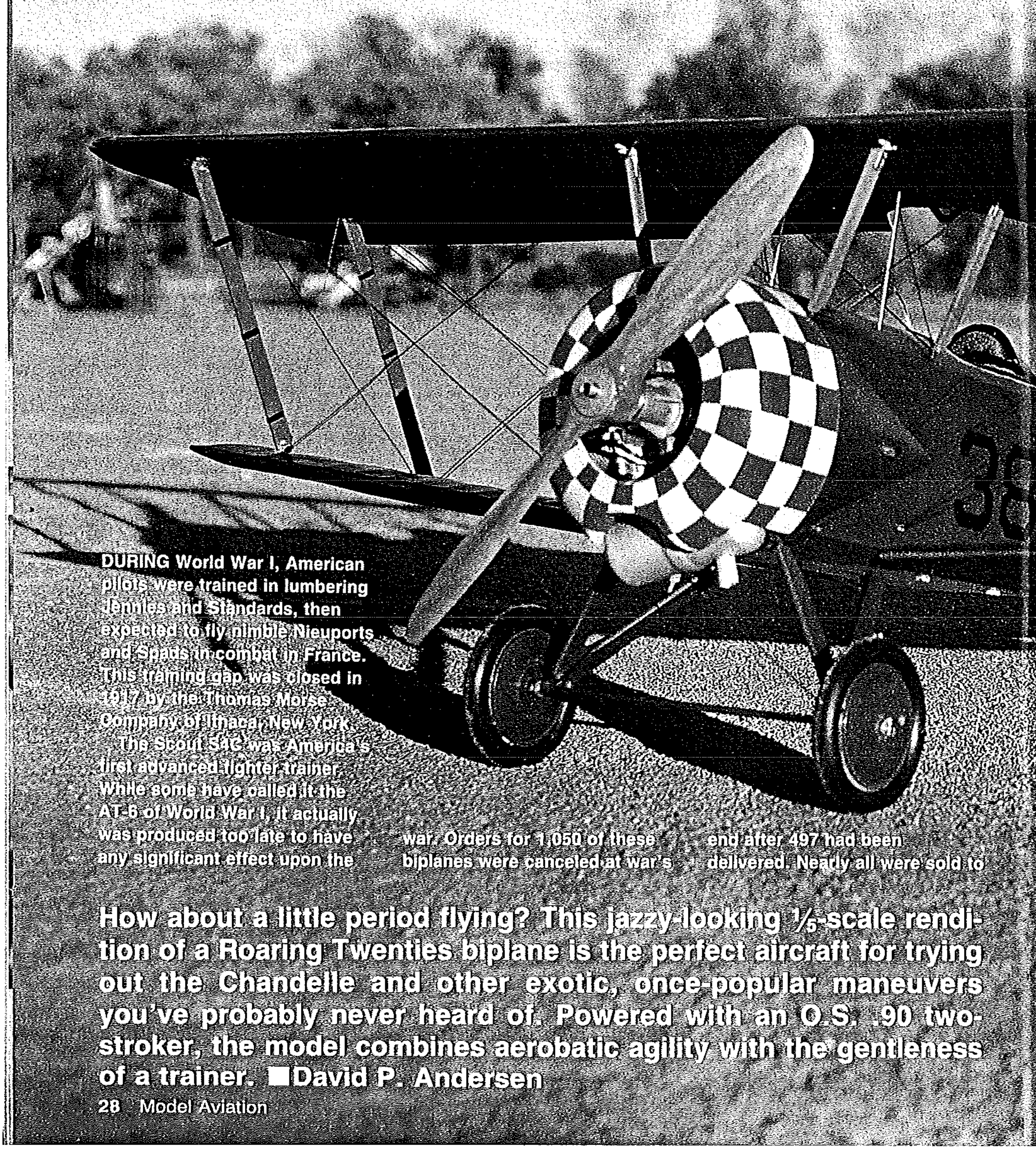
#689

Thomas Mor

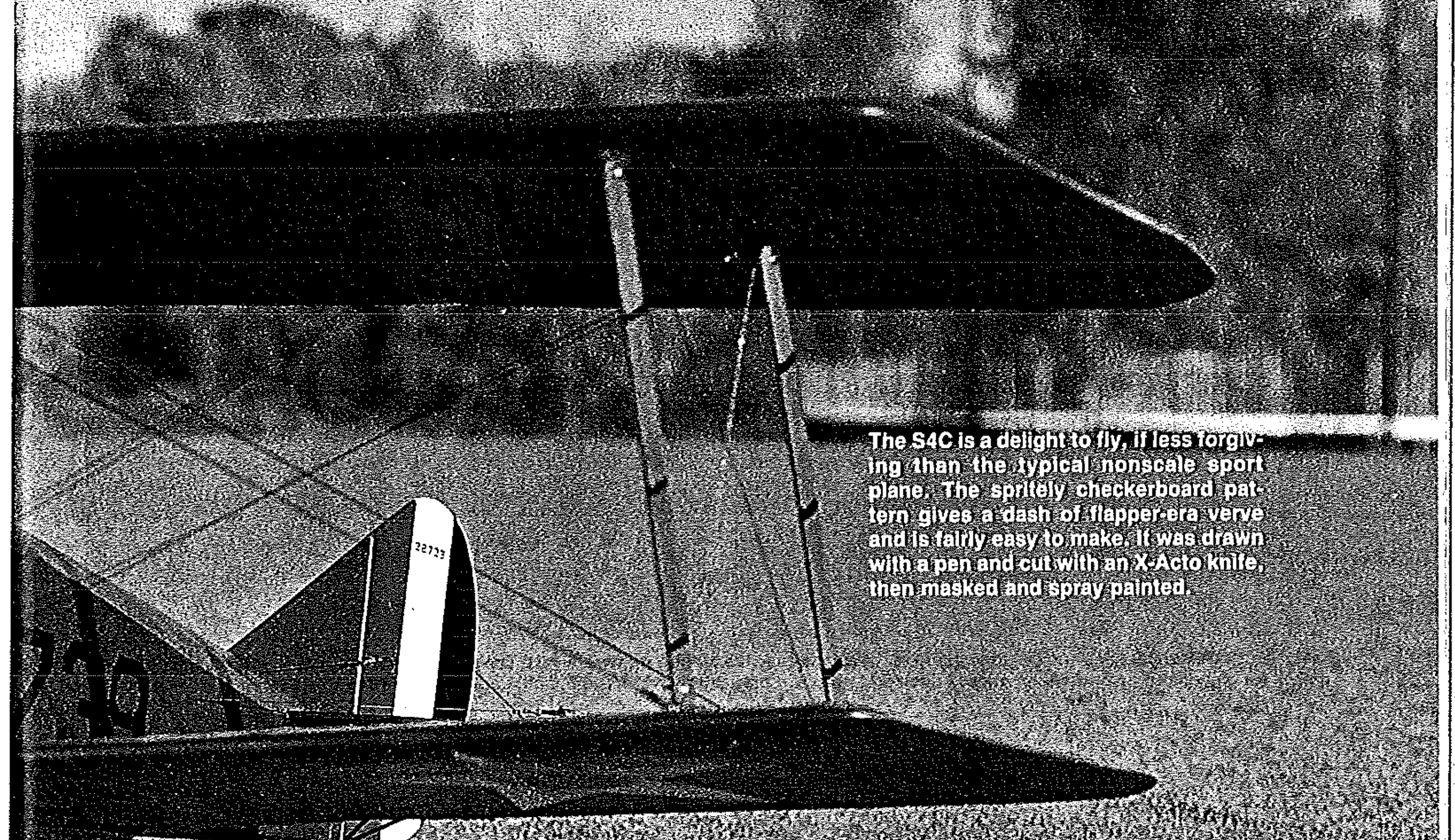


DURING World War I, American pilots were trained in lumbering Jennies and Standards, then expected to fly nimble Nieuports and Spads in combat in France. This training gap was closed in 1917 by the Thomas Morse Company of Ithaca, New York.

The Scout S4C was America's first advanced fighter trainer. While some have called it the AT-6 of World War I, it actually was produced too late to have any significant effect upon the war. Orders for 1,050 of these biplanes were canceled at war's end after 497 had been delivered. Nearly all were sold to

How about a little period flying? This jazzy-looking ⅕-scale rendition of a Roaring Twenties biplane is the perfect aircraft for trying out the Chandelle and other exotic, once-popular maneuvers you've probably never heard of. Powered with an O.S. .90 two-stroker, the model combines aerobatic agility with the gentleness of a trainer. ■David P. Andersen

se Scout S4C



The S4C is a delight to fly, if less forgiving than the typical nonscale sport plane. The spritely checkerboard pattern gives a dash of flapper-era verve and is fairly easy to make. It was drawn with a pen and cut with an X-Acto knife, then masked and spray painted.

the public, and the S4C was widely used throughout the Twenties both as a private airplane and in flying schools. Many of the apparent Sopwiths in movies such as "Wings" and "Hell's Angels" were actually Tommies, just as AT-6s were used to simulate Japanese Zeroes after a later war.

With its gentle trainer qualities and aerobatic agility, Tommy was a delight to fly. Those are precisely the qualities we look for in a vintage RC Scale model.

I decided on the following design objectives for the Tommy:

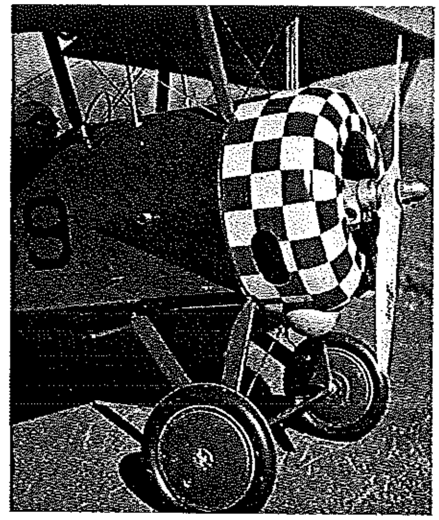
- The model would be 1/5-scale. Engine: O.S. .90 two-stroke, with O.S.'s swing muffler.
- Scale accuracy good enough to win Sport Scale contests; adaptable to FAI Scale with the addition of surface detail.
- Shock-absorbing landing gear.
- Must fit in a subcompact car with the wings intact.
- Can be built with inexpensive materials and tools.

All the documentation you'll require to compete in Sport Scale is included in this article, and additional references are supplied.

