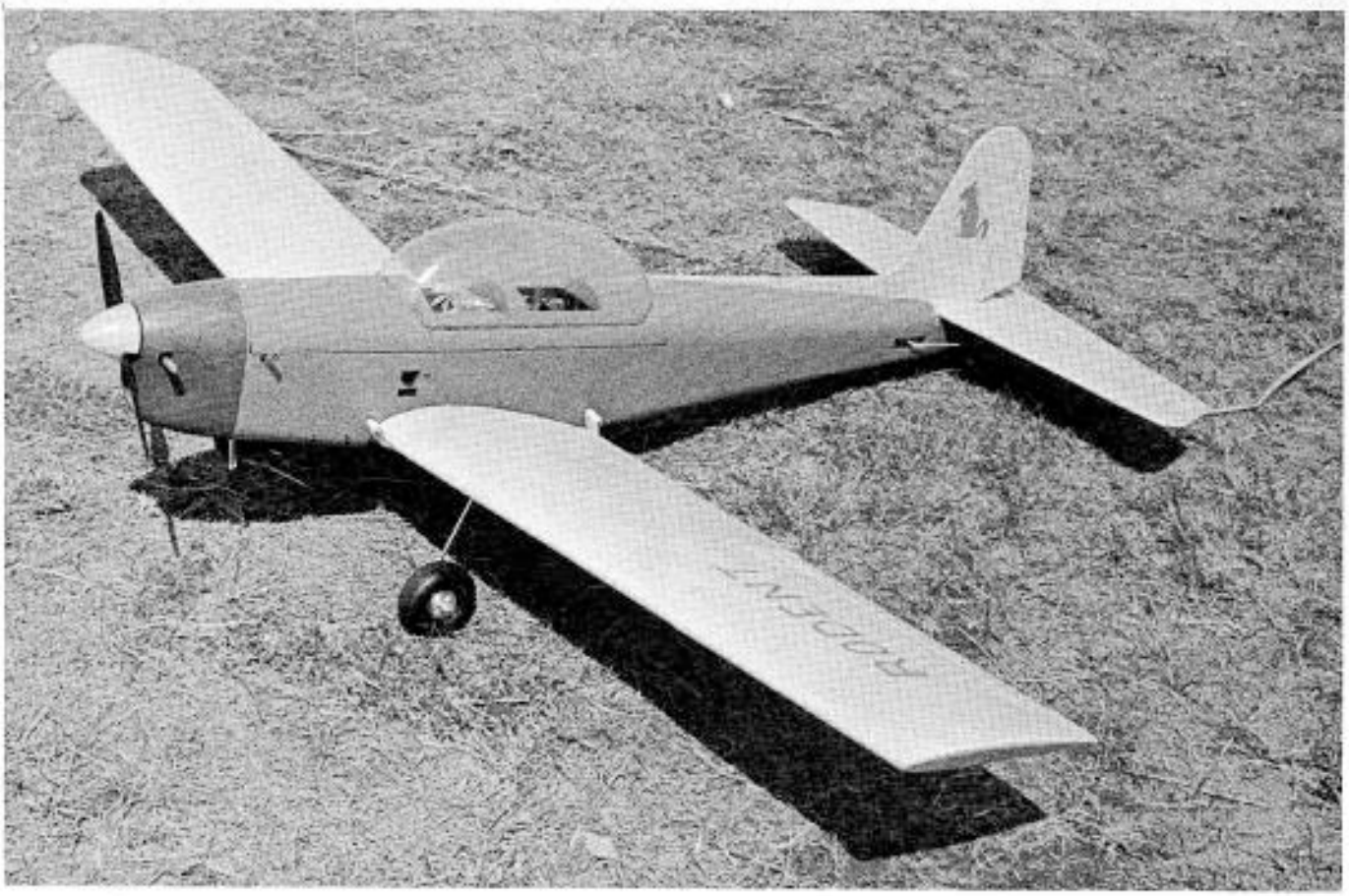


THE RODENT

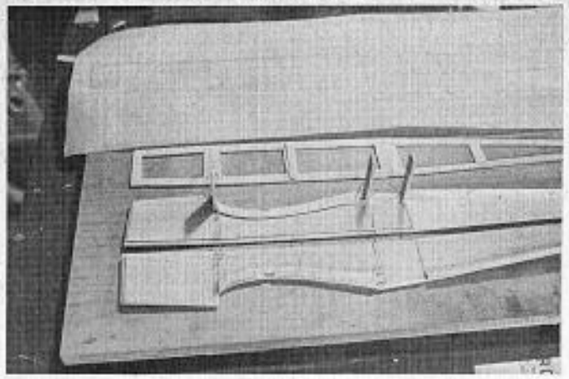
BY ABBOTT W. LAHTI

A 40" SPAN, .049-.10 POWERED LOW-WING AIRCRAFT DESIGNED FOR THE LAHTI PULSE PROPORTIONAL SYSTEM. BEARING A STRONG RESEMBLANCE TO THE DEHAVILLAND CHIPMUNK, THE MODEL IS QUITE CAPABLE OF ADVANCED PERFORMANCE.

