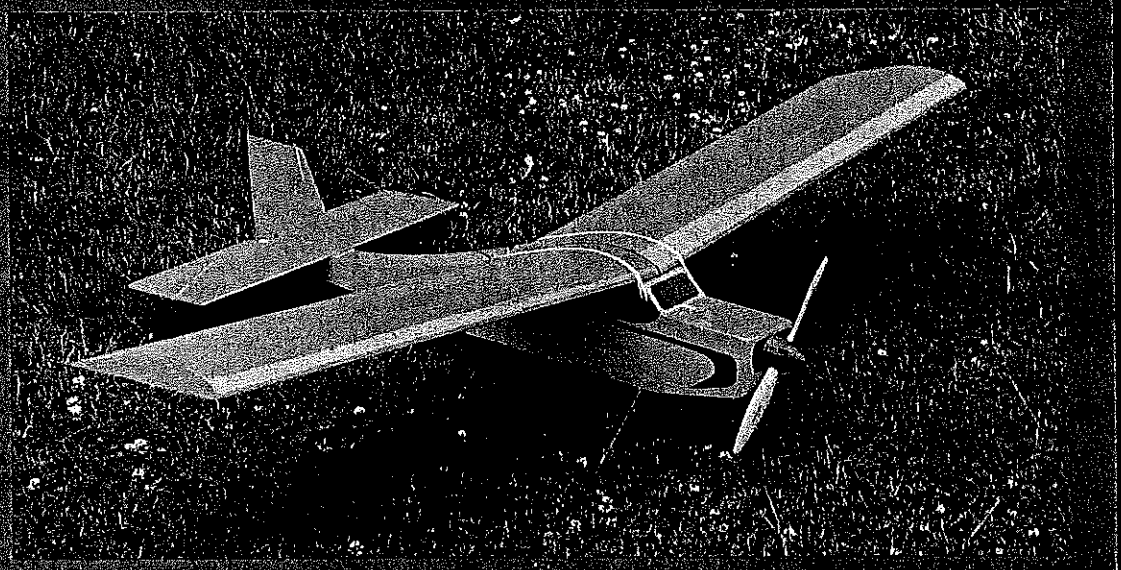
#771

REVOLT!

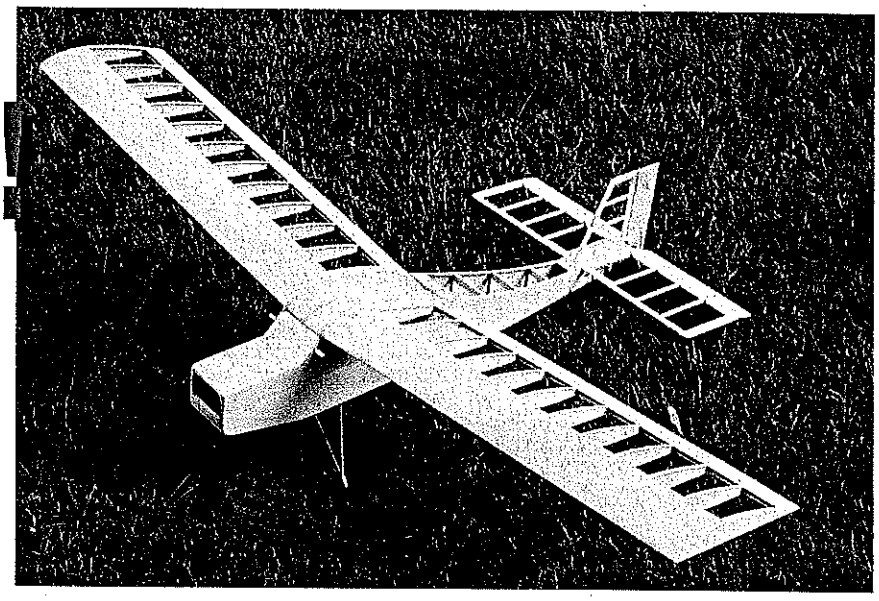
It's no shock that this model can handle a variety of power systems.



■ Bob Kopski

REVOLT!

The REVOLT! originated in 1992 as a model that could be used to easily test fly a wide variety of Electric products. It is a simple outline, 600-square-inch cabin design with heavy Fifties and Sixties influence. It has a 12½% thick flat-bottom wing section with decades of known good flyability. It employs proven

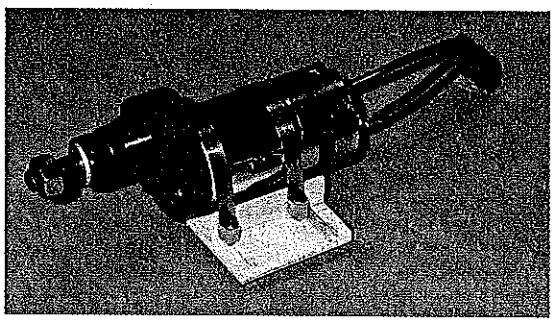


This completed REVOLT! framework, with landing gear attached but no engine or radio, weighed 17.6 ounces. Classic lines and gentle flight characteristics.

incidence, moment arm and tail surface area proportions.

The cabin and motor mount designs were developed to easily accommodate an unprecedented range of motor and battery systems with room left over. The entire framework design, wood sizes, etc. were all selected to support the intended goals.

It had to have a spacious fuselage so that motors, speed controls, radios and whatnot could be easily installed and removed. Since it would use a wide range of motors, it also had to accommodate a wide range of motor batteries.



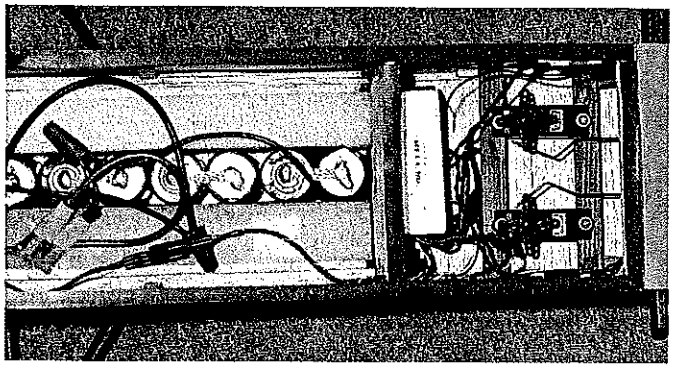
This low-end power Master Airscrew/3:1 gear drive is held to motor plate with brass straps.

