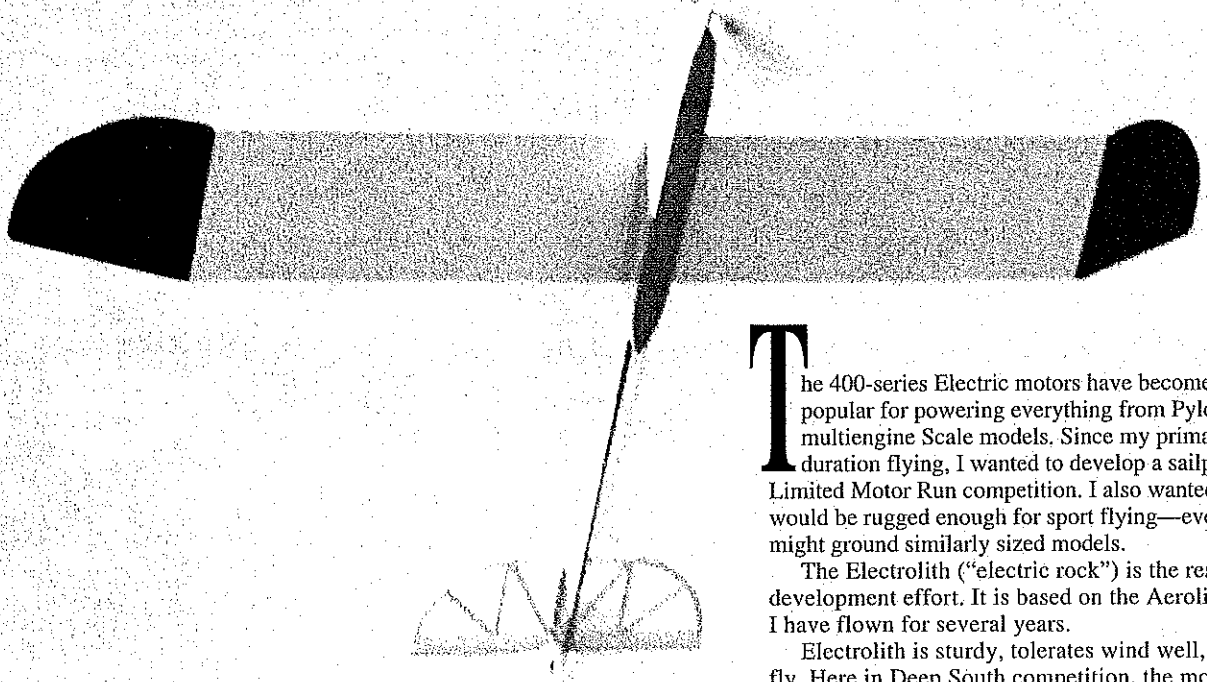
# ELECTROLITH

■ Ken Cashion



Simple but unusual planform. Photos of Electrolith in flight were taken by Bettie Cashion, the author's wife.

The 400-series Electric motors have become increasingly popular for powering everything from Pylon racers to multiengine Scale models. Since my primary interest is duration flying, I wanted to develop a sailplane for 400-series Limited Motor Run competition. I also wanted a model that would be rugged enough for sport flying—even in a wind that might ground similarly sized models.

The Electrolith ("electric rock") is the result of that development effort. It is based on the Aerolith original design I have flown for several years.

Electrolith is sturdy, tolerates wind well, and is a delight to fly. Here in Deep South competition, the motor run times are 90 seconds, with eight-minute flight times. At a recent windy contest, for a 400-Series All-Up-Last-Down event, I managed to shoehorn a pack of seven 1,000 mAh cells into the model; it won.

For 400-series Limited Motor Run competition (sometimes called "½A"), the preferred power is the 400 motor, 4:1 gearhead, and an 11 x 8 folding prop. Generally, seven 500AR SCR cells power the motor. I put a stator ring on the motor to limit the current (and heat) a little, and used a small electronic speed controller (ESC) rather than a servo-operated switch (though the switch would work perfectly well if wired with a prop-brake function).

The motor, gearhead, and prop package is known as the "½A 400 Ultimate Combo" (NCR 400) and is available from New Creations R/C, Inc. The motor comes timed for competition, but without the stator ring.

## CONSTRUCTION

After reviewing the plan, make a kit by cutting all pieces. A 1/16 plywood rib template simplifies cutting the majority of ribs. The ribs are cut as one piece, then cut to fit as they are

laid out on the wing plan. Cut F1, F2, P1, P2, P3, P4, and the pod bottom slightly oversize. Trim for proper fit after assembly.

