

# INVADERFOIL

## DIY PAIPO FOILBOARD

WEEKEND PROJECTS – HOW TO MAKE A PAIPO FOILBOARD



INVADER HYDROFOILS INSTRUCTIONALS

# How to Make a Paipo Board for Your Hydrofoil

## Materials Required

1. Obeche or Paulownia Wood 1200 x 450 x 20. If your timber supplier rips the planks you may get 2 planks of 220 wide each. This allows creativity to add a 10mm stringer with marine ply.
2. Marine grade penetrating epoxy. I use solvent free Flowcrete Ivory 340/5/LV with activator on a 2:1 ratio. (The industrial use for this epoxy is as a cement crack sealer and a marine ply sealer, in case you cannot source this brand). It is a slow cure epoxy.
3. Thickening agent to mix into the epoxy, like Q cell, to glue the stringer in. Fumed silica/Cabosil also works but is terribly hard on curing and challenging to sand once cured.
4. 3 large G clamps to clamp your planks together to glue the stringer in.
5. Carbon Fibre cloth 1m 200g plain weave.
6. Glass Fibre cloth 198gsm 1.5m x 1.5m
7. Glass Fibre stringer tape 3m.
8. Masking tape.
9. Non-powdered nitrile gloves.
10. Spabond Marine Grade two part epoxy or a marine grade epoxy with a thickener like cabosil/fumed silica. Do not use the supermarket squeeze tube epoxy unless it states marine grade.
11. 100 grit dry sandpaper (an orbital or electric sander makes life easier).
12. Various water sandpaper grits from 150, 400, 800 and up for polishing the glassed board.
13. Wood planer and or sander to shape your board.
14. 38mm wood cookie cutter drill bit.
15. 25mm wood paddle bit.
16. 4 x stainless steel pronged T nuts.
17. 4 x 35mm M8 stainless steel bolts.
18. Liquid quick release.
19. Modelling clay.
20. Plastic squeegee (bought or made from a yoghurt tub lid).
21. Plastic measure cups and spoons.
22. Craft knife/scalpel.



23. Wooden tongue depressors.
24. Paper cups or old yoghurt tubs.
25. A roll of paper towel.
26. Acetone.
27. Rubbing alcohol/surgical spirits.
28. Respiratory mask with organic vapor filter.
29. Your foiling base plate or a home-made jig to ensure the inserts remain straight and in alignment whilst the epoxy cures.
30. A few syringes and needles (only needed if you have air pockets on the rails after the glassing is cured.)
31. Cotton wool.
32. A sheet of plastic and a work area you can easily access from all sides, with elevating blocks or magazines to work on. Something like a small table or tressels works well.



## Wood selection

Paulownia is usually used to make wooden Paipo Belly boards and Alaia Surfboards. It is lightweight and strong and stands up well to marine conditions, however if you are unable to source it, as we were, you can use Obeche wood. It's not as light or as easy to sand, but it is still soft enough to work with without making the job too strenuous. Before purchasing the timber, check with your supplier what options they have.

