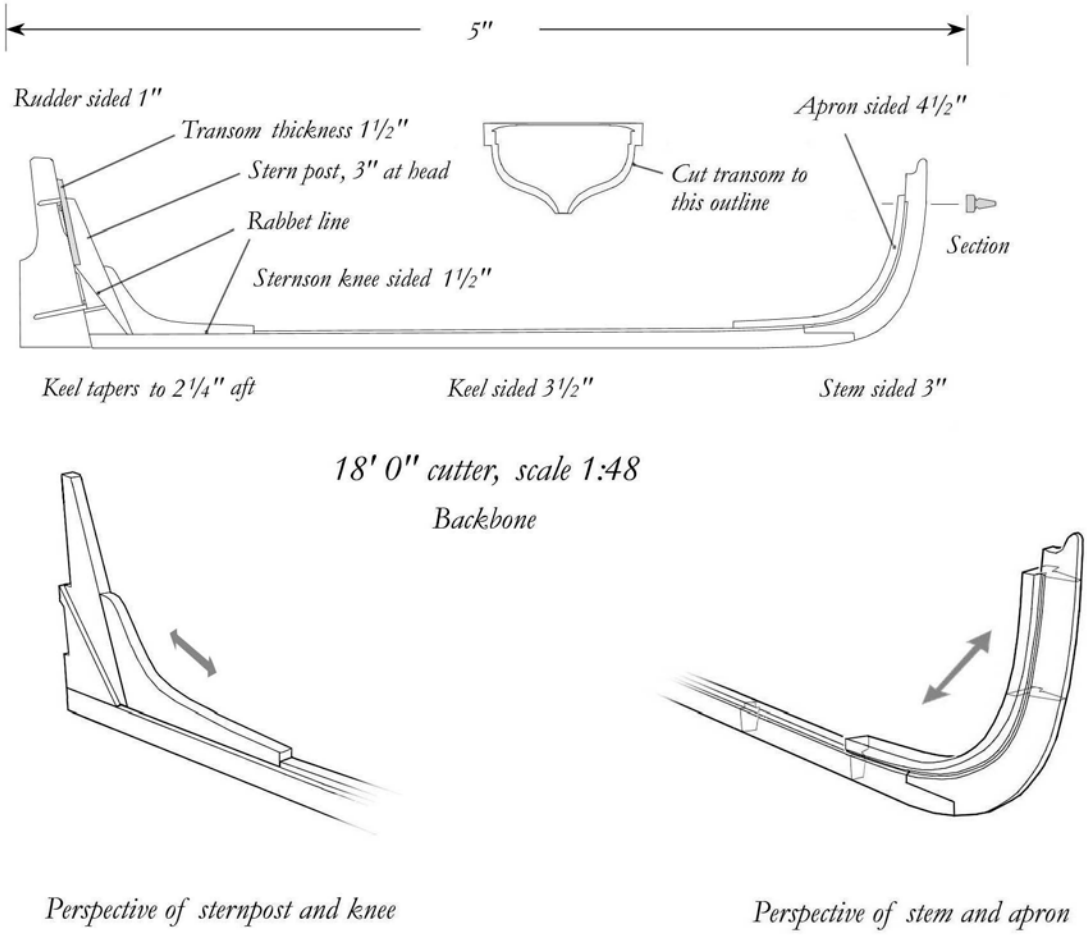
Building an eighteen foot cutter

There are many different methods to build small open boats. This is just one of many possible ways to achieve a satisfactory result. Here is a list of useful tools:

Surgical scalpel blade holder
#11 blades for the above
Swivel vise
Small cutting mat
Clutch lead holder and 4H leads
A sheet of 220-grit garnet paper
A sheet of 80-grit garnet paper
Small bottle of white glue
An 0 or 00 size quality 'round' brush
Ship's curves: *make them as described in the instructions*
Heat bending tool
Necessary wood, pre-thicknessed
Card for templates
90% ethanol
Painters' tape
Swiss files
Steel straight-edge (6" or 12")

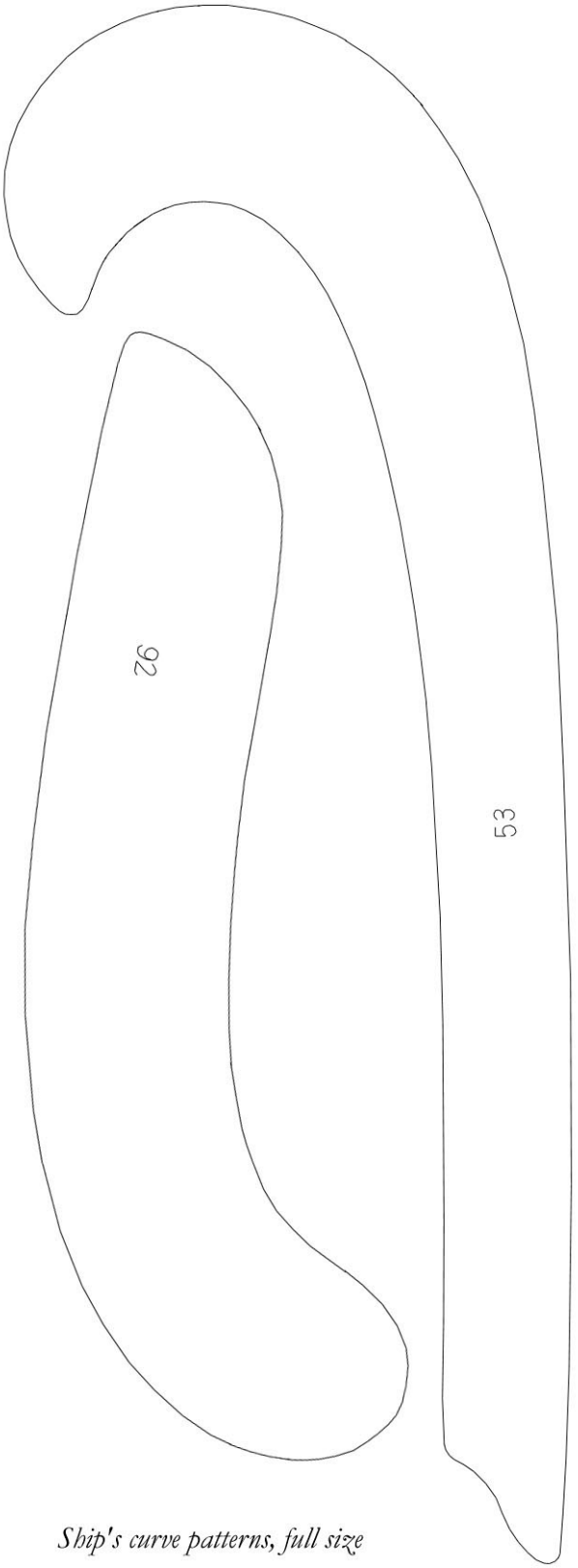
Let us begin with the keel. This is to be cut from stock 3½" thick. (All measurements given here, unless specified, are in scale feet and inches.) Note that the fore end of the keel begins to rise or 'rocker', so that you must allow for this when laying and cutting it out. Do not worry about tapering the keel at this point. Cut the keel piece a little over-length, say by about ¼" full size. Allow the extra length to overhang at the stern. Now mark out and cut the scarph joint at the bow.

