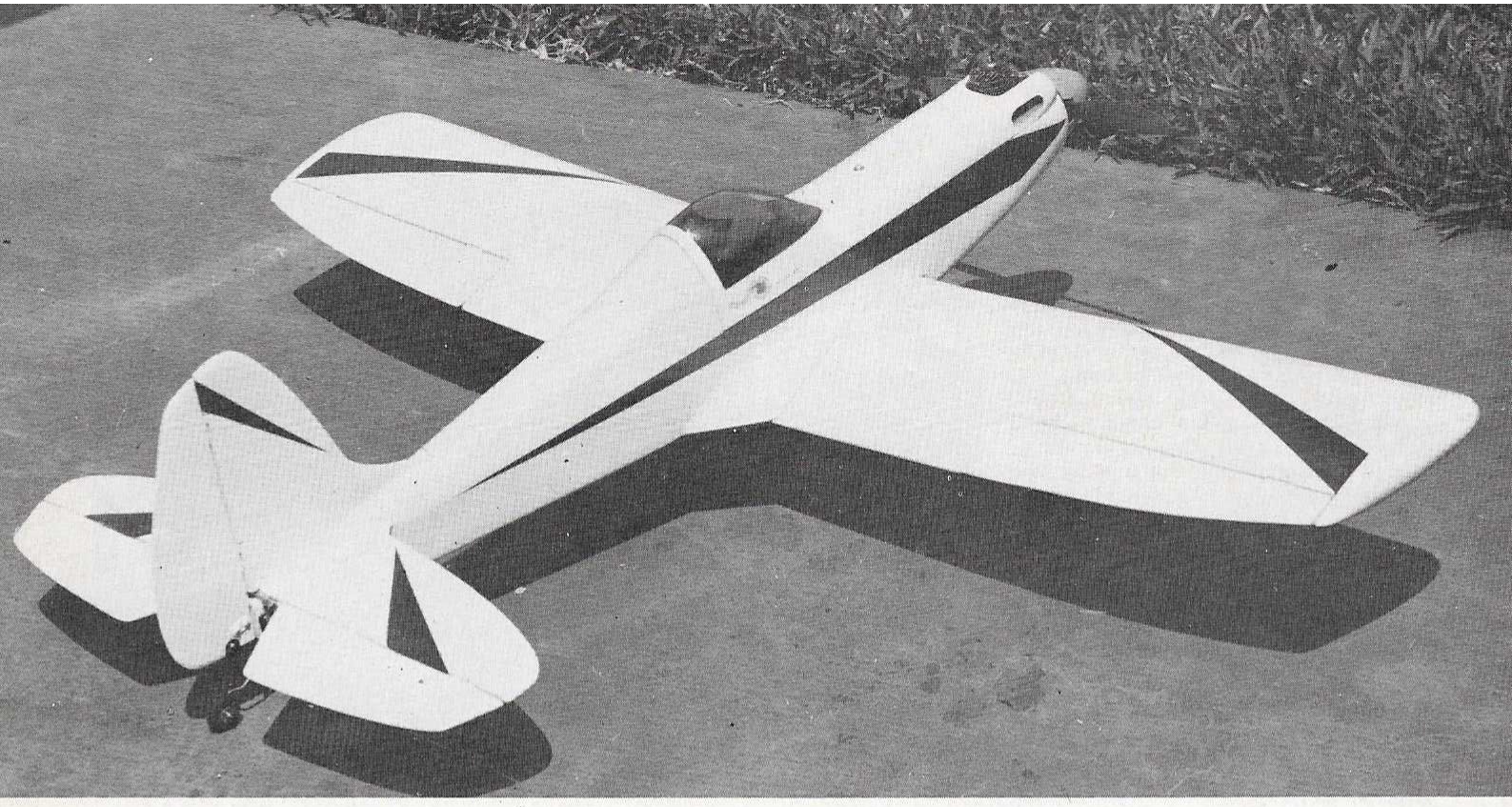
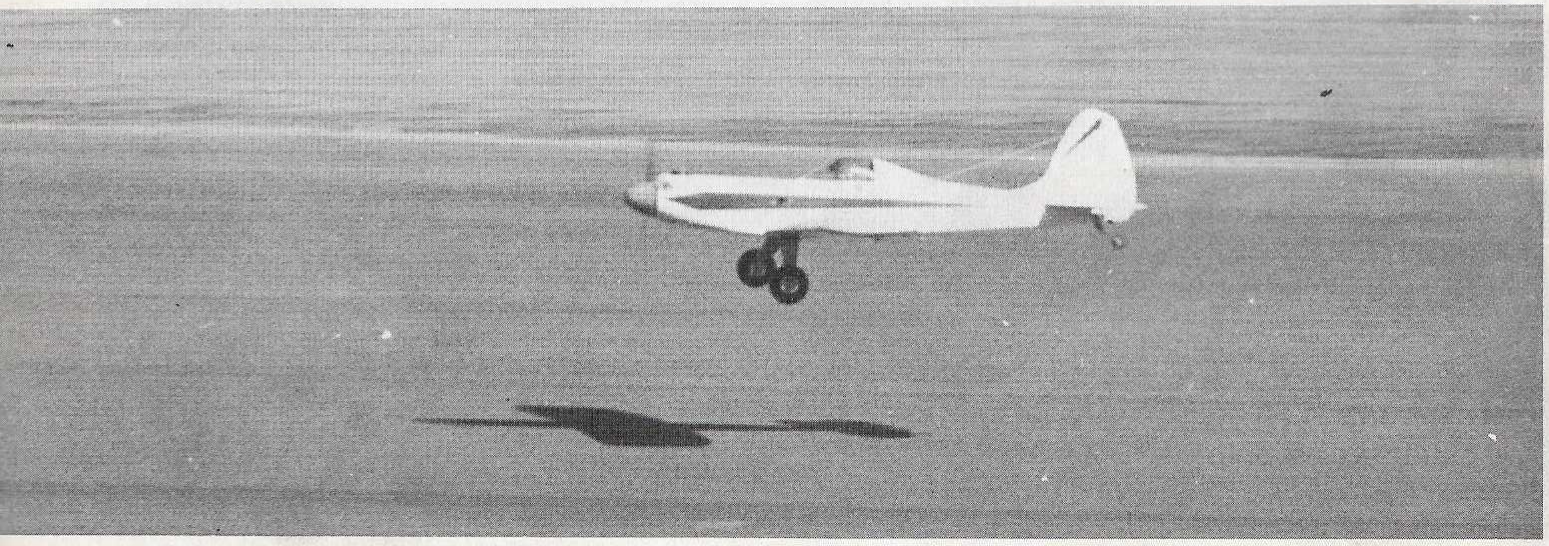
