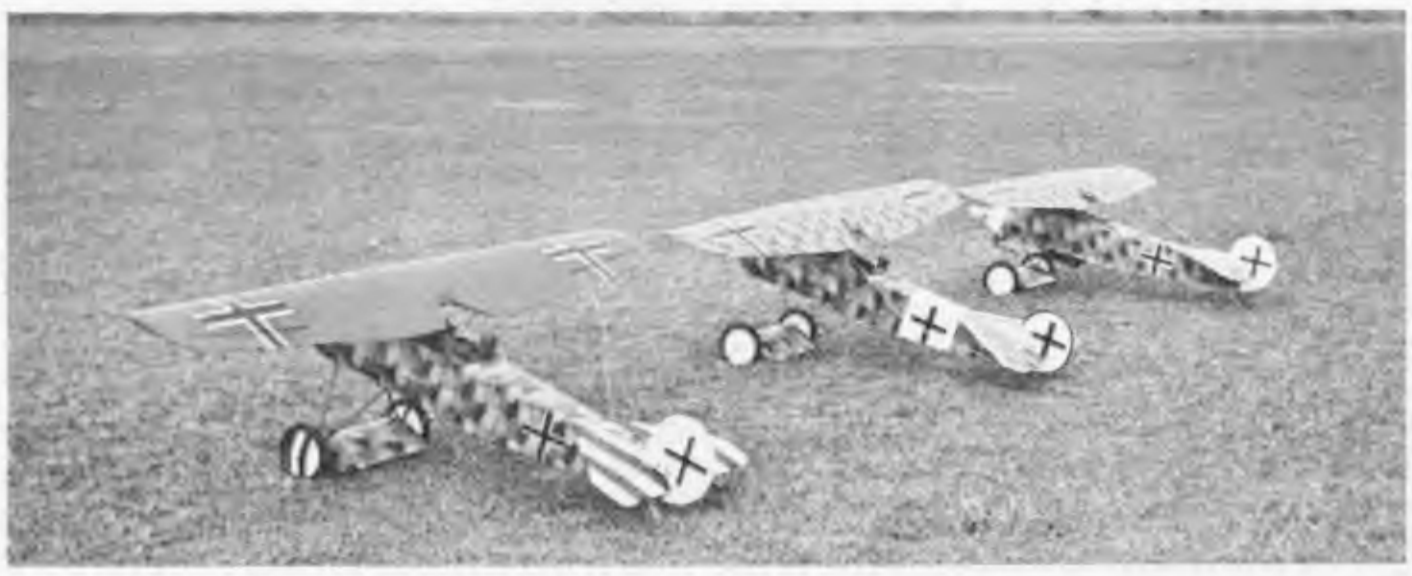
Fokker DVIII

. . . a parasol monoplane. A monoplane without flying wires—what could be simpler to build?/by Fred J. Suellentrop



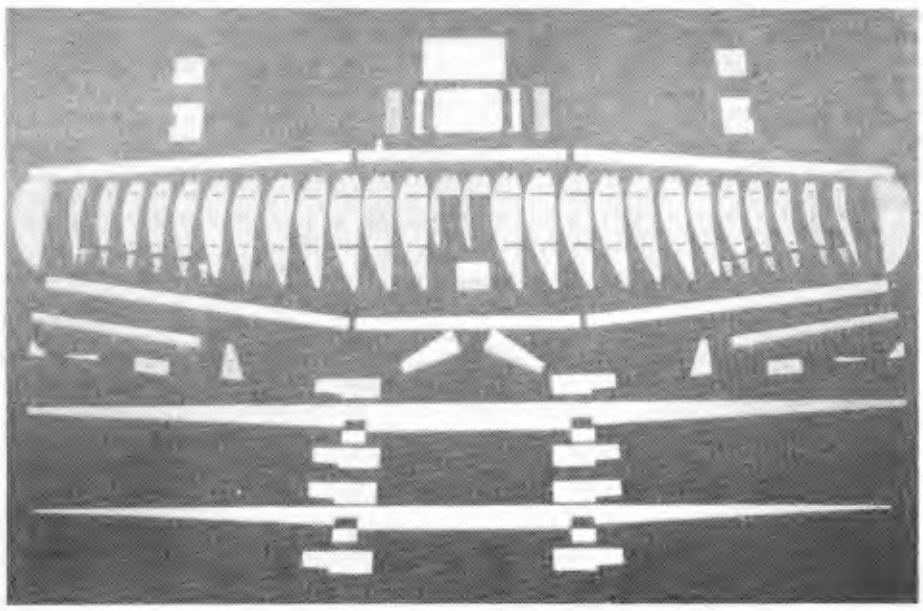
One Sunday afternoon after witnessing a WWI Jamboree, I was feeling sorry for myself because I did not have a WWI flying machine. I was not so much interested in competition flying as I was in just having a model with the particular flying characteristics found in WWI aircraft. It was evident that the airplanes that best resembled the old WWI airplanes in flight used scale airfoils and were aerodynamically built to scale. In most cases, however, a scale airfoil meant structural problems which could only be solved by making the flying wires functional. The flying wires add something desirable to the appearance of a model, but they also add a lot of work and drag. I was looking for a simple airplane to build with a scale airfoil but hopefully without complicated rigging.