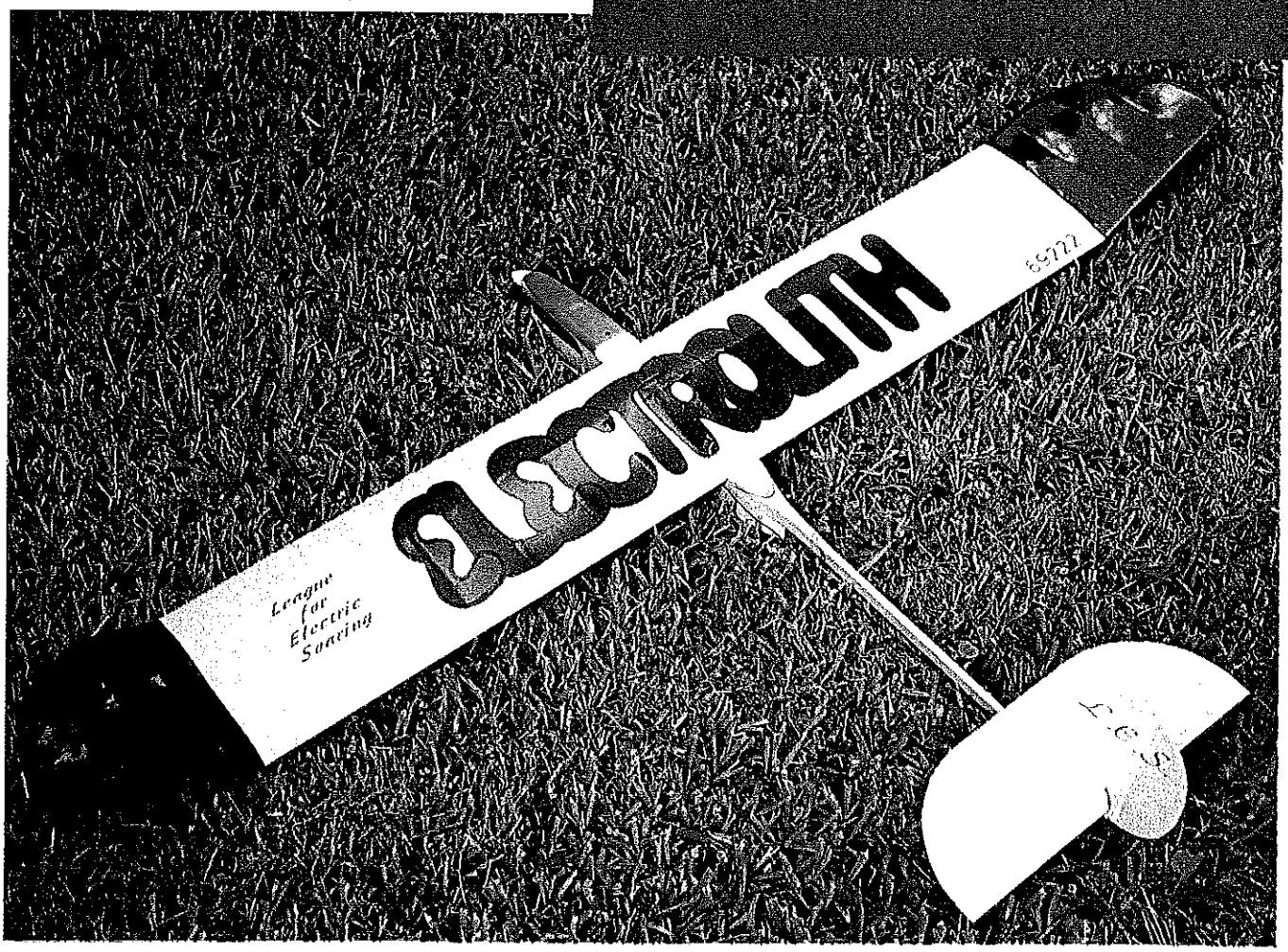
Hobbico Bullet thick and thin cyanoacrylates (CyA) and accelerator were used exclusively.

**Empennage:** Build all parts over the plan using hard balsa for the leading edge (LE), fin/rudder spars, and stab center; use soft balsa elsewhere, especially for the elevator. Before the rudder clearance is cut in the elevator, the dowel should be inset and sanded to the thickness of the elevator.

**Wing:** Lay out the wing plan so the center section can be constructed in one piece. Cut the rib notches in the trailing edge (TE). Secure the TE, bottom center sheeting, bottom LE sheeting, spar, lower capstrips, and LE (it will be shaped later). There should be no break in the center sheeting at wing center. Add center plywood braces. Cut the ribs to fit between LE, spar, and TE, and start gluing the ribs in place, leaving dihedral ribs until after the tips are joined to the center section.