Because the airplane was intended as a test flight vehicle, it had to be a stable, comfortable flyer—much like a good basic trainer. To fly well with "low" power systems, the design had to be lightweight. At the other extreme, the model had to be strong and durable. And regardless of the power system, it had to fly reasonably "long"—otherwise it would not be practical. The final requirement was that the finished Electric should have an attractive appearance without jeopardizing the design intent.

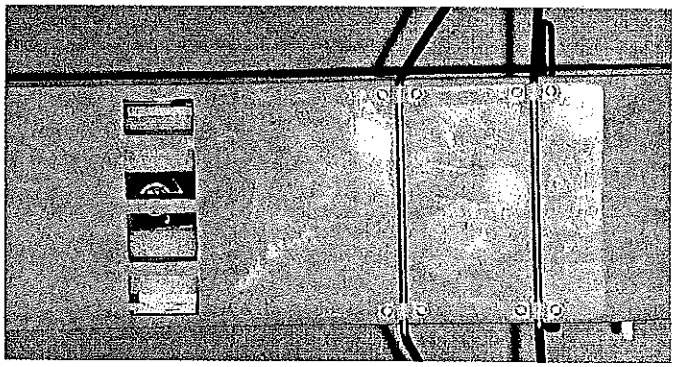
REVOLT! evolved throughout 1993 and served very well as a test vehicle. Several manufacturers' developmental Electric products were test flown in more than one of my REVOLT!s. Another model was outfitted with a telemetry system that allowed ground recording of inflight information such as motor current, battery temperature, etc.

Beyond this utility, REVOLT! slowly began to emerge as a terrific sport Electric that could readily serve as a solid basic trainer. It's clear that one could outfit the plane with a lower- cost power system to get started, then easily upgrade to an advanced power system later. One trainee learned to ROG (Rise Off Ground) with one of my models, and as I write this, he's building two of his own!

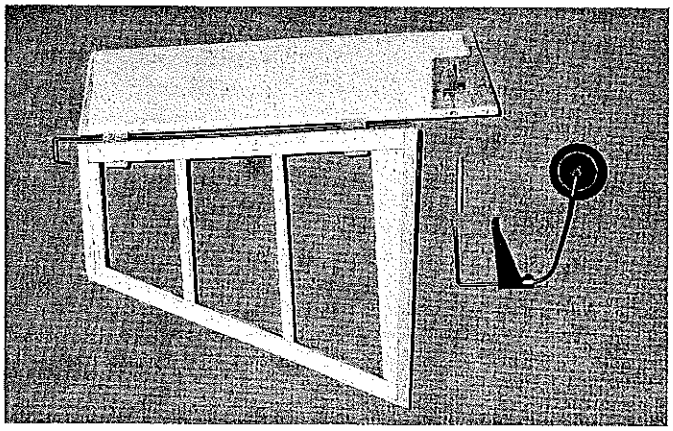
When properly trimmed, this stable, gentle flyer can self-recover from any adverse attitude and fly "hands off." And more than once I have been told, "it looks great!" This airplane is just so all-around "nice" to look at and to fly that sometimes I



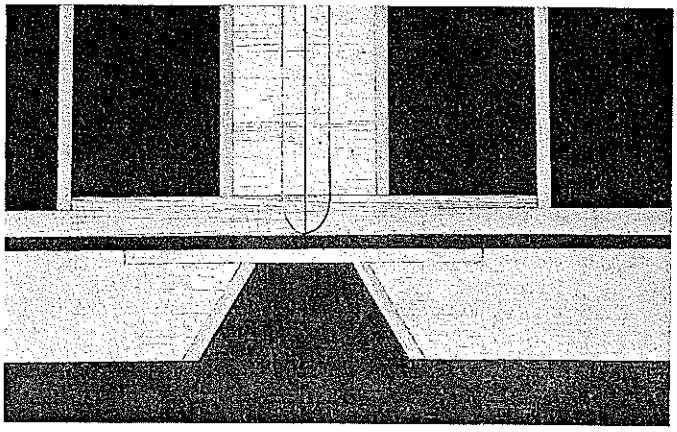
Seven-cell motor battery has foam fill in cabin area. Receiver, battery, and servos fit between formers F3A and F4A.



Bottom view of fuselage shows landing gear attachment and cooling air exits. Gear plate has cloth reinforcement.



Rudder/fin/tail wheel assembly. After covering, a single hinge pin will be held to the fin with tape.



Stab/elevator framework. Markings on stab show rudder position—omit/trim away covering in that area.

forget its original purpose!

For routine flying at the lower-power end, REVOLT! works very well with the Master Airscrew and geared cobalt 05 motors on seven 1.4 SCR or 1.7 Ah SCRC cells. (I've even used two 7-cell packs in parallel, to extend the flight time.)

At the higher power end, I've found that direct and geared 25s and 40s on 14 and 18 cells respectively can produce rather spirited flight. Of course, anything in between—such as the direct and geared cobalt 15s and the Graupner Turbo 700—also flies REVOLT! very nicely. I've even flown it with both smaller and larger power systems than these intended limits. REVOLT! has been flown at weights ranging from 52 to 94 ounces.

When flown as a sport model, typical REVOLT! flight times range from a solid 6-8 minutes with lower-power, lower-cell-count systems, on up to 14-16 minutes for the bigger systems flown the same way. Such flights include taxi, takeoff, climb out, loops, touch-and-gos, just cruisin', and other simple maneuvers consistent with a three-channel model.

As with any Electric, the best flying is usually accomplished using a speed control for efficient use of battery resources—to apply high power when needed and reduced levels when not.

A word before construction begins: The plans shown are the latest version. However, some of the photos were taken during REVOLT! design evolution, and may show minor structural details that differ from the present plans. The plan takes precedence, while the photos offer good overall guidance.

