Specific information on the ocean cockpit option can be found in the Shrike Too Build Options.
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Reasons for the Shrike project

This manual describes a lightweight sea kayak design for stitch and glue plywood construction. The design can be simply adapted to the size and shape of the intending paddler. The reasons for the project are:

1. There is enormous satisfaction in building a kayak and using it to travel our beautiful waters.
2. For a significant number of people, modern sea kayaks have become too heavy and/or too expensive. Our rotomolded plastic double kayak weighs 44kg (97 pounds) when empty, and cost £2000. Single fibreglass new sea kayaks frequently weigh over 27 kg (60 pounds), and cost upwards of £2,500. The weight of these craft is such that many people are unable, either through limitations of strength, disabilities, injuries or age, to place them on the roof of a motor vehicle, the normal mode of transport, or to carry them up a landing beach or slipway. This is an important aspect, and one which excludes many people from fully partaking in this wonderful pastime.
3. Paddlers have differing preferences for shape, size and height of the cockpit. Commercially available kayaks may not meet these individual preferences.
4. The young people we meet have little opportunity for learning practical skills. The described construction should be within the capabilities of enthusiastic young teenagers.

Intentions of the project:

To produce a sea kayak for day trips that is:

1. Half the weight of many commercially available sea kayaks. She weighs 14.5 kg (32 pounds)
2. Elegant and beautiful, to produce pride of ownership.
3. A serious sea kayak, so that it is a craft for life, not one adapted for novices on flat water.
4. Simply constructed at low cost by an amateur with very few wood-working skills. (The prototype has cost £320, using the highest quality materials. This cost includes over £50 in delivery charges)
5. Constructed from three sheets of 3mm (1/8th inch) BSS 1088 marine plywood and epoxy resin, using "stitch & glue" construction.
6. Constructed from full-size plan drawings of all panels, to be available at cost.
7. Able to be simply adapted to cope with some variations in the size, weight, strength, preferences, and disabilities of paddlers.
8. A combination of traditional West Greenland hull design with the advantages of modern developments, e.g. bulkheads, hatches, keyhole or ocean cockpit and an optional skeg.
Dimensions

Length .................. 5.304m (17 feet 4.8 inches)
Beam .................................. 0.546m (21.5 inches)
Cockpit internally........... 0.833m long x 0.394m wide (32.5” x 15.5”) (These dimensions can be varied to suit.)
Clearance height, keel to underside of foredeck at front of cockpit........... 0.318m (12.5”) (This can be reduced to suit.)
Keel to top of rear rim of cockpit................................. 0.229m (9”)
Weight............................... 14.5kg (32 pounds).

About the design

There is nothing original in this design, but its implementation enables the deck and cockpit shapes to be radically varied with great simplicity. This simplicity is obtained by installing a one-piece compound curved foredeck and fitting simple flush plastic hatches throughout.
The hull lines are based on information gained from the books listed later in this manual. In particular, Shrike closely resembles the West Greenland Disko Bay kayak collected in 1927/8 and now at the Canadian Museum of Civilization in Ottawa. It is design 65 in Harvey Golden’s superb 2006 book “Kayaks of Greenland”.
These classic and beautiful lines, the result of centuries of development, produce a hull that is manoeuvrable, and suited to rough water. The Greenland hull is here combined with the best of modern sea kayak construction developments, e.g.

Bulkheads to increase safety by reducing the flooded volume of the cockpit more efficiently than inflatable bags.

A keyhole cockpit to ease entry and exit, particularly on beaches in rough seas.

Hatches to provide watertight access to stowage.

Epoxy stitch and glue plywood construction to produce a light and strong structure with high durability.

An optional ocean cockpit.

A lifting skeg to produce better tracking when the wind is off the bow.
Possible variations from the standard design

Reduce the clearance height at the front of the cockpit (under the foredeck beam, named the masik by the Inuit) to the owner’s preference and desired knee height when paddling. This is achieved by simply changing the shape of the masik and the top of the foot bulkhead. Shrike has a 317mm (12.5”) clearance (left hand picture below). The second Shrike, Shrike Too, has a clearance of 267mm (10.5”) (right hand picture below). This creates a longer flat section of foredeck at the bow, enabling the fitting of a larger forehatch, if desired. The clearance should not be increased beyond 317mm (12.5”) as this would risk splitting the plywood. Shrike was designed to accommodate a wide variety of paddlers who might wish to test paddle the kayak. In the future I will opt for 292mm (11.5”) for my personal Shrike. Builders with access to another kayak which seems comfortable can measure the clearance and use that measurement for building the masik. The plans provide the shapes for a selection of clearance heights.

Adjust the length and width of the cockpit, from Keyhole to Ocean to suit the physique and preference of the owner. The length of the cockpit should only be adjusted by maintaining the position of the rear of the cockpit, and changing the length from that point forward. The position of the centre of the seat should not be changed. In such a light kayak, the position of the paddler’s weight is particularly critical. Shrike’s keyhole cockpit has proven to be a little narrow for some paddler’s comfort, so in future I will increase the internal width from 393mm (15.5”) to 419mm (16.5”). The plans adapt to your desired width.
Adjust the freeboard\textsuperscript*{(*)}{(*)} (height of the deck above the waterline) to suit the maximum planned load and usage. Lower or raise the freeboard by 1 cm (0.4”) for each 15 kg (33 pounds) below or above 80 kg (176 pounds) total load.

This photo is of Shrike with a total load of 82 kg (180 pounds):

![Photo of Shrike with 82 kg load](image)

Whereas this is the Shrike with a load of 91 kg (200 pounds):

![Photo of Shrike with 91 kg load](image)

Choose clear finish or painted. Clear varnished finish over epoxy coating is easier to maintain than paint, but requires more care to protect the panels from marks and scratches during construction. Here’s the Shrike Too with a clear finish:

![Shrike Too with clear finish](image)

Adjust the position of the foot bulkhead to suit your leg length. The basic Shrike plans give 100mm (4”) clearance beyond the feet of this 1.83m (6 feet) tall male. Moving this bulkhead will entail a slight adjustment of the bulkhead template in the plans. More simply, the bulkhead can stay in position, and any space filled with a foam footrest.

