SECTION 1 – INTRODUCTION

1.1 Terminology

1.1.1 We shall use boatbuilding terminology throughout as the words usually have precise meanings.

1.1.2 Most of the names of the structural items are fairly clear from the drawings themselves. Rather than give a long list of terms, the names of the various structural elements will be introduced as they occur naturally during the build of the boat.

1.1.3 One name that often causes confusion however is "floor". In boatbuilding terms a floor is a transverse structural member that lays across the centreline structure and helps to link the centreline structure to the hull skin and other parts of the transverse structures. The "floor" that you walk on in a boat is known as the "sole", though in a dinghy they are usually called the "floor boards".

1.2 Principals of structure

1.2.1 The hull skin is supported by a sub-structure consisting of longitudinal and transverse elements. In this way individual panel areas of hull skin are kept reasonably small and regularly supported.

1.2.2 The transverse structures are the three thwart assemblies, which are each made up as complete assemblies, from their individual components

1.2.2 The transverse structures are bonded to the skin both directly and using fillet joints. Fillet joints increase the bond area and they smooth the transition from the relatively very strong transverse to the weaker skin structure.

1.2.3 The principal longitudinal structure is the backbone/stem/keel lamination. The thickness of the laminations of this change around the forefoot of the boat because the curve becomes sharper, so thinner laminates are required to be able to bend around it without breaking.

1.2.4 Other hull longitudinal structures are the gunwhales and the laps of the planks themselves.

1.2.5 The whole of the structure of the boat is put together and coated using WEST™ system materials. Fastenings are used largely for convenience in holding parts together while the epoxy cures. Some of these may be temporary, to be removed later, but most will remain in permanently.

1.3 The Drawings

1.3.1 The drawings and information to build the boat are divided into groups as follows:

037/001 Proposal drawings
037/002 Build instructions
037/003 Longitudinal structures
037/004 Transverse structures
037/008 Rudder, tiller & fittings
037/009 Daggerboard & case
037/011 Spars, sails & rig

1.3.2 Drawings carry an "issue number". This is to allow modifications to be made to the drawings – perhaps because of a mistake on them or because of a change in requirements. It is best if old issues are thrown away upon the issue of a new version – otherwise the wrong drawing can very easily get inadvertently into use.

1.3.3 All dimensions on the drawings, specifications and instructions will be millimetres unless otherwise noted. The most common non-metric item is wood screws which are still measured in inches for the length and gauge for

the thickness.

SECTION 2 – THE "LINES"

2.1 What are they?

2.1.1 The boat is designed on a computer and resides in the computer as a sets of data representing 3-dimensional surfaces. However, to build the boat, we have to start with some 2-dimensional shapes and build these up into the 3-dimensional object that is the boat as a whole. The 2-dimensional shapes that we look at for this purpose are known collectively as the "lines".

2.1.2 When boats were designed manually, the design itself was built up from drawing and measuring the 2-dimensional shapes – so the 3-dimensional design was also derived from the lines. Although this is no longer the case, we still tend to draw out from the computer-generated 3-dimensional surfaces the same 2-dimensional views as were previously used to design the boat.

2.1.3 A major difference however is that manually drawn lines were drawn at a reduced scale (so they could fit on a piece of paper) and they needed to be drawn out full size so that they could be checked for accuracy and "fairness". This process is known as "laying off" or "lofting". Computer generated surfaces are inherently fair and entirely accurate dimensions of them can be obtained directly from the computer – so lofting is no longer required.

2.1.4 Another major difference is that, with manually drawn lines, the designer only knew the shape of the hull on the lines. With computer generated surfaces we know the shape of the hull everywhere. This means that we have the facility to extract the accurate position of any point on the surface of the hull. It is this facility that allows us to provide accurate dimensions, bevels etc. of the majority of the elements of the boat.

2.2 Datum points

2.2.1 We have to set datum points from which other points on the boat can be measured. The datum points on your boat are as follows:

2.2.2 The Datum Waterline (dwl). This is a horizontal line drawn at the approximate flotation position of the boat. It should not be confused with the Load Waterline (LWL) which is the calculated flotation line under specified load conditions.

2.2.3 The Zero Point. This is the intersection of the dwl with the ghost centreline of the boat. The ghost centreline is where the centreline of the boat would be if it were not cleaned off to a 40mm wide flat to accept the keel and stem.

2.2.4 The Centreline. This is the fore-&-aft centreline of the boat.

2.3 Point measurements

2.3.1 Position. This is measured forward and aft of the Zero Point. Positions aft of the Zero Point are negative. So Position -400 is a point 400mm aft of the Zero Point.