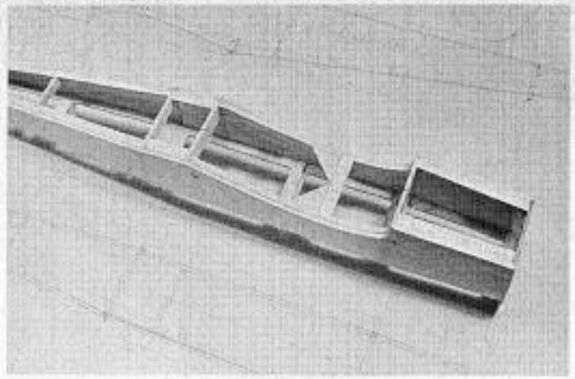
My favorite light aircraft has for a long time been the British and Canadian DeHavilland "Chipmunk" primary trainer, so I decided that sometime I would build an R/C model of one. The available "Chipmunk" kits were for larger models, but having a personal preference for smaller aircraft, I decided to make one from scratch. It used simple construction techniques based on Owen Kampen's crutch idea and either the Midwest or Testor replacement foam wings. Furthermore, it was a good test bed for my decoder, which was described in last month's issue of R/C Modeler. The result is not a scale "Chipmunk" but does bear a strong family resemblance, hence the name of the "Rodent."

The prototypes were originally flown with a throttle equipped Cox 0.049 Medallion with a QZ muffled cylinder assembly (most flying sites in the Boston area require mufflers). This motor combination provides considerable power in a very light package. If you are an experienced flyer or very sporting, the design provides room for a 0.09 or 0.1 engine. It is too bad that Cox does not make a QZ assembly for their 0.09 and 0.15 engines. They would fit in these smaller cowled models very nicely. An OS Max .10 provided the additional margin of power for truly outstanding performance.

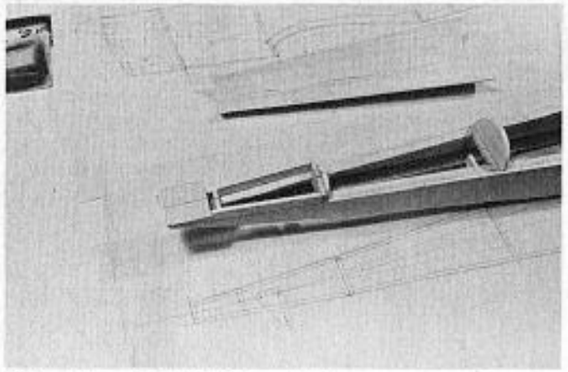
Coupled aileron and rudder, plus elevator, are used for control. The ailerons are responsible for its smooth performance and it is recommended that they be used. A lightweight, high-pulse rate, pulse proportional system should be used. My system as well as the Airtrol RE-1 are both very suitable. The dual Rand system with the small battery would be all right, but the large battery takes up too much room and is too heavy. Conventional Galloping Ghost has not been used but it should not



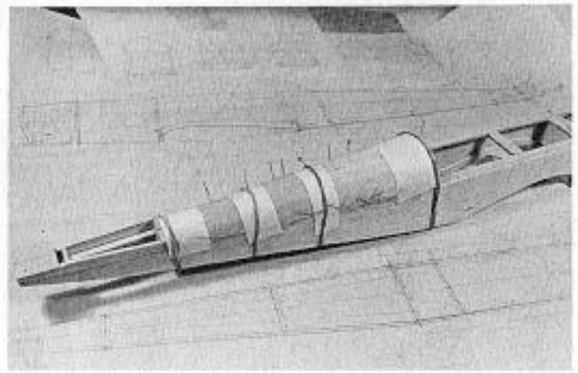
Pre-bent sides and doublers, wing saddle, & formers F2-F4.



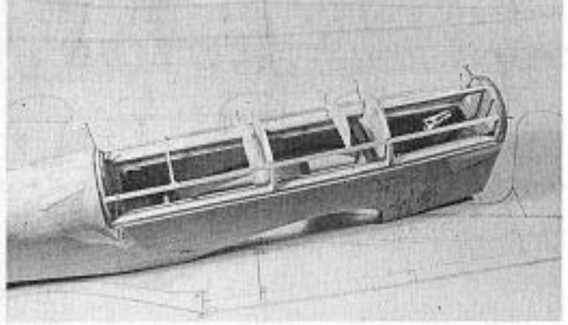
Assembled fuselage, bottom view.



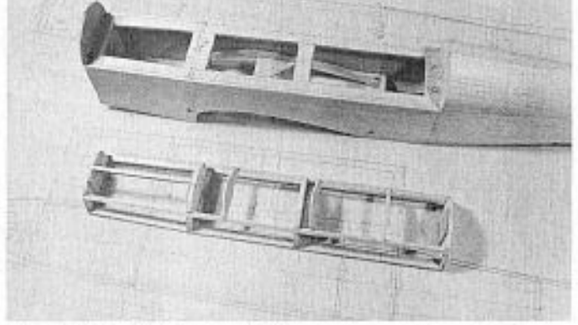
Stab saddle with F-10. Note pre-bent rear cover.