As my search progressed I discovered that Fokker's chief designer, Reinhold Platz, built airplanes the way I like them—cantilever wings without external wires for bracing. His more popular designs, the Dr-1 triplane and the DVII biplane, are seen frequently as the subject of model builders. But his last fighter design to reach production before the end of the war was a parasol monoplane. A monoplane without flying wires—what could be simpler to build?

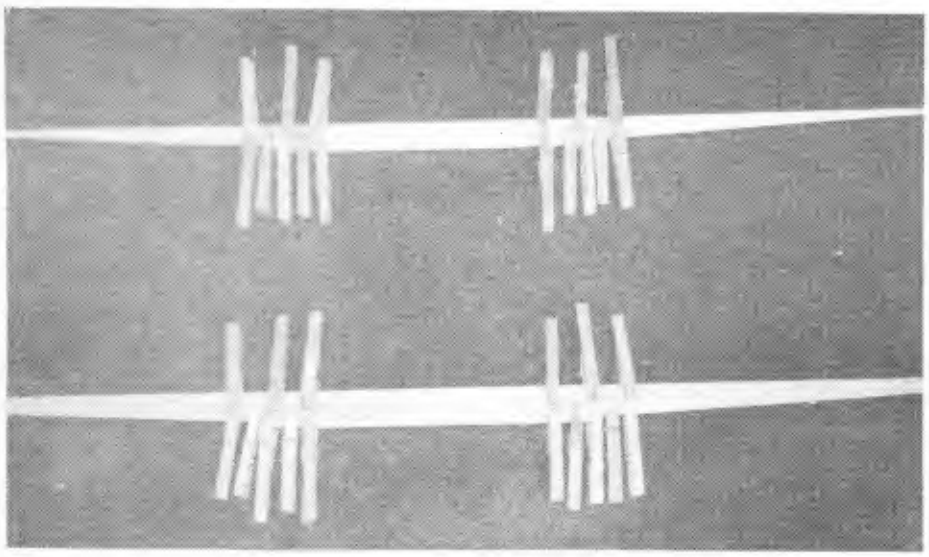
Platz had wanted to build a monoplane earlier but Fokker had him make the triplane and biplane first. When Platz's first production monoplane was ready it was designated the EV following the earlier Fokker monoplane designators, EI through EIV. The E represented the eindecker or single-wing notation. As the early production models of the EV began to reach the front, some of them decided to shed their wings in flight. Although this was later traced to poor workmanship rather than a weak design, the wings were brought up to a new production standard and the airplanes redesignated the Fokker DVIII. Reference material may be found

under either designation or sometimes both as the EV/DVIII. Most warplane markings that we may be interested in will be of DVIII's. No matter what designation was used, this sleek (sic) airplane became known as the "Flying Razor Blade" of World War I.