![Bulkhead template](image)
Hatches or no hatches. The prototype Shrike in the photographs was designed as a light-duty day cruiser, so no fore hatch is fitted, and the forward compartment is filled with an inflated buoyancy bag. There is a hatch in the foot bulkhead. A very small fore hatch could be fitted well forward, on the flat section of deck. A larger fore hatch can be fitted if the masik is lowered, as described above. For day trips, the day compartment provides adequate stowage, and no fore hatch is necessary. The stern compartment hatch is required for access for maintenance if the optional skeg is fitted. The day hatch is the small disc immediately behind the cockpit. A day compartment is very useful for keeping small items together, especially on day trips, when these items are all that are carried.

The Shrike Too, with its lower foredeck, has sufficient room to allow a 200mm (8”) hatch in the foredeck, allowing easy access to enough storage for multiday camping trips.

Skeg or no skeg. (Rope or wire adjusted lifting skeg or no skeg.) A skeg adds weight, complexity and expense, but helps to avoid strain on upper limb joints when dealing with strong winds from off the bow. We recommend a wire operated lifting skeg.

Light duty, or heavy duty to cope with rocks and beaches. Shrike was constructed to be light weight for ease of transporting, and for light duty paddling, rather than rock-hopping and landing on harsh beaches in rough conditions. However, The Shrike has taken some scrapes from submerged rocks and rough beaches, and a lick of paint is all that has been required. For extra resistance to penetration from collisions from rocks, the inside of the hull can be coated with glass fibre woven cloth. For extra resistance to abrasion from rocks and beach landings, the outside of the hull can be similarly coated. Any extra glass coating beyond the cockpit floor and coaming top will have a weight penalty, beyond the 14.5kg (32 pounds) of the prototype. The hull could be constructed from 4mm plywood, with greater puncture resistance than the 3mm we have used, but again with a weight penalty. The decks should stay at 3mm to enable the extensive double curvature required. If this option is taken, the design requires two sheets of 4mm and one sheet of 3mm plywood, instead of three sheets of 3mm.

Costs

Build a Shrike not to save money, but to obtain a lightweight kayak fitted to your needs, while gaining immense satisfaction from constructing and paddling your own sea kayak.

For the prototype Shrike, in the photos, the cost was about £320, including over £50 of delivery charges. In my workshop I already had various materials, such as trash timber and plywood for temporary moulds, superglue, disposable brushes, webbing tape and line for deck outfitting, temporary screws, white spirit for brush cleaning, a workbench, a full complement of hand and power tools, disposable gloves, etc. Costs, in pounds Sterling were:

Three 2440mm x 1220mm (8ft x 4ft) sheets of 3mm thick Robbins Elite BSS 1088 marine plywood £130
4 kg epoxy resin and hardener (Probably 6kg are required if panels are coated with glass cloth.) £69
50m of 50mm wide woven fibreglass tape £17
West filler and fairing powders £10
Rollers and brushes £10
Glass cloth for cockpit floor and cockpit coaming top surface £3
Paint £6
Minicell foam for seat and backrest £20
Hatches
Skeg slider (also known as a glide box) and wire and tube from Kari-Tek
£25
£30

Total = £320

Estimated time to build
Professional wood-workers could probably complete the construction in a week, plus painting or varnishing. Enthusiasts with little or no previous experience could spend a very happy winter of spare time, lovingly creating their kayak, and learning the techniques involved. The enthusiast can produce as fine a finished result as the professional. It will just take a lot more time; especially thinking time.

Prior study material
Those who have little previous experience of stitch and glue construction may benefit from reading or viewing some of the following material:

Chesapeake Light Craft (CLC) produces excellent kits for S & G kayaks. The [website](http://www.chesapeakelightcraft.com) is a great source of knowledge. In particular, there is a very good CLC DVD on S & G construction, featuring the excellent John Harris. This bargain DVD is available in the U.K from [Fyne Boats](http://www.fyneboats.com). CLC also has a great series of [construction tips](http://www.chesapeakelightcraft.com). If you find the Shrike project too daunting, a CLC kit, available through Fyne Boats in the U.K, would be a great option. A fine-looking craft is the [Night Heron](http://www.chesapeakelightcraft.com).

Nick Shade is a scholar and a gentleman who produces [great kits and designs](http://www.nickshade.com). He offers free plans for his S & G Night Guillemot design. Most of what I know about S & G construction has come from Nick Shade.

Pygmy Boats also supplies many good kits, including the [Murrelet](http://www.pygmyboats.com). The Pygmy Boats [website](http://www.pygmyboats.com) also contains much information useful to the builder.

Good books and sources for inspiration and information:
"Kayaks of Greenland" by Harvey Golden, ISBN 0-9787221-0-8. This is a monumental book of great importance in preserving the history of these kayaks. A work of love and great dedication. Harvey Golden, we salute you!


An excellent and [comprehensive article](http://www.duncanwinning.co.uk) by Duncan Winning on the influence of Greenland design on modern kayaks.
Preparatory Work

“Cut the crap and just build the boat!” is a good plan, but we first need a suitable place to work, some materials, and a few tools. Here are some suggestions:

Workshop

The minimum building platform must support rigidly the two external hull moulds, 1270mm apart, parallel and horizontal, at a comfortable working height:

At a minimum, the two moulds could be attached rigidly to two fixed trestles. They **could** be fixed direct to a floor, as an efficient way to destroy your knees and back during the construction!

I used a pair of trestles, and laid one section of an aluminium ladder across them as a rigid base for a worktop. An 18mm plywood top, 1300mm x 600 mm would be good. Mine is unnecessarily long at 4880mm x 610mm (16 ft x 2 ft), prepared from a sheet of 18mm shattering plywood ripped down the centre.

A trash bin at each end of the kayak saves a lot of walking

A tidy shop is a safer shop. A vacuum cleaner is good inside the hull, and for keeping the floor clean.

Good lighting is essential. Bright neon ceiling tubes are good.

A workbench, e.g. Black & Decker Workmate type, is good for cutting and mixing.

