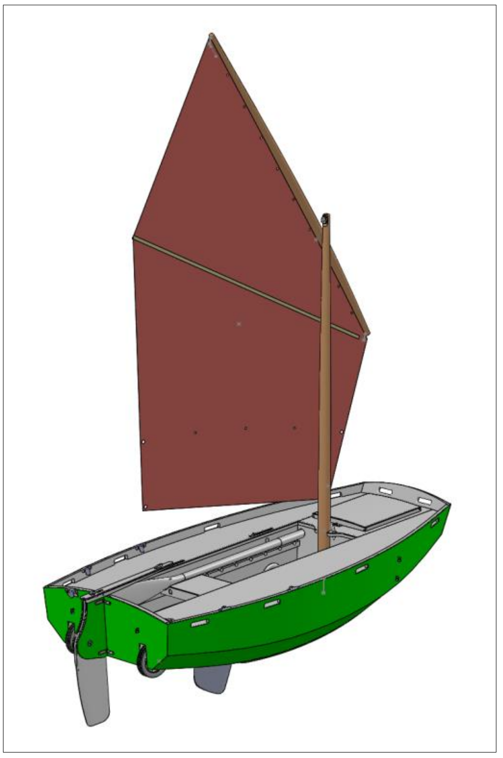
A General Purpose 'Pram' Dinghy

Design by John Perry

Current Revision 01 - 2021-04-10

General Features



The aim is a general purpose boat, a little under 2.4m overall length, that can be used with oars, small outboard motor (2 to 3 h.p. suggested) or under sail.

This could be used as a yacht tender although it is acknowledged that for many yachts an inflatable tender is more practical being more easily carried on board and less likely to damage the parent yacht or other boats when left at a quayside. Also, these days an inflatable tender is probably cheaper than the materials to build a plywood tender.

A stowage compartment at the bow is accessed through a lockable hatch having a 450 x 450 clear opening. This compartment should be rain and spray proof but it is not intended to be watertight in the event of capsize. There are good size buoyancy tanks at the sides of the boat so it is not necessary to consider the bow compartment as part of the buoyancy provision.

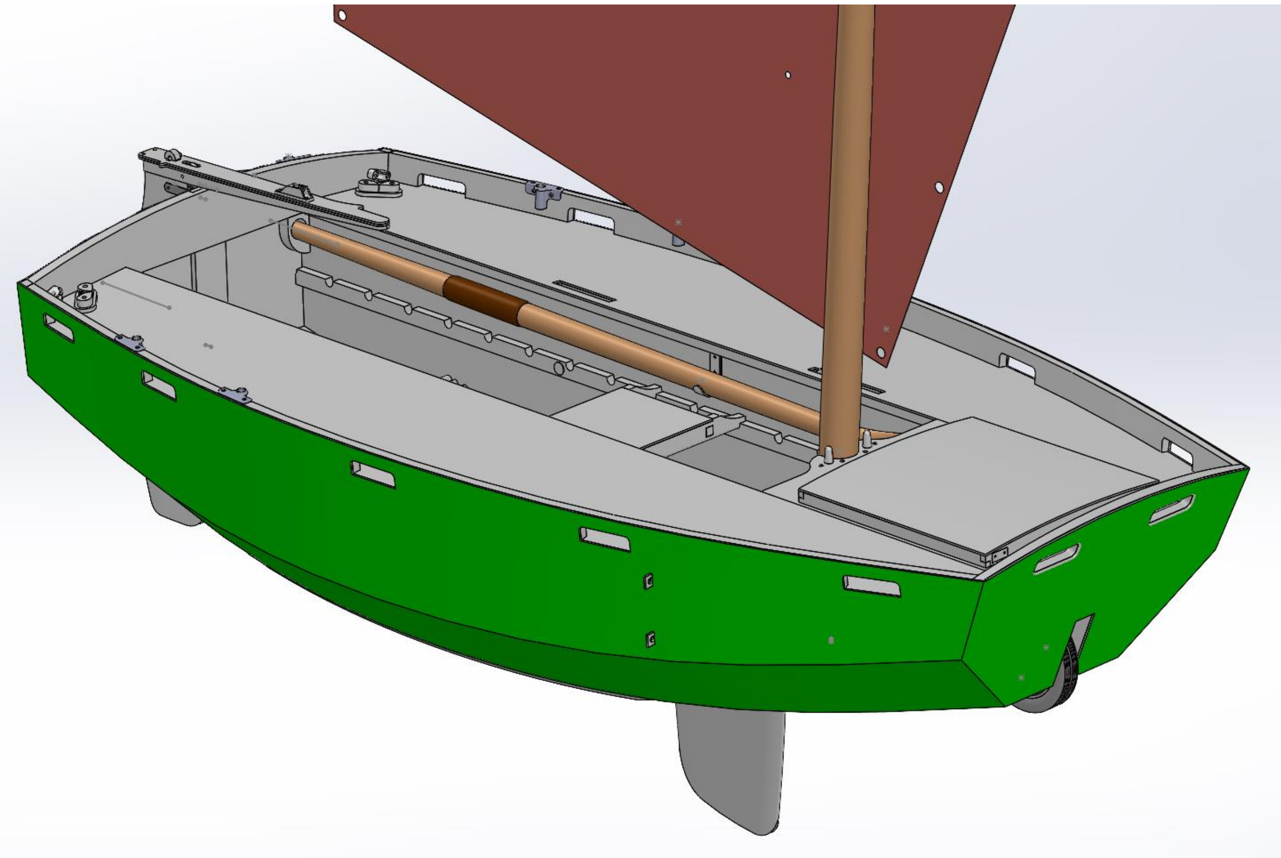
Built in wheels are included to make the boat easier to move around on shore but if these are not required they could be omitted with little alteration to the rest of the design. Rubbing strakes under the hull combine with the wheels to give good protection when landing or launching.

The rig is a boomless standing lug with spar lengths to fit inside the boat, lying above one of the bouyancy tanks. A full length batten gives extra sail area and is expected to improve sail shape and reduce flogging.

Lifting hand holes are provided all around the topsides to aid lifting and carrying the boat, these can also be used for attachment of fenders and mooring lines.

The flat bottomed hull without a skeg will be very manoeuvrable under sail or oars but will lack directional stability when the rudder is not in place. For straight course rowing over any distance (or for single oar sculling) it is suggested that the rudder is fitted, without the tiller, and held centred with a drop in bracket (See drawings). With the rudder held centred the boat will have good directional stability, even with the rudder blade only slightly immersed for shallow water.

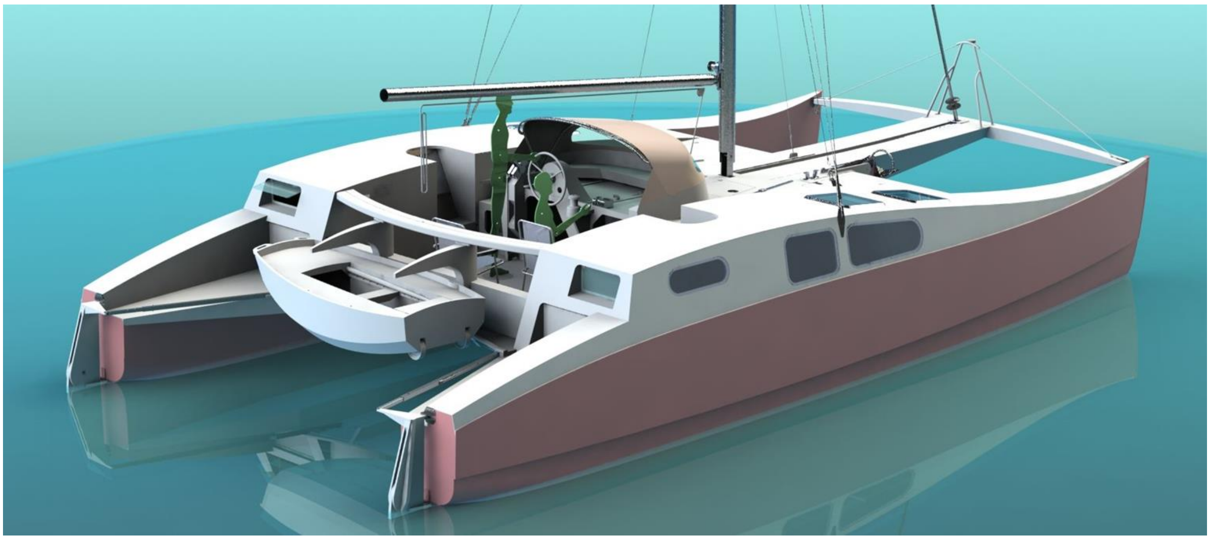
Version with Alternative Wheel Location



A version (as above picture) was also drawn with a single wheel at the front, rather than two at the stern. The boat could then be used on land very much like a wheel barrow – the oars could be projected through holes (not shown in the picture above) through the top of the transom to make handles. This would require small modifications to the bottom panel and a small number of other parts, the overall outline of the panels would be unchanged from the .dxf files included with this document. Any builder should be able to work out what the modifications would be if they prefer the bow wheel option but alternative .dxf files for the modified panels have not been produced.

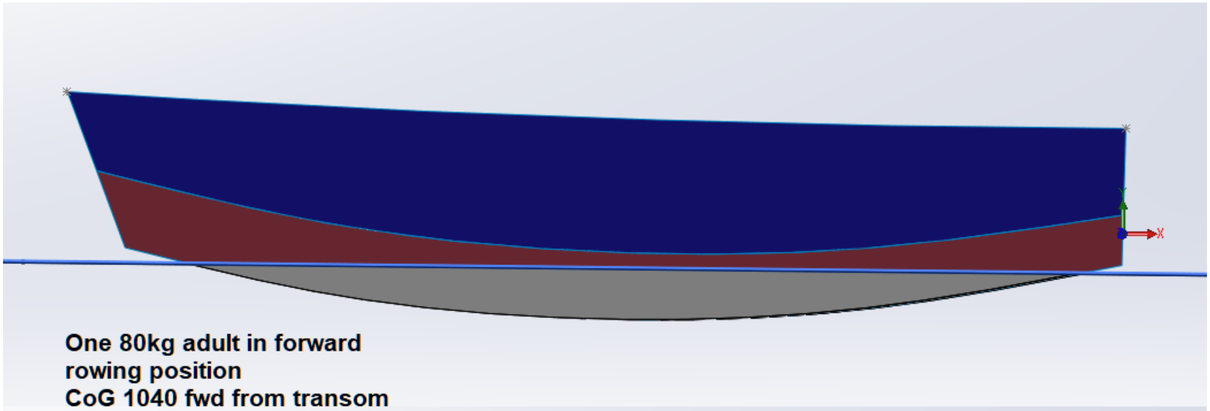
Background

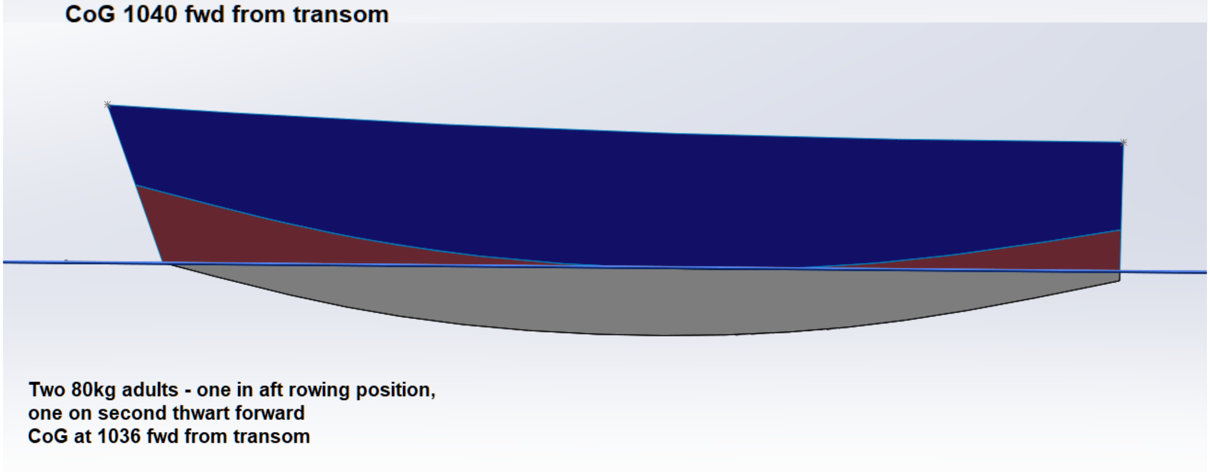
At around 2005 the author designed a 10m LOA sailing catamaran but never built that boat, instead he purchased a 32 foot trimaran designed by Ian Farrier. A plywood tender was part of the design of the 10m catamaran, the intention was to have it on davits at the stern of the catamaran as shown below. The current tender design is based on that previous one but with features to make it a sailing boat.

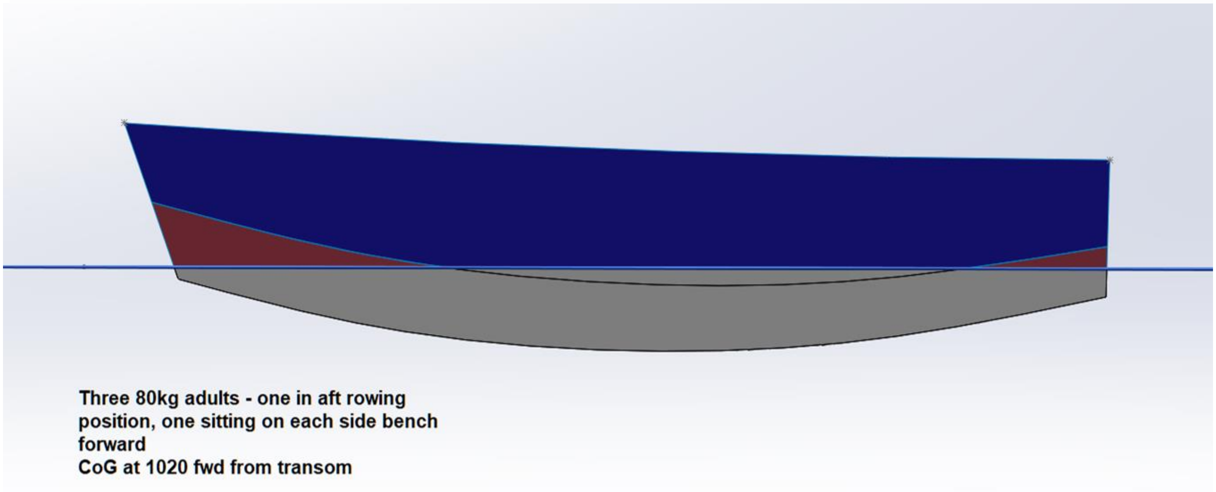


Floatation

The boat is intended to carry one, two or three adults. Two pairs of rowlock sockets are fitted together with two rowing thwarts which are adjustable fore and aft.   The forward pair of rowlocks are for rowing solo, feet resting on a removable footrest (stretcher), the aft pair are for rowing with a passenger, the rowers feet resting on the inside of the transom. A single passenger would sit on a second thwart forward or two passengers would sit one on each of the side tanks forward of the rower. The resulting floatation levels are shown in the diagrams below. Each diagram is to scale but the scale of the three diagrams is not identical. The flotation calculations assume sea water and 80 kg per adult, hull weight 44kg (includes sailing equipment and grp sheathing on hull exterior). (empty hull weight approx. 32kg, depending on build)







Drawings and .dxf files

The line diagrams provided in this document show the construction from various angles and these diagrams together with the .dxf files associated with this document (see list below) should give the dimensional information a builder would need. If any important information is missing just ask. Not all parts are included as .dxf files since the dimensions of some parts are set by the dimensions of other parts they attach to. Also there are some minor parts for which dimensions are left to the builder's discretion..

