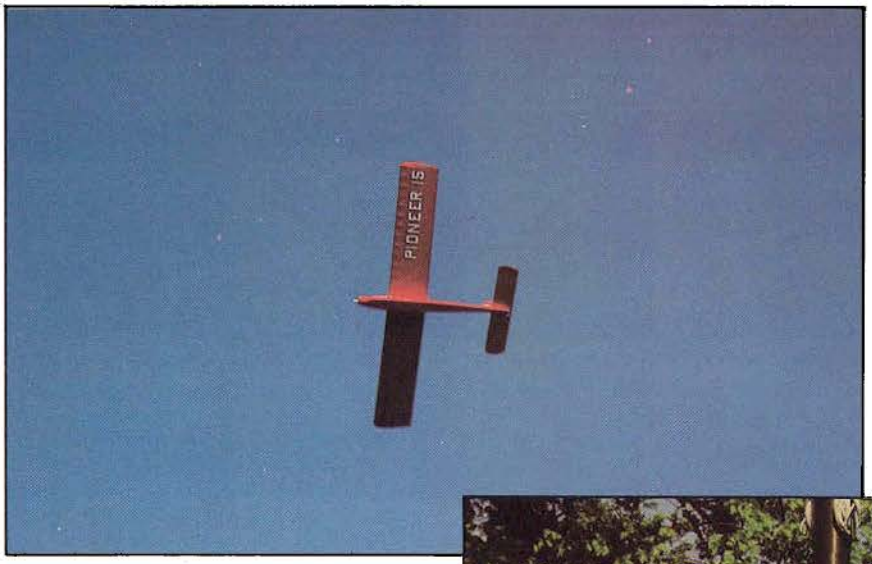
PIONEER 15



A 74" span, Astro 15 powered sailplane that utilizes the full potential of electric power, combining the best of soaring with silent powered flight.

Photos By Susan Dougherty

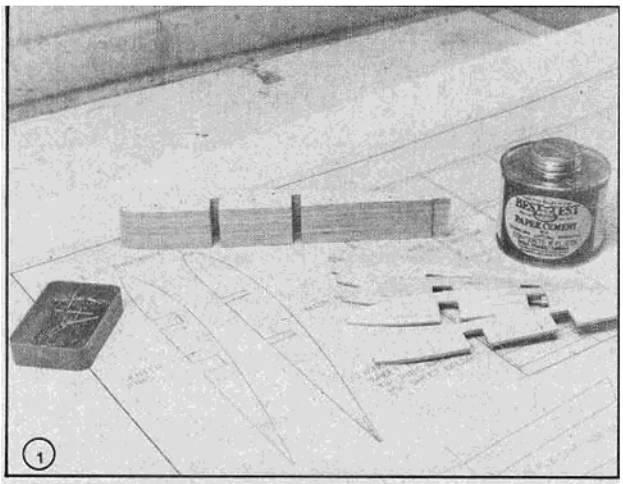
By James V. Zarembski

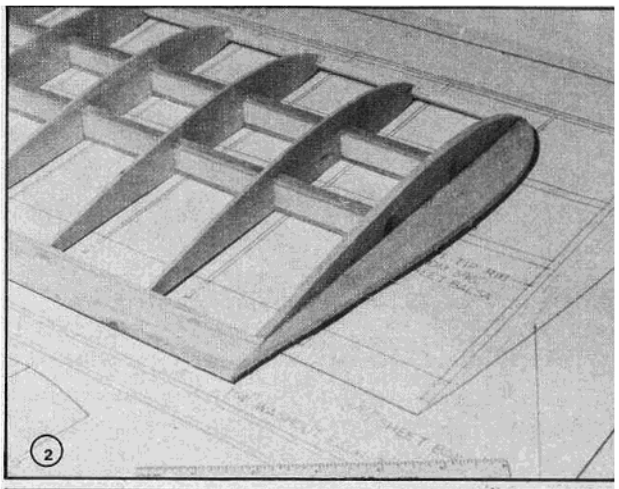
The Pioneer 15 is an electric powered sailplane designed for the sport flyer. The model is built around the fabulous Astro 15 electric motor system. Using a Cox gray 8/4 prop, the Pioneer will quickly climb to thermalling altitude from even the most confined flying sites. Because it is electric the noise problem associated with gas models is nonexistent. This brings the possibility of flying in areas now not open to conventional glow powered RC models which might also be too small for high start or winch.