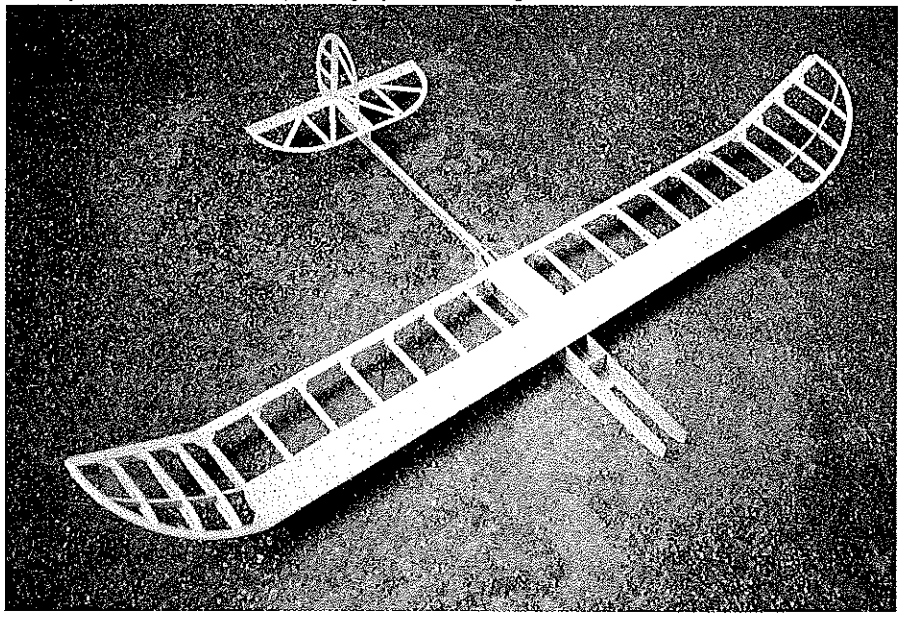
Before removing the center section from the building board, lay out the tips. Secure the notched TE to the plan as a reference. The laminated tip goes together very quickly using CyA and accelerator. Cut 24 strips (12 for each tip) of 1/32 x 3/8 x 14 balsa. Make the wingtip form and cover with plastic kitchen wrap. Rubber band the ends of the first strip over the former, and add one 1/32 strip at a time, gluing each in turn. This will produce a very light, slightly oversize, rigid LE. Sand the nominal 3/8 tip to 5/16.

The tip spars are done the same way, using four strips 1/32 x 5/8 x 9 strips per tip. Sand the nominal 5/8 to 17/32.

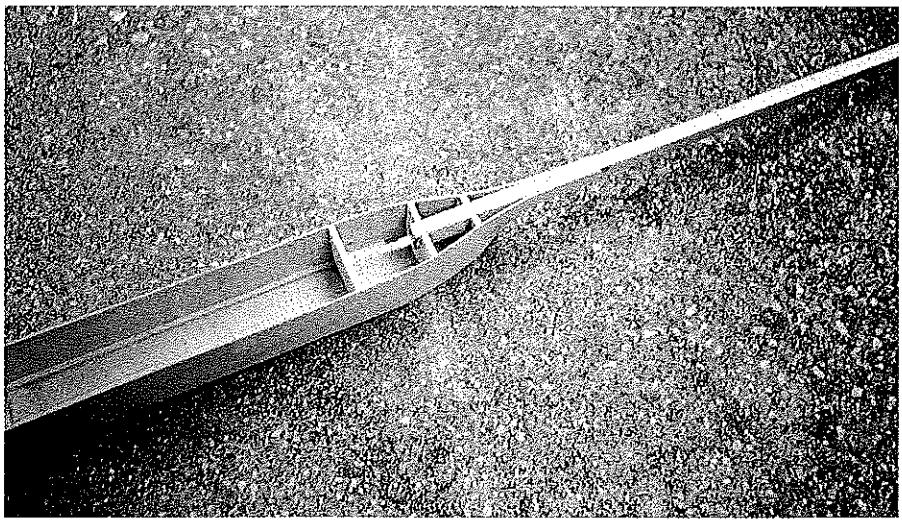



**Main wing panels are covered with Micafilm "for light rigidity"; wingtips are covered with MonoKote.**

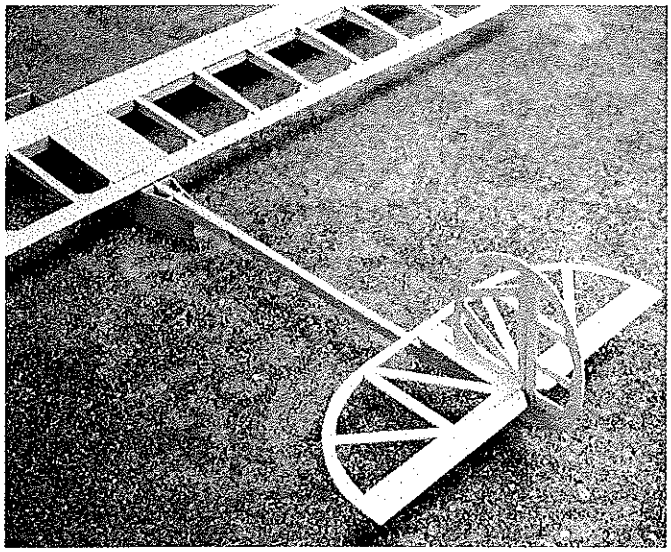
Photos by Ken and Bettie Cashion Graphic Design by Jill Ann Cavanaugh



