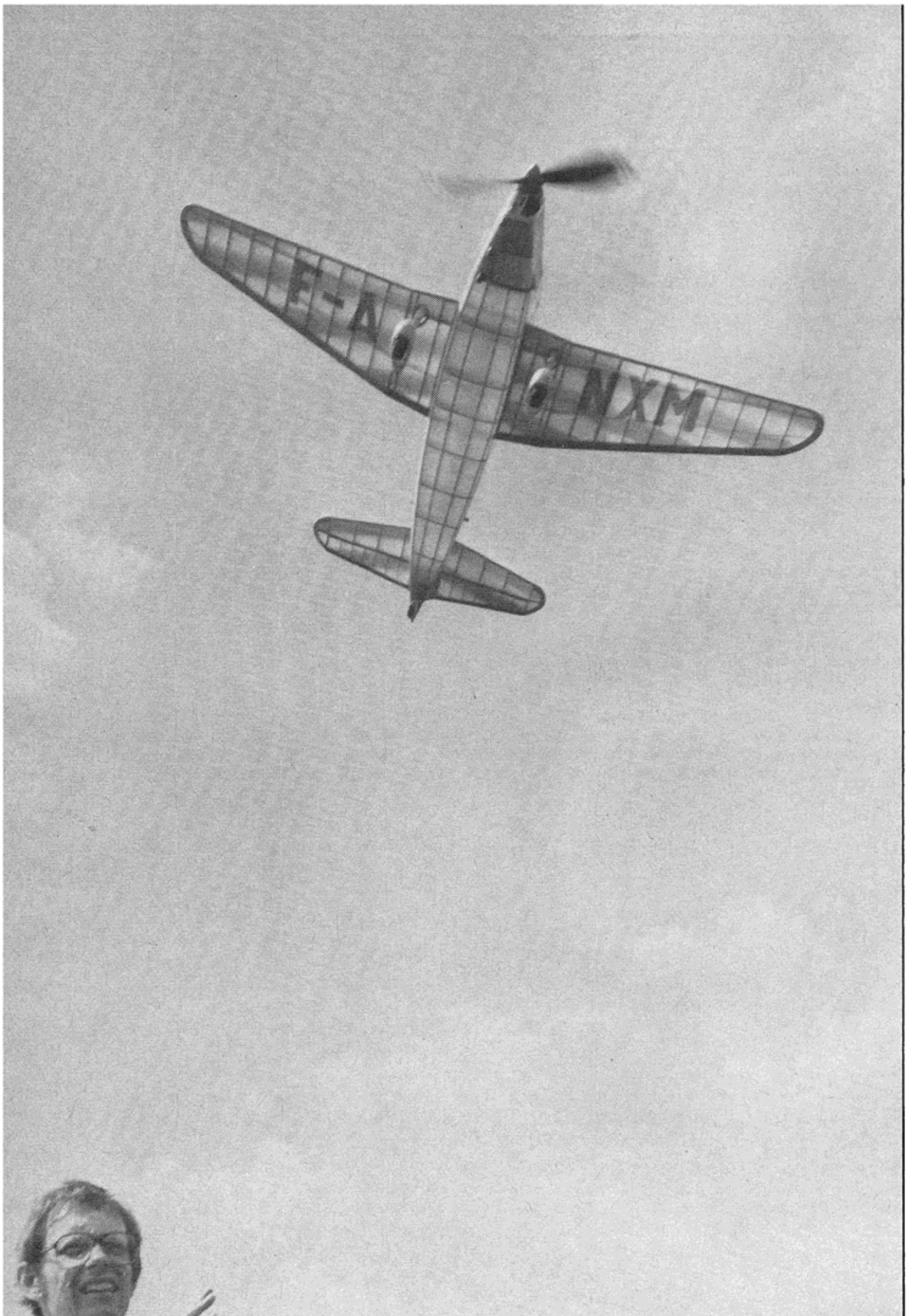


PHOTOGRAPHY: CAROL REES

Caudron C 635 Simoun

by Dave Rees

Rubber Scale is perhaps the hardest fought event at the Nats. This ship won in 1980.

