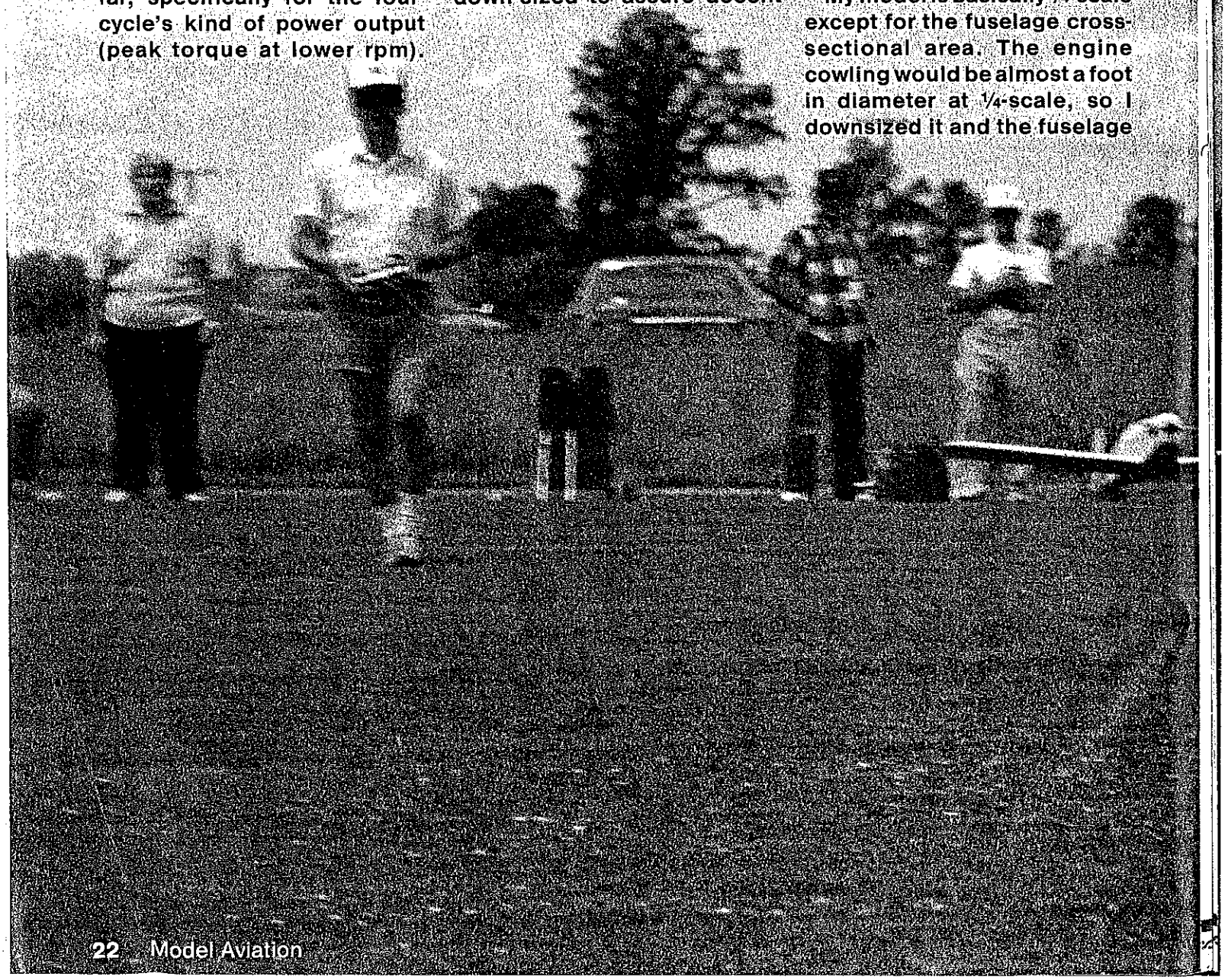
FOKKER D

■ James E. Gilgenbach

THE FOUR-CYCLE revolution is definitely in progress. New engines of this type are appearing on the market at an ever-increasing rate. They're quiet, reliable, relatively inexpensive, and have a realistic, pleasing sound. The only real problem is that few model aircraft have been designed, so far, specifically for the four-cycle's kind of power output (peak torque at lower rpm). Sure, you can use a four-cycle with relative success in a number of existing designs, but most are three-channel types (rudder, elevator, and throttle) or small four-channel types.

World War I aircraft appear to be ideal for four-cycle engines, though most of these planes have a lot of drag and must be down-sized to assure decent performance. There are several WW I monoplanes, however, which are clean enough to perform well. My favorite has always been the Fokker D.VIII, known to Allied pilots as the Flying Razor Blade. It would undoubtedly have superseded the D.VII had the war been prolonged.

My model is basically ¼-scale except for the fuselage cross-sectional area. The engine cowling would be almost a foot in diameter at ¼-scale, so I downsized it and the fuselage



D.VIII

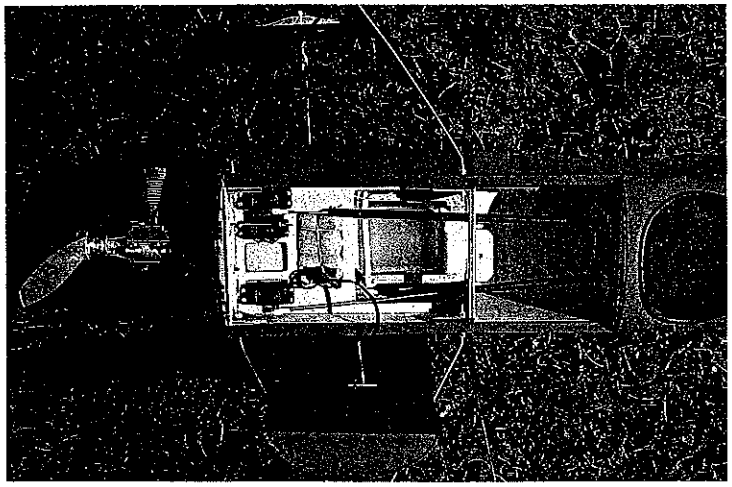
This semiscale replica of one of Germany's last World War I designs is for a .75-.90 four-stroke engine and five-channel radio (fifth channel for bomb drop). With nice flight characteristics and appearance inherited from a classic design, coupled with the pleasing four-stroke sound, it's a delight.

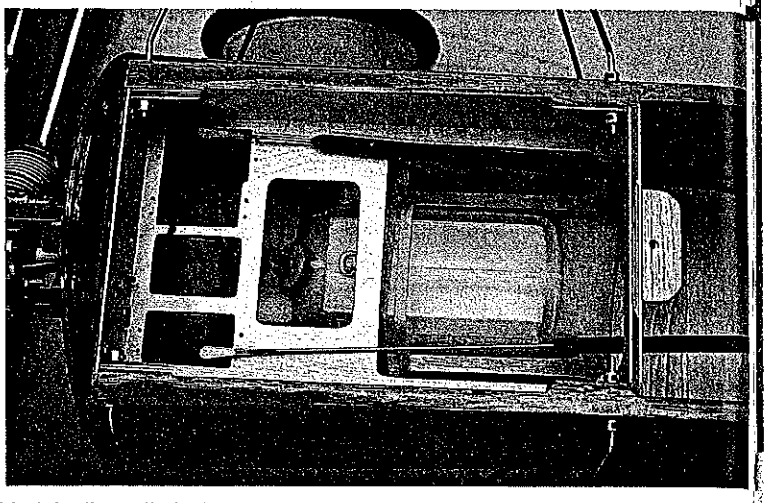
cross-section to better suit the engines and props I planned to use.

Based on the flight performance of the model, I would say that Rheinhold Platz and Tony Fokker had the right idea when they designed the full-size one. Friends say that it is impossible for me to make a bad landing with the Fokker no matter how bad a pilot I am. All I have to do is line up the plane with the runway and throttle back. It then settles in to make a beautiful two-wheel landing.

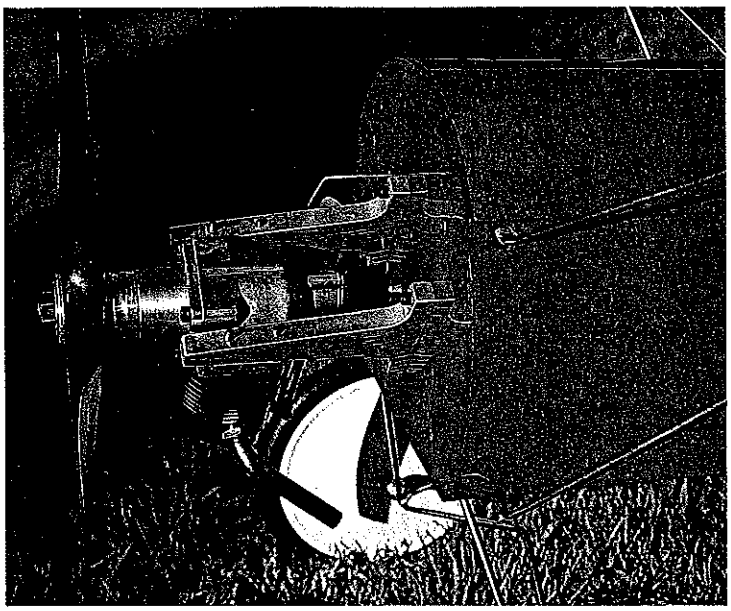
A touch-and-go with this aircraft is the most pleasurable I have ever experienced, and ground handling and takeoffs are excellent. In-flight performance is dependent upon the power plant used. With a .60 or .75 four-cycle it will have a scalelike performance, but with a .90 four-cycle the model's performance approaches that of a Pattern ship.