An internet search for 'free dxf file viewer' will list free software apps that can display dxf files and show dimensions. Just one example is 'LibreCad' – this software will open the .dxf files provided for this design and display the shapes of the parts. The dimension functions in LibreCad can then be used to display the dimensions needed to mark out material to cut the parts.

Machines that automatically cut plywood and other sheet material generally use .dxf files as input so it should be possible to use the provided .dxf files as a basis to cut the plywood parts by either a computer controlled router, a water jet machine or a laser cutting machine. The author's experience is with water jet cutting which would be suitable for this design.

It would be necessary to 'nest' the .dxf files for the plywood parts prior to machine cutting in order to optimise the use of plywood sheets. Companies that offer a computer controlled cutting service may be able to do the nesting, or there is nesting software available to download, for example from 'my nesting.com' which charges a small fee from your credit card each time you use there software. It is actually free if you only use that once, but that is optimistic. An alternative to using a cutting service is to have the .dxf files printed on a large format printer to produce paper templates for cutting the plywood manually with a jigsaw, or the plywood could of course be marked out and cut manually in the traditional manner.

The dxf files that form part of this design are each given a file name made up as follows:

Sequential part number for each part - Letter indicating material – number indicating thickness in mm - number indicating number of identical parts required –optionally a description.

The letters used are:

P – Plywood (either a single sheet or multiple sheets glued together to required thickness)

W – wood that is not plywood

WP – parts that can be made from either plywood or wood that is not plywood

F – Fabric

M – metal

So, taking this file name as an example:

019-P12-2-rudder stock side piece.dxf

019 is the part number, P12 means 12mm plywood, this is followed by '2' because there are two identical parts, then there is a descriptive name. Since 4mm plywood is the principle material for this project it is fine to make these rudder stock parts as three pieces glued together. All the plywood used to build this boat could be 4mm thickness and there may well be a cost saving by using one thickness of plywood throughout.

For the non-plywood parts the dimensions of the dxf files are generally for 'blanks' to cut out the part from plank stock – for many of these parts bevelling of edges will be required after cutting out a 'blank'.

Let the designer know of any discrepancies in dimensions. If there are conflicts between dimensions of the dxf files and the drawings in this document, the dxf files are likely to be correct since they were taken directly from a complete digital model.

DXF Files Associated with this Document

001-P4-2-topside panel
002-P4-2 chine panel
003 P4-1-bottom panel
004 P4-1-Stern transom
005 P4-1-Bow transom
006 P4-1-Port side deck
007 P4-1-Star side deck
008 P4-1-Port tank side
009 P4-1-Start tank side
010 P4-1-Bulkhead
011 P4-1-cb case side
012 P4-1-Foredeck
013 P4-2-Wheel housing side panel
014 P8-2-Inspection hatch backing
015 P4-1-cb pivot pin cover
016 P4-1-mast foot rest
017 P4-2-outer cover over wheel axle
018 P4-2-stiffener for oar hole in bulkhead
019 P12-2-Rudder stock side piece
020 P12-1-Star thwart support rail
021 P4-1-Forehatch lid underside panel
022 P4-1-Forehatch lid top panel
023 P8-1-Tiller top
024 -P4-2-Thwart top
025 P16-1-Rudder blade
026- WP17-1-Rudder stock centre piece
027-WP19-Centre board
028-WP12-1-Port inner wheel axle support
050-W12-2-blank for under hull side strake
051-W12-1-blank for under hull centre strake
052-W12-1-Stern transom vertical stiffener
053-W18-1-Bow transom stiffener
054-W25-1-Stern transom stiffener
055-W18-1-Port Thwart support rail
056-W12-2-In-whale
057-W18-1-deck level mast support
058-W18-1-Bulkhead stiffener
059-W18-2-Foredeck support
060-W12-4-Forehatch coaming
061-W9-1-Floor centre stiffener
062-W9-2-Floor side stiffener
063-W9-2-lower mast support
064-W25-1-mast foot locator
065-WP12-1-Starb inner wheel axle support
066-WP12-2-outer wheel axle support
067-W12-2-front of wheel housing
068-W12-2-top of wheel housing
069-W18-4-support block for footrest
070-W18-2-tank side top member
071-W18-1-cb case top member
072-W18-1-cb case outer stiffener
073-W22-1-cb case forward member
074-W22-1-cb case aft member
075-W22-1-cb case to bulkhead attachment
076-W22-1-support for cb case clam cleat
077-WP12-2-support for cb case pivot rod
078-W12-2-hatch lid transverse member
079-W12-2-hatch lid longitudinal member
080-W12-2-hatch lid diagonal member a
081-W12-2-hatch lid diagonal member b
082-W17-2-rudderstock forward member
083-W22-2-Tiller side member
084-W18-1-Foot rest
085-W18-4-Thwart transverse member
086-W18-4-Thwart longitudinal member
100-F-1-Sail - for nominal dimensions only

General construction notes

This Is a typical 'stitch and glue' plywood boat and since there is much written about stitch and glue boat building, both on the internet and on paper, full description of the technique is not included here but a few points to note are as follows:

Good quality marine plywood is easier to work than cheap plywood (less tendency to split or splinter) and makes for a stronger and longer lasting boat. Gaboon/Okume marine plywood is very suitable for this project. Avoid plywood that has outer plies that are very thin by comparison with the inner plies.

Softwood is generally suitable for the wooden parts that are not plywood. Spars, oars and other long parts should be from clear grained timber. Sitka spruce is ideal for spars but other clear grain softwoods can be used. Sitka spruce is also good for oars, although some builders prefer to make oars from a denser softwood to give a surface that is less easily dented.

Epoxy resin is recommended as the main adhesive used throughout this project although polyurethane glue is an option for close fitting wood joints only.

All wood parts should be coated with epoxy, defects filled with epoxy filler and/or high build epoxy primer and then an appropriate paint system applied – plenty of information about paints and fillers on the internet.

Although the drawings show sharp corners on wood parts, all wood parts should have the corners well radiused prior to epoxy coating – epoxy and paint do not adhere well to sharp corners! Also glass-epoxy sheathing will not lie around a sharp corner, so external hull seams should be radiused prior to sheathing. If this is done using an angle grinder and abrasive disk it will also trim off copper wire ties used for stitching the panels.

An external sheathing of glass and epoxy is recommended for the outside of the hull but is not required internally, other than possibly on the floor if heavy use of the boat is anticipated. 200gsm glass cloth or thereabouts is suitable for sheathing, although thicker or more than one layer could be used for greater durability at the expense of weight.

Different builders will have different ideas about the joining of stitch and glue hull seams. The author would suggest a strips cut from biax glass, say 400 to 600 gsm and about 60mm wide bonded along each seam on the inside but only overall glass sheathing on the outside of the hull. Further glass/epoxy reinforcement externally along the seams could be applied for extra durability but will create ridges in the external surface of the hull which would need to be faired with epoxy fairing compound if a nice external finish is the aim.

Generally the main grain of plywood (i.e. the grain of the outer plies) should be aligned along the length of elongated parts. The hull bottom and the side decks are exceptions, these would be better with the main grain aligned transversely across the hull which would require scarf joints to cut from normal sized sheets. The three strakes bonded to the inside of the hull bottom provide longitudinal strength so the plywood grain is best aligned for transverse strength, however builders who do not want to make a scarf joints can probably get away with longitudinal grain for the bottom panel and two or three stiffeners could be glued to the underside of the side decks to provide transverse stiffness. Or as an alternative to scarf joints, the dxf files could be amended to provide dxf files with zig-zag joints for these panels.

A small number of parts would best be made with a lath, e.g. bushes for centreboard, pulley sheave for lifting centreboard, belaying pins. If no lath is available these parts could probably be turned from plastic material by mounting in the chuck of a drill or purchased items could be used. 3D printing is also an option for some small parts – some public libraries now offer the use of 3D printing machines.

The drawings show the plywood parts with several tabs and slots for quick assembly but if cutting the plywood by hand it is not worth incorporating these, the assembly can alternatively be done with just wire ties and/or screwing to temporary wood blocks.

Design revision suggested: The drawings included in this document show the centreboard case on the port side of the boat. For a right handed sailor it might be slightly better to have this on the starboard side which would also partly balance the weight of the yard on the port side. This minor change makes no difference to the cutting out of material, so the .dxf files are unchanged, only the assembly changes.

Purchased items required

Plastic clips to hold oars when oars not in use - 2 off

Oars if not home made – 2 off

4” plastic inspection hatch for buoyancy tank, larger can be used if preferred – minimum 2 off. (Additional inspection hatches could optionally be fitted at the aft ends of the buoyancy tanks)

Plastic or stainless steel hinge, approx. 50 x 25 folded, for foredeck hatch – 2 off

Rowlocks with side mount sockets. Stainless steel or bronze would be ideal but expensive, plastic ones are adequate for most use. 5 off if two rowing positions plus single oar sculling is required.

U bolt and small padlock to lock forehatch (optional)

U bolt(s) for attachment of tow rope/painter to bow transom (optional)

Mainsheet fairleads – 19 dia. Allen plastic fairleads or similar – 2 off

Mainsheet cam cleats – to suit preferred rope size – 2 off

Clam cleat to hold centreboard up-haul – 1 off

Short length of 16mm to 20mm wide webbing with Velcro sewn on for centreboard downhaul – 1 off

Pull ring, toggle or similar to sew to free end of above webbing

Set of light duty rudder gudgeons and pintles – drawings are based on those available from Fyne boat kits but many other types would be suitable - 1 set.

Masthead pulley for halyard.

Pulley(s) to make purchase for clew downhaul – e.g. 2:1 purchase with 2 pulleys, lower pulley attached near mast base. (optional)

Eye strap for securing lower pulley of clew downhaul – 1 off (optional)

Snap shackle or strong hook to attach clew downhaul to sail. (optional)

Cordage – suggested sizes 6mm polyester for halyard and clew downhaul, 8 to 10mm for main-sheets

Length of approx.10mm dia elastic shock cord for rudder blade downhaul and approx 4mm shock cord to secure pin holding tiller to rudder stock.

Wheel – Machine Mart part No. ML808 – (204mm diameter, bore for 1/2” axle) or similar – 2 off (This wheel suits a wheel casing width 50mm, as drawn, if a different type of wheel is used the wheel casing may need some alteration. 1/2” ID washers can be used to centralise the wheel in the wheel casing.

Length of 1/2” dia bar stock to make axles for wheels and centreboard and 8mm bar stock to make axles for centreboard up-haul and down-haul rollers – stainless steel ideal but brass or aluminium could be used.

Universal joint for tiller extension (optional)

Sundry woodscrews, machine screws, nuts and washers which should generally be stainless steel.

Hull Assembly

This section covers the sequence of work to assemble the hull from the point at which all the main plywood parts have been cut out, by automatic machine or otherwise, and plywood parts have been pre-coated with epoxy on internal surfaces only. If the hull bottom panel has been made in two pieces it is assumed that these are now scarfed together and the three 9mm thick stiffeners will also have been bonded to the inside of the hull bottom panel

Note that If workshop space is limited it is advantageous to start the assembly by making small parts such as rudder, centreboard, spars etc., these can then be stored to free space for the hull.

It should be possible to assemble the hull without using a conventional 'building jig', the shape of the plywood parts cut according to the .dxf files giving the shape of the hull with some temporary bracing to hold parts orthogonal and avoid twist along the length of the hull.

The assembly of the hull is described as the following sequential steps:

1. Port and Starboard Side Panel sub-assemblies
2. Port and Starboard Side Deck sub-assemblies
3. Bulkhead sub-assembly
4. Assembly of main hull structure with internal taping and epoxy coating
5. External epoxy coating/sheathing/fairing and painting

Port and Starboard Side Panel Sub-Assemblies

The centreboard case is built onto the port side panel and the wheel housings are built onto the aft end of both port and starboard side panels. The inside of the wheel housings and the inside of the centreboard case should be sheathed with epoxy and glass cloth as the parts are assembled.

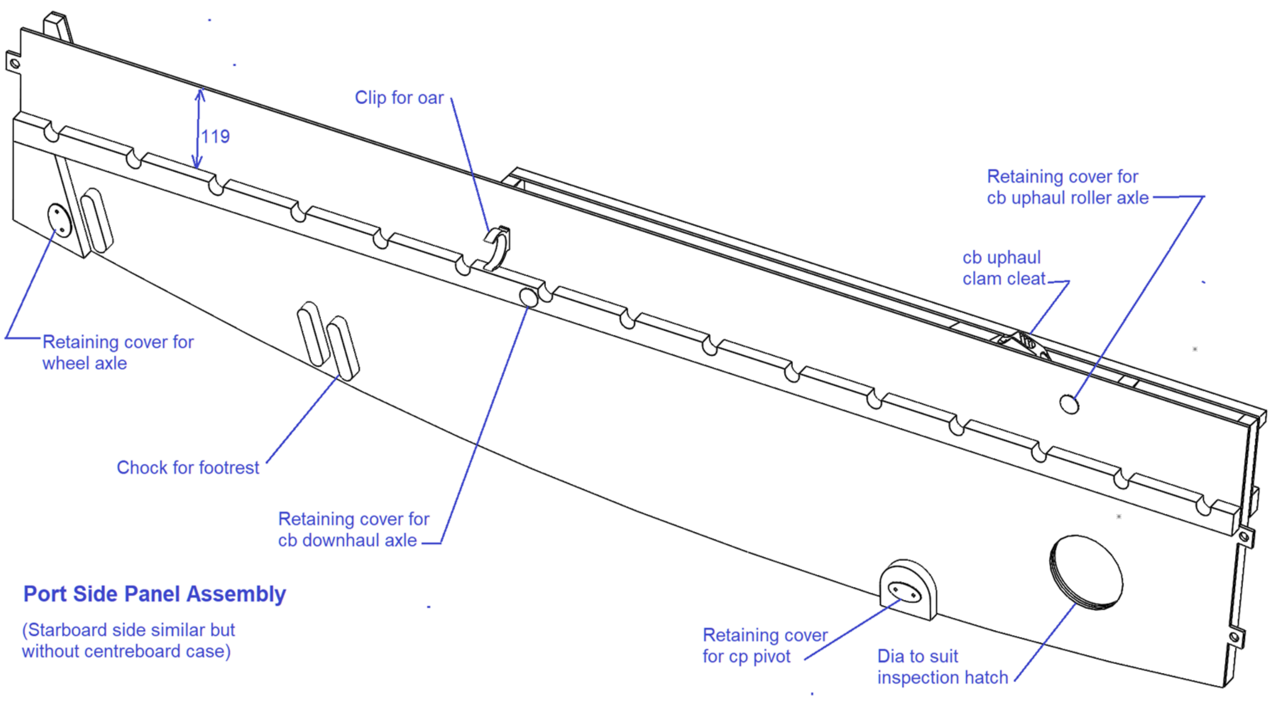
The design is based on a centreboard thickness of 18mm but this can be increased if preferred provided that the parts that control the width of the centreboard case are dimensioned such as to give a case width approximately 2mm greater than the centreboard thickness.

The centreboard is lowered by pulling on a length of 20mm (¾”) wide webbing that passes over a roller and attaches to the upper corner of the centreboard with clamp plate held down with wood screws – see drawing of centreboard. A pull ring or similar can be sewn onto the free end of the webbing to form a hand grip. Part of this length of webbing has Velcro sewn onto it and this engages with Velcro wrapped lengthwise round a small piece of wood (a 50 x 18 x 4mm piece of plywood suitable) fastened with wood screws to the aft inside of the centreboard case just under the slot trough the side deck. The Velcro will release if the centreboard hits the seabed. The release force can be adjusted by altering the length of Velcro that comes into contact and/or by packing under one end of the piece of wood round which the Velcro is wrapped so as to adjust the 'pull off' angle.

The centreboard is raised by pulling on a cord that passes round a roller and attaches to the upper corner of the centreboard. This cord is held in a small clam cleat.