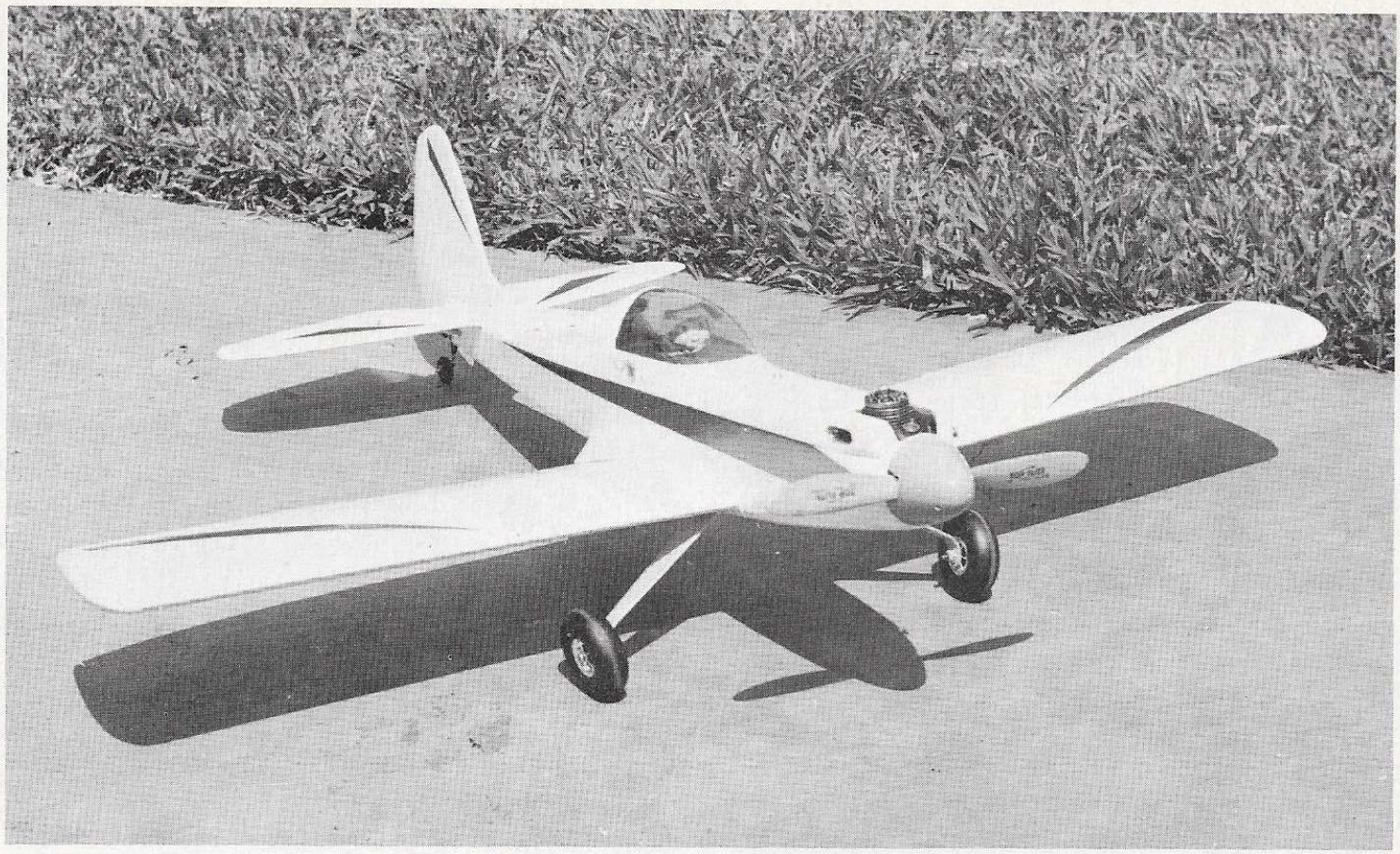