The next job is to cut in the rabbet. This is easier to do than on a ship model. It is simply a right-angled rebate. I cut my rabbet with the scalpel. If you've never used a scalpel before, you need to be very careful. The extremely sharp blade was designed for cutting skin and flesh, which it will do very efficiently if you are not careful! It is much keener than your average X-Acto blade, so treat this tool with respect.



To begin the rabbet, mark out the lower line along the side of the keel with a sharp 4H lead. When marking out, you need to be extremely exact. If not, your rabbet on each side of the keel will be at different heights and the boat lop-sided. Once satisfied with your mark-out, take a metal straight-edge and position it on the keel. You will need to place a piece of card or wood of similar thickness to the keel under the straight-edge as a shim to stop it rocking or slipping. With *extremely* light pressure, run the scalpel blade along the keel to the point where the rabbet begins to rise at the bow. To follow the rise of the rabbet here, follow the instructions in the next paragraph.

In order to cut this curved line, a template is needed. I have supplied patterns for two ship's curves (next page), assuming that you do not have a set of your own. Glue these to a piece of 1/32" (actual) thick model aircraft plywood or clear acrylic sheet, cut them out and sand the edges smooth. These curves will be essential when it comes to cutting planks.



Ship's curve patterns, full size

To complete the rise of the rabbet, use a suitable section along one of your new curves as the template. Turn the keel over and repeat this process on the other side. Now mark out the top of the keel. The rabbet should be 1" deep. Again, position your straight-edge with a shim under it, and run your blade along the line lightly. Repeatedly cut lightly from side and top until the strip of wood separates in a nice curl. If you have handled your scalpel deftly, the rabbet should be crisp and clean.

Next is the stem and apron assembly. I opted to make this in one piece. If you wish to make the two pieces separately, feel free to do so. However, to get a nice close fit at the joint between stem and apron will be extremely tricky. Assuming that you will make this from a single piece, note the grain orientation (grey arrows on the perspective illustration). Mark the combination piece out on 4½" stock. Cut out the scarph joint with the lower edge of the apron and fit this to the keel. Don't cut the rest of the stem/apron to shape yet. (This will allow you to adjust the piece before finishing it so that the stem will be positioned exactly relative to the keel. This is critical for the backbone to fit your plug properly.) Once you are satisfied with the fit of the scarph joint, check that the stem exactly fits over the scale drawing. If it does, cut the rest of the profile out. If not, erase the pencil line, re-draw it in the correct position and cut it out.

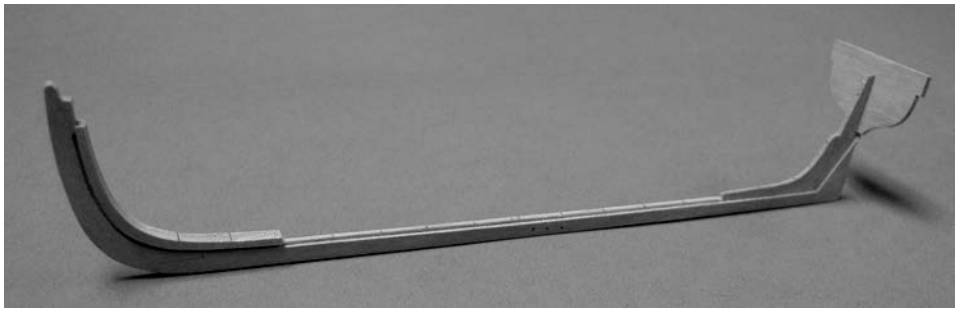
Before gluing up the scarph joint, the stem needs to be narrowed to 3" thick from the aft side of the stem rabbet forward. Mark out the rabbet if you have not already done so, ensuring that both sides match.

Using a ship's curve as a guide, run your scalpel blade along the aft rabbet line on both sides of the stem. With a well-honed chisel, pare the sides of the stem until it is 3" thick. The stem will be tapered later on. Next, mark the fore edge of the stem rabbet and cut this as you did the keel rabbet. Note that rabbet stops below the upper end of the apron. When satisfied with your work, glue and treenail the stem/apron to the keel. As the apron is 1" thicker than the keel, shim the keel ½" up from the bench so that the stem is centered on the keel.

The next step is preparing the keel for the sternson knee. Cut the top of the keel down to the lower rabbet line (see the illustration). Make sure that the top surface is truly level and

flat, and that the cut is exactly according to the plan. If it is 'off', the sternpost will be either too far forward or aft and the backbone will not fit the plug.