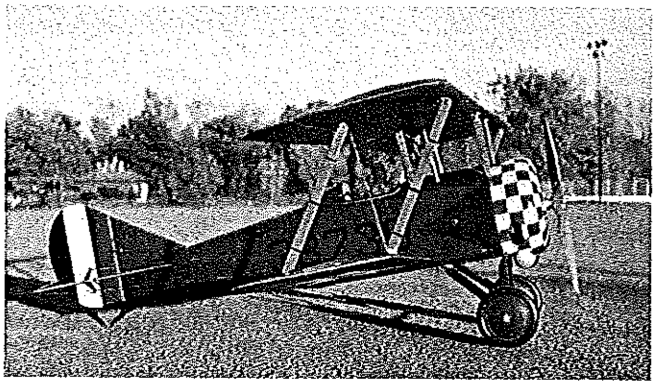
The S4C is a delight to fly. Since it's a trainer, ground handling and stability are superior compared with that of World War I fighters, yet it has the look of a Camel engaging the Red Knight. Still, the Tommy is less forgiving than the typical nonscale sport airplane, so only experienced builders and seasoned pilots should consider it.

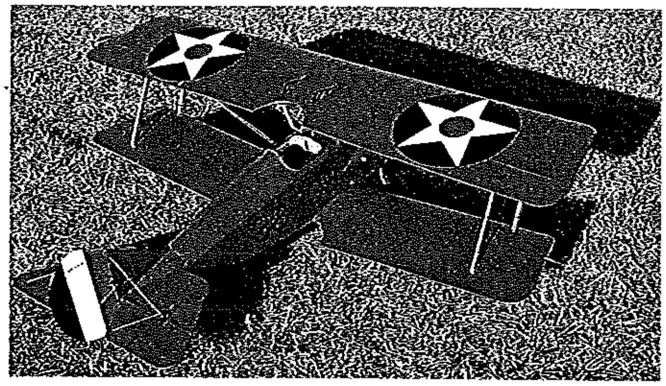
If you'd like to return to the romantic years of the Jazz Age, pull up the sheepskin collar of your leather jacket, wipe the oil off your goggles, and come on down to your workshop. Break open a mason jar of bootleg

The original S4C. These aircraft were trainers, not high-performance fighters. They were designed for gentle handling and nimble aerobatics. The wide-apart landing gear, long fuselage, and large tail gave them exceptionally good ground handling for planes of the era.

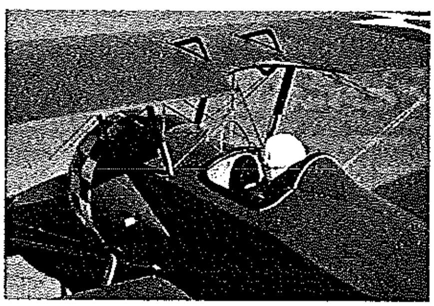


Although the landing gear looks stiff, it was designed to flex rearward and upward. The rear struts have coil springs hidden inside the fuselage. The engine is cooled by both a scale cutout in the cowl and an unseen air duct. The propeller is a 14 x 6 Zinger.

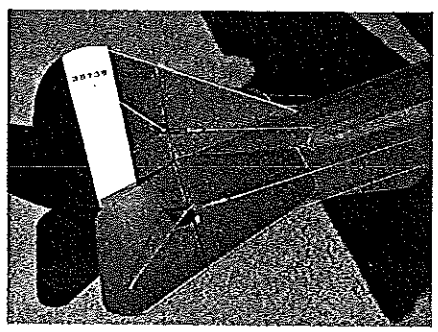




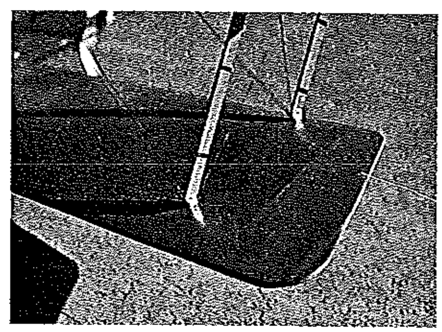
Left: The S4C's dapper lines and bright markings capture the essence of the Twenties. Right: The generous wing area—nearly 10 square feet—makes for slow flight and a floating glide. Touch and goes are particularly nice. The insignia are late WW I Army Air Service.



Aileron control is with the Nieuport system. Pushrods in the fuselage drive rocker arms in the wing, and torque tubes from the rocker arms rotate the ailerons. It's simple, effective, and scale. Clevises at the pushrod ends provide convenient field adjustment.



Proctor control wires guide the rudder and elevator just as in the full-size version. While they're extremely effective, huge control surfaces do require some discretion—full rudder at full speed can cause a snap roll.



The wings can be removed for maintenance and repair. The mahogany strut attaches with a 2-56 nut and bolt and a single screw. The receiver antenna extends through the lower wing. Push it in for static display.

hooch, put a scratchy old Bix record on the Victrola, stack the balsa, and get ready to start cutting. This will be one of the most enjoyable airplanes you've ever built. In fact, it's the cat's pajamas!

Would the Red Baron bounce? The idea of using a coil-sprung landing gear in this model occurred to me while flying a fifth-scale Fokker Triplane. Its gear was similar to the type used here, but the struts were rigid. You'd hear a shuddering clunk as the unyielding gear hit the ground.

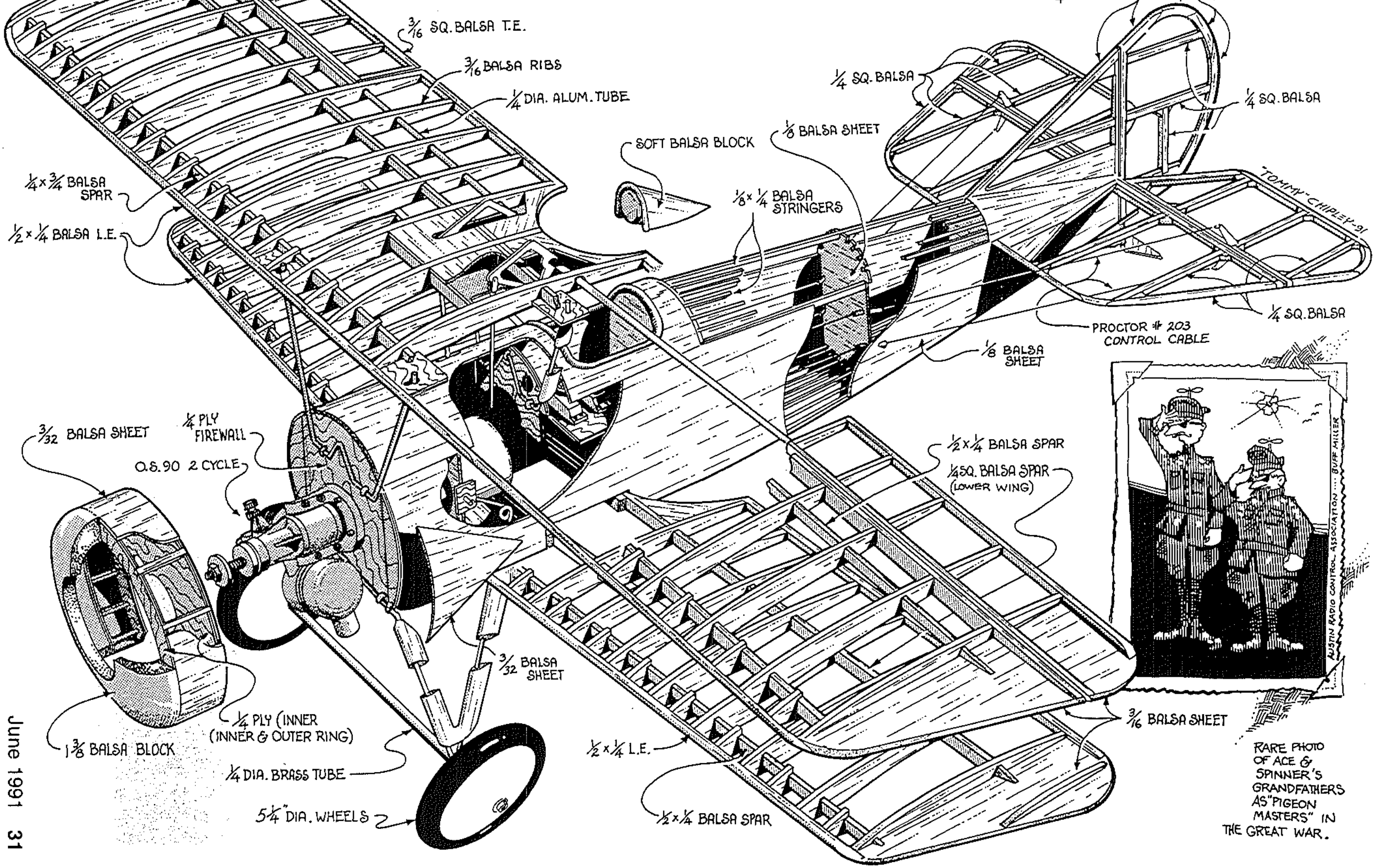
I expected the forward strut to buckle from this abuse; to my surprise, the aft strut bent instead. Apparently the rearward landing force is greater than the upward force. Since the forward speed of the airplane is greater than the downward speed, this stands to reason. Why, then, did full-size airplanes of the era have axles that allowed only a small amount of upward travel? The answer lies in their slow landing speeds—only six miles per hour at fifth-scale equivalence. Since our models must land faster than that, greater rearward shock absorption was needed.

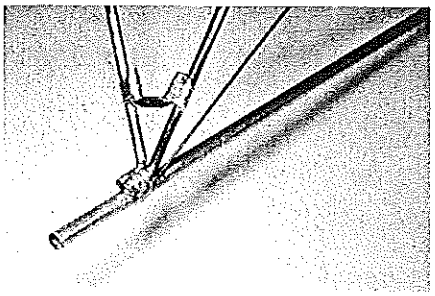
My solution was to allow the forward struts to swing backward and slightly upward by attaching them with J-bolts to the firewall. The rear struts have coil springs inside the fuselage, anchored in plywood bearings in the middle of the fuselage sides. The springs will compress on landing, allowing the axle to rotate rearward and upward (mostly rearward).

