LOCATING STRINGERS ON BULKHEADS

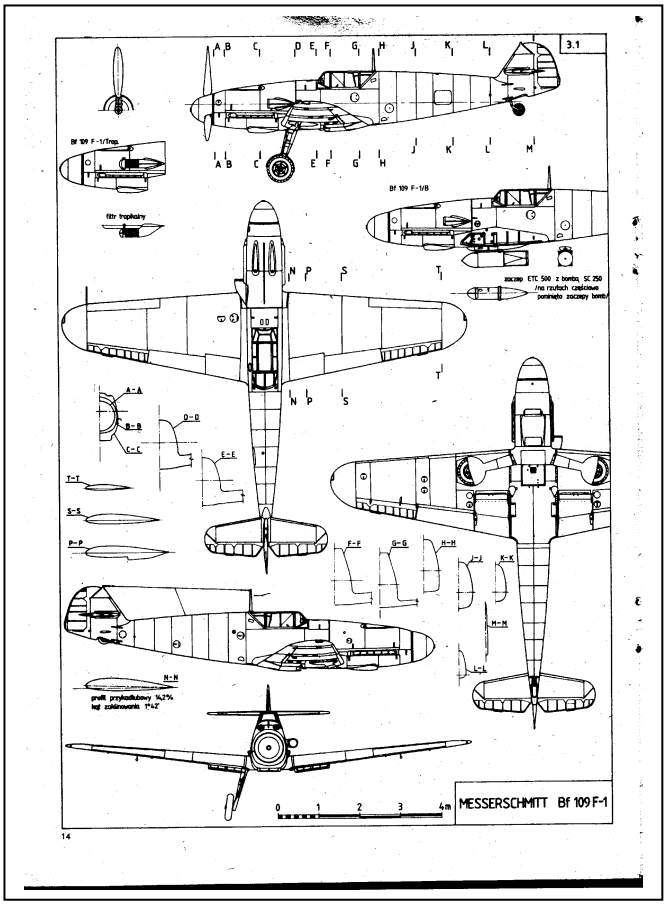
John Berryman

INTRODUCTION:

When we design stick and tissue models (as opposed to building from someone else's plans), we are often confronted with the need to distribute stringers equally around the circumference of a series of oddly shaped and sized formers (bulkheads). Consider the Bf-109F, which is round at the nose, roughly trapezoidal at the center of the fuselage, and egg-shaped aft of the wing. After some years of effort, I have developed the following method for distributing stringers. It does not involve computation, and I suppose that it can be done with a pencil and paper, but it is far easier to accomplish with the use of a CAD program. In the following presentation, I make use of TurboCAD, and the subject will be a BF-109F.

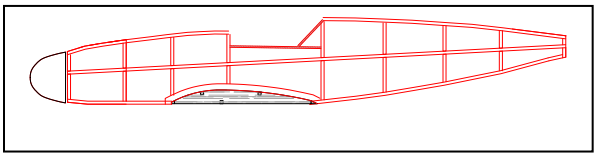
THE 3-VIEW:

Here is the drawing from which we will work:

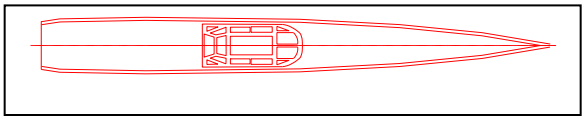


The first steps will probably be quite familiar to you, so I will breeze through them. First, we establish the "crutch" for the fuselage (the top and bottom outlines) and a rather arbitrary line that runs from nose to tail-post.

Here is what this looks like for the 109:



We also establish a top-view of the fuselage:



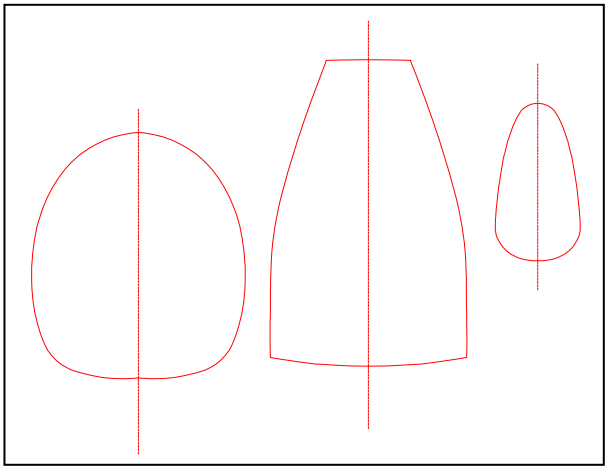
A word of explanation is appropriate here. NEVER establish a top-view by drawing the left and right sides of the fuselage! In my experience, "generally available" (i.e., free) three-views are NEVER truly symmetrical. Instead, establish the best orthogonal center line you can, draw one side of the fuselage, and using the

"COPY ENTITIES - MIRROR" command, make an exact mirror image of the side you've drawn.