Trace and cut out the sternson knee, aka deadwood, from 1½" stock. Make sure that the grain of the wood runs diagonally. Next is the stern post. Trace and cut this from 3" stock. It will also be tapered later on. Cut the rabbet in with scalpel and chisel. Study the perspective drawing first to see how the rabbet angles up the post to the notch for the transom. Cut the angled recess for the rudder iron on the aft edge of the post. It is quite different to those on a ship: study the drawing carefully. Glue and pin the stern post and sternson knee together. Again ensure that the knee is centered on the fore side of the post. Now glue and pin this assembly to the keel. Finally trim the aft end of the keel to the correct angle.



Cutter backbone completed: model by Greg Herbert

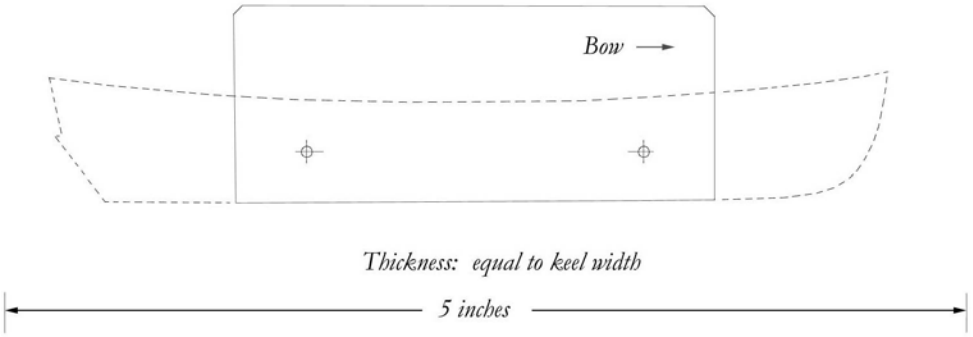
The transom is cut oversized from 1½" stock as shown. Don't make it any smaller or there will be insufficient material to cut a bevel for landing the planks on. The final shape and bevelings will be made later on. Set the transom blank aside for the moment.

Next, drill the stern post, keel and stem for the three ring bolts shown on the plan. Use a suitable size drill, depending on the wire gauge that you use. The ring wire can be of 24 gauge copper or brass wire, the bolt of a finer gauge. Make but do not fit these ring bolts yet.

The last important item to take care of is to carefully and clearly mark out all the station lines on the upper surface of the keel. Glue and pin the transom to the stern post.

Part 2 – Preparing the plug

The plug needs to be prepared before you can proceed. The inner surface of each half needs to be sanded smooth, flat and flush with the edges of the other sides. This is easily done. Place a sheet of 80-grit garnet paper on a level surface and 'scrub' each half-plug until all the excess resin has been removed.



If the locator holes for the dowels have not been drilled, carefully mark out and drill them so that the two sides and center plate align precisely, as shown above. Now assemble your mold. Do not cut off the 'fin' protruding from the top of the plug, as this is how the plug will be held in your vise. File out the slot at the forefoot of the bow just enough to accommodate the apron. It should be a nice sliding fit. To complete work on the mold, lightly sand the outer surfaces with fine sandpaper: just enough to remove the gloss and be able to make pencil marks on it.

Part 3 – Inserting the backbone, lining out the planking

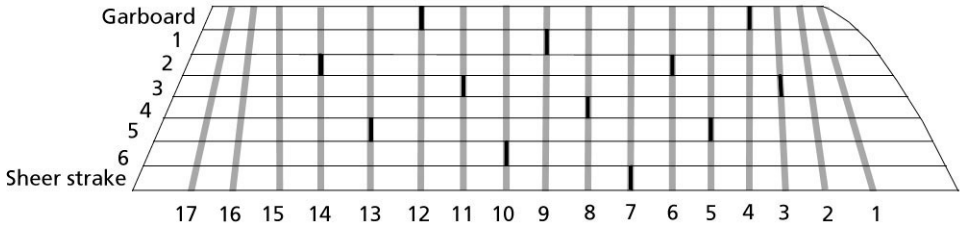
If work on the backbone of the boat was accurately done, it should slide into place on the mold nicely. If not, make the necessary adjustments. If there is any gap between the aft end of the plug and transom, fit shims to take up the space.

The next order of business is to line out the planking on the mold. Eight strakes of planking are about right for this cutter. Cut a few narrow strips of paper to use as tick strips. Bend a strip around at midships, putting one end into the keel rabbet, and mark the half-girth from the side of the keel to the sheer strake edge of the mold. Flatten out the paper and divide

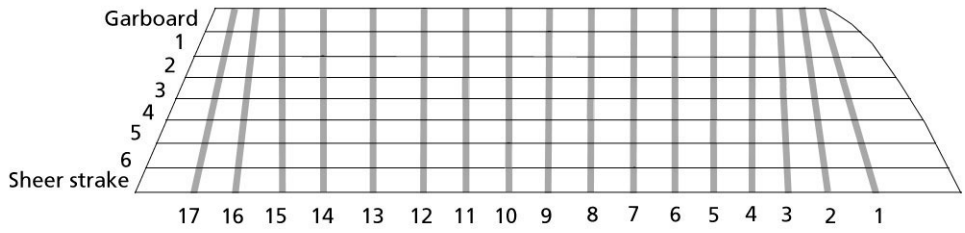
this distance into eight equal parts. You can do this using a radiating scale or proportional dividers. Transfer the tick marks onto the mold on just one side for the moment.

Repeat this process at the first and last square frame positions. Now carefully and lightly pencil the 'seam' lines on to the mold. Run the garboard strake out just ahead of the keel/stem scarph joint. This is the geometrical part of the exercise. Now examine the side of the hull from all angles. While the planking has been marked out mathematically, it may or may not run 'sweetly' to the eye. Adjust the lines of the run of planking until you are satisfied that it looks right visually. This step is part of the art of a good planking job.