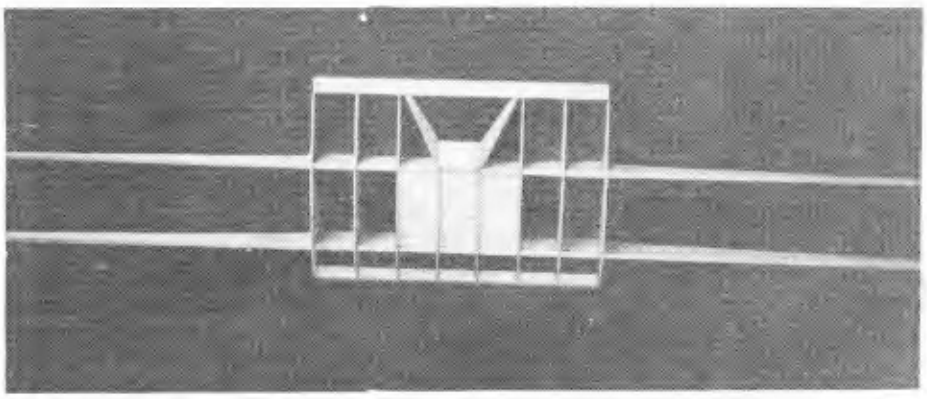
Since this wing was self-supporting, it had very thick spars in the center section producing a 20% thickness airfoil at mid-span. The Fokker/Platz wing design technique was to determine the size spars required to carry the load and build a wing around them. Since the stresses were greater at the center than out toward the tips, the Fokker cantilevered wings had tapered spars—becoming fairly thin at the tips—about 7% thickness for the DVIII. The airfoil shapes were determined by using streamline shapes of varying thicknesses from root to tip about a basic mean camber curve. The basic mean camber curve was similar to the airfoil found on the earlier wire-supported wings. When a 20% thickness streamline shape was added to this at the root section, it produced a flat bottom airfoil. But the 7% thickness at the tips produced a highly undercambered tip section. This thickness taper provided the desirable effect of washout at the tips, and with the upper surface straight from tip to tip, this thickness taper also produced dihedral.



Layout of precut wing parts shows hard balsa spars cut to shape and notched for spruce blocks that will be the attachment points to the cabane struts. / Photo by Fred Suellentrop.



Substantial Clamping is used when cementing the thin plywood webs to the spars to prevent them from curling away from the spars at the edges. / Photo by Fred Suellentrop.



Center section of wing completed on flat surface. Note that the trailing edge of this section is not cut to shape until the final sanding. / Photo by Fred Suellentrop.

So . . . we had found a World War I airplane that had a fascinating airfoil section, a cantilever wing without any flying wires, and many of the color schemes used a lozenge pattern camouflage. The lozenge pattern could have been a detriment if we were to consider painting. But, I considered it an added bonus because I had been wanting to use some of that Coverite lozenge camouflage ever since it first showed up at the local hobby shop. Since it came in either 1½" or 2" scale I had another choice to make—I like small airplanes (my workshop is small) so I studied the 1½" scale in more detail. I found that one roll of the Coverite lozenge camouflage material would cover the entire airplane at 1½" scale. I also found that a near-scale plastic cowl was available at the supermarket in the form of whipped topping bowls, if I wanted a simple cowl. This fixed the selection as a Fokker DVIII in 1½" scale with a lozenge pattern camouflage color scheme.

The design had to be as light as possible, since a four-function radio was going to be carried by about 2 square feet of lifting area—including the subwing. Also adding to the weight of WWI aircraft were those oversized wheels. On the full-size aircraft, it was estimated that the subwing produced enough lift to support the undercarriage. The same is true of the model—so do not cut corners by omitting the subwing.

The major deviation from scale was the wing covering and this was done in the interest of weight. The wing of the full-size DVIII had a plywood sheeting on both top and bottom. But a sheeted wing would be a little too much of a weight handicap for the 1½" scale. The finished models have been weighing in at about 44 oz. for a wing loading of 22 oz. per sq. ft.

Another weighty area usually found in many WWI models is a large chunk of lead added to the nose to balance an otherwise tail heavy airplane. It is my belief that if extra weight is needed, it should be used as structure instead of ballast. In this design you will find a simple lightweight rear end framework and a rather hefty front end. This helps keep the engine in place and protects the radio equipment in case of hard landings—which can be typical for WWI airplanes. Of the three airplanes built to date, no extra weight was required for balancing.