The "Simoun" was the immediate successor of the Caudron racers designed by the famous French engineer Marcel Riffart. Originally designed C 620, it was first shown at the 14th Aeronautical Show in Paris in 1934. It was powered by a 220 horsepower Renault "Bengali" six cylinder engine, and became the first civil aircraft to exceed 300 KPH (186 mph). The airplane was an immediate success and large numbers were ordered, including nearly 500 for the French army. It also served with the "De La Compagnie Air-Bleu" as standard light mail carrier. Many notable long distance flights were made in this tiny craft, speed records were established to all sorts of unlikely places such as Paris - Madagascar, Paris - Saigon, Paris - Hanoi - Paris, Paris - Tokyo and the crossing of the South Atlantic in 1936. (Ref: Bjorn Karlstrum and Heller Ref. 165)

I shall begin this discussion where any successful competition model must begin - with the documentation. Listed on the plan are the most readily accessible items, the first being available from Peck Polymers, P.O. Box 2498, La Mesa, CA 92041, for 60 cents. (Scale Drawing BH-163). The second is a plastic scale model kit available in most hobby shops for a dollar or so. Do buy both *before* starting construction, as there is much detail that cannot be shown on a building plan which you must work out ahead of time. Save the kit box and instructions as they will be cut up to provide color and marking proof. The kit shows two decorations, one for the Paris to Tokyo race in 1937, and the other a military scheme. I chose the former because I felt it had slightly more "dazzle factor" to a scale judge. These are all you need, so don't spend a lot of time searching—it is possible to have too much documentation according to the new AMA rules.

This model should not be considered a beginner's project due mainly to the scale detailing required, but construction is straightforward and a relatively inexperienced builder should be able to achieve a good flying aircraft. It is designed from the start with AMA outdoor scale rules in mind. For those who fly mostly FAC rules, you will find the Caudron lacking in sufficient handicap points for serious competition. The moments are good, the size is large enough to be less touchy in trimming, and there is plenty of room for a fully wound rubber motor. The landing gear is well placed for good takeoffs and allows a rugged mounting design. The only changes I make from scale, are to enlarge the stab a few percent, double the dihedral angle, and lengthen the landing gear just a trifle. The prototype flies very stably and may even work with *everything* to scale, although you're on your own here since I haven't tried anything but what's shown.

There is one factor which should be kept upper most in your mind while building and that is: lightness. You won't need to use anything but the four to six pound per cubic foot balsa. Don't add a harder piece here or there for more strength; this design will be strong enough if you use the lightest of material. I have listed some miscellaneous weights of things on the plan for those who like to keep track of how the weight is coming along as they build. This prevents unpleasant surprises. There are often two schools of thought in structure design; one uses smaller cross section wood of a medium weight and the other uses larger cross sections and super light wood. They both arrive at the same weight and strength in different ways. You will notice that I adhere to the latter because of the greater section modulus effect and increased glue area at the joints when using larger wood. But enough of philosophy, let's get down to the balsa shavings.

The fuselage sides should be built on top of each other. Note the grain direction on the 3/32 thick fill-in at the nose. Drill a hole through both sides at once for the motor peg using a piece of brass 1/8 tubing sharpened by twisting a countersink bit in one end. This makes a cleaner hole then a drill and does not disturb the wood fibers around it. Soak around the hole with Hot Stuff. Ambroid glue is used throughout the airframe applied via a hypo. Also note that the four verticals from D3 through F5 are continuous while the horizontal member running along the thrust line is interrupted. It is a good idea to soak these intersects slightly with Hot Stuff for maximum strength. The 1/16 thick filler pieces at the wing joint are glued in place so they will be flush with the outer surfaces of the fuse. Acetate glues reach their maximum strength after 24 hours, so let the fuse dry at least overnite while pinned down. Then remove from the plan and sand both sides carefully until all is one even surface. Separate them with a double edged razor blade and bevel them on the inside edges for the rear joint. Add 3/32 cross members measuring from the top view, noticing that the lower cross member at one is shorter than the upper at A (see front view). At B2 both top and bottom are equal as are the rest. Next cut out the formers and glue them in place except for J. In case you are wondering why I picked 1/20 x 3/32 for the stringers, the reason is that a standard flat "pattern file" is exactly .050" thick (1/20") and you can use one to make those notches with great accuracy of width. Add the 3/32 square piece from B to C and cover with soft 1/32" sheet decking. The curves at the front of the fuse are so subtile and characteristic of the Simoun that I found it impossible to make them from thin sheet and look right—hence the blocks. I suppose you could vacuform them, but then I prefer colored tissue to color dope, and it is much easier to cover balsa than styrene with tissue. Use the very softest, lightest of blocks and hollow them to a wall thickness of between 1/16 and 3/32". The 1/32" plywood bulkhead ties it all together into a nose that will take a beating and not wear out. You may install the lower stringers now, but the top ones must wait until the stab and rudder are in place. Alert modelers may notice from the pictures that the prototype has only four stringers instead of the five shown top and bottom. This is done to reduce paper sag and improve the contour of the fuse. You get the benefit of my experimentation.

