Starting a scratch-build using *The Anatomy of the Ship*

Introduction

So you've made a few plank on bulkhead kits and you want to stretch yourself, or find there isn't a kit of the ship you want to build. An excellent starting point is The Anatomy of the Ship series of books. The plans are there and all the research has been done for you, right down to the spokes on the wheel and the hinges on the stove. But how do you start? With a little bit of thought it isn't difficult to translate those plans into what amount to kit components, and you can build kits, so what's the problem?

What about the expense of the wood if you mess it up? Try following the tutorial and make a false keel and bulkheads for your preferred vessel from a sheet of 5mm plywood. That's hardly going to break the bank, and if you like what you've made then you can continue to build.

The method I'm outlining is a 'quick and easy' way to get started. Depending on the plans you're using some bulkheads may need to be constructed from the plans, but nearly all are already drawn for you in the body plan. There will certainly be areas where you think there is an easier or more obvious way to do things. Treat this tutorial as a 'how it could be done', rather than a 'how it should be done'.

The tutorial uses Photoshop 7, second-hand copies of which can be found cheaply on eBay, but any low-cost photo editing software will do the job admirably. The process can be followed equally well using scaled photocopies and a lot of cutting and pasting but, since you have access to a computer, the job can be made a whole lot easier and more versatile, as long as you're familiar with basic Photoshop type software.

Things you'll need to know how to do:
- create new layers
- change layer transparency
- change image/canvas size
- crop
- transform – rotate in 0.1° intervals, flip
- use the measure tool to create guides in the correct place
- using the marquee to select and transform elements of the image
- snap
- drawing with the pen tool

Have a look through the help files for your software before you start to make sure you're familiar with the terms. This'll save a lot of frustration later on. I haven't gone into a great amount of detail of how to use the Photoshop tools as you might not be using the same product as I am. You'll need to have a good working knowledge of your own program so you can perform the same or similar operations as those described in the tutorial. There are, however, more detailed instructions on how to use Photoshop in the tutorial I've linked to in the next section.

Scanning the plans

I'm going to be using *The 24-gun Frigate Pandora* by John McKay and Ron Coleman. Start off by familiarising yourself with the tutorial Digitising and Scaling Using Photoshop. For this tutorial I've scanned at 150dpi but I'd use 300dpi if these plans were actually going to be used to make the vessel. Beware of errors when scanning close to the centre of the pages where it is difficult to lay the book flat.

Don't join the two scanned halves by butting the edges together – use the scale on the scanned pages. Guides can be dragged to the 5' divisions on the scale ruler on one half of the scan. These should be equidistant. Make new guides the correct distance apart and drag the second half of the image into position (*fig.1*).

fig. 1
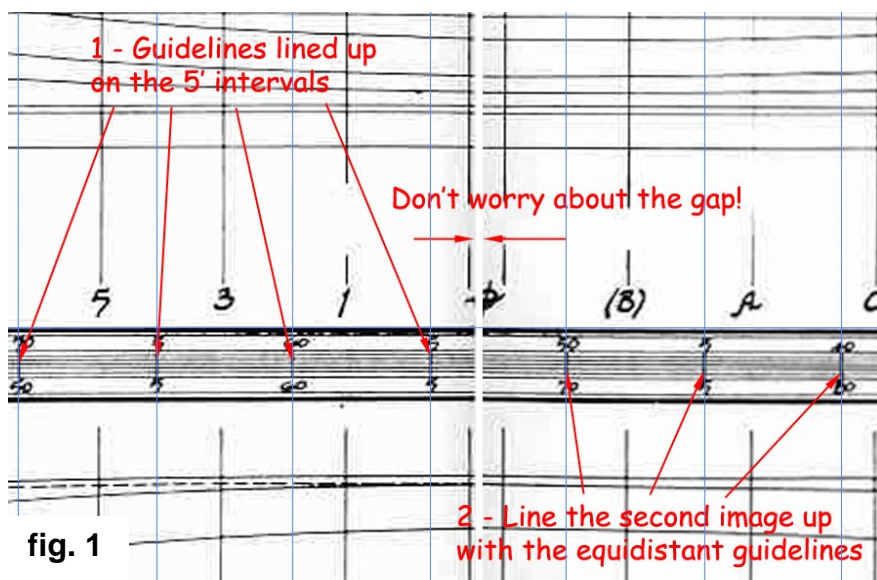
The image has been rotated to ensure the base/centre lines are horizontal and vertical. The plan can be split into sheer (side view), body (end view) and half-breadth (top view) plans to make things easier to handle. Elements of the plans can be rotated independently by dragging a marquee around an area. The transformation is only applied to the part of the plan that lies inside the marquee. For example, the keel might be horizontal but the baseline of the body plan might be slightly tilted. You can't rotate one without the other if they're on the same layer unless you use the marquee tool to isolate the body plan and rotate it independently.

It's good practice to add new elements to the drawing on new layers. This makes errors easier to correct and you can also show or hide them. This is useful if you want to see some parts of the drawing without others. Text can be added to the drawing to annotate it and then hidden for the final print out if it's not required. Altering the transparency of a layer is also very useful, as will be seen in a moment. Don't forget to name the layers. This makes life a lot easier when you have more than a few in use.

Choosing the bulkhead positions
The bulkheads we're going to be making are already drawn on the body plan (end view), but we have to decide which ones to use. Along the bottom of the sheer plan are a number of positions labelled with numbers and letters. Each one of these corresponds with a cross-section on the body plan.

Since Pandora has a quarterdeck I'm making sure there is a bulkhead where it ends, so there is something there to support it. Strategically placed bulkheads at this stage will make your life a lot easier later on. We're going to use an *Inboard Profile* drawing to help choose the 'right' ones. We could have started with this scan, as the stations are marked on it, but it's very useful to have both the lines and the Inboard Profile on the same composite, for constructing drawings of bulkheads between stations.