2.3.2 Offset. This is measured out from the centreline. So a point at Offset 870 is 870 mm out from the centreline. If necessary an offset is designated port or starboard. Port is the left-hand side of the boat (when you are facing forward); starboard is the right hand side.

2.3.3 Height. This is measured above or below the dwl. Heights below the dwl are negative. So Height -50 is a point 50mm below the dwl.

2.3.5 Thus any point in the boat can be identified by three co-ordinates – Position, Offset

and ÏHeight. These co-ordinates are often brought together in tabular form – somewhat confusingly known as a "Table of Offsets". You will see Tables of Offsets on the drawings – either complete ones, or ones giving just the necessary information (perhaps just Positions and Heights).

2.3.6 Now we will just identify the various lines we use to find the shape of the boat.

2.4 Sections

2.4.1 A section is a vertical athwartships (across the boat) slice through the boat (like a slice of bread off a loaf).

2.4.2 Sections are designated "s" followed by their position. Thus s -400 is a section through the boat 400mm aft of the Zero Point.

2.4.3 Sections are used to obtain the shape of frames, bulkheads and any athwartships element.

2.5 Waterlines

2.5.1 A waterline is a horizontal fore-&-aft slice through the boat.

2.5.2 Waterlines are designated "wl" followed by their height. Thus wl -50 is a waterline 50mm below the dwl; wl 200 is a waterline 200mm above the dwl.

2.5.3 Waterlines are use Åd to obtain the shapes of horizontal elements of the boat.

2.6 Buttocks

2.6.1 A buttock is a vertical fore-&-aft slice through the boat.

2.6.2 Buttocks are designated "b" followed by their offset. Thus b 200 is a buttock 200mm out from the centreline.

2.6.3 Buttocks are used to obtain the shape of any fore-&-aft items.

2.7 Diagonals

2.7.1 Diagonals are fore-&-aft slices through the boat taken at an angle (i.e. neither horizontal nor vertical – but some angle in between).

2.7.2 Diagonals are designated "d" followed by the height on the centreline of their start point and the angle (usually downwards) that they make to the cent reline. Thus d 100 45° is a diagonal that starts on the centreline, 100mm above the dwl and is at an angle of 45° with the centreline.

2.7.3 Diagonals are not often used directly to obtain shapes of items but the are often used to help delineate the shapes of other items.

2.7.4 An offset on a diagonal is measured down the line of the diagonal from the centreline.

2.7.5 We are not in fact using any diagonals on your boat.

2.8 Body Plan & Grid

2.8.1 The body plan shows the outlines of the sections, with the waterlines, buttocks and diagonals drawn as a grid over them.

2.8.2 If you refer to drawing 037/004/04 you will see a body plan (although only a single section is shown) and a basic grid.

2.8.3 The grid is used to obtain the shape of various components and to check the 'm for shape and accuracy once they are made and assembled.

2.9 Setting out the grid

2.9.1 The basic grid as shown on drawing 037/004/04 needs to be drawn out on a flat, level surface. We will call this the "setting out floor". Make all the lines on the grid at least 100mm longer each end than the biggest length required – so that when a component is laid on the setting-out floor, the lines stick out around the edges.

2.9.2 The best type of surface is a board floor – chipboard or plywood is ideal. This should be thick enough to take small nails to bend battens around and also to screw chocks to for laminating. 20mm material is about the right thickness. The floor should be emulsion painted white, so that pencil or ball-point lines show up clearly. As the thwart assemblies are going to be assembled directly on the floor it is important that it is rigid and flat – and preferably level. Make the floor big enough for the largest assembly, with some to spare – 1 sheet of 1220 x 2440 x 20 chipboard would do fine.

2.9.3 You will need a metre folding rule, a 3 metre steel tape, some 20mm wire nails, a couple of battens (say 2000mm long x 15mm x 10mm – good clean pine with no knots, planed up straight and square) and if possible a few weights (10kg or more). You will also need a straight edge (about 2500mm long x 145mm x 20mm, planed).

2.9.4 Draw the grid out on the setting out floor. Use a pencil or fine ball-point pen. Start with the centreline and then draw the dwl truly at right angles to it. Boatbuilders usually use a 3:4:5 triangle to check for square (90°). So, to check the dwl/centreline for square measure a multiple of 3 (say 600mm) along the dwl from the point of its intersection with the centreline and mark this on the dwl. Now measure the same multiple of 4 (in this case 800mm) up the centreline from the point of its intersection with the dwl and mark this off on the centreline. Now join the two points and measure this length (the hypotenuse of the triangle). It should measure the same multiple of 5 (in this case 1000mm) exactly.