CONSTRUCTION

Stab and Rudder: I like to begin a new model by building the tail surfaces first—they are simple and result in a quick sense of accomplishment. Assembly of these surfaces is mostly straightforward, with only a few special points to be made:

Choose wood appropriate for the purpose. Leading and trailing edges and ribs should be medium-firm and straight. Choose light sheet for the stab center section, elevator and rudder; no need for "strong and heavy" here!

The elevator can be hinged with almost any plastic hinges, or with plastic tape as illustrated. The rudder uses pin-type plastic hinges.

The combined rudder linkage connection and tail wheel/bearing assembly is strong and functional. This design allows easy assembly of these parts after the model is completed and covered, and easy disassembly should the need arise. The rudder and tail wheel combination is free-moving, thus eliminating unnecessary load on the rudder servo. Care in the alignment and assembly of these parts ensures this.

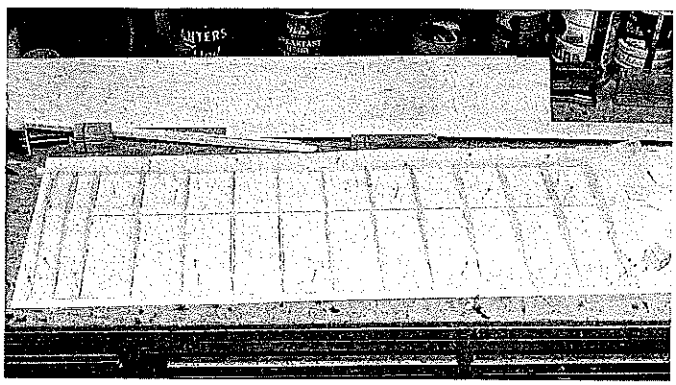
The tail wheel tiller slips freely in a 3/32 ID aluminum tubing bearing in the rudder. This is the only touchy part: the 1/8 hole for the tubing must be drilled correctly in the balsa. The 1/64 plywood side plates toughen-up the immediate area.

The rudder horn is carefully located so that its mounting screws pass through the rudder above and below the tubing, adding clamping strength in this area. This results in almost a direct drive from the pushrod to the tail wheel tiller.

A long hinge pin of .020 music wire replaces the short pins that come with the hinges, to simplify assembly and disassembly. Note that the tail wheel bracket is conveniently attached to the fuselage with screws.

The location of the wheel collar on the tail wheel strut is set to allow the tiller arm to just center and float freely in the aluminum tubing bearing. The collar/tail-wheel-bracket

Wing spar components are 3/16 square balsa and spruce in staggered lengths to optimize strength while saving weight.



Right wing panel under construction. D-box construction is strong and warp-resistant. Airfoil is 12 1/2% thick.

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interface takes up the vertical loads on the tail wheel with no significant burden on the rudder and its hinges. This installation has worked very well, and I feel it could be effectively used on many other models.

As for the woodwork, just assemble the tail structures as shown. When all the tail pieces are done and trial fitted, sand the surfaces and round the edges as shown. Carefully drill 3/32 holes for the elevator and rudder horn machine screws.

Typical weight of the tail surfaces before covering is 1.4-1.5 ounces. This will increase to about 1.9-2.0 ounces with covering and hardware.

Wing: The time-honored D-tube structure and is strong and warp resistant. This means it must be built warp-free, because it won't be easy to remove any twists that are built in! While of classic nature, this structure does employ some refinements to assure strength where needed and light weight everywhere.

The first (and unusual) task is to assemble spar sets. REVOLT!'s multipiece spars are built from 3/16 square firm balsa and spruce of staggered lengths. This uncommon approach results in less weight overall and high strength where it's important. A side benefit of assembling spars from pieces is that straightness can be assured.

Cover the plan with waxed paper and pin an aluminum straightedge (like a yardstick) on it. Cut the individual spar sticks, noting that the upper and lower spars have different amounts of spruce and balsa. Make all of these parts a bit longer than necessary; it's easier and even desirable to cut them off later.

Begin spar assembly by trial-fitting the spruce and balsa pieces to verify accuracy. If everything looks good here, separate the pieces and reassemble using medium-thick cyanoacrylate (CyA) glue. Apply accelerator on one wood side, apply the adhesive to the mating (unaccelerated) wood side, and then press and hold the pieces together in place against the straightedge. Place the four completed spar assemblies on the bench alongside each other, then run a sanding block them—rotating the spars to get all sides and edges.

With the spar assembly out of the way, wing construction can begin. The ribs can be medium-firm wood; the planking and capstrips light A grain. Choose firmer sheet for the TE pieces.The LE strip should be cut with the top edge beveled 38 degrees as shown. If it's not easy for you to do this, make the rectangular LE stock 1/16 higher than shown and butt the top LE planking against its inside edge at the appropriate assembly step.

Precut all 1/16 sheet LE and TE planking to proper width but a bit longer than the plan dimension. The LE top and bottom planking stop at midspar to allow the rib capstrips to rest on the spar. The top planking sheet width is greater than the bottom width, due to the airfoil curvature.

Begin wing assembly by putting the LE and TE bottom sheet in place over the plan—allow for a bit of overhang at the centerline. Using the plan guide marks and a straightedge, mark the rib locations on the sheet. I recommend a fine-point roller ball pen for this, but take care not to ding the wood with it. Glue the LE strip on the sheeting. Glue the 1/8 square TE capstrip in place. Install the center section sheet, stopping it 3/16-1/4 behind the spar rear edge location; this gap will be filled later. All sheeting is to extend slightly beyond the wing centerline; it will be trimmed later.

Glue the bottom 1/16 x 3/16 capstrips in place with thin CyA. Mist the LE and TE sheeting at the marked rib locations with accelerator.

Set a bottom spar (be sure it's a *bottom* spar!) in place, with spruce end toward the root, but do not glue. Allow it to overhang the centerline. Temporarily set several ribs in position from root to tip and over the loose spar to align it.Position these ribs accurately and glue to the LE, planking, caps, and TE sheet by running thin CyA over the interfaces. Install the remaining ribs.