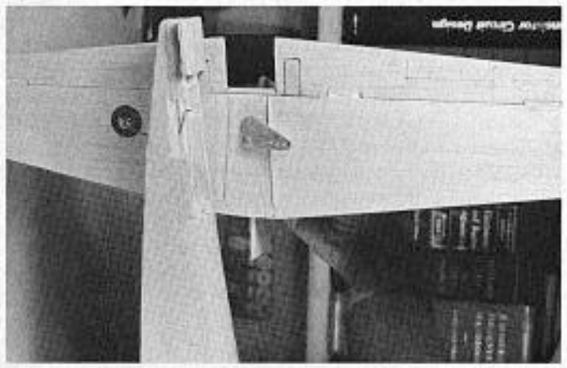
Rear cover being glued in place.



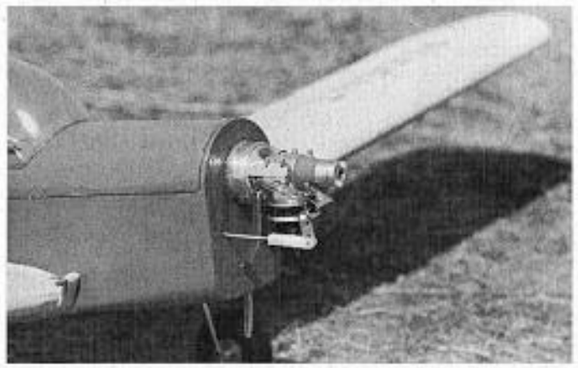
Hatch being built on top of fuselage.



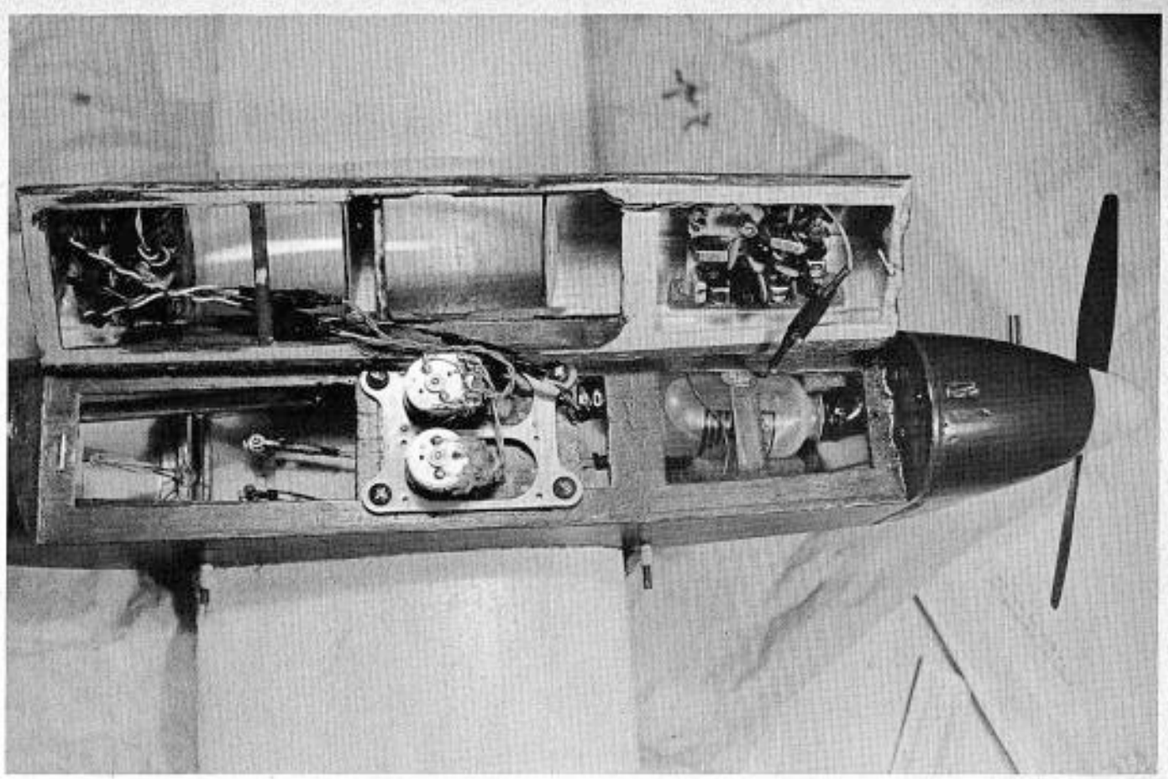
Completed hatch frame with fuselage.



Tail assembly - note tail wheel linkage.



View of .049 engine and throttle.



The Lahti system installed in the 'Rodent.' Note the aileron linkage and the internal rubber band antenna tensioner. The antenna runs along the outside bottom. The converted SH-100 receiver does not use its case since it is not needed and only adds weight. The receiver is cemented to foam with G. E. Clear Seal. Note the crutch construction technique used for both the fuselage and hatch.

present any problems if the control surface throws are not excessive.

A foam horizontal stabilizer is not used since part of the Chipmunk character is obtained by the shape of the stabilizer which cannot be approximated by the foam unit. Also, a 1/8" sheet stabilizer permits more room to unobtrusively connect the steerable tailwheel to the rudder.