2.9.5 Now draw the waterlines above the dwl and parallel to it – these are at heights of 100mm and 200mm above the dwl.

2.9.6 Now draw the buttock lines each side of the centreline and parallel to it. These are at offsets of 20mm (the rebate line), 100mm, 200mm, 300mm, 400mm and 500mm out from the centreline.

2.9.7 There are no diagonals to draw for your boat.

2.9.8 This is the basic grid and part or all of it is used to mark out most components. You will also need waterlines at other heights to set out the thwarts and knees. You can draw these on the basic grid now – or later as you need them.

SECTION 3 – MAKING THE FWD THWART ASSEMBLY

3.1 Setting out the components

3.1.1 Look at drawing 037/004/01. You can see that the thwart assembly consists of two bulkheads, four knees and the thwart.

3.1.2 We start by drawing the outlines of the assembly on the setting-out floor. There are basically two outlines, at -550 and at -750.

3.1.3 Look at the Table of Offsets headed "Bulkhead at -550". If you look at the Offsets of for the "Aft Face of Components", you will see that they are generally bigger than those for the "Fwd Face of Components". This is because the boat is curving in to the stem, so the aft face of an item will tend to be wider than the fwd face. Further aft, this position will be reversed because the boat has reached its maximum beam and is

then curving in towards the transom. The difference between the size of a component at any particular point on two faces gives rise to a bevel (angle) on the edge of the component, so that the bevel matches the curve of the boat at that point. Not all the curves on the boat change direction at one place, so there are places on the boat where the bevel reverses around the edge of a component.

3.1.4 When drawing the outline of a component, we draw the larger shape and then bevel back to the smaller.

3.1.5 So, for the components at -550, the larger shape is going to be the aft face, so we shall use these dimensions to draw the outline. Whenever you draw out on the setting-out floor, just cast your eye over the relevant Table of Offsets to establish the larger dimensions.

3.1.5 First draw out the bulkhead. use the offsets at -556. On the centreline plot in a Height of -94; i.e. measure 94mm down from the dwl on the centreline of the boat. This will give you the ghost centreline.

3.1.5 In a similar way plot the Heights at b 20 (Rebate), b 100, b 200 and b 300. Plot each height on its buttock, measuring vertically from the dwl.

3.1.6 Plot out the Offset 398 on the dwl; i.e. on the dwl measure out 398mm horizontally from the centreline. In a similar way, mark the offsets on wl 100 and wl 200.

3.1.7 Now we need a special waterline – the bottom of the thwart at Height 270. Draw in a line parallel to the dwl and 270mm above it. Plot out the Offset of 561mm.

3.1.8 Drive a 20mm nail into the setting-out floor at each point plotted. Bend a batten around the outside of the nails and secure it in place with weights or nails driven on the outside, opposite those on the inside (don't drive nails through the batten itself).

3.1.9 The batten should lay fair around the nails, touching them all. If it doesn't, then check that your measurements are correct and have been applied to the right lines. Also check that your grid is truly square and the correct distances apart. If the line still won't lie fair, then the mistake is in the figures themselves – probably a typing error. So please give me a call.

3.1.10 The batten can depart from the nails by a millimetre or so, if this produces a fairer run – the computer cannot always emulate the fairest run of real wood!

3.1.11 Once you are satisfied with the line, draw around the inside of the batten. Repeat the procedure on the other side of the boat so that you have a complete outline.

3.1.12 Now draw the hull side outline of the knee. Use the -570 dimensions for this. You will need two new waterlines at heights of 290 and 350.

3.1.13 Draw the waterlines in and plot out the Offsets.

3.1.14 Plot out the sheer. Because the sheer of the boat is rising as it goes forward, the higher Height is on the fwd face (-550). So plot the sheer point at Offset 534 and Height 420.

3.1.15 Draw in the outline with a batten as before. Let the batten run down parallel to the bulkhead outline for some distance to induce the correct curvature – it won't lay on top of the outline, but just a little outside it – because we are further aft than the bulkhead outline.

3.1.16 Mark the knee outline on the other side of the boat.

3.1.17 Mark out the rest of the knee, referring to the "General Geometry of Thwart Knees" detail on the drawing. The easiest way to find the centre of the 100mm radius is to draw out a 100mm radius circle on a piece of stiff card and cut it out, making sure to keep the centre marked on the card. Then draw the inside face lines of the knee at 30mm and 25mm parallel in from the outer edges. Push the card pattern up to the inside lines so that its circumference just touches both lines. Prick through on the centre of the circle. Using this as the centre, scribe the two arcs at 100mm radius and 115mm radius. This will be the laminated part of the knee. Note that the inside end of the knee is vertical, but that the top end of the knee is square to (90° to) the line of the hull.

3.1.18 Mark out the components at -750 in the same way. You can use different coloured ball point pens for the -550 components and the -750 components to avoid confusion.