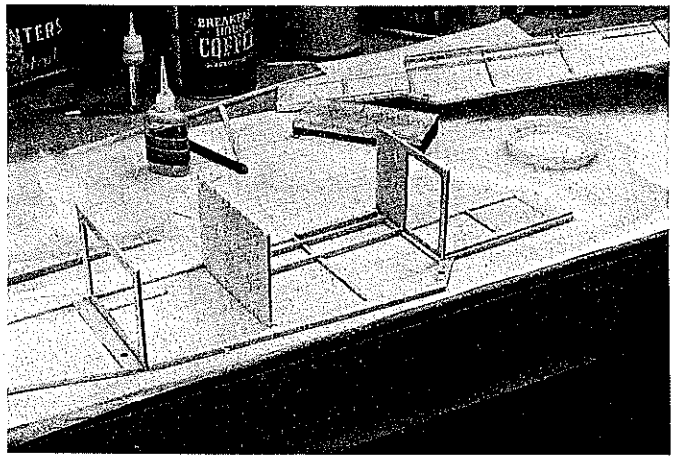
Note that the root rib is placed at a 6° slant inward. Try to do this accurately with the pattern provided. Be sure that the spar is glued to the bottom planking by running some thin CyA at the interface.

Cut and install the shear webs as shown—*do not* omit this important step! Trial-fit the top spar, making sure it rests properly on all ribs and webs. Remove it, put accelerator on the inside (bottom) surface of the spar, and apply medium-thick CyA in the rib notches and on the web tops. Press the spar in place (accelerator side down) with the spruce end overhanging the centerline slightly.

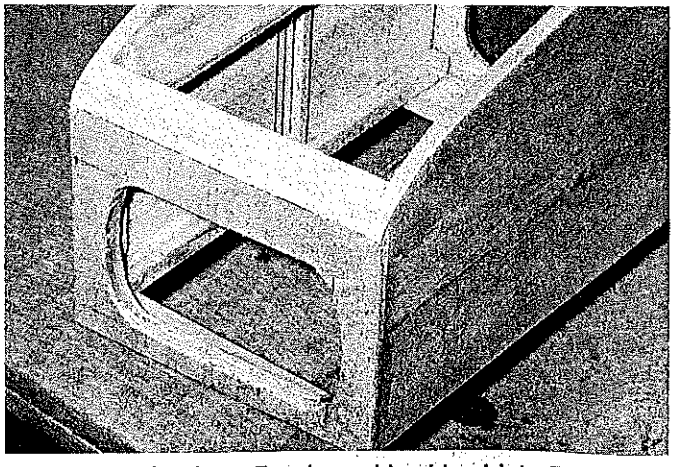
Trial-fit the top LE planking, remove and spray accelerator on the inside. Apply medium-thick CyA to the LE strip, top spar surface, and on the rib top edges between the LE and spar. Carefully place the top sheeting in position (accelerator side down, with some root overhang) and press, pin, or weight in place as needed. The TE sheet pieces are handled in similar fashion.

Install the top capstrips and center sheeting, noting that the latter is also stopped 3/16-1/4 behind the spar edge. Assemble the other wing half the same way—be sure to build one *right* and one *left* panel!

Carve and sand the LE to shape, and sand both panels to finished quality. Pay special attention to sanding the root spar and sheet overhang material flush with the angled root ribs.Trial-fit the dihedral joint by propping up



Fuselage assembly—use a square to check proper alignment of formers. Revolt! has 3/16 right thrust built-in.



F1 assembly in place. Fuselage sides blend into F1 to make sheet covering easier.

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the wingtips three inches at a point 3 1/4 inches from the bench. Sand the root surfaces as needed with a large flat block to get a tight fit with good endgrain-to-endgrain contact everywhere.

When the fit looks good, separate the panels, mix up some Hobbypoxy Formula I, and lightly coat all root endgrain. Allow the adhesive to soak in for 20 to 30 minutes. Mix more epoxy, apply to the roots, and join the panels with pin pressure. Leave this assembly undisturbed until the epoxy has cured.

Carefully cut out ribs #1 and #2 behind the rear spar edges. Remove about 3/16 of rib material by sawing, sanding, or filing through the purposely-left top and bottom center sheet gaps. Sand or file the inside spruce spar surfaces clean and flat in this area.

Cut and epoxy the plywood dihedral joiner against the spruce spars, making sure it does not extend above or below them. Fill any space between the cut rib ends and the dihedral joiner using balsa scrap and glue. This wedges the joiner between the cut rib ends and the spar.

The top and bottom center sheet gaps can now be filled with scrap sheet and sanded. Install the center TE 1/64 plywood reinforcement with medium CyA right over the dihedral angle; this material easily follows the shape. Sand the wing to your satisfaction in preparation for covering.

The ready-to-cover wing should weigh 7.5 to 8 ounces. A MonoKoted wing weighs 9.5 to 10 ounces. This wing does exceed my personal rule of thumb governing wing weight for Electrics (simple Electric sport wings should weigh 2.0 ounces per square foot, +- 10%). The REVOLT! wing is 10%-15% beyond this, because it can carry some pretty heavy power-system loads!

Fuselage: The structure is strong and light; this combination is obtained by using more wood pieces than usual. This does not make it difficult to build—it's just a little more work.

Begin the side sheet preparation by joining two three-inch-wide 1/16 straight grained balsa sheets (light but firm) for each fuselage side. Stack these two side blanks (I use 3-4 small pieces of double-stick tape), cut and sand to outline shape. Note: do *not* cut the curvature in the fuselage front bottom side view until called for later.

Be sure the bottom edge is straight and cut the wing dowel holes and pushrod exit slots. A sharpened brass tube can be used as a "cookie cutter" for round holes in balsa.

Separate the sides, align one over the plan side view and the other over the phantom side view (bottom edge to bottom edge) and pin in place. Use a straightedge over the plan guide marks and a roller ball pen to simultaneously mark all vertical location guidelines on the two sides.

Remove the sides, measure and mark all horizontal locator lines on each sheet (for the cabin side braces, motor plate rests, servo rail rests, etc.).

Cut and install the fuselage side pieces. Run a large sanding block over these pieces to smooth and equalize. Bore wing dowel holes.