Before beginning construction, collect all the materials, adhesives (Titebond, and either Sig or Hobbypoxy formula 2 epoxy, and a tube of clear acetate cement), several new No. 11 Exacto blades and some single edge razor blades. Cut out all the parts except for F-10 and label them. Use a metal straight edge for all straight line cuts. Mark the former positions on the sides and crutches. Mark the fuselage position and the fin position on the horizontal stabilizer.

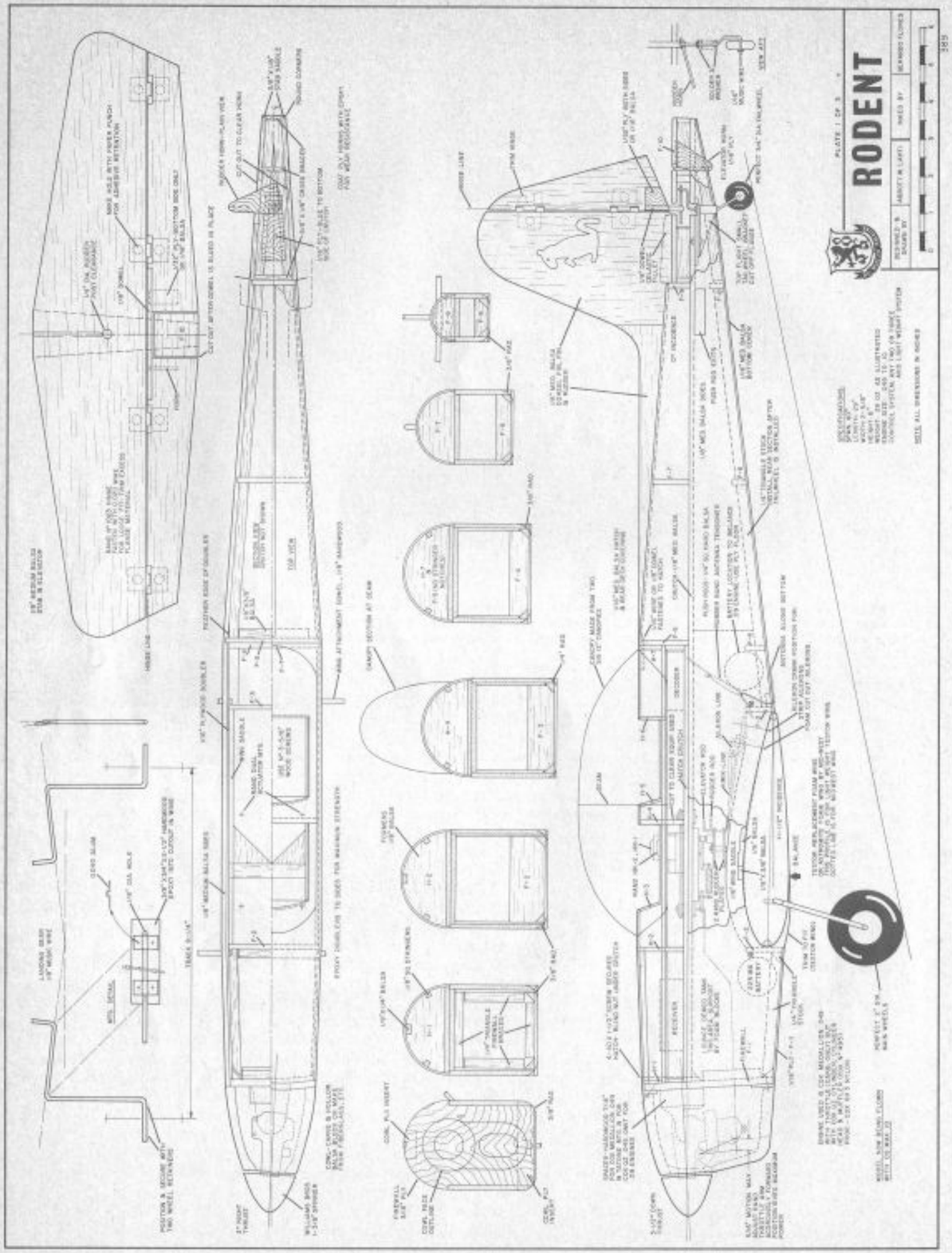
Fuselage

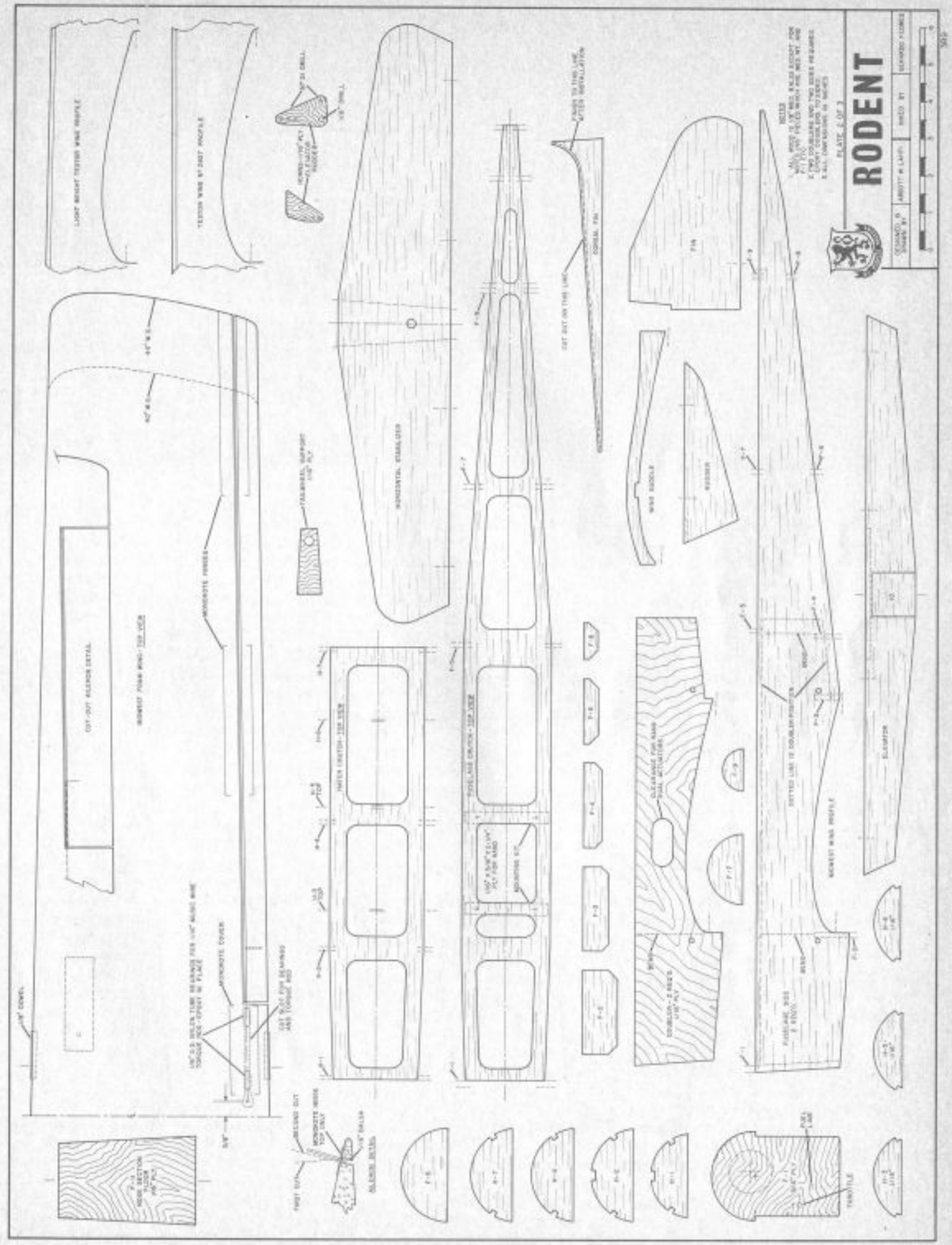
Pre-bend the sides to conform to the crutch by cutting a narrow vee almost through the wood on the inside and bending inwards. Pre-bend the front of the doublers by cutting part way through on the outside. Don't worry about lack of strength; the cuts will be filled with epoxy. Lay the sides out on the bench, inside up. Coat the doubler with epoxy and position onto the sides, making sure that there is a 1/8 inch clearance for the firewall and crutch. Pin in position. Shim the nose ends with 1/8" scrap and the tail ends with any convenient prop. Scrape away the epoxy where it has oozed out into the crutch and firewall area. Check the alignment against the crutch. Glue the 1/16" x 5/16" x 2¼" ply Rand mounting strips and the tailwheel support on what will be the underside of the crutch. Glue and pin F-2, F-3, and F-4 onto one of the sides. Insure that they are perpendicular with a square. Epoxy the wing saddles in position.

When the adhesives have hardened, pin the crutch bottom side up on the bench over some Saran Wrap. Allow the nose section to overhang the edge by an inch or so. Flow Titebond along both edges of the crutch and on the other ends of F-2, F-3 and F-4, and pin the sides in position. Epoxy the firewall, F-1, in position. Now add F-6 and F-8. When this has set up, fit and glue the four 1/4" triangular firewall braces. Now fit and glue the 1/4" triangular braces cut from scrap. Allow the glue to harden and remove the fuselage from the bench and trim off all the glue flash. Cut the flanges off a small Top Flite tailwheel bracket and bolt it in position with 2-56 machine screws and lock washers. Cut away the crutch under the nuts to permit them to seat securely on the plywood. Now cut, fit and glue the rest of the 1/4" triangular longerons in two sections on each side aft of F-8. Glue and pin F-9 in position; then cut, fit and glue the 1/8" x 3/8" stabilizer saddle and add the cross braces. Glue F-5 and F-7 onto the crutch. Allow to dry thoroughly.