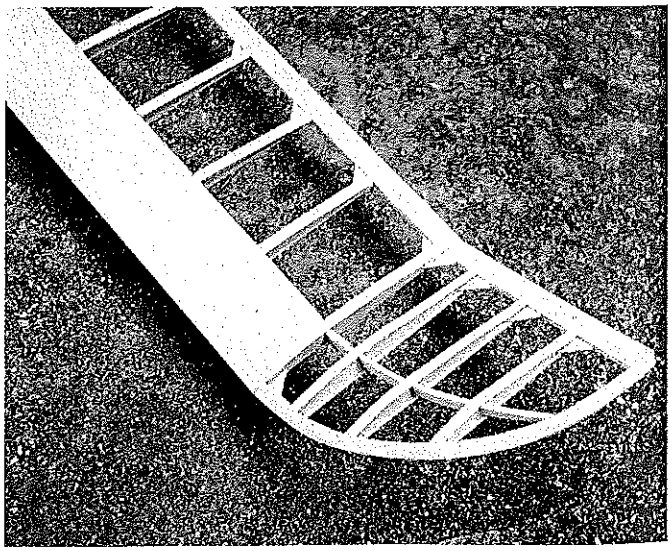
**Initial framing. Construction is rugged enough for contest use or sport flying.**



**Pod-and-boom design dates to Frank Zaic Floater series. Fuselage sides and boom are 1/32 plywood; top and bottom of boom is hard 1/8 x 1/4 balsa.**



**Empennage leading edges, spars, and stab center are hard balsa; balance of the tail structure can be soft balsa.**



**Wide capstrips increase covering contact area for improved torsional rigidity. Tip spars are relieved between ribs.**

Cut the ends of the laminated tips and spars to length and secure to the plan. Cut and secure the lower capstrips to the plan and cut the tip ribs to fit. Mark the LE and spar at the ribs, remove the LE and spar from the plan, and taper both. The spar should be the height of the ribs; the LE should be 1/32 higher than the ribs.

Glue the tip to the TE, the spar to the tip, and three tip ribs in place, leaving the dihedral rib for later. Add the upper cap strips only to the tip ribs at this time. Add TE/rib gussets to the tips and center section.

Remove the wing sections from the board, place the wing center section LE at the edge of a table, and plane/shave/sand away excess wood on top of the LE to approximate finished shape (the upper LE material must follow the basic curve of the ribs before the sheeting is applied).

Cut the plywood dihedral braces to shape. Support the tips at proper dihedral, trim LE, spar, and TE dihedral joints to mate, and then secure dihedral braces to the center section. After confirming proper dihedral, secure the tips to the center section. Cut and CyA the dihedral ribs in place. There is a capstrip on top and bottom of each dihedral rib—eight total for the wing. This makes the dihedral joint 1/2 inch wide, facilitating the covering process.

Secure the wing to the building board again. Confirm that the joints are firm and pieces are aligned, then LE and center sheeting and capstrips.

Remove the wing from the board and final-shape the LE. Before covering, remove a small amount of material from the upper edge of the tip spars between the ribs. This prevents the tightened covering from contacting the upper edge of the tip spar, interrupting tip airflow. The fairings at the LE and TE will be added later.

**Fuselage:** The fuselage construction is based on Frank Zaic's Floater sailplanes.

I built several Floaters and liked his plywood pod-and-boom construction. The thin material permits a small frontal area combined with considerable strength and a relatively large volume for equipment—always a consideration in Electric models.

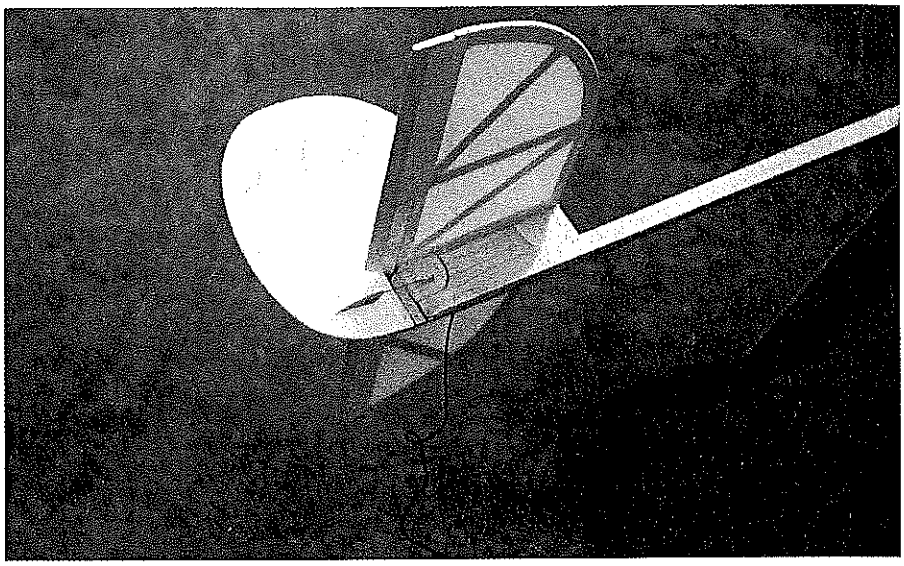
Cut the sides from 1/32 plywood. Pod formers F2-F6 are cut from 1/8 Lite Ply. This construction method is a little different, but not difficult. If the fuselage is to have a natural finish, accurate building will prevent subsequent sanding from exposing plywood veneers underneath the outer veneer, except in streamlined areas where this can accent the general appearance.