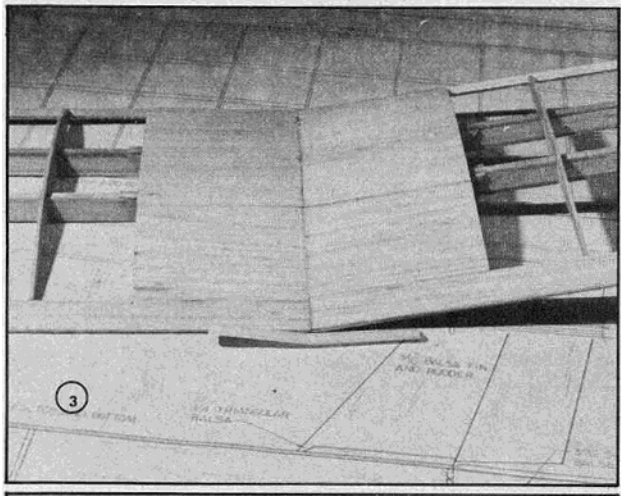
Once Pioneer 15 is flown up to 800 feet (in about 80 seconds), you simply shut off the motor and begin to soar. From the time the prop is stopped by the unique prop stop system, incorporated in the design, until the moment you land, the Pioneer 15 reacts like a high performance RC sailplane. Like any sailplane, flight duration is a function of the lift conditions and the pilot's soaring ability. The Pioneer 15 will not let the thermal chaser down. It will circle upward on the slightest puff of lift. If, however, you fail to find the big thermal the first time up, the nature of the electric powered sailplane allows you to turn the motor back on and climb back up to altitude. You get a second chance - - - .

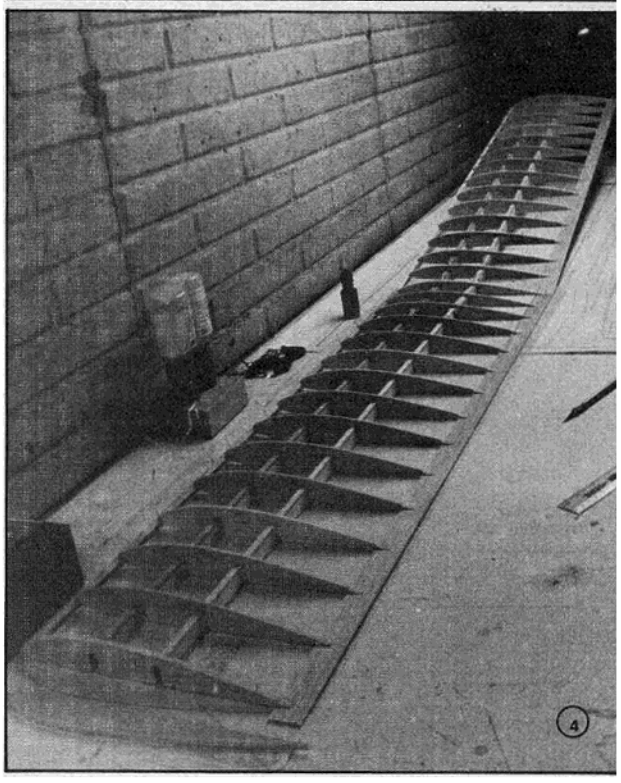
The average duration of the Pioneer 15 with the Astro 15 system is between 10 and 15 minutes in still air conditions depending on the ready-to-fly weight of the model. Twice my Pioneer has surpassed 45 minutes in the warm thermals of an Ohio summer morning. Thirty minute flights are not uncommon.

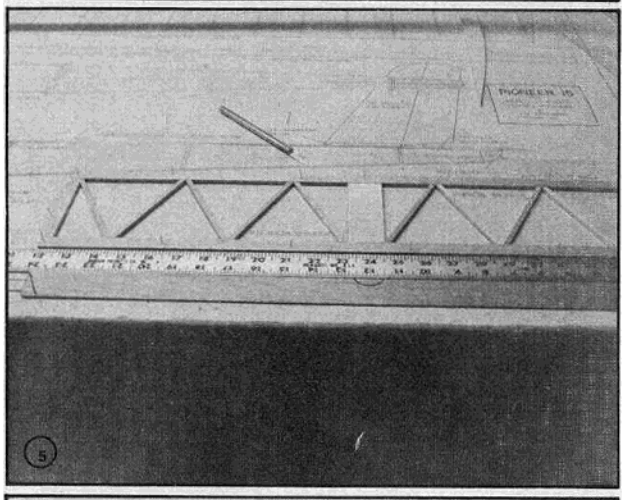
Landing is no problem. The Pioneer 15 can be slowed to a walking pace and gently brought to a stop on the grass of