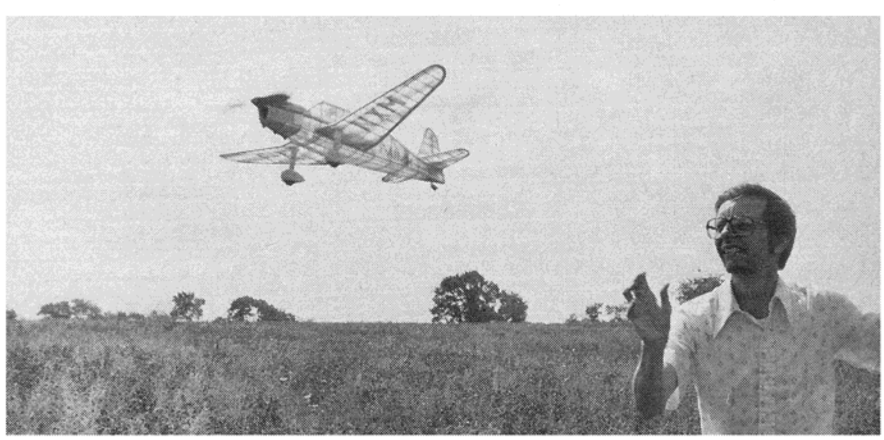
The next items to construct are the tail parts. You will first notice that I use movable control surfaces at the tail. I like them because I am constantly trying different improvements and ways of trimming, and movable surfaces make this easy. Their main drawback is that they are easily bumped *out* of adjustment, too. This is most important in mass launch events where you may not notice a bumped elevator when things get frantic. I use fairly heavy aluminum hinges which stay in place pretty well, but I get in the habit of checking the aircraft over carefully before each flight.

The stabilizer is one piece and has almost scale airfoil thickness, both of which make the stab strong and warp resistant. A flat stab is more prone to "potato-chip" warp on a hot day in the sun. You can cut the ribs individually if you like, or build the whole thing from 1/16 x 3/16, which I think is faster. Shim the leading and trailing edges until they are centered; then when the glue is dry, sand the whole stab to shape just like you would a hand launched glider wing. The fillet block is cemented to the stab spar and carved into fillets at the rudder joint. You can hollow a little from the underside where it fits on the fuse, but very light wood is a must for this piece. Make X-acto knife slots for the hinges but don't install them until after covering is completed. Bevel the leading edge of each elevator about 15° to permit movement at the hinges. Note that there are stab ribs 3/32 thick directly in line with the top of the fuse, although not very clear on the plan. These are necessary for a good joint with the fuse and as a paper anchor point. Next cover the stab, top and bottom, starting the tissue at these ribs and leaving the center open for now. Cut a hole for the fin spar in the 3/16 fillet block Cement the stab to the fuse with "Hot-Stuff" after poking some pin holes in the covering to improve penetration.

The fin and rudder are next, and can be built with exactly the same techniques as used for the stab. Nothing is more distressing than a fin that is simply glued to the top formers and gets knocked off every time the aircraft flips over on landing. This one won't. It is anchored at the bottom of the fuse and even provides the structure into which the tailwheel is cemented. When the fin is completed and sanded to shape, cover both sides beginning one rib above the stab. Slip the spar through the stab, align and cement in place. Now you can install that J former which fits just behind the stab leading edge, bracing it with a fillet of 1/16 sheet as shown.

Install the upper fuse stringers beginning with the outermost ones, and glue at the rear, first. You will have to do some fancy beveling at the end of the stringers to make them all come to a neat point right at the fin spar. This is the trickiest part of the airplane, so take your time and get a good fit. Dope the framework all around the windows with the color of the ship you have selected and glue the acetate on using Ambroid applied with a hypo. Ambroid softens the acetate and make the strongest wood-to-window joint I have found. Be very careful not to get any on the window parts. Cover from B to F and from the thrust line to the top in a single piece on each side. Carve a nose block from medium balsa and bush with tubing for the prop shaft at the angle shown. I use tubular beads from those mens necklaces that were so popular a few years ago. They are 3/8" long with an inside diameter of exactly .048", usually of plated brass. "Hot-Stuff" one at each end of the hole in the nose block. With this much rubber motor I think a ball bearing thrust washer is a good idea. Sig makes one that just fits .047 wire; their name for the size is "small". Make the 1/4" sheet plug-in to fit snugly in the plywood bulkhead, then saturate it with Hot-Stuff around the edges to prevent wear. The fuse is essentially done except for covering, so next make the wings.