Start by scanning and adjusting (rotate, crop etc) the two halves of the Inboard Profile drawing. In the image, I've dragged the aft half onto my original drawing. You can see that it hasn't been scaled at the moment (*fig.2*). Change the transparency of the Inboard Profile layer to about 50%. Now we can see the sheer plan behind it (*fig.3*).

fig. 2

fig. 3
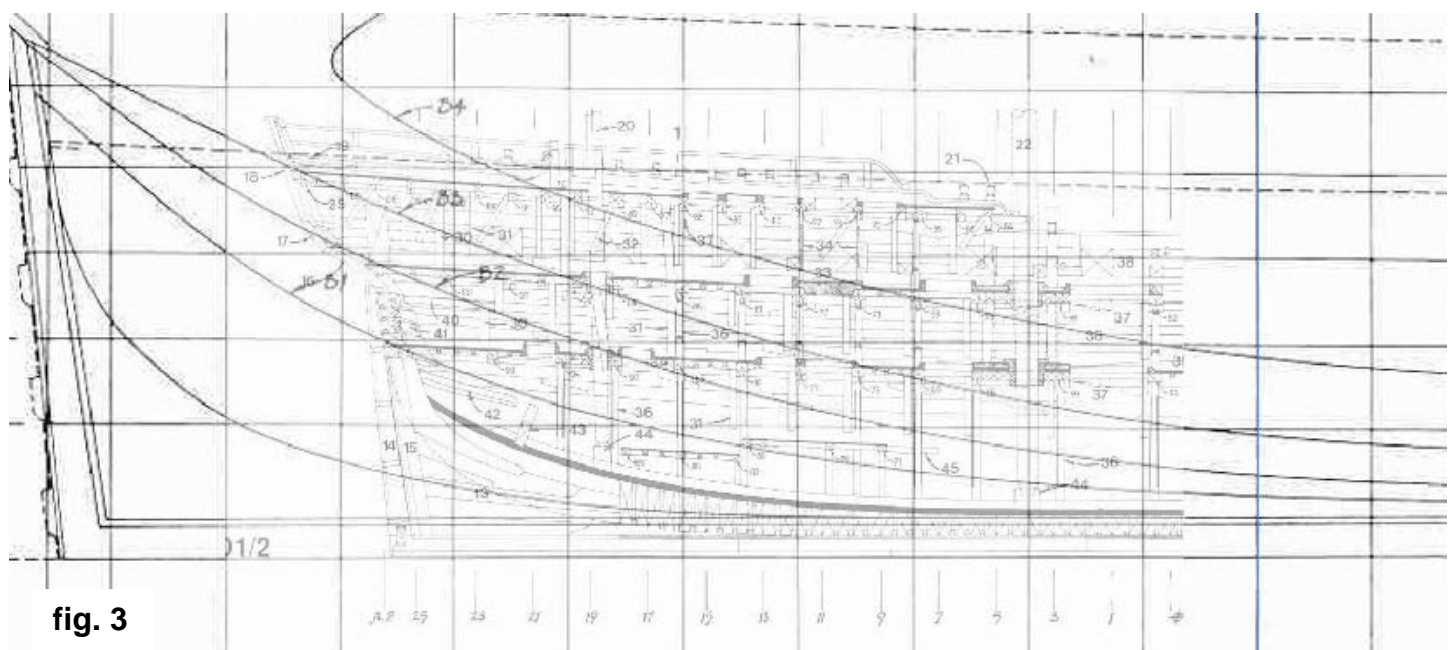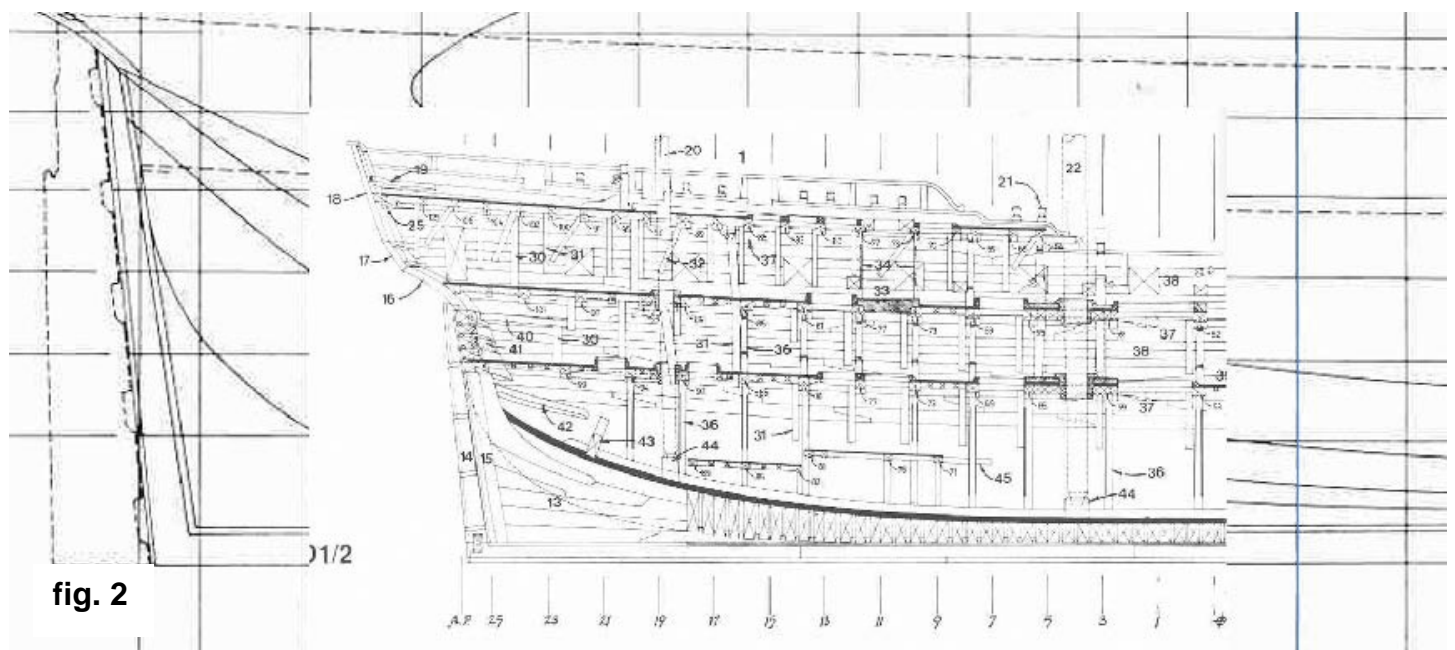
We're going to transform this layer by increasing the size of the image until the Inboard Profile and the sheer plan correspond exactly. Select the Inboard Profile layer and then start to transform it (Ctrl T). A box appears around the part of the image we're going to rescale. Hold down shift (to constrain the proportions) and drag one of the corner handles to increase the size. Clicking in the box and dragging moves the position of the image on the layer. Small horizontal and vertical adjustments can be made by using the arrow keys. With a little juggling the Inboard Profile can be scaled to coincide with the sheer plan layer underneath. *Figure 4* shows the layer scaled and almost in position.