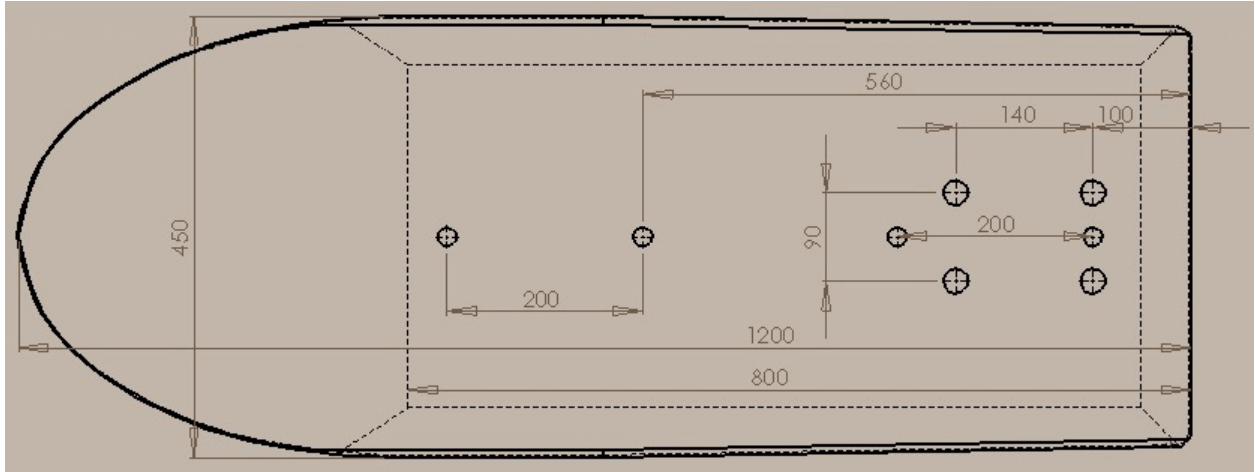
We chose to use Marine Ply for the stringer to get the striped grain down the centre, plus we happened to have some off cuts from a previous trial board.

## Method

### Board Preparation

1. Select the direction you want your wood grain to go when all the planks fit together. The timber occasionally has a warp to it so choose how best you want to glue it all together.
2. Lay plastic down to prevent any epoxy spills and sticks on your work surface or flat floor.
3. Make sure your G clamps will fit across the planks when glueing together (min 500mm)

- Mix your epoxy thoroughly before adding your thickener, then glue your edges and sandwich the stringer between the two planks on your flat work surface. Try not to have too much epoxy oozing out, you can always fill any crevices later during board layup, but oozed epoxy will need to be sanded off if it's visible with the finished product (ie a deck pad might hide some of it).



- Place your 3 x G clamps and tighten them up until your planks and stringer are firmly sandwiched together. Place one clamp in the middle and the other 2 at either end. Ensure the board stays flat and nothing shifts out of alignment while you tighten the clamps.

**Tip:** To help keep the board flat whilst curing, you can place heavy objects on top (just avoid the glue). Cooler boxes filled with water and heavy tool boxes make great weights. To elevate them and avoid the glue in the centre, place them on a few dumbbell weights or books either side of the stringer; anything to raise the weights over the stringer to avoid the glue.

- Leave to cure overnight.