3.2 Making the -550 bulkhead.

3.2.1 The bulkhead is made from 6mm ply. The grain should run horizontally.

3.2.2 Get out a piece of ply, large enough to make the bulkhead from.

3.2.3 Lay the ply on the setting-out floor, with the grain horizontal and so that it covers the outline of the bulkhead on the setting-out floor. Pin the ply to the setting-out floor so that it cannot move about. The face uppermost will be the aft face of the bulkhead. Mark it "aft" lightly in pencil.

3.2.4 With a straight edge laid over the ply, transfer the grid lines on to the ply – mark lightly as you will need to clean these off later (at least if you are clear finishing).

3.2.5 Plot out the offsets of the bulkhead outline as ¶3.1.5 – ¶3.1.11 on to the ply. Mark the top of the bulkhead at Height 270.

3.2.6 Measure and mark the two circular apertures for the inspection covers. In this regard, it would b e best to have a RWO cover to hand to check that the aperture size is correct. With the WEST coating, it might be as well to cut the aperture say 1mm all round bigger. Also measure and mark the central slot in the bulkhead – at 110mm wide about the centreline and finishing on the dwl.

3.2.7 Where b 20 intersects the hull draw a horizontal line – this will be the underside of the hog. The little bit of bulkhead from b 20 to the ghost centreline is not required. Measure and mark the notch for the hog at 100mm wide about the centreline and with the top at 70mm below the dwl (as shown on the drawing).

3.2.8 Similarly mark the notch for the mast step at 60mm wide and 40mm below the dwl.

3.2.9 Remove the ply from the setting-out floor and cut around the outside lines (don't cut the notches, slot or apertures yet). Use an electric jig saw with the correct blade for the thickness of ply you are cutting. Make sure the saw is cutting square – adjust the base and/or blade if necessary. Follow the blade instructions with regard to the degree of blade oscillation recommended for a "clean cut". Use a sharp blade. Use an insert in the base (if available) to help prevent chips. Have a try out on a piece of scrap 6mm ply to get the best cut. Cut reasonably close to the line.

3.2.10 Lay the bulkhead on the setting-out floor and check that it matches its outline. Plane the edges until it does.

3.2.11 Look at the Table of Offsets for Bulkhead -550, and look at the offsets and heights for Position -550. By subtracting the smaller offset or height from the larger, we arrive at the bevels. An offset bevel is measured and applied horizontally and a height bevel is measured and applied vertically.

3.2.12 Starting at the top, we can see that at Height 270, the offset bevel is 3mm (499 – 496 = 3). So at the top of the bulkhead, on the fwd face, measure in 3mm.

3.2.13 At wl 200, the bevel is 3mm (477 – 474), so on the fwd face measure 3mm in. Repeat the procedure on wl 100 and the dwl (2mm and 3mm respectively).

3.2.14 On b 300 the height bevel is 1mm (48 – 47), so on the fwd face at b 300, measure up vertically 1mm. Repeat this for b 200, b 100 and b 20 (Rebate).

3.2.15 Mark the fwd face outline with a batten (held round the inside of the marks with weights). Plane the edges of the bulkhead so that the fwd face matches its outline. Try not to change the shape of the aft face. If you draw a line around the edge just 1mm in from the aft face and only plane this line off with the very last few strokes, then you will know that you have not disturbed the aft face. A spokeshave is better than a plane for cleaning up and bevelling the edges.

3.2.16 Because the bulkhead is fillet jointed to the hull skin, the edges are not going to be seen – so the bevels etc. do not have to be perfect. However, it is not a difficult process and you will find the planking goes better if the edges are bevelled correctly.

3.2.17 Cut the 110mm slot in the bulkhead and the circular apertures. The edges of the slot need to be straight, clean and square – so cut them carefully.

3.2.18 Cut the notch for the hog. The top horizontal face will be bevelled off as the ghost centreline bevel – in this case 1mm (94 – 93).

3.2.19 Cut the notch for the mast step – the top of this is not bevelled as the top of the step is a level 40mm down from the dwl.

3.2.20 The ply is a bit delicate now, because it is only 40mm wide in the area under the 1 €10mm slot. Keep a piece of timber cramped across it (or screwed temporarily to the aft face) while you handle it, to prevent it being inadvertently broken.

3.2.21 Clean any pencil lines, marks etc. off the bulkhead and sand it smooth. WEST coat the bulkhead both sides two coats. WEST coat the edges of the bulkhead, the 110mm slot, the hog notch and the mast step notch, just one coat only (as a build up of WEST will prevent the various components from fitting properly). You can coat the edges of the circular apertures two coats however. Fudge plenty of WEST in any screw holes made for the temporary stiffener (use a pipe cleaner) and then fill the holes with WEST/#405.

