

NO MORE CORPORATE BULLSHIT! FUK WALL ST

"THE ART COMMUNITY IS NEAR AND DEAR TO US – WE EMPLOY IN-HOUSE ARTISTS TO DO SIGNAGE ON OUR CHALKBOARDS."



LIBERUM KAYAK

By Stephan von Muehlen, Benjamin Cohen, and Dylan Gauthier
A project of Mare Liberum.

Build This Kayak with Bamboo and Cable Ties.

The Free Seas / Mare Liberum is a free form publishing, boatbuilding and waterfront art collective, based in the Gowanus, Brooklyn.

Finding its roots in centuries-old stories of urban water squatters and haphazard water craft builders, Mare Liberum is a collaborative exploration of what it takes to make viable aquatic craft as an alternative to life on land. The project draws from sources as diverse as ocean-crossing raft assemblages, improvised refugee boats built in Senegal and Cuba, and modern stitch-and-ply construction methods which make complex, classic boat designs approachable by novice builders.

Our latest project brings together classic stretched canvas kayak and canoe skinning with a plywood, bamboo, and cable-tie hybrid framework with the goal of making quick and durable kayaks to get you out on the water with the minimum investment in tools and space.

Refer to the Bill of Materials for a complete list of everything you will need to build a Liberum Kayak. You will also want to download the pdf file for the Liberum Kayak from the www.thefreesas.org website. You will have to print out this file at full scale (4' x 4'). If you do not have access to a large format printer, you may have this done at your local copy center.



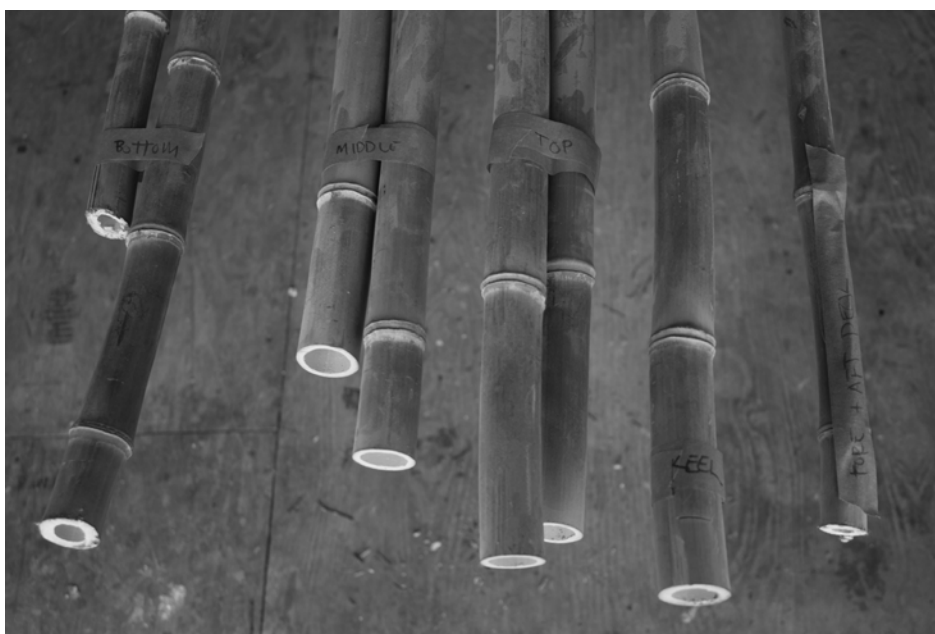
BILL OF MATERIALS:

Bamboo (1" - 1.5" Dia.) Look for straight, consistent diameter pieces.	Miscellaneous Wood Glue Screws (wood or sheetrock) Grommets Cable Ties, 11".....200pcs
Foredeck (x1).....44" Notch one end 3".	Line Upholstery Tacks
Aft deck (x1).....44" Notch one end 3".	Staples Epoxy
Top Stringer (x2).....161-3/4"	Canvas Sealer
Middle Stringer (x2)....155-3/8"	(Could be house paint, beeswax with linseed oil, or tar. Water based primers and paints make the canvas tighter up).
Bottom Stringer (x2)...140-7/8"	
Keel (x2).....126-3/16"	
Plywood (1/2").....4' x 4' Enough for all the plywood parts. They can be made up of scrap pieces so long as they fit.	TOOLS Jigsaw Clamps Snips for Cable-Ties Propane Torch Drill Bits (1/4") Hole Saw, Spade or Forstner Bit (1 1/4") Driver Bit for Screws Grommet Die
Stem (x1)	
Stern (x1)	
Frame 1 (x1)	
Frame 2 (x1)	
Frame 3 (x1)	
Frame 4 (x1)	
Frame 5 (x1)	
Frame 6 (x1)	