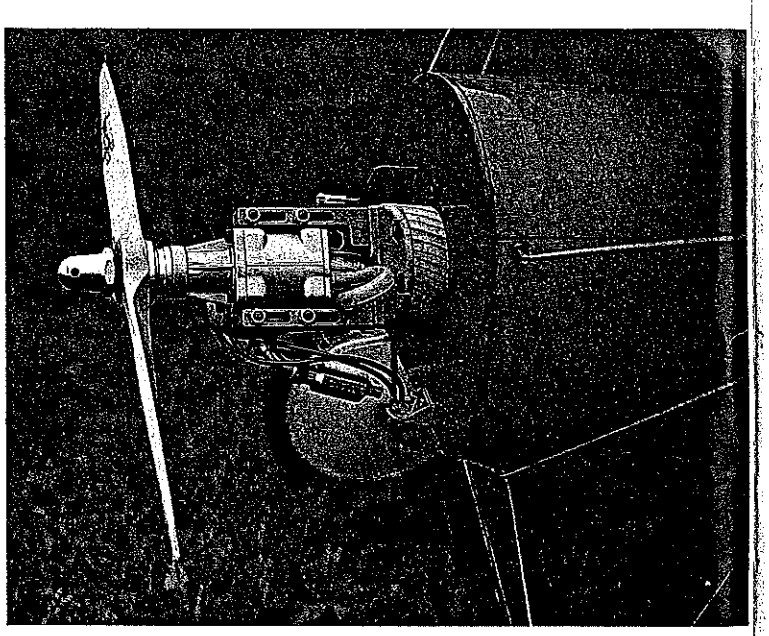
Graceful touch-and-goes with this model are something to behold. This plane was the crowd's favorite at a recent fun-fly by the Calumet Flyers.



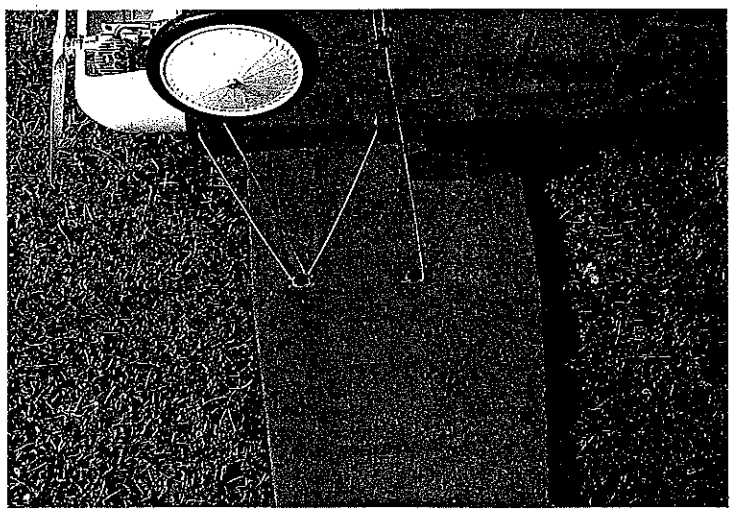


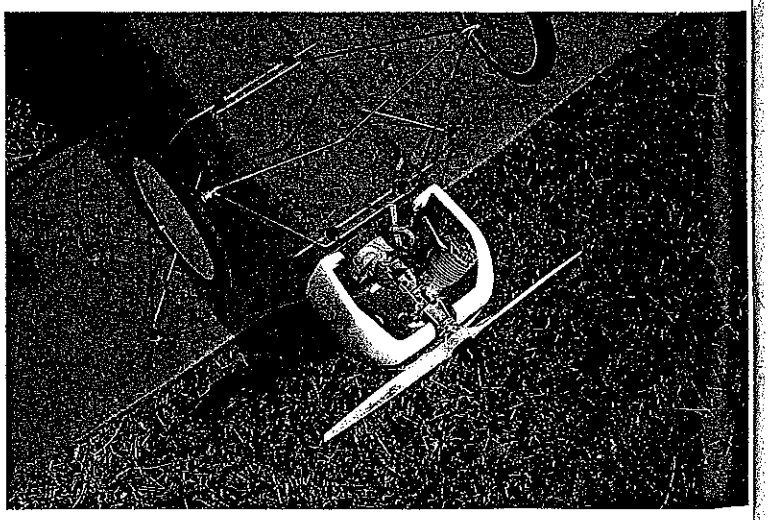
Left: To maintain the proper CG, the battery pack and servos are right behind the firewall, the battery pack located directly below the servos. Right: Trays for servos and fuel tank shown here. The fuel tank is held in place by a rubberband with foam packing below, in front, and in back.





Left: A Sig engine mount was used for the Magnum .91. With the exhaust valve pointing downward, hydro-locking has not been a problem. Right: An Edson mount was used for the O.S. FS .90 and .75 engines in conjunction with a spacer to get the prop in the right location.

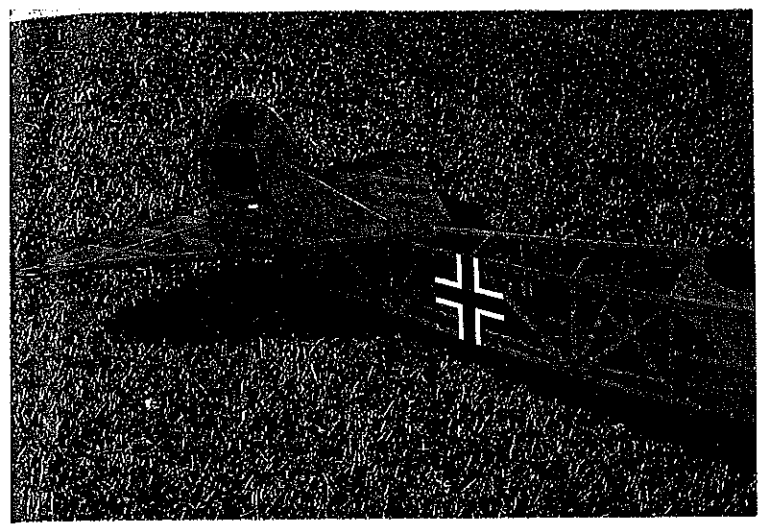


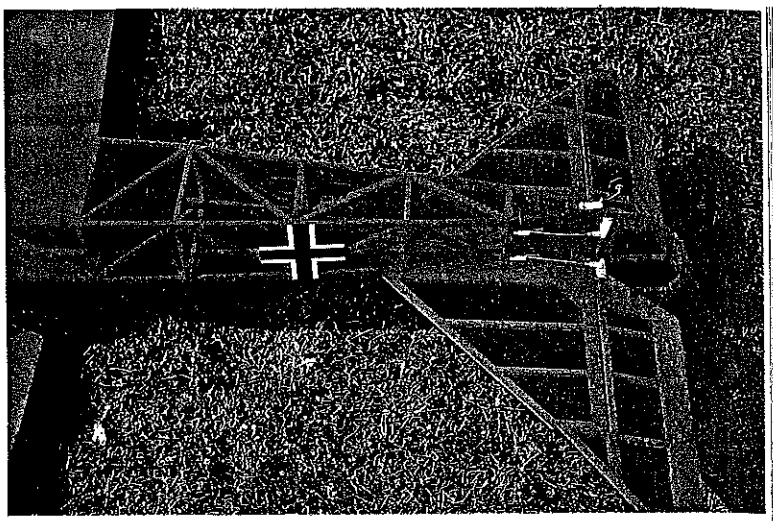


Left: Wing is attached to the cabane and struts with ¼-20 nylon bolts. Author's stress tests proved this to be an extremely strong method. Right: Landing gear and wing struts are held in place with the same ¼-20 nylon bolts. Collars on rear struts allow wing incidence changes.

Construction of this model is straightforward with no exotic or non-standard materials being used. I prefer to build the wing first, then the fuselage and tail surfaces. With this model, however, you could build the components in any order.

The wing has spruce spars, Lite Ply and balsa ribs, and balsa sheeting. I was unsure of how much load the ¼-20 nylon wing bolts and hold-down blocks could take, so I conducted an experiment prior to designing





Left: With transparent MonoKote covering, the internal structure can be inspected periodically for possible failure or damage. Tail surfaces are removable for transportation or storage. Right: Diagonal braces greatly increase the fuselage's rigidity while keeping the rear end light; consequently, no nose weight was required. With a tail moment this long, that wouldn't be the case if sheeting had been used.

the wing mounting arrangement.

I inserted the threaded Wing Mfg. metal insert into the hold-down block and glued the block to a ceiling joist in my basement. I then drilled a 9/32-in. hole through the middle of a 1 x 2 x 10-in. wood handle and bolted the handle to the hold-down block using a Du-Bro ¼-20 wing bolt. Next, I had my kids hang on to the handle, one by one, to find out at what point the bolt or hold-down would fail.

I started with Jayme at 50 lb., then Jeannie at 100 lb., Barbie at 120 lb., and finally Karl at 135 lb. No failure occurred, so I hung on the handle, myself, and to my surprise the bolt and hold-down did not fail even though I applied my full 170 lb. This test proved to me that my method of attaching the wing was more than adequate.

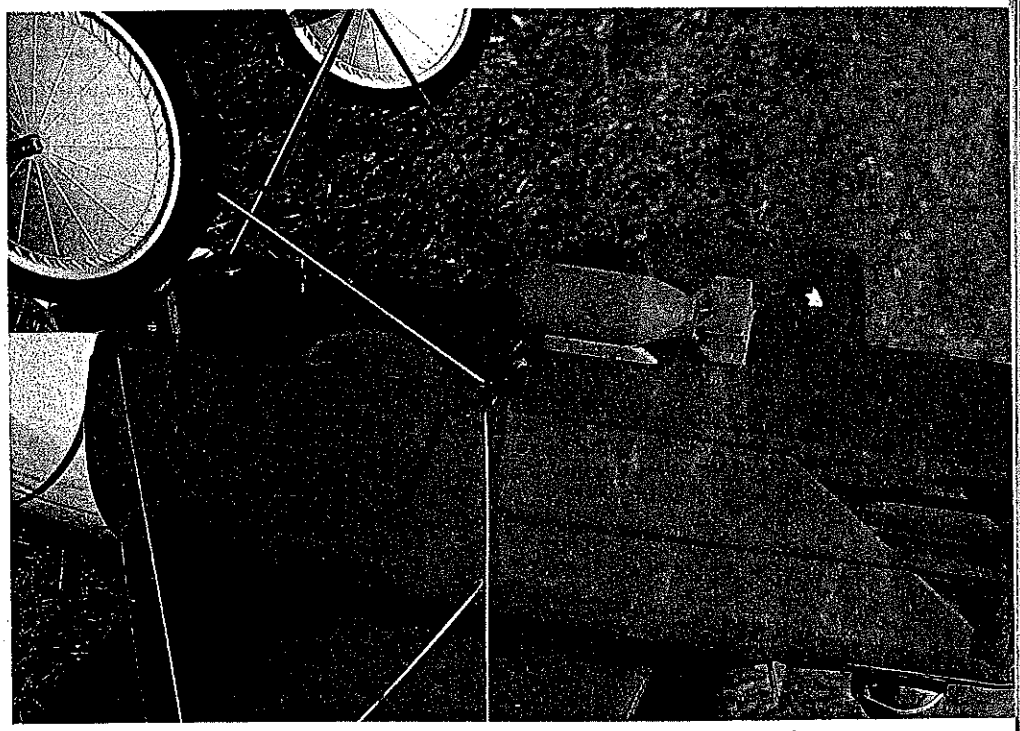
As an approximation, if just the front two wing hold-down assemblies took the full load, and the model weighed 10 lb., the wing attachment system could withstand a positive load of 34 Gs. That's far more than this airplane will ever need.