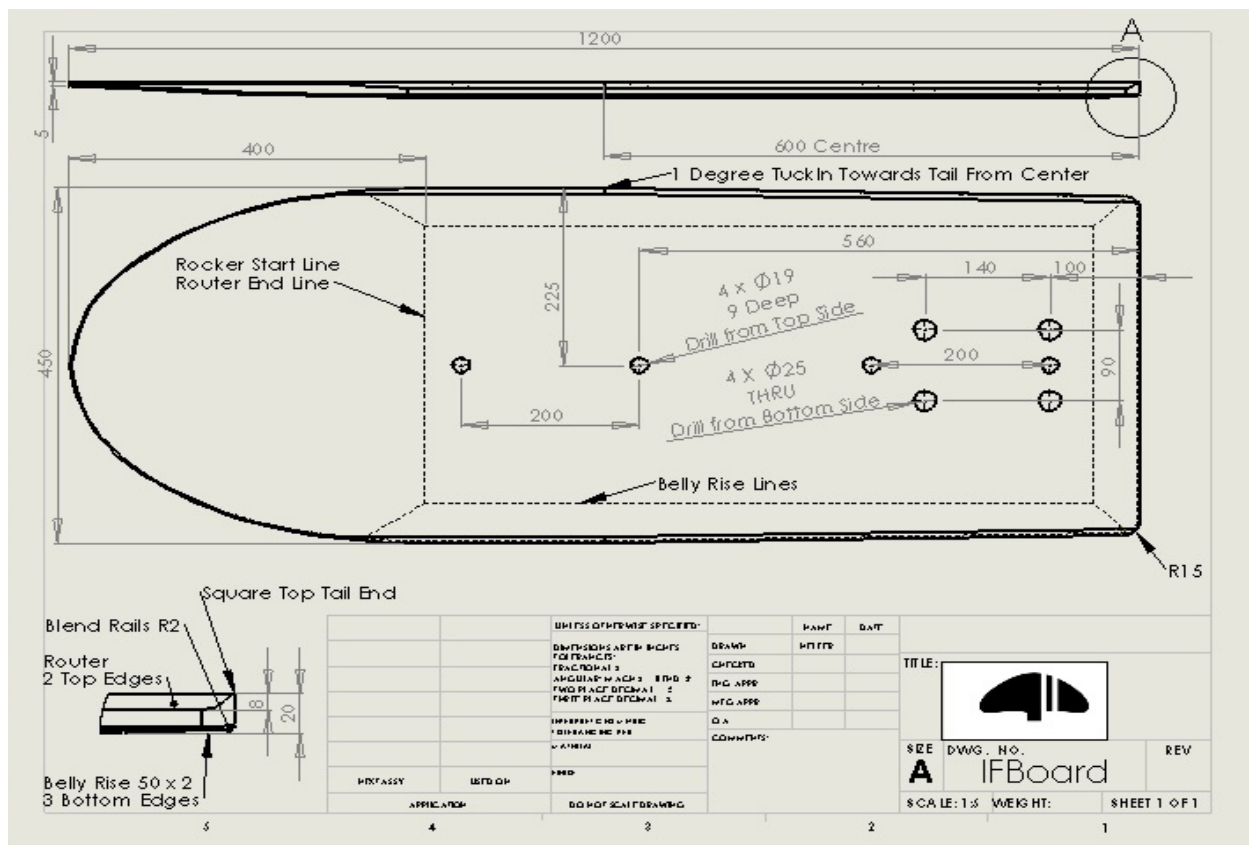


## Board Shaping (Wood Work)

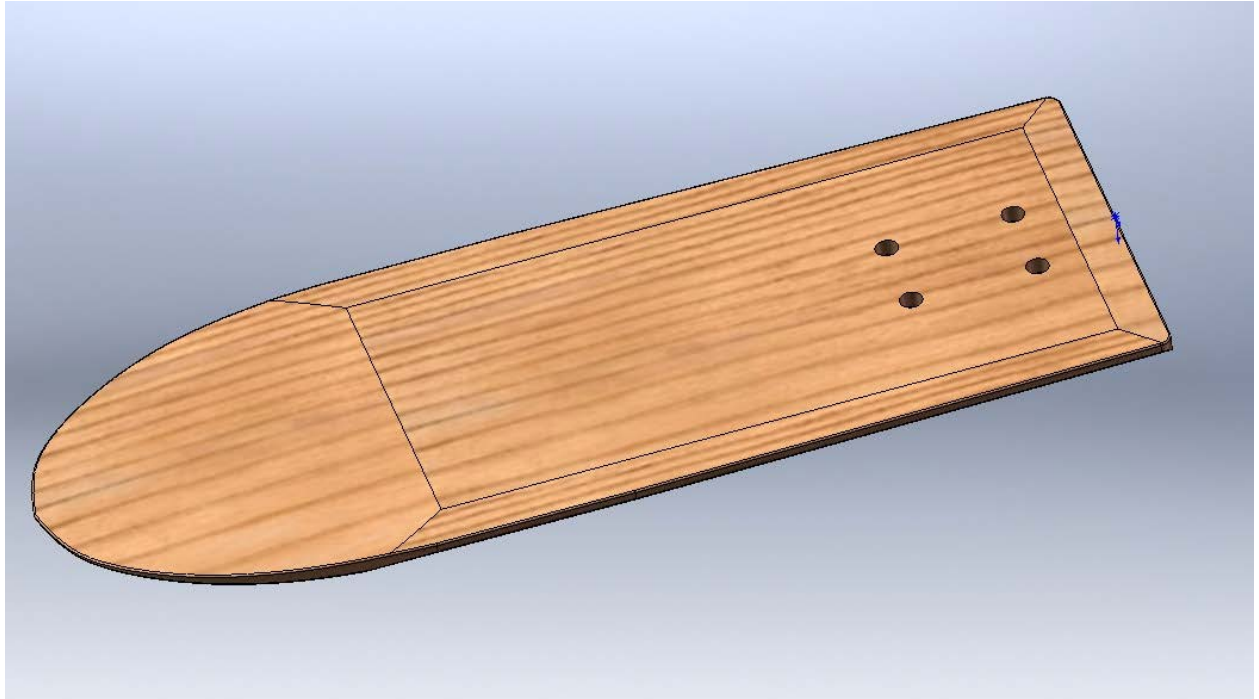


1. Using our template, mark out the profile of the board and then cut out the outline with a jigsaw.
2. Pencil the belly rise and rocker lines onto the bottom deck.
3. Using a planer or sander, shape these areas to remove excess wood and allow your paipo to take shape with the very slight change in angles we have on the template. Your top deck remains flat so the only rocker you will have is from this little bit of shaping on the underside. It isn't much but it's all you need for a super easy-to-ride board.





4. Be careful not to make your nose too thin, end with a min of 5mm.
5. Round off all your edges, even the square edges should be lightly sanded to remove a sharp edge.



6. Using the template (separate downloadable pdf on the website), mark out your pedestal holes and foot strap holes. You do not need the rear foot strap (or the front one for that matter) but the marks are there if you want to add them.

## Foil and Foot Strap Placement

1. Using your 38mm cookie cutter drill bit, drill out the 4 pedestal holes.