THE FORMERS:

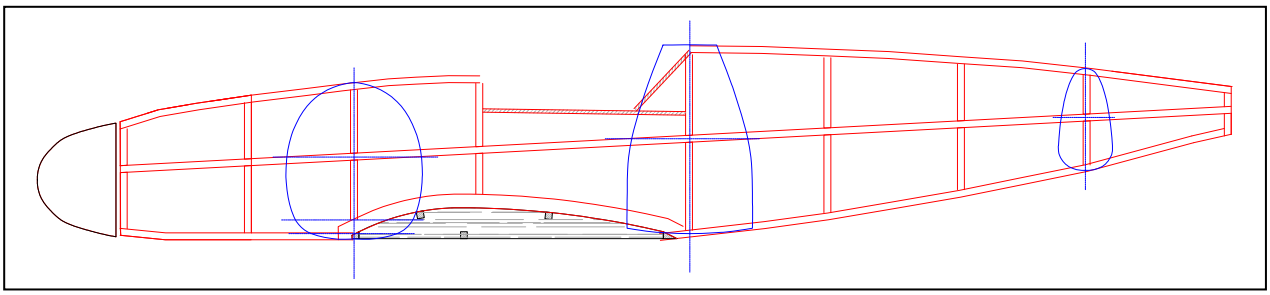
We will work with three of the eight formers of this fuselage: The second former, the former just aft of the trailing edge of the wing, and the former just forward of the tail-post. In practice, stringers would be located on all eight formers using this method.

First, using the fuselage sections on the plan, draw each former, mirror image it, and draw an orthogonal line connecting the meeting points of the former halves; then group the outline. Here is what each former looks like at this stage:



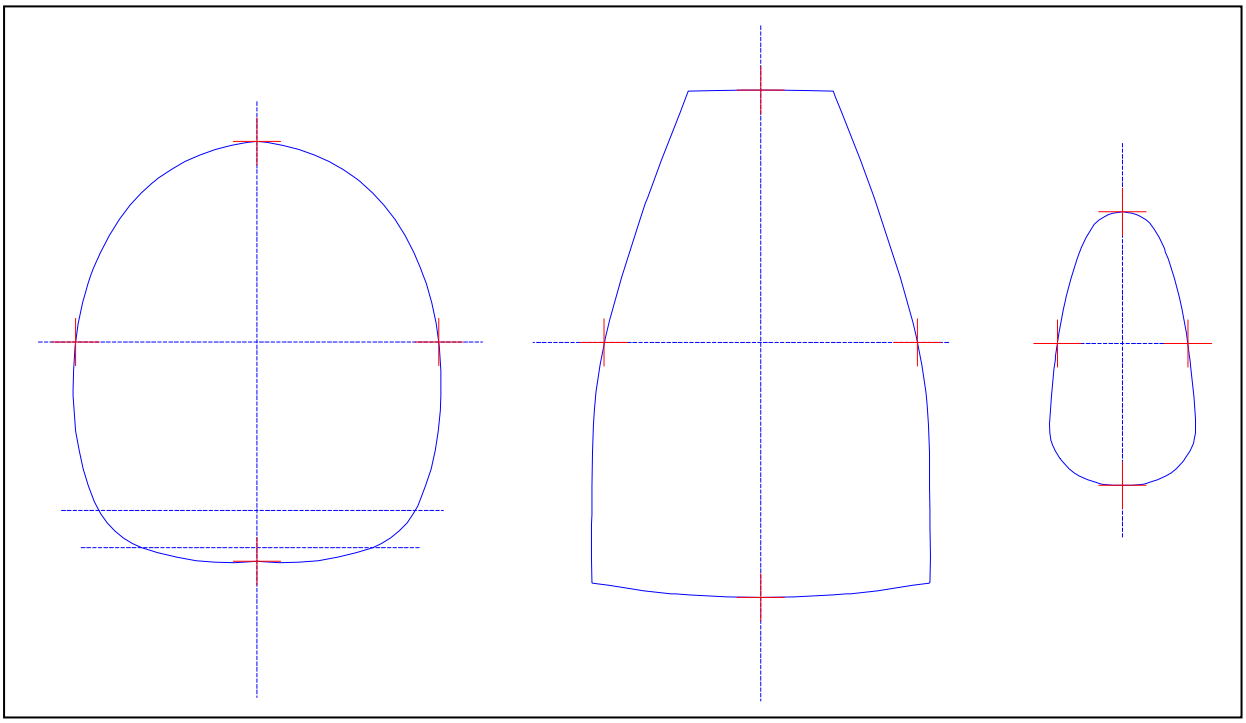
Now, move each former to its appropriate place on the side view and scale it to the appropriate LENGTH. Almost certainly, the formers will not scale exactly to your side view. Then, flip each former 90°, move it to the top view of the fuselage, and scale it for WIDTH. Again, some adjustments are likely to be necessary.