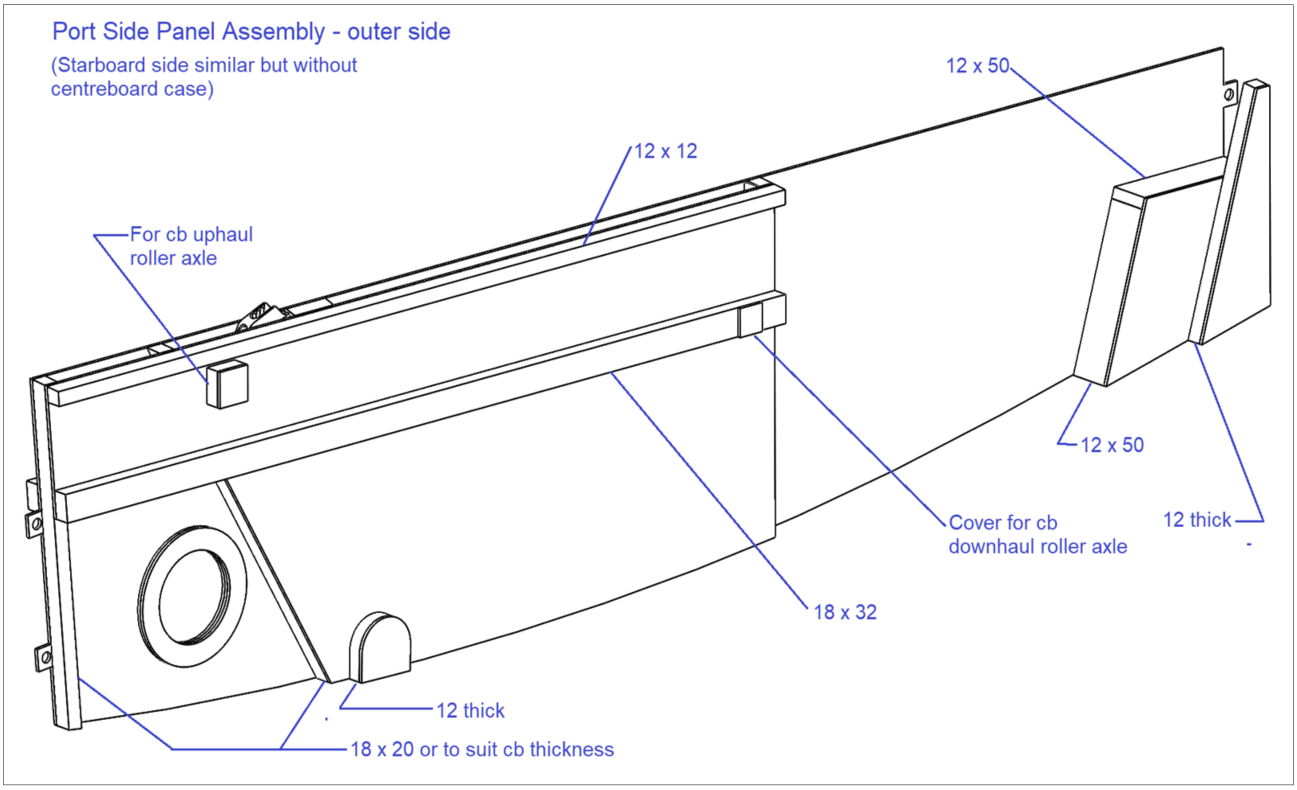
The two rollers for the centreboard up-haul and down-haul run on 8mm diameter axles (although different axle sizes could be used to suit purchased parts) and the wheels listed as purchased items run on 1/2" diameter axles. These axles are inserted from outside the buoyancy tanks and are then retained by small covers cut from a plastic such as Formica, these covers being held In place by a week sealant, e.g. silicone bathroom sealant. The wheel axle covers are additionally retained by wood screws.

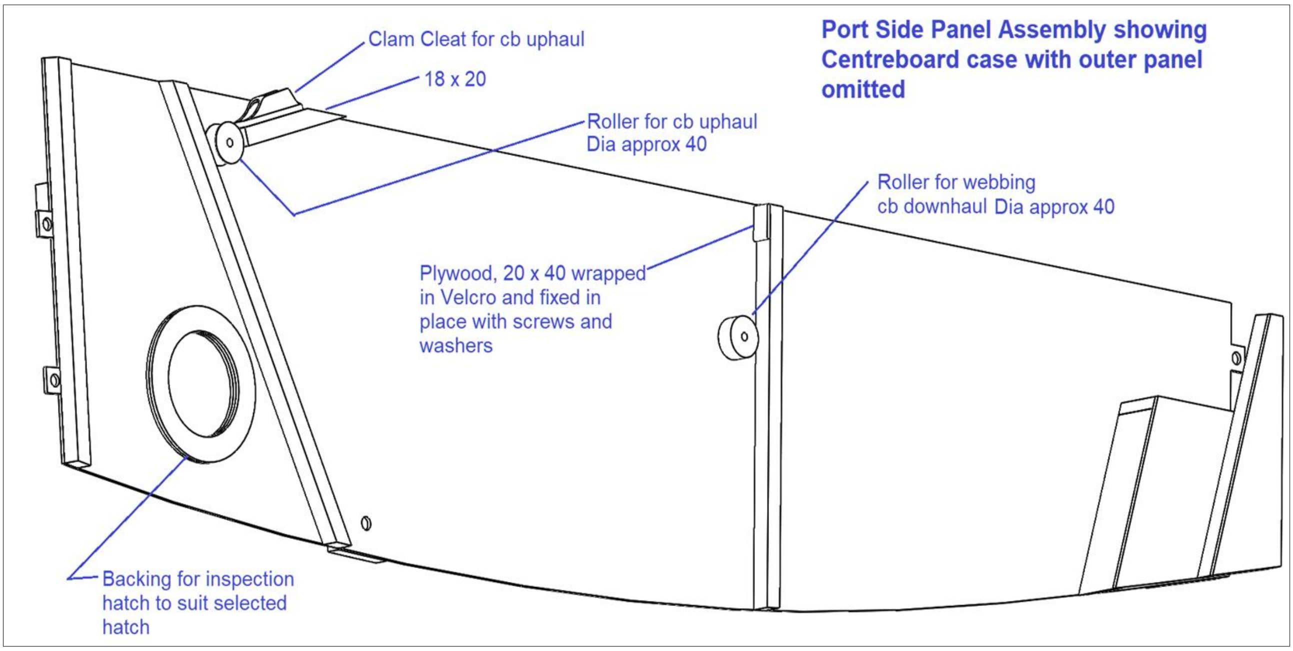
The axles for wheels and centreboard up-haul/down-haul rollers have one end drilled and tapped to allow a screw to be inserted for removal. The other end of these axles fit into blind holes drilled slightly oversize then well coated with epoxy, thickened as necessary before inserting the axle, the axle being greased or waxed to allow removal from the epoxy.



Port Side Panel Assembly

(Starboard side similar but without centreboard case)



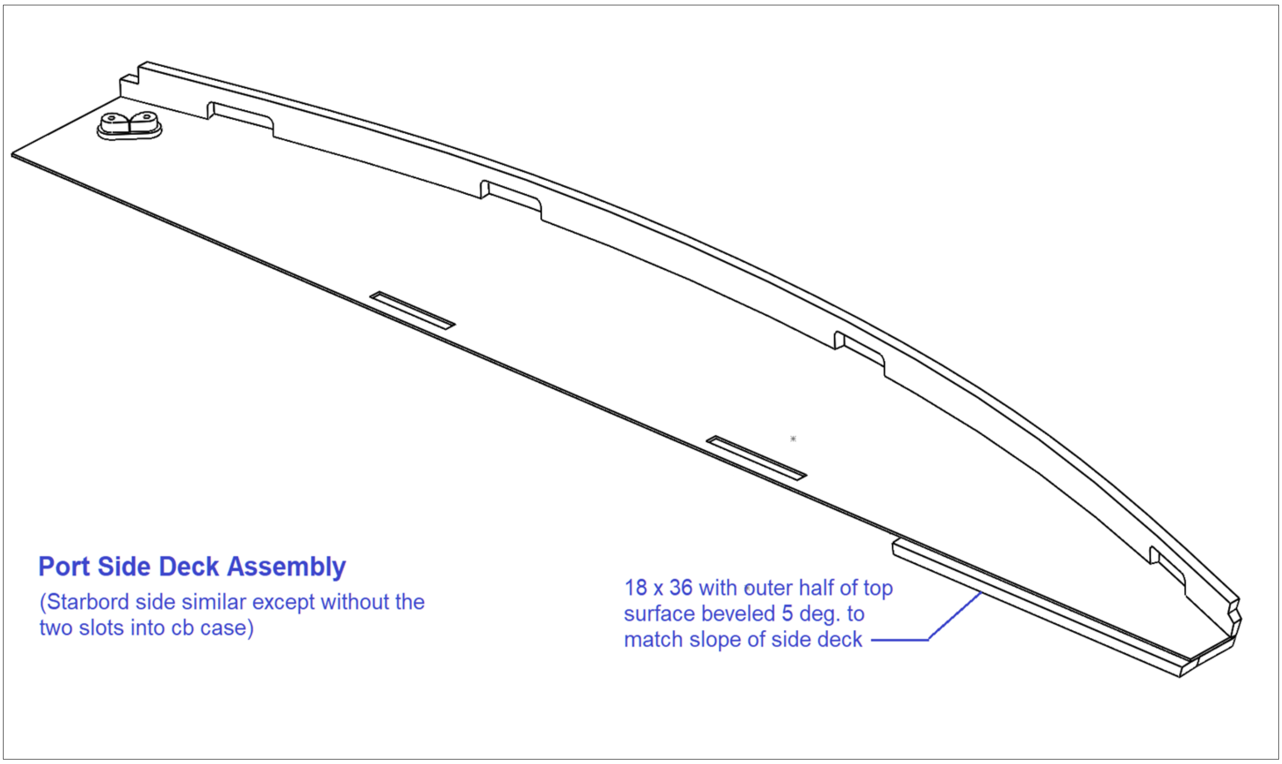


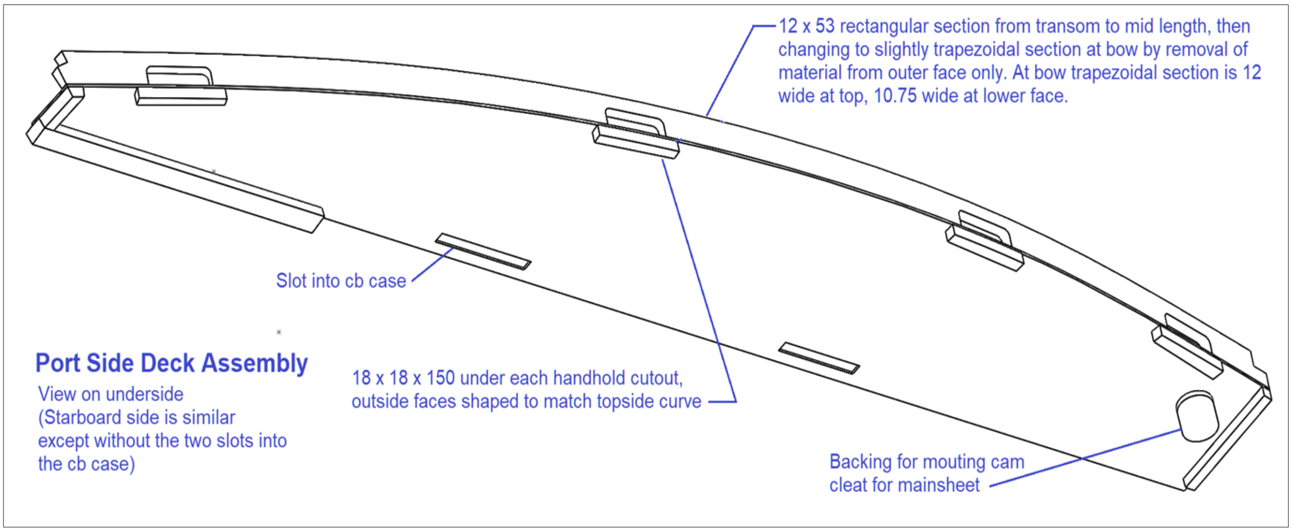
Port and Starboard Side Deck Assemblies

These assemblies form the top of the buoyancy tanks. All work must be completed on the insides of the buoyancy tanks before the side deck assemblies are permanently epoxy bonded in place.

These assembles include a 12mm thick timber that fits inside the 4mm plywood topsides to form a 16mm thick up-stand at the gunwale. For a yacht tender it is useful to be able to put ropes or small items of luggage on deck and not have them slide overboard, this is the main purpose of this upstand. At a later stage this up-stand should be radiused and glass epoxy sheathed for durablity and to protect the end grain of the topside plywood. An option for a stronger construction is to laminate a 12 x 25 mm timber strip onto this up-stand, above the handhold cut-outs, this being either inside the topsides or external. The authors preference would be to have such extra reinforcement internal to leave the topsides flush, avoiding a ridge that could catch on pontoon edges etc.

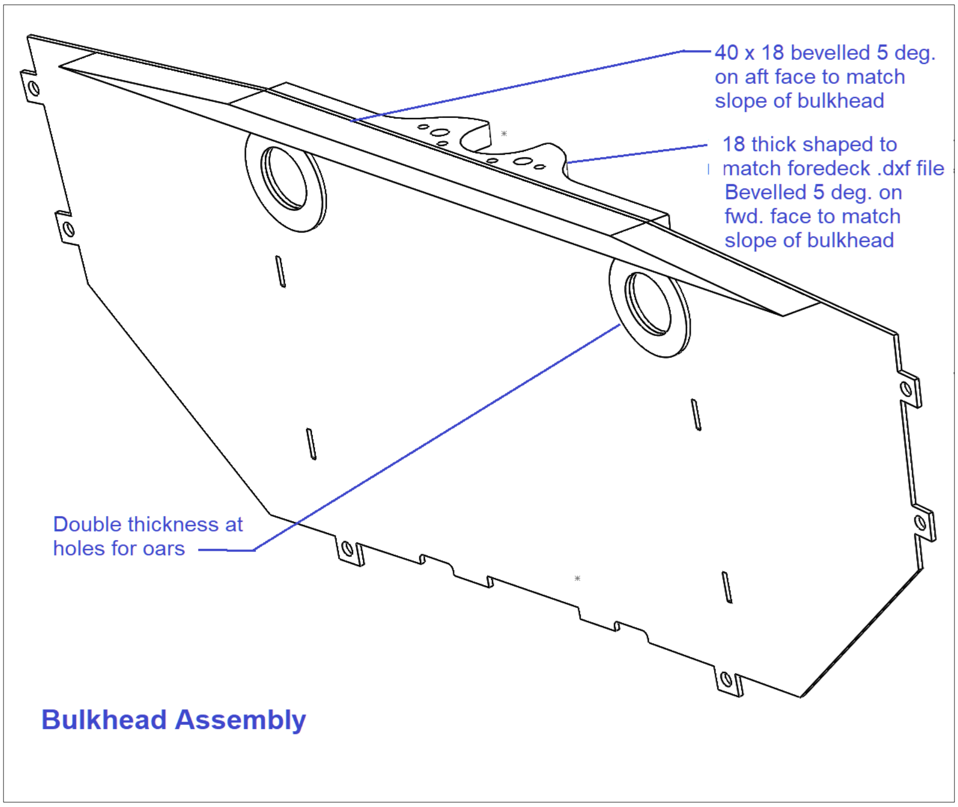
Note – These drawings show four hand hold slots in each topside, the design has now been updated with five, the .dxf files provided are correct for five slots





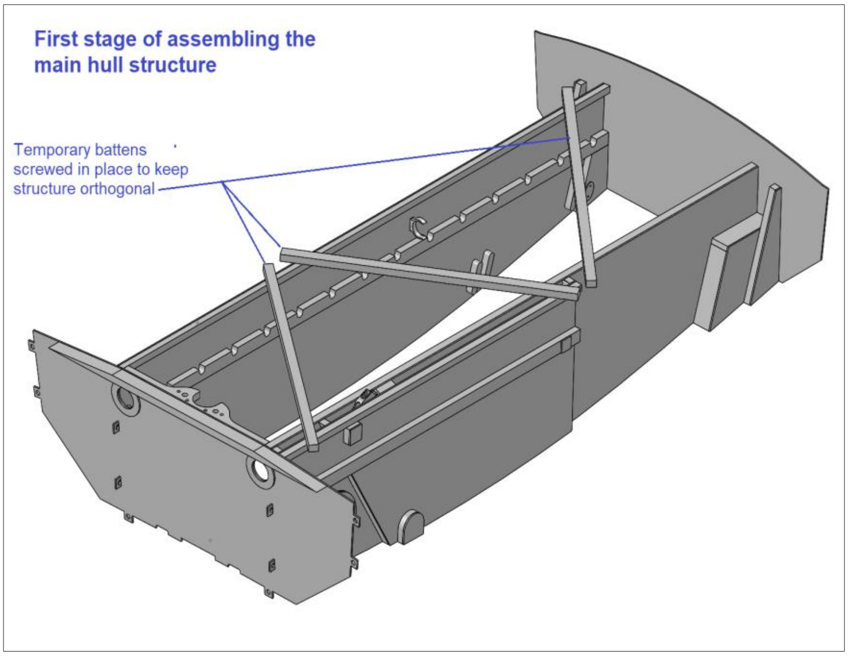
If cam cleats for the main-sheets are to be fitted to the side decks (as shown in view below) then backing pads for screws to attach these must be in place before the side deck assemblies are bonded into the hull structure.