3.3 Making the -550 knees

3.3.1 You can use the blocking of the knee as a jig to laminate the curved section of the knee on. If you have a bandsaw, then you can laminate the knee up double thickness (plus an allowance for sawing) and then cut it in half afterwards. The knees are 20mm sided (i.e. from side to side – thick). if you are going to laminate two up together you will need material approaching 50mm wide to allow for the saw cut plus cleaning up. If you are going to make the knees individually, then you will only require material a shave over 20mm – say 22mm.

3.3.2 Get the solid timber for the blocking out.

This can either have a mitre join across the corner, or can be one piece with the grain running at about 45°. Get the timber out a bit bigger than is required for the knee and rectangular so that the edges are laying at 45° to the base of the knee – i.e. about tangential to the radius.

3.3.3 Mark the larger outline of the knee on the timber (from the setting-out floor) and mark the 115mm radius (see ¶3.1.17). Cut out the radius and the inside lines of the blocking.

3.3.4 Prepare the laminates – you can saw these yourself or you can buy 3mm sliced Khaya laminates (if you have difficulty finding these – call me).

3.3.5 You will need cramps and cramping pieces (small squares of thin ply or hardboard) to prevent the cramps marking the outer laminate.

3.3.6 Have a dry run (i.e. no glue), to check that you have all to hand and that the laminates can be cramped up OK. So tapered chocks may be necessary to allow the cramps to get a hold. If you have real difficulty getting the cramps in, or getting them to hold, you can make up another cramping piece with a convex A radius of 100mm and its other edge parallel to the outer edge of the blocking. The laminations will thus be jammed between the two pieces and the cramps can all lie square. Cover the cramping piece with parcel tape, or wax it well, to prevent it getting bonded to the knee itself. Also make sure your working area is covered with polythene or waxed well to prevent the knee getting bonded to it

3.3.7 Once you are satisfied that you have all the tools to hand etc. gluing up can proceed. Have some plain resin/hardener mix and some thickened with #403 microfibres.

3.3.8 Coat the inside face of the blocking with plain WEST/hardener.

3.3.9 Glue the first laminate (WEST/#403) and lay it glue face up on the bench; coat one side of the second laminate with plain WEST/hardener and lay it WEST side down on the first laminate; spread WEST/#403 on the top face of the second laminate; coat one face of the third with plain WEST and lay it WEST face down on the second; coat the other face with WEST/#403 – and so on until all the laminates are piled up.

3.3.10 Now coat the inside face of the blocking with WEST/#403 (the process of coating first with plain WEST/hardener and leaving it for a while before coating with WEST/#403 is known as "wetting out" and is used on absorbent timber, end grain areas etc.) Turn the bundle of laminates on edge and lay it against the blocking; tighten up the cramps, starting from the centre and working towards the ends. If the laminates tend to slip sideways as you tighten the cramps, cramp a piece of (waxed) ply on top of the laminates/blocking.

3.3.11 Plenty of excess glue will squeeze out – you will get better at judging the correct amount with practice. Clean off as much of this excess as possible – it is much more difficult once it has cured. Allow the lamination to cure for minimum 15 hours at 15°.

3.3.10 After curing, remove the cramps and cut the outside of the knee to shape (remember that the sheer Height is greater on the fwd face, while the Offsets are greater on the aft face) Clean up the faces. Lay the knee on its outline on the setting-out floor to check for a good fit. If you made it double width, cut it in half and clean up the sawn faces.

3.3.11 Bevel the hull side of the knees to the -550 sizes.

3.3.12 The notch for the gunwhale can now be cut. It is basically 12mm deep and 40mm high.

So, on the aft face of the knee, mark a line 12mm parallel in from the hull side. Measure down 40mm from the sheer and mark a line in square to the hull. Now look at the Height bevel for the sheer, which shows that the sheer is 1mm higher on the fwd face (420 – 419). So measure up 1mm and mark a new line square to the hull. Or do the sums to start with and only measure down 39mm. Cut out the notch.

3.3.13 The vertical face of the notch is bevelled as the sheer Offset bevel (534 – 527 = 7), with the bevel coming off the fwd face. The bottom of the not ˛ch is bevelled as the sheer Height bevel (1mm) with the bevel coming off the aft face.

3.3.14 Radius the corners of the knees off as shown on the drawing and radius or chamfer (about 3mm) the inside edges. Sand the knees up smooth and WEST two coats (only one coat on the bottom edge, outside edge and notch).