The balance point was the same for each airplane, and they each required a slight amount of down elevator trim. This appears to be typical of all Platz-designed Fokkers. Both flying pictures and some flight test reports show that down elevator trim was required on the full-scale machines. We also found that the ailerons were very effective, even though they were relatively small. This, too, was a reported characteristic of the full-size airplane. When we first started testing the model, it appeared to duplicate the DVIII flying characteristics about as well as could be expected. Once the airplane was trimmed for level flight and I began to get used to the aileron response, the airplane became more and more fun to fly.

Landings can be somewhat of a challenge, however, and they require some practice. The model must be brought in straight and level, with reasonable flying speed. The throttle is cut clear back only after touchdown. In case of dead stick landings (some of my best) a fairly steep glide is used to keep up good flying speed for the touchdown. Then, with a slight flare, the model will touchdown smoothly. Don't ever try to stretch an approach of a WWI airplane, since they do not have the higher lift to drag ratios that we can get used to in trainers and pattern ships.

The radio fits into this model like you might fine one packed for shipping. Every part is going to be in its proper place, or you aren't going to get it in and still balance the airplane. The original model had a Heathkit radio with subminiature servos. A similar installation was obtained with a Kraft radio and KPS-12 servos. But don't start cutting wood—unless you plan to install small servos. However, if you have read this far, you must also have some fascination for small airplanes, so we can assume that you have a small radio and are anxious to get started building.

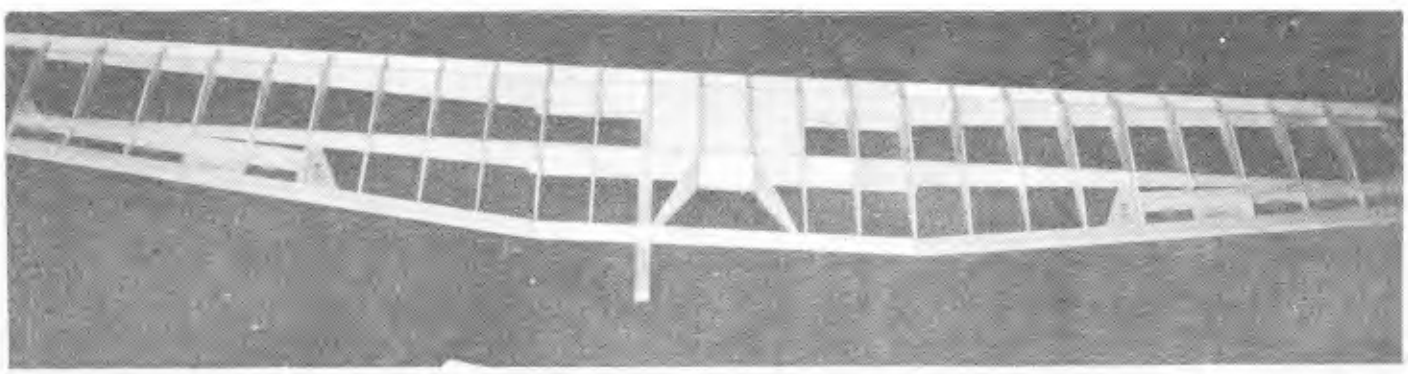
Construction

A group of construction pictures are presented with this article to help explain the construction sequence. All of the wing parts were pre-cut and the aileron hinges were fit (not glued yet) in their respective pieces before any cementing began. The scale center section of the wing is thick enough to accommodate a subminiature aileron servo. Therefore, the spars are extended down to the flat bottom of the center section to make a frame for an aileron servo access hatch. These extended depth center section spars are also used to mount the spruce attachment blocks where #4 sheet metal screws will be used to attach the wing to the wire cabane struts.

The first assembly should be the wing spars with their 1 x 3/16 x 1/2" spruce blocks and associated plywood webs. Aliphatic resin glue was used here, so substantial clamping (clothes pins) was used to prevent the webs from warping away from the spars. When the spar assemblies are dry and you are satisfied they are straight, begin the center section assembly in a flat surface. Make sure that ALL ribs have been drilled for the aileron push rod BEFORE you put them in place. Your favorite glue or adhesive can be used for the wing construction.