There is one point to note. If this model were carvel built, the seam lines are in the correct places. However, this is a clinker-built boat and the planking overlaps have to be taken into account. Allow a scale 1½" for this purpose (1/32" full size). Redraw each 'seam' line this distance above (toward the gunwale) the existing lines. Then, using your tick strips, transfer the mark-out to the other side of your plug. Again, view things from every angle to make sure that your planking will run smoothly and in manner pleasing to the eye.



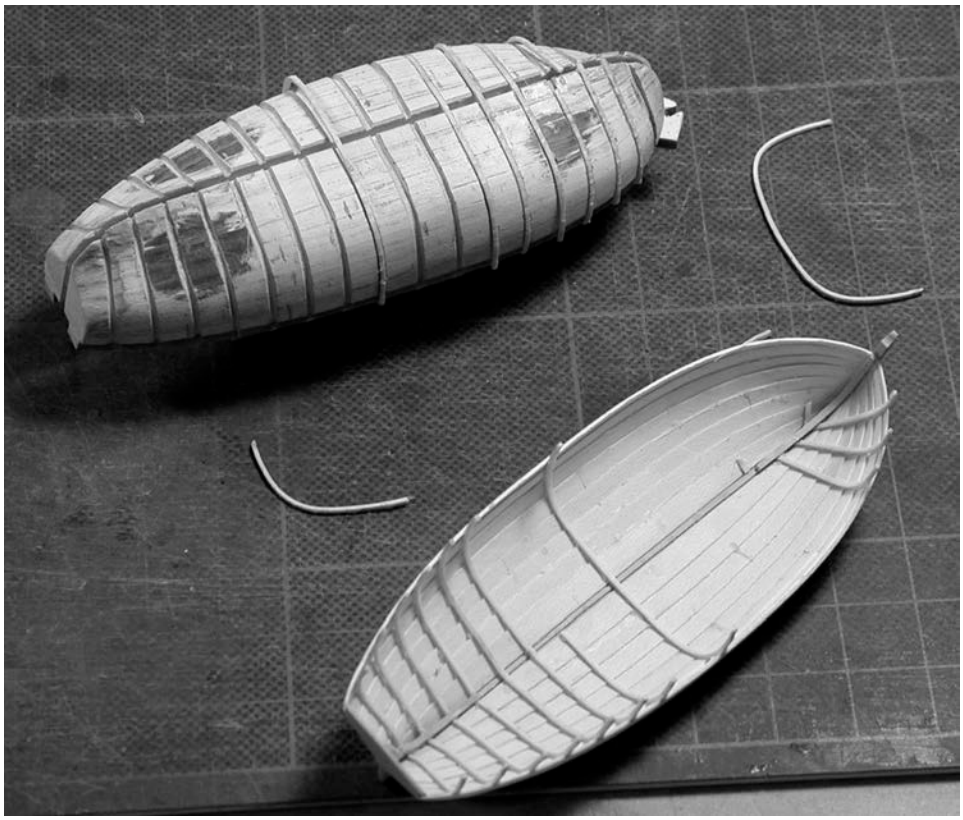
One possible planking shift scheme for 18' 0" cutter



Design your own shift of plank!

The last thing to take care of is the butts of the planking. Just like other planking jobs, there is a careful shift of these butts to be observed. I've provided one possible shift of planking in the illustration (previous page), and given an additional blank for you to work out a different scheme for your amusement or education. When satisfied with the shifts, transfer the mark-out to your mold. It will be difficult to pencil inside the grooves for the frames, so place the marks consistently just to one side or the other. The resin plug should not require waxing or other parting agent.

If the model were carvel planked, now would be the time to bend in all the frames. However, as there is so little gluing surface between frames and plank, it will be easier to build the hull shell first. When I built my cutter, I put in the frames as I had for the carvel boats. On removing the hull from the plug, most of the frames remained on the mold!



The result after removal of the boat from the plug (see text above).

Part 4 – Planking up

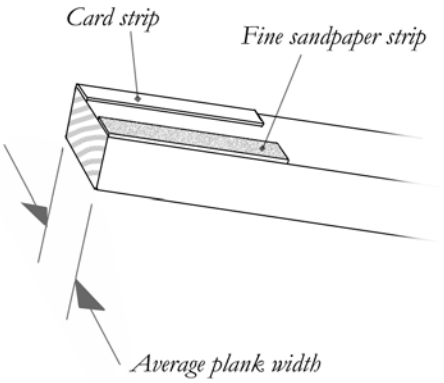
Planking can now commence. Begin with the garboard, working from the bow aft. The first thing to do is make a card template of the plank. Hold the plug and backbone in your vise then rotate and lock the vise at a comfortable angle. Take a strip of card somewhat wider than the garboard and trim the upper edge (as you look at it) to fit the rabbet at the stem. Make sure that the garboard does not creep further up the stem than described, or the hooding ends of the other strakes will end up too narrow and spoil the run of planking.

Mark the position of the butt on your card, as well as several other station lines. These are where the frames will fall. Then transfer the width of the plank from the plug to the card. Make sure that the depth of the rabbet and the overlap is included! Join the dots using a suitable ship's curve to complete the outline of the plank and cut it out carefully with a sharp scalpel blade and curves.

Once satisfied with the card pattern, transfer this to 1/64" thick holly stock and cut out the first plank carefully as you did the card pattern. To bend the plank to shape, wet your fingers and moisten the plank. Holly will easily form simply with the moisture and the heat between your fingers. Let the plank air dry for a few minutes. Using a small brush and white glue, glue the plank into the rabbet.

Repeat this process on the other side of your model. Move on to the next garboard plank aft and repeat the process. The upper (rabbet) edge of the plank should be a straight line this time. Finally complete the strake, if it consists of three planks, with the aftermost plank. Be very careful to fit the aft end accurately into the rabbet of the post. This joint will be obvious in the finished model!