Tools

- Steel metric measuring tape, at least 6m (18feet) long
- Steel metric rulers, one 1m long, one about 300mm long
- Small block plane with sharpening stone
- Electric jig saw with fine wood-cutting blades or fine panel hand saw
- Electric drill with drill bits and screw driver bits, and a hand screwdriver for temporary screws for decks.
- Spirit levels, one at least 600mm long, and one about 150 mm.
- Utility knife (e.g Stanley knife) with many spare blades
- Adjustable sliding bevel
- Five long kayak securing straps for torturing the foredeck
- West Systems foam 180mm rollers

Optional tools:

- Hot glue gun with wood adhesive sticks
- Electric staple gun and stainless steel staples. I used Arrow T50 10mm (3/8th inch) staples.
- Vacuum cleaner for cleaning inside the hull

Materials

- Three sheets of 3mm (1/8 inch) quality waterproof plywood (BSS 1088 marine is best) available from CLC. Elite marine plywood from Robbins of Bristol, UK is perfect, if expensive.
- 3 to 6 kg of slow-curing low odour epoxy resin and hardener, the quantity depending on whether or not the hull and deck are glassed. I used 4 kg of Professional Systems Epoxy in the UK. In the USA, I’ve used MAS epoxy
- 50m of 50mm wide glass fibre 175 gm woven tape from CFS.
- 2 square metres of 300 gm woven glass fibre cloth for the cockpit lip top, and the cockpit floor from CFS.
- If desired, Hulls are usually sheathed with woven glass cloth of 200gm/sq. m (6 ounces/sq.yd)
- Disposable gloves - box of 100
- 20m of copper wire for stitching, approx. 1.2mm diameter (Mine was from scraps of domestic electrical wire.)
- Many disposable cups for mixing, e.g. used yoghurt pots
- Disposable cheap 25mm (1”) paint brushes. At least 20.
- Tongue depressor mixing sticks for shaping epoxy fillets from CFS.
- Thick plastic sheet is useful for preventing epoxy adhering to workbench, workmate, etc.
- Hand wipes (I’ve used Ever-Build Multi-use Wonder Wipes in the UK)
- Rags and paper towel roll
Paint or polyurethane varnish to protect epoxy from ultra-violet light. Optional: Super-glue with accelerator. Evo-Stik Mitre adhesive in the UK and E-Z bond in USA have worked for me.

**Epoxy for beginners**

Stellar advice on epoxy and safe workshop practice [here on the CLC website](#)

But a few thoughts from me:

- Mix only small batches of epoxy. It's heavy, and a little goes a long way.
- Epoxy coat the panels using West firm foam rollers. These produce a result that is far more even and economical in epoxy than any brush.
- Use acetone to clean epoxy from tools, workbench and hull, only if the brand of epoxy is compatible with acetone. (Professional Systems Epoxy is NOT.)
- Tongue depressors produce good fillets. Hold vertical for the smallest fillet, flatter for the largest.
- Buy four 50ml disposable plastic injection syringes from your local farm supply for measuring resin and hardener. **Gluzilla epoxy** in frame gun tubes is a neat way to fillet the chines and keel, but it's expensive.
- Beware amine blush, which forms on some brands of set epoxy after a few hours. Try to do several stages within a few hours. E.g. coat, fillet and glass tape.
- Work as if epoxy is not gap-filling, and use that property only when your best efforts fall a little short.
- Use an epoxy system with low odour, and slow initial cure to give enough time for complex tasks.
- Epoxy dust can cause allergic reaction. Use overalls & long cuff disposable gloves and a dust mask when sanding. Polyester resin could be used instead of epoxy as it's cheaper, but it is weaker, and its smell precludes its use within the home.

**Measurements list, for later reference**

All measurements for the construction are measured in millimetres from the Datum Line. This is a line drawn across the worktop, square to the long edge, and approximately 3230mm from the bow of the finished kayak.

All measurements are in mm from the Datum Line (+ means forward of Datum, - means aft of Datum)

Because the external and internal moulds have a thickness, and the hull tapers, those located at +ve measurements, are placed aft of their line, and those with -ve measurements are placed forward of their line.

Aft deck beams are at -517, -700, -924 (and front of skeg box), -1133

Aft deck beams are of 12mm square cedar for lightness

Radius of curvature, R, to draw a non-standard masik with beam L and height above sheer D:  \[ R = \left(\frac{L^2}{4(D^2)}\right) / (8D) \]

For Shrike R = 384mm (15.1") on beam of 546mm (21.5") and height above sheer of 114mm (4.5") , knee clearance under cockpit side deck is 317mm (12.5")

Centre of seat is at +250 (i.e. 300mm forward of aft cockpit bulkhead). This measurement should not be changed.

One external mould is at Datum, the other is at +1270mm

My foot bulkhead is at +1255

Cockpit rear bulkhead is at -50

Day compartment bulkhead is at -345

Internal moulds are at +1860, +630, and -800

LOA 5300mm (17ft 4.75"), Beam 546mm (21.5")

Bow is at approx. +3230, depending on amount of rounding.

Aft end of 40mm wide masik is at +783

Internal cockpit opening is 838 long by 395 (max.) wide (33” x 15.5”)

Centres of 125mm wide cheek plates are at +265

The front of the cockpit opening is against the masik at +783
At last, starting construction

Making the two external moulds.

These can be fabricated from any rubbish sheet material. I used 9mm plywood from my trash bin and my friends’ workshops. From the plans, instead of cutting out the mould shapes, one can prick through the paper onto the plywood with a nail or other sharp point, so as to indicate the eleven corners. These can then be joined by drawing on the plywood with a sharp pencil and a steel ruler, and the shape cut out with the jigsaw. A 50mm square batten is then screwed to the base of each external mould.

Setting up the two external moulds.

Draw or snap a centre line down the surface of the build platform. Select a position and draw the Datum Line across the surface at right angles to the centre. Choose the position of the Datum Line, bearing in mind that the bow of the kayak is approximately at +3230, and the kayak has to fit into your available space. (Approximately, because you can choose the degree of rounding of the stem and stern to suit your eye.) Now draw a parallel line at +1270. Screw the two external frames to the build platform at Datum and +1270, vertical and square. Your platform should look like this:

Cutting the panels

Two of the three plywood sheets are used for the four hull panels, i.e. the port and starboard bottom panels and topsides.

I laid the two sheets of ply on an aluminium ladder section on the floor, and used a Skilsaw (hand-held circular saw), to rip each sheet into 5 equal 244mm wide strips.

The bottom panels are shorter than two sheet lengths, so they are constructed from just two full lengths of these strips of plywood. The topsides are longer, so a short length (I use 645mm) must be inserted between two full length strips to make up the length to more than 5400mm, to allow for scarf joints, if used. The sections can be joined with 8:1 ratio scarfs, 24mm wide. Here’s a blog post on how to do it.

Or perhaps use glue and tape butt ed joints as described here. These are simpler, just as strong, but will require more fairing (sanding) before varnishing or painting.