Return each former to the side view, and using the nose-to-tail-post line, establish where that line will cross the former. Here is what that process looks like for the three formers in this exercise:

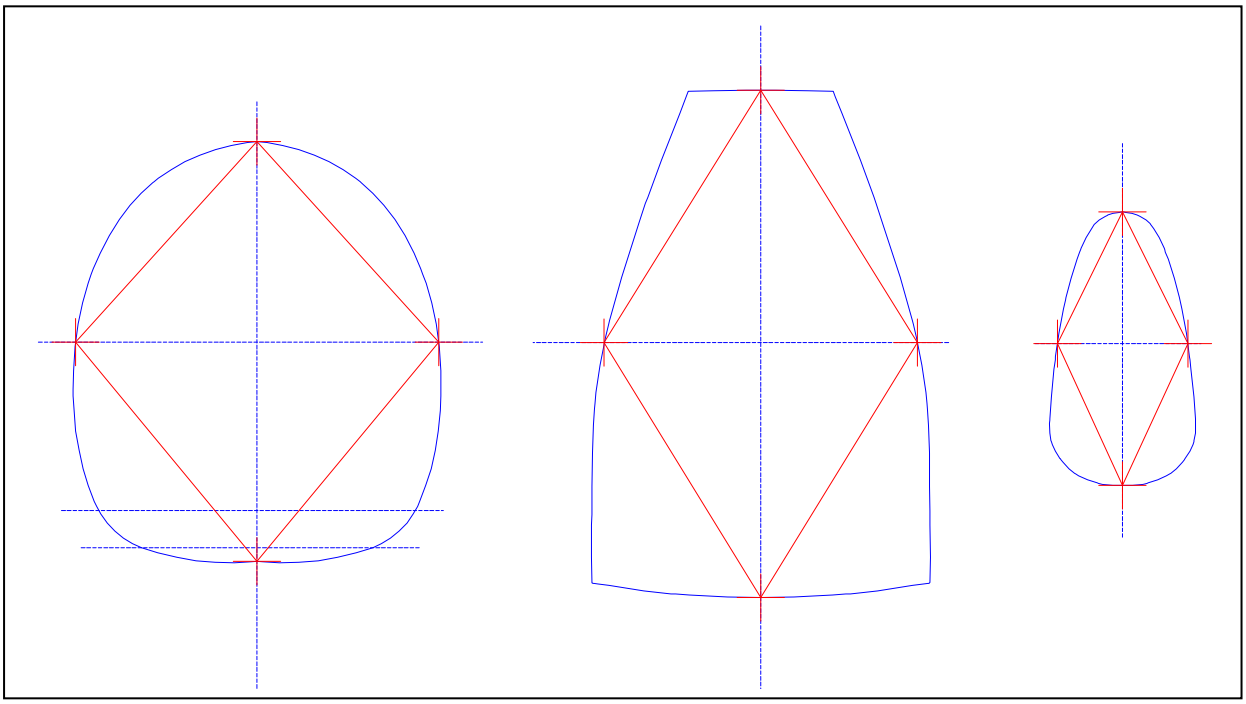


Note that for the first former, we have also established where the wing saddle will meet the former.

Now, we remove the formers from the fuselage. We will assume for this P-Nut model that between each intersection of the former and a center line or nose to tail line, there will be 3 stringers. Using SNAP TO – INTERSECTION, place a cross at each intersection:



Next, again using SNAP TO – INTERSECTION, connect each cross with a line:



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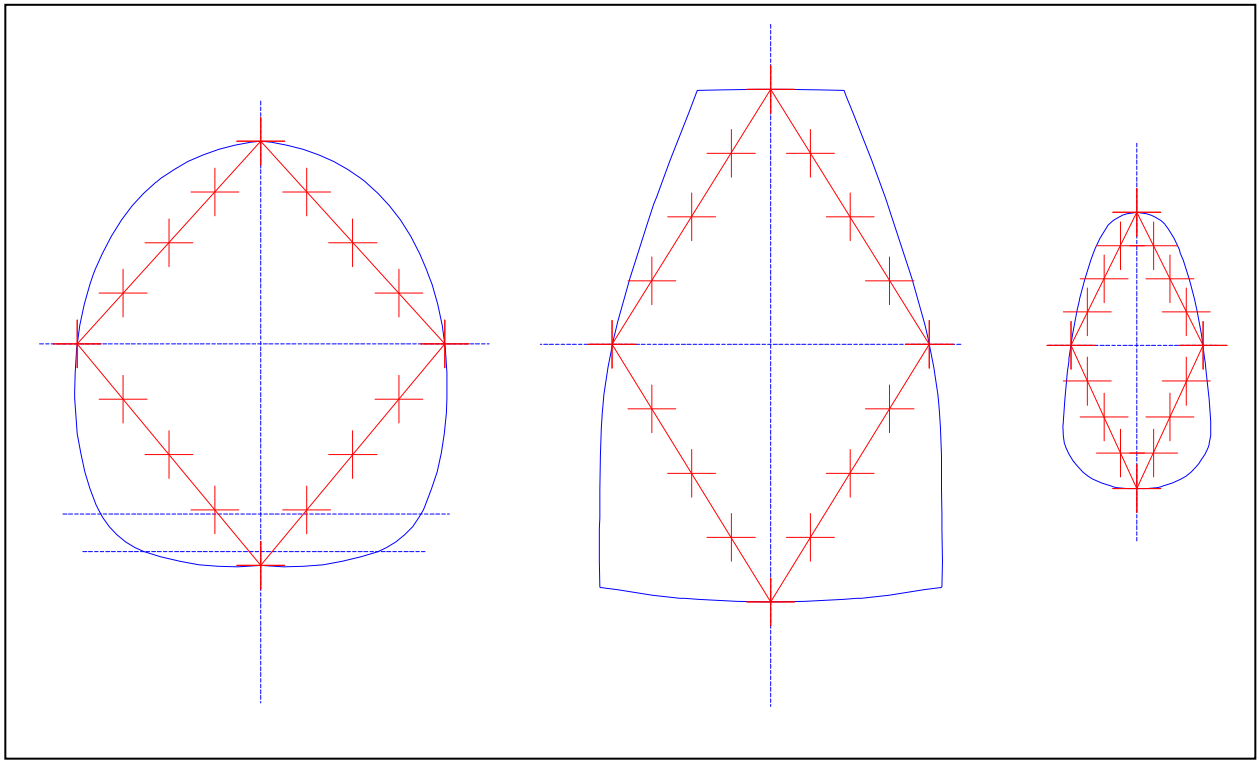
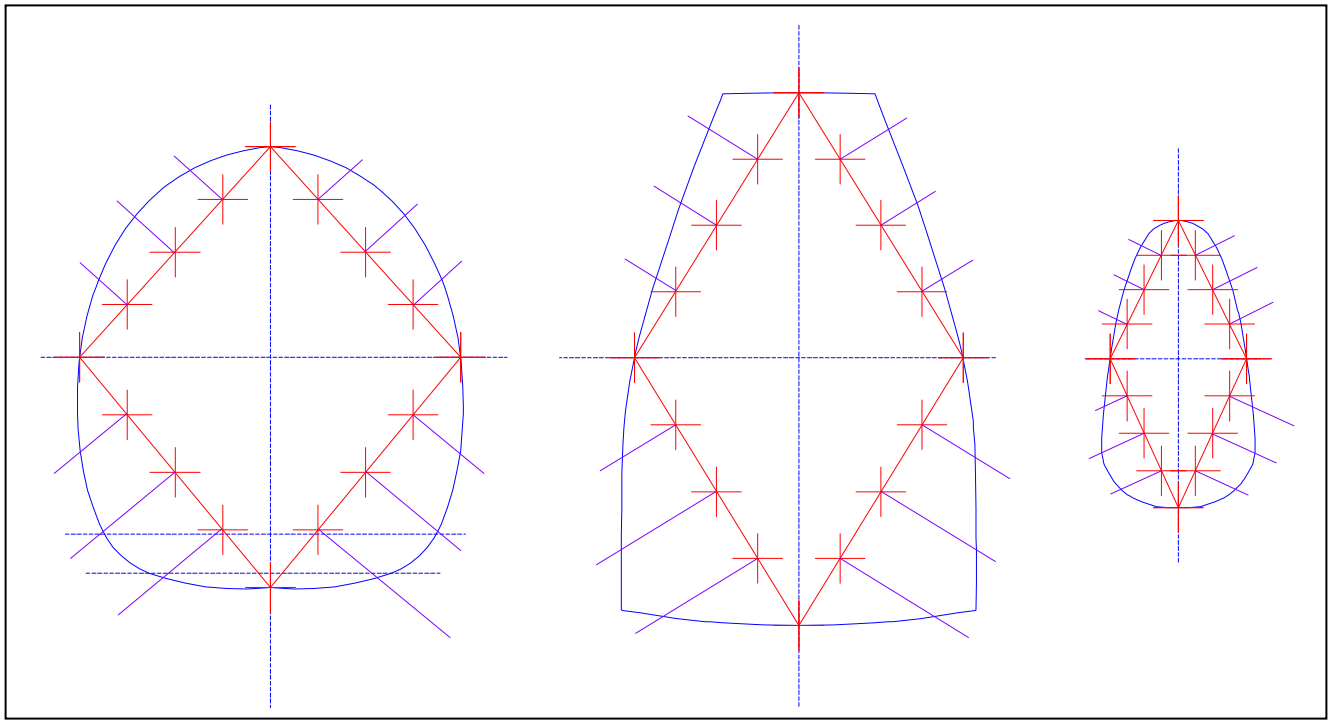
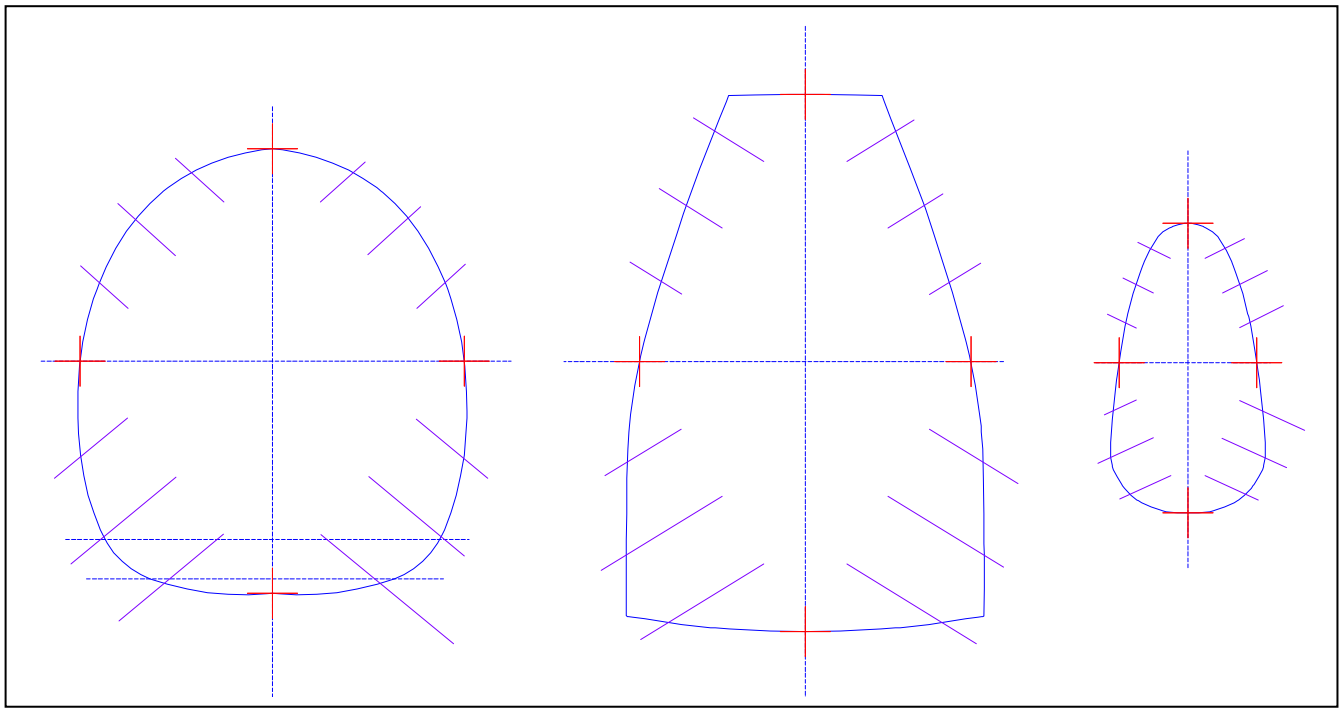
Now, using the appropriate SNAP TO – INTERSECTION and EDIT – COPY ENTITY - FIT LINEAR commands, select a cross (e.g, the top centerline cross) and distribute THREE intermediate stringers between it and the nose-to-tail line, to do so; make FIVE copies of the cross. Repeat for each line. The result looks like this:



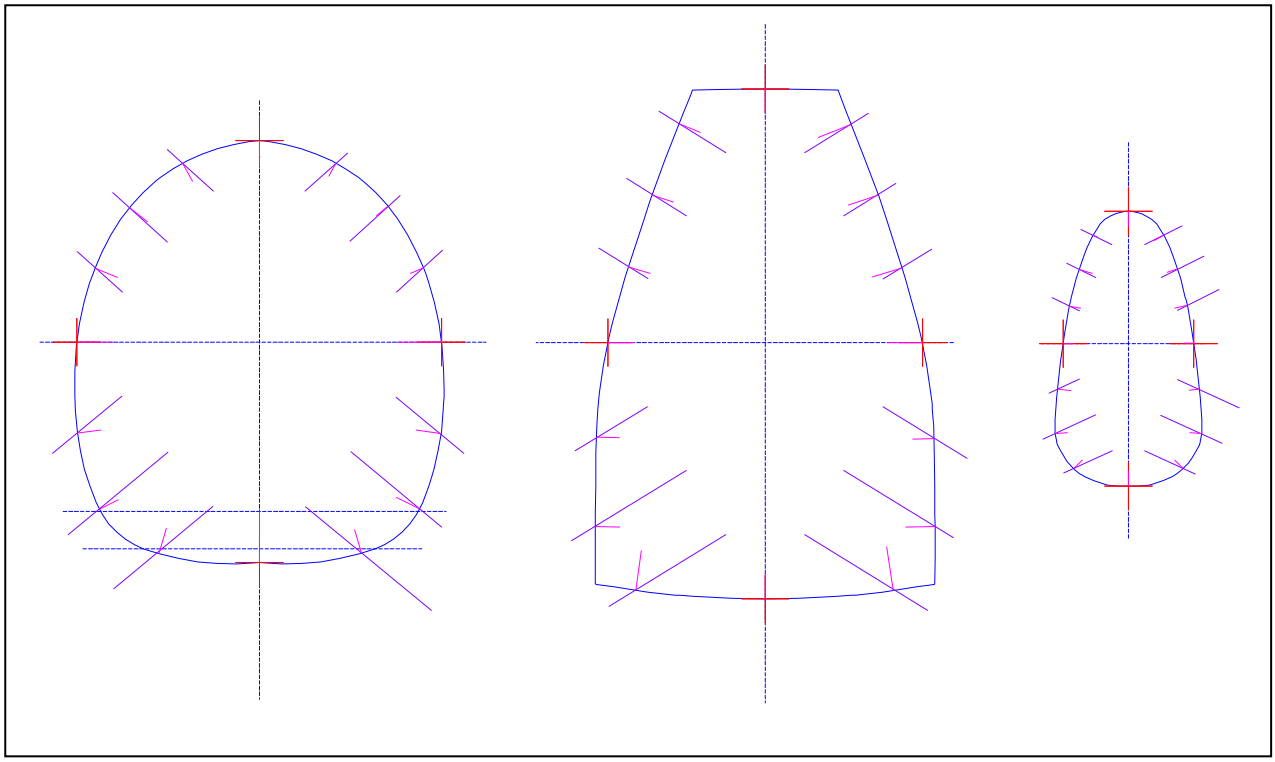
Next, using the PERPENDICULAR LINE command draw lines perpendicular to each line, beginning at the intersection of each point and line and extending beyond the outside of the former. Here is the result:



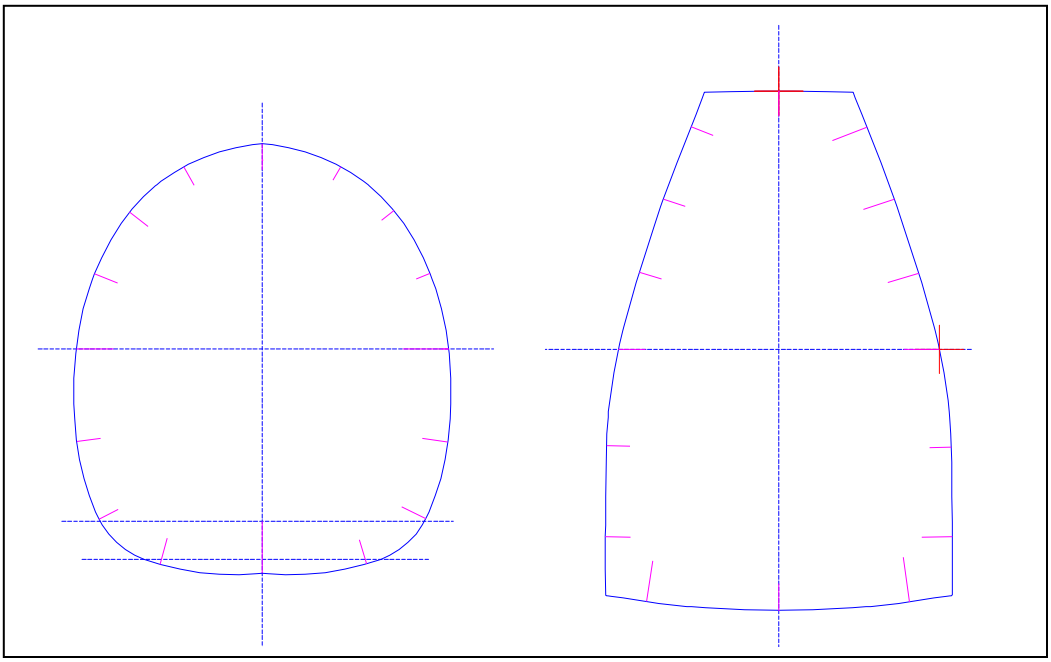
At this point, we're done with the crosses and lines, so let's make our lives easier by cleaning up the drawings:



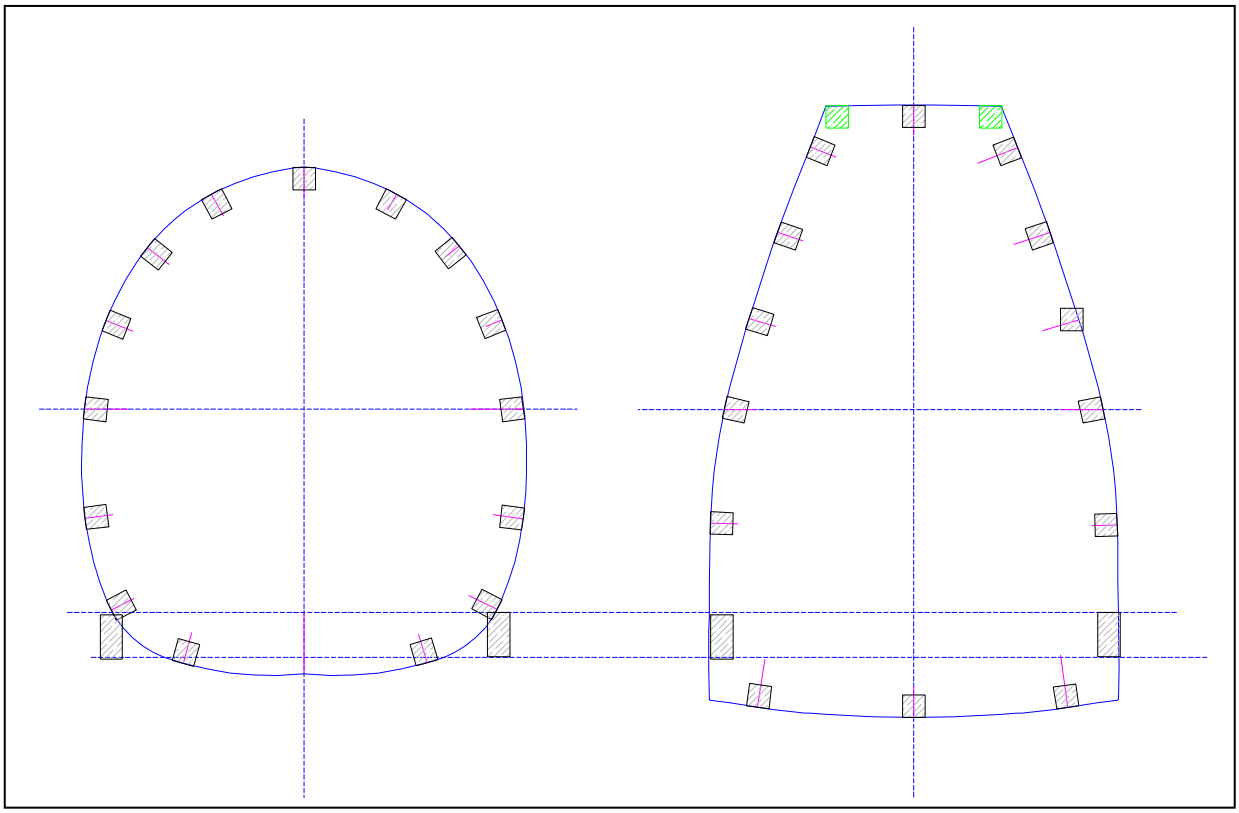
Now, again using the PERPENDICULAR LINE command, we will draw a series of short lines from the intersections of each line and each remaining cross perpendicular to the border of the former.



