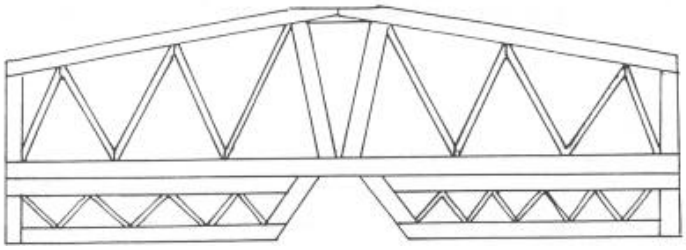
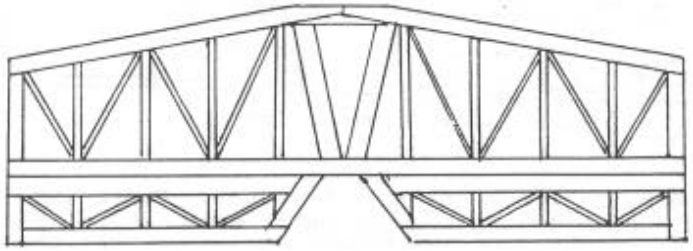
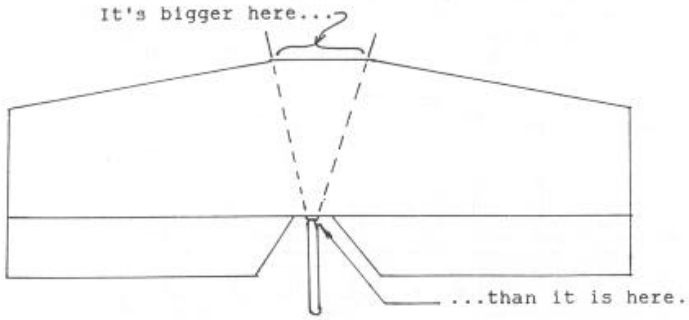


If you're worried about having the lumps showing through the covering, you can use a combination of these two. Put in the needed ribs and put in 1/8" x 1/16" diagonals that don't touch the covering.

This gives geodesic strength and the right appearance, using triangles.



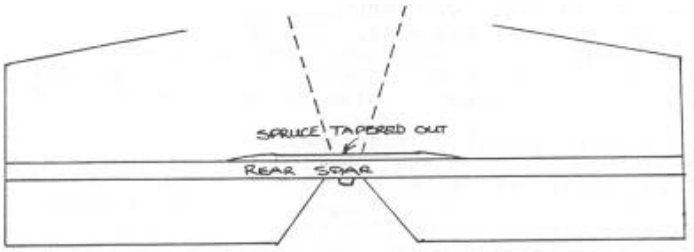
In the tail there is probably only one piece that has to have a little strength added. Most of the plans and kits I've seen just make the tail out of heavy wood. Sometimes it is sheeted. This type of stab often fails. The reason is that the tail isn't the whole story. There is a fuselage in there.



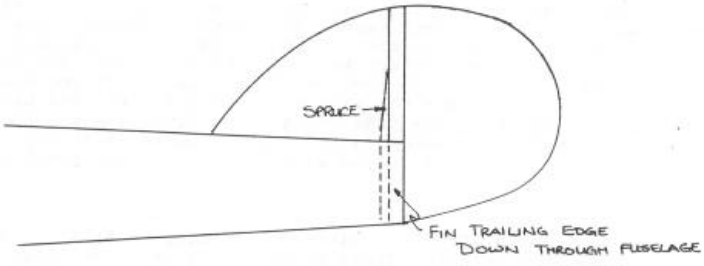
Moving the elevator is causing loads on the tail. Most of the load is caused by deflecting the surface, not because there is an air load on it. The forces are occurring at the back of the stab, which is sitting on the narrow end of the fuselage. The stab is flexing up and down at the rear. There is a stress riser where the stab rests on the fuselage. That's where the stab fails. It cracks and the stab fails. A cure for this problem is a piece of 1/8" X 1/4"' spruce tapered out at the ends. It adds a gram or two and increases the strength by 100 - 200%, even for a fully sheeted stab, it adds a lot of strength. (see figure top of next column)

Vertical stabs can be done the same way. Lots of airplanes have the tail glued on top of the fuselage.