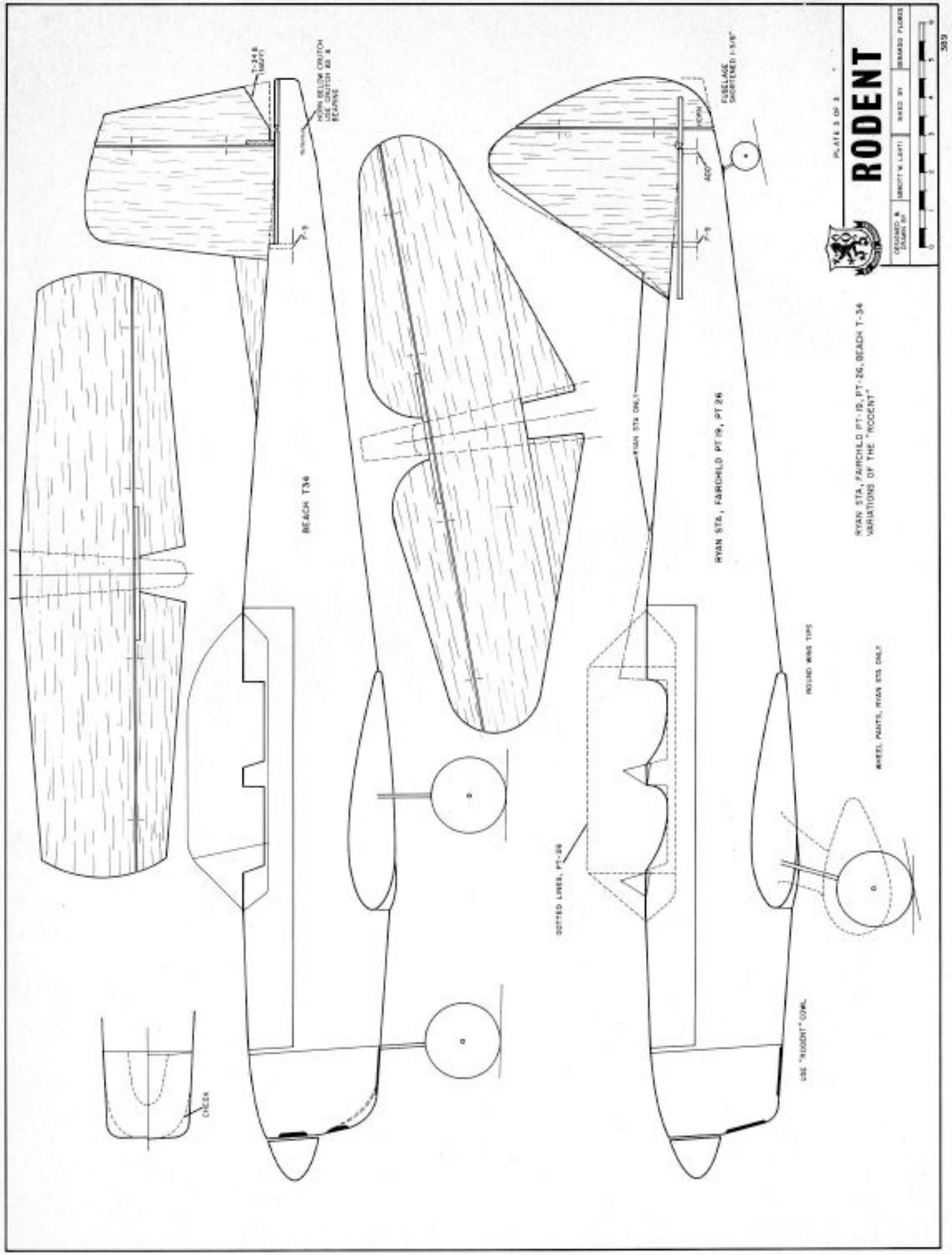
The hatch is begun by lining the hatch area, F-1 and F-5, on the fuselage with Saran Wrap and pinning the hatch crutch to the fuselage crutch. Insure that 1/16" clearance exists along the hatch crutch sides which will be eventually occupied by the 1/16" sheet hatc h cover. Glue H-1 in position, laying it against F-1. Do likewise with H-7, fitting it snug against F-5. Glue H-2 and H-4 on the crutch. Add the 1/8" square side stringers and the 1/8" x 1/4" top nose stringer which is cut out from scrap. Now glue H-3 and H-5 onto the stringers, slanting them forward.

Make a 6" x 36" sheet of 1/16" balsa





FULL SIZE PLANS AVAILABLE – SEE PAGE 70



by taping two 3 inch sheets together closely on one side. Open the crease and fill with acetate cement (which is waterproof), then lay flat to dry over pieces of scrap balsa so that air can circulate underneath hastening the drying.

When the hatch formers and the 6 inch sheets have dried, remove the tape and cut the wide sheet into the approximate lengths of the hatch and rear deck. Soak them in water until very pliable, then wrap the rear deck over the fuselage formers and hold in position with rubber bands. Use file card strips under the bands to avoid forming grooves in the wood. Also position the bands over the formers to prevent the deck from becoming swaybacked. Bend the hatch cover over a 2½" diameter bottle or tube. Let these dry completely. They can now be trimmed, glued and pinned in position. A vee in the hatch covering extending from H-1 to H-2 will allow it to conform to the change in curvature.