Bulkhead Assembly

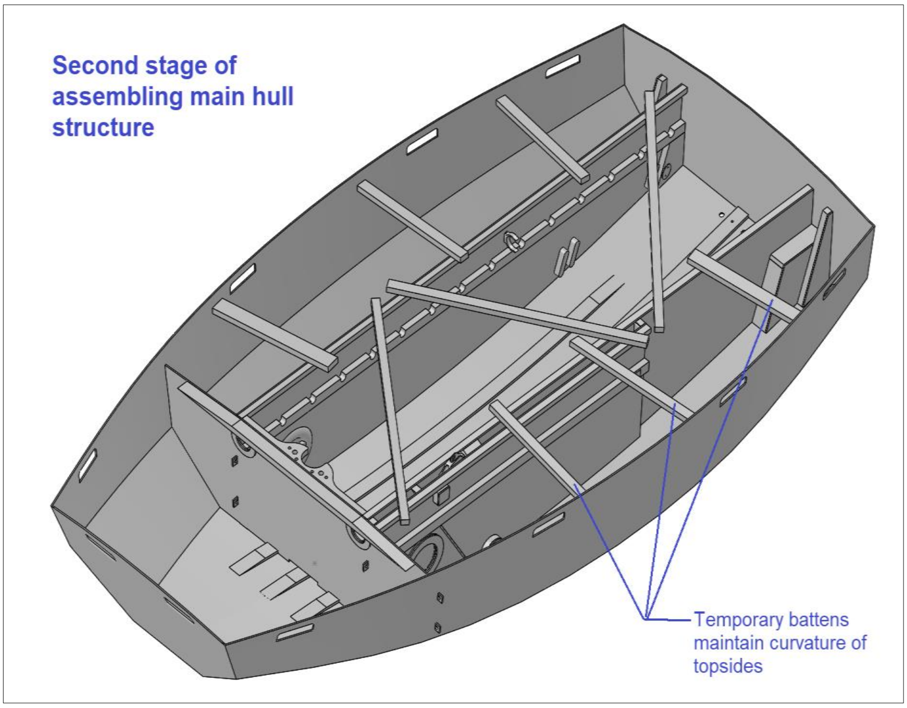


Assembly of main hull structure with internal taping and epoxy coating

The first stage is to assemble the stern transom, the port and starboard side panel assemblies and the bulkhead assembly, as below:

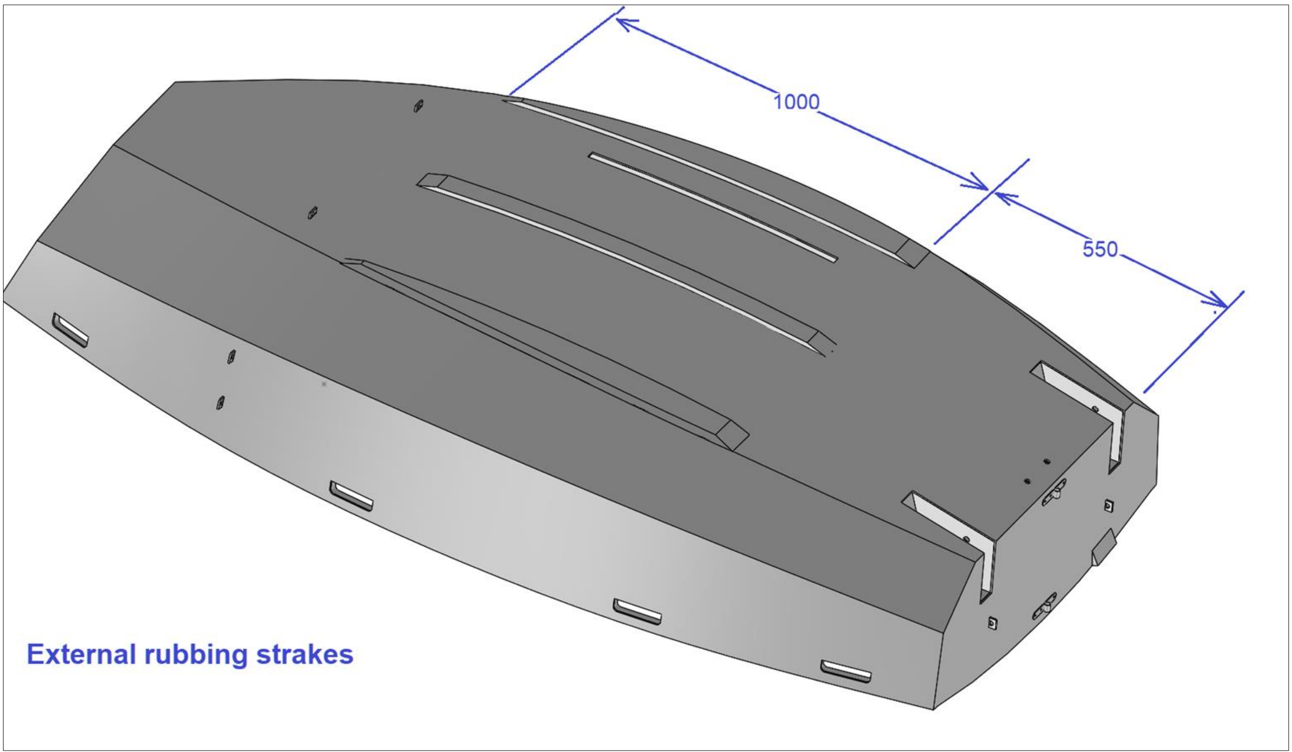


The next stage is to wrap the bottom, chine and topside panels around the above structure and to fit the bow transom as below:



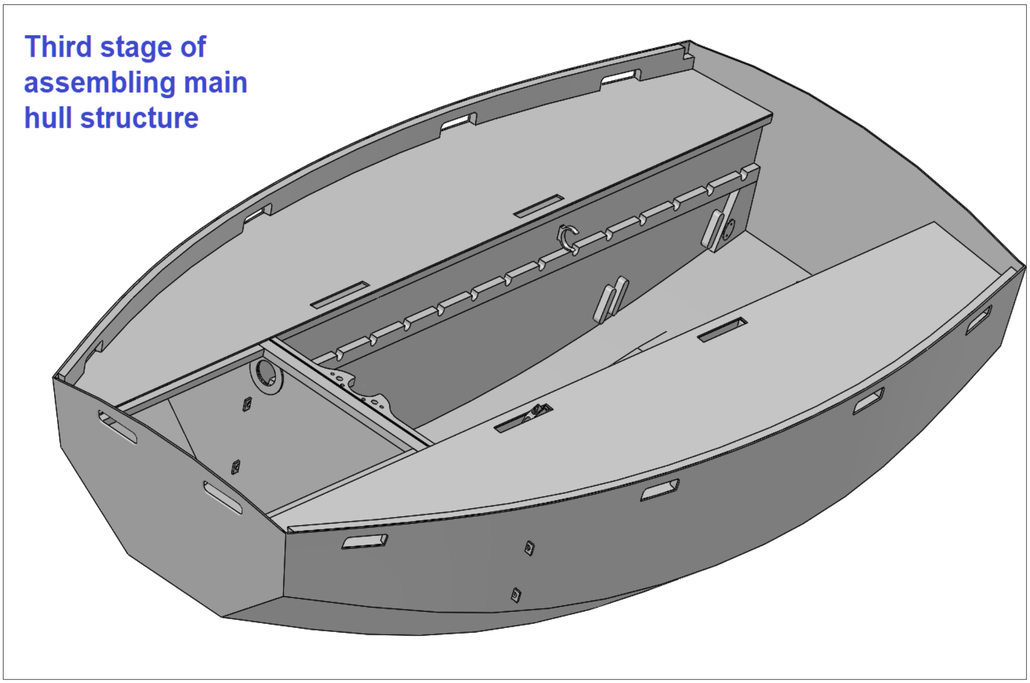
The hull skin panels join edge to edge along the longitudinal hull seams but they overlap the thickness of the bow and stern transoms – i.e. the transoms fit inside the other hull panels. Initial fixing of the hull panels is by wire or cable ties at interval along the seams, then the seams are internally taped with glass and epoxy and/or joined with epoxy fillets (consult articles/books on stitch and glue boat building if necessary). During this process the hull should be repeatedly checked for twist along the length of the structure and the temporary cross bracing should be adjusted to remove such twist. Temporary battens are fitted to maintain curvature of the topsides as shown and this can be checked by offering up the side deck assemblies.

If external rubbing strakes are required they should be fitted at this stage, but before fitting them patches of glass-epoxy sheathing should be applied externally to the areas of the hull where the rubbing strakes are fitted, these patches extending say 50mm all round the footprint of the rubbing strakes. The rubbing strakes can then be screwed onto the 'wet' epoxy sheathing using short wood screws from inside the hull. For greater durability, at expense of weight, additional thickness of 'sacrificial' timber could be screwed onto the rubbing strakes and this could optionally be protected by screwing on strips of 16 gauge stainless steel.

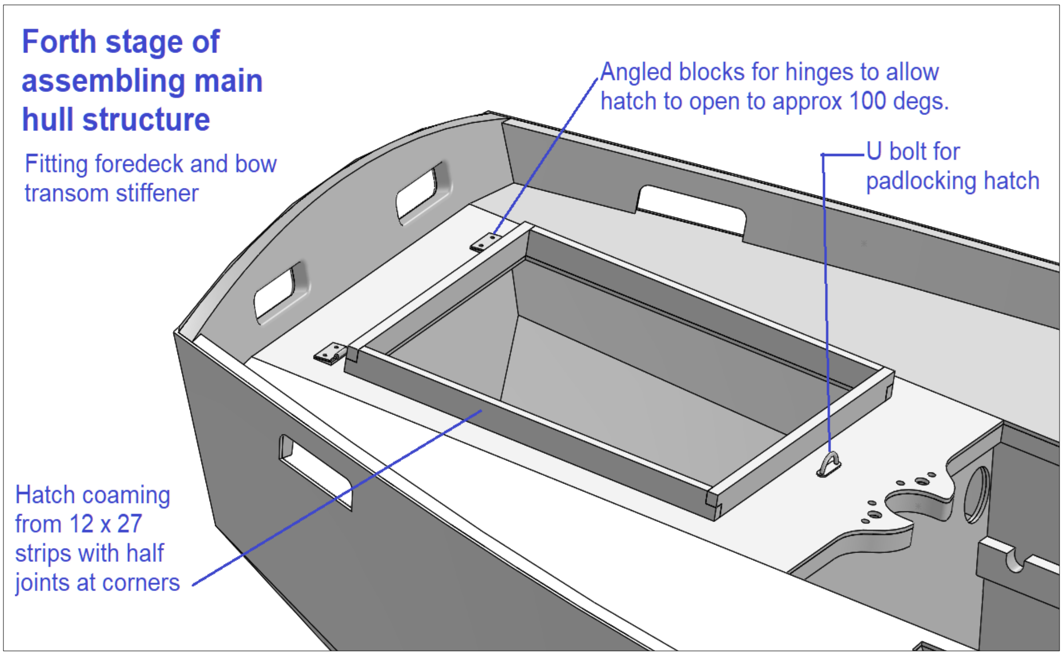


External rubbing strakes

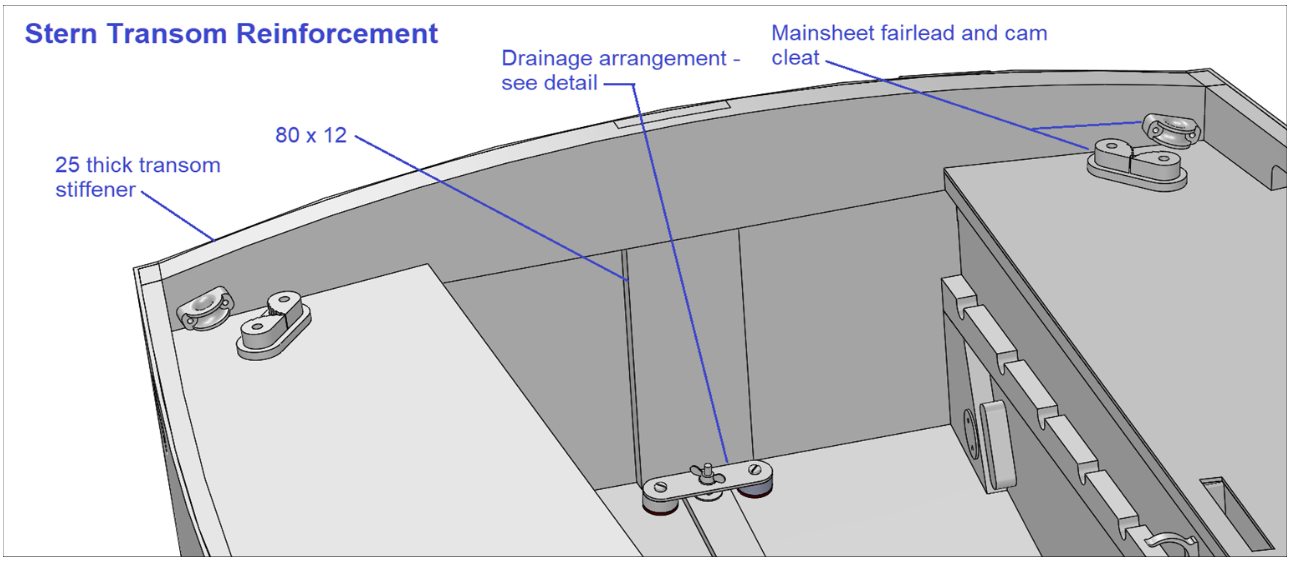
Next the temporary bracing is removed and the side deck assemblies are bonded in place. All work within the buoyancy tanks must be completed prior to this stage. The result is as below.