When building the fin, continue the trailing edge of

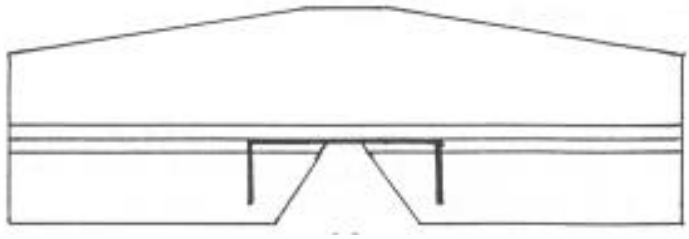


the fin down through the fuselage. Reinforce this with a small piece of spruce, tapered to avoid a stress riser.



Little tiny pieces do wonders.

Make the elevator spar continuous through both sides. Make both sides as one piece and tack glue it to the stab. It's all one piece. It is carved and sanded and then the two parts are popped apart. I always set in a piece of block on both sides of the elevator.



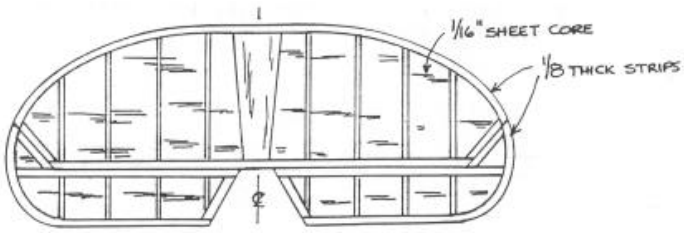
Take a piece of wire (small airplane 1/16", medium 3/32", large 1/8") and make up a "U". Slot it into the two halves while they are still attached to each other. When you are done, you can cut it apart. Glue the stab in and finish the sheeting. You can still fish the wire through the fuselage when you're finished. Glue on the elevators with epoxy when everything is lined up nice and straight. It seems to work pretty well. Keeping wood in there makes sure that everything is straight when you make the final attachment.

Some planes require different ways of doing things. Sometimes you have to run two push rods and horns to 2 separate halves.

To make a curved tail outline with straight pieces is a pain. Making a laminated tail is easier. Use a piece of ply or foamboard, and under cut the outside dimensions by about 1/4". Cut strips of 1/16" X 1/4" balsa and stack it up with white glue between the

laminations, wrap it around the ply or foamboard form and tape it in place. Let it dry, take the tape off, pin it down and fill in inner structures. You can use 1/32" strip for the really small airplanes. It is very strong, like eggs and circles. It weighs virtually nothing.

If you don't want to do all that, you can use the "core" method.

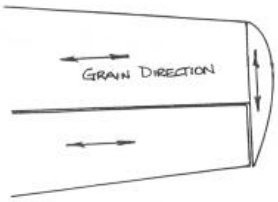


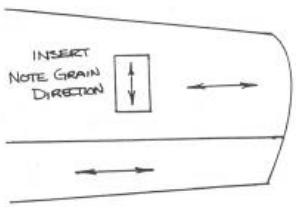
Turn it over and repeat on the other side. Then sand it to section.

A lot or people think that by cutting a bunch of lightening holes they are cutting a lot of weight. If you add it all up, you save a few grams and end up with a floppy piece of sheet. It probably isn't worth it. The same is true for ribs. It's unbelievable how little weight you save. It looks nice, but that's about it. That doesn't mean that you shouldn't lighten that great big piece of 1/4" ply, but for typical lightening of balsa, it's usually not worth it.

Small planes don't need a built up tail. Use sheet balsa. Use "C" grain. It's that speckled, very stiff stock. My little Shrike has that. It is very stiff for its weight. It gives strength and torsional rigidity. This is the place you use "C" grain. It doesn't bend very well, so of course that's what you get in kits for wing sheeting or fuselage sides!