3.4 Making the -750 bulkhead.

3.4.1 This is drawn out and made in exactly the same way as the -550 bulkhead.

3.4.2 If you screw a temporary stiffener across the bulkhead, screw it on the fwd face.

3.4.3 The mast step does not come through this bulkhead, so no notch is required for it.

3.4.4 Coat the bulkhead etc. as you did for the -550 bulkhead.

3.5 Making the -750 knees.

3.5.1 These are made and finished in exactly the same way as the -550 knees.

3.6 Making the thwart.

3.6.1 The thwarts are usually made from 20mm solid timber. Get the timber out, planed to thickness and cut to width (220mm full).

3.6.2 The angles and bevels of the ends of the thwarts can be obtained from using both t he Tables of Offsets.

3.6.3 Decide on the top face and the fwd edge of the thwart. Mark the fore-and-aft centreline on the top and bottom faces.

3.6.4 On the top face mark off each side of the centreline the fwd edge offset of 498mm (from the -550 table) and the aft edge offset of 569mm (from the -750 table). Join the lines and cut the thwart to length both ends.

3.6.5 Turn the thwart over and mark off each side of the centreline the fwd edge offset of 493mm (from the -550 table) and the aft edge offset of 564mm (from the -750 table). Join the lines and bevel the ends of the thwart..

3.6.6 Radius the fwd and aft edges of the thwart (max. 8mm radius). Sand the thwart smooth and WEST two coats – the ends only one coat.

3.7 Making the slot ends.

3.7.1 The slot ends are also made from solid timber.

3.7.2 Get out the timber 200mm wide and 20mm thick – and a bit longer than is needed.

3.7.3 Cut the tops square. Mark the dwl, 270mm down from the top.

3.7.4 The angle of the bottom ends (from aft to forward) can be found in the Tables of Offsets, using the b 100 heights. The fwd end will be 79mm below the dwl and the aft end will be 93mm below the dwl. Mark these and cut the

bottom off.

3.7.5 The bevel of the bottom ends (from inboard to outboard) can be found on the setting-out floor. Just draw a short buttock at the bottom of the hull 20mm out from b 100 (i.e. b 120) and measure the height at this buttock. this will give you the bevel in the usual way. Do this at -550 and -750 for the fwd and aft edges. Plane the bevel off.

3.7.6 The fwd and aft edges of the ends are rebated to take the ply bulkheads. Check the thickness of the WESTed bulkheads – it is probably a bit more than 6mm by now. Cut the rebates 15mm wide and to the WESTed ply depth. From the dwl to the bottom, the rebate is cut off completely, so that the width of the the ends is reduced to the inside distance between the bulkheads. Radius (3mm) the rebate outer corners.

3.7.7 Sand the ends smooth but don't WEST them yet.

3.8 Assembling the components.

3.8.1 Be sure to sand pre-WESTed areas thoroughly in way of new bonding. When screwing as well as bonding, bore off for the screws, blow the drillings away and and have a dry run before bonding.

3.8.2 Assemble the knees on the thwart and screw and WEST bond them to the thwart. Screw up through the thwart into the knees (use 1·5" x 8g countersunk screws). make sure the knees are in their correct places – outside edges flush with the outside edges of the thwart, faces parallel with t he thwart edges and the correct distance apart.

3.8.3 Get out two lengths of 15 x 15 cleating and screw (1" x 6g countersunk screws) and WEST them to the underside of the thwart so that their distance apart (outside to outside) is the same as that of the bottom width of the ends (theoretically 200mm less 2 x 6mm, but maybe a little less because of the WEST coating on the bulkheads). The cleating will stop 70mm in each side of the centreline in way of the outside faces of the ends. You can also fit a piece of cleating across the thwart between the lengthwise bits for the top of the ends to land on.

3.8.4 Now fit the two bulkheads and the ends together to the thwart. Fit a couple of spacers around the periphery between the bulkheads to keep them the right distance apart. Cramp the assembly together.

3.8.5 Drill off for screws from the bulkheads into the ends and cleating (0·75" x 6g countersunk screws) at about 100mm spacings. If you wish to dowel over the screw heads (which looks good if done nicely), you will have to drill very carefully with the Stanley "screwsink", allowing the countersink cutter to enter only about 2mm. On the dry run don't pull the screws to hard home as, on the final run, you may pull them right through the ply. Cut plugs from a matching hardwood, using a Stanley "plugcutter" and glue the dowels in with WEST. Clean them off flush once the WEST has cured and sand over – coat the dowels with a dab of WEST before the final WESTing. If you decide not to dowel over the screws, then only let the "screwsink" countersink cutter just mark the surface of the ply: the screw will then pull in nicely flush.

3.8.6 Once all fits nicely together and the fastenings are bored off, you can bond the components together (WEST/#403 as usual) and drive the screws. Dowel over the screws if you are going this route. Clean off any excess glue (particularly on the outside faces). Allow to cure at least 15 hours at 15°C.