Components will be assembled directly over the plan, so it should be protected with a sheet of wax paper before beginning construction.

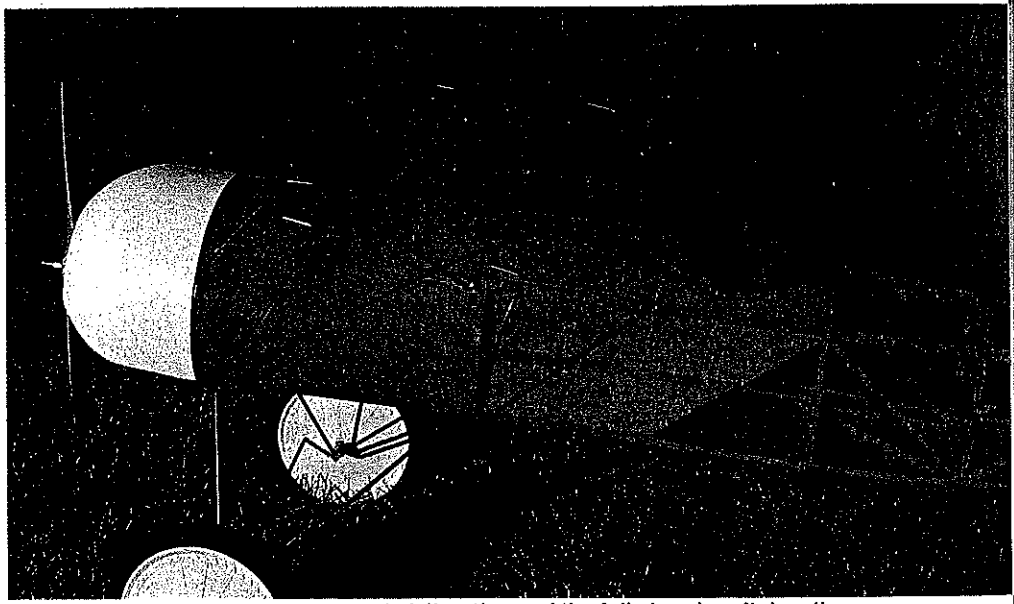
Start by cutting out all the ribs and sanding them to final size. Install the Wing Mfg. hold-down insert into the hardwood blocks, and carve out the strut grooves. Cut all the spars to length, and bevel the outer ends of the top spars. Cut all the leading edge (LE) and trailing edge (TE) sheeting to length, making sure that the top sheeting extends to the tip plate. Mark and cut out the front mounting block and aileron horn plate on the bottom sheeting, and glue them in place.

Glue all the bottom sheeting and cap strips together over the plan, followed by gluing the bottom spars and ribs in position. Place a ⅛-in.-high by ¼-in.-wide shim under the sheeting and cap strip at R4, and weight down the assembly between R7 and R8; when finished, the top of the wing should be straight.

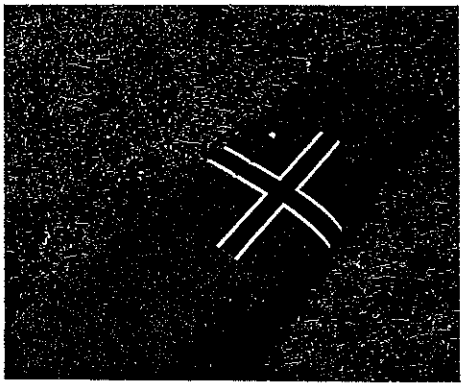
Glue on the top spars and shear webs from R1 through R8—including an extension of the shear web at the center section to serve as a brace for joining the



A Vortac bomb release system adds an extra touch of realism and fun. Author reports that he has found accurate bombing to be more difficult than he originally anticipated.

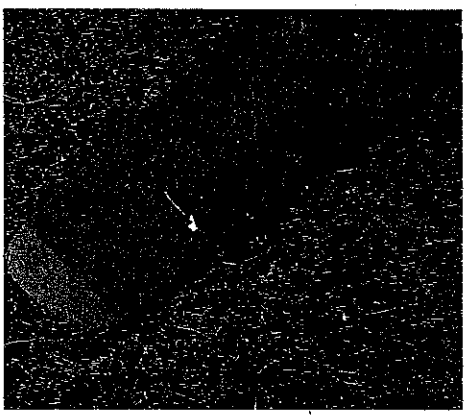


The cabane and strut locations closely follow those of the full-size aircraft. Landing gear cross braces provide just the right amount of spring action to soften rough landings.

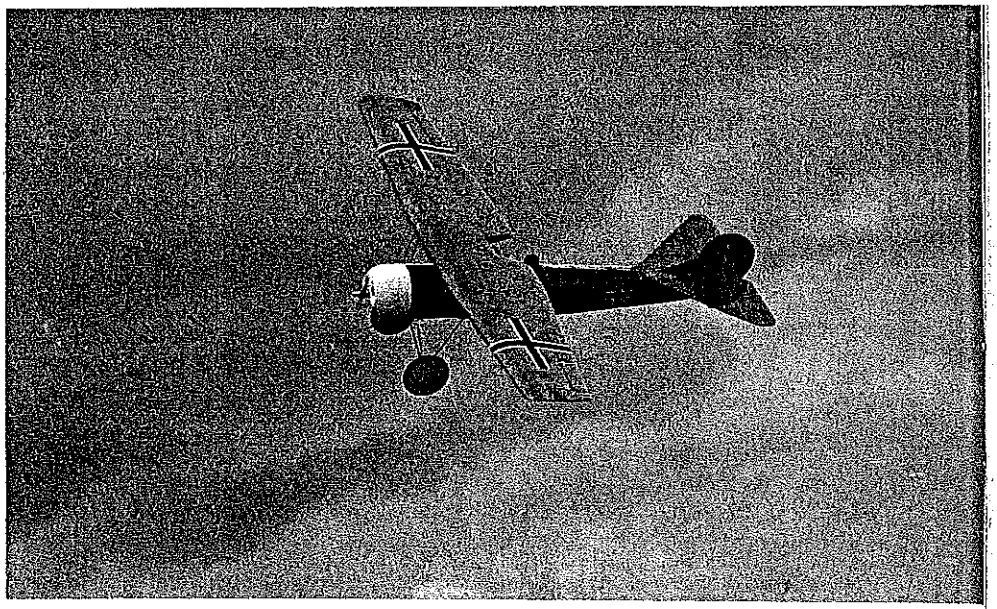


Although not shown on the plans, a balsa-covered foam wing was originally built for the prototype model, and you might want to take that route, yourself. The foam wing was fine aerodynamically, but the built-up wing was thought to be far more attractive, particularly with use of the transparent covering.

Hatch on the bottom of the wing (both versions) allows easy access to the aileron servo and linkage. A hole in the hatch provides a convenient exit for running the servo wire.



In the foam wing, Sullivan cables were run to the aileron horns. The built-up wing has fiberglass pushrods and bellcranks instead.



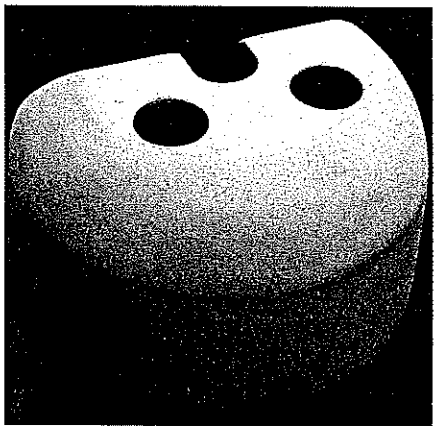
Out of the morning sky, Baron Von Crashenbach (our author) dives to make another strafing run on Allied ground troops. (As usual, his single bomb landed far from its intended target.)

wing halves together. Glue a full-span ⅛ x ½-in. balsa strip onto the top spar. Position the ⅜ x ¾-in. aileron leading edge pieces; mark and saw to the proper height. Glue the forward aileron LE to the bottom sheeting and rear spars. Cut through the bottom sheeting at R10 to R14, but leave several spots uncut so the aileron is still attached.

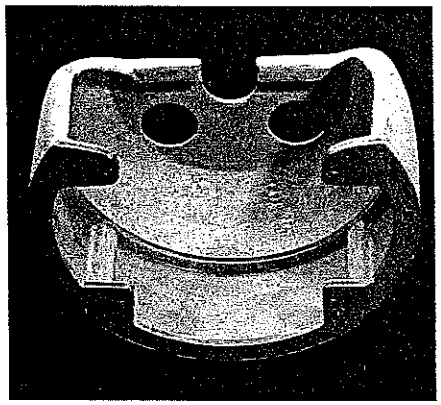
Position and glue R10a and R14a to the bottom sheeting, then do the same for the ⅜-in.-wide LE between the two sub-ribs. Proceed to the small ends of R11, R12, and R13, and glue them to the bottom sheeting. Position and glue the ⅜-in. pieces between R1, R2, and R3.

The leading edge is next, so mark and carve it to shape for installation to the wing assembly. Remove the wing from the plans, and glue the bottom LE sheeting along the LE and to the front portion of the ribs. Trim the bottom LE sheeting, and sand the top of the LE and wing. Be sure to properly contour both the leading edge and the balsa strip on top of the main spar.