When these joints are set, very carefully cut out the paper templates from the plans, and tape or staple these to the plywood. Draw round the templates very precisely, using a sharp pencil. Long gradual curves are best marked every few centimetres, and the marks later joined up using a long flexible batten to ensure a fair curve. (I used a length of plastic conduit for electrical wires). Mark the Datum Line from the plans onto the bottom panels.

Use the jigsaw to cut the panels just outside the perimeter line, and then use the small block plane to finish to the line. If you have decided to vary the freeboard (deck height above the water-line), before cutting the panels run a pencil line parallel to the top of the topsides, either above or below. (Adjust freeboard by 1 cm for each 15 kg above or below an 80 kg load.)

You should now have two of each of these panels.
Assembling the hull panels

Place the two shorter bottom panels symmetrically on top of each other, and drill clearance holes for your copper wire along the straighter side (keel) every 100mm, about 6mm in from the edge, through both panels, thus ensuring that the holes line up opposite each other for wiring. Joining these two edges will produce the keel line.

Now the exciting bit, which you deserve after all that preparation:

Plane or sand a bevel on the top mating edges of the bottom panels at the keel and at the chines, and on the lower edge of the topsides. This will assist in keeping the joined edges from sliding off each other. A couple of passes with a block plane or 80 grit sandpaper should be enough.

**Loosely** wire together the two keel straighter sides of the bottom panels, with the bevels upwards. Place the joined bottom panels into the external frames (remembering which is the bow), and start to open up the two bottom panels, like a butterfly opening its wings. If necessary, loosen some wires to ease this procedure. Align the Datum marks on the bottom panel edges with the Datum external frame. Wire the bottom panels tightly to both external moulds at the outer edges (chines) and at the keel. This requires four wires on each mould, with two holes in the panel and one in the frame for each wire, so 24 holes in all. Keeping these near the edges of the panels will ensure that all these holes are covered when the keel and chine joints are taped. I’ve roughly mocked up a demo:

Now drill wiring holes along the lower, straighter, edge of the topside panels, and the stems (bows) and sterns. Loosely wire together the stems and sterns only. Spread the panels apart, and wire them to the bottom panels in the external moulds. Start at the stern, making a fair curved join between the bottom and topside panels, and work towards the bow, drilling and wiring to the bottom panel and external frames as you go. Ensure you even out the wood at the bow and stern, and that the datum marks are aligned between the bottom panels and the topside panels. I’ve added 6mm to the topsides panel patterns at the bow to allow trimming to shape. Remove the wires at the bow and trim carefully with the block plane to produce a graceful fair joint between the bottom and topside panels. Then replace the wires:
Here’s a photo of Shrike with the hull wired. Note the wiggles in the gunwales, these will all be smoothed out once the sheer clamps are added.

Now cut out from scrap plywood the three internal moulds to be stationed at +1860, +630, and -800, and wire them vertically and square at the topsides, chines and keel, as shown here, but at a slightly later stage, with the sheer clamps (batten along the inside of the gunwales) fitted and the seams glued:
The sheer clamps are light softwood battens, about 25 x 15 mm in section, which fit inside the gunwales to enable the decks to be fixed down, and for deck rigging to be fitted to the finished kayak. It is difficult to find battens that long, so two lengths can be scarfed together. I used a simple 45 degree angle for this, with a short tapered block glued on the inside of the joint to strengthen it. At a later stage I removed these blocks with a hand saw, once the joints were reinforced with the topsides plywood. You can see one of the blocks in the below photo. In future I will use scarfed joints for simplicity, although they require a little more care.

Kerf sawing is the technique of assisting timber to bend by sawing part way through it. Kerf saw the sheer clamps at bow and stern to enable the upturns to be completed without undue stress: Now dry fit the sheer clamps with temporary round head screws through the gunwales or many clamps), sawing the sheer clamps at the stem and stern so they fit together:

The sheer clamps are fitted with the 25mm edge against the plywood. Clamp a batten across the gunwales at +600 to fix the maximum beam at 546mm (21.5”). The sheer clamps run flush to the top of the plywood when aft of the cockpit, but from there forward the sheer clamps are allowed to rise up above the plywood by up to 6mm. The 900mm nearest the bow can again be left flush to the top of the plywood, as the foredeck becomes flat from that point to the bow. The protruding part of the sheer clamps is later bevelled to accept the curved edge of the deck. Note the fillet of glue in the stem, this is where you can use up any excess thickened epoxy to strengthen the bow.
Now STOP!

This is a critical point. Any imperfections in the curves of the hull at this point will be fixed once the seams are glued and taped.

Check that the stem and stern are fair and graceful.
Check that the chines make a fair curve, with no hollows or bumps. Trim out the bumps, fill up the hollows with softwood shavings, and adjust the wires.
Check similarly that the gunwales are fair curves. Take particular care at any joint in the sheer clamps. Plane the outside of the carlin joint as necessary.
Now that the hull is held to shape at multiple points, all the minor imperfections in the plans and moulds may be forced into the keel, hidden under the hull.
Release the hull from the two external moulds, and gently turn it upside down on some cushioning.
Check that the keel line is a fair curve. It probably is not. If not, it must be corrected.
Panels can be partly unwired to trim a panel if it is slightly too wide. If a gap needs to be filled to create a fair curve, I slice tapers of softwood from a stick with a utility knife, and push them vertically down until they jam in the gap, about 20mm apart. I then superglue them in place, and slice off the excess of the tapered pieces after the glue has set. The gaps are then filled with thickened epoxy.
If, and only if, every curve is beautiful, turn the hull right way up and re-fix it to the two external moulds.
Glue the sheer clamps in place with slightly thickened epoxy. If the temporary screws or clamps are insufficient to completely pull the ply to the sheer clamps, back them up with stainless staples or more screws. The temporary screws must be very slightly tightened and released every couple of hours after gluing, so that the screws are not permanently bonded in place. Any staples will remain. As an alternative to temporary screws, a large number of clamps may be used to enable fastening-free construction, as detailed later in the construction of Shrike Too. This avoids marks showing through if a clear finish is desired.
Dot superglue and accelerator along the inside of the chine and keel joints and stem and stern about every 25mm:
When the superglue has hardened, clip and remove all the copper wires in the keel and chine seams. An alternative to the superglue is to use small dots of thickened epoxy, but this could take a day to harden before the next stage can be started.