Mix some more epoxy and smear it thinly around the inside of the fuselage from F-1 to F-4. This fuel proofs that area and adds a little more strength. Then epoxy F-11 onto the fuselage. The aft bottom cover is not installed until later.

Cowl

This can be carved from a balsa block and hollowed out so that the walls are about 1/4 inch thick. It will be coated with epoxy inside and out after it is fitted over the engine and all points of interference with the throttle eliminated. Alternatively, it can be made from fiberglass or the Hobbypoxy easy-does-it method over a slightly undersized solid mold. This technique is recommended because it provides more room inside. The cowl fastens to F-1 with two No. 3 x 1/2" wood screws.

Tail Surfaces

Glue sections of 1/8" dowel into the rudder and elevator. When dry, cut away F-10 and glue it onto the fuselage. Fit your favorite nylon hinges (I prefer the Rand No. 1023 hinge) and assemble the rudder to the fin and the elevator to the stabilzer. Make a hole in the hinge flange with a paper punch for adhesive retention. Insure that there is no binding. Next epoxy the fin to the stabilizer, making certain that they are perpendicular. When it is secure, epoxy the rudder horn to the rudder dowel extending through the stabilizer. Angle it as shown on the plans. At this point the tailwheel is fitted to the fuselage. Its wire bends back and up to intercept the matching hole in the rudder horn. Now glue the stabilizer to the fuselage on its saddle, making sure the tailwheel wire has engaged the rudder horn. Fit either a nylon or plywood horn to the elevator. The plywood horns should be coated with epoxy for wear resistance. Now add the Celastic rudder fillet.

Wing

Midwest or Testor 44 inch foam wings are used. Check the profile against the plans since the two that Testor supplies as replacements for its aircraft and the Midwest wing all have different cambers. The fuselage wing cutout must match it. Strip ailerons are recommended because they are the easiest to build. Draw two lines 9/16" and 5/8" on the wing top forward of the trailing edge. Refer to the plans as to the cutting angle made along those lines. Discard the narrow foam wedge. Glue the foam trailing edge to a strip of 1/16" balsa with Titebond. Make certain that there are no warps and that it is perfectly straight. This is now a very light, torsionally rigid, foam aileron. Bend and fit the 1/16" music wire torque rods. Slide two sections of 1/8" O.D. nylon tube over each wire prior to making the last bend. Epoxy them to the ailerons after cutting away some of the balsa backing. Cut a 1/8" square trench in the wing to accept the torque rods and the nylon bearings. Attach the ailerons to the wing with a 1/32" clearance by a single layer of MonoKote strip. Now epoxy the bearings to the wing, then cover with a MonoKote strip. Slab ailerons are made in the same way if you desire to use this kind.

Epoxy the landing gear blocks into the under side of the wing. Bend 1/8" music wire to form the two landing gears. Fasten them to the blocks with metal strips or Veco wire retainers. Use No. 3 x 1/2" wood screws.

The designed wing span of the Rodent is 40 inches (shortening is done prior to the aileron construction) but if you are not too experienced a flyer, start out with the full 44 inch span.

Equipment Installation

Begin by installing the servos or actuators. If Rand units are used, they can be assembled on Rand's dual actua-

(continued on page 84)

(continued from page 39)

tor mounting plate. Fasten this to the top of the crutch with Rand grommets. Cut away the crutch and H-4 as necessary. My Rodent uses an HR-1 mounted in an HR-2 base and the HR-2 is really an LR-3 with the elevator plate removed. Connect the rest of the electronics temporarily to check the mechanical phasing and to see whether they will "go around" without fouling the doublers. A little cutting may be necessary. The rudder and elevator pushrods are made from 1/4" square hard balsa with Kwik-Links epoxied to the horn ends and 1/16" music wire on the actuator end. I prefer the Rocket City keepers because they slide axially taking up little room to connect or disconnect. Add the 1/16" lower rear sheeting, grain lengthwise, and round off all the bottom corners.

To have coupled rudder and ailerons, a second Rand rudder plate is bolted to the existing one with 3-48 x 1/2" machine screws and spaced 3/16" from it. I used the ferrules in a Rand mounting kit for spacers. A 5/8" length of 3/32" O.D. brass tubing is fitted over each crank end of the aileron torque rods and soldered, over which the Aileron Links are positioned. Temporarily assemble the wing to the fuselage with dowels and rubber bands. Fit a pair of Kwik-Links from the added Rand rudder plate to the Aileron Links. Drill out the rudder plate's holes so that the links are free to move up and down 30 degrees. Open up the Kwik-Link ends so that they do not bind on the Aileron Links. The stunt in connecting these is to previously attach the Kwik-Link to the rudder plate (Rocket City retainers again), reach into the fuselage, grasp the Aileron Link with your thumb and first finger, and snap the Kwik-Link in place with a pair of long nose pliers.

The engine is bolted to a radial mount which is in turn bolted to the firewall. The 0.049's require a 7/16" spacer in back of the radial mount. Right thrust is obtained by drilling out the engine crankcase mounting holes and skewing it on the radial mount. Adjustments are readily made this way. Use a Ny-Link between the throttle and actuator.