fig. 4
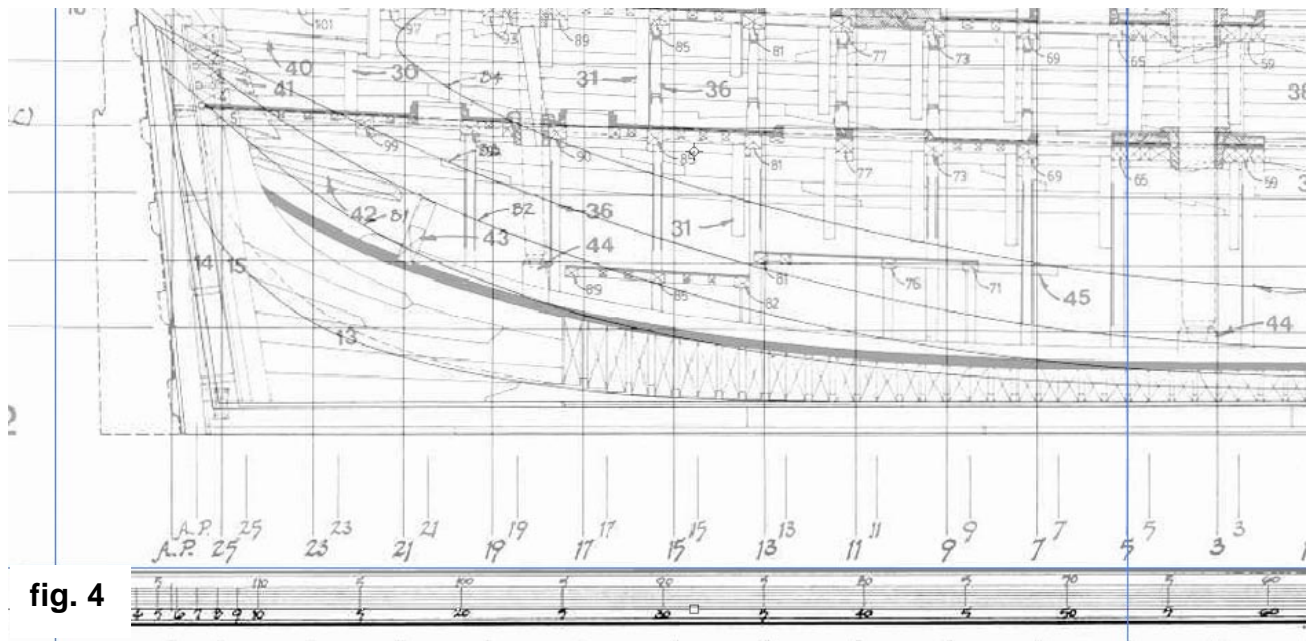
Increase the transparency of the layer so the Inboard Profile can be seen clearly. We can now mark the position of the bulkhead at the end of the quarterdeck, which happens to be at station 5 (*fig. 5*). The next important bulkhead is the break of the forecastle, which is situated nearest to station I (*fig. 6*).

fig. 5

fig. 6
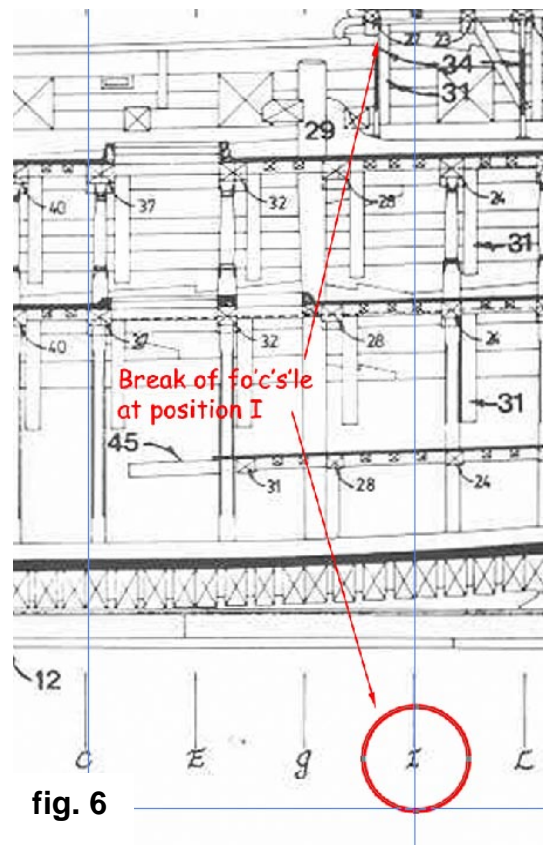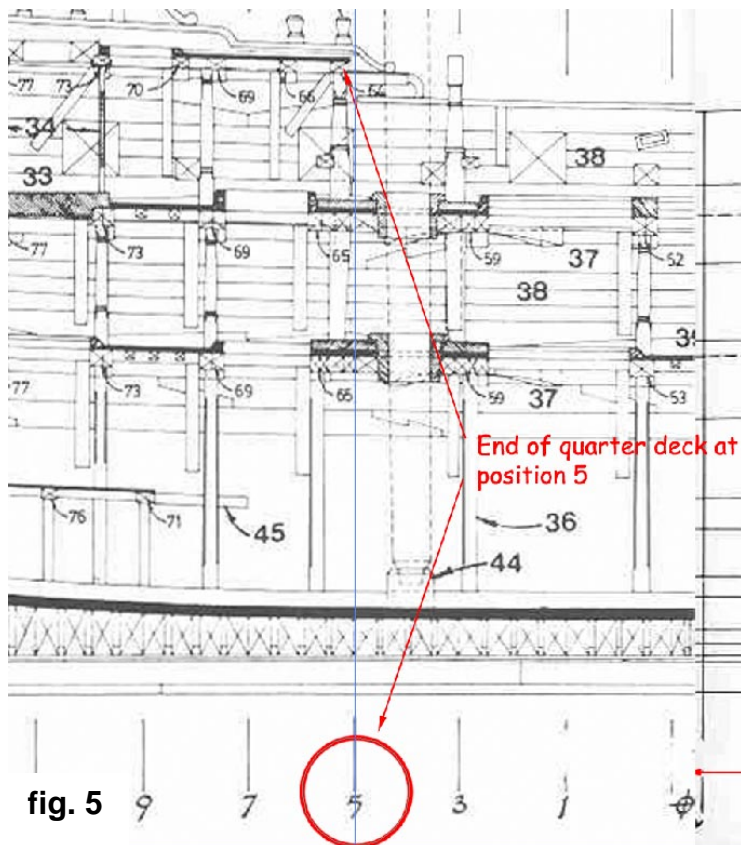
Next we need to mark the positions of the masts on a new layer, using the Inboard Profile to help us. The important dimensions are the width of the masts at the partners (where they pierce the deck) and the rake (the angle of the mast). Once you've marked these, hide the Inboard Profile layer (*fig. 7*).
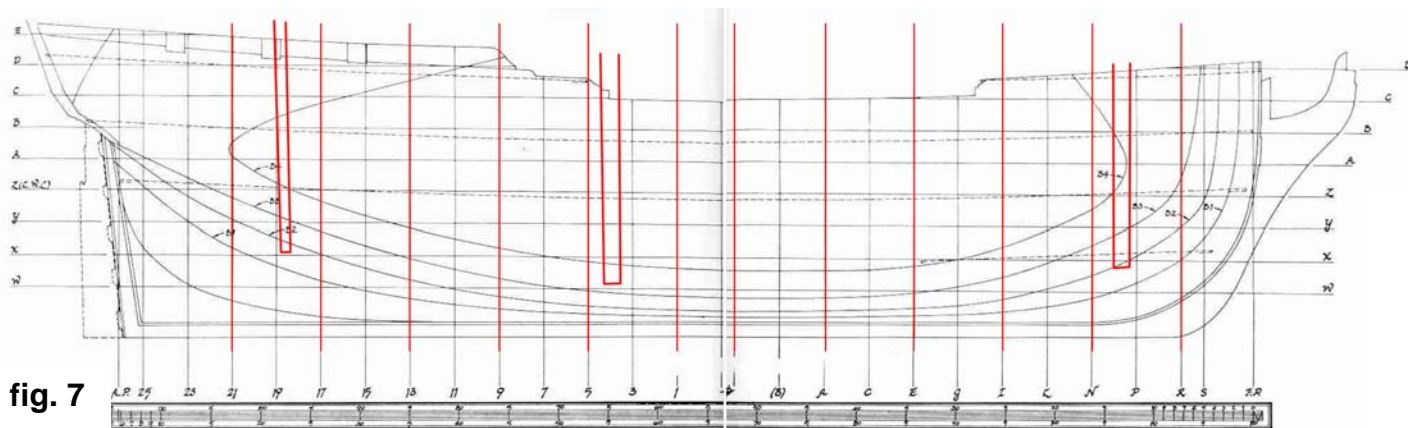

