chisel and mallet, a wood rasp and sand paper. Spokeshave is a Clifton, only a few years old and a superb tool.

Draw knife was my great grandfathers and once you get used to it can be a very delicate instrument as well as a tool to remove a deal of material swiftly.

Thanks for the info and links on drawknives etc. How about a big chisel or slick for roughing in spars and oar blanks? A slick just looks like a great tool to use, as in this photo from Jim Ledger:

Timo4352's comment:

I have an old time hardware store near me that has a lot of used older tools. They are for display as well as for sale. I have bought some planes, a spokeshave, and a drawknife from them. The prices are reasonable, and the tools are in good used shape. Can't beat the old stuff in my opinion. Maybe you might have a similar store nearby.

Wish I knew a store like that, I've only found a few tools in antique stores. Lots of slicks are on Ebay, with a big range of prices.

Tom Hoffman's comment:

On Ebay there are several 2" - 3" socket firmer chisels, just change the handle to a longer one. I made one that way years ago with a big heavy 3" socket chisel, I found in an antique store.

http://www.ebay.com/itm/Vintage-34-L...AAAOSwx-9W0yiR

Varnishing

Figure 62 - On the varnish tree

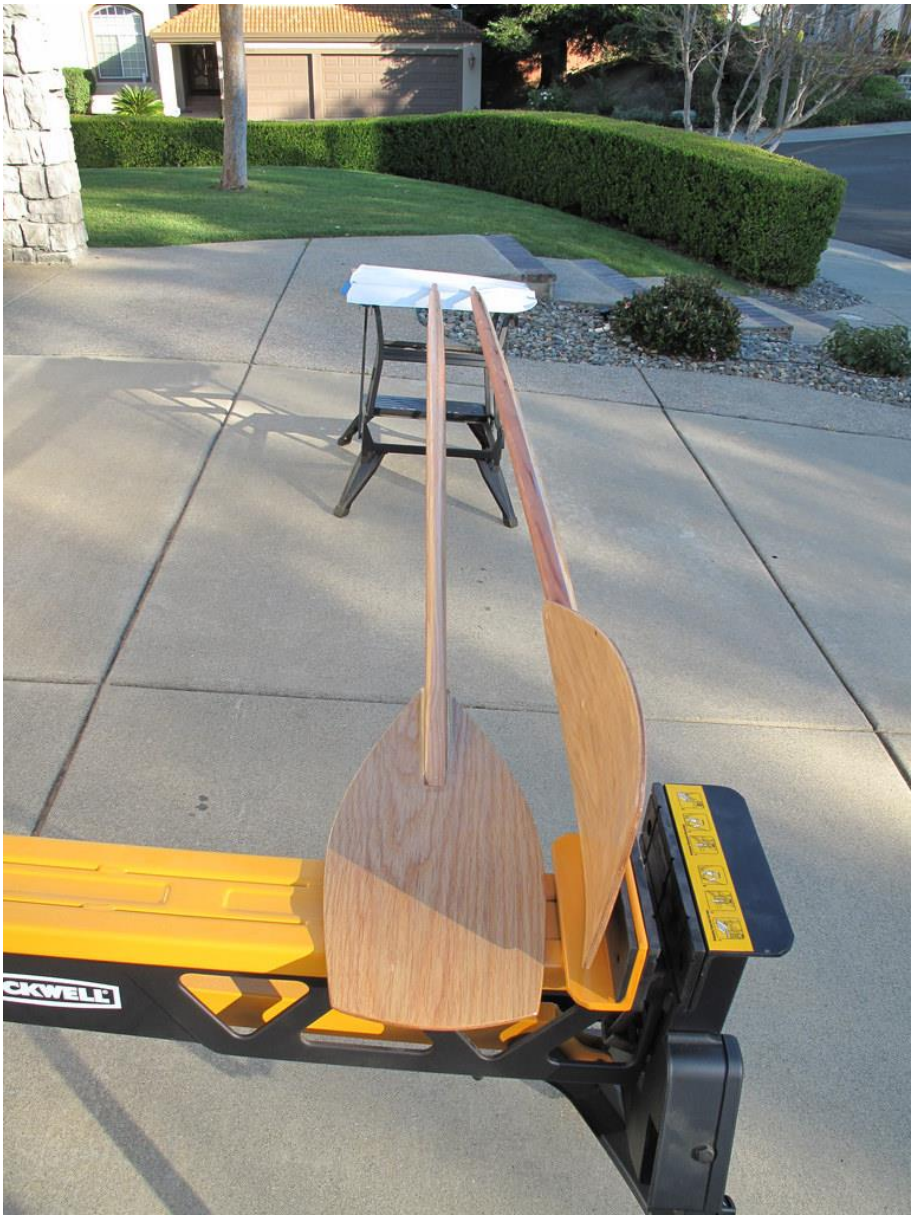


Figure 63 - Three coats of Spar varnish

Sorry for the slow progress, just don't have a lot of free time at the moment. I did manage to put 3 coats on this weekend (along with several drips and many adhered bug legs), I'm going to call that enough for testing. Rope wrap would need several coats of varnish, so I'll put that off and use my D-sleeves and Douglas oarlocks for sea trials next weekend.

Deflection Tests of the Finished Oars

Figure 64 - Deflection tests of the finished oars

D-sleeves and temporary bike grips installed, finished weight is 3.6 lb / 1.62 kg each.

These measure 10.9 and 11.2 cm with the 10 kg weight, beyond soft. Remember the Pococks were 4.8 cm (medium stiff) and my fiberglass shafts were 17.2 cm. Since I like the fiberglass ones, I have high hopes for the new laminated ones to have a similar, low stress feel at the catch.

There is a storm forecast this weekend, with heavy rain (that's OK) and wind gusts to 45 mph on Suisun Slough (hmmm, maybe too much for a first test). I hope it eases up from that.

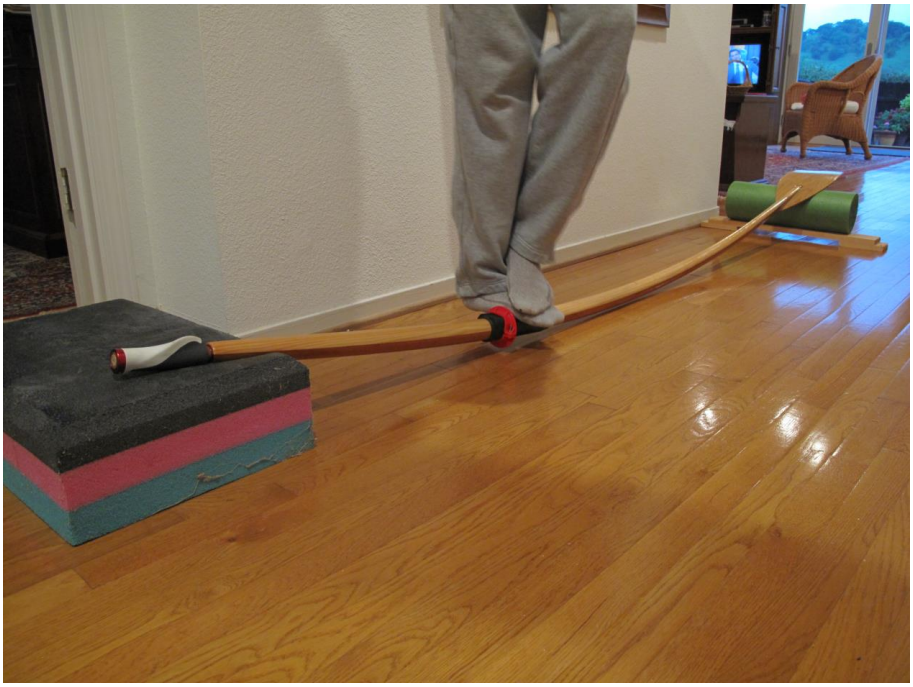


Figure 65 - Breakage test

I was not sure I should try this, but after the breakage tests what the heck.
200+ lb / > 90 kg on the oarlock location with no creaks or cracking noises.