On small airplanes a sheet balsa tail is not a bad idea. If you are using a sheet balsa tail and you're worried that it's going to warp, you can add tips of balsa with the grain going the opposite direction. This prevents the sheet from cupping. Another ancient trick is to cut a slot in the middle of the panel and let in a small piece of balsa with the grain going the other way. If you know that one, you're showing your age.





These are both ways of dealing with a sheet tail. On small airplanes, (250 to 300 sq.in.), you'd probably end up heavier with a built up tail. It would be thicker and therefore cause more drag.

FUSELAGE:

This is the single biggest piece of structure that people over build.

A lot of old timer kits and plans knew what they were doing when it came to wings and tails. The wings were beautifully designed. The tails were works of art. Unfortunately, the fuselages were built like baseball bats. The reason was that they were built to crash half a dozen times before they were trimmed out. We don't have to worry about that, ("It says here in small print").

Fuselages are one place to save a lot of weight. Unfortunately, it depends on what you want to do with the fuselage. If it's a sport plane (it doesn't matter what size it is) you can get away with sheet balsa and a few stiffeners. With 05's, use 1/16" sheet balsa sides and 1/8" sq. in the corners. For 25 to 40 use 3/32" sheet with simple cross bracing and 1/16" sheet top add bottom, cross grained, and you're done.

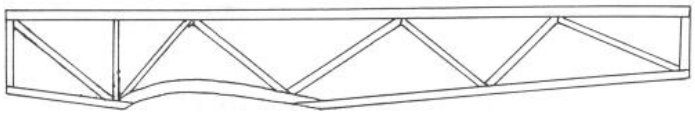
If you're talking about big scale fuselages, try doing the same thing and it weighs a ton. As the size goes up, the volume goes up as a cube. The fuselage becomes very heavy, so you have to look at other ways to do the realistic or scale structures.

The following is more for realistic or scale structures.

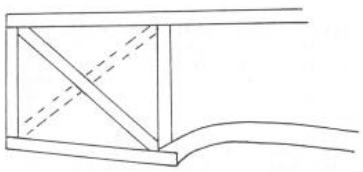
The simplest way is the old box type old timer structure.

Then you put in cross braces, jig the whole thing and cover it up. That's okay, but remember the triangles.

You're better off with diagonal braces.

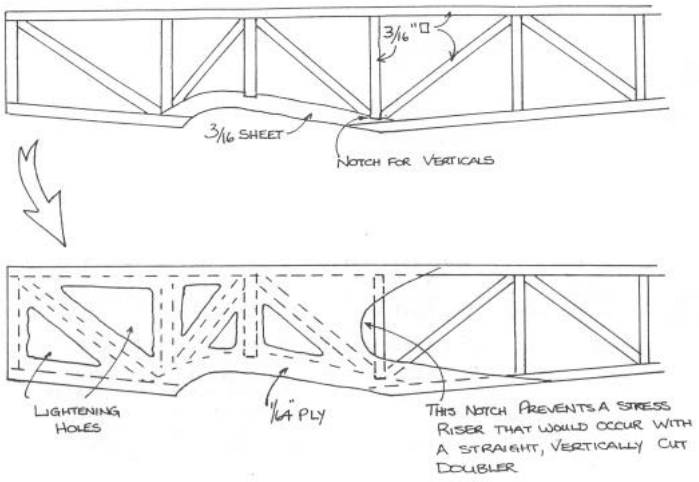


Even with verticals at the bulkhead position, you want to add a little strength so put in a diagonal like this:

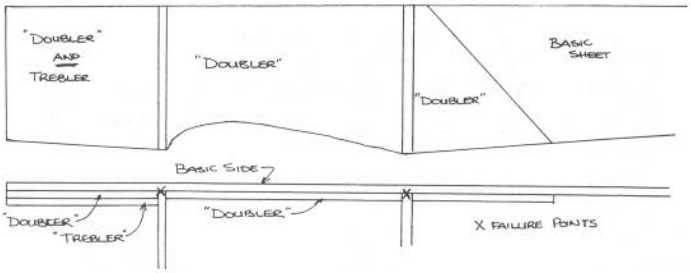


If you think about it, as you come into land, the motor wants to continue down and this diagonal, in compression, prevents the bay from parallelogramming. The triangle is doing its job. You can also put one going the other way.