fig. 7

If we now mark the stations shown above we have a good start on deciding which bulkheads we're going to make to form the shape of the hull. They are all 4.25 cm apart (at 1:64 scale), which should be sufficient to create a good foundation for the first planking. However, the deadflat, the station where the beam is greatest, doesn't fall at a convenient position if we want all the bulkheads to be equidistant. It's important (in my opinion) to have a bulkhead here, as this is a defining dimension for the ship. It may look untidy at this stage, having a bulkhead appearing 'out of step' with the rest, but this isn't important. You could leave this bulkhead out but this would leave a gap of about 7 cm between bulkheads without support for the first planking – too wide for me.

Gunports
It's a good idea to consider the position of the gunports now. It can be inconvenient, but not too problematic, if a gunport lies on a bulkhead. Use the Inboard Profile layer to roughly position them in the drawing. Great accuracy in marking the outlines isn't required at this stage (*fig.8*).
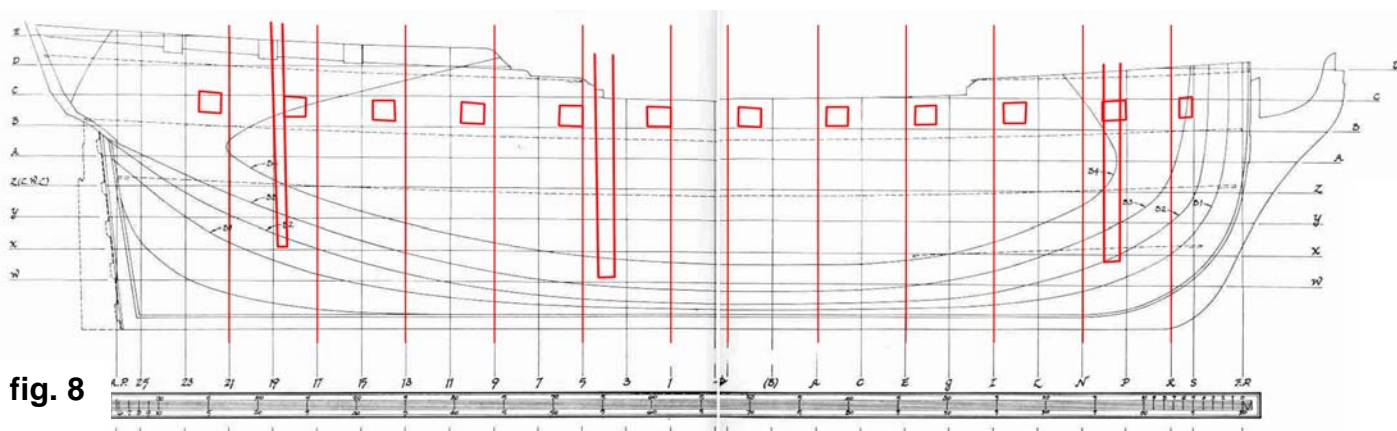

fig. 8

We can now see that all the gunports lie between our bulkheads so there won't be any problems when we come to create the openings at a later stage. If we found that a port did lie on a bulkhead we would have to plan how we are going to make the openings a bit more carefully. In this case we can create a framework between the bulkheads that will outline the ports, which can then be planked over. Next we're going to make the template for the false keel.

False Keel
This can be simply made using the Inboard Profile. In our example Pandora has a long quarterdeck and fo'c's'le so the false keel can't extend upwards into these areas. The simplest way to start is to draw it on a new layer over the Inboard Profile layer.