Add 1/4 fuselage side pieces, including 1/4 square hard balsa LG mount strips, 1/8 x 1/4 hard cabin side rails (on edge), and 1/8 x 1/4 hatch rest rails (flat). Sand these pieces as above. Stack the fuselage side assemblies and sand outlines to match.

Cut Formers F2 (1/8 birch plywood) and F3A (1/8 balsa). Assemble former F4. Make sure these formers are of equal width, the correct individual height, and are cut square. Mark the locations of the three 1/8 x 3/8 cabin floor rails on F2 and F3A. Cut the 1/16 birch plywood landing gear plate to shape.

Begin fuselage assembly by cutting the right fuselage side parallel to and back 3/16 from the nose (for right thrust). Trim the 1/8 x 1/4 hatch rest rails back 1/8 from the front. Trial-fit all formers in the fuselage sides and trim as needed. Rest one fuselage side flat and glue F2, F3A, and F4 in place; use a square to assure alignment. Assemble the remaining side to the formers.

Put waxed paper on the plan and place the fuselage over the plan top view; pin in place at the cabin area only. Assemble the tail post pieces, draw the fuselage sides together at the rear, and glue the post in place. Pin against the plan while making sure the post is perpendicular to the bench.

Add all 1/16 x 3/8 fuselage top and bottom crosspieces. This is most easily done by cutting 1/16 x 3/4 to length, then slicing in half to yield two equal-length crosspieces. Rubber-band-loaded modeling clamps are very helpful in these steps.

With the fuselage still pinned in place,

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Revolt!