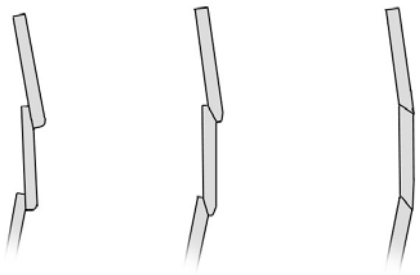
Once the garboard is completed, there is a small but critical step to take before proceeding with the next strake. This is to bevel the lap of the garboard. If you do not do this there will be a gap with the edge of the next strake and the lap will not glue together properly. This will compromise the whole structure.



To make this bevel you will need to construct a special sanding stick. This is made as shown above and will form the bevel correctly. You will need a left and right-handed version of this stick. I made mine two-sided so that I could simply flip it over. You can see the bevel formed in the photograph above. Be sure not to get over-enthusiastic and make the bevel too wide! If in any doubt, make a light pencil line 1/32" in from the plank edge. This operation completes the first strake.

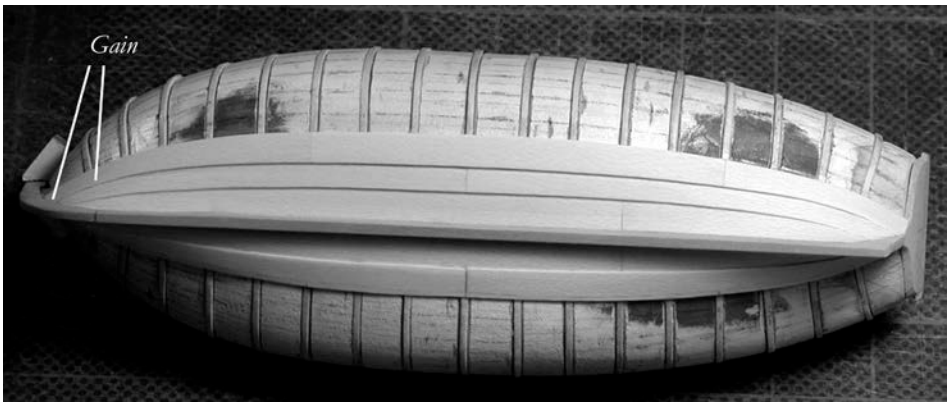
Now make a card pattern for the foremost plank in the second strake. To approximate the curve that you will need, hold a ship's curve up against the model to see what will be about right and make your first pattern. Make adjustments until a fair match with the garboard is achieved, then transfer plank widths at various points along the plank as you did before. Cut the pattern, check it against the model, and then cut the plank.

Before gluing up the plank there is the small but vital point of the 'gain' to be taken care of. This is where, at bow and stern, the clinker overlap disappears and the planks become flush. If you do not do this, the planks will never fit the rabbet at the bow.

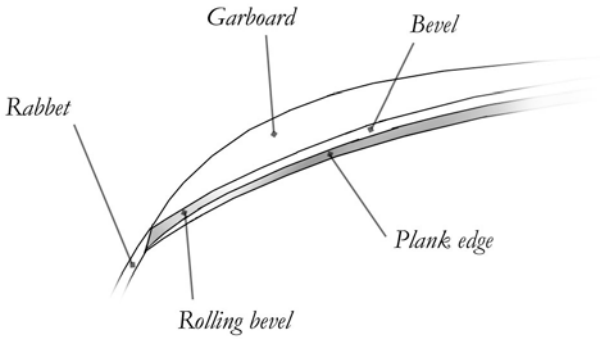


The diagram shows how this occurs. It is made over the last 12" of plank at the bow. The section at the left shows the normal lap. As one moves from this to the gain the bevel increases (center) until it becomes 45° and the planks flush (right). In

the case of our cutter, the same thing will apply at the stern where the planking goes into the rabbet or over the transom. The gain may be sanded into the plank edge or cut with a small, sharp micro-chisel. I prefer the latter as one can control the 'roll' of the bevel with greater precision. A guide is to check the plank edge while shaping this. The edge should feather down to nothing at the rabbet.



Third port side strake in place, showing gains fore (marked) and aft



This point is shown at the left. The angle of the bevel increases, without becoming wider, as the plank edge diminishes to zero at the rabbet. Be careful not to let the bevel get wider, or there will be an ugly shadow at the seam with the next plank.

To cut the gain in the adjoining edge of the second strake, the rolling bevel starts from the square edge and turns *under* to 45° along the same distance as the bevel on the plank already in place. The two planks should then sit nicely flush to each other at the rabbet.

Part 5 – Beveling the transom

Continue planking, alternating sides, until you reach the transom. This will probably be at the third strake. It is now time to bevel the transom. The planking in place serves to

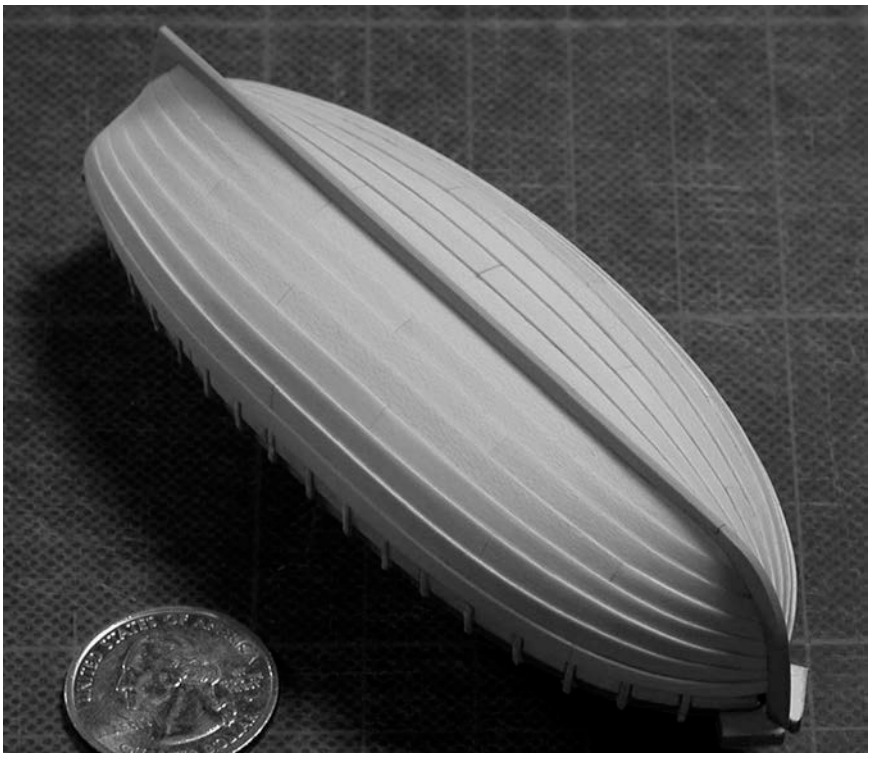
give stability and lateral support to the sternpost and transom. Beveling is best carried out with Swiss files. Turn the model until it is stern-on to you. The changing angle of the transom edge is defined by the shape of the plug. It is simply a matter of filing the transom to conform to the contour at the aft end of the plug.

