With photographs by the author.

If strips make planking easier for amateurs, how much easier are they for professional boatbuilders? Dick Phillips continues his new series on building

Roxane in Wood

Some boats are built to strict measurement rules and specifications which stipulate the tolerances to which they may be assembled and the materials from which they must be constructed. Other boats impose few such limitations on builder and customer, allowing them a virtually unlimited choice of modes of construction and boatbuilding materials. Designer Nigel Irens offers a number of options to which Roxane's 28'6" (8.7m) hull may be built. Charles and Gillian Taylor asked me to build their Roxane using western red cedar strip planking over a Douglas fir backbone and frames, all sheathed with epoxy resin and glass cloth. The best known other option is, of course, the GRP version which is built by Concord Beheer BV in the Netherlands.

Another timber built option for Roxane is to plank up with the more dense species, Douglas fir, using thicker strips with a thin layer of glass cloth. This method allows the builder to bright finish the hull inside or out with the minimal layer of glass/epoxy coated with varnish displaying the natural grain of the timber. It is also an option which may be preferred by those who feel that it is more eco-conscious to use a larger proportion of the renewable resource, timber. This method of construction relies more heavily on the properties of the timber with the glass cloth providing some abrasive resistance and serving the purpose of retaining a thicker layer of protective epoxy resin.

The decision to use western red cedar strips was influenced mostly by Charles and Gillian's mooring which they wish to retain. It is situated on one of the tributaries of the Fal and although in deep water most of the time, it is one of those which dry out on spring tides. The bottom is clean sand and will not present a problem when Roxane takes the ground but with this type of mooring, the wrong combination of wind and ebbing tide could cause the boat to sit on mooring chain or even the sinker itself. With such a possibility and the fact that some of their cruising may include drying out on tidal rivers, it was decided the more prudent option would be to build with a substantial layer of glass/epoxy on her bottom.

Laminating the inner stem needed all the clamps we could find.

The laminated inner stem – apron – in position on the building jig.

With the transom, laminated from 2 layers of 1/2" (12mm) marine ply, in place, we begin work to fit the inner keel or hog.

The hog and apron are joined with two staggered scarph joints.

The Backbone

Before starting the planking process, we had to make and fit the backbone structure. On a modern wooden boat this consists of the inner stem, inner keel, transom knee and transom; traditionalists please read: apron, hog, stern knee and transom. Whatever terminology you use, this structure is vital to the longitudinal strength and stiffness of the hull. It also keeps the port and starboard sides together! In keeping with Nigel Irens's design principles, the structure is engineered to make full use of the material properties of the timber and resins. For this reason, the scantlings – dimensions – of the parts may appear somewhat fine to the aforementioned traditionalist but they are as heavy as is required for the stresses to which they will be exposed, even under the most severe conditions.

The inner stem was laminated first as it is a substantial lamination and would require to cure fully before being released from the jig. Its moulded thickness is 1 1/2" (38mm), made up of four laminations of 3/8" (9.5mm). To find out what thickness will bend around a given curve, try a sample of the thickest realistic lamination. In this case, you might thinkthat three laminates just over 1/2" (12.5mm) might be feasible, so cut a test laminate and try to bend it around the required curve. If it proves too stiff, plane it down to a thickness which will bend easily and also make up the required thickness in full laminates, for example, 4 x 3/8" (9.5mm) or 5 x 3/10" (7.6mm) or 6 x .... The sided width of the inner stem has to be 9" (228mm) to give enough width where it joins the inner keel.

At the start of the project, along with the CNC machined building moulds for the building jig – see W68 – Alec Jordan of Jordan Boats also supplied us with a stem template and transom pattern. This stem template was used to set up the laminating jig by positioning the brackets around the curve and bolting them in place. In order to keep the laminating jig clean, we wrap the glued up the laminations in polythene.

The glue mix is made up from epoxy resin with colloidal silica and wood fibres added; the silica makes it thixotropic and stops it running while the wood fibres bind it together improving its tensile strength. When clamping up a laminate like this, there is some risk of glue starvation by over tightening the clamps. Care should be taken to avoid this but of course, the glue joint must be closed. To ensure that all of the glue is not squeezed out, I usually score up the faying – mating – surfaces with a sharp knife or chisel. This roughened surface packs the surfaces apart slightly.

The inner keel also requires laminating but as the curve is so much more gentle than that at the forefoot, we used two laminations of 3/4" (19mm) to achieve the same 1 1/2" (38mm) thickness. The main difficulty we encountered in making this part was to find Douglas fir wide enough to span the necessary 16" (406mm) siding. I managed to track down some 12" (306mm) wide stock at John Moody's timber yard in Devon and ensured nobody else got it first by fetching it myself. This gave me the chance to meet John, the boatbuilder who sells timber, face to face for the first time. We have had numerous telephone conversations when I was purchasing timber in the past and have several friends in common but had never met. The great advantage for us when dealing with John

Laminating the inner keel in situ over the building moulds. The inset shows the jig we made for scarphing the strip planks with the router.

is that he not only understands timber but he also understands boatbuilding – a great combination!