WILDFIRE

By GEORGE P. HARRIS

Designed for the new, lightweight digital systems and a hot .15 to .19, the Wildfire will do virtually every maneuver in the book. The roll rate is fantastic, with no tendency to drop a wing at any speed.





When I designed the Firefly (RCM Feb. '68) I thought it might help start a trend to smaller models, but not long after that Bonner 4RS appeared and made it possible to shrink the size even further. The Wildfire was designed specifically for the new, small digital systems, but with a little effort and a shoehorn it is possible to get other light gear, such as PCS, into the little bird. With the new smaller servos becoming available in other systems, there will be a choice of equipment.

Since lower cost is a big advantage with the small models, a few design tricks were used to help a bit more. For instance, the wing has a flat center section so that the distance from the root rib to the tip rib is exactly 18 inches, just cut 36 inch stock in half. Both wing tips and the fillets come out of a 36 inch length of 1" x 1½" balsa. The wood merchants won't like this and they can cry along with the fuel manufacturers—the little engines don't drink much! The structure is all sheeted for rigidity and allows you to use a lighter covering.

The ailerons incorporate washout, as on the Firefly, since this has proved to be very successful. Roll rate is fantastic but there is no tendency to drop a wing suddenly at any speed. With the controls set for maximum throws the airplane is very sensitive and capable of doing anything you want it to, but it is easily tamed by just reducing the throws. However, in full fighting trim it has good stability and has been flown hands-off for the full length of the San Diego Drones 400 foot runway, without dropping off. The original model had surface motions of about 25 degrees up and 15 down on the ailerons, 25 degrees each way on elevator and 30 each way on rudder. Tail dragger landing gear was used partly for a change and partly to get rid of the steering unit in the small nose. Ground handling is good with the wide track Hallco main gear and there is no tendency to ground loop. On take-off the tail comes up quickly and the bird will fly itself off, while landings can be two or three point, depending on how much you want to impress the tourists.

