

THE CASE AGAINST BOX FUSELAGES

By Tom Arnold

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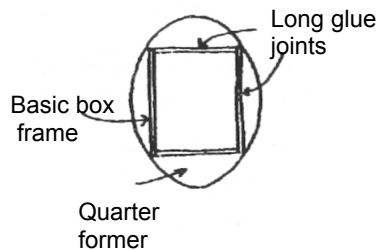
One of the most sacred traditions of rubber scale modelers is the ubiquitous Box Fuselage. The classic Bellancas, Pipers, and a host of Golden Age ships had box fuselages that were easy to make (once you got the technique down), very light, and took a tissue covering magnificently. Combine that with the fact most were high wing cabin types that were inherently stable and it all made for some great days at the flying field. Because of these excellent results, the wisdom grew that the simple Box Fuselage was the secret behind those feather light flyers and it was. Next came the evolutionary step of the Quarter Former which was a clever way to give a round bulkhead to the nose area over the basic Box Fuselage which predominated from the wing aft. So far, so good it was still the best choice of construction technique.

However, with the elliptical or rounded fuselage shapes of the metal monocoque aircraft of the late 30's and 40", the Box Fuselage and Quarter Formers were adapted for the entire fuselage with the confidence of its inherent superiority for lightness and strength. Take a look at some of the better Golden Age Kits (P-51 , P-47, P-39, et. al.) and the careful engineering of the box frame is quite evident.

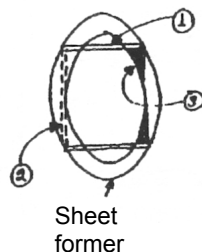
Not only that but they are indeed light and fly like bandits. So what's the beef? They are tough and tedious to build, that's what. They use a minor mountain of small pieces, all of different shapes, and the preciseness of their gluing and alignment can really take the steam out of a smoothly moving project. Repairs are maddening and many minor crackups become major repair jobs. So while different techniques like the Half Shell method have come along and are used, they tend to be heavier and held in less esteem for blood-and-guts contest flying than the Box.

The Editor (he was the editor of Scale Staffel at the time) feels the Box and Quarter Formers have been oversold and the Half Shell is only close to greatness but not there.

First off, lets look at the 2 regarding strength and the famed lightness from a graphic point of view as opposed to weighing (mostly because he's got no sensitive scale) it all scientifically. Our assumptions are gong to be based on 1/16" sheet formers and 1/16" square Box Frame members. Here's a typical Box Frame and Quarter Former bulkhead:

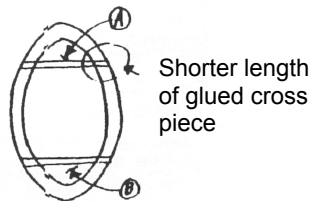


and here's a sheet balsa former:



- 1) This is a key point. This is a 1/16" square cross brace glued to eliminate the former from splitting. It allows also the former to become lighter the larger it is built (see drawing below).
- 2) Notice that the sheet former has the 1/16" vertical piece of the box frame buried in the former as a matter of course. Sort of a "phantom upright".
- 3) This small triangular corner piece is the only extra balsa weight that a sheet former carries over the box frame and it is not exactly useless weight as it strengthens the

comers much like a gusset would. Note in this example of a large former, it actually has less balsa in it due to the open Area A & B.



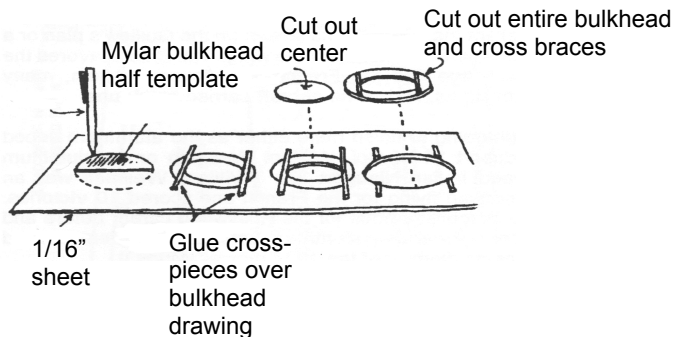
With these sketches in front of us here's the case for a sheet former vice a Box Frame and Quarter Formers.