2. Using your 25mm wood paddle bit, bore out the foot strap holes to a depth of 10mm (the depth of your binding nut inserts.). The point of the paddle will poke through to the other side but don't worry, this gets filled later. ***Make sure you bore out from the top deck and not the underside you have sanded your rocker and belly rise on.***
3. Wipe down your board with a clean rag and remove all the dust. A little surgical spirits or rubbing alcohol helps to clean it up.

## Make your jig

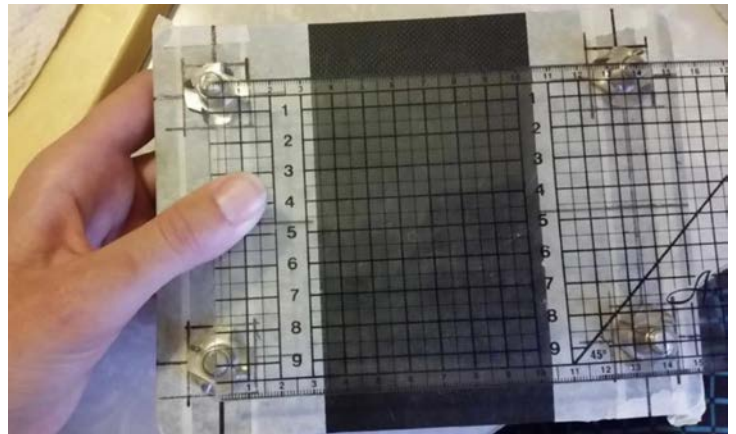
1. Get an off cut of a vinyl floor tile/plank and mark out your pedestal holes. The vinyl should be a similar size to your template for the holes. If your hardware or flooring shop can cut the tile to the template size that would be ideal, but you can also use a jigsaw or a hacksaw to make it the correct size.

2. Place masking tape or white labels over the area where the holes will go. Extend the tape to the edges of your vinyl tile. Mark the holes with large cross hairs so your drill holes are precise. Make the crosshairs run from end to end and side to side. Mark the cross hair lines on the edges of the vinyl too.