The foredeck and fore hatch coaming are now bonded in and the stiffening member added to the bow transom, as below:

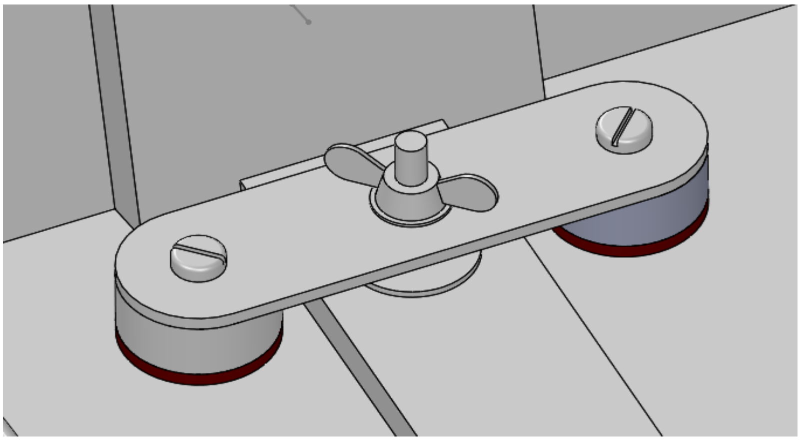


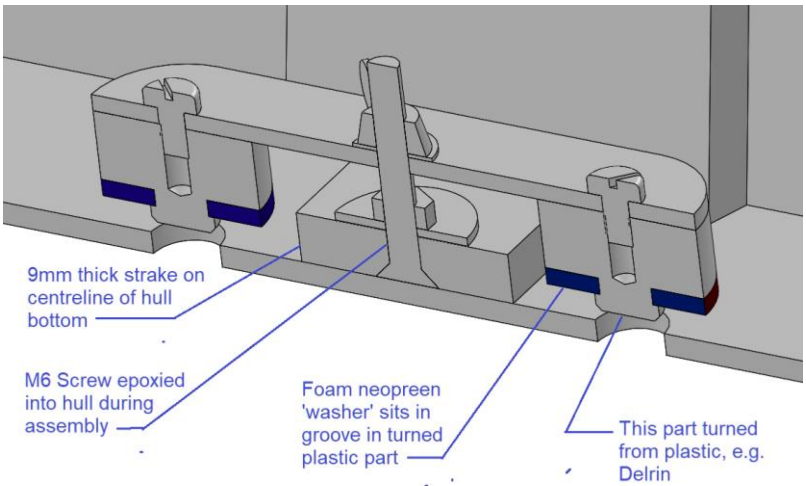
Then the reinforcing framing is added to the stern transom as below.



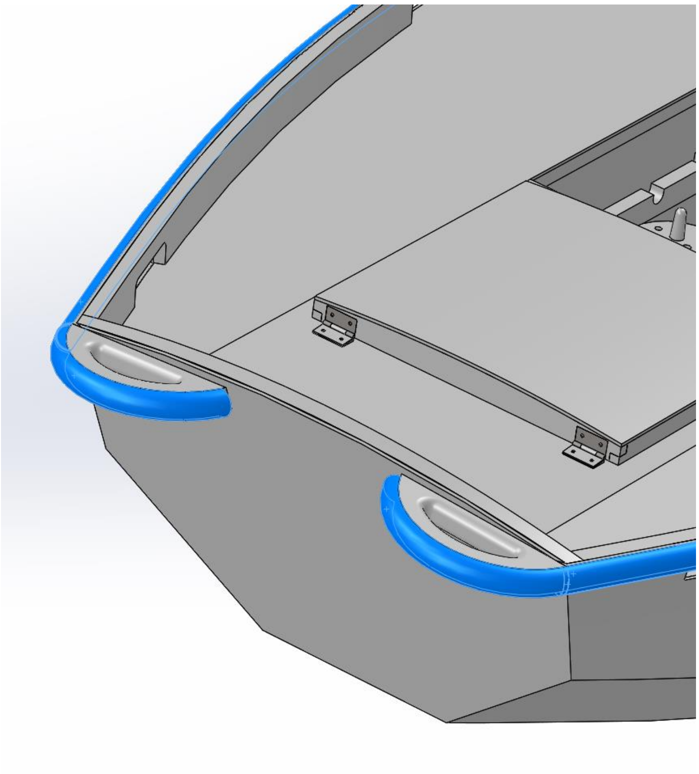
The exterior of the hull can now be sheathed with glass and epoxy, filled, faired and painted, and the fittings can be attached, completing the main hull.

The drawings below show a hull drain arrangement the author has found works well on another craft, although conventional drain bungs could be used if preferred.





The arrangement sketched allows the hull to drain to the last drop and leaves the outside of the hull flush when the drain is closed. The second drawing is a cross section showing the drain with the wing nut unscrewed, the cross bar can now be turned so the water can freely drain through the two holes in the hull skin (ply grain around these needs to be epoxy sealed of course). The cross bar can be aluminium, stainless steel or a strong plastic such as Tufnel or G10.



An all-round fender could be fitted to the gunwale, either a 25mm wide 'D' section fender strip or a traditional rope fender. However, it is difficult to fit such fendering round the corners of a 'pram' dinghy, one possibility that also provides alternative lifting handles at the bow is sketched above – 'D' section fender shown in blue.

Assembly of small parts

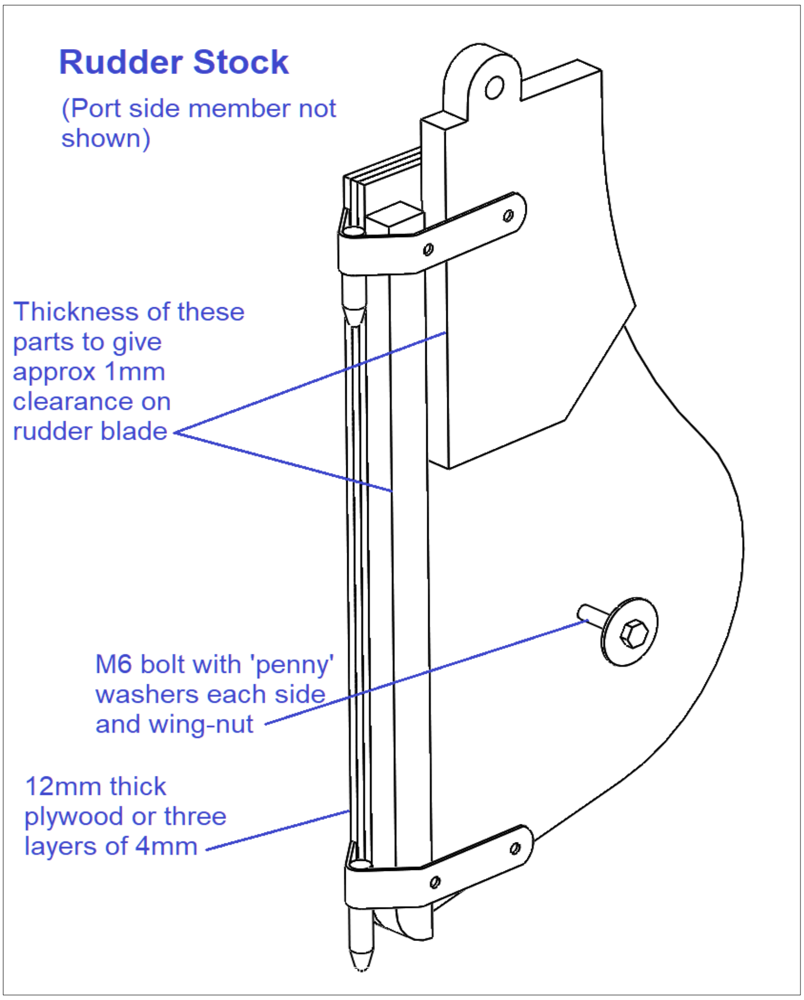
Rudder and Tiller

The rudder has a lifting blade with a cord to raise it and an elastic cord to hold it down. The tiller as drawn is removable for stowage in the forward locker but could alternatively be permanently glued to the stock for simplicity and rigidity.

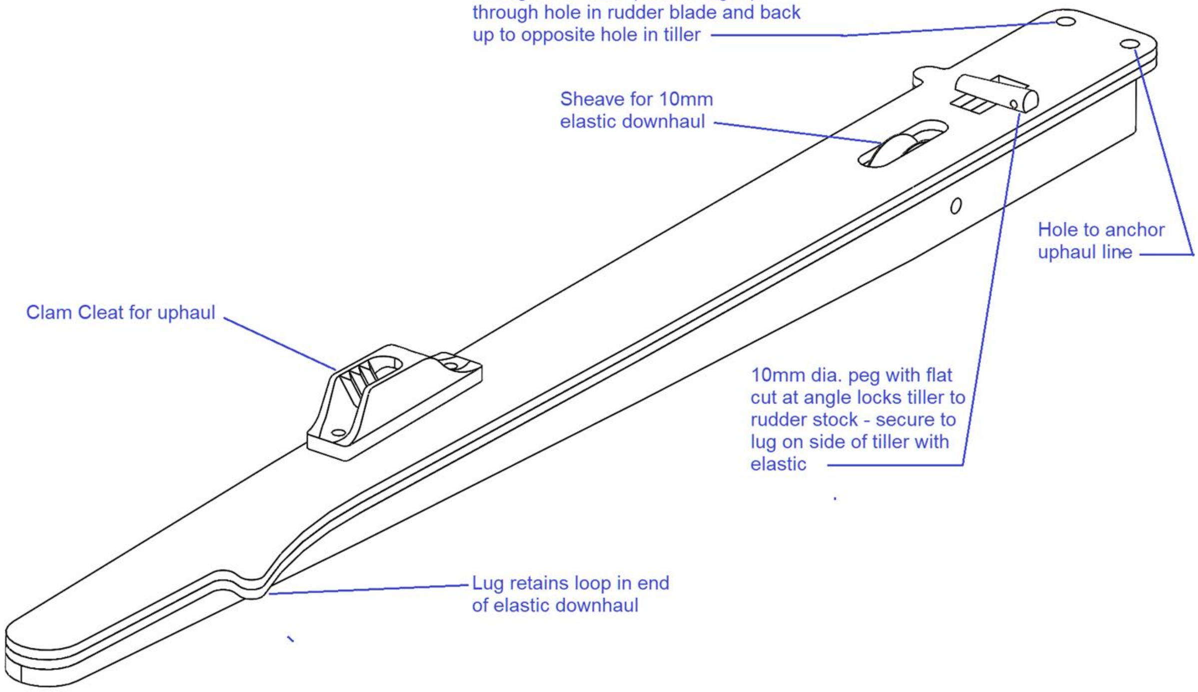
It is recommended to sheath the inside surfaces of the rudder stock sides with epoxy and glass as the rudder stock is assembled.

The rudder stock is designed to allow the rudder to lift to a high angle so that it is less vulnerable to damage when lifted.

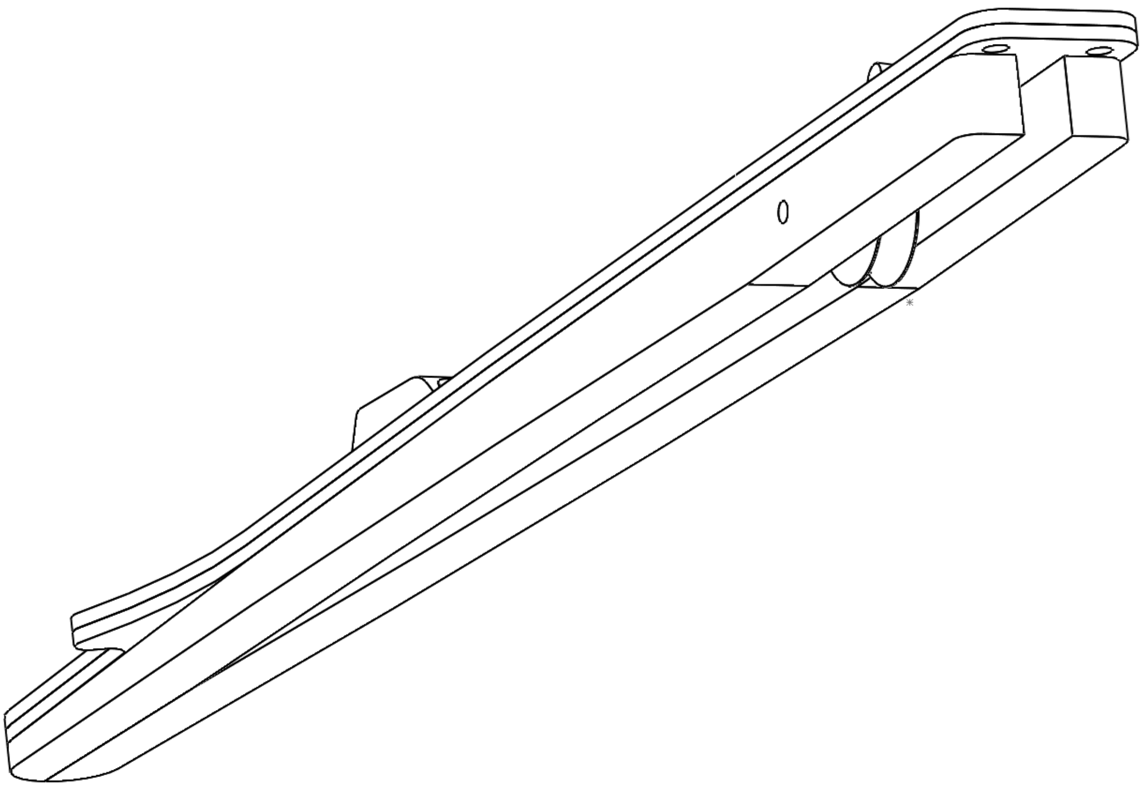
A short tiller extension is an option



Tiller



Underside of Tiller

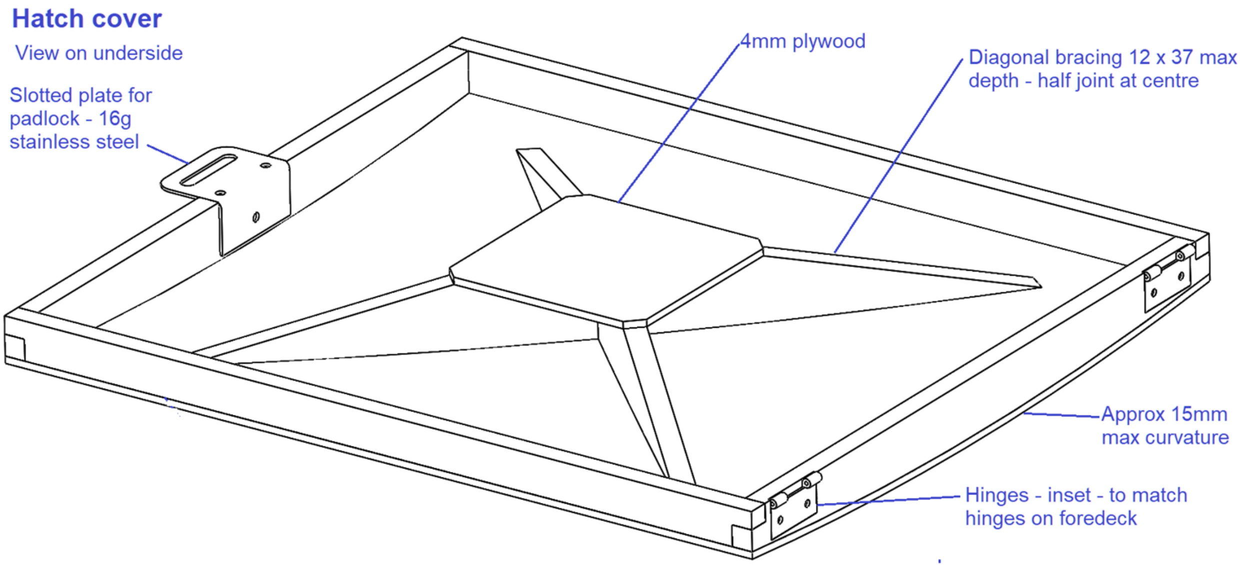


Hatch Cover

The foredeck hatch must be fitted with a cord stay to prevent the hinges being damaged by the hatch opening more than about 100 degrees.

The hatch is strengthened by diagonal bracing on the underside.