Part 6- Completing the planking

Once the transom is bevelled you can continue planking. Be particularly careful to get the gain just right at the transom, so that there is a tight joint between strakes as well as no gaps under the planks at the transom. The most awkward spot to plank is at the junction of the stern post and transom. Wetting the plank and applying heat with a hot iron will help conform it to the shape of the boat here.

The sheer strake should be level with the top of the plug at the sides. Ensure that all is equal on both sides of the model. Before the moment of truth – removing the model from the plug – there are a few refinements to carry out. Gently sand the sharp corners of the planks to a small quarter round. There should be no edges to catch or get chipped off. Don't overdo this, however, or the crispness of your planking will be lost.

Next, you can sand the aft part of the keel and sternpost slightly on each side to put in the taper. Do the same at the bow. Now taper the stem to the cross-section on the plan. It is easier to carry these operations out while the boat is still supported. Lastly, take your pencil and lightly mark the edge of the sheer strake with the positions of the frames. Now all that is left is to pop the model from the plug. Remove the model from your vise and place right way up. Take a piece of scrap wood about the width of the slot in the plug. Push this down the slot from above at the fore end and tap lightly. Repeat this at the aft end. There may be some alarming cracks or other sounds, but after a bit of persuasion the shell, which is quite flexible, should come free. Sit down and enjoy a good, stiff Scotch.

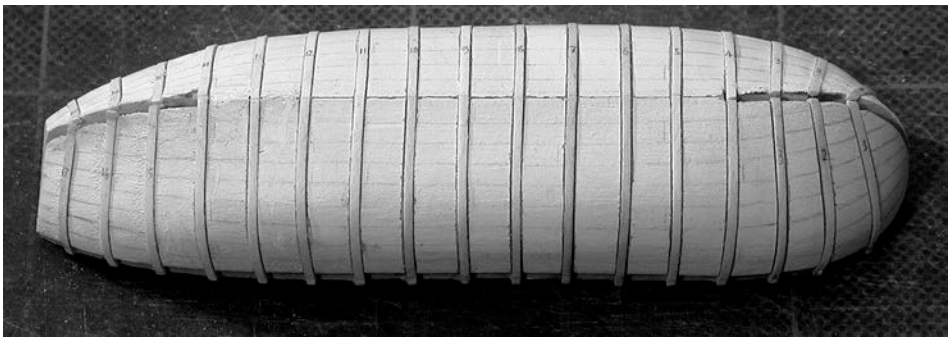


The cutter before removal from the plug.

Part 7 – Frames

Take the plug and replace it in the vise. File out the slots for the frames in the center plate of the plug. Now begin with the midship frame. Using a tick strip, find the length of holly needed to wrap around the plug, allowing a little extra on each side above the sheer line. Take a length of 1½" (1/16" full size) square holly and soak it in water for a minute or two. It will now be flexible enough to wrap around the plug. Clip or white glue the ends to the rim of the plug while the wood 'sets'. I used small 'Bulldog' clips. Repeat this process for the other full frames.

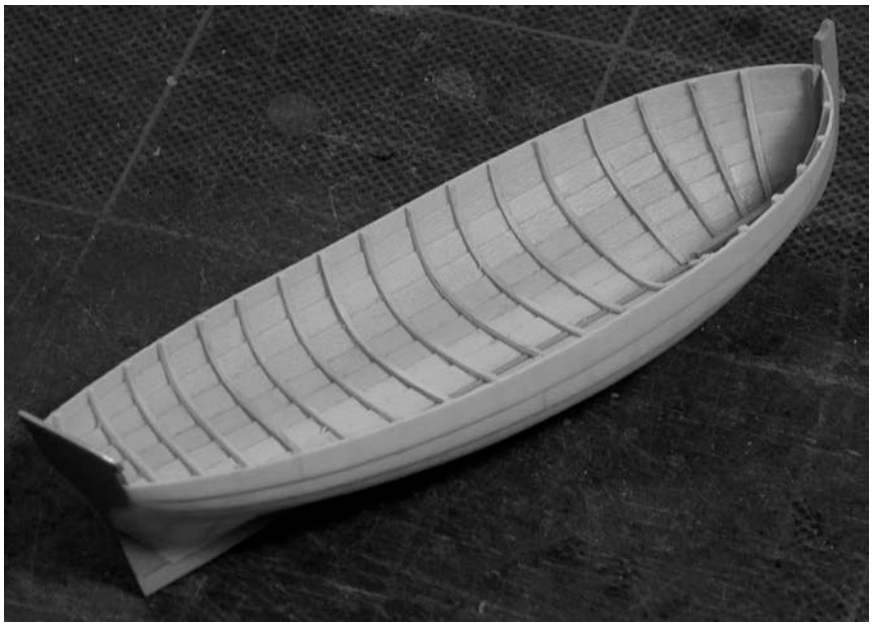
As the frame dries, clearly pencil its number on the outer surface. A lot of the midship frames look identical once taken off the plug! You may need to apply a hot iron to persuade the frame to form the reverse curves further aft.