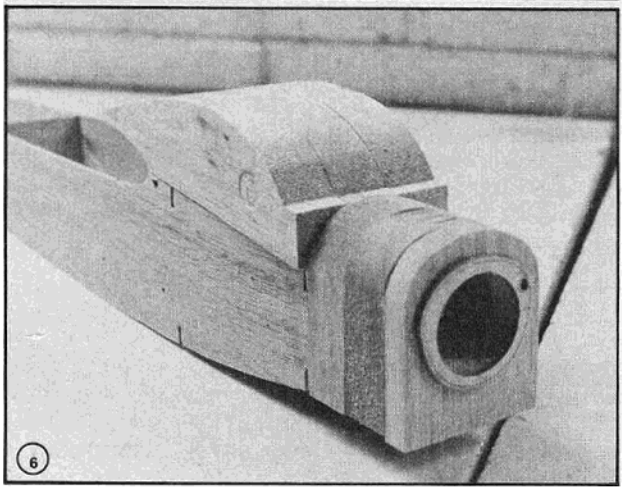




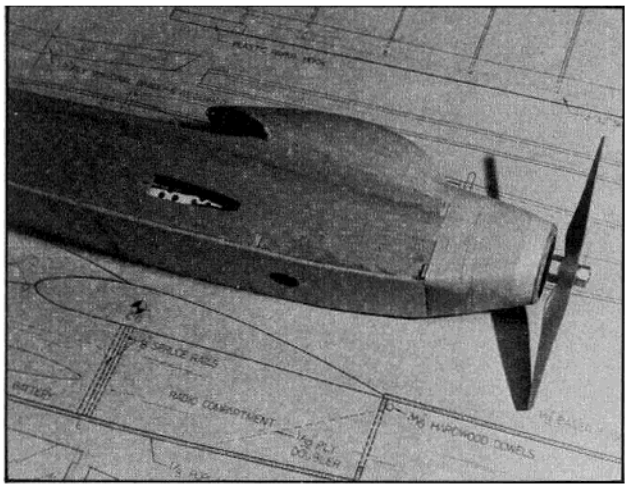




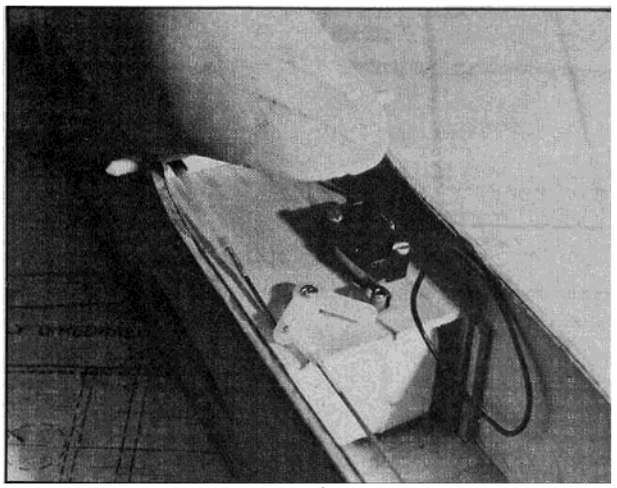




(1) With your full size set of RCM plans for the Pioneer 15 in place on the workbench, you can start by cutting out the wing ribs. (2) Close-up of wing tip and laminated spar construction. This spar construction provides a really rugged wing. (3) Center section of wing is sheeted and trailing edge reinforcement added. (4) A long shot of the semi-completed wing on the author's workbench. (5) Constructing the stab and elevator. (6) A shot of the nose and cabin area before shaping.



The nose and cabin section after shaping. Note cooling vents.



A look inside shows the prop stop arrangement as described in text.

your flying site without even wrinkling MonoKote. If, however, you fly from a rocky, or otherwise treacherous, flying field, a single rubber or metal skid should be added.

Once on the ground a full recharging of the motor battery can be obtained in 15 short minutes. By all means use the Astro Flight charger because the 15 minute shut off timer will save your precious batteries from being ruined by overcharging.

Another advantage of electric power is that the model can be disassembled quickly and you can be on your way home (or to the model shop) without reeling in a high start and without degreasing your model as would be required with a sailplane or glow powered sport planes.