Step by step: Building the Liberum Kayak

1. Harvest the Bamboo.

Bamboo is an invasive species in much of North America that grows very quickly. You may have to be bold and ask around, but we have found that people are generally happy to let you cut it down and take it away if you ask nicely. There are as many ways to select and prepare bamboo as there are people with advice to give online. We have found that most of them work. We recommend selecting long straight pieces that range from 1" to 1-1/2" in diameter and are over 15' in length. The more consistent the diameter along each piece's length, the better. You will need at least 10 pieces per boat. Expect to lose a piece or two along the way. More is better at this point.



2. Cut the pieces to length.

Pair your pieces of bamboo to the parts list in the Bill of Materials. Make sure that the piece for the keel is nice and straight, and the top-, middle-, and bottom-stringers are matched to be about the same diameter and straightness. This will result in a fair and true kayak. Begin cutting the pieces to length, starting with the stringer pairs, the keel, and then the fore- and aft-deck.



3. Cure the bamboo.

Use a propane torch to cure the bamboo. This will prevent it drying and cracking over time. We have found that this goes much faster if the bamboo is allowed to dry for a couple of weeks before curing. We have also found that if you let the bamboo dry for too long before curing, it may become brittle. Be careful not to heat it up too fast or too much because the chambers between the rings may pop from the trapped steam pressure inside. It makes a loud noise and destroys your bamboo. You may even want to drill a small hole near the ring to let the steam out if this becomes an issue.



4. Cut Notches on the Fore and Aft deck, and both ends of the keel.

We recommend using a jig saw to do this. First, trace out a rectangle that is the thickness of the plywood and 3" deep in the middle of the bamboo. Make two cuts in the bamboo along the 3" lines. You can clean up the other side of the cut later, so really only worry about getting the top side right first. Make short diagonal cuts into the corners to chop out the unwanted tab and clean out the short side of the notch by gently grinding it away with the jigsaw blade. Repeat on the opposite side of the notch. It's a little bit of a hack job, but it works. Make sure that when you are cutting the notches at both ends of the keel, they are aligned so that the stem and stern are coplanar and that any natural curve in the bamboo is in the same plane, i.e., you want the bottom to have a nice curve and the stem and stern to be straight up and down.

5. Attach the printed outlines of the frames to the plywood.

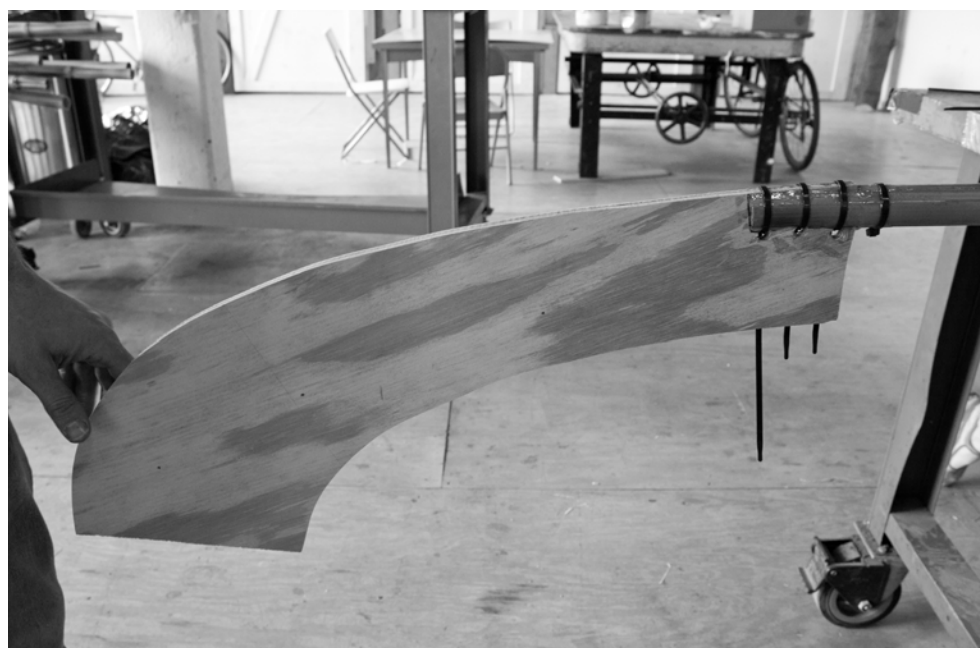
Tape or spray mount the full-scale printout of "Frame Drawings.pdf" to the plywood. You can cut out the individual parts and match to smaller pieces of plywood if you prefer. Don't use anything permanent because you will want to remove the paper before sealing the plywood.