3. Drill out your 4 holes with an 8mm drill bit. They must be exact so use a pilot hole with a smaller bit if you need to. (Remember to clamp the vinyl down so your drill doesn't get stuck).

4. Now tape over the entire area with clear, wide packaging tape so that your jig won't stick to the epoxy and that your cross hairs are covered but visible. Cut through the taped over holes with a scalpel (you don't have to make it perfect, just pop it through in a cross so your bolts can slip through easily).



5. Place your 35mm bolts' thread in the quick release agent and let them dry on a paper towel. Do **NOT** put the T nuts in the quick release.

6. When the bolts are dry put washers on each of them and slip them through the holes and screw your 4 T nuts (prongs pointing at you) onto the bolts at the centre of each crosshair.

7. Measure the distance between all your bolts to be 100% sure you have 90mm wide x 140mm long. This cannot be slightly off so take your time to be sure the T nuts cannot move.

8. Take your plank and place your vinyl jig over the holes and line up the cross hairs on your board with those on your jig. If your jig is bigger than the original board holes template you will need to draw lines on the board to extend the points marked out during your cookie cutter preparation.

9. The photos I have used here are from a skimboard conversion but the procedure is identical to place the inserts. You will see that I originally used the vinyl jig with the pedestal, but you only need the vinyl if it is stiff. I also added nuts and washers to



alter the length of my bolts so they ended flush with the board rather than poking out. This gives a smooth finish and a lot less sanding later so add the nuts if you can.

10. Place the jig onto the plank and line up all your crosshairs. Mark the lines on the board at the exact line up points clearly in pencil or pen. You can remove all other pencil marks off the plank if you wish but this side will be face down into the boogie board. Make sure you keep the points marked to line up your jig.



11. Secure your jig to the plank with 2 small self-tapping screws into the wood. You can drill tiny pilot holes with a Dremel.

12. Now with the jig fixed to your plank, flip it over and double check the T nuts each sit in the centre of their respective hole. Your bolts should either be flush with the plank or longer... not shorter. Flush is best for a level finish as you can level the epoxy by skimming over the tip of each bolt with your tongue depressors.



13. If you are happy, place the plank on a flat surface so you can fill the holes.

14. Mix your Spabond or thick 2 part epoxy (marine grade) with a tongue depressor. I like Spabond as the color changes when the two parts are mixed properly making it easier to know when it's fully blended.

15. Split a tongue depressor into two and squish the epoxy into your holes. Try to fill between the prongs of the T nuts and add more epoxy as you fill the hole to the top. Poking the epoxy up and down tends to push out air bubbles so play a bit with each hole so you are happy it is thoroughly glued up before moving to the next hole.

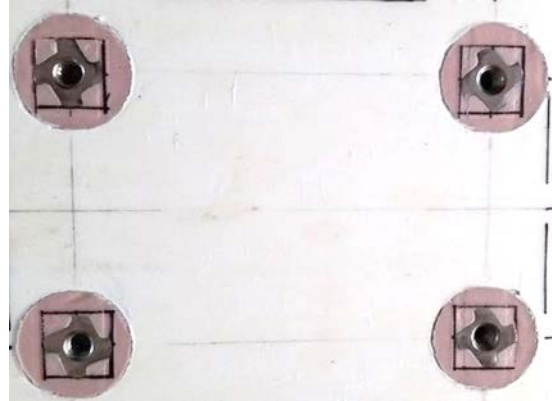
16. Mix small batches of epoxy at a time.

17. Try to leave the epoxy level with the plank surface when the hole is filled. You can spatula it with the tongue depressors to level it nicely. If your bolts stick proud of the deck level you will need to try to level the epoxy whilst working around the bolt. Once

cured you can trim any excess down, but try to get it as level as possible with the plank of wood.

18. Once the holes are filled leave it level to cure for an hour or so.

19. Check if the epoxy is hard. Once hard you can remove the jig by carefully unscrewing the bolts from the holes. The epoxy must not still be gooeey or you will ruin the thread. Your quick release should allow you to unscrew each bolt, having left a perfect epoxy thread behind with your inserted T nuts.