Fit the bulkheads.
Cut out the bulkheads to the plan dimensions from the 3mm plywood using utility knife (or jigsaw and plane), and notch the top corners to fit round the sheer clamps. I find that four passes of a utility knife blade will cut through the plywood. Make the first pass very light, so as to guide the later passes. This helps a wayward blade from slicing the top off one of your fingers.
If desired, use a hole saw on the bench to create a hole for the foot bulkhead drain plug before installing that bulkhead. If no forehatch is to be fitted, cut a hole for a watertight access hatch in the centre of this bulkhead, to assist in drying out the forward compartment in case of leaks through, for example, the drain plug. Dry fit the bulkheads vertically and square at their positions and then superglue or wire them in place:
Aft cockpit bulkhead at  -50
Day hatch bulkhead at  -345
Foot bulkhead at +1255 (Do not fit this bulkhead at this stage if you are changing the foredeck height by varying the curve of the masik, or adjusting its position to suit your leg length.)

The three internal moulds can now be removed. If the beam changes when an internal mould is removed, replace it, clamp or screw a temporary batten across at that position, and then remove the internal mould. Keep the temporary beam clamped at +600, the point of maximum beam. Now you are ready to epoxy fillet and tape the seams.
Epoxy filleting the seams.
Place neat epoxy fillets along the entire inner keel and chine seams, around the bulkheads, and up the inside of the stem and stern.
Epoxy fillets can be a ghastly mess or an elegant source of pride. I use wood mixing sticks (tongue depressors) to shape the epoxy, thickened to peanut butter consistency with West 406 colloidal silica. For narrow fillets, such as those around bulkheads, the stick is held vertically. For wider fillets, the stick is angled, or a piece of plastic sheet can be curved to serve as a shaper. I always pre-wet with unthickened resin the plywood surfaces where the fillets will be placed. The fillets must now be taped.

Taping the filleted seams
I tape the keel and chine fillets, and those around the foot bulkhead, but not those around the other two bulkheads, as they are comparatively lightly stressed. I use 50mm wide woven glass fibre 175 gm tape, with two layers along the keel.
The fresh fillets are very soft and vulnerable. If the glass tape is immediately placed on the wet fillets it is all too easy to dent the fillets with the fingers or brush. Once the fillets are dented under the tape I’ve been quite unable to flatten the surface. One option is to be very, very careful. Another option is to leave the fillets for a couple of hours until they are less vulnerable, but before the dreaded “amine blush” coats the surface of the epoxy. Then wet the fillets with resin and lay in the glass tape. Another method of causing fewer disturbances to soft fillets is to pre-soak glass tape on the work bench before applying it to the epoxy fillets.
When cutting glass tape, make a half inch cut into the centre of each end to prevent unravelling. When wetting out glass cloth and tape, only use enough resin to make the tape clear. More will not be stronger. Epoxy resin is heavy, and it only gains full strength when glass fibres are added.
After the fillets are completed I coat the entire inner surface of the hull with resin where it has not already been coated during the filleting and taping.

Glassing inside the cockpit
Now is the time to cover the floor of the cockpit with glass cloth. This adds to the impact resistance of this vulnerable area, and protects the floor from grit and sand on the paddler’s feet. I used 300g/sq.m. woven cloth as that was easily available. 200g would be lighter, it would take up less of the heavy resin, and it could be the same material you might use if you decide to glass the outside of the hull. Pre-wet the plywood with the minimum resin, lay in the cloth, pre-cut to shape, and stipple a minimum of resin into the cloth to make it go clear. Trim the edges of the cloth near the chines with a utility knife when the resin is firm but not hard.

Fair, fill and tape the outside of the hull
Leave the hull for a day to let all that set, release the hull from the two external moulds, turn it over, and rest it on the work surface with some cushioning under the gunwales. Fill any gaps in the keel and chine seams with thickened epoxy. Ensure the stem and stern form graceful curves. Trim these with a block plane if necessary. Add thickened epoxy to the stem and stern to form a rounded cap. Let these set, and then sand a rounded edge to the stem, stern keel and chines. Now glass tape the chines and keel to the ends of the stem and stern. I put a second layer of glass tape along the main flat and vulnerable section of the keel. Snip the selvage edges of the tape to assist the curving of the tape at the stem and stern. Turn the kayak back to upright, and place it in the external frames.
Building and fitting the masik.

The masik is the foredeck beam at the front of the cockpit. It is the main support for the foredeck. It also sets the clearance height for the tops of your legs when paddling. Some paddlers, especially rolling enthusiasts, like a low masik. Many others would prefer a high masik. This enables the knees to be lifted, and the strain taken off tight hamstrings, the cause of many a backache when paddling. Try sitting on the floor with the legs straight out for an hour. I last about a minute before my back howls in anguish. The Shrike clearance under the masik is 315mm (12.5"). Shrike Too has a 266mm (10.5") clearance, enabling the fitting of a useful sized forehatch. The height of the masik can be reduced by adjusting its curve, as described later. Increasing its height beyond 315mm (12.5") risks splitting the plywood deck when it is bent round the masik. The profile of the masik is drawn in the plans for 10.5", 11.5" and 12.5". As discussed earlier, my next Shrike will have a clearance of 11.5".

To construct the laminated masik:
Cut 5 strips of 3mm ply from your offcuts, at least 700mm long and 45mm wide, to finish down later to 40mm.
Cover a section of your workbench with thick polythene to avoid the epoxy sticking the masik to your workbench.
Cut out the full-size profile of the masik from the plans and staple or pin it to your workbench.
Screw 5 blocks of approximately 50mm thick timber to the bench, three inside the curved line, and the end two outside. Clamp the five strips temporarily over the middle three to establish the correct position of the outer two. The line from the plans shows the outside of the masik.

Now withdraw the strips, brush the inner sides of the strips with slightly thickened epoxy, replace the strips in the blocks, and clamp lightly so that glue oozes very slightly all along the masik lamination joints. I eventually used about nine clamps, but the first three are shown here:

Leave the masik to set hard, preferably for a couple of days, before removing it from the jig, planing the edges to a finished width of 40mm. The edge of the masik will look like this offcut:

Creating a custom masik to reduce the knee height clearance

To form a custom masik height, if the standard heights are not ideal:

The curve is part of a regular circle, to place even stress on the curved plywood.
The radius of curvature of your desired masik, R, with height above the sheer line, D, and beam of the kayak ( less 6mm, the two hull plywood thicknesses) at the masik (+783), L, can be calculated from the equation:

\[
R = \frac{(L^2) + (4*(D^2))}{8*D}
\]

Now tie a non-stretch thread round a drawing pin on some paper, and at a distance of R, roll the thread round a pencil. Draw an arc of a circle of radius R:
That is the outside profile of your modified masik. Now draw a chord of length \( L \) (beam at the masik) across the arc. Now proceed as for the construction of the standard masik.