A plug for a longboat with all the frames bent in.

Cant frames should be made one at a time. Allow the inner end to overlap the slot. I use pieces of painters' tape to hold the cant in position. Once the frame is dry, ensuring that it does not slip, gently file the inner surface of the cant with a flat Swiss file, using the slot as a guide. This way you will get a perfect bevel on the inner end of the frame.

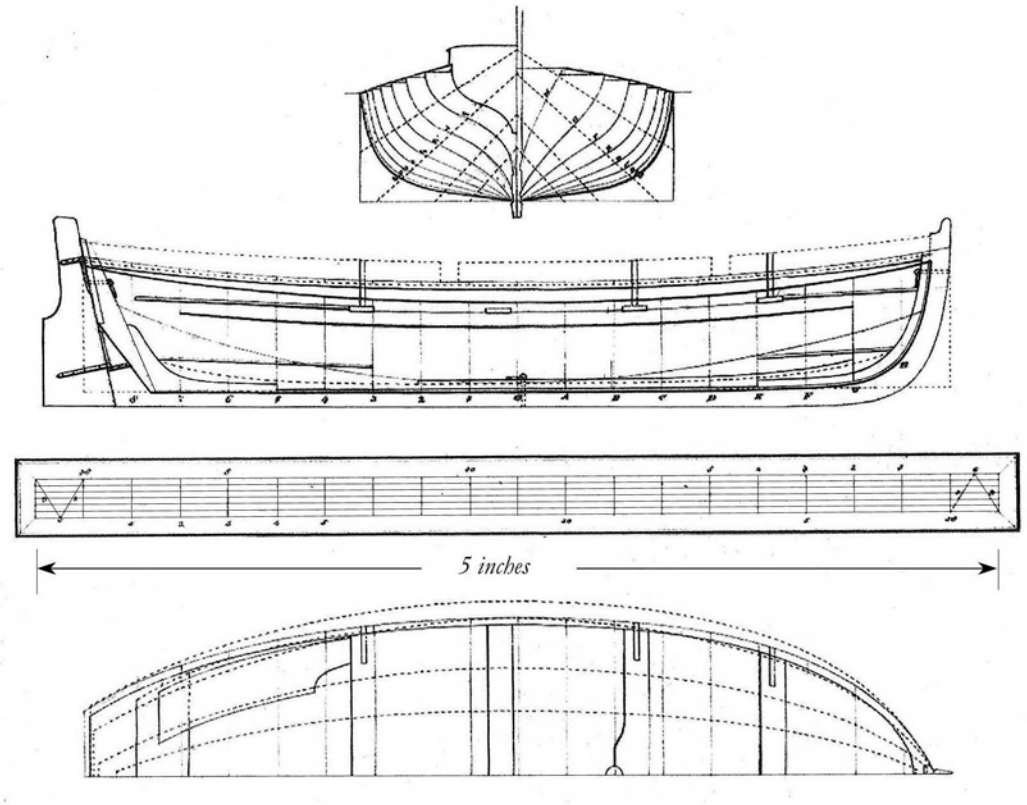
Take your shell and, using the mark-out that you made at gunwales and keel, glue in the frames. Trim any excess off down to the gunwales, keeping the tops horizontal. Use a sanding stick across the boat to refine this. It is surprising how sturdy the hull has become. It should now look like the one shown below.



The basic hull completed; model by David Antscherl

The last task is to remove any excess glue from inside the boat. Moisten any glue remnants using isopropyl (rubbing) alcohol and a brush. After a few minutes the glue will turn rubbery and can easily be scraped off with a suitable tool. I use a dental elevator for this, which resembles a miniature blunt chisel. Particularly if you are using a transparent finish you will need to be meticulous about this. This will complete the basic boat.

Part 8 – Fitting out



18' 0" cutter draught, c.1800

There are numerous items to make to complete your cutter. The first of these are the *risings*. Risings are the longitudinal stringers that support the thwarts. For most of their length you can take their shape from the sheer plan (above), but at the bow you will need to make a card pattern. Be very careful as you mark the position of the risers; they need to be both at the correct height below the top of the sheer strake and at the same level across the boat. Nothing looks worse than a series of thwarts that are not level and parallel with each other. Mark the positions of the thwarts. Note that there are ½" scores in the tops of the

risings to locate the thwarts; this will be very helpful later on. Cut the risings from 1½" thick holly, wet bend them, allow them to dry and glue them in place.

Next is the keelson. This is an 8" wide plank, ⅞" thick, that runs from the aft side of frame 2 to station G. (All the scantlings for this cutter can be found on pages 306-307 of Volume II, *The Fully Framed Model*.) Look carefully at the sheer plan and you will see it above the dashed line indicating the top of the frames at the keel. This plank sits directly on top of the frames.

The bottom boards may be put in next. Officially this is called the *footwaling*. I put in two boards on each side of the keelson about 7" wide, with about 2" of air space between them. Run these between the two small platforms fore and aft.

The platforms under the forepeak and stern sheets will need to have card patterns cut to shape first, notched out to fit the frames. I made the fore platform of three planks and the aft one of five, with the outer planks hooking into the adjacent ones as the platform narrows. Make sure that these platforms sit inside the hull at the correct height.