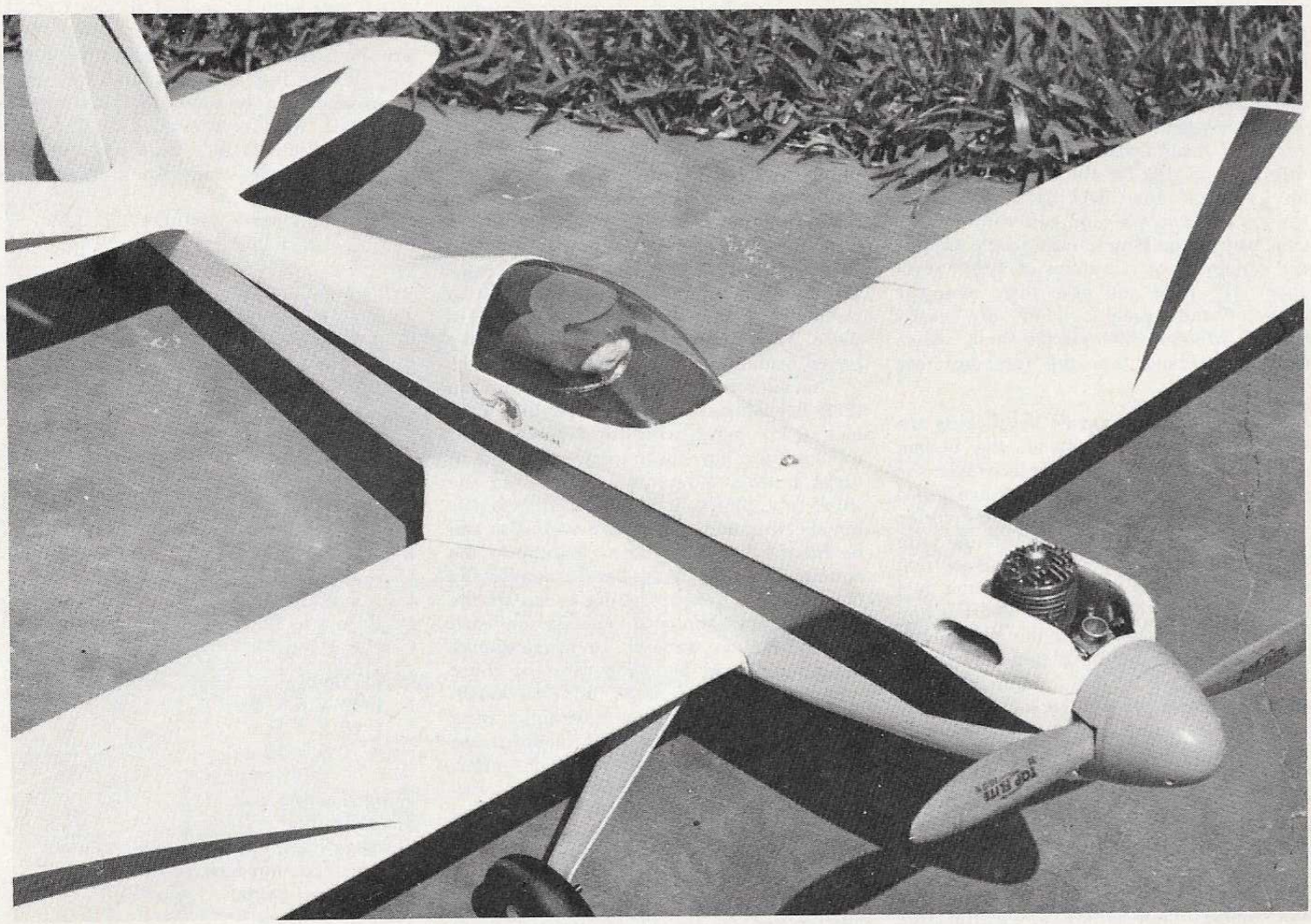
The airfoil section is a 15% semi-symmetrical laminar flow type (NACA 642A215) and has very good characteristics for models. I do not like full symmetrical sections that are supposed to make the model fly the same upright or inverted, but don't. As any book on airfoil theory will tell you, a symmetrical airfoil will not develop positive lift at Zero degrees angle of attack, but must be at about 2 degrees positive, so the model must fly slightly nose up, which, in turn, increases drag. When flying inverted the airfoil must again be at 2 degrees positive, so there is a trim change of 4 degrees between upright and inverted flight. These are just typical figures but apply to most of the sections in present use. On the other hand, a semi-symmetrical section will develop positive lift at zero degrees angle of attack and some will even develop useful lift at a slight negative angle, so the model can fly flat with minimum drag. When inverted, the semi-symmetrical section may have to be held at a positive angle of 1 or 2 degrees, depending on the section (this is relative to airflow and has nothing to do with angle of incidence, which is a fixed rigging angle on the airplane). But the trim change from upright to inverted is only 2 degrees. In any case, unless the wing, tailplane and thrust line are all on the same horizontal line, the flight characteristics of upright and inverted flight will be different due to the change in downwash effect on the tail, just to mention one reason. Anyhow, full size aircraft don't have symmetrical control response so why should our models? There, I've said it, now I will get down off the soap box and wait for the arguments to start.