Type: RC Electric sport/trainer

Wingspan: 60 inches

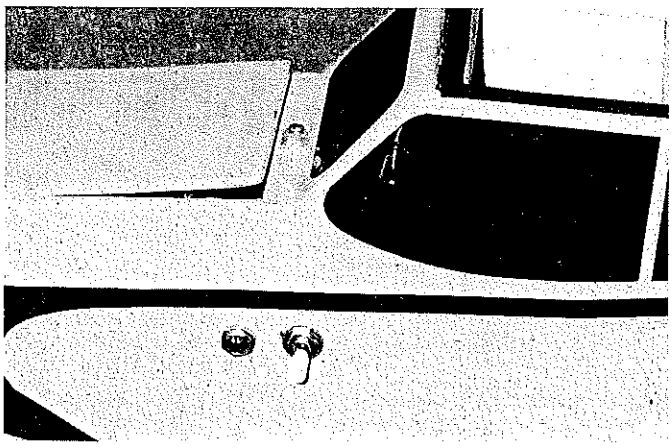
Motor size/type: 05 to 40

Number of channels: Three

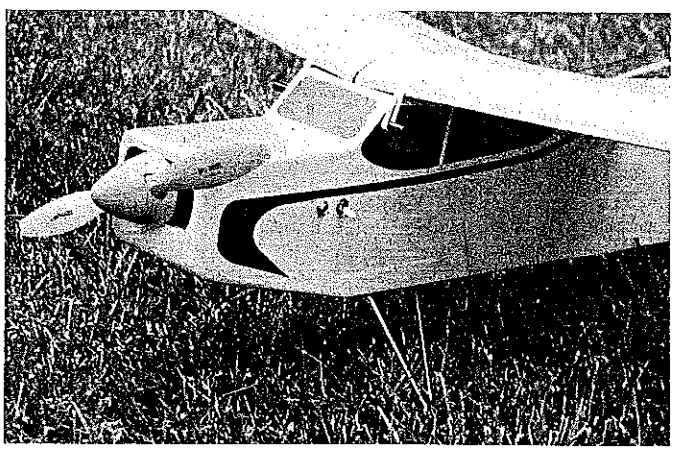
Flying weight: 50-100 ounces

Construction: Built-up

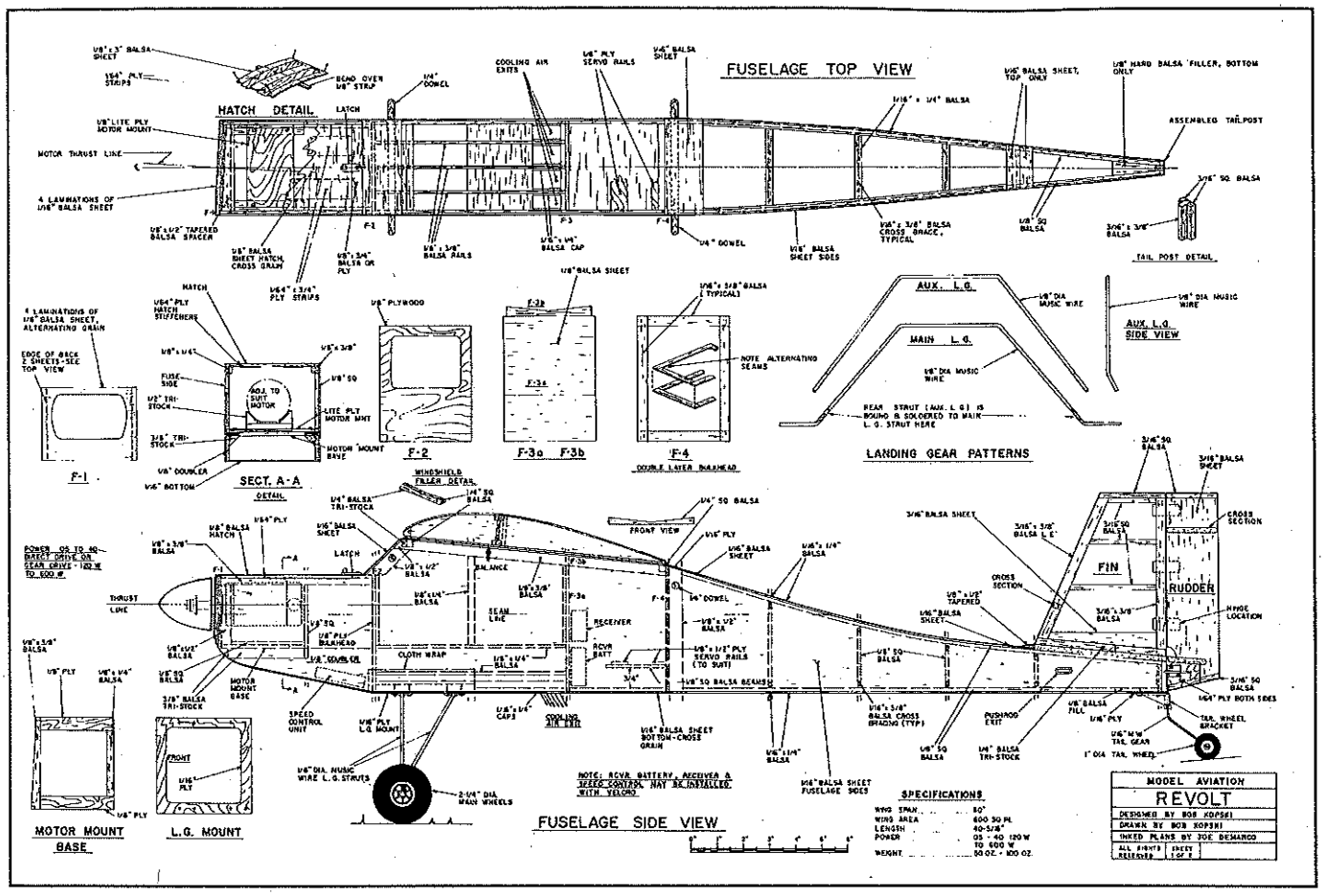
Covering/finish: MonoKote or similar

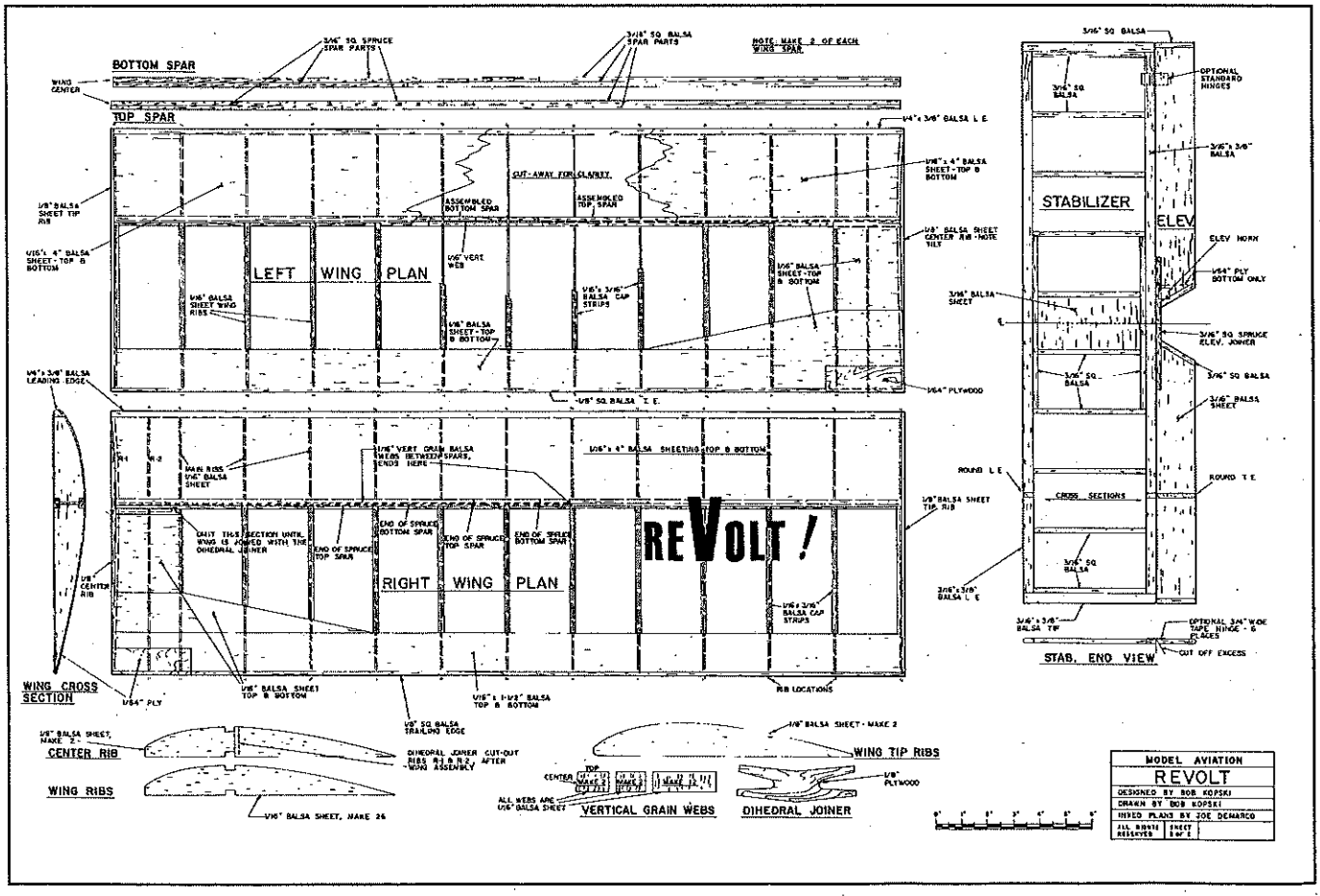


Convenient hatch pops up when hold-down is released. Arming switch and charging jack are also visible.



Large air intakes on each side of the spinner keep all of Revolt!'s power system components cool.