It's up to you where you want the edge of the keel. In the example I've made the edge the inside of the rabbet line (*fig.9*). A strip can then be added to the edge of the false keel to make the rabbet, as in Chuck Passaro's Syren build. The templates for the sternpost, keel and stem can be made at this stage too.

fig. 9
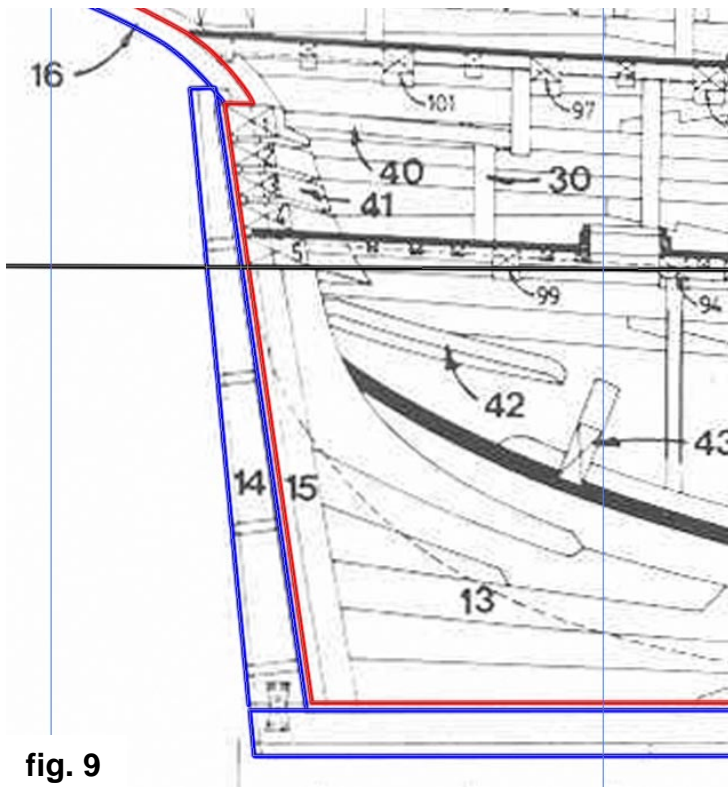
Notes for *fig.10*

1 – This is where the cabins start. Aft of this position is enclosed so there is no need to extend the main deck aft of here, unless you wish to include interior detail.

2 – The blue line marks the outside of the stern frames at the centre line; the red line marks the inside. How you decide to frame the stern will dictate the line you use.

3 – The slots for the masts can be drawn in. The depth isn't important, but the width and rake are.

The black line in *figure10* is the load waterline. The keel is horizontal but the waterline isn't, as the stern sits slightly lower in the water than the bow. We're going to use this line to help construct bulkhead and keel slots of the correct depth.

Make the layer with the station lines you drew earlier visible, then create vertical guides the width of your bulkheads aft of the stations aft of the deadflat, and the same distance forward of the forward stations. Use these to construct the slots for the bulkheads. The slots are as deep as the load waterline. In my example the bulkheads are hypothetically made from 5mm plywood, so the slots are 5mm wide (*fig.11*).
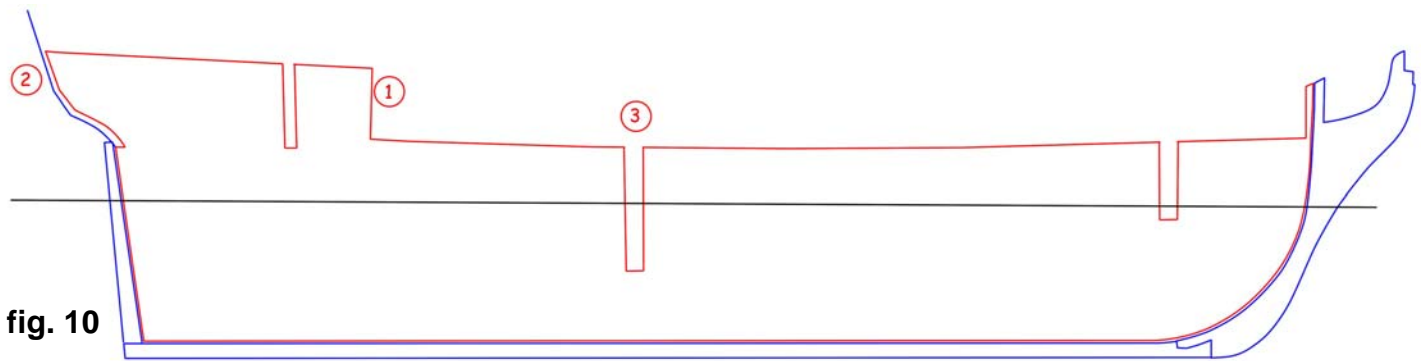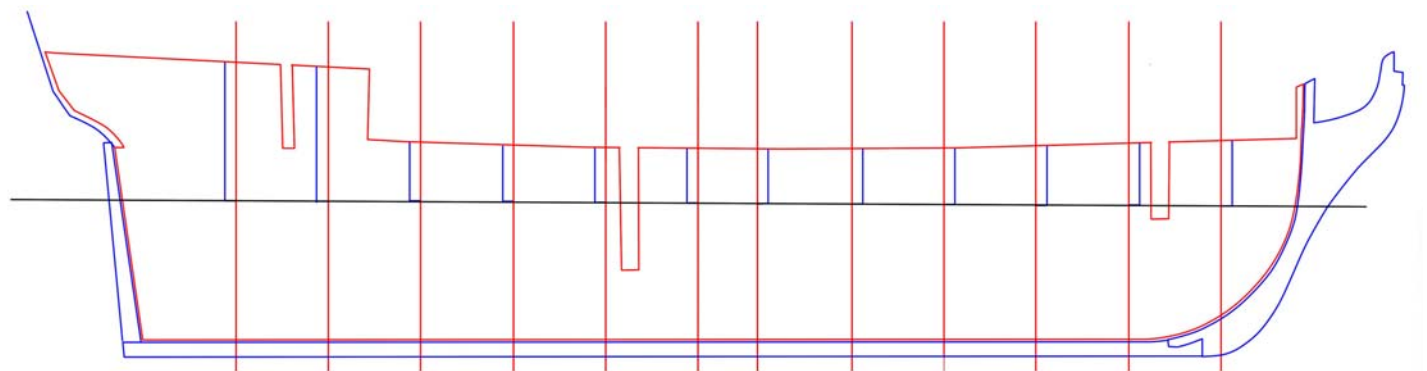

fig. 10

fig. 11

Bulkheads at the bow and stern

Bulkheads near the bow and stern need to be more closely spaced. The hull curves more dramatically in these places so it's a good idea to have a good foundation for the planking. Extra bulkheads between stations can be constructed by using the plan lines and following Russ Barne's article Interpreting Line Drawings for Ship Modelling.