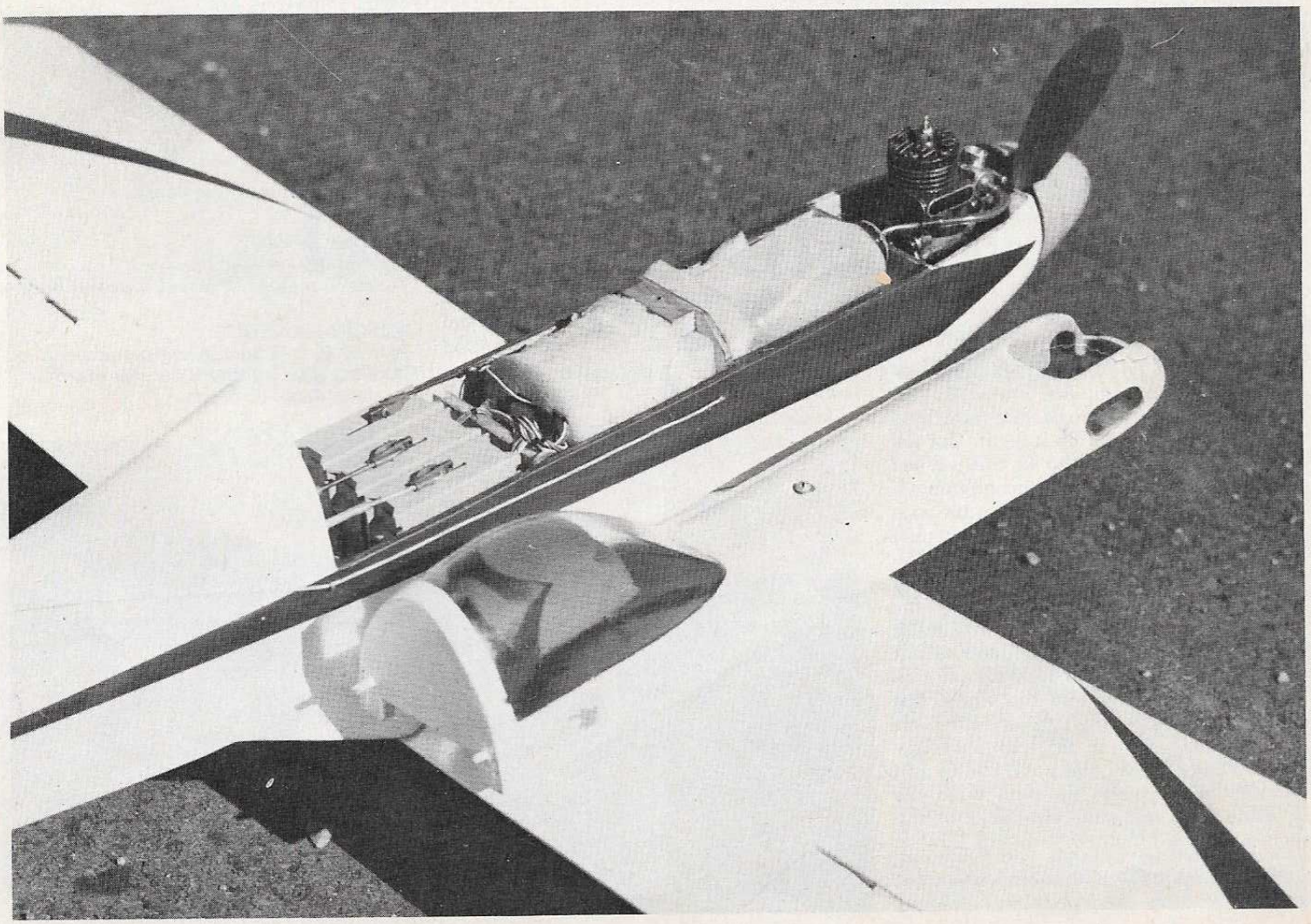
Don't leave off the wing fillets, they are not there just for looks. I have been preaching the use of fillets for years to anyone who will listen and there are good reasons for using them. My lecture on this subject requires diagrams though, and this is not the place for it. The excellent series on aerodynamics in RCM agrees with me, anyhow!