DESIGN EVOLUTION

During 1975 and 1976 it became apparent after the success of the Electroglide 62 (August 1975 RCM), the Astro Flight Fournier RF4, and several of my own designs, that a truly high performance RC sailplane could be developed for electric assisted launches. After talking to Bob Boucher at Astro Flight, it became evident that the Astro 15 motor system has the best power-to-weight ratio of any of the electric systems currently available. Thus, the Astro 15 was chosen as the foundation around which the Pioneer 15 was designed.

Using the 57 ounce weight of my Fournier RF4 as an example of the weight of an Astro 15 powered model, it was determined that the Pioneer 15 could be built to a design weight of 50 ounces including a 3 channel radio installation. To assure soaring capability, a wing area of 730 square inches was chosen to yield a design wing loading of 9.9 ounces/foot. The key to the light weight of this model is a strong light airframe and the use of a 5 volt voltage regulator to convert power from the motor battery for the use of the RC units.

The NACA 4412 section was chosen for the wing ribs. Since the wing is built without leading edge sheeting, the MonoKote shrinks between the ribs giving approximately a 9%-10% wing thickness. This is the key to the use of this thick airfoil for wing ribs of electric models. In a twin powered model in 1975 the leading edge was sheeted, resulting in a slow flying, high drag, poor performing model. The original wing of the Pioneer 15 had the wing ribs so closely spaced that it also evidenced less-than-desirable performance. In three subsequent models the spacing of the ribs was altered to empirically lead to the rib spacing used in the Pioneer 15. With this wing you can expect a fast powerful climb and a relaxed leisurely glide. It is quite a combination designed into a simple wing structure.

The stabilizer and rudder assemblies are typical of many RC sailplane models. The stabilizer can be rubber banded, attached with nylon bolts, or epoxied in place. I use rubber bands to allow for disassembly, but you can take you choice.

The fuselage incorporates a shoulder mounted wing for stability and uses tried and proven techniques for ease of construction and strength. The nose block and canopy are laminated from 1" balsa and carved to shape. This results in strong yet light construction for the nose area of the Pioneer 15.

The fuselage formers C, D, and F, are cut from 1/8" poplar plywood using notches to assure perfect alignment of the fuselage. This simple step saves a great deal of construction time and virtually guarantees a straight fuselage.

The prop stop, used in conjunction with the wiring diagram shown in the full size plan, allows the prop to be stopped horizontally to reduce drag during the glide and to prevent broken props. This feature actually saves 3 ounces of weight which would be necessary if a single wheel landing gear was used.

The two capacitors are each soldered to the motor leads and then are both soldered to the same small length of

PIONEER 15

Designed By: James V. Zarembski

TYPE AIRCRAFT
Electric Powered Sailplane
WINGSPAN
74 Inches
WING CHORD
10 Inches
TOTAL WING AREA
730 Square Inches
WING LOCATION
Shoulder
AIRFOIL
Flat Bottom
WING PLANFORM
Constant Chord
DIHEDRAL, EACH TIP
3⅝ Inches
O.A. FUSELAGE LENGTH
40⅝ Inches
RADIO COMPARTMENT AREA
(L) 7" X (W) 2-11/16" X (H) 2½"
STABILIZER SPAN
24⅝ Inches
STABILIZER CHORD (incl. elev.)
5-7/16"
STABILIZER AREA
130 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
8 Inches
VERTICAL FIN WIDTH (incl. rudder)
4¾" (Avg.)
REC. ENGINE SIZE
Astro 15 Electric
PROP SIZE
Cox 8/4 Gray
LANDING GEAR
Skid
REC. NO. OF CHANNELS
3
CONTROL FUNCTIONS
Rudder & Elevator
Motor On-Off Prop Stop

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa, Ply & Spruce
Empennage	Balsa
Wt. Ready-To-Fly	50 Oz.
Wing Loading	9.86 Oz/Sq. Ft.

wire. The wire is, in turn, attached to the motor by wrapping the end of it to one of the motor end plate screws. This is to ground the capacitors to the motor frame. The resistor is mounted in the area ahead of the switch on the electrical deck.

To operate the system the Astro Flight switch is turned from 'charge' to 'fly' mode. The RC unit is now powered. When the motor servo is turned to the "on" position, two things happen. First, the prop stop NyRod is retracted. Second, when the bellcrank is at the end of its stroke, it actuates the switch starting the motor.