Christopher designed Shrike Too’s deck and cockpit with his preferred options of an Ocean cockpit, a lowered foredeck, zero fastenings construction and clear finish. Description of his build is in the Shrike Too Build Options

**Fitting the masik to the hull**

The masik is notched into the sheer clamps with its aft edge at +783. The masik is installed square to the centre line, of course, but it is not vertical. It is fitted parallel to the sheer line at that point, by sighting across the masik at the far gunwale. I sawed and chiselled a simple 45 degree notch, 40mm wide, out of the sheer clamps. I then sawed the two ends of the masik so that they fit into the sheer clamps, just butting up to the inside edge of the plywood hull skin. I made a bad job of this, but really thick epoxy rescues the incompetent, fortunately.

Glue the masik in position with temporary support from, for example, a couple of screws through the sheer clamps.

**Bevelling the sheer clamps.**

The decks are glued down onto the top of the sheer clamps, which must be planed to the correct angle. This angle varies throughout the length of the sheer clamps.

From the stern, along the stern deck and up to the rear of the cockpit, the sheer clamps are planed horizontal, so that the flat stern deck sits straight on it.

From there, forwards, the angle varies to accommodate the landing angle of the tortured deck plywood. The angles at various points can be found by temporarily fitting the plywood foredeck, and measuring the angles at various points with your sliding bevel, which you can make from plywood, as shown later.

If the bevelling proves a little challenging, thickened epoxy will be your friend.

**Stern deck beams**

The stern deck beams are installed to suit the hatches you will fit. I fattened up the aft cockpit and day compartment bulkhead tops on the day compartment sides to give a larger land for gluing down the stern deck, and fitted further beams of 12mm square cedar at -517, -700, -924 (at front of skeg box), and -1133 (not shown in this photo):

I also added three fore-and-aft short beams in the day compartment area to suit the day hatch, and to strengthen this area. All the beams are notched at 45 degrees into the sheer clamps or beams, and epoxy glued into position.

**Skeg**

Here the options are wire or rope adjusted lifting skeg or no skeg.

If a lifting skeg is chosen, it is formed from two layers of 3mm plywood laminated together while weighted down flat, and cut to the plan profile:
The actuating wire is epoxied in place, as shown in the plan:

![Image of epoxied wire]

The skeg box is cut to the plan profile from 3mm plywood, with 12mm square cedar internal framing. The outside of the box is glass sheathed, and the wire terminal epoxied in place. The inside of the box is given two coats of resin before assembly.

Mark the position of the front of the skeg box on the keel line at -924, and drill a 2mm hole down through the keel. Turn the kayak over and carefully mark out and jigsaw a slot aft of this 2mm hole so that the skeg box is a sliding fit into it. Turn the kayak upright, and fit the box into the slot so that its base is flush with the outside of the keel, and plumb vertical. Fillet it and glass tape it, ensuring it stays vertical and at the correct height with temporary bracing as required:

![Image of skeg box installation]

The skeg pivot is a 6mm stainless steel bolt with the thread section cut off, epoxied and glass taped into position on each side of the skeg box.

![Image of skeg pivot]

The skeg box must be able to cope with the stress from the skeg colliding with rocks or a beach. To avoid this stress causing damage to the surrounding thin hull panels, the skeg box is braced to the stern deck and beams with triangular gussets:

![Image of braced skeg box]

The skeg slider, tubing, wire and compression fitting are from Kari-tek. A rope actuated skeg is an alternative available from CLC. Another rope system for a skeg is at Blue Heron Kayaks.
Fitting the decks

Before fitting the decks, it is helpful, but not essential, to make some 3mm plywood tools (left to right in the below photo) for measuring bevel angles, marking 25mm from the gunwale to guide taping, locating the edge of the topsides, and for finding the sheer clamps centre if screws are used. The bevel gauge at left has a large notch to clear the overhanging deck before it is trimmed. The next right, to mark 25mm in from the gunwale, has three layers of plywood. The top layer is 25mm back from the point of the bottom layer. The concealed middle layer is another 25mm back to allow the overhanging deck to slide into the gap between top and bottom layers. The next right transfers the position of the gunwale onto the deck to facilitate marking the deck for trimming to size by panel saw, and then block plane. The tool at far right has the same notch to clear the deck, and a beak to extend the point beyond the gunwale edge to the mid-point of the carlin. (9mm for my Shrike). This is to mark the line for temporary screws to secure the decks.

The plans do not show the outline of the decks, as the plywood sheet can be laid over the part-built kayak, and the desired shapes transferred directly. Alternatively, use sheets of newspaper, taped together, and take a pattern from the deck area. Allow 20mm overlap on the gunwales. Cutting the panel too small would be bad news.

The foredeck is fitted before the stern deck. The full length of a plywood sheet is necessary to stretch from the centre of the masik to the bow of the kayak.

For decking information on the screw-less alternative with ocean cockpit follow this link. The remainder of this section relates to the keyhole cockpit version.

Lay the plywood sheet over the foredeck, with one short edge lying along the centre of the masik, across the kayak. Tightly clamp the plywood at the centre of the masik in order to locate the plywood while the fitting process continues. Use a scrap of plywood under any clamps to avoid damage to the plywood.

Bend the plywood across the masik, and clamp the plywood loosely to the ends of the masik. Bend the plywood towards the gunwales and mark a trimming line underneath the plywood so as to leave a safe margin, about 20mm, hanging over the gunwales.

Remove the plywood, cut to this line, and then replace the plywood and the clamps.

Place the five straps around the foredeck, and gradually tighten them equally:

The plywood should buckle at a point about 900mm from the bow.

While doing this, check that the top of the foot bulkhead is not obstructing the bending process. Trim the top of the bulkhead if it is distorting the deck.

Before the plywood reaches the gunwales, check the size of the excess overhanging plywood. If it is more than about 20mm, it is worth trimming it a little closer, to avoid the excess plywood snapping across the gunwale as pressure is applied.