**Boom:** Shape the hard balsa top and bottom strips at the aft end, and holding one boom side on a flat surface, glue the strips in place, but do not try to press the aft end of boom and strips together.

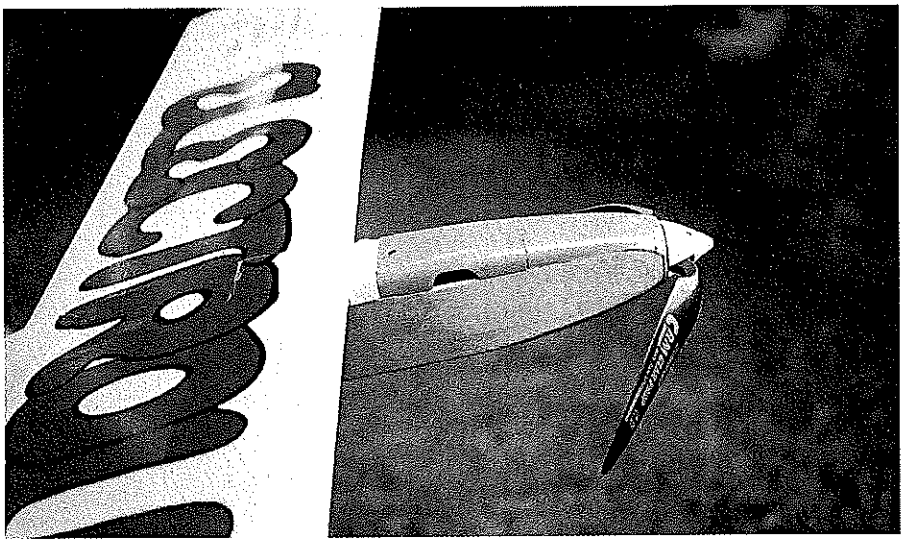
This is the time to decide what type of pushrods to use. If tubes will be used, lay in the tubes and secure in a few places. They should be overlength and trimmed to size later. (Use proper CyA or epoxy on plastic tubing.)

The other boom side is glued with the boom still held on the flat surface. Press and shape the aft boom sides and glue in place. Glue small pieces of 3/32 balsa in the plywood stab support, then fair the front and back of the stab support with soft balsa. Confirm that the top of the stab support and the top of the boom are parallel. This is important—the incidence will be set at the fuselage/wing saddle.

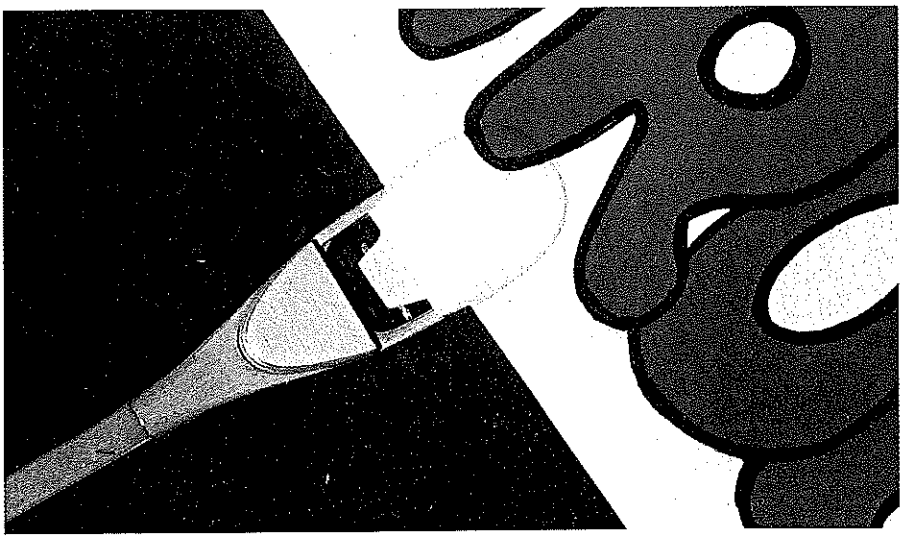
**Pod:** Glue 1/8 square spruce longerons (do not use balsa) to the pod sides. By this time, the size and location of the servos should have been decided and the actual location of F4 determined. There should also be some idea of where the other gear



Small throttle control cable is used for pushrods, with Z-bends to fit the plywood control horns. Bottom of pod and top of boom should be parallel.



Right side view shows air cooling exit in canopy. Upper nose fairing, canopy, and forward wing hold-down fairing are made from one piece of soft balsa.



Tab on wing trailing edge slides into fuselage. Forward portion of wing is secured with 10-24 nylon bolts; one bolt would do, but author prefers to use two.