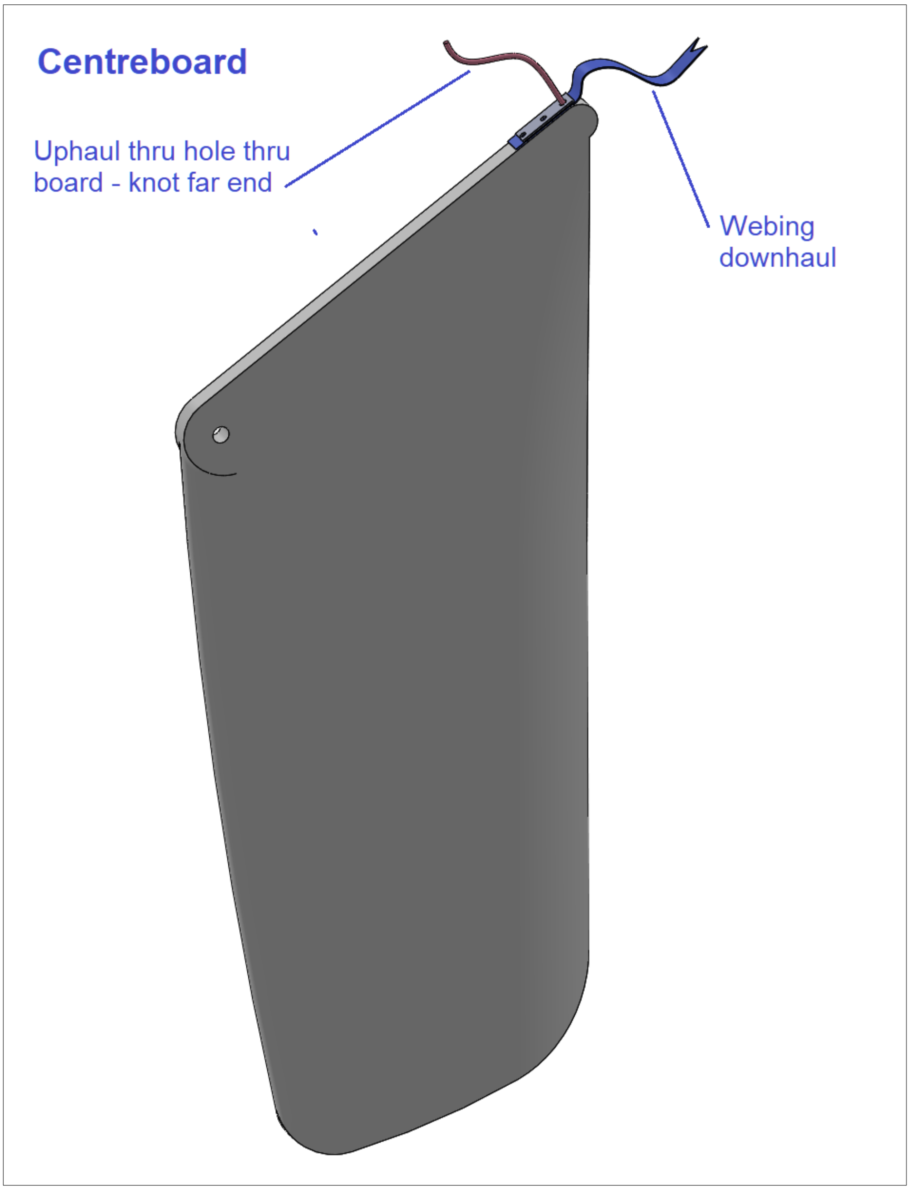
The hatch cover can be locked closed with a small padlock through a U bolt that passes through the slotted plate as drawing below. A simple turnbuckle catch can be made from a small piece of plywood, say 25 x 50, this being screwed to the foredeck alongside the slotted plate to provide a way to hold the fore hatch closed without using a padlock.



Centreboard

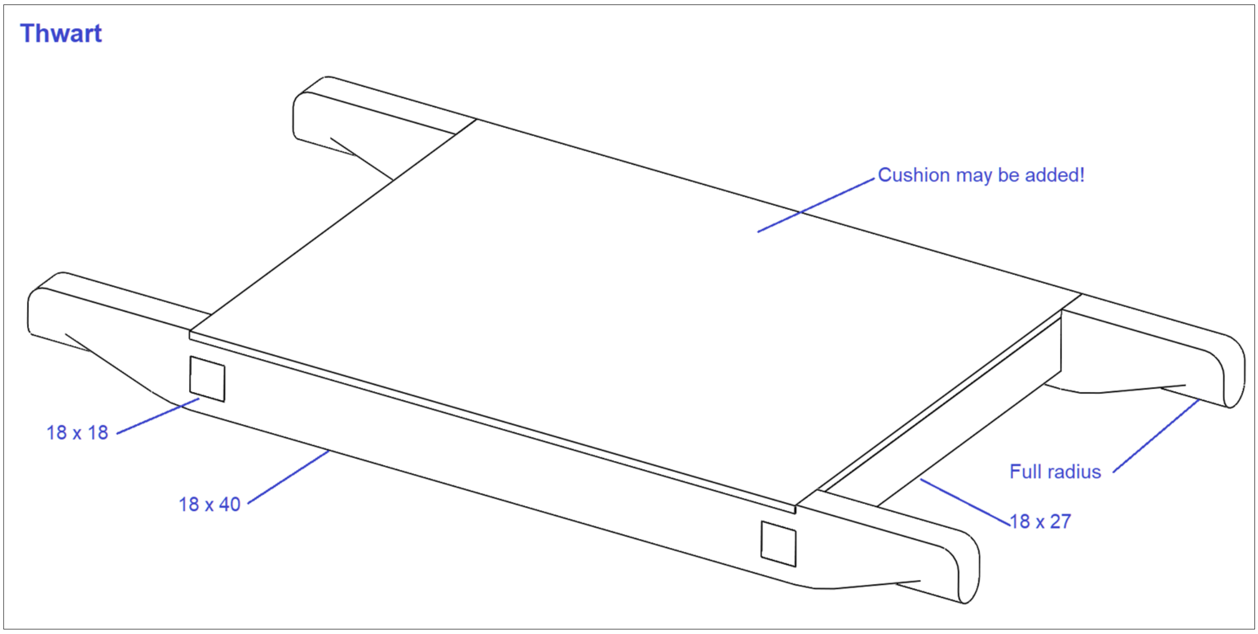
The design features a pivoting centreboard offset from the centreline of the hull (an off-centreboard) The author considers a pivoting board superior to a sliding 'dagger-board' although it is more complicated to build. A pivoting board is less vulnerable to grounding damage. it can stay permanently in its case so does not take up space in the boat when not under sail and it allows some adjustment of the centre of lateral underwater area. But if the builder prefers a dagger-board this could easily be substituted – it would be in the location to give similar centre of lateral area as the centreboard and would slide vertically.

The leading and trailing edges of the centreboard (and rudder blade) should be shaped to streamlined profiles, this shaping can extend approximately 30mm back from the leading edge of the centreboard and 60 mm forward from the trailing edge of the centreboard. It is recommended to apply epoxy-glass sheathing to the centreboard and rudder blade with extra thickness at the leading and trailing edges. The thickness of such sheathing needs to be taken into account to achieve suitable clearance with the casing. The centreboard can be plywood or can be made from strips of wood glued edge to edge. If the latter, then epoxy sheathing should resist warping, it may also be beneficial to let a transverse half thickness piece into the top edge.


Centreboard
Uphaul thru hole thru
board - knot far end
Webing
downhaul

Thwart

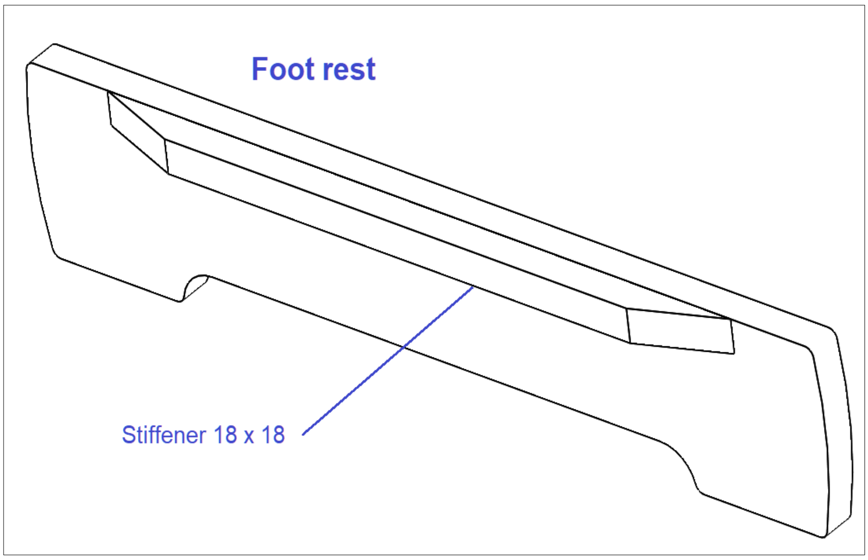
Two thwarts allow a rower and passenger to both be on the centreline. The thwarts are fore and aft adjustable in steps of 115mm by notched rails attached to the side panels.



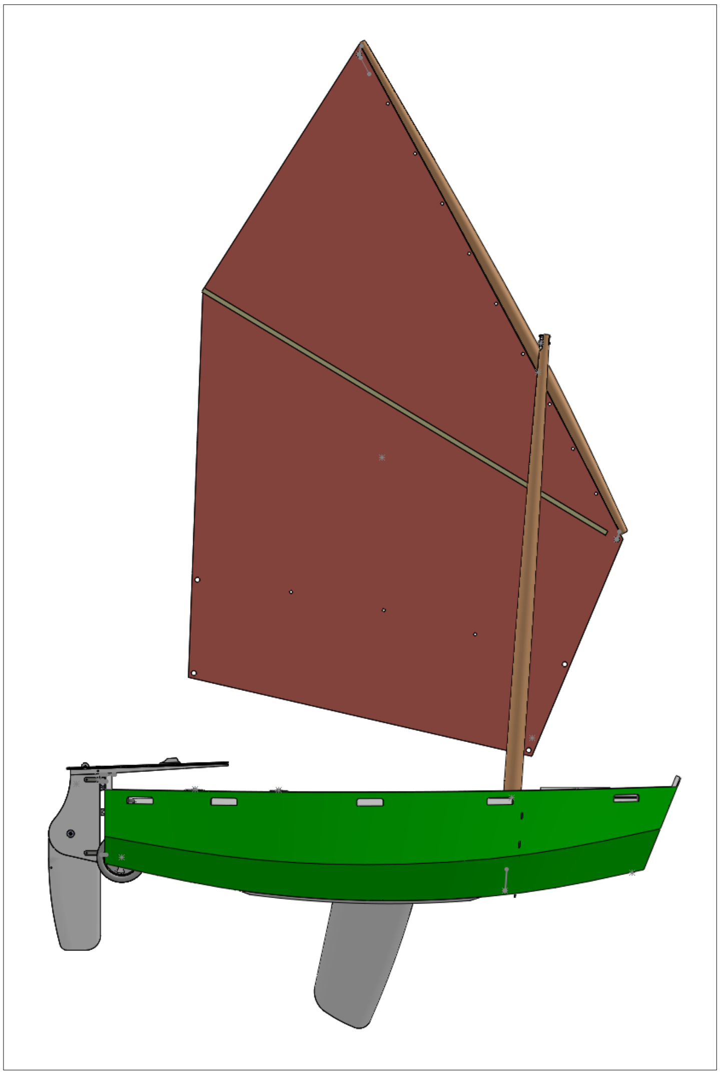
Footrest

The foot rest is used only when rowing with the forward pair of rowlocks, i.e. with one person on board. The footrest is held in place by chocks on the side panels. If preferred, additional chocks could be provided to allow adjustment for leg length.

The ends of the footrest are slightly curved so that it cannot jam.



Rig



The rig, as at right, is a standing lug sail on a non-stayed mast. A full length batten makes it part way to being a junk rig without the complication of sheets to the batten ends. The sail is loose footed so that it can be lifted over the head(s) of the crew when tacking - this is considered the best option for a very small boat. Sail area as drawn is 3.3 m^2, which is similar to the Optimist children's sailing dinghy. Sailing performance should be similar to an Optimist dinghy with similar payload, i.e. rather slow in light winds or when heavily loaded but capable of sailing in wind strength to around F8 in sheltered waters. The sail aspect ratio is greater than that of the Optimist dinghy which should slightly help windward performance but will also increase heeling moment but the hull being slightly wider than the Optimist hull allows more righting moment to compensate.

A single slab reef taking 400mm off the foot of the sail is suggested, a second reef would be possible.

The suggested mainsheet arrangement is two separate main-sheets, one for each tack (similar to the usual sheeting of a foresail). The twin mainsheet is some extra complexity but for sailing to windward this arrangement should give a good sheeting angle together with down tension on the clew. The sail area is such that it is probably acceptable to have no mainsheet purchase, i.e to have each mainsheet terminating at the sail clew. If some purchase is required the clew corner of the sail could be divided into two fabric layers with two clew cringles, one for each main sheet, the fixed end of each being secured at the transom to give a nominal 2:1 purchase (ignoring friction) without needing blocks attached to the sail.

The use of two main sheet positions was common on traditional lug-rigged working boats, typically there would be a hook at each stern quarter and the main-sheet would be swapped between hooks on tacking. The use of twin main-sheets, as suggested for this design, provides similar control of the sail but should be easier for short tacking.

Spars and Oars

Wooden spars are suggested, it is considered that these suit the character of the boat but aluminium tubes could be an alternative.

	Mast	Yard	Oar (typical)
Overall length	2295	2295	2200
Distance from lower end to maximum diameter	400	850	630
Diameter at lower end	54	30	30 (inner end)
Diameter at maximum thickness	72	54	46
Diameter at upper end	36	25	40 (at root of blade)

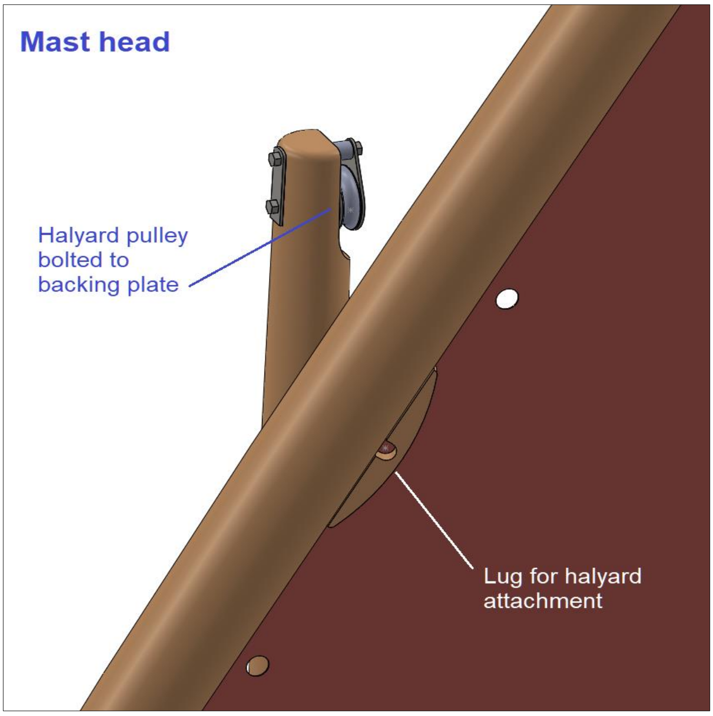
(Estimated factor of safety for mast is about 2.0 based on two 80kg adults sailing with full sail in wind strength Beaufort 8, taking modulus of rupture for the mast timber to be 70MPa)

The location for maximum thickness of the yard is also the position for the hole in the lug for attachment of the halyard to the yard. This lug is also be used to attach a cord loop round the mast to limit the distance the yard can swing away from the mast while the sail is being raised. This loop may only be needed when the sail is reefed.