Now to work. Construction is very simple and no special tricks or jigs are needed. I like to start by cutting everything out and putting together what amounts to a kit, so everything is at hand, but to each his own.

The fuselage sides should be completed with all doublers and the engine mounts attached and the longerons and spacers glued in place. The 1/32" ply doublers add greatly to the strength with little weight and prevent the sides from splitting lengthwise. Formers F1 to F5 are then installed and the assembly squared up before pulling the tail end together. A spruce tail block provides a solid foundation for the type of tail wheel shown, but if you use another type just reinforce as needed. Control linkages should be made up while the fuselage is still open in order to get the clearances, or use Nyrods which don't have the problem. The bottom sheeting and top deck are now added, the top side sheeting overlapping the longeron for a solid joint. While this is drying, shape the tail surfaces and stick them in place.

Then build up neat fillets with plastic wood, Epoxybond, triangular stock, or what have you. Do not build up the nose until the wing is done, so you can drill





through F2 for the wing attachment dowels. The top hatch extends from the spinner to the rear of the cockpit and is aligned by dowels at the rear and the top part of F2 at the front. A single retaining screw gives quick access to all the goodies inside. The front end of the hatch is filled with block and cut to fit the particular engine. I made a flat top cowl with a slot through one side for the exhaust. The top block on the rear deck is shaped to fit the canopy you use and can vary to suit. One way of making a neat frame around the canopy is to cut strips of 1/32" sheet about 3/8" wide and glue them over the edge of the canopy. They are easily shaped around the curves and, when sanded to blend into the fuselage, look very neat.

The wing is best started by sticking the main spar webs upright on the bottom spars and nailing these in place over the drawing. The lower rear spars are glued to the trailing edge sheeting to overlap the front edge and are blocked up with 1/8" scraps under the sheeting. Note that the rear surfaces of the wing, top and bottom, are flat, which makes construction easier. For uniformity, all the ribs can be cut in a stack to the basic pattern and the various ribs trimmed as required. Drop all the ribs in place then add the other spars and leading edge pieces. If you build on a dihedral board the center section can be put in and all top sheeting added before removing the wing from the board. The spars are spaced so that the sheeting joints are all-over spars, which makes a very smooth surface. This is important in order to obtain the benefit of the laminar flow section. Somewhere along the line remember to put in the aileron linkage, depending on how you are building the wing. Also, fill in between the rear spars along the aileron bays to provide anchorage for hinges. Complete all sheeting before adding the leading edge caps, which should be shaped carefully. A ply plate, or rails, can be glued in the center section for the aileron servo, which is coupled to the pushrod by a wire pin bound and soldered to the brass tubing at the center. The main landing gear is secured to a ply plate which is epoxied to ply ribs in the forward center section and is covered by the fairing blending the wing into the nose.