Play in the rear struts is achieved by cutting small openings at the point where they enter the fuselage. This provides a good tolerance; a rearward throw of over two inches is possible before damage will occur. Compare this with an upward-only throw of only ½ in. and no rearward motion whatsoever if scale shock chords are used. Touchdowns are silent, obviously

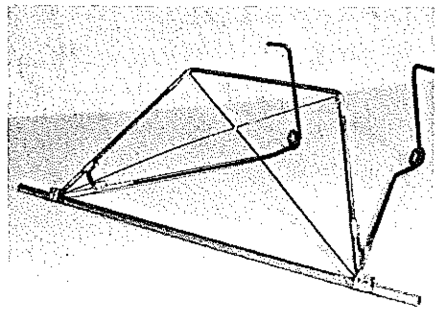
Thomas Morse Scout S4C

David P. Anderson

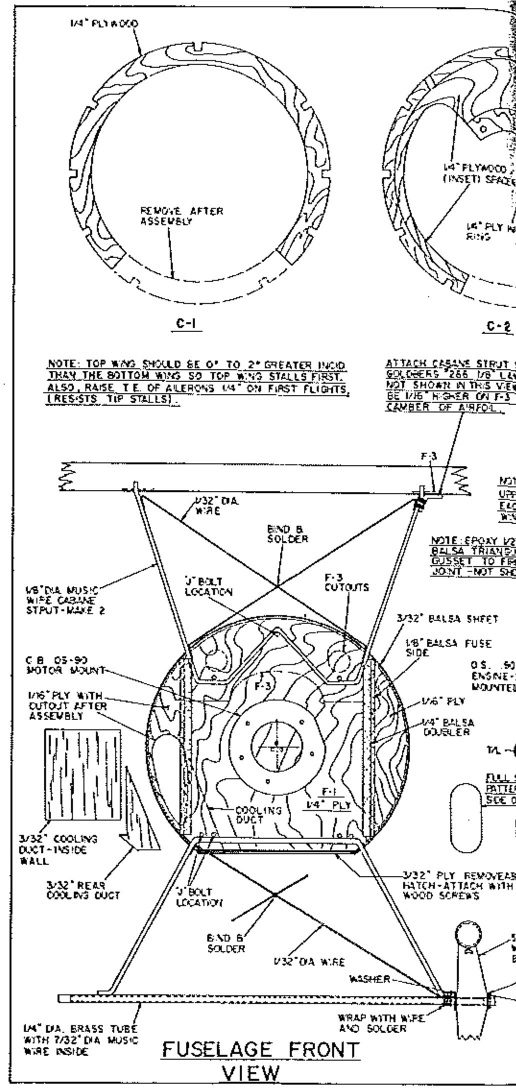


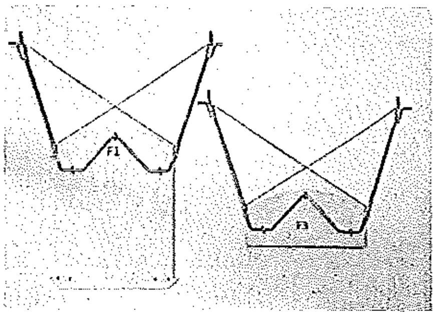


The rear landing gear strut is the most difficult part of the S4C to build. It attaches to the front strut at the axle. The hole in the end of the axle end will receive a cotter pin to retain the wheel. The wheels are made from wood and automobile fuel line tubing.

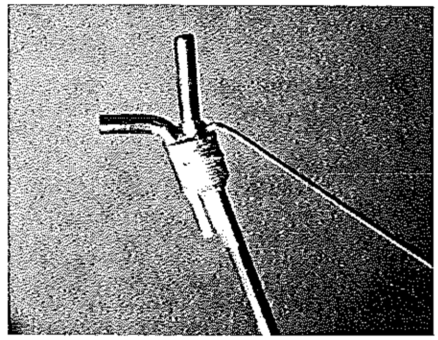


The landing gear metalwork completed. Coils in the rear strut provide up to 2 in. of rearward and upward flex. The wire is blackened from baking in the oven, something the author's wife hadn't planned on.





The cabane struts are assembled and soldered directly over the plan, scorching the paper. They are then J-bolted to F1 and F3. Since accurate alignment is important, all assembly is done over the plan.



The top of the cabane strut. The vertical part plugs into a ply support in the wing. The horizontal part is held to the same support with a Carl Goldberg nylon landing gear strap.

cushioned, with little tendency to bounce. If one wheel strikes before the other, the model isn't wrenched off course.

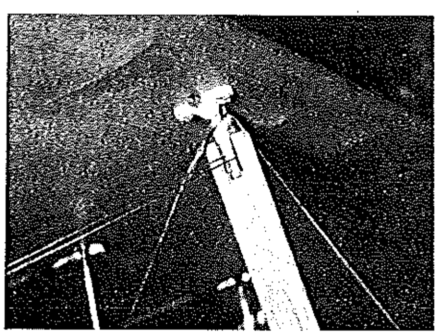
Begin making the landing gear by bending the front struts and their cross braces. Use a Breiten coil bender or the equivalent; don't try to bend heavy wire with pliers and a vise. Position the pieces of the front struts over the plans to make sure they're true; correct as necessary.

The axle is a ¼-in. brass tube with a hole in each end. Sand the wires and axle where solder will be applied. Apply solder flux, and lightly coat these areas with solder. Again lay the parts over the plans, holding them in place with alligator clips and clothespins. Fuse each joint with a hot soldering iron. Don't wrap the joints with wire at this point; we simply want to hold everything together for the next step in assembly.

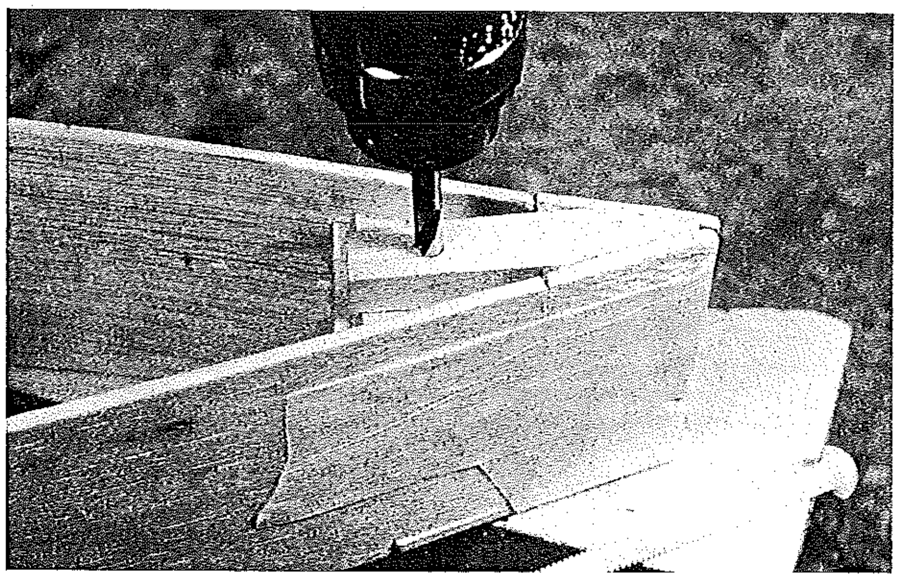
Making the rear struts is the most difficult part of the project—it's hard to get those angles and lengths just right. Fortunately there's a comfortable margin of error.

Bend the coil first, leaving plenty of excess wire on either end. Bend the angle about 5° less than that shown on the plans. Make the other bends. Place each piece over the plans to check out the angles. If either is incorrectly bent, throw it away and try again.

When you're satisfied that the legs are bent correctly, temper the wires by heating them for about 20 minutes in a 500° F oven. Shut off the heat, and remove the wires when the oven has cooled to room temperature. The heat will relax the internal tension caused by the bending and greatly strengthen the wires. The relaxation process will also bend the coil another 5°; that's why you bent it 5° short.



The completed cabane strut. The landing gear strap is screwed to the ply support in the wing. The mahogany strut is decorative, but all wing wires are functional.



After the hardwood top and ply bottom have been added to the tail piece, the latter is taped in place and a 7/32 hole is drilled through the entire structure.

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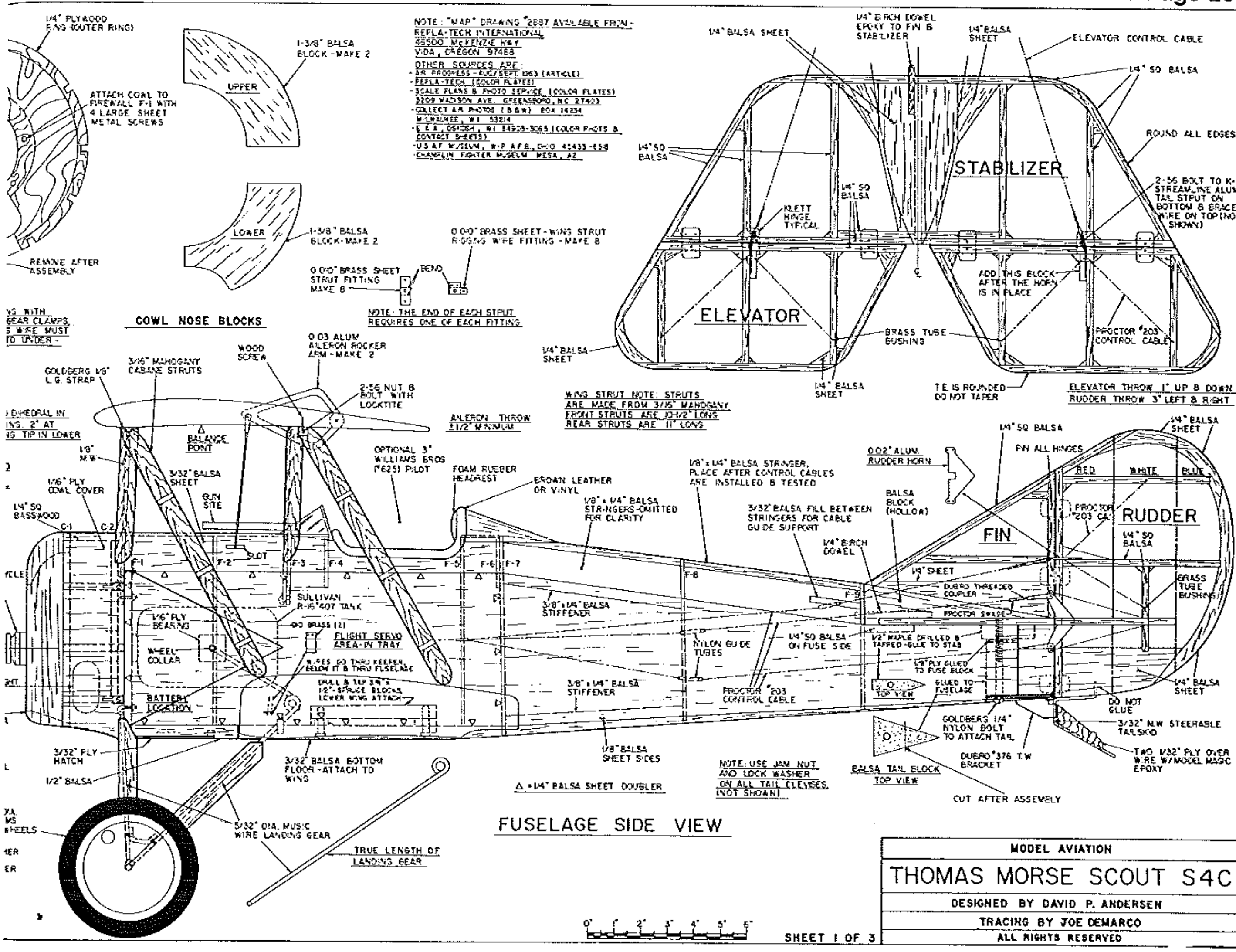


Clean and tin the axle end of the wire. Prop up the whole landing gear assembly with weights, clamps, and strips of wood. Check the angles against the plans, making sure the gear is correctly positioned. Wrap all joints well with copper wire, and solder the gear in place. Bind and solder the intersection of the cross braces; this will prevent metal-to-metal electrical noise.