If you want to use CAD software to draw the bulkheads then have a look at Drafting Frames Using CAD. With a little bit of thought Photoshop can be used to construct them, though the tutorial uses AutoCAD.

The plank-on-bulkhead kit experience you already have should help you decide the number and positions of the extra bulkheads to be added fore and aft. There is another way of going about making the shape of the bow and the stern by using filler blocks, but this is the subject of another tutorial.

Making the bulkheads
The bulkhead templates can be taken straight from the body plan. This usually shows the dimensions before planking, so you'll have to consider how thick your planking is going to be on the model. It's easier to adjust the planking thickness than the bulkhead dimensions. In our example Pandora's planking should be about 1.5mm thick at 1:64 scale.
Let's start with the bulkhead at the break of the quarterdeck, station 5. Start off with the body plan, make a copy of it and then mark the centreline and baseline with guides. Station 5 is one of the aft cross-sections, which are on the left side of the body plan, so delete those sections on the right (you're working on a copy, right?) (*fig.12*)
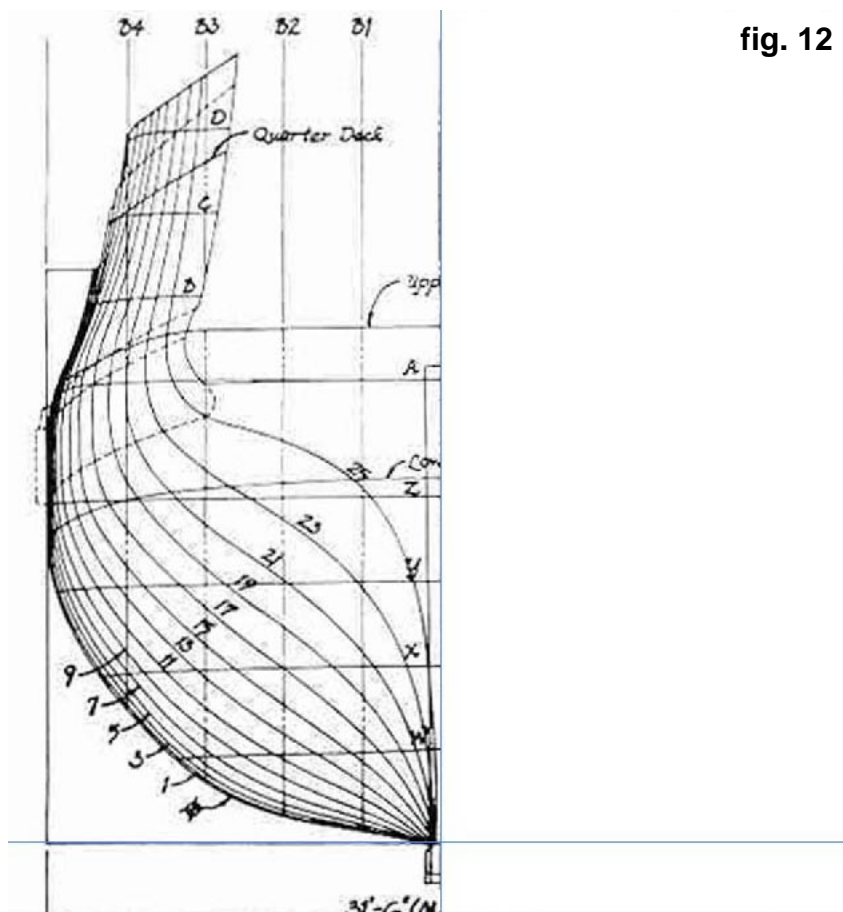

fig. 12

Now erase, or paint over, all of the other lines outside station 5. Be careful where the lines are difficult to distinguish because they are very close together. If in doubt then erase slightly outside of the line. You are making a template for a bulkhead and it's easier to remove wood later on than to add it.

I'm starting with station 5 for the tutorial. If I were making all the bulkhead templates I'd start off with the deadflat and not erase anything. I'd make another copy, then erase everything on the outside of station 1; copy again and then erase everything to the outside of station 3, and so on. Once you have all the templates made you can erase the lines from the inside of the cross-section.

An alternative method is to trace the lines on a new layer. New layers can be added for each new line, previous layers being hidden as you progress so the drawing doesn't get too cluttered and confusing. Don't forget to add the reference lines (centre, base, load water line) so we can align everything up later on.

Now we need to copy and flip to produce the whole bulkhead (*fig.13*). We now have the outside of the bulkhead so what about the inside lines for the deck and the bulwarks? The Anatomy of the Ship book provides drawings of cross-sections from which the bulwark dimensions and the deck cambers can be taken. If cross-sections aren't available for all of the stations you're using then the 'missing' information can be constructed from other plans in the book.

There is a drawing of the cross-section at station 5 so we're going to scan it and add it to a new layer on our image. Use the method outlined previously – drag the cross-section onto our image (it will create its own layer), change the transparency and transform/scale it. In *figure 14* I have erased all of the internal lines from our bulkhead. The bulkhead inside dimensions can now be marked on one half of image, then copied and flipped to complete the bulkhead. I've used a much thicker line than I would normally, for illustrative purposes. The 'shelf' at the top of the bulwark is to support the quarterdeck (*fig.15*). Don't forget to label each of your bulkheads and give them logical file names.