The wings are made in two halves joined at the fuselage centerline. They will plug through holes in the fuse sides. Start by making an accurate template of the rib's upper surface from .025 sheet aluminum. Roofing flashing is a good source of this thickness and it is very soft and ductile for use in the tail hinges too. This airfoil is a high-speed-low-drag type to give minimum drag in the climb. It is called "French Curve No. 2", so named because I have two French curves. Slice up a pile of ribs from some 1/16 sheet using an X-acto knife and the template, aiming for 1/16 width as best you can. I used over and under ribs both for lightness and because I dislike plotting all those different ribs for a tapered wing. This way uses all the same ribs—you simply trim to the right length. Cut the leading edges and spars from sheet and taper them using the root rib and tip rib



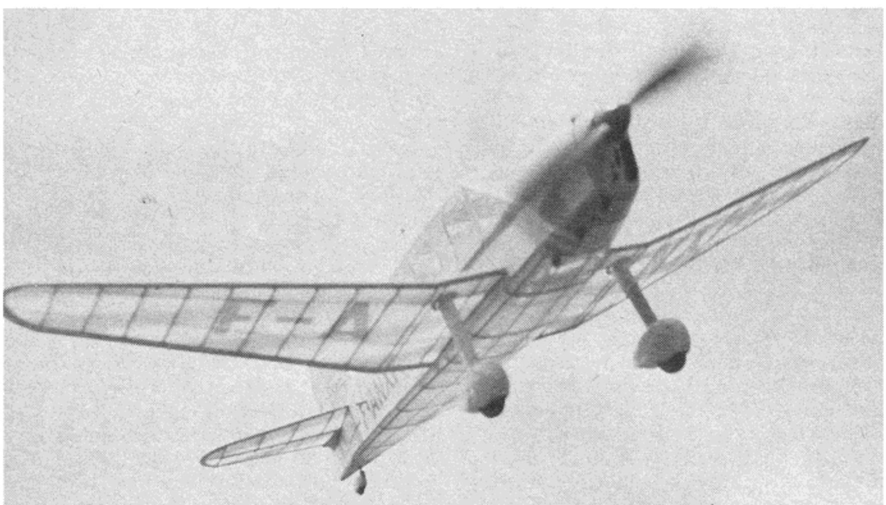
Take it easey for those first few test hops until the airplane is flying safely. Notice the high weeds to absorb trimming errors with no damage. The author won the 1980 Nats with this ship.

as thickness reference for either end with a straight line between them. See front view. Incidentally, those two ribs close together at the dihedral joint serve no mysterious purpose; they simply simulate the ones on the scale three view. Don't think you should use medium wood for the spars to increase the strength, it's not needed. This type rib permits a spar almost the full airfoil depth, so use as light a piece as you want. The bottom of the airfoil is dead flat, so you needn't shim up the leading and trailing edges or the tip. Pin them down to the plan and glue in 1/16" square pieces for the rib bottoms. Next glue the spars to the ribs, holding them vertical with pins. Glue the rib tops on, beginning at the fuse end, cutting each one to just the right length. Note that the end ones match the fuse curvature exactly. Cut off more from the tail of each rib to maintain the proper curvature as you progress toward the tip. When the glue dries, notch the spars and prop the tip up for two inch dihedral, cementing scrap pieces of 1/16 to reinforce the joints. Notice that the trailing edge ends at the lower fuse longerons. The straight crossmember is glued into the fuse so rearward impacts on the wing will not crush in the fuse sides. Sand the wings into a good airfoil shape, tapering the trailing edges to about 1/32".

Carefully measure down from the thrust line and cut the holes in the fuse for the wing spars and leading edges. Make sure you are correct, as this is the only control of the 1° incidence. Try the wings in the fuse to make sure the spars meet properly on the centerline, and trim as necessary. You will have to spring the spars slightly to fit through the holes.