FUSELAGE TOP VIEW
HATCH DETAIL
TAIL POST DETAIL
AUX. L.G.
MAIN L.G.
AUX. L.G. SIDE VIEW
LANDING GEAR PATTERNS
SECT. A-A DETAIL
F-1
F-2
F-3a F-3b
F-4
FUSELAGE SIDE VIEW
MOTOR MOUNT BASE
L.G. MOUNT
FIN
RUDDER
SPECIFICATIONS
WING SPAN ..... 80"
WING AREA ..... 800 SQ IN.
LENGTH ..... 40-5/8"
POWER ..... .05 - .40 (20 W TO 600 W
WEIGHT ..... 50 OZ. - 100 OZ.
MODEL AVIATION
REVOLT
DESIGNED BY BOB KOPSKI
DRAWN BY BOB KOPSKI
INKED PLANS BY JOE DEMARCO
ALL RIGHTS RESERVED
SHEET 1 OF 2


BOTTOM SPAR
TOP SPAR
LEFT WING PLAN
RIGHT WING PLAN
REVOLT!
STABILIZER
ELEV
STAB. END VIEW
WING CROSS SECTION
CENTER RIB
WING RIBS
WING TIP RIBS
VERTICAL GRAIN WEBS
DIHEDRAL JOINER
MODEL AVIATION
REVOLT
DESIGNED BY BOB KOPSKI
DRAWN BY BOB KOPSKI
INKED PLANS BY JOE DEMARCO
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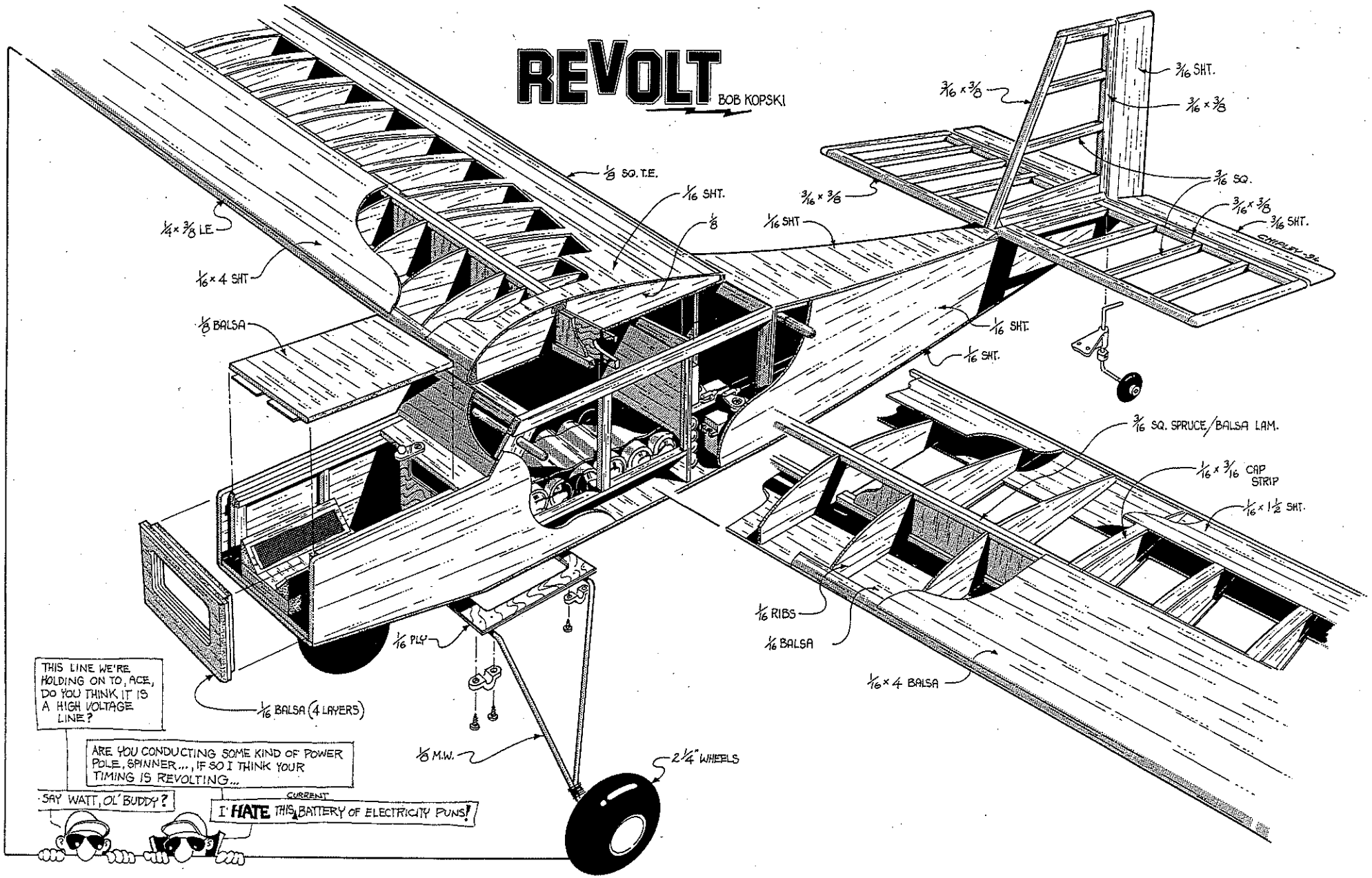
SHEET 2 OF 2


REVOLT
BOB KOPSKI
1/8 SQ. T.E.
1/16 SHT.
1/8
1/4 × 3/8 L.E.
1/16 × 4 SHT
1/8 BALSA
1/16 PLY
1/16 BALSA (4 LAYERS)
1/8 M.W.
2 1/4" WHEELS
3/16 × 3/8
3/16 SHT.
3/16 × 3/8
3/16 SQ.
3/16 × 3/8
3/16 SHT.
1/16 SHT
1/16 SHT.
1/16 SHT.
3/16 SQ. SPRUCE/BALSA LAM.
1/16 × 3/16 CAP STRIP
1/16 × 1 1/2 SHT.
1/16 RIBS
1/16 BALSA
1/16 × 4 BALSA
THIS LINE WE'RE HOLDING ON TO, ACE, DO YOU THINK IT IS A HIGH VOLTAGE LINE?
ARE YOU CONDUCTING SOME KIND OF POWER POLE, SPINNER..., IF SO I THINK YOUR TIMING IS REVOLTING...
SAY WATT, OL' BUDDY?
I HATE THIS CURRENT BATTERY OF ELECTRICITY PUNS!

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sand the top edges from F4 to the stab LE location to make them smooth and equal. Glue the 1/16 x 1/2 plywood crosspiece at F4; 1/16 sheet aft of this; and the 1/16 sheet at stab LE. Add the 1/16 x 1/4 top longeron and crosspiece capstrips.