## ELECTROLITH

**Type:** RC sailplane

**Wingspan:** 57 inches

**Motor:** Speed 400

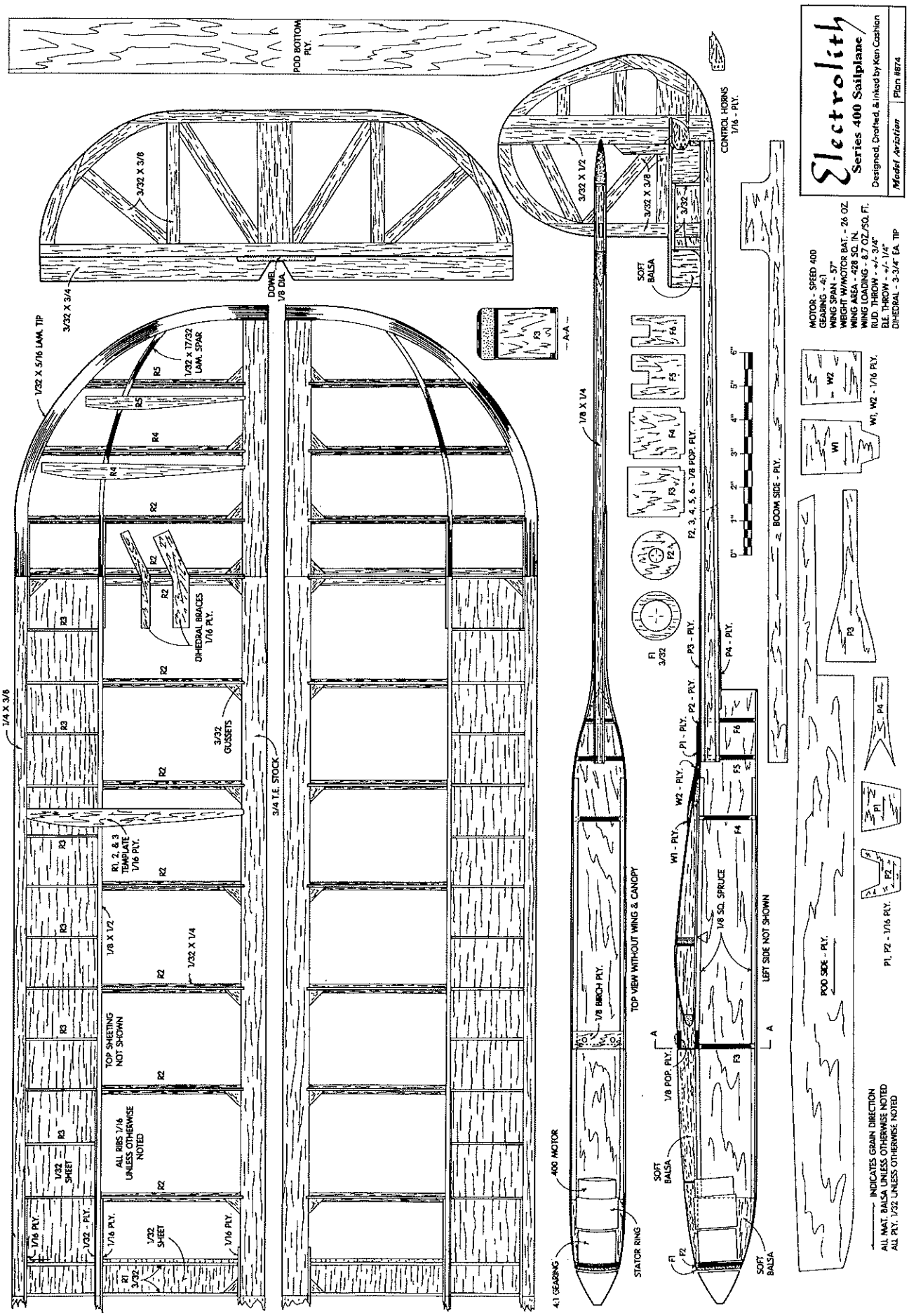
**Functions:** Rudder, elevator, motor

**Flying weight:** 26 ounces

**Construction:** Built-up

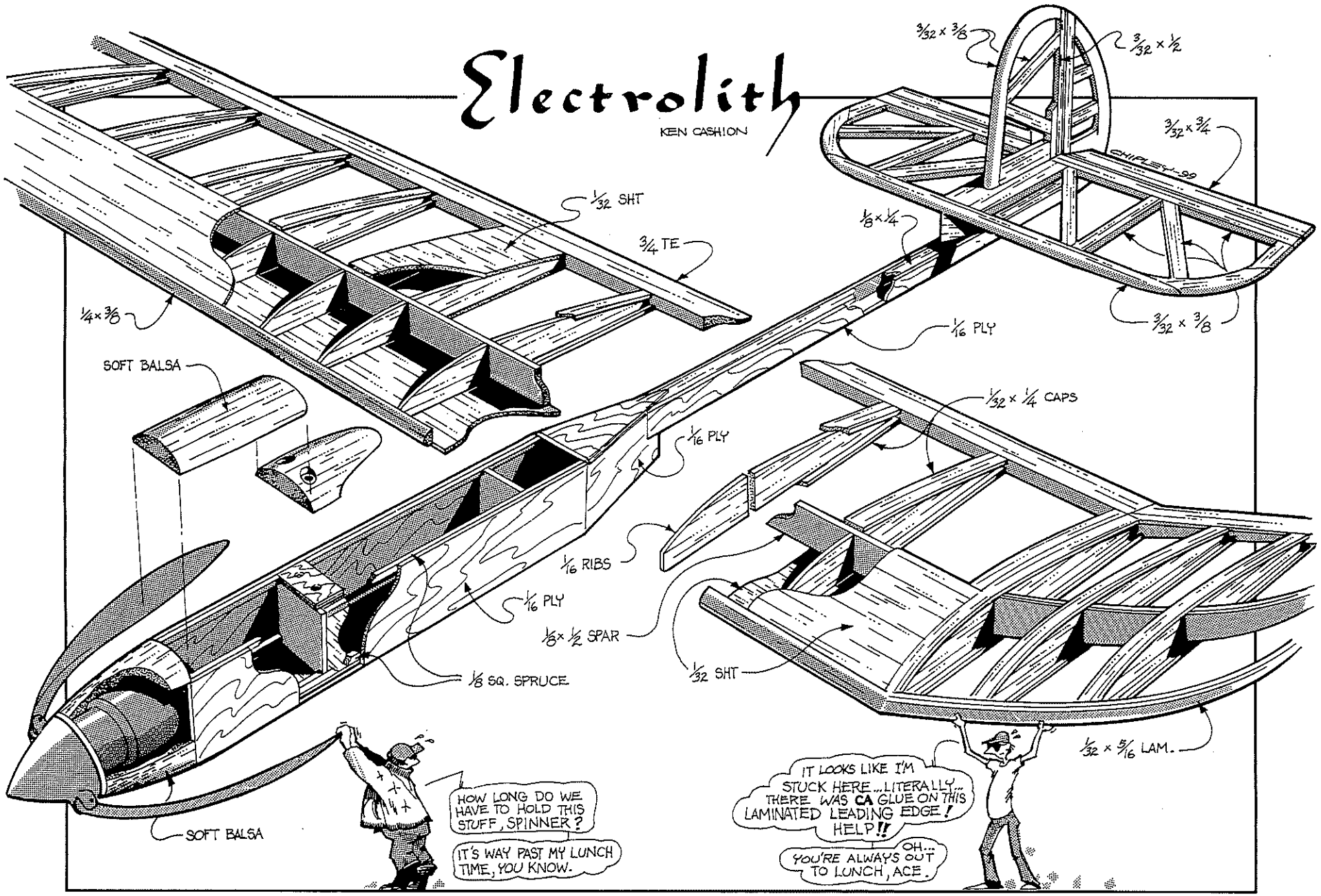
**Covering/finish:** Film on flying surfaces; lacquer on fuselage

Full-Size Plans Available—see page 173



# Electrolith

KEN CASHION



will be installed, so that minimum-size clearance holes can be cut in F3 and F4.

While the pod bottom is secure on a flat surface, confirm that boom notches in F5 and F6 are on the centerline and that the formers are in good contact with the pod bottom. Glue F3-F6 in place.

Trial-fit the pod sides to check fit to the pod bottom, then carefully glue pod sides to F3 and F4 and the pod bottom between F3 and F4. Do both sides at the same time to maintain symmetry; do not let the pod twist during this operation. It is OK if the pod bottom is slightly oversize, because the edges can be trimmed later.

Compress the lower, aft pod sides to touch at the pod rear behind F6. After beveling the inside plywood edges to fit when compressed, join them with thick CyA. (Keep the accelerator within reach.) If alignment is true, reinforce all pod joints with a second liberal dose of CyA and accelerator.

Shape the outside surfaces of the balsa block to conform to the plan, glue the block to the pod sides, press the pod bottom to the nose block, and glue in place. The nose cross-section should remain square at this time.