1. The sheet former has only 2 more 1/16" square cross braces than the Box. However, glue weighs more than balsa no matter what kind you use and the Box has 2 more lengths of glued vertical pieces. No matter how you hack it, 4 glued pieces weighs more than 2.

2. In the larger sizes, the sheet former has less balsa in it and a much shorter length of a glued cross brace. That means lighter weight overall.

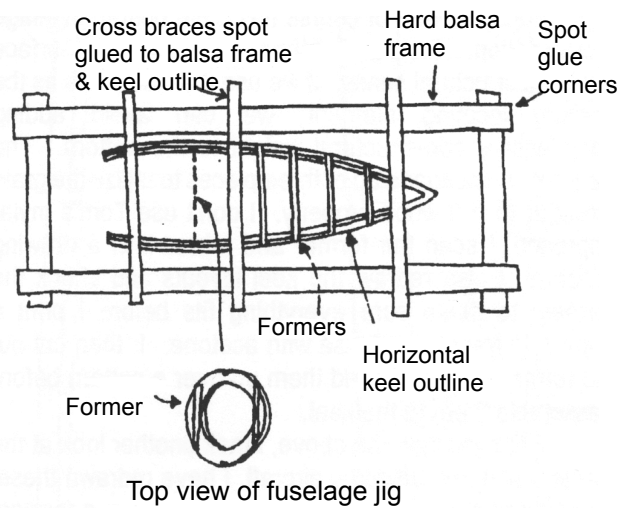
3. The only excess weight the sheet former carries is the little corner triangles of balsa and it adds to the rigidity of the former. Since rigidity of the former really is the limiting factor as to how narrow you can cut it, every little bit helps and it allows you to cut it as close as you dare. This whole argument depends on the 1/16" cross brace on the top and bottom of the sheet former. Without it, the sheet former is far too weak and the Box Frame is king. But with it, it's a whole new game.

The actually cutting of the sheet formers is a breeze. The Editor cuts a half former from a piece of mylar and with a ball point draws it out on a sheet of 1/16" balsa. The template is flipped over and the second side is drawn joined to the first. This will give you a symmetrical former. Now, you may not have the correct size or shape depending on how sloppy your initial engineering was but being symmetrical you at least have the same correction (usually sanding) to both sides of the fuselage. The 1/16" square cross braces are glued in place on the sheet balsa/drawn former and they can extend beyond the edges of the drawn former. The former is cut out, the inside hole is cut out and it's done, fast!!



The next challenge is how to assemble the full formers into a fuselage. The newsletter a while back ran an article on different fuselage building techniques and the easiest, truest, and fastest of the methods has got to be the external jig method. As a review here's how it works.

If the fuselage has a straight centerline, a laminated outline (usually two 1/16" square strips) of the top view is made. A number of strips of 1/16" sheet scrap approximately 1/8" to 3/16" wide is then tack glued across these horizontal keels and extending out both sides a good bit. (These cross pieces should not be placed to interfere with slipping the formers into place.) Now the whole floppy affair is set in the center of a picture frame-type of external jig and the cross braces tack glued to the frames sides. The formers are now slipped into their appropriate spots (a little pre-notching of the formers and/or the keel helps, of course), square up and hit with CA glue. The top and bottom stringers are added (they could also be laminated keels if you are dealing with a complex shape) firm it up and then the remaining stringers added. The frame affair can be picked up, turned around and easily worked on. (Ed. Note: This was written before Buzz Trabbic of Rocky Top Models started producing his fuselage building fixture. See: http://www.rockytopmodels.com/rta-004_details.htm)



The only caution is to stand it up on end against the wall to prevent you from accidently crushing your handi-work as you putter around your workbench. When completed, the cross braces are cut off and cut out of the fuselage and there you have it.

The only change to this whole procedure is if the fuselage has a curved fuselage centerline (like an Me 109). In this case, you mount the vertical (i.e. top and bottom) keep outlines in the frame. Otherwise, all is the same.

The builder may wonder why not always use the vertical keels as the basis for your fuselage especially since so many 3 views show it in such great detail. Besides that's kind of where a plane has its personality. You can, but it's a little more difficult to insure both side stringers (or keels) are symmetrical. The eye can pick up a side asymmetry a lot quicker than some isolated erroneous outline on the top or bottom.