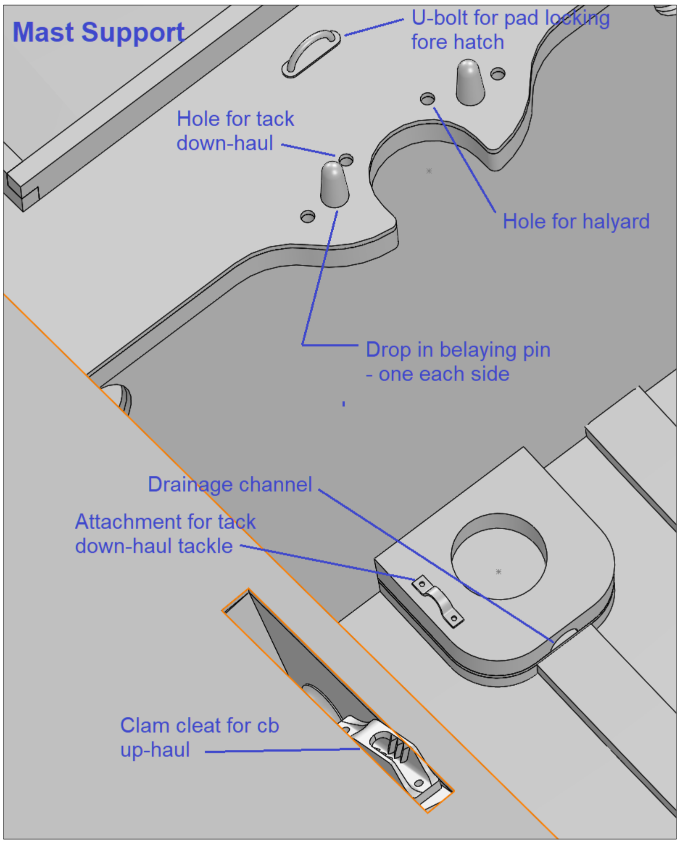
Oar dimensions can be adjusted to suit personal preference or ready made items available. If making from scratch it is desirable for the section at root of blade to be oval, with larger diameter fore and aft. The easiest way to make the oars is to glue a plywood oar blade to a shaft but this is not as good for single oar sculling as an oar made conventionally with a shaft that blends smoothly with the blade.

This boat will not be particularly suitable for single oar sculling since the transom is fairly low, but if single oar sculling is required then it is suggested that a extra rowlock socket be mounted on a wedge shaped block on the transom – see stern view drawing.

Glass-epoxy sheathing or traditional leather can be applied to oars in vicinity to rowlocks and to mast and yard where they are in contact when sailing. If collars are fitted to oars these may need to be trimmed to allow oars to stow as shown on drawings.



The arrangement at the mast head is as drawing above,
The yard is transversely drilled in a vertical plane close to each end for attachment of the sail and a wooden lug for the halyard is offset 25 degrees from this vertical plane. A loop is spliced into the halyard and fastens round the yard 'luggage tie' style



The drawing left shows the arrangement to support the mast.

The mast sits in a recess at the hull bottom and is held in place by a wrapping a cord a few times round two belaying pins at deck level. This arrangement is considered easier to use than having the mast plug into a socket, especially with the boat afloat. If preferred, a hinged mast gate would be an alternative to a cord lashing. The recess into which the foot of the mast is inserted should be tapered, a taper included angle of about 16 degrees is suggested.

The mast is raked forward, this is to achieve balance under sail but it also makes stepping the mast easier – the mast will stay in place while the securing lashing is being set up.

It is anticipated that considerable tension will be required on the sail tack so a tack downhaul with pulley blocks giving at least a 2:1 purchase is suggested. The lower block would attach to the eyestrap close to the mast foot (see drawing) and the clew downhaul would be taken from the upper block through the hole shown at foredeck level to a snap shackle or strong hook to clip onto the tack of the sail. The removable belaying pins shown in the drawings can be used to tie off both the tack down-haul purchase and the halyard as well as being used for the lashing securing the mast.

Sail

A .dxf file is provided for the sail, this is intended to provide the nominal overall dimensions but a skilled sailmaker, amateur or professional, will build appropriate curvature into the sail allowing for the bending of the yard from tension in the halyard. A good sailmaker may ask to inspect the yard to judge its stiffness.

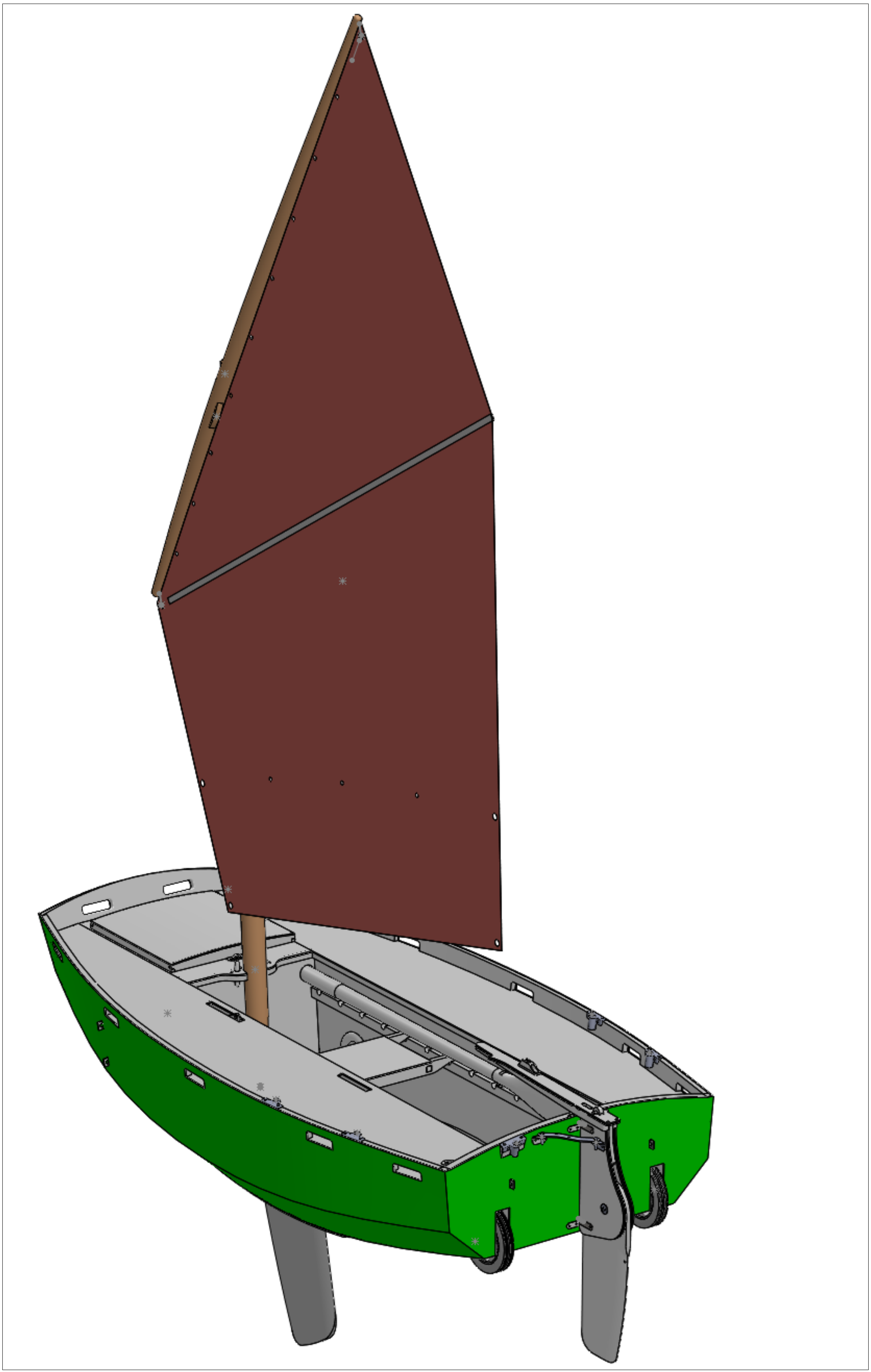
The full length batten in the sail can be from fibreglass sail batten material, stiff over the aft third of the length but then increasingly flexible towards the luff. The full length batten should reduce flogging of the sail during hoisting and tacking, a second full length batten midway between the one drawn and the sail foot could be considered to further reduce flogging.

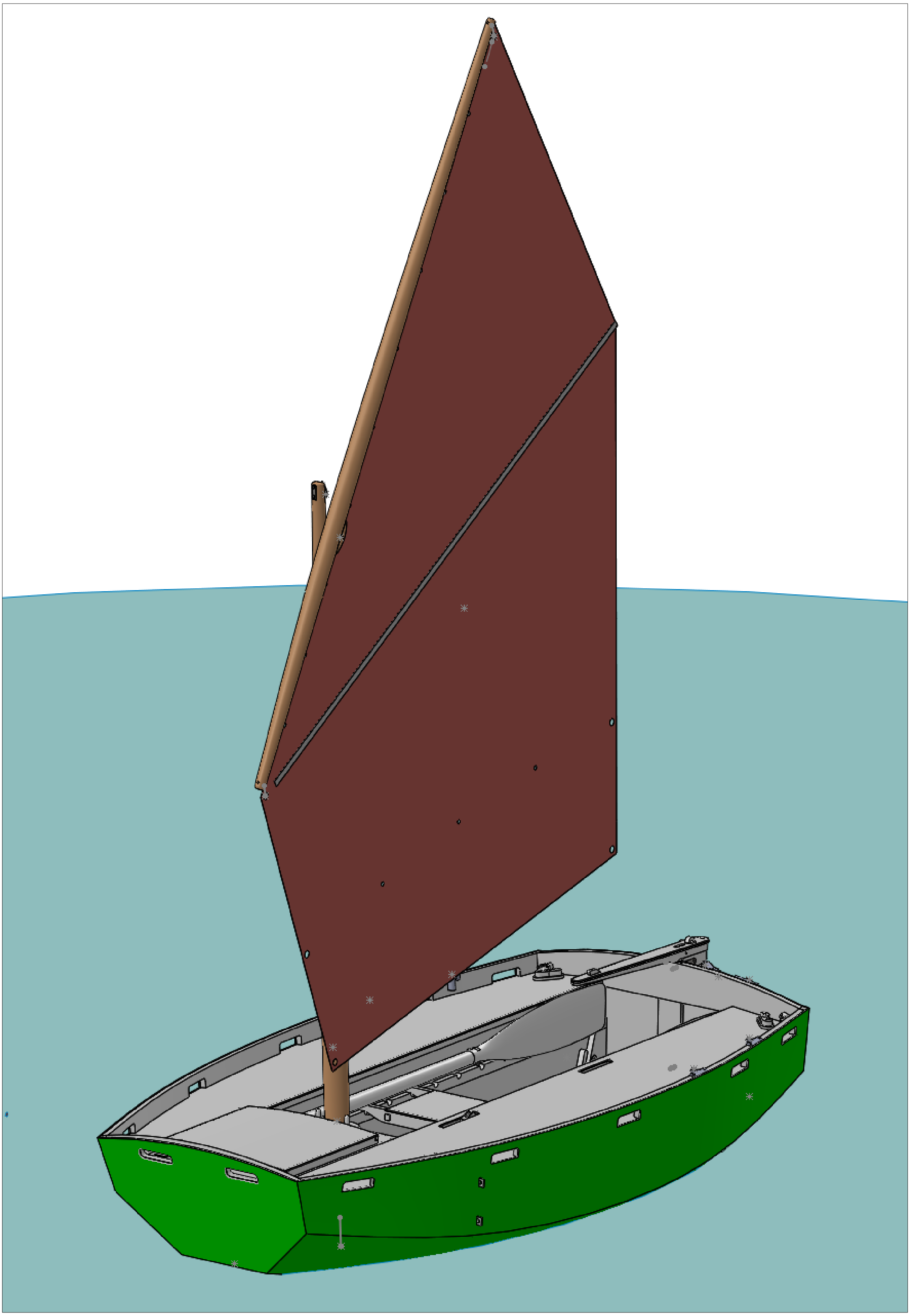
The sail area as drawn is limited by the desire to make both the spars stow in the length of the boat – they will lie on top of one of the buoyancy tanks when not in use. If this is not a requirement a higher performance option would be to increase the mast length by say 400mm with that length added to the foot of the sail and with a second full length batten midway between the batten drawn and the sail foot.