3.8.7 Once the assembly has cured, sand it all

over, inside and out, but paying especial attention to the outside to get a visually good finish. WEST over the ends of any dowels and any other areas of bare wood two coats. Sand finally and WEST the third coat. The outside edges of the bulkheads knees, and the bottom edges of the ends still just have one coat of WEST.

3.8.8 Store the assembly until required.

SECTION 4 – MAKING THE MID THWART ASSEMBLY

4.1 Making the components.

4.1.1 The bulkheads, knees and thwart are made in a similar manner to those for the fwd thwart assembly.

4.1.2 There is very little bevel on the components – in fact none at all on the -1650 bulkhead.

4.1.3 There is no central slot in the bulkheads and thus no end pieces.

4.1.4 Note that the bottom radius on the fwd edge of the thwart stops in way of the centrecase structure (see 037/009/01)

4.1.5 If you wish to cut an aperture in the -1850 bulkhead, similar to that in the -2750 bulkhead and then fit a watertight hatch into it, then you can do so. Ask for drawing 037/004/05 – this will show you the shape and size of a suitable aperture and the design of the hatch.

4.2 Assembling the components.

4.2.1 Again, this is very similar to the fwd thwart except that there are no end pieces, so it is best to have a temporary spacer running right across between the bulkheads.

SECTION 5 – MAKING THE AFT THWART ASSEMBLY

5.1 Making the -2750 bulkhead.

5.1.1 This can be set out and made in the same way as the other bulkheads.

5.1.2 The only real difference is that the inspection covers are replaced by an inspection hatch. This is because the bulkhead is too shallow to take inspection covers in places where the apertures are useful during construction. The apertures are used during construction to reach inside the assemblies to carry out the fillet jointing to the hull skin. Most of the planks can be fillet jointed as they are put in place but as you near the thwart, this becomes impossible and so the work has to be carried out by reaching through the apertures.

5.1.3 Once the hull is completed, the hatch can be blocked up by gluing an insert into the aperture and then a new aperture cut for a RWO inspection cover. Alternatively, the whole aperture as drawn can be left and a watertight lid made for it.

5.2 Making the -2750 knees.

5.2.1 These are made and finished in the same way as the previous knees.

5.3 Making the thwart.

5.3.1 Again, this is made in a similar way to the previous thwarts except that the aft edge is bevelled off 2mm (Position -2917 to Position -2915) to suit the angle of the transom.

5.3.2 The thwart as shown is only 177mm wide. If you wish to make it a bit wider – say 220 to match the others – then it is quite OK for there

to be a greater overhang over bulkhead -2750. Just continue the angle and bevel of the thwart ends along the same lines for the greater width.

5.4 Making the transom

5.4.1 The transom is set out direct on its timber rather than on the setting-out floor.

5.4.2 The transom is 18mm thick. it can be made from solid timber or ply . Ply can be a piece of 18mm or two pieces of 9mm glued together.

5.4.3 If you are using solid timber and cannot get a piece wide enough, then two pieces can be edge glued together.

5.4.4 If you have to glue the transom up from two pieces you will need to be able to cramp them together, while the glue goes off. The best type of cramp for this job would be sash cramps – three preferably. You will also need to prepare four pieces of timber to cramp across the join each side in order to ensure that the transom remains flat. If you don't do this, the cramping pressure can bow the timber and open the join up in the process. Suitable timber for these cross pieces would be about 30mm square and about 350mm long (dimensions completely uncritical and dependent on the reach and size of the G-cramps that you have)). Cover the faces with parcel tape so they don't get glued to the transom.

5.4.5 Prepare the edges to be joined – planed flat and straight. Now have a dry run to ensure that your cramping procedures etc. all work OK and that you have all the items of equipment conveniently to hand.

5.4.6 Wet out the edges to be joined with the resin/hardener mix. Then mix #403 microfibres with the remainder. Coat the edges with this, bring together and cramp up. Clean off the excess glue as much as possible while it is still wet. Leave at least 15 hours at 15°C minimum before un-cramping and working on.

5.4.7 If you do not have access to sash cramps you could use spanish windlasses to pull the joint together again keeping the two parts straight by cramping pieces of timber across the join. A spanish windlass is a length of thin rope (about 6mm Ø in this case) tied together in a loop around the two parts to be pulled together. A strongish bar (e.g. screwdriver, or a piece of about say 6mm Ø steel bar) is inserted in the loop and twisted around and around so that it tightens the loop up. Arrangements have to be made to prevent the bar untwisting when it is let go (perhaps yet another bit of string tied to the end and secured to something fixed). If the outer edges of the timber being pulled together are sensitive to damage you will need to put a protector under the rope forming the spanish windlass, else it will make grooves in the timber. It may sound a bit unlikely, but a spanish windlass does work quite well and can give plenty of pressure for gluing. You will need to keep the cross bars lightly cramped across the join while the windlasses are being tightened up or else the whole thing will just fold up. Once the windlasses are fully tight, finally tighten the cramps on the cross bars. If the timber won't seem to slide between the cross bars as you tighten the windlasses, a sharp blow (use a mallet) on the outer edge of one of the pieces of timber forming the transom will usually help. As with cramping, have a dry run with the windlasses to see if it all works OK.