Landing gear this short cannot absorb landing shocks without transmitting damag- to take a permanent set. It is a good idea to add scrap pieces of 1/16 balsa to the sides of the wing spars where the landing gear legs meet the wing. These should be carefully cut to permit "sproing" clearance and yet suuport the tissue rather than leave a ragged tissue hole. See the section view A-A. ing loads to the airframe. The old torsion bar is the best solution with the one end anchored in the fuse filler sheets. Bend up the .031 wire measuring from the plan and install following the detail drawing. The wire size may seem too small to you, but it has been carefully selected to give optimum flexing and yet support for takeoffs. It is almost impossible to flex these far enough for them

Covering is next. Cover the wings completely before installation into the fuse. Use a separate piece of paper from the last rib to the wingtip to avoid wrinkles. I use Ambroid glue instead of dope at the rib adjacent to the fuse to make sure the paper won't come off there. Do not shrink the paper until the wings are glued to the fuse as it will pull the end rib out of shape, never to fit the fuse again. I prefer to cover wings and tail with dry Japanese tissue rather than wet, because shrinkage is less severe and warps minimized.



The powerplant of the Caudron is shown here. Notice the braided motor which keeps the rubber from bunching at either the nose or tail and upsetting the trim. The nylon bobbin prevents rubber stress at the prop hook. The 10 to 1 winder is a must for winding such big motors.

The trickiest bit of covering is on the fin fillets, so start with them while the fuse is still uncovered. Cover the area bounded by J to the fin spar, and the first stab rib to the first fin rib. A separate piece is used on each side of the fin. Run the tissue grain spanwise with the stab, moistening it with water. After some fiddling with the position, dope the tissue fast to all the structure present. Hasten the drying with a hair dryer and take a look at your handywork. A nice taunt tissue fillet will result if all goes well. Pull it off and try again if too many wrinkles appear. Do not depend on the dope to pull them out. When both sides are covered satisfactorily, cover the elevator and rudder, shrinking them only with alcohol brushed on with a soft brush. Find your hinge slots and slice thru the tissue with a sharp blade. Slip the hinges into the stab and fin, fastening them with Hot Stuff. Now position the elevators and rudder on these hinges leaving perhaps a 1/64" gap so they can be flexed up and down. Take a piece of tablet paper and tear it into strips about one inch wide. As you apply the Hot Stuff to cement the hinges into the elevators and rudder, cement will try to run into the gap and glue everything up solid. Slide a paper strip into the gap and watch it suck up the excess. Keeping the strips moving prevents their becoming stuck fast. The rudder trim tab is installed similarly.

With the tail completed, the fuse sides are next. Lay a dry sheet of tissue, glossy side up, on the plan and trim to the fuse profile with about 1/4" excess all around. Holding it in place, cut the window outlines with a very sharp razor blade. The cuts must be exactly on the lines with no raggedness. You now have a tissue side with window holes that precisely fit the framework. Lay it on the fuse and position the window holes with the framing, ignoring the rest for the moment. Brush clear dope on the tissue around the windows, letting none get on the windows themselves. Dope the remainder of the tissue to the framework and trim off the excess. Repeat the process, cutting the holes in a piece of tissue with the glossy side down, and cover the other side of the fuse. Now for the curved parts. These are all covered wet to avoid wrinkles. The fuse top can be covered with a single pice if you're experienced, or in two halves longwise if you prefer. Allow some excess at the windshield end to lap over and become the window edging there. Cover the scuttle in similar fashion, again, lapping up onto the windshield to form the edging. Keep your overlaps with the side tissues to the width of the framing (3/32") for best appearance. Remember, only tissue is used for color, so every piece of wood must be completely covered. Do not cover the fuse bottom until the wing is installed.

Cut through the tissue over the wing spar holes in the fuselage, and slide both wings into their places. I held the two ends of the spar together with a spring clothespin; the wing became perfectly level at the center section and aligned correctly with the stab. Holes had to be punched into the fuse fillers for the ends of the landing gear anchors. These holes may be moved as necessary until both landing gear legs are parallel and at the correct angle as viewed from the side. Hot Stuff all in place (not the clothespin please!), adding scraps to brace the spar and leading edge joints. You may now cover the fuse bottom and shrink the remainder of the tissues with alcohol.