fig. 14

D3/10

Bulkhead 5

fig. 15

Bulkhead 5

fig. 16
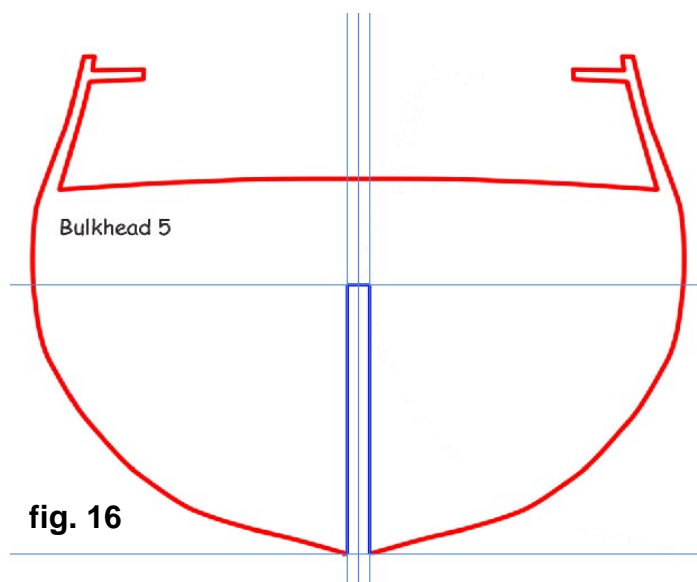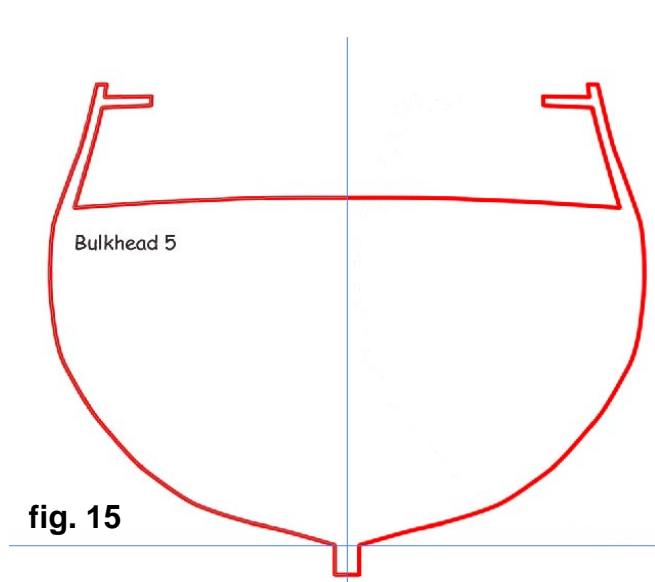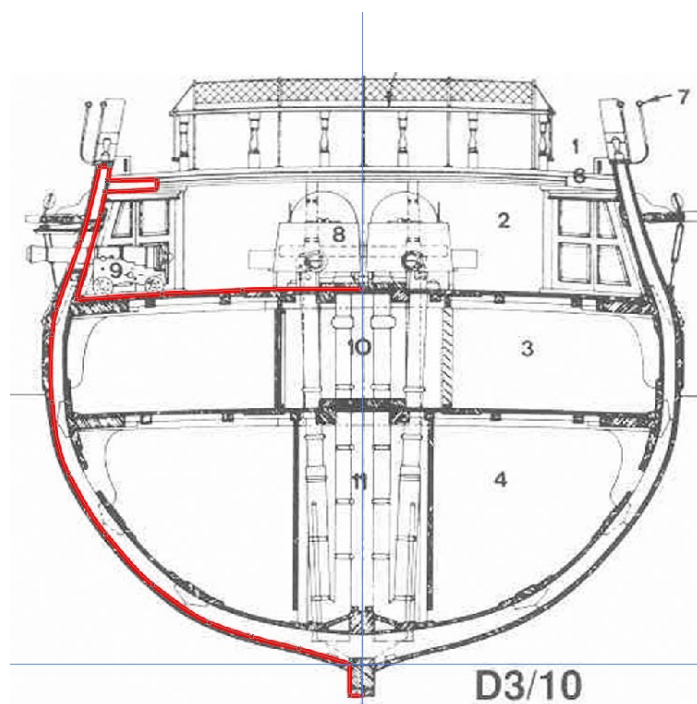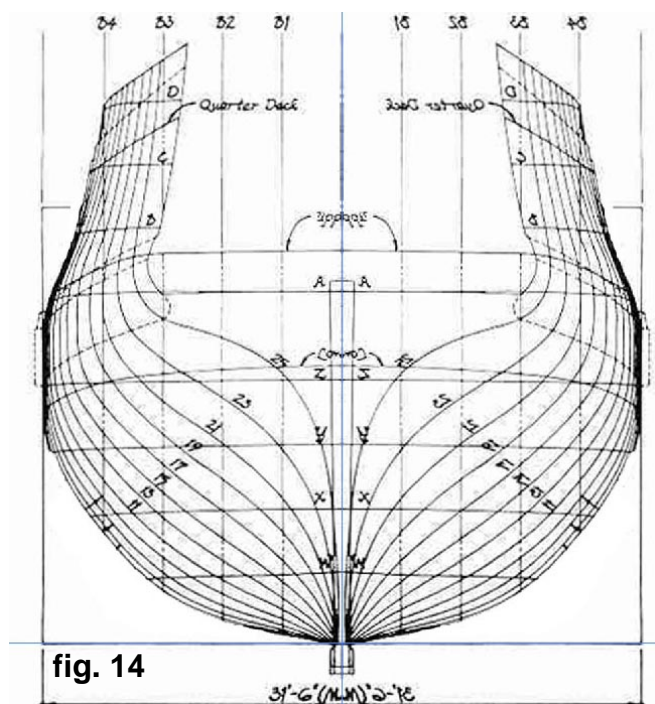
Finally, we need to make a slot in the bulkhead so it will slide into the false keel. The slot needs to be the width of the keel wide, which, in my hypothetical example, is 5mm. Add a horizontal guide across the load waterline and a vertical guide 2.5mm either side of the centre line. These guides can be used to construct the slot that will fit into the false keel (*fig.16*).

Stern frames
The stern frames are most easily built using a method similar to that used by Chuck Passaro in his build of Syren (*fig.17*). We'll start off by having a look at Pandora's actual framing and then break it down into components that are relatively easy to model.

In *figure 18* the approximate position of the bulkhead at station 25, the aft-most bulkhead, is marked in red. Note that it doesn't actually follow the framing of the real ship. The bulkhead on the model will be vertical but the framing isn't. This isn't a problem as the shape of the bulkhead follows the shape on the body plan, which is what we want. The red area approximately shows the bevel made on the bulkhead after fitting.

We do not need to be concerned with the timbers highlighted in blue, the transoms, as the shape of these will be made by the first planking as it flows over the bevel on bulkhead 25 and into the rabbet at the sternpost. This also goes for the timbers highlighted in yellow, the fashion and filling pieces.