5.4.8 Clean up the surfaces of the transom flat and smooth. You may end up at just under 18mm thickness; this does not matter. Decide which face is going to be the fwd face (the fwd face will be the larger face) and mark it.

5.4.8 Mark out the grid on the fwd face as shown on the drawing (037/004/03 – lower LH corner). The buttock lines are the usual distance

apart – b 20, b 100, b 200 etc. The waterlines are slightly odd distances. this is because we started out with wl 250 and wl 350, but up the angle of the transom these stretch to 251mm and 352mm above the dwl. The sheer is at 414mm above the dwl (again measured up the angle of the transom) and the base line for the top camber 15mm above this.

5.4.9 Now measure the heights on the buttocks from the Table of Offsets. All the figures in the Table of Offsets are corrected for the developed shape of the transom so that they can be marked direct on the timber.

5.4.10 Mark the offsets on wl 251, wl 352 and the sheer. The offset on the camber baseline is the same as the sheer – so this bit of the transom edge is vertical.

5.4.11 Mark the top camber heights, measuring from the camber baseline.

5.4.12 Draw the outline of the hull section and top section of the transom, with a batten in the usual way. From b 20 to the centreline the transom is flat for the keel to land on.

5.4.13 Now square the dwl across the edges of the transom timber and on to the aft face. The dwl on the developed aft face is 2mm higher than the dwl on the developed fwd face (see little sketch on drawing showing this). So measure up 2mm and draw in the dwl on the aft face.

5.4.14 Transfer the centreline round to the aft face. Mark in the rest of the grid a s shown on the drawing of the aft face, measuring all the heights from the new dwl.

5.4.15 Measure and mark the outline on the aft face in a similar manner to that on the fwd face.

5.4.16 Cut the transom out to the fwd face outlines and bevel the edges back to the aft face outline.

5.4.17 Leave the top edge of the transom un-radiused for the moment. WEST the transom two coats – just one coat on the edges.

5.5 Making the stern knee

5.5.1 The stern knee is made in the same way as the thwart knees. You can find its shape on the General Structures drawing 037/003/01. Note that it is 25mm thick instead of 20mm and the throat radius is 140mm rather than 100mm. The fwd end that abuts the -2750 bulkhead is left square, not radiused off.

5.6 Assembling the components.

5.6.1 Prepare a length of cleating 15 x 25 to screw and bond to the fwd face of the transom so that its top is level across at 270mm above the dwl. The top of the cleating will need to be bevelled (1·5mm) off so that it is level.

5.6.2 Screw and bond the stern knee to the transom. Its bottom edge will be 20mm up from the flat bottom of the transom, so as to receive the hog. Screw from the transom into the knee (1·5" x 8g countersunk brass screws) and dowel over the heads (you can cut a reasonable depth countersink into the transom – say 4mm deep).

5.6.3 Screw and bond the thwart knees to the thwart as before.

5.6.4 Screw and bond the 15 x 15 cleating to the underside of the thwart for the -2750 bulkhead.

5.6.5 Screw and bond the -2750 bulkhead ˇ to the thwart/cleating.

5.6.6 Now fit the transom/stern knee assembly

and the thwart/bulkhead/thwart knees assembly together. Bore off for a screw from the -2750 bulkhead into the end of the stern knee (1·25" x 6g) and from the thwart into the bevelled cleat across the transom (1·25 x 6g). Make sure the assembly is all square – brace from the transom edge to the bulkhead edge if necessary. Blow off the drillings and bond and screw together.

5.6.7 Clean and sand the whole assembly; WEST over the dowels two coats and then finally apply the third coat of WEST (except to the edges around the hull and the bottom of the stern knee.

END OF INSTRUCTIONS BOOK 1

See Book 2 for:

Mast step.
Jig.
Setting up thwart assemblies.
Making the apron.
Making the stem.
Making the keel.
Fitting the gunwhale.

See Book 3 for:

Planking the hull.
Floors
Dagger board and case.
Rudder and fittings.
Quarter and stem knees.
Floor boards
Sundry items.

See Book 4 for:

Making the spars.
Spar fittings.
Rigging.