Shape the two halves of the landing gear legs and cement onto the wires. I made the wheel pants out of .020 thick styrene pulled over a balsa form in a Mattel Vacuform. This is the lightest these parts can be made and looks best when painted with enamel sprayed from an airbrush. Balsa can also be substituted. All the little scoops, stacks, spinner, etc. can be made from one or two styrene sheets since they are small. Use only epoxy to glue them to the airplane as any acetate cement will melt styrene. Dope and sand the nose block with balsa filler using several coats, then airbrush the same color as the wheel pants. Brush a coat of clear dope on all tissue.

If you chose the color scheme used on the prototype, the stripes were put on the wings using red Pactra "Namel" from an airbrush. Notice that the stripes are *all* parallel to the leading edge of the stab, including those on the wings. I made the wing stripes 2.1 cm wide and the stab stripes 1.9 cm. The Heller kit gives good directions for these. The rest of the lettering was put on also with an airbrush.

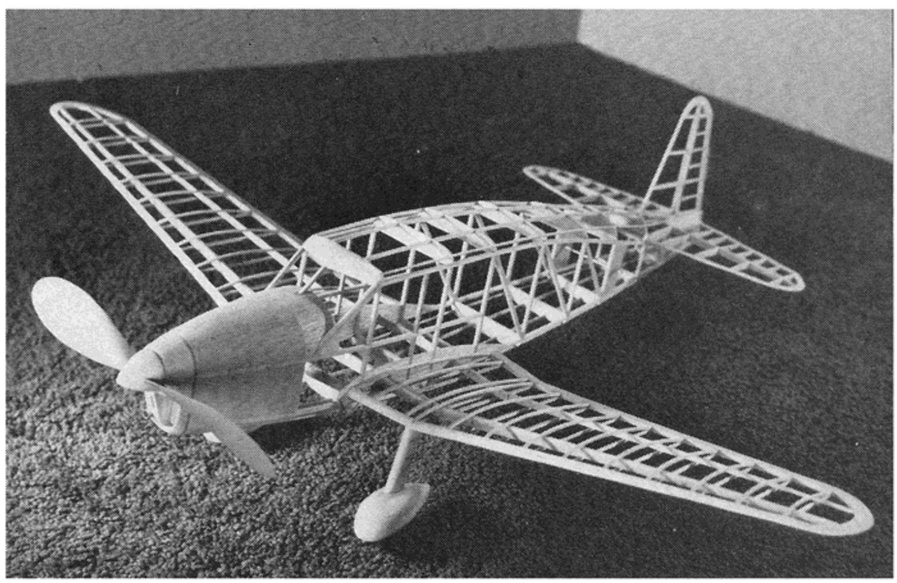
Just a word about masking. Don't try to use any kind of tape as this will rip holes in the tissue when removed, and doesn't make a crisp edge anyway. I used just plain typewriter paper laid on the surface and held in place with many 5/16-24 nuts along the edges to keep them from blowing up. A good airbrush will spray a small narrow band of paint with sufficient control to get a perfect stripe with this masking method. The fuse lettering was another matter. I cut these from .005 thick aluminum obtainable from offset printing houses. The metal is soft enough to be cut with an X-acto knife, yet stiff enough so that all those little points won't lift up from the spraying operation. Again, weight it with lots of nuts along the edges of the letters. The center of the A is separate and must be carefully held down with rubber cement, then removed immediately after spraying before the cement hardens too much. The small letters on the tail had best be done freehand.

The window and door moldings were cut from a three x five file card, painted yellow, and cemented to the tissue.

The 1980 AMA rubber scale rules have undergone some changes for the better, making it now a really challenging, well-balanced event. Since all flights must be ROG, my strategy was to overpower the airplane for quick takeoffs in the wind, which was somehow always present at the meets. The thinner airfoil, low drag, and lightweight allow this model to climb rapidly above the ground turbulence and achieve maximum altitude. If there were any thermals about, my odds of catching one was greater the higher the ship got.

The Caudron has a strong tendency to turn left under all that power, so a little right thrust and rudder will probably be needed. The flight pattern is a steep spiraling climb to the left, a momentary transition when the power runs down, followed by a circling glide to the right. Be careful not to braid the motor with too many turns or prop free-wheeling will be inhibited and the glide sink rate increased as a result. If the day is a cold, damp one, without thermals, this power setup will not turn in maximum times. The objective should be switched from maximum altitude to maximum motor run. A larger prop with this power or a longer, smaller sized motor with this prop will give better results.

Best of luck and I hope you stay out of the trees.



The sheeting and hollowed blocks at the nose distribute the stresses to the rest of the airframe (**top**). Tissue covering on acetate windows gives a realistic appearance (**above**).