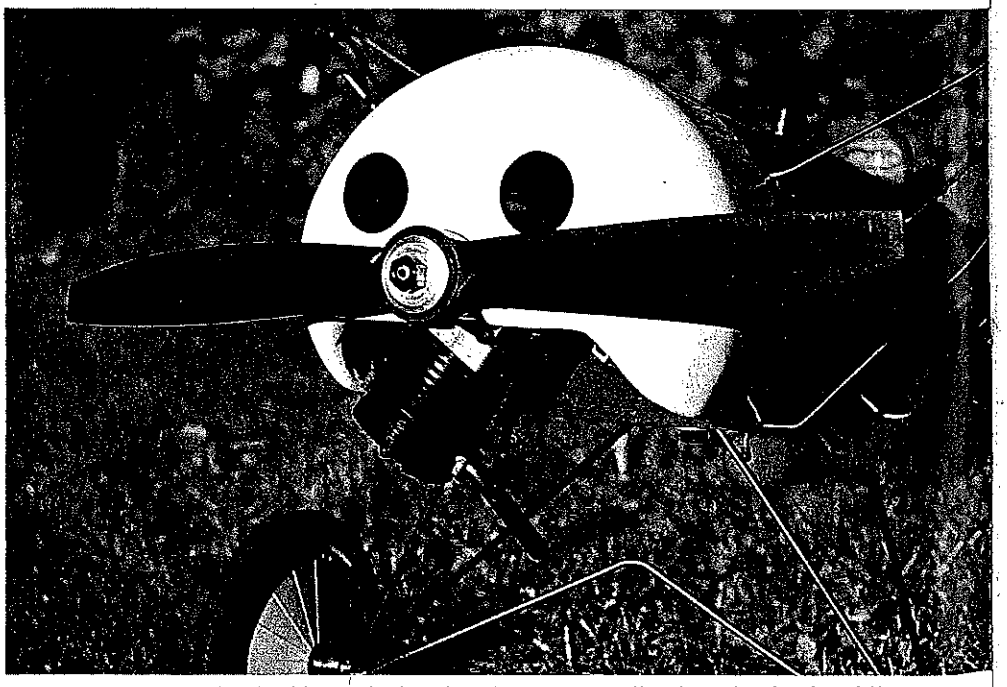
Mark and cut out the aileron hinge slots.



Plywood, balsa, and fiberglass were used in constructing the cowl. The bottom side is open in the fashion of the full-scale aircraft.



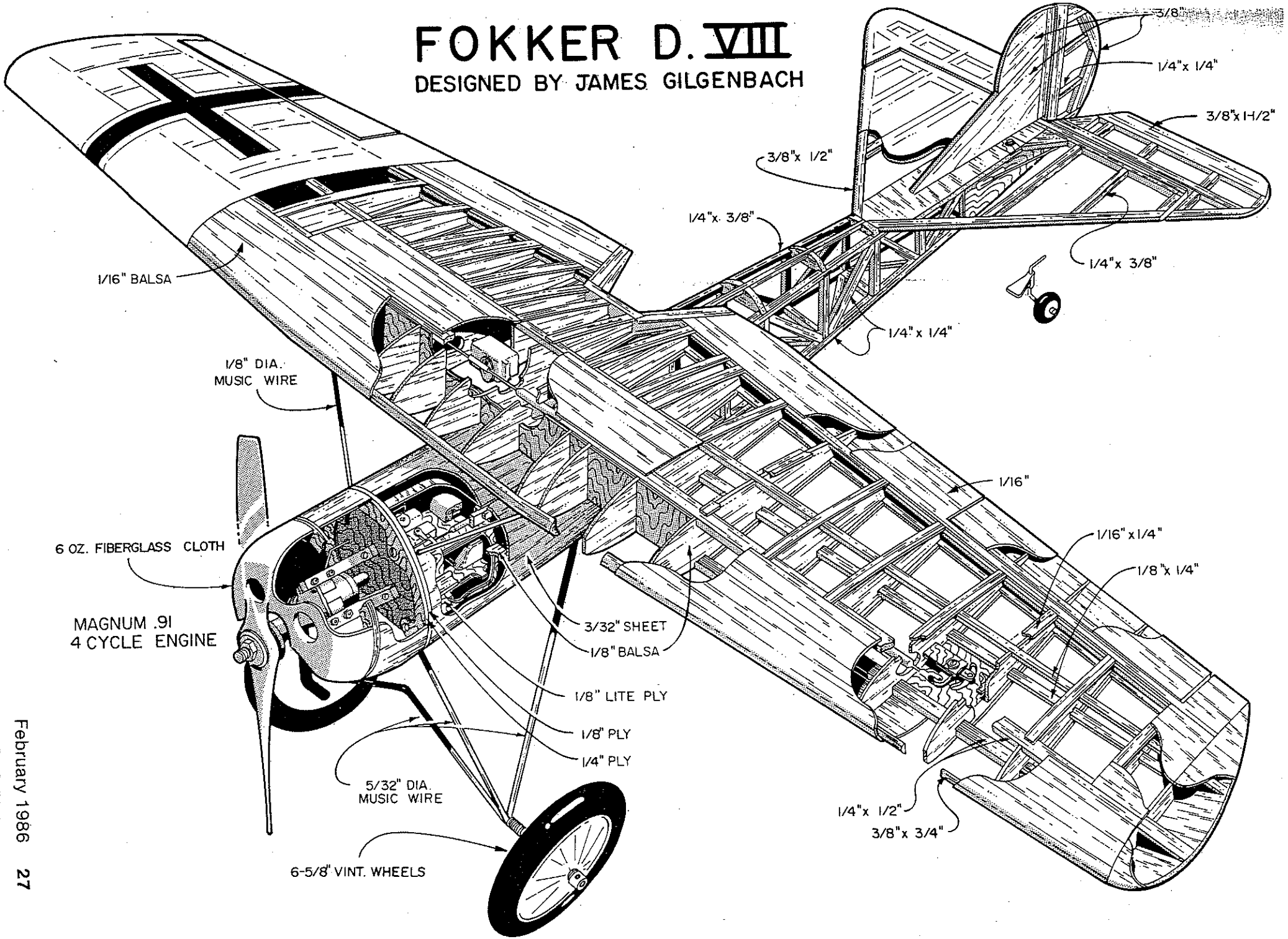
The cowl mounts to the fuselage with four 4-40 socket-head screws. Upper two screws are accessible through the cowl's air holes.



By inverting the engine in this particular aircraft, proper cooling is maintained and the oily exhaust is directed to the model's bottom, minimizing the time it takes for cleanup.

FOKKER D. VIII

DESIGNED BY JAMES GILGENBACH



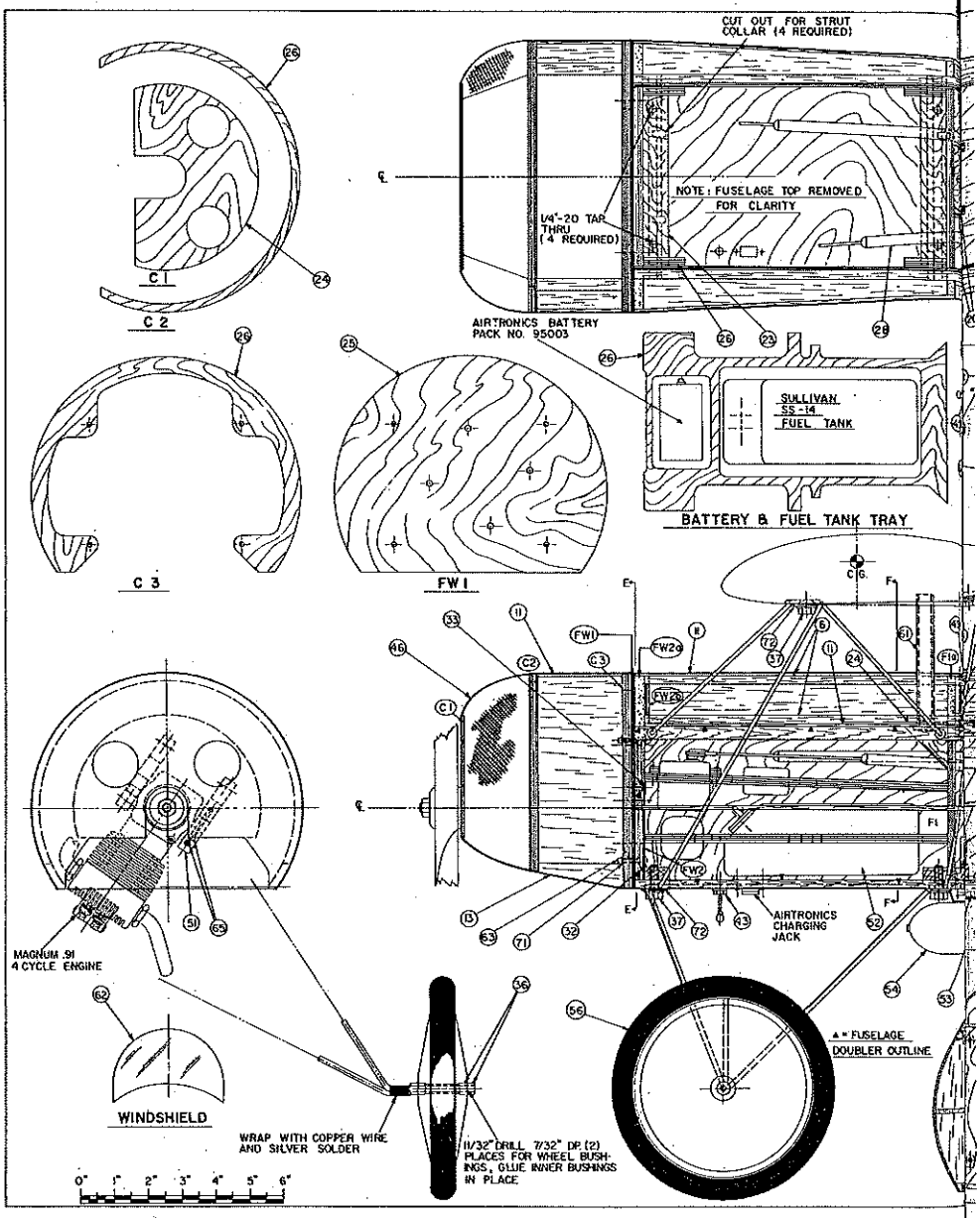
Glue on the top LE and TE sheeting, and trim the LE sheeting. Add the top sheeting at the wing tip, and cut and sand it to suit the tip plate, then glue on the tip plate.