The important shape to consider is the face of the stern timbers highlighted in green. To make this before fitting is quite a skilled job, but we don't need to do this, as will be seen.
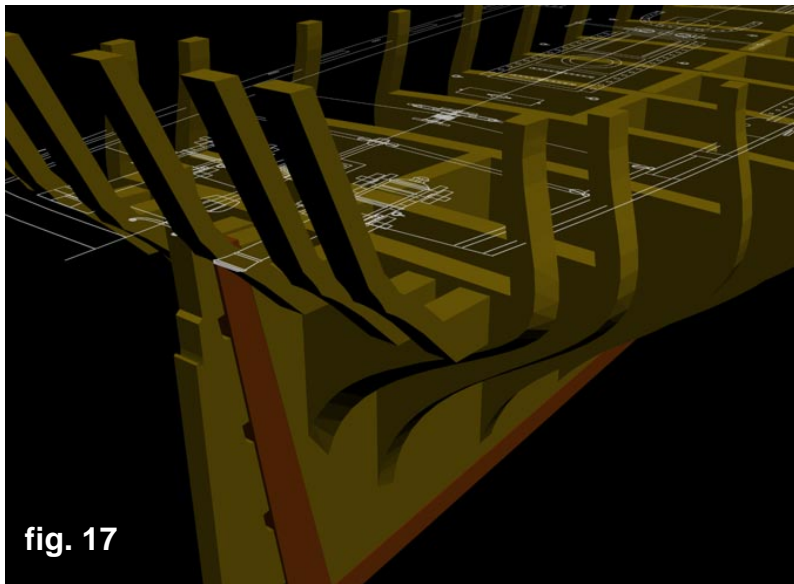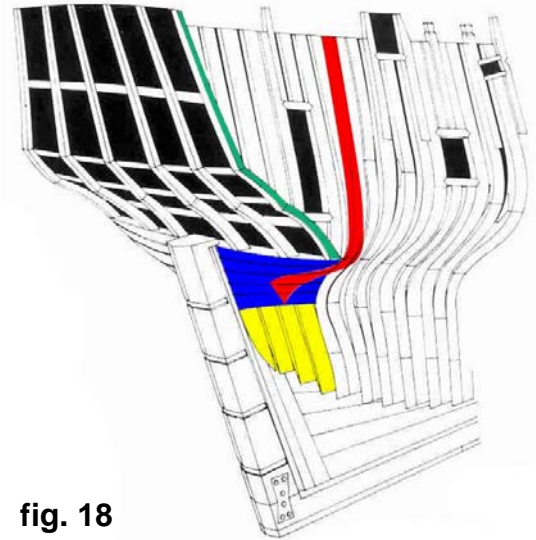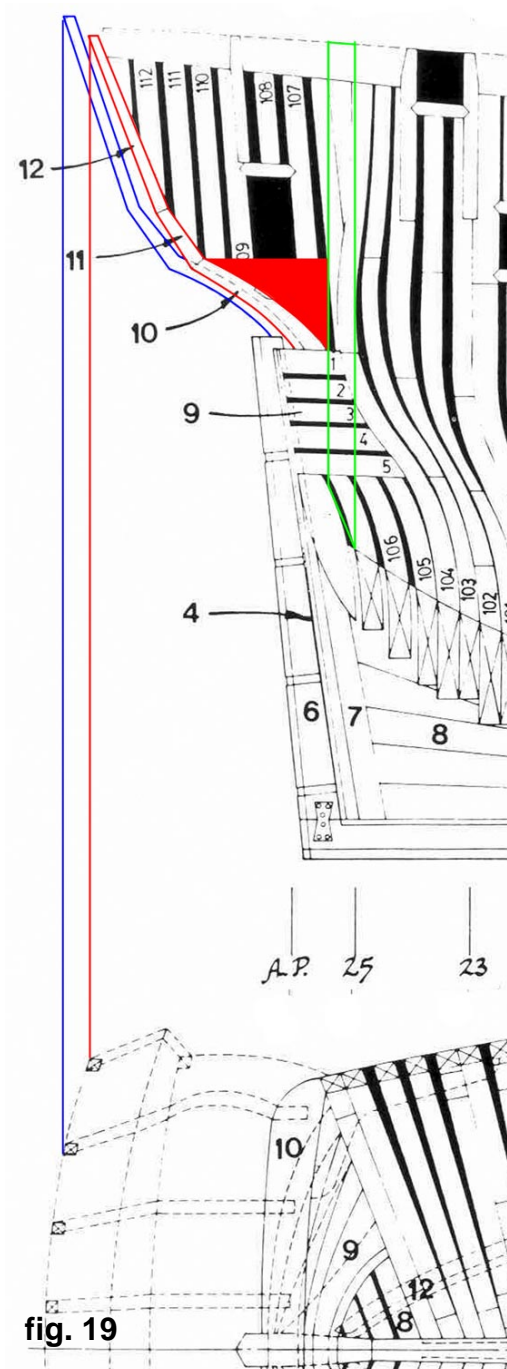
fig. 17

fig. 18

fig. 19

Now we'll get down to making the templates for the stern frames. In *figure 19* we have the view of the stern frames from the side and plan views. This isn't quite how it appears in the book as I've adjusted the image for my convenience. In plan view it can be seen that the timbers bend inwards towards the centreline, but this doesn't concern us as we only want the shape as shown from the side, highlighted in red and blue in the top diagram. In the actual vessel windows were placed between the frames. If these are to be glazed with a transparent material on the model then you will obviously have to shape the stern frames to accommodate them. Design your templates accordingly.

The green line is the outline of the bulkhead at station 25, the lower end showing the bevel to be made once the bulkhead has been fitted to the false keel. The red area is the extra material that will need to be added to the frame so it can be fixed onto the bulkhead in the correct position.

We now have enough information to construct the inboard frames, but how should we approach shaping the outboard frame, highlighted in green in *figure 18*? The trick here is to make this frame wide enough, when looking from aft, to shape the outboard face after it has been fitted onto the bulkhead. An alternative is to double up two frames, as shown in Chuck's Syren build. The final shape can be derived from two references: the run of the planking and the outline of the transom on the body plan. Pandora has quarter galleries that will hide your carefully sculpted lines, but you'll still need to get the profile right so the planking will lie correctly.

Conclusion
You're now in the same position as you'll find yourself in when starting out with many kits, except that you have an unbelievably good set of plans to continue working with, and a shopping list for wood. You'll still need to make or source other components but this is all part of the fun.

Remember, this isn't a 'build the Pandora' tutorial. Everything in this tutorial can be applied to any of the Anatomy of the Ship sailing ship books. One of the problems with a first scratch-build is having the confidence to actually start. Hopefully this tutorial will give you a push in the right direction. Go on, have a go. You know it makes sense!