The spars are internal in the outer wing panels so the ribs must be slipped over the spars in proper order from the tip. When the center section is dry, and the outer ribs are in approximate position, rock the assembly toward the tip until it is flat on the building surface. Align the ribs and glue them in place with that panel pinned—with all ribs touching, both fore and aft, to the flat surface. The leading edge material, near the outer two ribs, will have to be tapered slightly on the bottom edge before it can be installed with the outer panel pinned down. Build the ailerons in place and cut them out later, after the wing is sanded. The reinforcement webs at the tips, and by the ailerons, are required to prevent instant sweepback in a cartwheel or ground loop.

When the first tip panel is dry, rock the wing to the other tip and build that panel. But, before the last tip block is glued in place, make sure the aileron pushrod is installed. After this wing framework is dry and removed from the building surface, the servo compartment can be completed and the aileron linkage installed. The wing leading and trailing edges are then sanded



Each tip section is built by rocking the wing until that tip is flat on building surface. Note the 3/8" square block used here to keep wing tilted for proper dihedral. Also don't forget the aileron wire in the background—it must be installed before the wing tips. / Photo by Fred Suellentrop.

to shape. When you're satisfied with the shape of the tips, etc., the ailerons can be cut free and removed for shaping of their leading edges. After testing the aileron movement, cement the hinges in place. We used epoxy on the parts of the hinges that were exposed when pushed through the slits. The wing is now set aside for final assembly and covering.

The tail feathers are of simple framework. But the hinges are again installed first. This ensures good alignment and a small gap before the surface is built. Note that, for the stabilizer, there are two angled 1/8 x 1/4" pieces that will be used to attach the stabilizer to the fuselage. Therefore, these pieces are flat to the bottom surface and do not make contact with the upper surface. When they are dry, sand these assemblies to shape by rounding the edges. Then cut the elevator free, epoxy the hinges into position and set aside for final assembly.

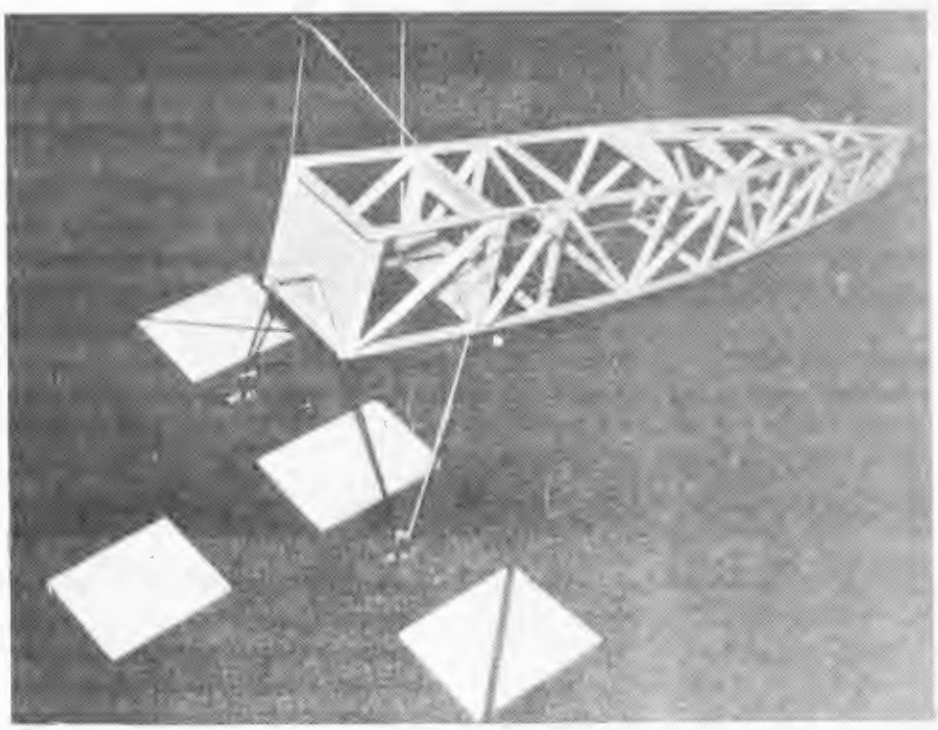
The fuselage is typical old-fashioned 3/16" square framework. Layup both sides and, when they are dry, make up the box using forms A & B to help keep it square. Pin this structure upside down over the plans, since the top fuselage frame is flat. This is used as the reference plane for all alginment since it is also parallel to the thrust line, the flat bottom of the wing center section, and the subwing's flat bottom. While the fuselage frame is setting up, the wire struts can be bent to shape. The payoff for accurate wire bending will be the ease of alignment in the final assembly of the landing gear, subwing and wing, and this cannot be overemphasized. The plans devote considerable space to "true size" wire shapes—so use them and don't be satisfied until the wire shapes overlay the plans. Then, make the out-of-plane bends and check the out-of-plane dimensions. This is best accomplished by holding the part of the strut that meets the bulkhead on a flat surface and measuring the dimensions given on the plans. Check and rebend in both views until you are satisfied with the shapes. Then bind all of these struts in their proper positions to formers A & B. When you complete the ends of the landing gear struts, the "slot" must allow free movement of the axle bushing up and down. The lower edge of these struts should be parallel with the fuselage upper framework (our reference) plane. The ends of the forward wing struts are also bound and soldered after their alignment has been checked. This alignment can best be checked with the fuselage inverted over the top/bottom view on the plans. Place the loops over the screw centers marked on the plans, and check to see that the fuselage upper frame is horizontal.