Finish cutting out the aileron, and carve and sand its LE to shape. Glue in the aileron linkage hatch floor, and then make the linkage hatch and support bracket. Drill the four hatch mounting holes through the hatch into the floor, and drill the two horn mounting holes into the aileron. Attach the aileron bellcrank assembly to the hatch and support bracket, and glue the support bracket.

Attach the aileron to the wing with hinges; attach the control horn; and hook up the linkage rod to the bellcrank. Check to see that there is free movement of the aileron through the linkages.

This completes half the wing. Repeat these steps to build the other half, and join the halves together. Add the remaining center section braces and the aileron servo hatch floor. Make the aileron servo hatch, position it on the hatch floor, and drill the two mounting holes. To complete the wing's construction, add the center section top sheeting and the remaining cap strips.

Install the aileron servo and remaining linkage; check to assure that the action is proper. Remove the servo and linkage, and finish-sand the wing. Then put the wing aside, in a safe place to avoid hangar rash, until you are ready to cover it.



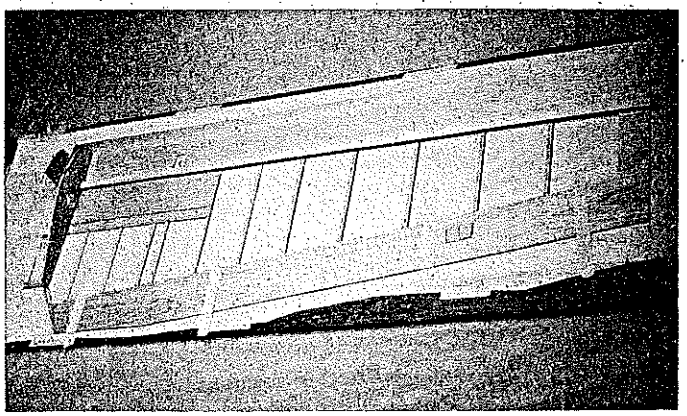
Fuselage. The most tedious part involves cutting/fitting the diagonal braces between the longerons aft of the cockpit. This area could be constructed more easily with 3/32 sheet balsa, but that beautiful see-through vintage look would be lost.

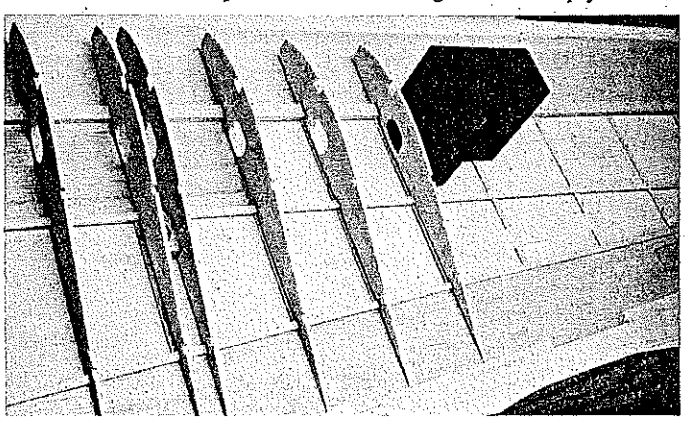
To achieve proper alignment, the fuselage is built upside down directly over the wax-paper-covered plans.

Begin by cutting out all the plywood parts and sanding them to finish size. Drill all the holes in the firewall, top hatch mount, and mounting plate for the tail surfaces; install all the blind nuts. Cut the spruce longerons and balsa cross braces to length, and finish-sand them. Glue (a thick cyanoacrylate—CyA—works great for all the gluing required) the longerons to the Lite Ply doublers. Make sure to build both right- and left-hand fuselage sides.

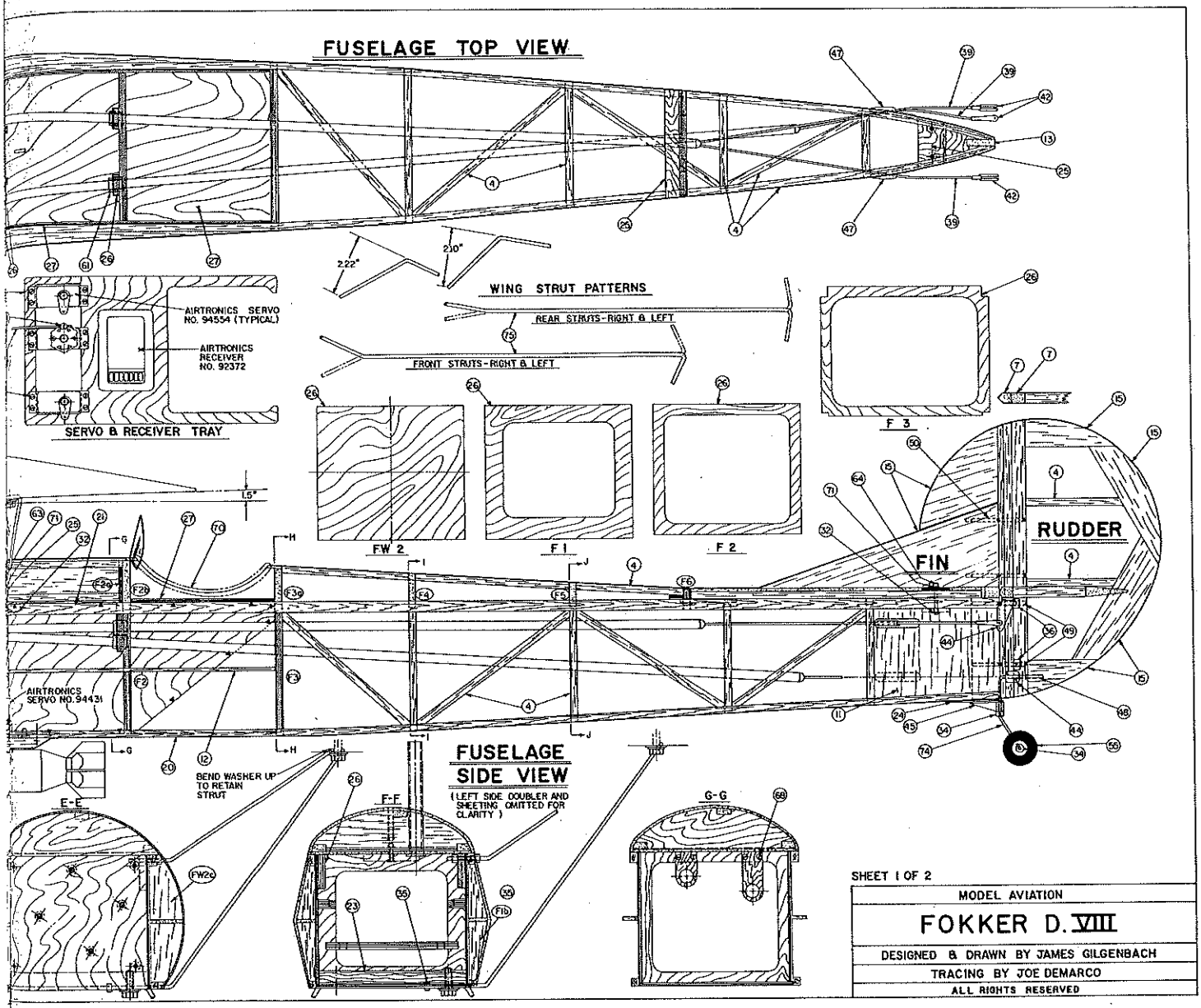
Position the doubler assemblies upside down on the plan, and glue F2 and F3 in between. (I use steel squaring blocks to align the formers properly in all directions. Add the remaining formers and cross braces, carefully working from the front of the fuselage to the back. Put the longerons together at the back of the fuselage, and glue them to the rear vertical post.

Cut and fit the plywood and Lite Ply bottom to the fuselage. Drill the holes for the fuel vent, switch, charging jacks, and bomb release; glue the bottom pieces and mounting plates for the tail surfaces. Cut, fit, and glue the diagonal braces to the rear portion of the fuselage. Glue the plywood





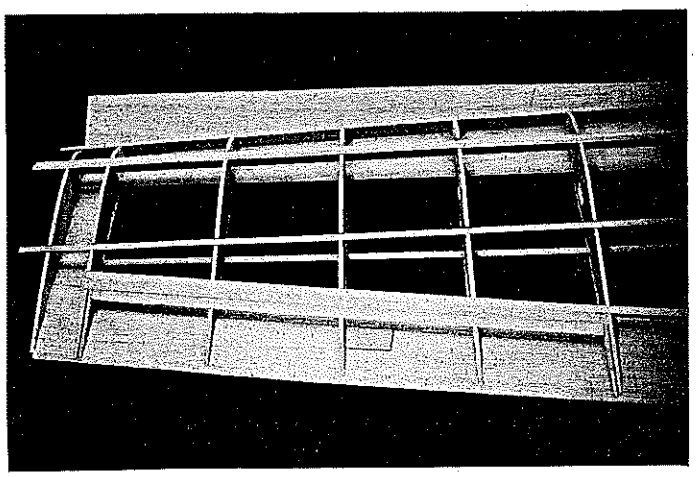
Left: Position the bottom wing sheeting, cap strips, and main spar over the plans covered with wax paper, and tape in place as shown. Right: Ribs and secondary spars are installed using a squaring block for alignment. Make sure you don't glue the hold-down tape to the structure.

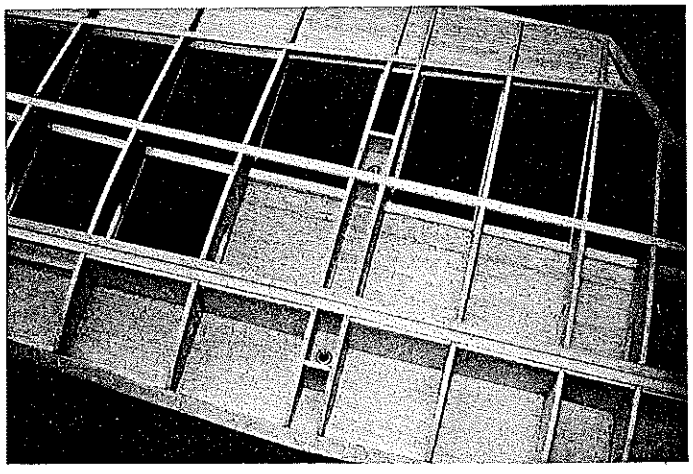


tail wheel mount and the 3/32 sheeting to the rear.