Pull the top, aft pod sides apart and test-fit the boom in the pod notches of F5 and F6. Confirm that boom is straight and aligned to the pod centerline when viewed from above and the side. The pod bottom and the top of the boom should be parallel. Secure the boom to the formers with liberal amounts of CyA and accelerator to build small fillets. Do not glue the pod sides to the boom during this operation.

(The boom could be epoxied in place and its alignment observed during the "setting" process, but I prefer to hold pieces in alignment and then immediately "freeze" their position with CyA and accelerator.)

Should a small misalignment occur, the stab support can be trimmed just before the empennage is attached. Allow the top, aft pod sides to assume the natural bending curve provided by the wood. After confirming symmetry, glue the sides to the boom.

Install the servo rails and temporarily install the control rods to determine servo

positions. Install the servos, saving the rod installation for later. Attention is needed here to make sure all parts move freely in the small space available.

(The less room used by the servos, the more room is available for battery packs and RC gear. Once the servos are in, they will stay awhile, but the batteries will be going in and out; having the extra room will be appreciated.)

Cut the birch plywood wing hold-down piece and glue in place. Fit pod fairings P3 and P4 and glue in place. Excess material can be removed to match the sides and bottom after the fairings are in place.

Place the wing on the fuselage and check alignment. When satisfied, position W1 at the top center TE and glue in place. (Note grain direction. W1 will need to flex a small amount for wing installation.)

Draw the outline of W1 tab on top of P3. Trim P2 to just clear this tab and glue P2 in place. Glue P1 to P2 and trim edges to fit.