Check frequently that the plywood is lying symmetrically across the masik. The loose clamps at the ends should allow the edge of the plywood to move slightly across the masik.
When the plywood reaches the gunwales, check that the plywood sits comfortably on the previously angled sheer clamps. If necessary, remove the plywood and adjust the bevel of the sheer clamps. Refit the plywood. Check that the plywood is resting closely on the masik across its entire length. Place temporary 19mm (3/4") pan-head stainless steel screws through the plywood into the sheer clamps at about 100mm intervals all the way from the masik to the bow, inserting them on alternate sides. Locate the centre of the sheer clamps by using the plywood tool on the right in the picture above. By carefully choosing the location of the screws, attempt to ensure that the plywood buckles evenly across the deck. Any unwanted distortion here can be sorted out later with West 410 fairing compound. Mark the athwartships centre of the masik, and the centre of the plywood edge on the masik, and ensure they stay together throughout the procedure. Fit several clamps across the masik if you are clear finishing the kayak. If you are painting, then temporary screws may be used. To show the gluing area, draw a line across the masik to mark the edge of the plywood, and mark underneath the overhanging edges of the plywood. Keep the straps tight, remove the screws, and slowly and evenly release the straps.

On the bench, roll a coat of epoxy resin onto the underside of the deck panel. The panel is immediately fitted. If the epoxy is allowed to harden, the panel will resist bending. Apply thickened epoxy to the top of the sheer clamps and the foot bulkhead and part of the masik, and place the panel in position, repeating the clamping and strap tightening, until the temporary screws can be re-inserted into their holes, and then tightened so that glue oozes all along the deck/carlin joint.

While this is setting, slightly tighten and release the screws every couple of hours to prevent them becoming a permanent fixture in the kayak.

Scrape off excess epoxy while it is partly set, particularly along the top of the masik. When the glue has set hard, the straps and screws can be removed.

Turn the kayak upside down, and fillet and glass tape the joint between the top of the foot bulkhead and the underside of the fordeck.

The edges of plywood can now be trimmed back to the gunwale using a panel saw, after marking the line with the third plywood tool from the left in the previous photo:

As I was planning to fit a wire operated skeg, at this stage I drilled a 6mm diameter hole in the top port corners of the aft cockpit bulkhead and the day hatch bulkhead, ready to take the outer plastic tubing. I also cut the opening for the skeg slider box in the port topside panel where it would fall naturally to hand. When preparing to install the deck I epoxy resin coated the inside of these two holes and the skeg slider opening.

**Fitting the stern deck**

The stern deck main panel uses the full length of the third plywood sheet, and stretches from the masik, aft to a short distance from the stern. Cut a panel to fit this area, with a 20mm overlap on the gunwales, as for the foredeck. Mark the centre of the short side of this panel, and preserve the previous mark on the centre of the masik. Ensure these marks coincide throughout the remaining procedure. Place weights on the length of the stern deck aft of the cockpit, to mate it flat to the sheer clamps.
At the aft cockpit bulkhead, (Datum -50mm) strap a beam across the kayak so that aft of this bulkhead the deck is flat. Place the other four straps round the hull, and gradually tighten them. The strain on the plywood overlaps is particularly great at a point just forward of the strapped beam, so trim the overlaps to about 10mm at these points. Cutting a smaller approximation to the cockpit opening in the centre of this panel will ease the bending strain required, so, from the plans, scribe a shape at least 50mm smaller than the final opening, and cut it out later on the bench.

Note that the two panels do not meet all along the masik. Using a pair of dividers or compasses, scribe the shape of the foredeck edge onto the edge of the stern deck panel. Check the angles of the carlin and note where adjustment is needed to fairly land the panel onto the sheer clamps.

The aft end of the panel tends to move during the fitting process. Locate it by fitting a plywood butt strap under the aft end, tightly between the sheer clamps. This butt strap will be used later to join the final small section of deck.

Remove the stern deck panel, plane the marked edge where it lays on the masik, and jigsaw the rough outline of the shape of the cockpit. Refit the stern deck panel, and gradually tighten the straps until the panel touches the sheer clamps along its whole length from the masik to the cross-strapped beam:

Repeat the removal and trimming procedure until you are happy with the fit. Place temporary screws down into the centre of the sheer clamps around the panel, and into the masik, as required to ensure an even joint with the foredeck. If you are clear-finishing the kayak, be aware that these holes will show through, so use only the minimum of screws. Stapling through scraps of plywood could be an alternative and less obtrusive technique.

Remove the panel, roll a coat of epoxy on its underside, and immediately glue the panel into position, using the same procedure as for the foredeck. Apply thickened epoxy glue to the tops of all the stern deck beams. Glue the panel as with the foredeck.

I found that the “wings” in the keyhole shaped cockpit opening were canted at too steep an angle for my eye, and I cut them off, later incorporating the wings only in the top cockpit rim. The hole for the cockpit then appeared thus:

The final small deck panel can now be fitted to the stern in the same manner, gluing to the sheer clamps and the butt strap. When the glue has set, the stern deck panels can be trimmed to the gunwales.

Put a light radius on the edges of the gunwales with a block plane and 80 grit sandpaper. Lightly mark a line 25mm in from the gunwales on the deck using the plywood tool you made for this purpose. This forms a guide for the glass tape. Apply resin and 50mm glass tape over the hull/deck joints.
Coaming

The internal width of the cockpit can be adjusted to suit the physique of the paddler. Try other cockpits to see which width will suit you. The internal length of the cockpit can be decreased if desired, perhaps to Ocean Cockpit dimensions. (See Shrike Too for construction details for an Ocean Cockpit)

From the plans, draw the inner profile of the cockpit lip centrally on the deck, and cut accurately to this shape. I did this with a utility knife. The front edge of the cockpit opening is the aft edge of the mask at +783, and the aft end of the opening is against the cockpit aft bulkhead at -50, making the opening length 833mm.

The cockpit coaming upstand is now created by bending the 3mm plywood around the inside of the cockpit opening:

Cut 30mm wide strips of the plywood of sufficient combined length to form the perimeter of the opening. The long straighter sides of the upstand can be created from these strips, superglued into position. The upstand is set vertically, and flush to the underside of the deck plywood. At certain points the upstand will extend a little below the deck, and these areas will be filled later from behind the upstand.