When the alignment checks out, the fillers C* D and E can be epoxied into place and the strut bindings coated with epoxy. Fill in the frame between A & B with 1/8" sheet, both sides and bottom. Install the rest of the formers, the three stringers; build the removable radio hatch, sheet and you have the basic Fokker fuselage. Note that the 1/16" plywood rectangular firewall fills in the front of the frame to bring it flush so that a 1/32" plywood firewall will cover the entire front surface of the fuselage. This 1/32" plywood firewall should be cut slightly oversized and sanded to shape after the epoxy has cured. The servos were installed as throttle, rudder and elevator from left to right but may be shifted, depending on which side of the engine has the throttle arm. The radio access hatch was secured with screws through the firewall and former H in front—and through former H in the cockpit at the rear.

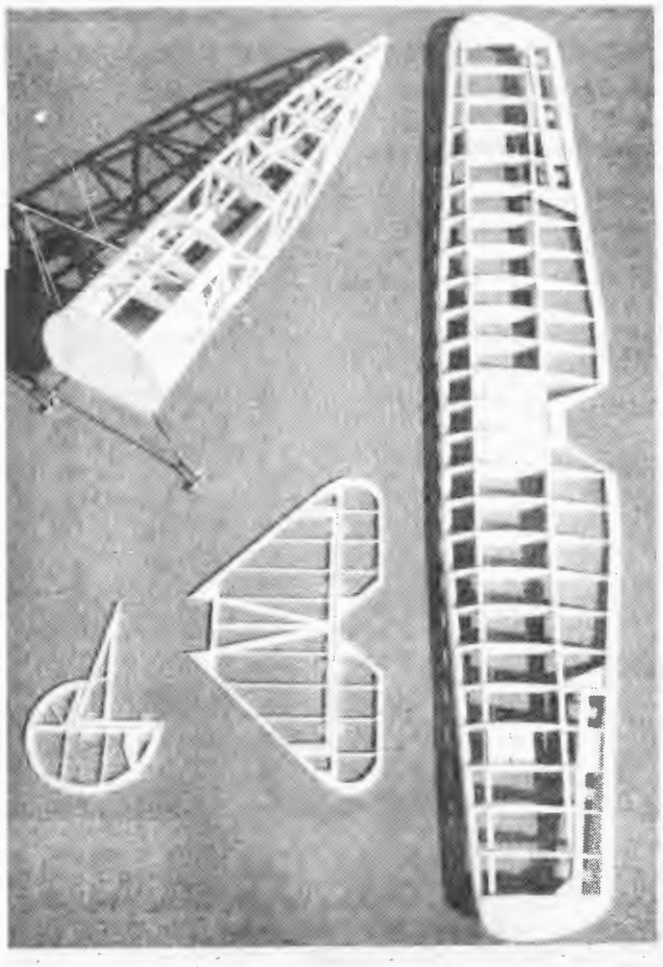
The tail feathers should be covered before cementing into place on the fuselage. The fuselage can be covered after the pushrods have been fit. And—Oh yes! we did not forget the subwing! The subwing is constructed from the bottom sheeting up around the landing gear struts. The top of the fuselage frame must be parallel to the working surface while assembling the subwing. This sets the incidence of the subwing, which is critical. The wing incidence is also critical and it should be set the same as the subwing, such that the flat bottom is parallel to the upper frame members of the fuselage. It can be adjusted slightly by moving the rear struts in or out along the spar, before drilling the holes for the attachment screws.