6. Cut the stem, stern and frames out of plywood.

Using the forstner bit, drill out semi-circles in the frames first. These will help locate the bamboo stringers later. Then using the jig saw, cut out the frames following the lines printed on the paper. Drilling the holes first makes the drilling less dangerous. Also, make sure you mark the stem and stern where the 3 small circles appear in the drawing. You will need to reference these locations later.

7. Sand and polyurethane (or paint) all the plywood parts. Don't forget to remove the paper!



8. Attach the keel to the stem and stern.

Drill small holes in the Stem and Stern to pass the cable ties through. Make sure that the distance between the holes and the edge of the plywood are matched to the diameter of the bamboo. This will make sure that the parts line up nicely. Apply epoxy liberally to the contact surfaces between the bamboo and plywood and hold them in place with the cable ties as shown. NOTE: Make sure that the square end of the cable ties are pulled in against the plywood so that they will not stick out when the fabric is stretched over them. You will see what we mean later.

9. Attach frames 1 and 6.

Attach the frames to the stem and stern with wood glue and screws. You will have to drill small holes in these frames for the cable ties as you did for the connections between the stem and stern and the keel. Please make sure that the frames are oriented correctly. The bottom of the boat is actually flatter than the deck at Frames 2 and 5! We have made this mistake before ourselves.

10. Attach fore- and aft deck to the stem and stern.

Attach the frames to the stem and stern with wood glue and screws. You will have to drill small holes in these frames for the cable ties as you did for the connections between the stem and stern and the keel. Please make sure that the frames are oriented correctly. The bottom of the boat is actually flatter than the deck at Frames 2 and 5! We have made this mistake before ourselves.

11. Attach the remaining frames to the keel using cable-ties.

Locate Frames 2 and 5 such that about 1" of the fore- and aft deck pieces extend beyond the frames, and cable tie in place. The remaining frames should be located 24" on center along the length of the keel.



12. Taper the ends of the stringers.

By dry-fitting the bamboo stringers in place, you should be able to approximate the taper needed for a nice fit against the stem and stern. Make sure the bamboo terminates on the stem and stern at the small circles in the drawing mentioned earlier. Draw a line parallel to the stem or stern on the bamboo, remove the stringer, and cut using the jig saw.

13. Attach the stringers.

Pre-drill 1/4" holes just below the points of contact for cable ties to pass through. Using the cable ties, attach the stringers in pairs. Because the shape of the kayak is created by the bamboo in tension, it is important that you do this carefully—ensuring that the keel stays straight and the frames remain perpendicular to the keel and parallel to each other. You will probably want to have a few people on hand for this step and use lots of cable ties. Keep the cable ties a little bit loose at first until all the parts are attached and then go around tightening everything up, looking to see that the boat is fair and true. You will notice that the stresses in the bamboo may become quite high. Be careful.



14. Cut the fabric.

The fabric should be trimmed to a size a bit larger than the boat, both in length and width. Remember the width of the fabric needs to go all the way around the hull. Be generous. It is easy to trim later and impossible to add more material.

15. Loosely wrap and trim away spare fabric.

Without attaching it, you can start to cut away a bit. Go slowly.

16. Stretch fabric stem to stern and attach with staples.

Staple a few times along the top, flat edge of the stem. Pull it fairly tight along the keel and staple again at the stern.