At the sharp bends, the plywood is sliced almost through from the outside at intervals of 10mm. I take 4 passes of a utility knife to cut through the plywood. After just 3 passes, the plywood bends easily round the curves. It matters not if the plywood breaks into shorter sections. Fit them all in position with super-glue and accelerator.

The plywood upstand serves merely as a former for the next stages, the strengthening of the upstand with epoxy and glass tape.

Coat the outside of the upstand with resin, and place a neat fillet of thickened epoxy around the perimeter joint: Then laminate a strip of 50mm glass tape all around the outside of the upstand across the upstand/deck fillet.

Next, laminate glass tape around the vertical inside of the upstand. Snip the outside selvage edges of fibreglass tape on internal bends as at front inside of cockpit coaming. Trim the excess width of tape when the resin is part set.

Now the upstand is strengthened, the top edge can be gently planed to produce a slight concave curve when viewed from the side, with the eye at hull level. Without shaping, the top edge will be almost straight, an inelegant profile. The concavity need only be very slight, as shown here with a plastic batten to indicate the curve:

The 6mm thick coaming lip is now created. It would be simple to create the lip from 6mm plywood. However, I wished to create the entire kayak from the three 3mm sheets, so I formed the lip from four pieces of 3mm ply, laminated together to form a 6mm lip, with joints staggered between the four pieces. The lip should be cut out with the profile shown in the plans, but with at least 10mm extra on the inside, to allow for variations in construction of the 3mm upstand.

Lay the rough cut lip in position on the upstand, draw round underneath and inside, and now cut to this line. Glue and clamp the lip on to the upstand, using weights, beams and clamps until glue oozes slightly all around the joint:
Clean off the excess glue before it has set.
When this has set, turn the kayak upside down, and fillet and glass tape the joint between the upstand and the lip.
When this has set, turn the kayak upright. Round the outside edge of the lip with sandpaper. The inner edge can be profiled with a router, except where the two inner wings come away from the upstand. The inner edge can then be sanded with 80 grit sandpaper glued to a 100mm diameter plastic drain pipe:

The final result:

The top of the cockpit lip and the inside of the upstand (except under the inner wings) can now be coated in resin and glass cloth for abrasion resistance and strength. As this involves double curvature, the woven glass cloth should be bias-cut (45 degrees to the strands), using a rotary cutter.
Bias cut glass cloth should initially be cut well oversize, as it is dimensionally unstable. (Use masking tape where the cloth is to be cut, and use a craft knife or rotary cutter to slice through the centre of the tape)
The cockpit rim near the seat is subject to heavy compression when one is entering or leaving the cockpit and to high tension when the kayak is lifted by the rim. Two 3mm plywood cheek plates, as shown in the plans, are now fitted and glued between the chines and the cockpit rim in order to cope with these stresses. These should initially be cut slightly oversize in order to cope with the inevitable variations between the kayaks under construction.

The hatch openings are now cut into the stern deck. I cut a small hole in the approximate centre of each intended hatch opening, and, with a short steel rule, established the position of the deck beams, and hence the line to jigsaw the accurate holes for the hatches. I used the inside of the hatch rims as templates to draw the lines.
As the stern deck immediately aft of the cockpit can be heavily loaded if a paddler sits on this area, I clamped and glued a short transverse beam just forward of the day hatch opening.
The entire deck area, cockpit rim and cheek plates can now be rolled with a coat of epoxy resin.
Coating

The entire hull and deck should now be lightly rubbed down with sandpaper. Carefully knock back any epoxy runs when set with 80 grit in an orbital sander. The dust should now be removed, and another coat of resin rolled over the entire hull and deck. Use West yellow firm foam rollers to coat the panels. A roller gives a far more even, thin, run-free coat. Avoid the use of brushes where possible, to avoid runs. This epoxy coating of the plywood should now be protected from ultra-violet light with layers of varnish or paint. I painted the prototype Shrike as I had spoiled the plywood surface with pen and pencil marks during the prototyping process. In future I will aim to clear finish the kayaks with varnish, as this should show less the inevitable scratches sustained while using the craft.

One advantage of paint is that any unfair sections and joints can be faired in with West 410 lightweight fairing compound before painting. Any amine blush must be washed off the epoxy coating with soapy water, and the surface lightly sanded, before any gluing, glassing, varnish or paint.

If you are now opting to cover the panels with glass fibre cloth, see the technique here.

There will be a weight penalty, but you may choose to accept this for the benefit of greater abrasion resistance of the hull.

One must attempt to create a dust free environment for varnishing and painting. I used fly spray in the shed the night before painting, after vacuuming the floor. I used Fortress Trade Professional black Gloss paint, on the basis that it was one tenth of the price of marine gloss. I applied two coats with a West foam roller, tipping off immediately with a wide soft good quality paint brush.

I painted the cockpit floor with the dregs of a can of grey International Interdeck non-slip deck paint.

Installing the skeg

Install the slider box into the hole in the port topside panel with polyurethane adhesive. The next day, install the plastic outer tube into the fitting on top of the skeg box so that it just reaches the inside of the box. Slightly tighten the nut. Thread the plastic tube through the holes in the bulkheads and cut it to length so that it just reaches into the end of the slider push-fit connection. Now remove the plastic tube from the fitting on top of the skeg box. Thread the end of the skeg wire up through the skeg box and into the end of the disconnected plastic tube. Thread the wire all the way through to the slide box and through the tube until it emerges from the end of the tube outside the hull. Reconnect the plastic tube to the fitting on top of the skeg box, and carefully tighten the nut.

Pull the wire so that the skeg is fully retracted. Push the actuating button forward until there is just enough space to place a finger in front of the button. Tighten the grub screw with an Allen key (hex wrench in the USA) to fix the wire in position. Cut the wire to length with cable cutters, after coating that section of the wire with 5 minute epoxy to prevent any strands unravelling.
Outfitting

Secure the hatches into the deck and the drain plug (and hatch, if fitted) into the foot bulkhead with polyurethane adhesive.

A foam seat can be purchased from Fyne Boats or one can be carved from a Minicell foam block, as can a backrest.

Deck fittings to hold deck lines can be made from 85mm lengths of 25mm wide polypropylene webbing tape, folded into loops. The deck loops can be fixed to the sheer clamps with 19mm (3/4") pan head M4 (no.8) stainless screws through 20mm M4 penny washers, as seen here:
Now go paddling. You’ve earned it.