To join the stem to the keel, we needed to cut two staggered scarphs on the laminations. This means that the stem will have the outer two laminations cut as a scarph just aft of Station 2 and the inner laminations scarphed at Station 3. These scarphs will then coincide with the two laminations on the keel which are cut to fit them. Effectively the stem will be joined to the keel over a distance of 18".(457mm). The two boards supplied by John Moody were machined down to thickness and trimmed to the approximate shape, allowing for waste, before bending them over the moulds on the building jig. After this test run, grounds – timber strips – were fitted to the bottom of each mould to provide both a cramping point for laminating and a place to secure the finished keel. The same method of application was used for glueing the keel laminations as was used for the stem but instead of wrapping it in polythene, we covered the bottom of the moulds with parcel tape to prevent any stray glue sticking the keel to the mould. As well as cramping the keel laminations to the moulds we added another two cramps in each space between the moulds to ensure an even glue joint.

While the glue was curing on the keel and stem, we cut out the transom to Alec's template. This is shown on the drawings as 1" (25mm) thick and as we had some 1/2" (12mm) marine plywood, we used two thicknesses glued together. At the same time we made a transom knee to brace the keel to the transom. This may be made from a solid piece of Douglas fir as the angle between the two is so great that there is little risk of short grain. We laminated ours with four off-cuts from the stem laminations and added a solid block of Douglas fir to fill it out to the bottom of the transom. A slot needs to be cut in the aft mould at Station 11 and some of the vertical beam needs to be removed to accommodate the knee on the building jig but this is easily accomplished.

The backbone structure now needed to be assembled on the jig; an operation which needs to be planned carefully. Each part needs to be trimmed within a few millimetres of its finished shape so that the final fairing-in may be completed after assembly on the jig. The stem is placed in position and the centreline marked on the inner and outer faces. The inner line is taken from the moulds and ladder frame while the outer line is plumbed down from a centreline which was set up after the building jig was finished. This line is suspended above the building area from two stout angle iron brackets bolted to the floor. Once the centreline is picked up, a series of widths are marked on both faces from dimensions given on the 'keel' drawing which gives detail of much of the backbone shape. Then the stem is trimmed back to within approximately 1/16" (2mm) of the lines.

Exactly the same operation was carried out on the keel after the glue had cured and it had been removed from the jig, cleaned up and had two strips of timber added to the sides to bring it out to the required width. These pieces of wood were glued on with the same epoxy glue mix and were held in line with 'biscuits' – small wafer-shaped pieces of plywood — and then held in place with sash cramps across the keel. With the transom cut to shape, the knee could be fitted between it and the keel. We then dry-fixed everything to check that it all aligned nicely before applying the glue.

Once the backbone structure in place and finally fitted, we then inserted wood screws to secure it all to the jig. This had to be done in such a way that they could be removed after the hull was planked up and turned over. Screws were therefore inserted where each mould meets the stem, keel and knee with additional bracing to ensure that the transom stayed exactly in position while the planking process was carried out. Everything was then disassembled so that the glue could be applied. Our routine for glueing up these joints is to wipe all surfaces with epoxy cleaner, score the surfaces, apply resin as a primer to the faces then thicken the resin and apply to both faces. This is what most manufacturers recommend – except perhaps the scoring – and if you follow their instructions, you find the system works. While the glue was setting we made templates of the keel and stem sections given on the keel drawings which assisted us when fairing in the backbone before planking. The last job before planking began was the application of parcel tape to all mould edges and any other surface to which the hull might stick.

Strip Planking

The most important phase of strip planking and indeed, any type of hull planking is the setting out. When set out properly ,traditional clinker, carvel or diagonal planking is a pleasure to behold. As well as the aesthetic value of properly set out planks, their ease of fitting and the economy in the use of material that may be gained when the optimum line has been struck is just as important. It is the same with strip planking: when properly set out and fitted, it should flow around the surface of the hull without any tight bends or painful contortions. For this reason the first stage in strip planking is to study the shape of the hull.

Roxane's hull shape is one which lends itself readily to strip planking. She has a relatively narrow beam with soft bilges, added to which she has no extreme concave shapes and beautifully flowing lines with no nasty surprises. The slight concave deadrise aft of amidships has the potential to cause some concern to the boatbuilder but with a little thought and batten-bending, a plan can be formulated. Experience must also count for something and readers may recall we built a strip planked Romilly, Roxane's little sister, some years ago.