17. Trim the fabric from the cockpit, and fore- and aft deck.

The cockpit sits between frames 2 & 5 and will be open. Leave 6" - 8" of fabric so that it can be pulled tight and grommetted later. Leave the same along the fore- and aft deck.

18. Begin grommeting in the middle of the boat and work out to the decks.

Fold the fabric back along the opening of the cockpit and along the seams at the fore- and aft deck. If you do not have a fancy grommet tool, you may have to remove the fabric now to make these modifications. If so, mark with chalk where more trimming needs to happen and you think the grommets need to go. You will need grommets every 8" inside the cockpit and 4" - 6" along the seams.



19. Cut and tuck where the deck meets the cockpit.

Reattach the fabric to the stem and stern if you had to remove it. Now you can start to tighten the skin by lacing the rope through the grommets and around the middle stringer inside the cockpit and between the grommets over the peak along the fore- and aft deck. Pull tight and tie off.

20. Clean up the fabric at the stem and stern.

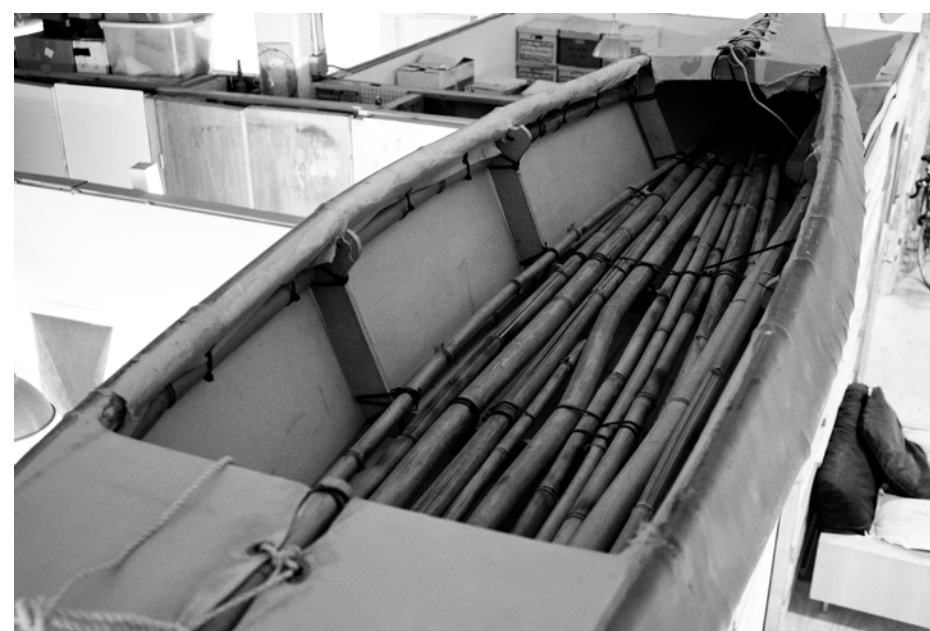
Beginning at the bottom of the boat and working towards the top, pull the fabric tight, tuck the extra material neatly against the plywood under skin, and attach liberally with staples. Make sure you are pulling out any gathering as best you can as you move towards the top by pulling pretty hard. This definitely works best with two sets of hands. Once you are happy with the how the skin fits, you can finish the stem and stern with upholstery tacks along the ridge. This looks nice and protects the skin a bit when you bounce into things in the water and drag your boat around.

21. Wet the whole boat and let it dry.

Use a sprayer to get the whole boat a little wet. This will help to tighten it all up and get rid of the few ripples you couldn't get out during the stretching.

22. Seal the fabric.

If you used canvas, prime it and finish with an outdoor, water-based enamel house paint. We have also used a mixture of 50% linseed oil and beeswax. This you have to heat until liquid, roll on, and reheat with a heat gun until it wicks into the raw canvas thoroughly. It will leak for a few minutes at first, but once the canvas gets a little wet and swells, it seals up nicely. Roofing tar also works—and is cheap—but pretty gross to work with. For a tougher skin, you can use nylon or polyester fabrics and then brush on a polyester resin. This is pretty toxic, so do it outside and use a respirator.



23. Put in the floor.

You are almost there. We have always used extra bamboo, roughly cut to lengths just a bit bigger than the cockpit and cable tied to the frames.



24. Escape the trappings of land!