Wheel pants are optional but really add to the looks. They are easy to attach to the Hallco gear if you do it right. Cut the recess in the inner side to fit the leg end closely and this will hold the alignment. To attach the pants, run a nut on the axle screw until it holds the wheel firmly, then turn the screw into the anchor nut on the leg until the nut just grips a piece of 1/8" ply. Remove the ply and push the pant down over the axle, then, with a flat wrench, reach inside and tighten the nut against the ply insert to lock the pant in place. This will also free the wheel just enough for free rolling. For some wheels with recessed hubs it may be necessary to use washers under the nuts. Unless you use very wide wheels the pant cores can be made from the same size block as the canopy fairing.

Now hold the wing in place in the saddle and mark or drill the holes for the leading edge dowels and the rear hold down screw. Epoxy the dowels in the wing and thread the maple block for the hold-down screw. The nose can now be built up and shaped to look pretty.

The wing fillets are easy to make if you first cut the side view curves to the upper and lower profiles then cut to the plan view shape. Finally, plane the dihedral angle on the face that is glued to the fuselage, which is easier than cutting the curves on an angle. With the wing bolted in place and plastic wrap over the center section to prevent glue from sticking, check the fit of fillets and glue them in place. While the wing is held down, the lower leading edge fairing can be added.

The ailerons are built upside down on their flat top surfaces. You may think they look a bit weird with the washout built in, but they have been very successful in flight testing. Screw nylon horns to the small ply plates and glue firmly to the top sheeting and root ribs. Scrap balsa can be fitted around the horns to support the bottom sheeting. Add small reinforcing blocks where you are going to install the hinges. Two should be enough on each aileron. If you want to be conventional, the ailerons can be made constant chord with all ribs the same and no washout. This will give you a straight wing and allow the ailerons to be made in one piece with the wing then cut out afterward. It is a matter of choice, but I recommend the ailerons shown.

If you use Rand hinges these can all be installed at this time since they can be disconnected for proper finishing of all the surfaces. With all the different finishes available now I won't attempt to recommend anything, except to keep it light. I build on the heavy side, and the original model weighed a little over 3 pounds ready to fly. Try not to go over 3½ pounds, the wing area is quite small.

A Veco .19 was used in the prototype and seems to be about right. A .15 will fly it for sport but might not have enough poop for the vertical stuff. With a .23 it would be wild and I suppose somebody will jam a .29 into one before long! Lots of power is nice since you don't have to fly at full throttle all the time. The tank compartment will hold a Pylon Brand RST4 (4 oz.) tank nicely, which is a good size for general flying.

For the first flights I suggest hooking the controls to the outside of the horns, except the rudder which is not so critical. After you get the feel of it you can decide whether to increase the throws. There are no unusual characteristics in flight, the glide is fast but good, and very tight approaches can be made. Spins require a full stall, with recovery quick and positive. Roll rate is incredible and the bird will do a triple snap like a spring unwinding.

Five . . . four . . . three . . . two . . . one . . . start building.

SHEET BALSA.
3 1/16 x 3 x 36
2 3/32 x 4 x 36
2 1/8 x 4 x 36
2 1/4 x 4 x 36

STRIP BALSA.
6 1/8 x 1/4 x 36
1 5/16 x 1/2 x 36
1 1/4 x 3/4 x 18
1 1/4 x 3/4 x 36

BLOCK BALSA.
1 1/2 x 2 x 3
1 1 x 1½ x 36
1 3/4 x 4 x 12
1 1 x 2½ x 18

PLYWOOD.
1 1/32 x 6 x 18
1 1/16 x 3 x 3
1 1/8 x 6 x 12

Wing sheeting.
Ribs, sheeting.
Fuselage sides, formers, doublers, spars.
Tail surfaces, top deck, nose, wing platforms, wheel pants.

Spars, longerons, braces.
Leading edge.
T.E. stock.
Hatch sides.

Center section fill.
Wing tips, fillets.
Nose.
Canopy fairing, wheel pants.

Fuselage doublers.
Nose plate, reinforcing.
Formers, mounting plates, dihedral braces.

MISCELLANEOUS.
Pair of 3/8 x 5/8 maple engine mounts.
Landing gear and hardware as shown, or stock items of choice.