20. Mix a little more spabond and blob it into the foot strap holes, sink your foot binding inserts into the spabond (do not remove the plastic film over the thread) and fill in any gaps with more epoxy. The insert should be level with the deck so you can easily smear off any excess spa bond with your tongue depressor, leaving a smooth finish flush with the deck. You should just see the plastic cover of the thread.

21. Leave the plank to continue curing overnight.

## Fiberglass Lay Up

### Preparation

1. Trim off any epoxy that sticks up after removing the bolts and sand it flat with the plank if necessary so that your deck has a smooth surface to attach your foil to. You want the insert and epoxy to be level with the wood for the best foil attachment and glassing finish.
2. Sand the epoxy and the insert on both sides with a rough 60 grit dry sandpaper. If it's shiny your epoxy won't adhere properly around these plugs.
3. Wipe down the board with rubbing alcohol and a clean rag. Remove all dust and all pencil marks.
4. Cover your work area with plastic to avoid epoxy spillage mess.
5. Elevate your board on a trestle or some old magazines above a table.
6. Cut your fiberglass cloth pieces. Use masking tape to mark off the cloth before cutting so you avoid any fraying or pulled threads. The more cloth you have overhanging the board, the easier it is to drape it over the rails due to extra weight

when the cloth is wet. It will also drape easier if you can lay it at a slight angle on the bias of the threads rather than at right angles.

7. Cut your lengths of stringer tape, also using the masking tape to seal the ends. Cut the lengths to hang over both ends of the board, nose to tail.
8. Plug your pedestal inserts with modelling clay from both decks so no epoxy can seep into the holes.

## Glassing

1. Mix up some Flowcrete penetrating epoxy and spread a thin coat over the top deck. It will soak in quickly if your board is level.
2. You can use gloved hands or a squeegee. I have tried a mohair roller in the past but find it wastes so much epoxy due to absorption and creates tiny bubbles on the surface. Squeegee and hands work best for me.
3. Place your stringer tape over the centre line on the top deck, on top of the sticky resin.
4. Add a thin coat of epoxy to wet the glass cloth completely. It will go transparent and any crevices left from gluing the stringer in should get filled. Don't add too much resin, it should soak in and not pool on the board unless it's filling an imperfection.
5. For a smoother finish, tape the stringer tape down with masking tape after you have epoxied it. The epoxy will be wet but the masking tape squashes the raised edges of the glass stringer tape down, leaving a flatter finish.
6. At tack off stage, remove the masking tape. Your epoxy will no longer be sticky so the tape should peel off without lifting the glass stringer tape. Check the "overcoat" time period and final coat period on your epoxy specs. This is your window to add another layer of glass and epoxy without the need to sand the



surface down. If you wait until the epoxy is fully cured you have to sand the board before adding the next epoxy/glass layer.



***If you want to place a logo on the board, this would be where you need to do it. A simple logo can be made with a standard home printer. Using a school glue stick (the dry glue not the liquid glue) tack the edges of your paper to some tissue paper. Cut the tissue paper to fit the A4 printing paper. Print your logo... As long as the tissue paper is glued down where it feeds through the printer, it should remain flat. Once dry, cut out your decal and place it on the board. Lay the glass cloth over the top and continue with the epoxy...***

7. Place your glass cloth over the board and add your epoxy until the glass is wet through (transparent) but not pooling on the board. Use your squeegee to spread the epoxy over the board and use your gloved hands to spread it over the rails.
8. Cut darts into your glass cloth frill to help it drape better over the rails and around any corners and curves. It should be wet sufficiently to have the glass stuck to half the rail (minimum). As it cures it's easier to wrap it tighter to the rails (the epoxy gets a toffee texture so you can still manipulate the draping while you add epoxy layers. Your rails



can get properly soaked to the point of dripping, but rather keep the top deck to thin layers at a time so the glass doesn't float up off the deck.