Remove the fuselage from the plans, glue in the landing gear mounts, and drill and tap the holes for the nylon landing gear bolts. Glue on F1, the cockpit floor, and the remaining top formers, stringers, and sheeting; cut out the sheeting for the cockpit. Complete this section by adding the side formers, stringers, and sheeting.

Build and fit the top hatch, and locate and glue its mount in place. Install the ½-in. plastic servo wire tube in the hatch. To form the lip on the bottom end of the tube, press the end squarely onto a hot plate or heated frying pan. Fuel-proof the servo tray, fuel tank tray, and the inside portion of the fuselage where exposed when the hatch is





Left: Remove wing from the plans. Bend the bottom leading edge sheeting up, and glue it to the leading edge. Trim flush with the top surface of the leading edge. Right: Wing hold-downs are nested between two Lite Ply ribs. Center sheeting extends one bay outboard of them.

removed. Install the trays for the servos and fuel tank.

Mount the engine, install the throttle servo and linkage, and check for proper operation. Remove these items for finish-sanding the fuselage. When done, put aside with the completed wing out of harm's way.

Tail Surfaces. Build the horizontal stabilizer, elevators, fin, and rudder directly over the plans. Note that the TE of the elevator must be shimmed up to a symmetrical shape. Once constructed, finish-sand all the components.

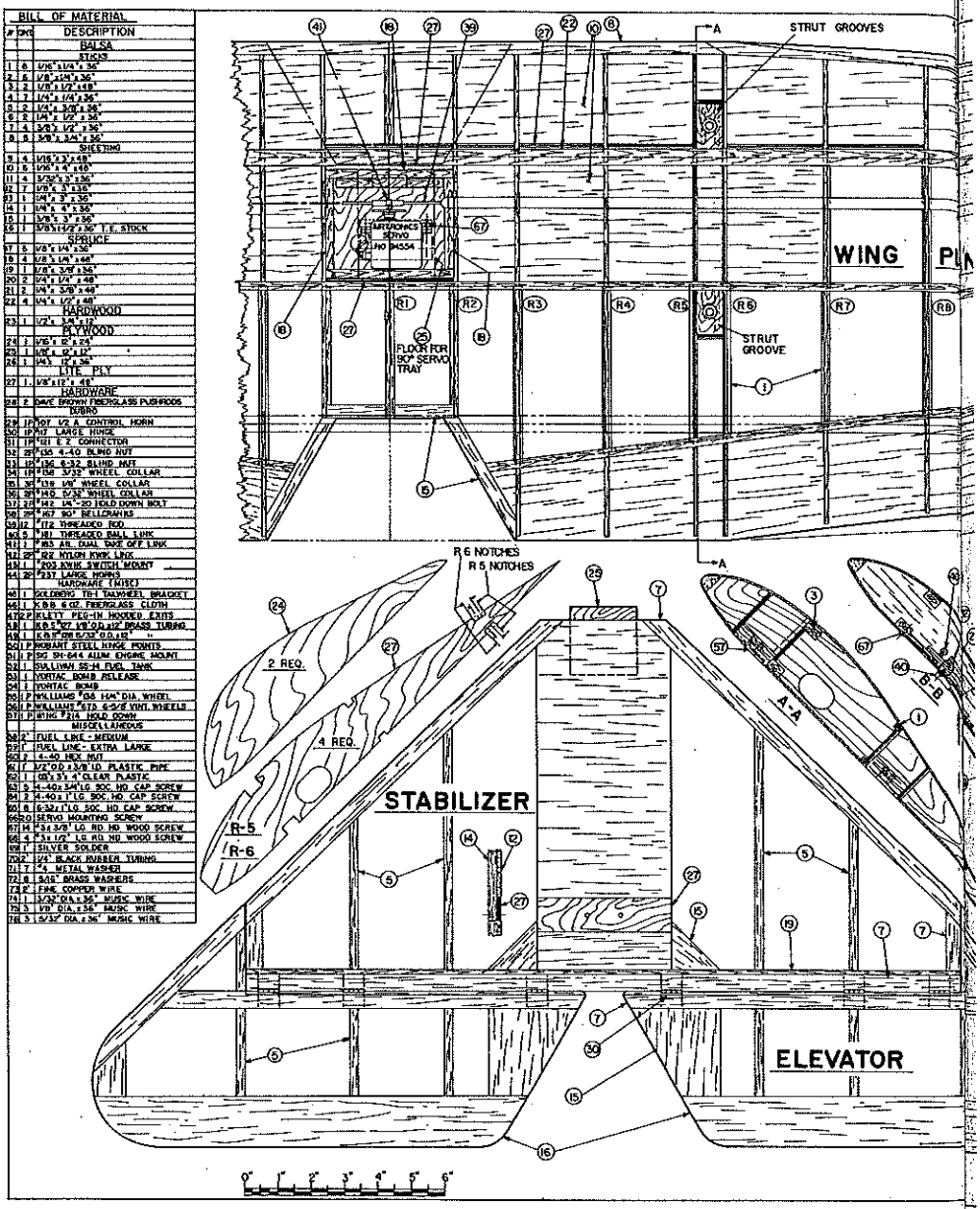
Install the tail wheel assembly and all the hinges and horns (but don't glue them yet). Assemble the tail surfaces on the fuselage, making sure the fit is proper. Do not, however, glue the fin to the stabilizer just yet; instead, use masking tape or T-pins to hold it in place. The tail surfaces are designed to be removed by taking out two 4-40 bolts and loosening two setscrews in the lower rudder. It is necessary to cut down the two Robart hinges so they slide freely in and out of the 5/32-in. O.D. brass tubes. Also drill a hole in the 5/32-in. tubes to allow the setscrews to tighten down onto the hinges, themselves, without crushing the tubes.

Install the radio gear and the rudder and elevator pushrods. Operate the controls to assure that no binding occurs, then position the pushrod supports up to F5 and screw in place. Check the controls again to make sure that they still operate smoothly. When everything is working properly, disassemble the components and set aside.

Wire pieces. The wing struts are made from 1/8-in. music wire with wheel collars used for final adjustment. Care must be taken to form the struts accurately. Otherwise, it will be very difficult to obtain proper wing alignment. Note that the left and right side struts are not alike.

The landing gear is made from 5/32-in. music wire. It is wrapped with copper wire and silver soldered.

I recommend that you use a Breiten wire bender, or similar, to form the struts and landing gear.

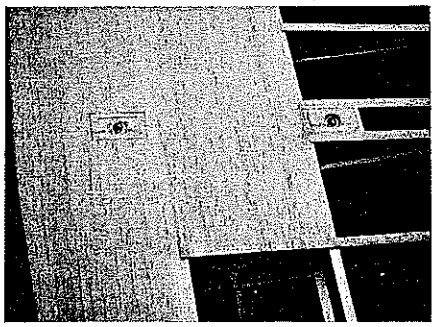


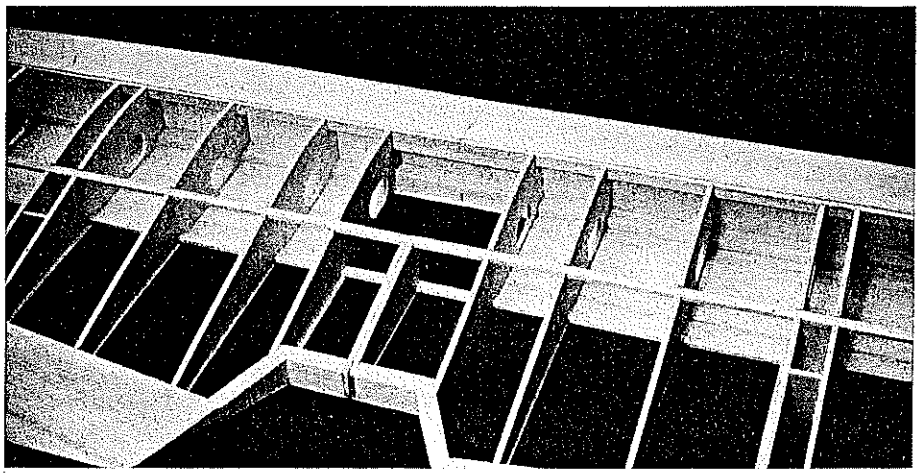
The cowl is made by building up a plywood, balsa, and Styrofoam frame and then fiberglassing it on the outside.

First, glue the 3/32 sheet balsa and 1/4-in. balsa blocks between C2 and C3. Cut out a 2-in.-thick piece of Styrofoam, and form it to the outside shape of C2; then tack-glue it to C2. Also glue C1 to the Styrofoam. Sand to the desired shape with 60-grit dry sandpaper.

Mix a batch of Hobbypoxy 2, and brush it onto the outside of the cowl plug; cover this with 6-oz. fiberglass cloth. Work out all the air bubbles, and set the cowl aside to cure.