Cut a length of 7/32 music wire, and slip it inside the axle tube. Don't omit this step; the brass tube alone isn't strong enough.

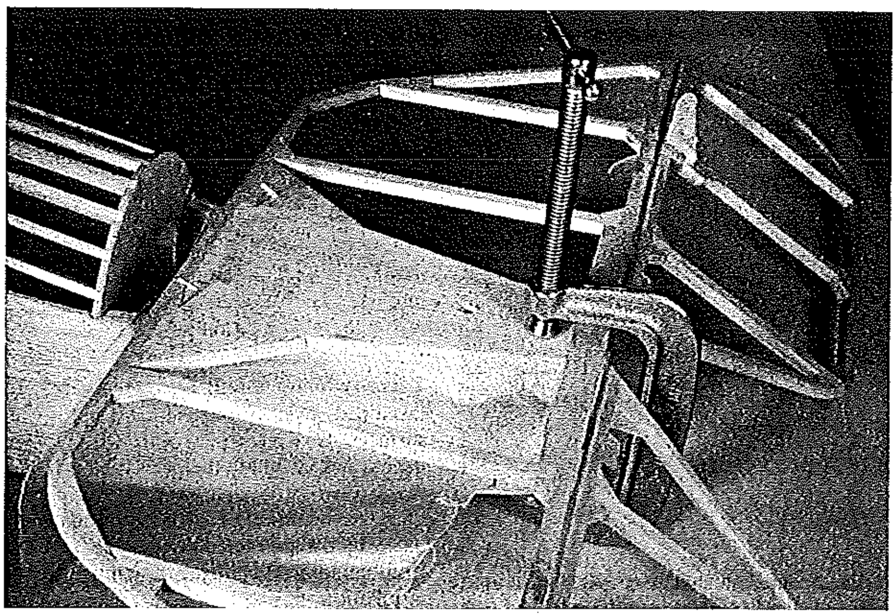
The plywood fairings will be added after trial fitting the landing gear to the fuselage.

Just like a Comet kit—well, almost. The fuselage uses classic construction—flat sides and bulkheads with lots of stringers. Select wood of identical density and grain for the sides. The sides must be of equal stiffness so that the fuselage remains straight when the ends are brought together.

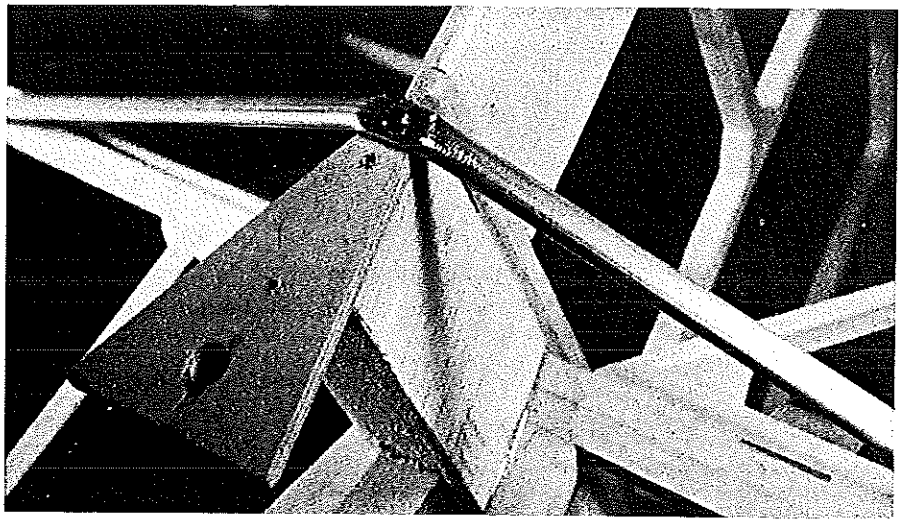
Cut out all the formers, add engine-mounting blind nuts and landing gear to the firewall F1, trial fit the aileron servos to F2, and add the guide tubes to F5. The cabane struts should be assembled over the plans and J-bolted to F1 and F3.

Lay the right fuselage side flat on an elevated surface, and epoxy the firewall F1 and former F2 in place. Fit the landing gear strut into the ply bearing in the fuselage side before the epoxy sets. Add the tank. Secure it to F2 with a dab of silicone glue—not too much or it will be difficult to remove. Add formers F3, F4, F5, F6, and F7.

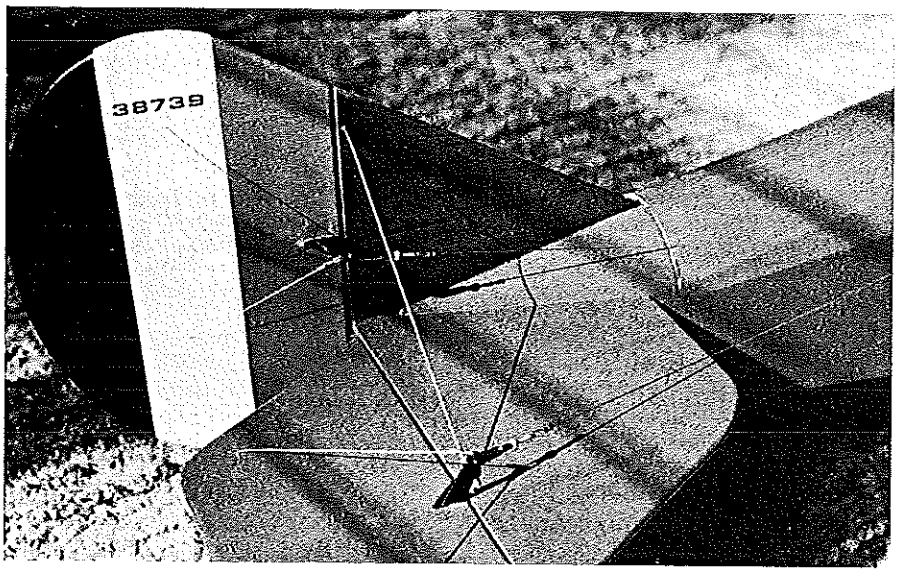
With the fuselage still on its side, add



The stabilizer is clamped and pinned in place on the fuselage, then epoxied to the tail piece. Waxed paper prevents accidental gluing to the fuselage. The fin and rudder are added next.

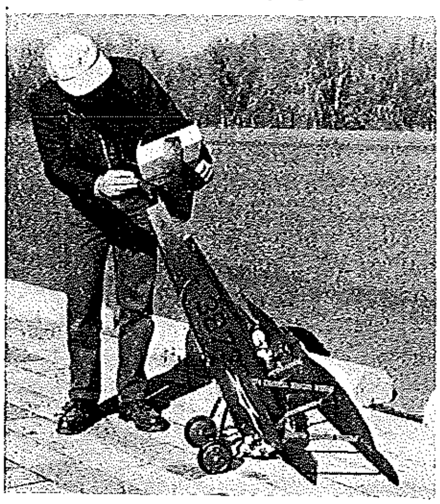


Trial fitting the one-piece K&S streamlined tubing tail strut. The strut is flattened at the ends and center, then drilled and screwed to the tail piece and bolted to the stab.



The removable tail is held in place by a dowel inserted into F9 and a nylon bolt from below. Quick-disconnect clevises are used on each control cable.

the other side, inserting the rear leg into its bearing. Pile on weight (an old 12-volt starting battery works well) to hold the side in place. Epoxy a large gusset of hard



Prince Charming searches for Cinderella by trying on the tail that was lost at the ball. Field assembly—one nylon bolt and six clevises—takes 1 min. 30 sec. The aging prince doesn't even have to bend over.

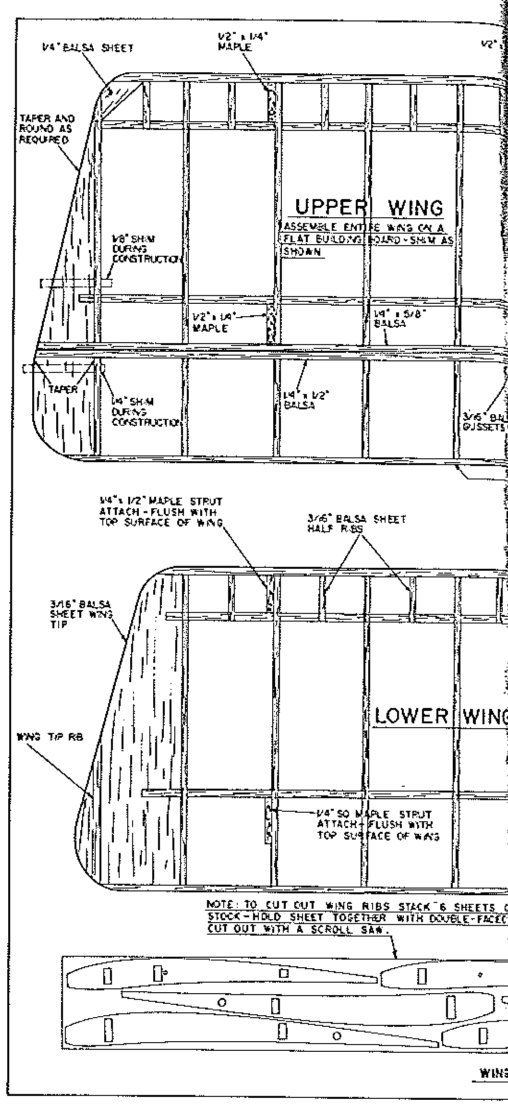
balsa or spruce at the firewall joints. Glue well—this is a high-stress joint. Temporarily pull the sides together at the rear before the glue sets. They should meet accurately; adjust them as necessary. Release the rear of the fuselage, and allow the glue to dry.

Add wheel collars to the ends of the rear struts where they project from the fuselage. These keep the struts from pulling out of their bearings.

Add the remaining formers and the triangular block at the rear end of the fuselage. The stringers are added later. Allow the glue to cure.

Thereby hangs a tail. I used the old-fashioned stick technique for the tail surfaces. Cover the plan with waxed paper, and assemble the parts over it; pin them down as the glue dries. Remove the hinge pins from the Klett hinges, and coat them lightly with oil; this prevents glue from jamming the hinges during installation.

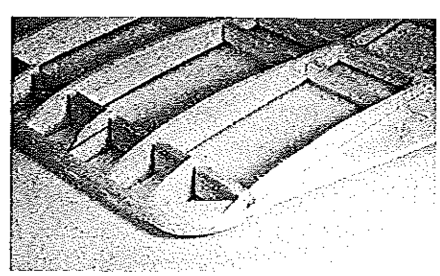
Note that the leading edges of the rudder and elevator halves are beveled to a point;



the hinge gap, especially for the elevator, should be airtight. Epoxy and pin the hinges in place.