There are three basic approaches to setting out strip planking. Start planking from the sheer, start from the keel or start halfway up the amidships section. This may seem simplistic and a little obvious but these options have some ramifications.

Planking from the sheer has the advantage of allowing the strips to follow its line and if bright finished, it looks similar to conventional carvel planking. The drawback could be, however that the edge bend becomes too extreme to fit when nearing the bottom of the boat and a new line may need to be struck.

Planking from the keel upwards has little going for it today when most boats are built upside-down but larger boats were often planked this way up to around the waterline when the edge bend necessitated a new line to be struck and the planking begun again. Some designs with extreme sheerline lend themselves to this approach.

First strips in place. Note the datum plank marks on the moulds.

Robbins' Rapid Strip is self-locating which speeds up progress.

Strips are held in place temporarily by screws and penny washers.

Planking from the halfway mark on the amidships section has the advantage of easing the amount of edge bend in the strips and sharing it between the sheer and the keel.

This is the method we used on Roxane. First, a sample strip is laid around the hull from a point halfway up the girth of the amidships section on Station 6, measuring from the sheer to where the last plank will fit at the keel. This strip must be straight with no kinks along its length and it must be laid with no edge bend when it sits on the moulds from the stem to the transom. When the strip has been laid so that its ends are equidistant from the forefoot and the bottom of the transom but still laying straight with no edge bend, the ideal line has been arrived at. We then mark this line on each body mould.

From this series of marks, we decide where we want to begin planking by measuring down from them towards the sheer in multiples of the plank width. We are using Robbins 'tongued and grooved' Rapid Strip in the nominal 1 3/4" x 5/8" (45mm x 15mm) size which actually covers 1 5/8" (41mm) when joined up. We measured down 15 plank widths which brought us to a point where we wanted to start the planking. This first strip runs from just aft of the stem head to Station 11, the last one and describes a moderate amount of edge bend as it follows the marks measured down from above. The amount of edge bend of following strips will now decrease as we plank up towards the middle of the mould where it becomes straight and as we progress up towards the keel, the edge bend will again increase gently.

There are three different types of strip planks: the simple square edge variety; the type with concave and convex edges often called bead and cove; and the 'tongued and grooved' type. This last is quicker to fit because it usually locates positively tongue into groove without edge fastening. Robbins supplied us with 20' (6.06m) lengths which we scarphed together in twos initially to give us the 30'9" (9.3m) lengths required to wrap around the sheer of the hull. We fitted the strips alternating the scarphs fore and aft and used the off-cuts to scarph in as shorter lengths were required.

The scarphs were cut on a scarphing jig with a slot to fit the 1 3/16" (30mm) router collar and the router was fitted with a 1/2" (12mm) straight cutter. We soon got into a routine of cutting scarphs on 24 strips, applying the glue and clamping them together on the floor with sash cramps, alternating the scarphs so that they aligned nicely in the tongues and grooves of the adjacent strips. Each scarphed plank was separated from the next by a length of polythene. Thus we had 12 strips glueing, 12 curing and 12 ready to be fitted at any time. The strips were fitted with the groove uppermost so the glue poured into it easily; with one person pouring while another followed spreading it evenly, the job took very little time.

At the start of each planking session, we cramped the strips together, tongue side up, on the trestles and applied resin to the tongues with brushes. We then put glue in the groove of the last strip fitted to the boat and fitted the next primed up strip. Once it had slotted tightly into the groove of the previous strip, it was held there temporarily by screwing it to the moulds. We drilled a clearance hole in the strip for the 1 1/4" x 8 gauge (32 x 4mm) round head screw before fitting a large penny washer to spread the pressure. Though very durable, Western red cedar compresses easily, hence the use of washers. At the plank ends, the strips were fixed permanently to the backbone with 316 stainless steel countersunk screws.

On the main body of the hull, we found it was not necessary to fix each strip to every mould and we developed a pattern of screwing one and missing one but ensuring that the strips either side were fixed at any one mould. However, we had two rules: at the end of each planking session we would fix the last strip at every mould to ensure that all the strips we had put on that session were held securely until the epoxy had cured. Most important of all, we would scrape off all the excess glue and wash down the surfaces with acetone, saving a large slice of time later on.

The time we spent carefully setting out the strips paid dividends, as they all swept around the hull easily requiring the use of a band clamp or luggage strap only twice to squeeze a number of strips together. At the forefoot area at the bottom of the stem, we had to use a cramp attached to the plank ends to apply some twist in order to get them to sit in the grooves. However, it is always best to look inside at the joints to see how they are fitting before applying too much clamping pressure to the strips: it is too easy to distort the fair lines which the strips naturally follow. Interestingly the strips followed the concave run at the aft end near the keel almost perfectly. We must have done something right!

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