9. Add a few thin epoxy layers between tack off stages until you are happy with the board appearance. It is not necessary to sand the board at the end, unless you want an ultra-smooth water sanded finish. Some people prefer the non slip waffle texture finish from the glass cloth so this is entirely up to you when you want to stop adding epoxy layers.
10. Leave the board to cure overnight.
11. Flip the board over.
12. Trim off the excess frill of fibreglass with your craft knife.
13. Sand the rail down with some 60 grit so you have a slight ledge of epoxy and glass without any sharp edges. Sand the rail nicely so that the next layup adheres nicely to the rails when you do your glassing.
14. The nose of your board should also have a nice bead of epoxy around the wood. You want to keep this bead of epoxy as an extra nose protector, so if there is a small channel left behind from yesterday's layup, that's ok, it will fill with more epoxy today.
15. Sand off any epoxy dribbles that have run onto the other deck using a 100 grit or higher so the board remains smooth.
16. Wipe the board down with alcohol to remove dust.
17. Mix your epoxy and follow steps 30 to 39.

## Carbon Reinforcement

1. Cut out your 2 rectangles of carbon. One at 96cm x 26cm and one 110cm x 40cm (you can adjust this if you wish as long as you keep one bigger than the other)
2. Trim off your excess glass frill and sand the rails.
3. Wipe the deck with alcohol to remove dust and grease.
4. Tape off the rectangle for your carbon cloth reinforcing with masking tape. 100cm x 30cm. Make the tape extend to the rails so you can still see the line once covered with carbon.
5. Rough sand the inside of this rectangle thoroughly. Retape it if you scuff the edges.
6. Mix some epoxy and lay your first smaller carbon rectangle within the borders of the masking tape.
7. Add more epoxy with your squeegee to saturate the carbon and the masking tape on the carbon. Once totally wet the tape will gently lift away from the cloth. Lift the tape off without pulling any threads.

8. Carefully lay your next rectangle on top of the wet layer and press it down.
9. Take fresh masking tape and follow your extended masking tape perimeter from end to end to give you a guide of where the rectangle on the board is underneath the cloth. You will use this tape line to cut the excess carbon off with a craft knife so be as accurate as possible with straight lines.
10. Now add epoxy and squeegee it onto your carbon to saturate it within the borders of your masking tape. Don't overlap the masking tape this time. Just spread the epoxy half way onto your tape so that it can't lift off the cloth this time. If you have little air bubbles coming through, your cloth is not totally wet through so squeegee a little more epoxy on. **Sweep the squeegee up, down and diagonally.**
11. Use any excess epoxy you have to smooth around the rails you have sanded. This will fill up any holes you may have missed on your layup.
12. Leave the board to cure overnight.
13. Now that your epoxy is cured take a long straight plank off cut or something to guide a straight line, follow the masking tape inside the masking tape perimeter and score through your carbon with the craft knife.
14. If the carbon is fully cured it should snap off, otherwise continue scoring it to cut through the carbon. You should be left with a perfect rectangle of carbon.
15. Remove all the masking tape from your board so you are left with only the carbon rectangle.
16. Sand your deck with a 150 to 180 grit to smooth off any bumps. An electric sander is handy if you have, otherwise a sanding block works well too.
17. Drill through your top deck insert holes (the fiberglass side, so you can see the holes). Use a small drill bit and punch through to the carbon side, and then dremel out the balance of the holes so as not to damage the thread.
18. You can use a straw to remove the modelling clay if you wish or simply screw your bolts through the board once the holes are open on both ends. The clay will worm its way out the other side. Use the bolts from the carbon side to check that they screw into your pedestal holes without difficulty. If they don't screw into the epoxy thread you may have to open the hole entrance up slightly with your dremel, but usually they screw in without any issues.
19. Once nicely sanded down and your holes are open you can clean the board with alcohol on a rag and apply a thin coat of epoxy to your sanded surface using your hands (in gloves). Be careful not to let any epoxy run into the thread holes now that they are open, but be sure your holes are sealed after you have drilled them out. This layer of epoxy will also seal up any damage you may have done with the craft knife and seal the carbon edges as well as give your board a final gloss. If you don't sand the board well, the epoxy may separate on the deck like oil and water, so you want to be sure you have a nice matt finish to the board before adding the light smear of epoxy. This applies to any additional coats you may wish to add to the board at any stage.