The way we make the tail piece is, well, kind of weird.

Add the plywood bolt bearer to the top of the fuselage block. Glue the top and bottom pieces to the end piece, using the fuselage as an alignment guide. Tape the end piece to the fuselage, and drill a pilot hole vertically through the entire assembly. Remove the end piece. Enlarge the hole in the fuselage and the lower ply part of the end piece to ¼ in. Thread the hole in the hardwood section with a ¼-20 tap. Reassemble the end piece and fuselage, and trial fit a Carl Goldberg ¼-20 by 3-in. nylon bolt.



The wing tip is rounded with a razor plane and sanding block. The outer rib is cut down to half thickness at the forward spar.

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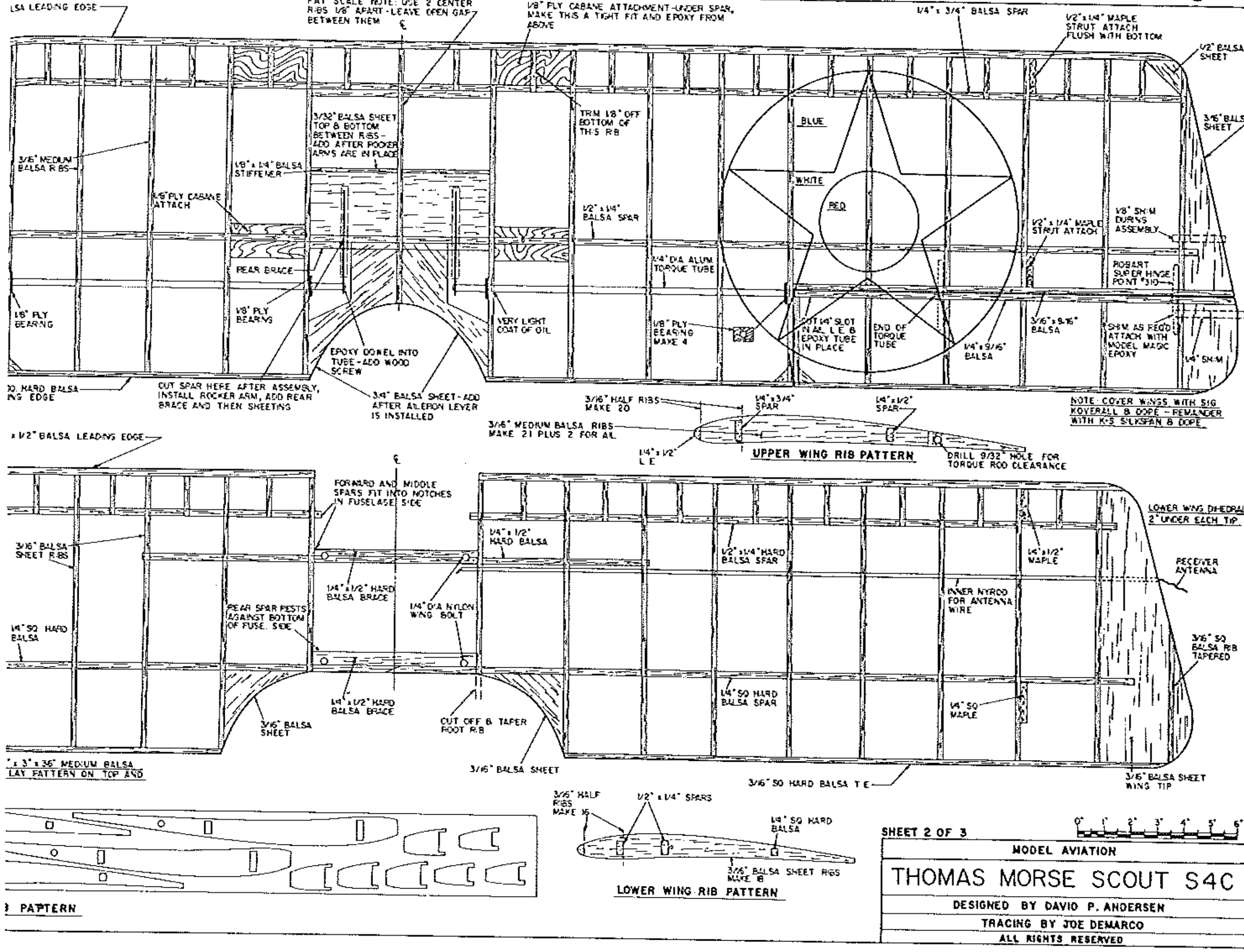
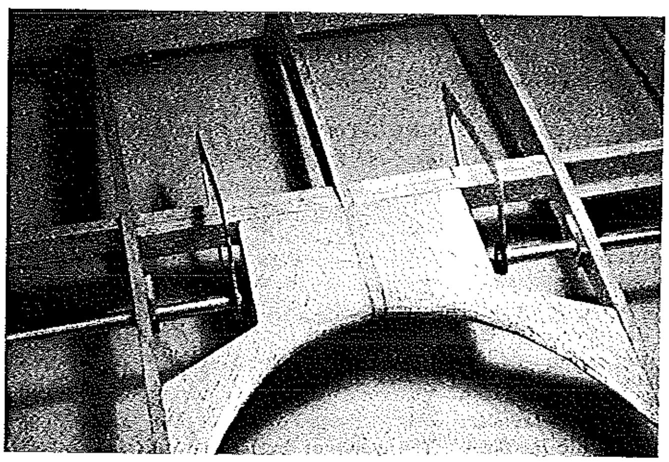


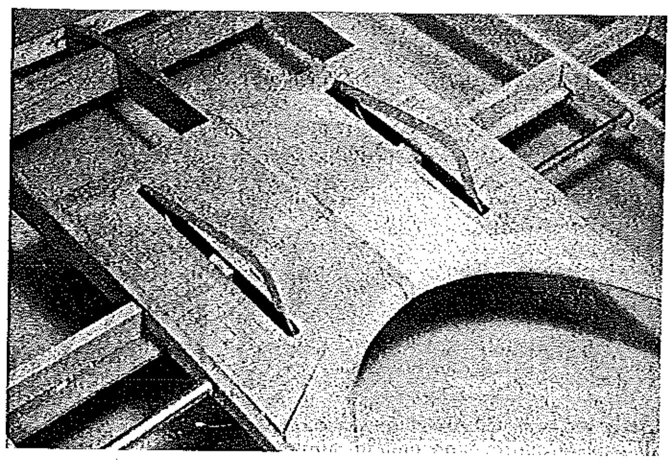
Straighten up and dry right. Place waxed paper over the tail saddle area, covering all parts of the fuselage proper but not the hardwood section of the tail piece. Position the stabilizer, and check for alignment. Lay a stick across the cabane struts, and sight it along the surface of the stab from the rear. You should see two parallel lines. Correct the alignment if necessary by trimming one of the fuselage sides. Clamp and pin the stab in place on the fuselage while epoxying it to the hardwood top piece.

Cut a hinge slot for the rudder in the tail piece; add the fin and rudder. Align the fin by placing a yardstick alongside it and up against the fuselage. Glue a rounded ¼-in. dowel in the fin-stabilizer corner. It must also fit into the hole in former F9. Puddle epoxy around the dowel to form a fillet and close any gaps.

Rough cut the tail cone blocks into triangular shapes. Set them in place, and mark the outline of former F9 with a soft-tipped pen. Plane and sand the blocks to shape. Hollow them out, refine the contours with additional planing if necessary, and give them a final sanding. Glue the blocks in place.

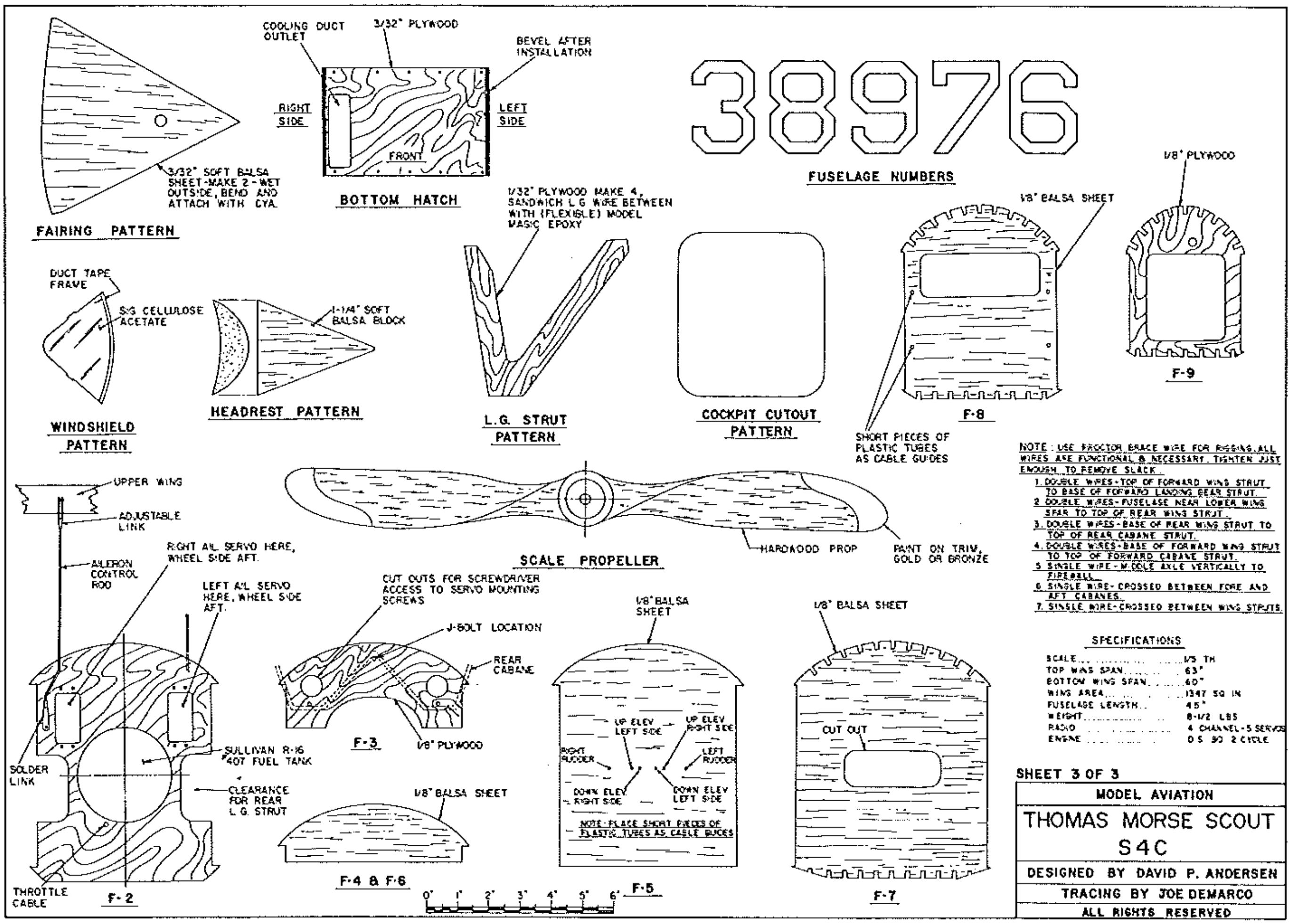
The tail strut is made from K&S streamlined aluminum tubing. Flatten the center with needle-nosed pliers, drill it for screws, and fasten it to the bottom of the





Left: The aileron rocker arms are epoxied and screwed to torque tubes. This requires cutting the rear spar. The wounded spar is repaired with a doubler after rocker arm assembly. Right: Slotted sheeting is added around the rocker arms after aileron assembly.