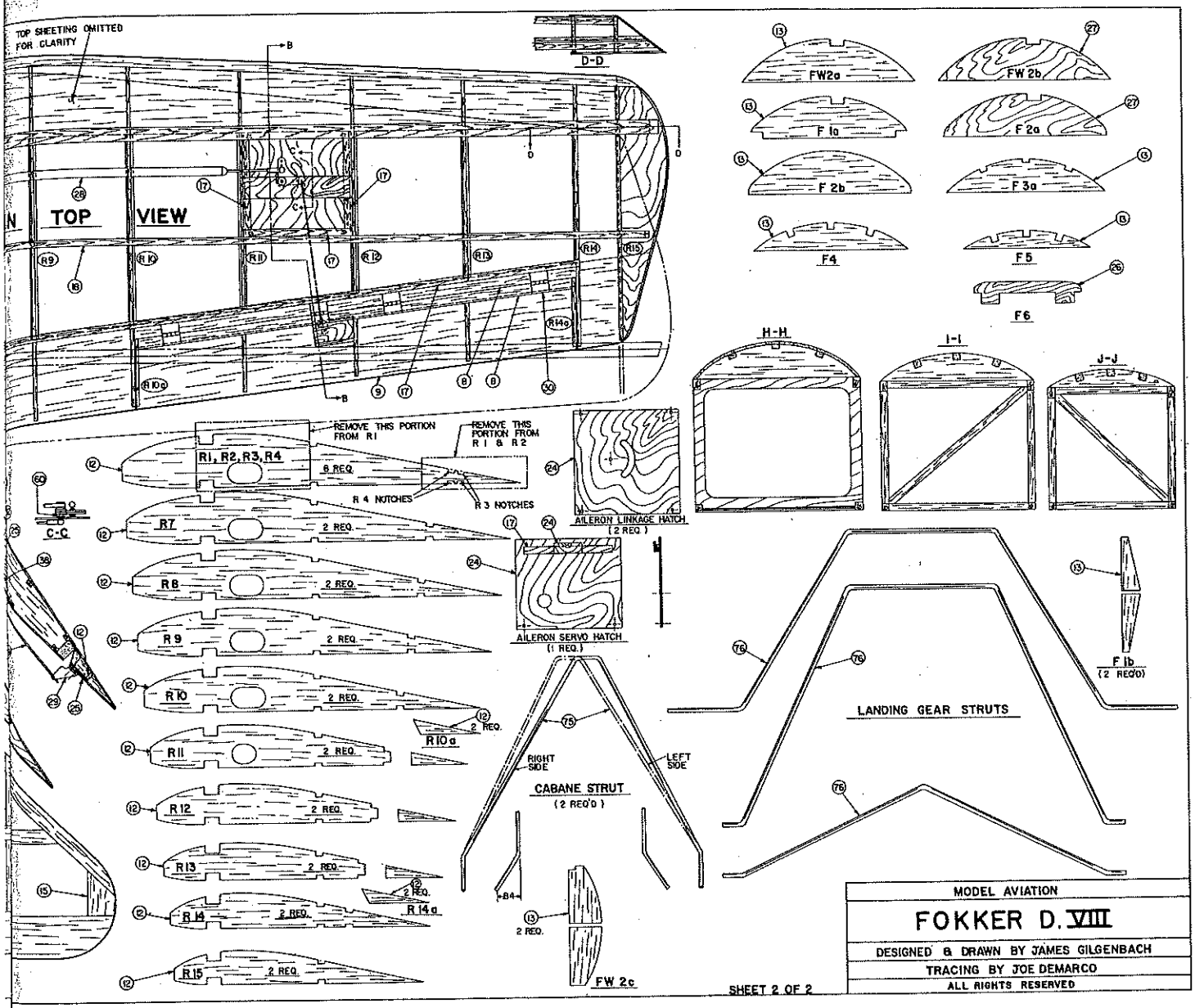
When the epoxy has cured, trim off the excess fiberglass. Rough-sand the structure, being careful not to sand through the





Left: Wing hold-down blocks are mounted flush with the bottom sheeting. The blocks have grooves where the cabane and strut wires will rest. Right: Joining the wing halves together with spruce strips at the main spar assures a strong center section. When finished, the top of the wing is straight (that is, *no* dihedral on the top wing surface). Control rods are of the fiberglass fishing rod type—very light and strong.

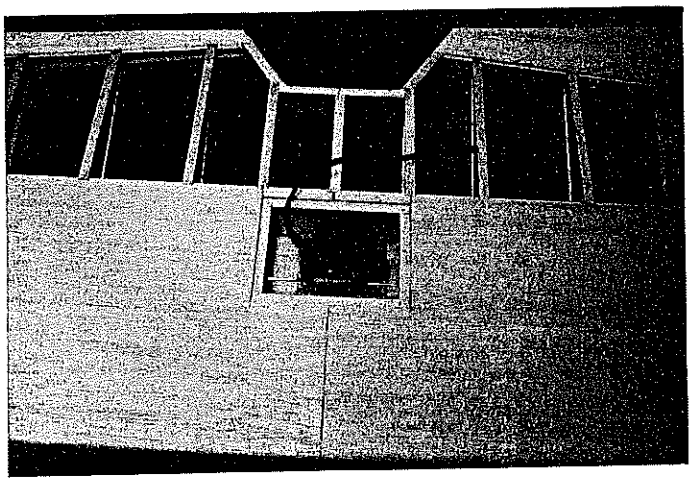
Full-Size Plans Available . . . See Page 164

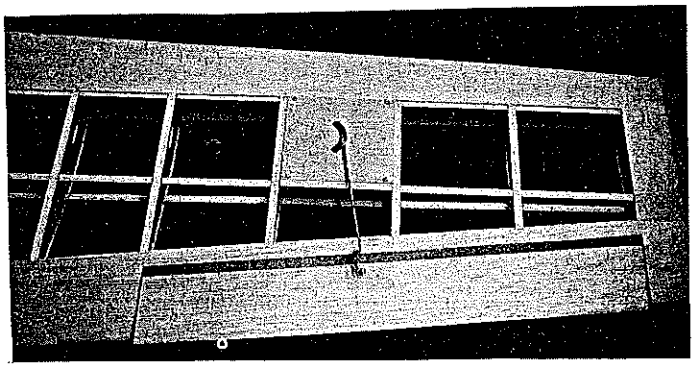


fiberglass. Mix up a batch of two parts microballoons to one part Hobbypoxy 2, and apply it to the fiberglass as a second coat. When this has cured, cut out the openings, and sand the cowl to its finished size; then dig and scrape out the Styrofoam.

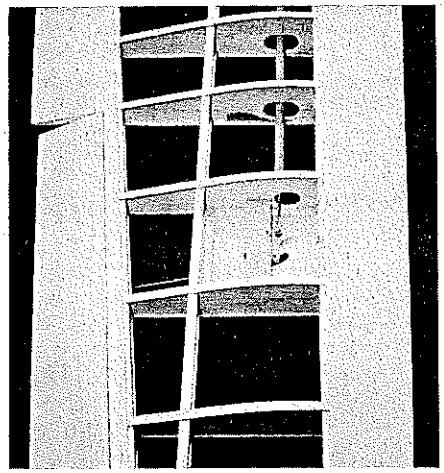
The outside of the cowl is complete at this point, but the inside must be treated in a similar manner for added strength, so mix up another batch of Hobbypoxy 2, and brush it onto the inside of the cowl. Add a layer of 6-oz. fiberglass cloth to the inside between C1 and C2 as was done on the outside. After curing, check to make sure the cowl fits properly to the fuselage and does not interfere with the engine and throttle linkage.

Assembly. A misaligned aircraft will never fly properly, and a jammed control can easily cause a crash. Before covering and painting, therefore, I recommend that you install all the components—including the radio, engine, and landing gear—and com-

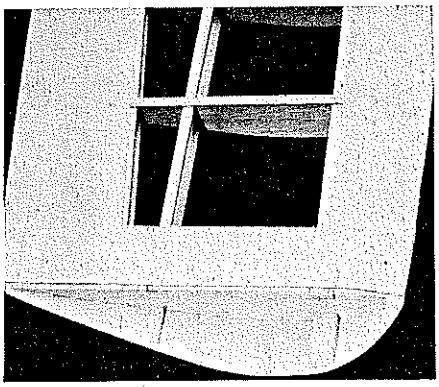




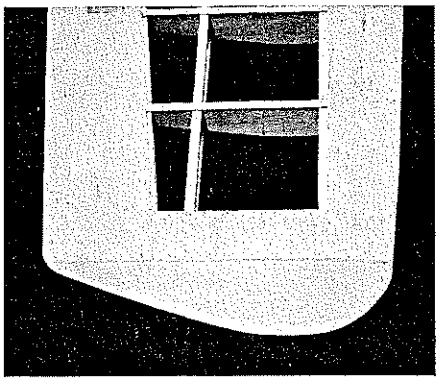
Left: There is room for even a much larger aileron servo, but any servo with over 45 oz./in. of torque is adequate. Author has used both the Airtronics 94394 and 99554 servos with good success. Above: Aileron bellcrank access is possible by use of a ball link on one end of the control rod in conjunction with a removable Lite Ply hatch.



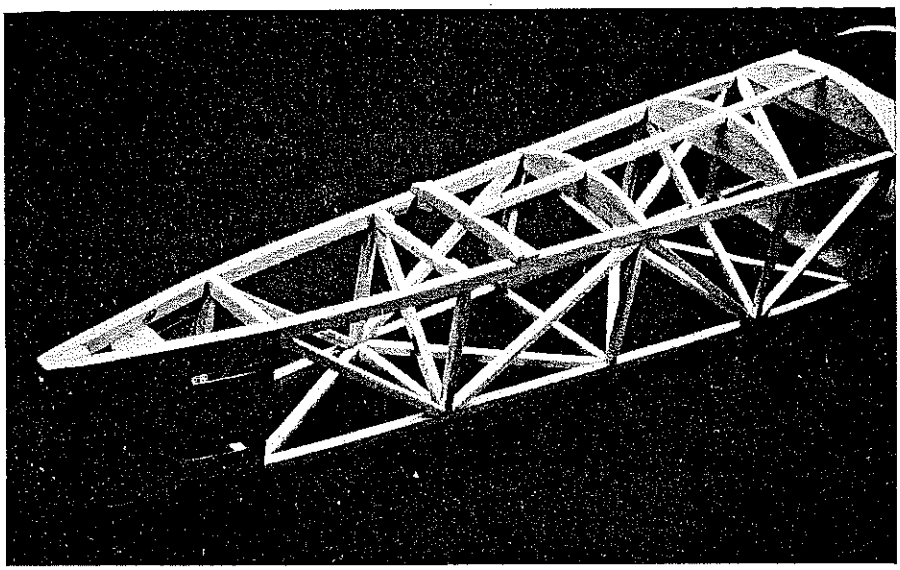
Two nylon bellcranks are bolted together to increase stiffness and, thereby, eliminate aileron flutter and spongyness. The ailerons are hinged just below the top wing sheeting.



Before installing the wing tip plate, sand the tip sheeting and spars to the correct angle, then bevel the tip rib to accept the tip plate.



A plywood wing tip plate minimizes damage from dings. If overall weight is of great concern, 1/16 balsa could be substituted for ply.



Turtleback of the prototype model had only one stringer, but plans show three for improved appearance. Note the mounting plate (with threaded inserts) for securing the tail surfaces.