And we clean things up again:

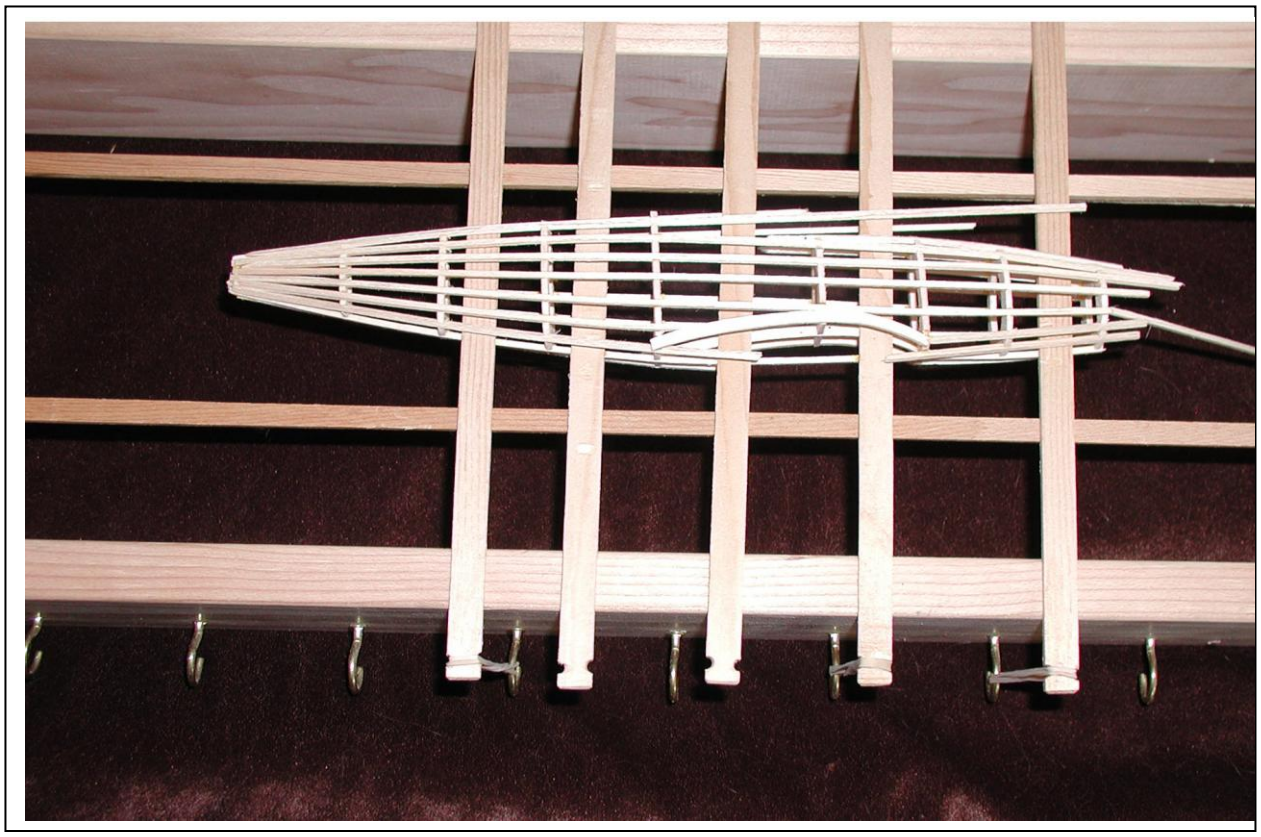


Yep. Each of those lines marks a stringer location. I usually guild the lily a bit and actually stick in the stringers, thus:



Note that I've done a couple of other things. On each former, I've done a size-check for where the wing saddle will fit. On the right hand former, there was interference; I've deleted the stringer, and made a mental note that on the model, the stringer will have to be cut to meet the wing saddle. Also note the two additional green stringers on top of the right hand former. They denote auxiliary stringers that I will need to insert in order to preserve the hard-edge shape immediately aft of the canopy that transitions to an ovoid shape at the next stringer aft.

And here's how it all works out in practice:



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