Full-Size Plans Available . . . See Page 203



tail piece. The outer ends are also flattened and bolted to the stab with 2-56 nuts and bolts. Fit the strut, and then remove it until all painting has been completed. Don't omit the tail strut; it is functionally necessary for pitch control. The stab must be rigid for the control cables to work correctly.

The steerable tail skid is a Du-Bro tail wheel bracket screwed to the bottom of the tail piece. You must cut a small notch in the rear portion in order to clear the tail strut. Substitute $\frac{3}{32}$ wire for the tail wheel wire, enlarging the hole in the bracket to accept it.

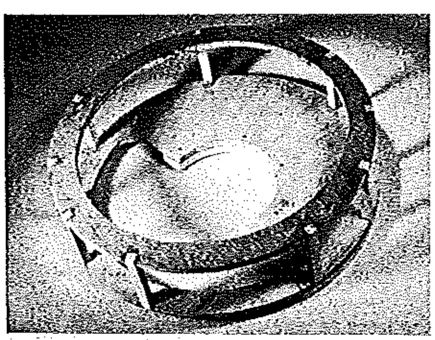
Form the tail skid wire except for the lowest bend. Insert it into the bracket, do the last bend, and fit the bracket to the fuselage. The top end of the wire should fit into the bottom of the rudder. Harden the inside of this hole with a coat of CyA (cyanoacrylate) adhesive. The tail skid wire rests in this hole without being glued; this permits removal of the entire tail skid assembly. Remove it for now. You'll be replacing it after all painting has been completed.

Only 84 wing ribs to go. Cut all 84 wing ribs and half ribs using the stacked rib method shown on the plan. Batch cut six at a time. Select medium to medium-hard balsa for the ribs; wood that's too soft will split during assembly. The thickness of the rib material matches the scale width of rib taping; from 15 feet the wing appears to have taped ribs. Scale purists may add rib stitching, but I think life's too short for that.

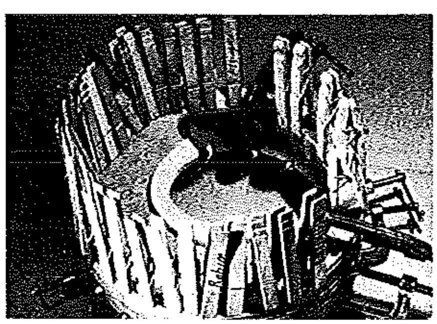
Test fit the spar holes on each rib with a section of spar material. Use a nail file to enlarge any that are too tight. The fit should be loose enough so that the rib will slide easily over the spar but tight enough to make a good CyA glue joint. This is tedious work; watching TV may help you get through it.

If you've ever built a Goldberg kit, you'll recognize the wing structure—double spars inside the ribs and no sheeting. Actually this method predates Mr. Goldberg; it's closer to the structure of the original S4C. (Clearly this is blatant plagiarism, but by whom? Goldberg or Thomas?)

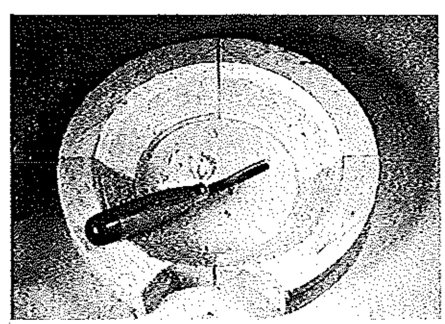
Select spars that are straight as an arrow. If you can't find perfectly straight spar material at the local hobby shop, cut them from sheet balsa. Slip all the ribs over the front spar, spacing them only



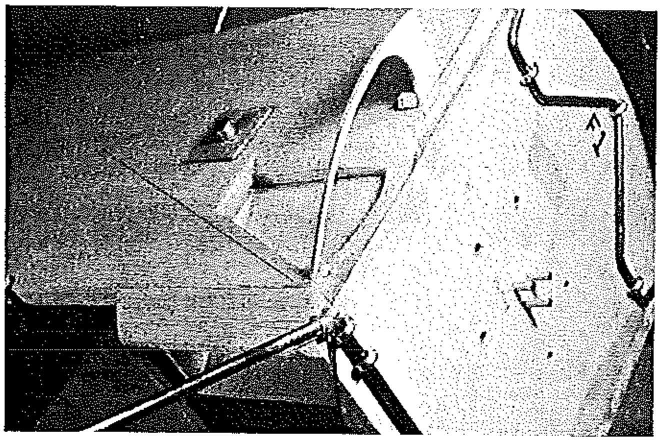
The ply-and-spruce cowl frame attaches to the firewall with four screws.

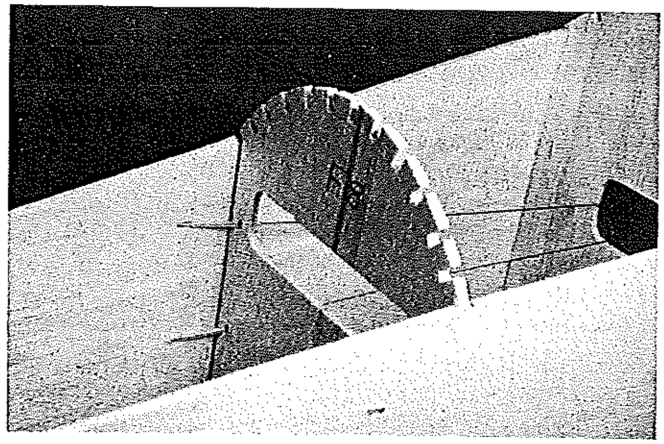


The $\frac{1}{16}$ ply covering is clamped to the cowl frame with every clothespin, C-clamp, and rubberband available while the epoxy cures.

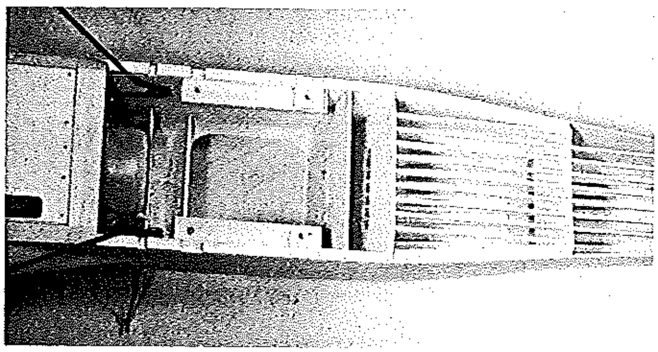


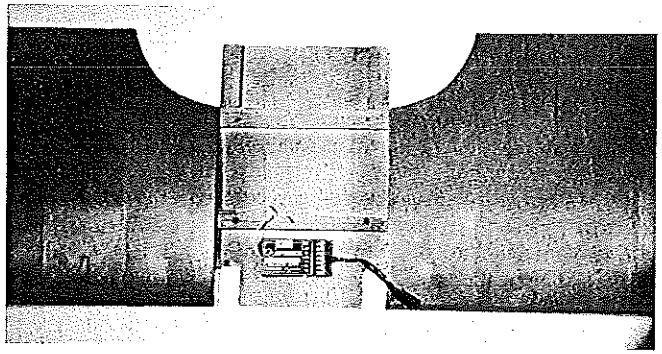
The inside of the balsa nose bowl is chamfered with a woodcarver's gouge before being attached to the cowl frame.



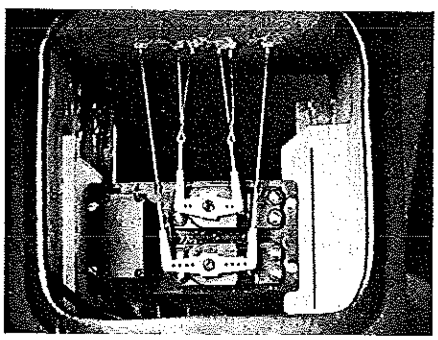


Left: A cooling duct behind the engine cylinder head provides airflow to the unobtrusive exit hole in the bottom of the fuse. More airflow is available through a scale pressure relief slot in the cowl. In both cases air must flow over the cylinder head before leaving the cowl. Note the wheel collar and ply bearing where the rear coil-sprung landing gear strut is attached to the fuse. Right: Plastic guide tubes extend through F8 and the fuse side to support the elevator control wires. Similar guide tubes for the rudder are located between stringers in the turtledeck.





Left: Bottom view of the fuselage. Classic flat-sided construction is used. The lower wing is attached with four nylon bolts to the spruce blocks shown. Note the cooling duct exit hole at lower left. Right: The receiver attaches to the fuselage floor with double-faced servo tape. The antenna runs through the inner Nyrod tube in the lower wing. The receiver is visible through the cockpit for preflight inspection.



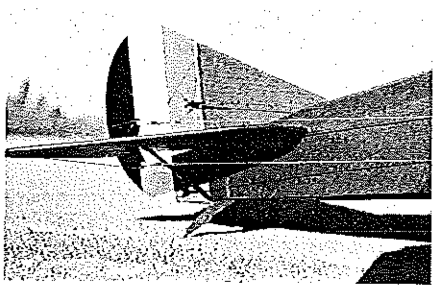
The elevator, rudder, and throttle servos are mounted crosswise in the cockpit. The elevator servo is at center, the rudder servo is on the bottom, and the throttle servo, mounted upside down, is to the left. A separate pair of control cables runs to each half of the elevator. The pilot is removed for easy access.

approximately for now (refer to the plan).

Insert the rear spar into the ribs, inching it along by moving each rib a little at a time. This will take about 30 minutes. When all the ribs are exactly aligned over the plan, Zap or Hot Stuff each one to the spars. These deeply penetrating instant adhesives work wonderfully here. How did Carl Goldberg get along without them?

Only 36 wing ribs to go. Add the leading edge before inserting the half ribs. Round the wing tips with a razor plane and sanding block as shown in the photos.