20. Once you are happy with your finish, leave it to cure a day or two. After that you can give your board a water sand polish with 1200 grit if you like or leave it as is. It needs these 2 days to complete curing otherwise you run the risk of the epoxy going milky.

21. Mark your foot strap hole positions on the rails with a pencil.

22. Stick on your deck pad



23. Locate your foot strap holes with a pin and place your foot strap on... Now you're ready to attach your foil.

***Most surfboard manufacturers should be able to tailor a deck pad to the specs of your board.***

***I had mine made to spec with brushed EVA foam and an oversized kicker for more float. If your deck pad is very spongy you may find your balance a little trickier. Any movement in your toes and ankles affects the direction and balance on the foil so you want the most direct response from your board. This is also the reason why your board must be stiff. Any bounce in the deck will affect your balance and pitch control.***

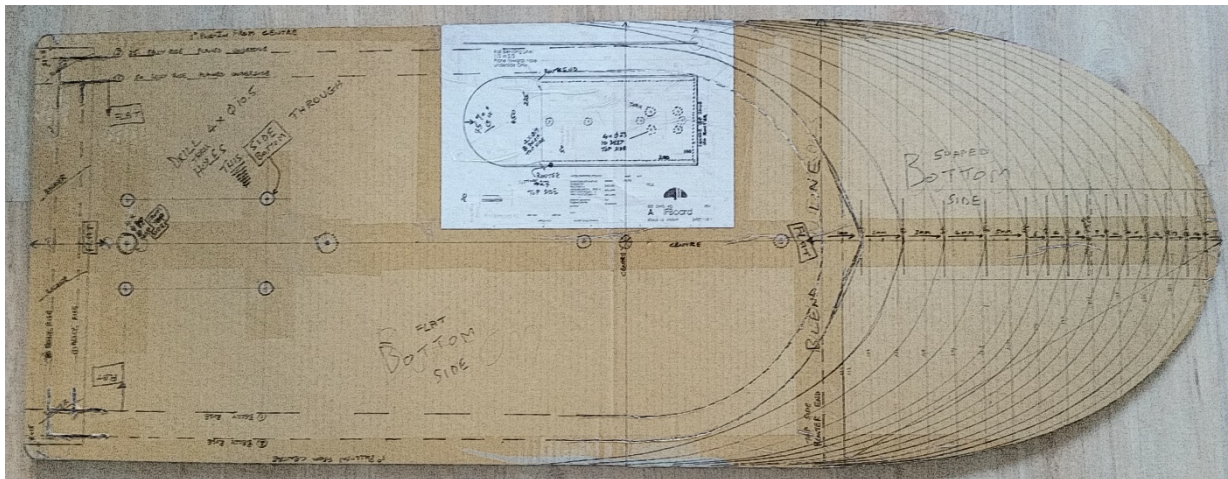
***Any nicks or damage to your board can be easily patched up with penetrating epoxy, so it's always a handy resin to keep in the repair cupboard for wooden boards.***



The original prototype board was made with 20mm marine plywood and penetrating epoxy. No glassing at all. The tail kicker was originally a pool noodle, cable tied on for floatation until we put a proper deck pad on. It served well as a learning board and is in fact the board seen in my kite foil tutorial on Youtube.



The original prototype cardboard board template with rocker lines and belly rise to cut and shape the Paipo.





Assemble your foil and get out on the water!