Figure 66 - It sprang back straight

Use

Figure 67 - Finally ready for a test

Figure 68 - Video still

Video https://www.youtube.com/watch?v=-0Za-pC_VOQ

I'm going to keep this setup of D-sleeve and bike grip until after the Open Ocean race, it works well for aligning the blades. The clunking sound of the sleeves bugs me for cruising, rope wrap will fix that later. The only other change will be some counterweight in the handles.

Edit:

Weight to balance at the handles is 2.7 lb / 1.2 kg.

A 5/8” / 16 mm steel rod or bolt is around .11 lb/inch / 1.58 kg/m, I can try up to an 8” / 203 mm length in the handle.

Hatchet Blades

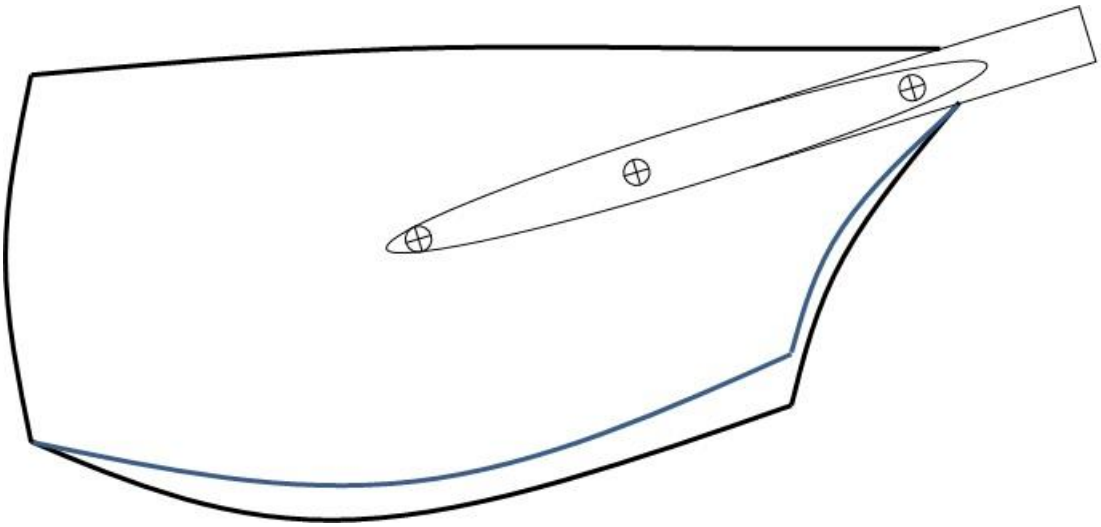
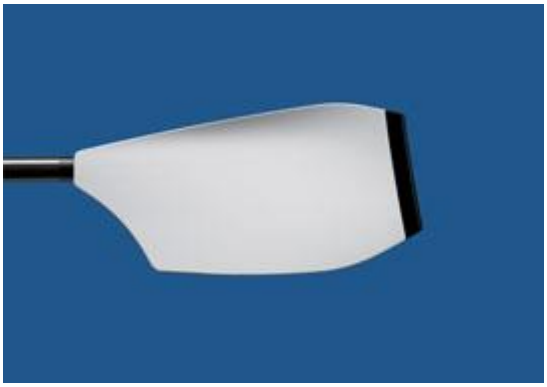


Figure 69 - Pattern for my hatchet blade

This was the pattern used for the hatchets, with the original and the now reduced area blade:

The reduced is better, lighter weight and still not much slip at cruising speeds.
Size 18" long by 8" wide.

For comparison - Concept 2 Fat2 blade (18" x 9"):



Since my oarlocks are a lot higher up than on a racing shell the loom is installed at a steeper angle, 17 degrees.

I like the hatchets in rough water. If you don't feather and a wave hits the blade it usually just knocks it into feather, no problem.

Figure 70 - My hatchet blades

I don't see any reason to change this pattern for the next set, just make them lighter.

Thanks to everyone on the forum for the help.

You guys straightened out several of my mistakes and got me on the right track to make these work. 👍