The leading edges of the ailerons should be rounded so that the center of curvature



Each half of the elevator is driven by its own pair of Proctor control cables. The rudder cables exit the fuselage slightly ahead of F9. The tail skid moves with the rudder. Why didn't they think of that in 1917?

is on the hinge line. Cut a ¼-in. slot in the inboard end to accept the aileron torque tube. Epoxy a dowel in the inboard end of the torque tube, and drill it with a pilot hole to accept a screw.

Epoxy the torque tube in place in the aileron, and coat it lightly with oil where the ply bearings will attach. With the ply tube bearings in place but not yet attached, slide the torque tube into the wing. Epoxy the Robart hinges in place using Model Magic. This formula is thick and light; it fills gaps well, and surplus is easily cut away. Glue the ply tube bearings in place on the ribs. Sand the aileron structure flush with the rest of the wing using a sanding block or T-bar.

Notice that the rear spar runs through the aileron rocker arms. You'll have to cut

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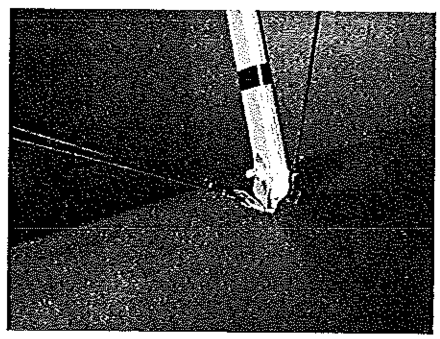
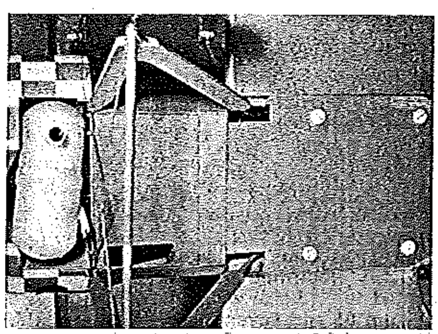


Each strut end requires two brass fittings. A screw under the strut (not seen) attaches the fitting to the wing, and a 2-56 nut and Loctite-coated bolt hold the strut to the fittings. The cables are Proctor wires and swages.



Bottom view showing the removable hatch with cooling duct, lower wing mounting bolts, and clearance holes for the rear shock-absorbing landing gear struts. Making the hatch removable gives access to the receiver battery and the fuel tank.

stalling angle, the Russian planes remained clearly under control at very low speed. Obviously far more than an air show stunt, this enables a fighter to rapidly reduce its speed in combat while an opponent whizzes right past and becomes a target.

The concept of enhanced maneuverability through sophisticated use of controls was introduced by Messerschmitt-Boelkow-Blohm in 1977. Rockwell entered the game in 1983, producing vectored thrust on an F-14 Tomcat flying test bed. Construction of the X-31 began in mid-1988. The first of two airplanes was rolled out of the factory at Palmdale, California in March 1990 and flown on October 11 of that year. The second X-31 was flown by a German pilot on January 19, 1991.

Building time was shortened considerably by using lots of off-the-shelf parts. The landing gear is from a Cessna Citation II and a General Dynamics F-16; the canopy, instrument panel, and digital displays are from an F/A-18 Hornet. Other parts are from the LTV A-7 Corsair II, the Northrop F-5 and F-20, and the Bell/Boeing V-22 tilt-rotor VTOL. Even the wing design was borrowed from the MBB experimental European Fighter Aircraft's clipped double-delta planform.

The designers also made liberal use of advanced materials in the X-31. Graphite-epoxy is used for much of the skin of the fuselage, wings, and vertical tail; the thrust-deflector paddles are carbon/carbon; and much of the aft fuselage is covered with aluminum/lithium.

Once the initial phase of the flight test program has been satisfactorily completed, the X-31s will be used in mock combat. To estimate their effectiveness, the Enhanced Maneuverability devices will remain active in one airplane but be shut down in the other. Later, the pair will engage in simulated combat maneuvers with current American fighters. They'll probably also be tested against some of the Soviet fighters that have been collected during the past few decades and are currently operated out of secret test bases in Nevada.

Specifications for the X-31: Wingspan, 23 ft. 10 in.; length, 43 ft. 4 in.; height, 14 ft. 7 in.; wing area, 226 sq. ft.; empty weight, 11,410 lb.; design gross weight, 15,935 lb.; fuel load, 4,136 lb. (about 700 gallons of jet fuel). The top speed is about Mach 1.3, or 850 mph at 40,000 feet. Such things as cruising speed and range are of little consequence for a research airplane. Power: one GE F404 turbofan engine, rated at 16,000 pounds.

So there you've got it. Flat turns will be the thing to do in the 1990s. Skid around to your heart's content. If your instructor screams at you, just tell him you read about it in *Model Aviation*. Of course, if he keeps yelling, you're on your own. Though you might consider swatting him with a rolled-up copy of this issue—once you've landed, come to a complete stop, shut down the engine, and purchased his flying school. □

Scout/Andersen

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the spar in two places in order to install the rocker arms. Slip the arms through the cuts, then repair the spar by gluing a doubler over the cut regions. Epoxy and screw the rocker arms to the torque tube. Finish the wing structure by adding the 3/32 sheeting around the rocker arm area.

Holy cowl! The cowl is built on a frame of two rings of ¼-in. ply and ¼-in. hardwood stringers. The rear frame is attached to the firewall with four screws, which are accessible with a long screwdriver even when the engine and muffler are installed. Install ¼-in. ply spacers behind the rear ring. The cabane struts and landing gear attach to the firewall in the gaps between the spacers. This space also allows trimming of the cowl to a flush fit against the firewall.

Build the frame first. Align it with a triangle before the slow-setting epoxy has hardened. Cut a single length of 1/16 ply about ½ in. wider than the frame. Apply slow-setting epoxy to the frame, and, beginning with the seam at the bottom, wrap the ply around it. Clamp the ply in place with lots of rubberbands, C-clamps, old frequency pins, clothespins, or what have you.

Remove the clamps when the epoxy has cured. Trim the 1/16 ply to the frame, and cut away the lower part of the frame as shown on the plan to allow room for the muffler. Fit the cowl to the firewall, trimming as required.

The nose bowl is cut from four pieces of 1⅜-in. balsa sheet. Since most hobby shops don't carry balsa in this thickness, you'll probably have to glue two ¾-in. sheets together. The inside of the cowl must be chamfered before it's glued to the cowl frame. A woodcarver's gouge works well for this.

After gluing the nose bowl in place, test fit the cowl to the firewall with the engine installed. If the nose bowl strikes the cylinder head, trim it on the inside. Cut a paper template from the plan, and round the outside of the nose bowl with a razor and razor plane. Use the template to ensure a uniform roundness.

Cut the pressure relief slot in the lower right side of the cowl. Your glow plug starter clip should reach the glow plug through this hole. Test whether it does, and enlarge the hole if necessary.

Be coolheaded. The engine cooling system works as follows: Propwash enters the front of the cowl, creating a buildup of compressed air inside the cowl. The compressed air escapes the cowl through only three routes. Some of the air leaks around the muffler, some passes out the pressure-relief slot, and the remainder exits through the cooling duct behind the engine cylinder.

In the last two cases, air must first flow over the engine cylinder and head before leaving the cowl. To block the airflow around and behind the cylinder, two sheet balsa baffles were installed in the cowl alongside of and very close to the engine cylinder. In retrospect, I'm not sure that the baffles are necessary. I estimate that half the air entering the cowl flows over the engine head. Note that cooling is better with the cowl on than when it's off. I have never flown the airplane with the cowl off and don't recommend it.

The cooling duct is behind the firewall (see photo and plans). It is made from two sheets of ³⁄₃₂ balsa.

Control cables: I used a scale control system because it's the simplest option available. The elevator cables require a plastic tube guide through former F8 and the fuselage side. Use a section of thin throttle cable tubing for this, installing it as shown on the plan and in the photograph. Glue the guide in place with a fillet of baking soda and CyA, and cut the tubes flush with the fuselage surface.

The rudder cables exit through the stringers in front of former F9. To hold the cable guides, add a small piece of ³⁄₃₂ balsa between the stringers in the location shown. Don't worry about paint clogging the tubes; they can be cleared with a pin.

Test the guides by threading a length of Proctor control cable through them to verify that they don't restrict cable motion when under tension. Remove the cable, and add the top and bottom stringers.

Control cables are attached to the Du-Bro threaded couplers with Proctor swages. Loop the cable through the coupler and the swage, then crimp the swage with a wire cutter.

Use metal clevises rather than nylon ones at the tail end of the control cables; they'll tolerate undoing for trips to the field. Prevent the clevises from turning by using a 2-56 nut and lock washer on each. Use nylon clevises at the servo end since they don't require a jam nut.

Mount the elevator, rudder, and throttle servos in a standard servo tray installed crosswise in the cockpit. Glue balsa blocks with ⅛-in. ply faces to the fuselage walls, and screw the servo tray to the ply face.

Mount a dummy pilot on a ply base the same way, but position it higher in the cockpit. I recommend the Williams Bros. quarter-scale pilot. Williams Bros. pilots run smaller than average, so the quarter-scale size will fit the ⅕-scale model.

Attach the pilot's base with screws; this allows access to the servos by removing the pilot rather than the wings. In my opinion a model without a pilot sometimes looks better in static display. Sport Scale contest rules require a pilot for flight but not for static display. The photos show it both ways. What do you think?

Mount the throttle servo upside down in the servo tray. This aligns the cable in a straight shot to the throttle.

Dope? Just say yes. When a model has as much surface area as this one, keeping the finish extremely lightweight is critical. The wings were covered with Sig Koverall attached with nitrate dope. Cover the bottom first, and add a small filet of white glue alongside each rib. This will assure that the fabric won't pull away from the undercambered rib. The sheeted parts of the fuselage were covered with lightweight silkspan, the open structure of the fuselage and tail with heavyweight silkspan.