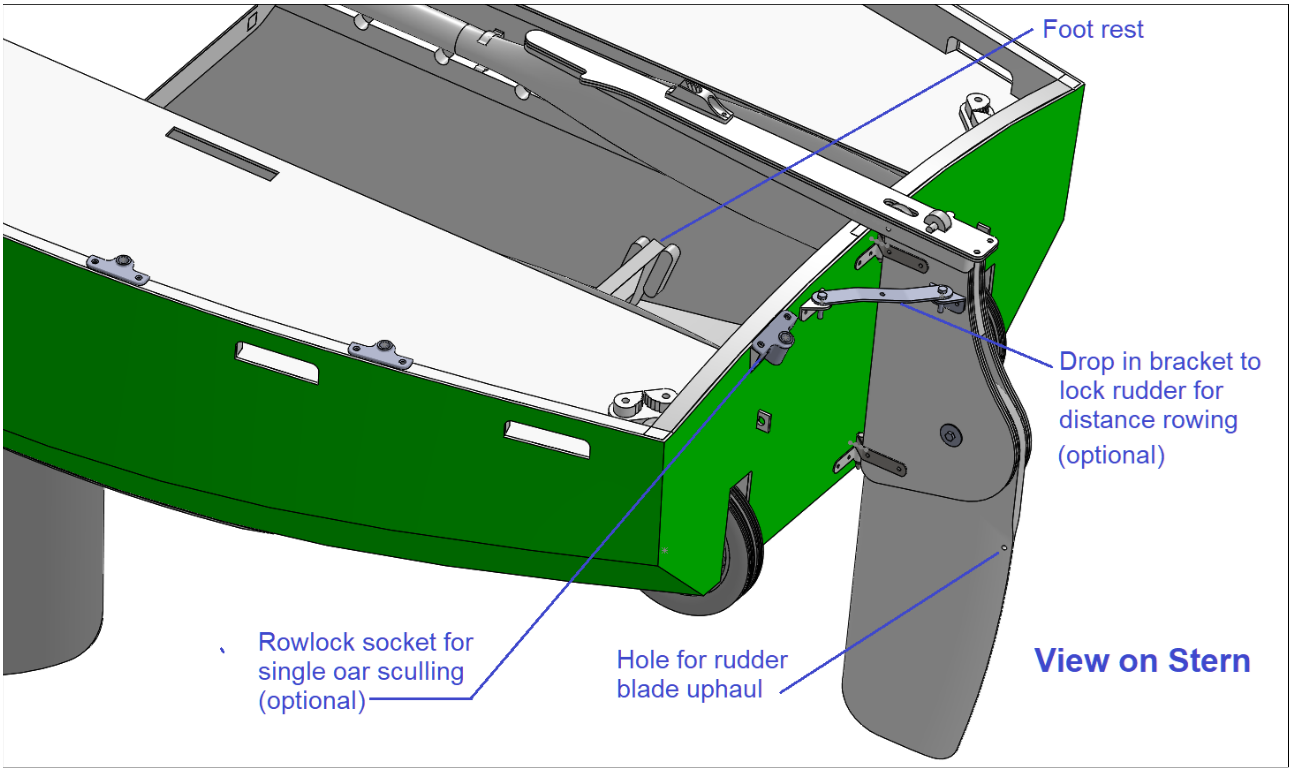
Sea Trials

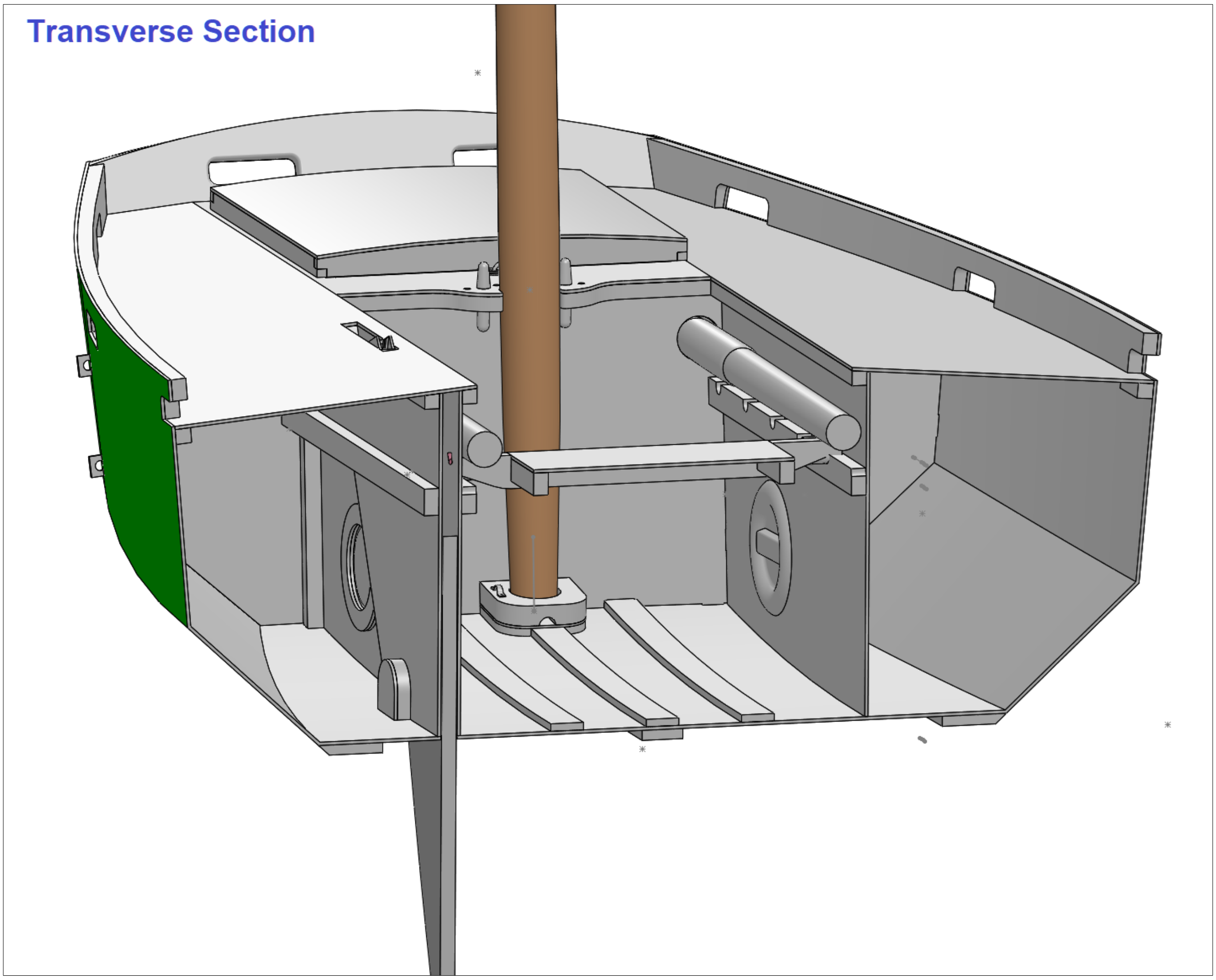
Since the rig of the boat is slightly unusual and is set on a new hull design it is suggested that the exact position of the main-sheet fairleads and the fully lowered centreboard should be set after an initial sea trial. The fully lowered centreboard position can be set by fastening a small block (not shown on the drawings) inside the centreboard case using screws through the port cockpit wall. For sea trials, the main-sheet fairleads could be mounted on a piece of plywood fastened with G clamps or similar to the inside of the transom so that they can be adjusted laterally. If cam cleats are used for the main-sheets then wide backing pads for these could be built in during the construction so that these cleats can be fixed in the best position after a sea trial.

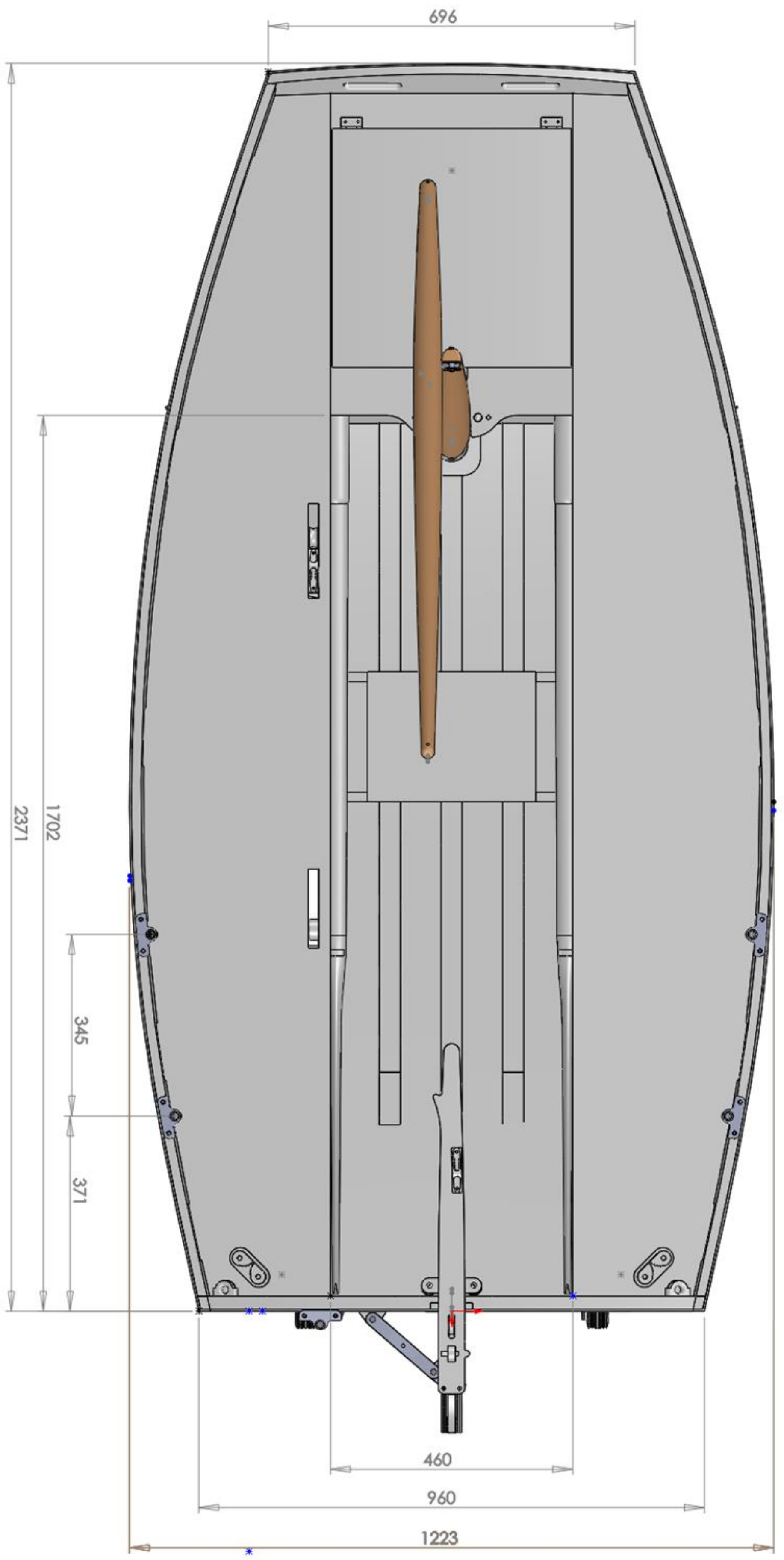
Pictures of Complete Boat

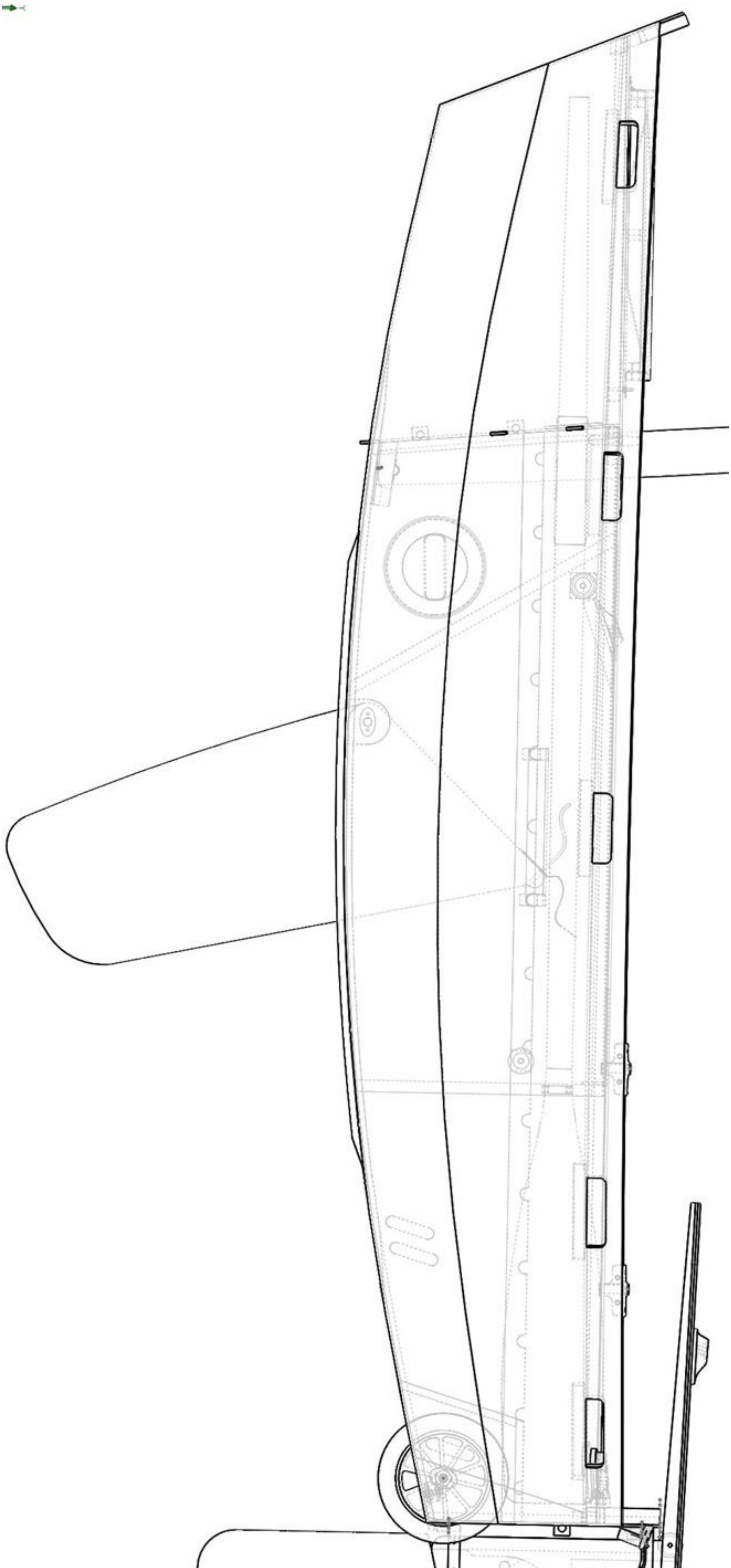


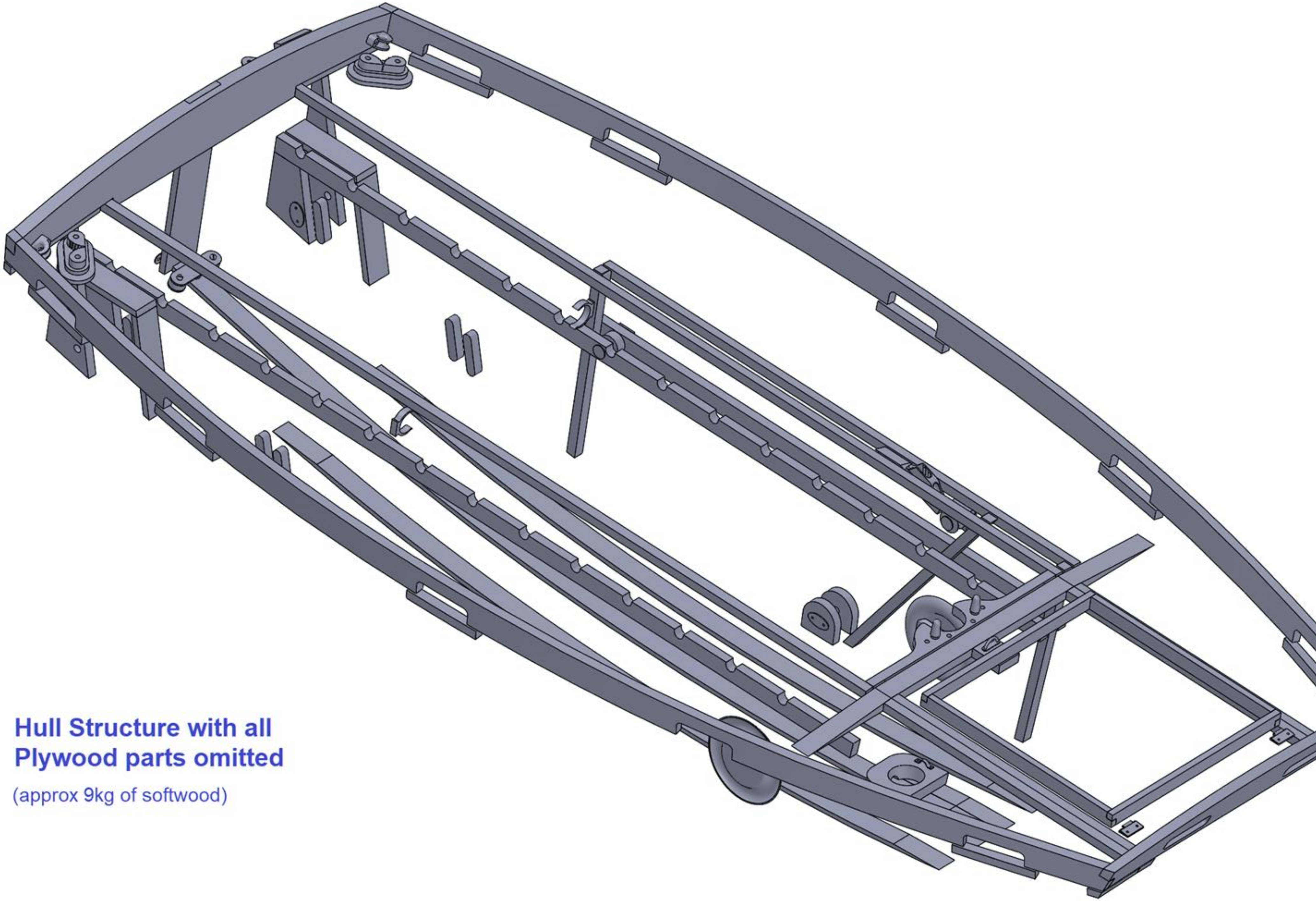



Foot rest
Drop in bracket to lock rudder for distance rowing (optional)
Rowlock socket for single oar sculling (optional)
Hole for rudder blade uphaul
View on Stern


Transverse Section


696
2371
1702
345
371
460
960
1223





Hull Structure with all Plywood parts omitted

(approx 9kg of softwood)