Check the wing alignment and the wing tab fit in the newly formed slot on the rear of the pod. Trim and sand wing tab W1 to get proper fit and/or alignment. Mark position for W2 on top of W1, remove the wing, and glue W2 in place. Excess material can now be removed from fairings.

Hollow a balsa nose block to allow a snug slip-fit of motor and gearhead. Secure F2 to the motor using two small screws into the gearhead.

Slip the motor, with F2 attached, into the fuselage to test fit and alignment. Trim the fuselage nose block to attain flush fit with F2. Using a very small amount of CyA, secure F2 to the fuselage. Remove and reinstall the motor through the "cockpit area" and confirm fit and clearances. After removing the motor again, add more CyA to secure F2 to the fuselage; then glue F1 to F2.

The upper nose fairing, canopy, and forward wing hold-down fairing is now constructed from one piece of soft balsa. Confirm that the top forward fuselage from wing LE to nose is flat, trimming where necessary. Cut this balsa piece to the general shape of the fuselage from the wing to the nose. Make it long enough to overlap a small portion of the wing LE.

Remove material from the rear of the fairing to match LE sheeting. A small amount of material may be removed under the nose fairing to provide clearance for the motor. Temporarily glue the fairing to the fuselage.

Cut the poplar plywood wing fairing piece slightly long, mark the location on top fairing, cut the slot, and CyA in place.

Draw the spinner diameter on F1 and start shaping the nose as indicated on the plan and in the photos; this is not critical. When you are satisfied with the shape,

sand the fuselage well, and cut the piece free from the fuselage. Cut this into three pieces to produce the top nose fairing, the canopy, and the forward wing fairing.

Securely glue the nose fairing to fuselage. Set the canopy and wing fairing in place, position the wing in proper alignment on the fuselage, and glue the wing fairing to the wing. Leave sufficient clearance at the canopy ends so the covering material will not cause binding during canopy installation. Remove excess material from inside of the canopy and cut the motor cooling vents.

Set the wing in place with proper alignment and drill through the wing fairing and wing hold-down brace with a #25 (5/32) drill as shown on plan. Remove the wing and harden the brace holes with CyA. Tap the holes for 10-24 nylon screws. (One screw would be sufficient, but I use two—and though a 10-24 is large, I prefer coarse threads when tapping plywood.) Make screw clearance holes in the wing fairing with a #12 (3/16) drill.

**Preassembly:** Trial-fit the fin and stab and check alignment. Trim the stab support until satisfied, and mark the outline of the mating surfaces so these areas can be left free of covering material to ensure a strong bond.

Install servo and empennage control horns. Pin the empennage in place and temporarily install pushrods to determine aft rod/horn location for neutral. Make aft pushrod connections. Leave the forward end of the rods long at this time. Remove the empennage.

**Covering:** I use Coverite Micafilm almost exclusively on Electric sailplane wings and empennage because the airspeed of such models can rapidly become excessive, and torsional rigidity is a must. I also use rather wide capstrips to increase cover bonding surfaces—again making the wing more rigid. I used MonoKote on the wingtips. Always secure covering where it is in contact with the structure; it should be a part of the structure, not just a shiny plastic bag containing model parts.

A small amount of blade work will feather the edges where plywood surfaces

overlap. To get a good finish on plywood, hold a single-edge razor blade nearly vertical, drag the blade with the grain and only the tiniest bit of wood will be removed. This is quite easy and produces a smooth, hard surface.

My fuselage received several light spray coats of fast-drying clear lacquer (available at Wal-Mart®). When the bottom gets scuffed, just sand that area lightly and respray. A variety of finishing materials could be used—use your imagination.

**Final Assembly:** With the empennage hinged (I used MonoKote strips), fit the vertical tail into the horizontal tail and set both on the stab support. When they are aligned, secure with CyA.

Install the pushrods and attach the aft ends to the control horns, position the control surfaces to neutral, and mark the forward pushrod ends at the servo horns. Cut the rods to proper length and complete the servo ends of the pushrods.

Install the motor, prop, and spinner. Install the receiver and motor controller; by moving the flight battery (I use a 270 mAh pack) and motor batteries fore and aft, determine their location to balance the model where shown on the plan. Install the switch.

When power is removed from a 4:1 gearhead and 11-inch prop in flight, the prop will continue to windmill unless the motor has braking capability. If a servo/switch arrangement is used for motor control, make sure there is a prop-brake arrangement on the switch.

Should an electronic speed controller (ESC) be used, it too must have a prop-brake feature. I do not recommend using battery eliminator circuits (BECs) unless the model is for Scale or general sport. When those models start to lose motor power, they land very soon; however, with duration models, it is easy to keep flying long after the battery can no longer power the motor—and sometimes the receiver loses power, as well.

Make motor controller, servo, and range tests with the prop removed.

**Flying:** With the control surface throws as shown on the plan and the CG positioned as indicated, the model will fly right from your hand and start a gentle climb. Be ready to press in a little *down* elevator should it start to balloon.

What follows for the rest of the flight is the flying fun for which you built the Electrolith. ✈

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**Sources**

New Creations R/C, Inc.
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Hobbico products are available from Tower Hobbies.