Since my motor is equipped with a muffler, the throttle controls the venturi only. The slotted link of the Cox throttle spray bar was removed and a strip of scrap 0.030" brass was bolted and soldered to the throttle arm. It must be bent to clear the muffler. Drill a No. 51 hole in it for the Ny-Link so positioned that the effective arm length is one inch. This allows a three position control with the fourth being an idle cut off. It is connected backwards in that the forward position gives full power.

The receiver, decoder and battery can now be installed as shown on the plans. G.E. clear seal is a convenient adhesive to hold these components in place. Isolate the receiver with foam. The battery is not connected until the plane is finished since its position determines the correct overall balance which is from 1 7/8" to 2 inches back from the wing leading edge at the fuselage. A one ounce Demco plastic three outlet tank is installed next if you are using an .049.

Use a 2 ounce Sullivan Pylon tank if you utilize the Max .10. Cradle it on foam blocks and retain it with a section of springy ice cream stick. Do not let it foul the throttle rod. The switch and charging socket can be fitted in any convenient place. I used a five pin socket connected to each battery cell to take advantage of Amp-Gate charging when those diodes become readily available.

Canopy

The canopy is fabricated from two 12 inch Sig canopies cut and fitted back to back. They are joined with a 1/4" wide scrap canopy section using acetate cement. After the fuselage is doped, it is retained with acetate cement.

Finishing

Any lightweight technique can be used on the wood surfaces. The method I used was to dope the entire structure with two coats of 50-50 clear dope and thinner, sand, apply dry colored tissue with 50-50 clear dope, add two thin coats of color dope, and finish off with a coat of 50-50 clear. All dope was brushed on. The next time I plan to use Super MonoKote over the clear doped and sanded wood. The foam wing was sprayed with two light coats of Testor's PLA which was also used on the cowl. The wings and tail were colored yellow and the fuselage Bonanza blue. Solarfilm can be applied directly to the foam wing due to the low heat needed for application.

The last step is the sealing of the wing saddle, hatch, and cowl. With coarse sandpaper roughen the fuselage wing saddle, the bottom of the hatch crutch, and the mounting face of the cowl. Apply a bead of G.E. clear seal to the roughened areas. Cover the mating surface with a smooth layer of Saran Wrap to prevent undesired sticking. Fasten the wing, hatch and cowl to the fuselage with their own mounting fixtures. After the G. E. seal has cured for eight hours, remove the parts, trim the flash and remove the Saran.

Flying

Hopefully the total weight is around 26 to 27 ounces and the aircraft is balanced correctly. Set all the control surface throws for about plus or minus 10 degrees. Later on they can be increased. Mechanically trim all the surfaces to neutral. A range check should be made. Run the engine to see if vibration bothers the electronics. The control surface movements must correspond to the appropriate transmitter stick movements.

A Cox No. 755-6 glow plug clip lead with the clips bent 90 degrees to the handle is used for starting. The bronze clips are brittle and must be bent with care and the bend solder reinforced. To start the engine, invert the plane, prime the venturi with 4 or 5 drops of fuel (Cox racing fuel is fine), pull the prop slowly through several revolutions, right the plane, and flip the prop smartly. It should start readily.

Hand launch the first flights and let it climb to at least 100 feet before maneuvering. The original Rodent flew "right off the drawing board" with only a slight reduction in the wing incidence, which change is incorporated in the plans. Shadow turns will not cause the nose to drop but a steep turn will unless up-elevator is applied. Loops and rolls require a shallow dive to pick up sufficient speed. Stalls are gentle and straight with no tendency to fall off on either wing. The glide is flat and the rate of sink is low. It penetrates the wind very well and can be flown when other planes are grounded. ROG's can be made from pavement or short, smooth grass. Begin the takeoff run with full up elevator. In all, the performance is quite scale-like.

If you are a beginner to R/C, by all means have an experienced flyer help you through your first flights.

Since its "Chipmunk" appearance is largely due to the shape and position of the tail surfaces, dorsal fin, canopy, cowl and landing gear, these can be varied to make approximations of other aircraft. The Ryan STA, Fairchild PT-19 and PT-26, and the Beech T-34 are examples which can be based on the Rodent fuselage and the Midwest wing.

List of Materials

1 Midwest or Testor 44 inch foam wing.
4 1/8 x 3 x 36 med. or med. light balsa sheets.
4 1/16 x 3 x 36 med. or med. light balsa sheets.
2 1/4 x 36 triangular med. balsa.
1 1/4 x 36 square hard balsa.
1 3/8 x 3/4 x 12 hardwood.
1 1/8 x 24 hardwood dowel.
1 1/8 x 6 x 12 plywood sheet.
1 1/16 x 6 x 12 plywood sheet.
1 3 x 4 x 6 med. balsa block for cowl or cowl mold.
1 3/32 x 36 music wire.
1 1/16 x 36 music wire.
4 Kwik-Links
1 Ny-Link.
1 pr. Aileron Links
6 Nylon hinges.
2 Sig 12 inch canopies.
Misc. – Wood screws, machine screws, 3/32 O.D. brass tube, MonoKote strips, Saran Wrap, wheels, adhesives, etc.