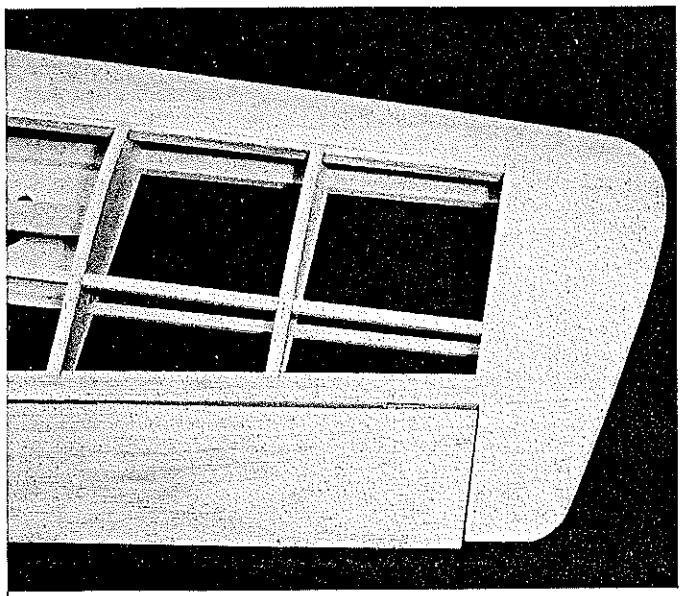
pletely assemble the aircraft. Make sure that all the alignments are correct, that there are no warps, and that all the controls operate properly without interference or binding. Extra effort applied at this point will more than pay for itself in satisfaction later.

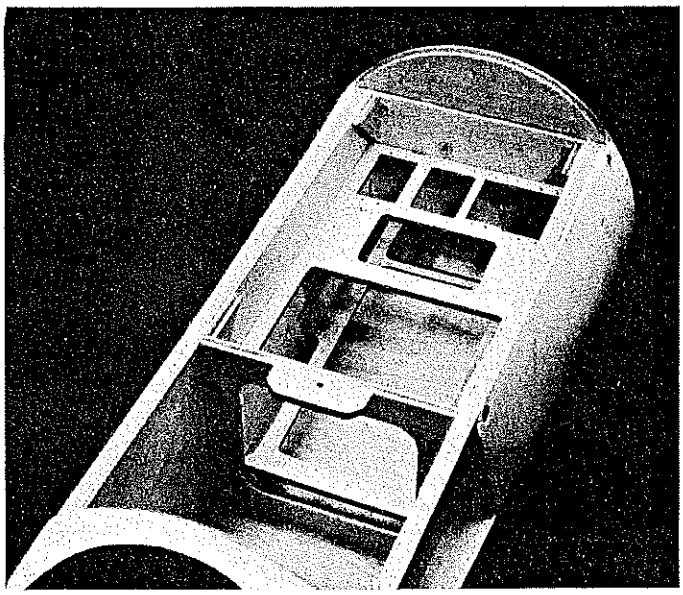
Covering and finishing is basically a matter of personal preference. Some old-timers would say that it is a sin to finish this aircraft with anything but silk and dope. However, this old-timer has had his fill of breathing dope fumes and smelling up the house. Because this Fokker is not intended to be true scale, I recommend the following:

Disassemble the aircraft and finish-sand all the parts with 220-grit paper. Prime and color the cowl with an epoxy paint for greatest durability. Cover the remainder of the aircraft with an iron-on film or fabric. It looks great in transparent MonoKote.

Trimming and flying. After covering and finishing, reassemble the plane and check out all the controls to be sure that they function properly. The elevator should have 1½ in. of up-travel and 1 11/16 in. of down. The ailerons should have 15/16 in. of up and 13/16 in. of down, and the rudder should have 1½ in. of travel left and right. Make sure the center of gravity (CG) is within the designated range. The throttle should be set up to fully stop the engine with the stick and trim fully back.

Attaining all of these settings was a piece of cake with my Airtronics CS7P radio. It has end point adjustment on the elevator and ailerons and total throw adjustment on the rudder, throttle, and retracts. It also has





Left: "To scale" aileron provides ample control. After the wing tip plate is installed, the tip can be sanded to a smooth, well-defined edge. Right: Install the servo tray after fitting the servos to it. Author recommends a Hobbypoxy 2 coating for the entire area exposed by the hatch.

servo reversing on all channels (which is probably the greatest invention since sliced bread). In addition, it has aileron/rudder coupling. This feature allows electronic mixing of the rudder and ailerons to make coordinated turns effortlessly. The amount of throw on the rudder, while being coupled with the ailerons, can be adjusted separately. I used the retract channel for operating the bomb release.

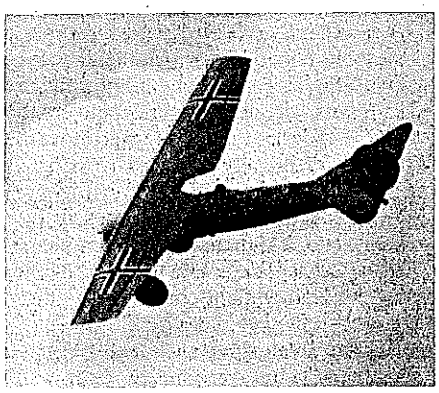
While on the subject of radios, one very important component which cannot be overlooked is the servo. To properly control large aircraft in the Quarter Scale range, strong, powerful servos are required for all the control surfaces. For the Fokker D.VIII, servos with at least 45 oz./in. of torque should be used. I originally installed No. 94394 standard Airtronics servos. With 48 oz./in. torque, they performed very well. However, being conservative by nature and somewhat perfectionistic, I later installed No. 99554 Airtronics coreless ball bearing heavy duty servos on the elevator, rudder, and ailerons. These servos have a whopping 73.5 oz./in. torque and are by far the smoothest servos I have seen.

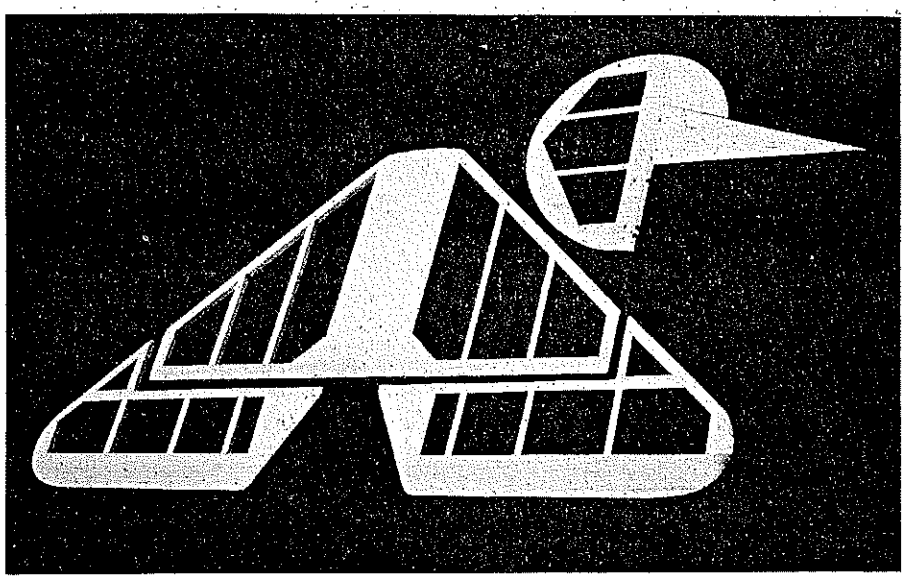
I have installed the receiver antenna wire inside the fuselage, encased in the outer portion of a Gold-n-Rod, running from the radio compartment back to the tail—a very clean installation. I hesitate to recommend this for everyone, however, as I do not know if other brands of radio will function properly with this arrangement.

To assure a safe, rewarding first flight, I recommend that you become familiar with the operation of your four-cycle engine. Run it on a test stand until it performs well at idle, mid-range, and top speed. Then mount the engine in the Fokker and test that it runs reliably on the ground. Don't expect erratic running to clear up once it's in the air. It won't!

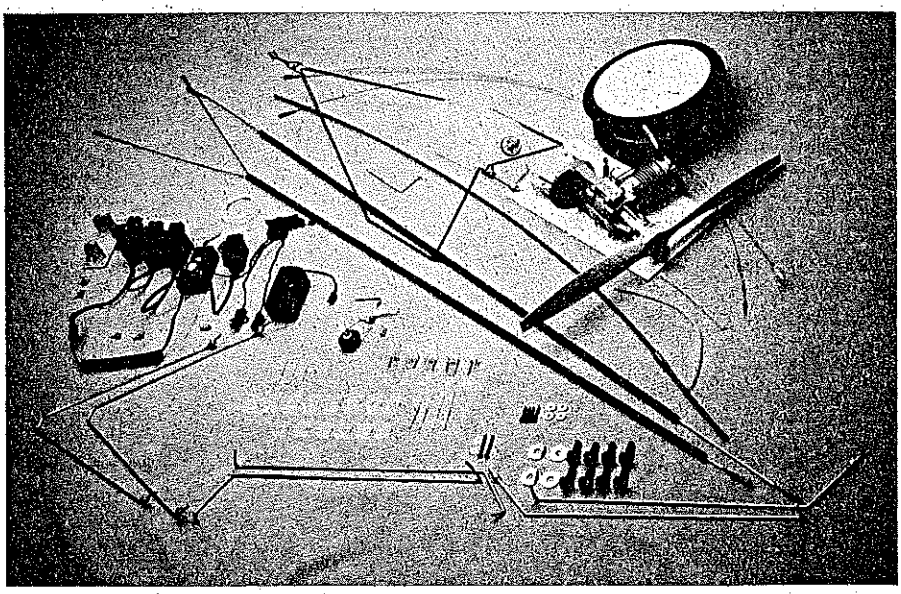
The recommended prop size for a .60 four-cycle is 14-in. diameter, 5-in. pitch; for a .75, 14-6; and for a .90, 15-6. After flying the Fokker for a season with an O.S. FS75 and an O.S. FS90, I installed a Magnum .91 from Pearson Power Products. The Magnum performed quite well in the semi-inverted position after it was broken-in properly.

As a final testimonial to the integrity of this aircraft, I can state, unequivocally, that after two seasons of flying (approximately 100 flights), I have yet to damage it in any way. For me, this *has* to be a new record.





Tail surfaces are quite large, probably accounting for the plane's fine flight characteristics. Glue the fin/dorsal to the stab after covering both—with the stab mounted on the fuselage.



Here are the hardware components required for the D.VIII. A well-defined bill of materials is listed on the construction plans. Everything should be available from your local hobby shop.