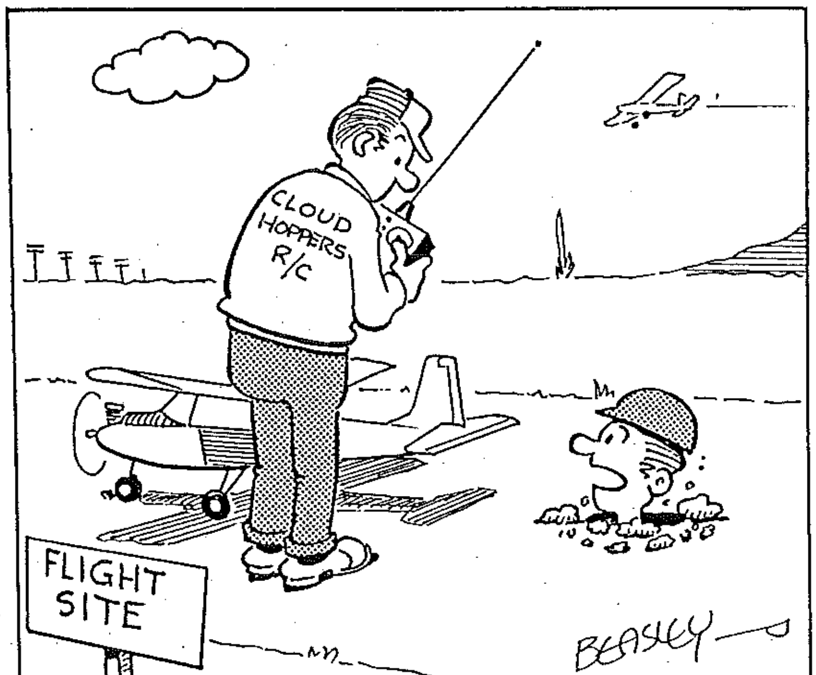
I used only three coats of dope—a base coat of nitrate, a coat of clear butyrate sanded to remove the fuzz, and a top coat of color. Prime all metal parts such as the axle and the tail strut with nitrate dope. Unlike butyrate, nitrate adheres well to metal. Butyrate, however, does bond well to nitrate. Paint the tail strut and tail skid separately. The painted and assembled tail should weigh no more than five ounces.

The prototype's color scheme was taken from the cover of the August/September 1963 issue of *Air Progress* magazine. I painted the roundels first, masking them off with vinyl electrical tape and spraying on the white, blue, and red in turn. The khaki brown color, also sprayed on, was prepared by mixing one quart of Sig chocolate brown and one pint of Sig olive drab dope thinned 1:1.

I gave the cowl several coats of butyrate sanding sealer, sanded them well, and sprayed on a coat of Cub yellow. Then I coated the entire cowl with Bob Dively liquid masking film. I drew the checkerboard pattern with a pen and cut it with an X-Acto knife. I peeled off every other square of masking film and sprayed with thinned Fokker red. Finally I removed the remaining masking film and sprayed the cowl with two wet coats of clear butyrate for gloss.

Don't drink the Loctite. The end of each wing strut requires a nested pair of brass fittings. The fitting closest to the wing is an attachment point for brace wires. The other fitting connects to the strut. Bend the latter into a U-shape, and attach both fittings to the hardwood block in the wing with a single screw. Bolt the second fitting to the wing strut with a 2-56 nut and bolt.

To prevent vibration from loosening the nut in flight, coat the bolt with sweet-



THIS IS THE ROUTE FOR THE NEW METRO SUBWAY??

tasting Loctite 242 Threadlocker. The Loctite requires 24 hours to set, however, so wait that long before flying.

Wing brace wires are Proctor No. 203 stranded wire or the equivalent fish leader. Stranded wire has an annoying tendency to unravel. This can be checked by treating the wire with a drop of Zap or Hot Stuff before cutting it. All brace wires are pulled just tight enough to take up slack; more tension than that is unnecessary stress. No adjustable turnbuckles are used; they're too expensive and they don't contribute to scale appearance.

Note that the lift wires and landing wires are double, but the cross wires at the cabane struts and interplane struts are single. Bind the latter at the cross point with a single loop of thread, and apply a drop of CyA. This prevents metal-to-metal electrical noise. The rear pair of lift wires runs unattached through the fuselage fitting, passes through the fuselage, and exits the other side and up to the strut fitting on the other wing. The forward pair of lift wires merely loops around the landing gear strut at the firewall. Similarly, the landing wires loop around the cabane struts.

Check your Pitots at the door. Here are a few tips to improve scale accuracy for higher static scores in sport Scale contests.

Paint the upper wing brackets and the tail nylon bolt head.

Recess the bolt heads on the lower wing. Fill the holes with modeling clay, and paint the clay. The bolt can be removed later by pushing a screwdriver into the clay.

Use two ribs rather than one in the center of the upper wing, and remove the covering between the ribs. This gives the appearance of two wings bolted together.

Add a scale Pitot tube to the interplane strut as shown in the scale views. AMA rules require that it be removable for flight. Don't ask me why.

Add a scale machine gun and sight as shown in the scale views. Make the gun from balsa blocks and aluminum tubing. Make the sight from a soda straw.

Push the antenna into the wing during static display. Don't forget to pull it out again before flying.

Make your own wheels from wood and automobile fuel line tubing to a scale diameter of 5⅜ in. You can claim more points in craftsmanship and accuracy of outline.

Different strokes. You might want to substitute a large four-stroke engine for the O.S. .90 two-stroke. Four-strokes require upright mounting and more airflow than two-strokes. They also need two more inches of space from prop to firewall. This makes things more complicated.

I suggest that you add a second firewall two inches behind F1 for mounting an O.S. 1.20 Surpass or Enya 1.20. Make a cutout in F1 equal to the front view of the engine, and use two separate wires for the front cabane struts. A nonscale cutout in the fuselage behind F1 will be needed for the cylinder head. Block off all airflow in the cowl except over the cylinder of the engine. Angle the muffler straight down between F1 and the new firewall. The glow plug is now under the top wing, so a remote glow plug jack such as Headlock will be required.

If you try this, please let me know how it works out.

My calculations show that an O.S. 1.08 two-stroke engine will also fit in the cowl. Turn on, tune in, check it out.

A reliable engine is absolutely necessary for any Scale model. Since the S4C has a great deal of built-in headwind, you'll be in trouble if the engine quits while the sky is above and the runway behind. The model doesn't glide very far. Always break in and tune the engine on a sport airplane with the prop, muffler, and fuel you intend to use. When the engine is completely checked out, install it in Tommy without changing anything.

No need for speed. Crosswind ground handling is poor. A crosswind tends to pass under the upwind wing tips and roll downwind, so always take off and land directly into the wind. That means steering with the rudder while holding the wings level with ailerons. If you have little experience with this, learn to do it on a sport airplane by taking off and landing in a strong crosswind.

While aileron response is sluggish, the elevators are sensitive and the rudder even more so. To turn sharply or quickly, you must bank with the ailerons and kick the tail around with rudder. Practice this skill at altitude; you'll need it during landing if there's any turbulence at all.

The large elevator and rudder are needed for control at very low airspeeds and during taxiing but are sensitive at higher speeds. The rudder is so effective that the plane can be flown without using the ailerons at all. You can even snap-roll on rudder alone.

The throttle has little effect on airspeed. The plane flies slowly regardless of the throttle setting, and power merely permits a greater rate of climb. Tall vertical maneuvers require that extra kick of momentum that you get with a faster plane. In any case they're not scale, since the full-size S4C had only 80 horsepower.

Nevertheless loops and rolls are graceful. Try a Chandelle—a climbing 180°-degree turn with the wings held level that was used for coordination training with Tommy and other airplanes of the period. Turn with rudder, using opposite aileron to hold the wings level and elevator to hold a constant rate of climb. You might also want to learn the *retournment* and the *renversement* as described in Rickenbacker's book, *Fighting The Flying Circus* (Doubleday, 1965). Baffle the flight judges by calling maneuvers by their period names—i.e., a spin is a *vrille*, a circle is a *virage*, and so on.

Except in totally calm air, it's unsafe to land the S4C with the engine at low idle as you would a Pattern plane. Instead, trim the plane to climb at full throttle, then approach the field at about quarter throttle, using the throttle, not elevator, to control the rate of descent. Apply a bit of *up* elevator when 10 feet of altitude remains, keep the wings level with aileron control, and watch the craft settle. Reduce throttle only after the plane is on the ground and rolling along.

Coming to a stop is the hardest part. Steer with the rudder to maintain heading directly into the wind until the plane comes to a full stop. When the tail comes down, the angle of attack of the wings will be above the stall angle, creating lots of drag and loss of directional stability. Pilots of the full-size airplane would suddenly apply full *up* elevator at this point and gun the engine to dig the tail skid into the sod. Since that's not practical with the model, we must rely on headwind and propwash to aid rudder steering. Don't let this frighten you; the worst that can happen is that the plane will flip over on its back—and speed is so low at this point that damage is unlikely.

The prettiest maneuver of all is the touch and go. Its slow, floating glide, gentle touchdown, long ground roll, and graceful lift-off have a character that's unique to old biplanes. You'll hear people say, "There goes a *real* airplane!"

I'm happy to tell you that I qualified for the 1990 Scalemasters with the S4C. If building and flying this model gives you as much pleasure as it's given me, your project will have been a success. Please write in care of *Model Aviation* and tell me about your adventures. I'll respond to every letter. If you need help, I'll answer questions as best I can. □

RC Electrics/Kopski

Continued from page 39

conversion—although I can't imagine why anyone would want to do that! Anyway, the Electric Fleet lists at $99.95, and Romey Bukolt, Mr. Concept himself, tells me you can buy 'em at your local hobby shop or from mail order providers like Tower, or direct from Concept at 2906 Grandview Blvd., Madison, Wisconsin 53713.

Those of you lamenting the lack of large Electric kits can now experience some relief in this regard. I'm now trying to decide just when I can schedule my kit on the bench!

Next, John Sermos of Sermos Connectors recently showed me some new things he's got in the works. One item already available is a tool to aid in contact installation and removal in the now-famous Sermos connectors. The device, an insertion/extraction tool, lists at $5.00. I will have a photo of this handy accessory in the near future.

John also has under development some new mounting accessories for his connectors. He is studying two approaches to mounting Sermos connectors on a model's surface for charger connector interface. I have some samples to try out, but it's still winter where I fly! Incidentally, many of you may be both interested and surprised to learn that professionally John is an ice skating coach who has over the years helped many of our young figure skating stars.

Electric meets are popping up all over, and I'll list some info I have right here. Frank Korman, President of the Dallas Electric Aircraft Fliers, advises that DEAF will hold its first Electric competition on Sunday, May 26 at the Eastfield Community College in Dallas, Texas. This is strictly an AMA events meet, and those scheduled include No. 610 and No. 618. In the past, DEAF has held annual fun flys and will do so again later this year. But for info on this early serious meet, you can contact the CD, Jack Hamilton, 11216 Sesame St., Dallas, TX 75238; Tel. 214/348-4669.

Next up is the Lehigh Valley Radio Control Society (Pennsylvania) meet of June 8 and 9. I've been attending the LVRCS Electric meet for several years, and it is a great fun fly with lots of easygoing activity and plenty of prizes. For info you can contact Ellis Grumer, 321 Aurora St., Phillipsburg, New Jersey 08865; Tel. 908/859-0969.

June 29 and 30 are the dates for the ninth annual Electric RC Fly-In sponsored by the Puget Sound Electric Model Flyers at Boeing Kent Space Center Field in Kent, Washington. This year the PSEMF will offer prizes and trophies for Most Aerobatic, Best Scale, Longest Flight, and