The axle is made to turn with the wheels as one assembly. This helps keep the takeoff run straight. A 3/16" O.D. brass tube is used to house the 1/8" axle with short pieces of 5/32" O.D. brass tube used as bushings in each end. These bushings are soldered, or glued, to the outer housing to prevent them from sliding out of place.

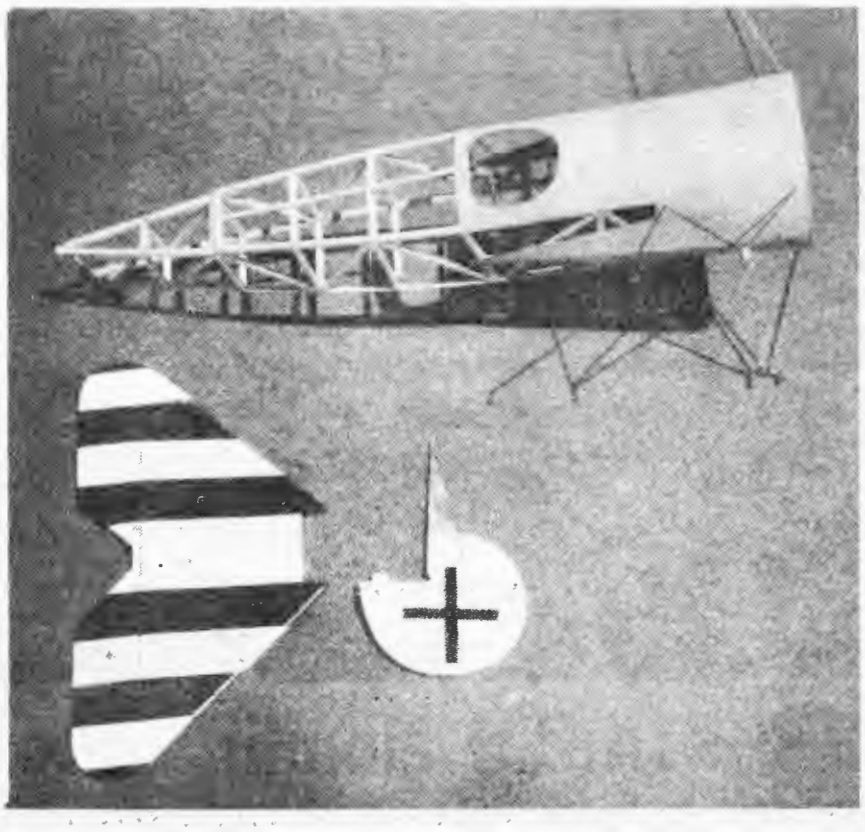
As stated earlier, the cowl can be cut from a plastic whipped topping bowl found at your local supermarket, or you can make one from fiberglass to the outline