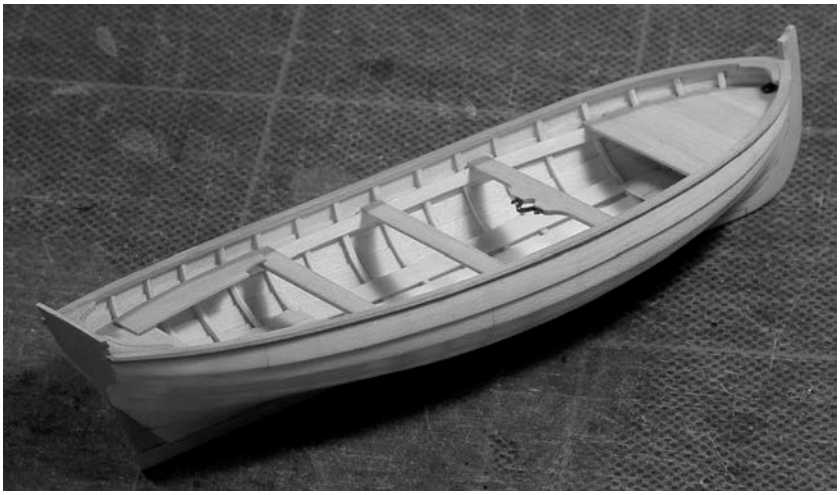
It is a good point in construction to fit the three ringbolts that you had previously made into the hull. I use a spot of epoxy to hold them in place. The mast step – I made mine of a block 6" square and 2" deep – is set on the keelson forward of the midships ring bolt. It needs to be positioned with its centerline exactly below the aft edge of the thwart above.

The fore platform is next. I made mine of three planks running athwartships. You will need to be very particular about the notches for the frames, as these will be very visible when the boat is completed. I advise going the card pattern route first.

The thwarts and stern sheets need no explanation and are of 1½" thick stock. Round off their edges before installing them. More elaborate boats have a molded edge to their thwarts, but this is a working, not fancy, boat.

The gunwale, of 1½" thick stock, should be made on two or three pieces. I scarph jointed mine, but as it will hardly be seen, simple butt joints will suffice. First make a pattern by

running a pencil along the sheer strake under a piece of card held on top. Make the foremost piece run to about the aft edge of the fore platform. The gunwale is only 2" wide: just sufficient to cover the upper edges of the frames and sheer strake. Fit the fore end carefully to the stem and centerline. Run either a very fine molding along the outer edge, or simply sand a half-round. The aftermost piece fits just under the overhang of the transom and finishes flush with its aft surface.



Gunwale, breast hook and transom knees completed

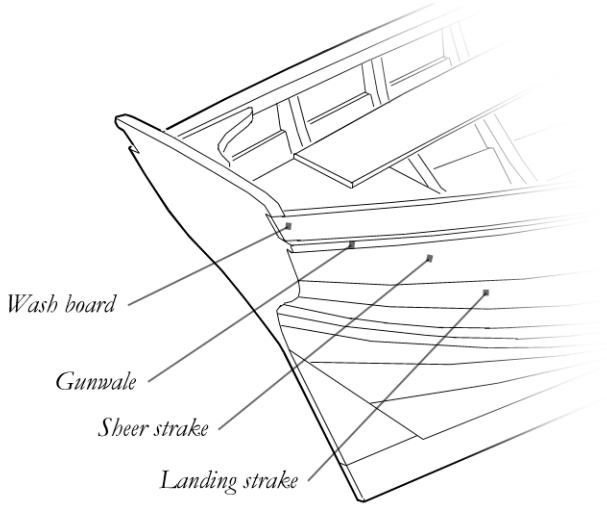
The breast hook at the bow is 1' 6" wide and no less than 2½" deep at the throat. It is the same thickness as the gunwale. I fitted the joint to the gunwale first, roughly shaped the aft edge, glued the hook in and then refined the aft edge so that it was vertical. There are also two knees, one on either side of the transom. Again, a similar technique was used to make and fit them as for the breast hook.

There are several knees to be made. These were, for me at least, a challenge. They are small and, except for the midships ones, angled to meet the sides of the boat and gunwale. The easiest strategy for me was to cut a triangular blank of 1½" wood and work to fit side and thwart accurately. I then roughly indented the long side of the triangle and glued the knee in place. Final shaping of the inboard face was done after this using Swiss files. Note that the side arms of the knees extend up beyond the gunwale to form supports for the removable wash strakes *(see last photograph, page 19).*

The *tholes*, supports for the oars, are tricky to make for this model. They are vertical posts that have slots in their sides to take the wash strake ends. The tholes are only 1½" square, peg into the gunwale and the slots are ¾" wide. I found that an X-Acto razor saw blade was the correct width to cut the slot, but started with stock that was a little larger in cross-section to make life a little easier. Ensuring that the tholes were vertical when fitting them was also a challenge. Note that the thole positions alternate from side to side: this boat was rowed single banked.

Next are the wash boards. Planking stock is used for this, and the usual card pattern routine is used. I believe that in the real boat a groove was cut in the gunwale to house the lower edges of the wash strakes. Once the wash boards are in place, it is impossible to see that the gunwale is not grooved. As you fit the aftermost boards, complete the shaping of the upper part of the transom. The board should fit neatly into the notch *(see photograph, following page)*. There must have been some form of peg and retaining forelock at the transom to hold the aftermost board in place, but I have yet to discover how this was actually done.

The rudder and its irons are straightforward enough, if fiddly to make and fit. The rudder is of 1" thick wood (the specification in Steel is actually ⅞") and is in one piece.



What is not shown on the official draught is the tiller: it is made of iron. A flat iron band fits over the rudder head just above the transom and a straight short iron tiller projects forward from this (illustration next page). Note that the upper rudder iron has a short pintle pin and

that the lower one is a gudgeon. The corresponding fixtures on the stern are a small eyebolt in the transom to engage the pintle and a long pintle pin in the recess of the post. With this arrangement, the rudder can be shipped and unshipped from inboard. To ship the rudder, the long pintle is engaged first and the rudder slid down until the upper pintle slips into the eyebolt The capsquare for the mast is similar to one for gun carriages and is attached to the aft side of the second thwart *(see photo below)*. You now have a completed your 18 foot cutter model!