Install the 1/8 x 3/4 crosspiece at the base of the windshield and the 1/8 sheet tapered-width crosspiece at the top nose location. Sand across all top edges as required. Add the 1/8 x 1/2 triangle-section crosspiece at the stab LE location. Remove the assembly from the board.

Complete the fuselage bottom assembly by installing the 1/8 x 3/8 hard balsa battery-bearer strips between F2 and F3A. Sand these flush with the fuselage bottom edges and glue the 1/16 birch plywood landing gear mount plate in place. Add the bottom surface 1/16 balsa sheet crossgrain from this plate back past F4 as shown. Allow for the air exits.

Cut to fit and install the 1/8 bottom sheet fill between the longerons at the rear. Install the 1/16 hard sheet over this area as shown. Install the bottom 1/16 x 1/4 longeron and crosspiece capstrips. Trim and sand overall as required.

Assemble the motor bearer frame over the plan; remove, sand, fit in the fuselage, and glue in place. Add the three hard 3/8 triangular-stock pieces underneath the bearer frame as shown. Sand the front fuselage edges flat in preparation for installing the front former. Cut away the 1/8 x 1/4 rear motor plate rear balsa crosspiece (this was a temporary brace).

Assemble F1 from four alternating-grain hard 1/16 sheets. Note that two thicknesses fit inside the fuselage opening and two cover the full front. The easiest way to do this is to make the "inside" ones to fit, glue them to oversize "outside" ones, and trim the latter to size. Cut the front opening in this F1 stack and glue in place.

Using a plan tracing as a guide, mark, cut, and sand the fuselage left and right side bottom nose curvature. Sand the bottom of F1 smooth to this curvature. Add the 1/16 crossgrain bottom sheeting from the plywood LG plate forward, following the forward curvature past F1. This is most easily done by applying accelerator to the sheet and medium-thick CyA to the fuselage pieces. Trim, sand, and blend into F1.

Cut, fit, and install the top cabin LE and TE balsa wing saddle cross pieces, F3B, and the 1/16 windshield sheet. Assemble the hatch pieces from light A grain 1/8 sheet and 1/64 plywood and install the hold-down. Cut and fit the wing dowels, and remove temporarily.

Sand the fuselage thoroughly. The fuselage should weigh 6.0 to 6.5 ounces ready to cover, and 6.5 to 7.0 ounces when covered with MonoKote.

Assemble the landing gear, fit it to the fuselage, then remove. Assemble the tail wheel bearing and strut, temporarily install as shown, and remove. It's best to mark and drill the holes with a 1/16 bit before first inserting the #2 x 3/8 sheet metal screws. When the screws are removed, put a drop of thin CyA in the holes to toughen the threads. Don't reinstall the screws before the glue has cured!

RC Equipment Installation: Cut the servo rails to size and glue them in place as required for your servos. Make and install pushrods of your choice. Temporarily install the rudder and elevator horns and trial fit the tail surfaces in place using pins to hold. Make and trial fit all linkages. Remove the hardware and tail surfaces. Install receiver, battery and wiring harness behind F3A. I use double-stick Velcro to mount the receiver and battery to the floor or to the former. (Coat the wood with Ambroid first, let dry, then attach the Velcro.)

Power System Installation: Cut a 1/8 Lite Ply motor mount plate to the width needed for your motor. It should be long enough to just slip in place between the fuselage sides and on the bearers.Mark the mounting hole locations and drill with a 1/16 bit. Position the plate on the bearers locating it fore/aft as needed by the motor. Hold in this position, and using the plate as a guide, drill into the bearers and triangular stock with a long 1/16 bit.

Remove the plate and enlarge the existing holes with a 3/32 bit for clearance. *Do not* redrill the bearer holes. Remove the plate and temporarily insert #2 x 1/2 sheet metal screws in the bearer holes. Remove and coat the

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threads with CyA. Mark the thrustline on the plate, using the plan as a guide. Be sure to allow for the intended right thrust, and for the prop shaft to emerge centered in the nose opening.

Cut any needed spacer pieces (and the triangular stock) to form the motor-nesting V-block. Allow for the 1/16 foam motor rest tape. Trial-fit the plate with the motor resting in place to verify proper placement, and remove.

Cut and form the motor tie-down straps from .016 x 1/4 brass strip to suit. The square pull-down tubes are 1/8 ID brass. Mark and drill the motor tie-down screw holes in the motor mount plate. Glue 2-56 blind nuts on the plate bottom.

Trial-fit the motor and tie-downs to the plate using 2-56 x 3/4 socket head draw screws. Install this assembly in the model, verifying thrustline, prop center, and overall clearances.Install the motor battery, using snug-fitting plastic foam block to fill any excess space. The foam prevents the escape of cooling air and keeps the pack in place. Incoming (cooling) air is intended to flow between the cell intersections for battery cooling.

Install the speed control where shown with double stick Velcro. Install the wiring harness/arming switch/charge connector assembly to suit. Interconnect the speed control and receiver, and charge and test the motor system.

Covering: Remove the heavier equipment and surface-mounted hardware in preparation for covering.

Install the iron-on cloth reinforcement over the landing gear plate. Use a household iron with a paper towel between it and the cloth, and follow the manufacturer's heat recommendations. I've used Bondex Mending Tape for this sort of work for more than 25 years. It's available at most sewing departments, and it makes an easy, inexpensive, very strong assembly.

My REVOLT!s are covered with MonoKote, but any of the light weight coverings will do. I prefer to cover the individual tail surfaces first, assemble the fin to the stab, then attach the entire tail assembly to the covered fuselage. Be sure to leave covering off were the glue joints will be made.

After the covering is done, reinstall all equipment. Verify balance and shift the motor battery as needed to stay within the indicated range. Some of the largest power systems may require some weight to be added at the rear of the fuselage. Check out all equipment and control surface directions and throws.

At this point, you're done! (I like to photograph new planes right here.) There's nothing more to say except "Go fly a REVOLT!" And here's hoping you enjoy this Electric as much as I have! ✈