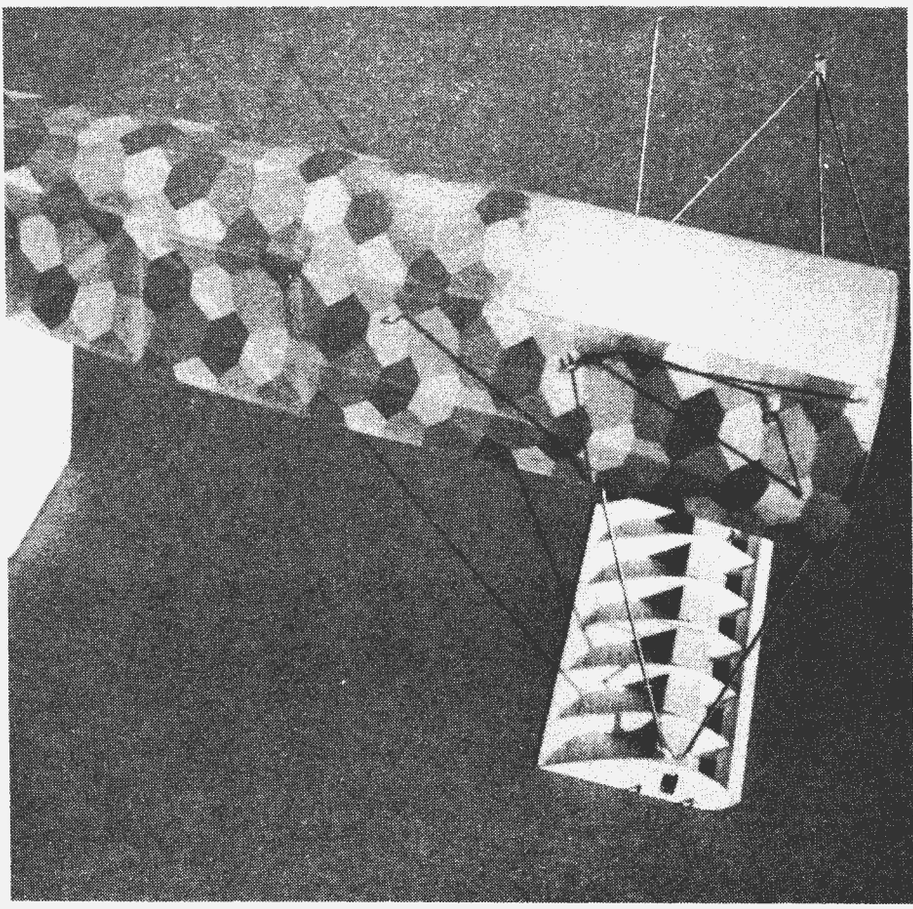


RIGHT: After the struts are bound to the formers 1/8" balsa pieces C, D and E are used to fill in the space between the wires. A 1/16" plywood plate [F] is then used to cover the wires and bring this surface flush with the front of the frame. The other pieces shown are 1/8" balsa to fill in between the frame between formers A and B. Photo by Fred Suellentrop



LEFT: Completed frames ready for sheeting and covering./Photo by Fred Suellentrop. BELOW: This fuselage was sheeted with 1/64" plywood. The tail feathers were finished prior to mounting on the fuselage. This particular model was set up for scale control cables and a scale tail skid./Photo by Fred Suellentrop.





The subwing is constructed around landing struts with fuselage blocked up to a horizontal position for accurate alignment. The 3" wide 1/16" sheet is first placed on the working surface. The fuselage and landing struts are aligned to this sheet and then the subwing is built around the struts. The sheeting is completed after this [dry] frame is removed from the board./ Photo by Fred Suellentrop.

shown on the plans. Finish the covering; put on the markings, and let's go on patrol. Or, maybe we better think about that first flight a little before we try it. Remember, we set out to duplicate WWI flying characteristics, so we might experience some of the undesirable traits as well as the good ones. A snap roll and inverted crash in less than one second is possible, if you try to pull this airplane off the ground. Point your beautiful DVIII directly into the wind, apply full throttle, let the tail come up and then fly it off the ground.

If you built with the CG at the forward end of the range shown on the plans, you should easily get the feel of the airplane and begin to trim out the slight turns and the slight climb. But, if your CG is at the rear of the range—DON'T touch the rudder!!—at least until you trim the elevators and get some altitude. The CG toward the rear produces outstanding spins and snap rolls, if you like that sort of thing.

Now that things have settled out, and you begin to enjoy the feel of this new machine—you look around the sky and find a stray Sopwith Camel. Go after it, you have one of the hottest fighters of WWI. RCS

This picture puts together all of the loose ends. It shows the shock cord [elastic] suspension completed and the engine installation [a S.T. 23 in this case].. Although a lozenge pattern was not called for on the wing in this particular color scheme, Super Coverite was still used for its strength. If you are interested in detailing you might note the strut fairings, fiberglass cowl, those Spandau guns, and the wire bracing on the landing gear struts. These were the only external wire braces used on the DVIII./ Photo by Fred Suellentrop.