Another thing that you can add for very little weight, but a tremendous amount of strength in the front end is 1/64" plywood.



Many kits use a very poor design for fuselage construction.

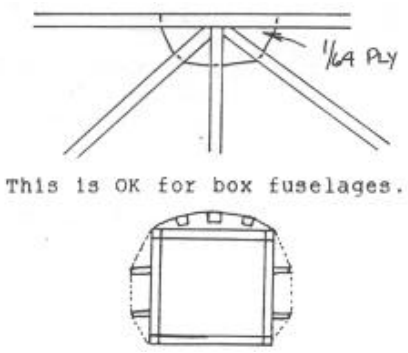


With the above construction, the plane comes in, bounces and breaks. There you have it - a fishead, lying on the flying field.

You're better off using 1/64" ply like this.

If you think you need extra strength, this is the way to go. The nice thing is that every square inch of this 1/64" ply can be used. Save everything for gussets and local strengthening. Never throw any away. The smallest pieces can be used.

If you are building a truss structure style fuselage, and you want to make it bulletproof, take 1/64" ply and gusset the inside of all joints. It adds hardly anything to the weight, but adds a tremendous amount of strength.



The method to the side is okay for box fuselages. In a lot of old timers, boxes are fine. Then you can add some formers and stringers and it looks a little nicer and you can get some really attractive fuselages.

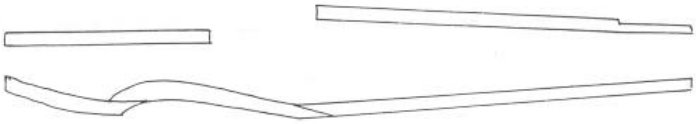
Sometimes the structures get more complicated and you can get carried away and park great big sheets of balsa as formers and stringers or sheeting. The basic truss structure box is redundant as the outside of the fuselage is not taking all the loads and the stress. The structure never sees any load. When the outside structure fails long before the inner sees the load, suddenly the load shifts to the inner structure and it fails instantly.

When you see huge bulkheads with a small box in the middle, it's time to redesign.

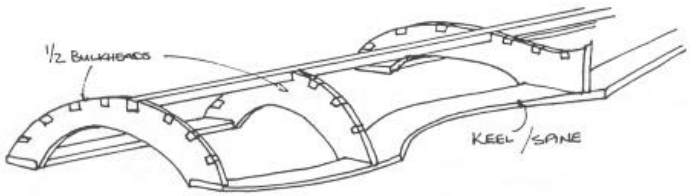
Half-shell:

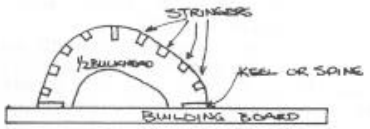
This is an old free flight method. I love building on a half shell, or crutch, which is similar.

First lay down a spine:



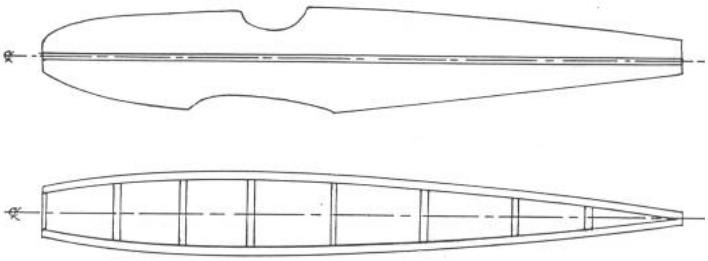
Make all bulkheads in two pieces and glue the bulkheads to the keel. Then add the stringers.





Essentially you are building a complete half of the fuselage. After finishing it, unpin it from the board, add the remaining bulkheads and the remaining stringers. If everything was done properly, it should end up straight. This is building on the half shell. The Mew Gull and the Spitfire were done this way.

A method similar to this is using a crutch. When building a fuselage that is normally a great big circle , and you don't want to build on the half shell, this method works well if the original airplane was built with the inside on some sort of tubing framework, but the outside is more streamlined. Use a datum line as the



basis for a crutch. It even looks like a crutch.