At the desired altitude, back off the power slightly to stop the motor power. The dynamic brake circuit will then slow the prop to a few hundred rpm's. At this point the prop stop NyRod can be used by moving the motor control to full off.

Without the dynamic braking circuit the prop would continue to revolve at a high rpm due to airflow over it and would cut the NyRod. The idea of stopping a prop was first tried by my friend De-Wayne Evans about three years ago. However, it was not made practical until Bob Boucher suggested that the dynamic brake circuit should be used in conjunction with this idea.

CONSTRUCTION

The first step I use is to cut out all of the components to, in essence, prepare a kit for Pioneer 15. I might suggest that you purchase two sets of plans — one for construction and one to be cut up for parts templates. It may seem like a lot of money for cut-out paper templates, but it will save a great deal of time in fabricating of the parts. I cut out all the part outlines 1/4" to 1/2" oversize and rubber cement these portions of the blueline print to the required balsa or plywood sheet. I let this dry an hour or so and then use a Dremel saw to cut out the part to the exact outline of the blueline. In the case of fuselage sides, wing and stab tips, and wing ribs, I stack the number of sheets required over one another and pin them together for cutting. Use about 20 pins for the fuselage sides and make sure your jig saw blade is perpendicular to the table bed. You always get identical fuselage sides this way. Incidentally, while the fuselage sides are pinned, drill the holes for the wing and stab hold-down dowels.

The 6 center ribs can be cut at one time. However, you should use two stack cuts of 12 ribs each to produce the 24 main ribs required. Once you see the ease of parts production using these methods, you'll understand why I use constant chord wings. Plywood parts such as the dihedral brace can be stack cut also. Use small brads instead of pins to hold the stack together.

Wing:

Use aliphatic resin to join the 1/8" x 1/4" spruce spar caps to the 1/4" x 1/2" balsa spar cores. When dry, bevel the center of the four sections and epoxy the 1/8" plywood dihedral braces in place to yield the two spars required. You must make sure that both spars have the same dihedral angle. Note that the spars are completed before assembly of the wing halves.

Start with the right panel. Pin down the trailing edge and the 3/16" tip rib. Move the spars in position and install the sheeting under the center section. Add the ribs using aliphatic resin and complete this portion of the wing construction by adding the leading edge. After this dries, remove the pins and build the other panel. When dry, remove from the board and add the wing tips and center top sheeting. Sand smooth, MonoKote, and add 1/4" washout to each top. Use acyanoacrylate cement to fasten the plastic paper hook (used in report binders — get it from a school supply company or drug store) and the wing is complete.

Stab:

Simply cut the 3/16" square strips to size and assemble with the cut-out parts using aliphatic resin. Sand to shape, cover, and assemble the elevators to the stab using 6 nylon hinges of your choice.

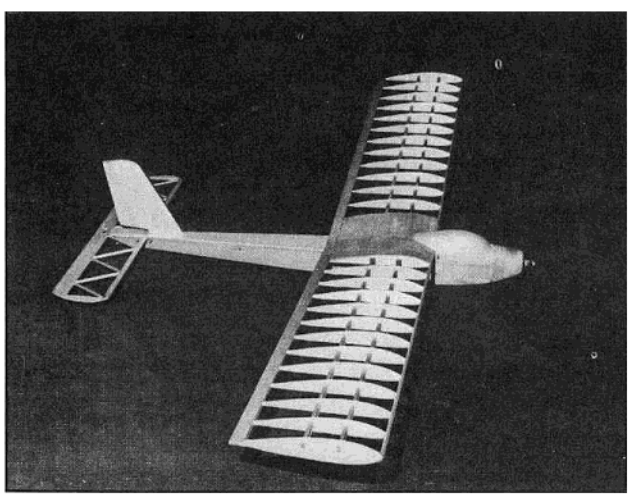
Fuselage:

First laminate the nose piece and the canopy from 1" light sheet balsa. While this is drying, add the 1/32" plywood fuselage doubler to the front of each fuselage side and the 3/32" balsa doubler to the rear of the fuselage. I use 5 minute epoxy for this to get a quick smooth strong bond of the plywood doublers. Simply mix a small batch of epoxy and spread evenly over the fuselage area. Remove most of the epoxy and push the 1/32" plywood doubler in place on the fuselage holding it in place with several pins. Use a Dremel jig saw or a razor knife to cut the notches for the fuselage formers in the 1/32" plywood after the epoxy has set up.

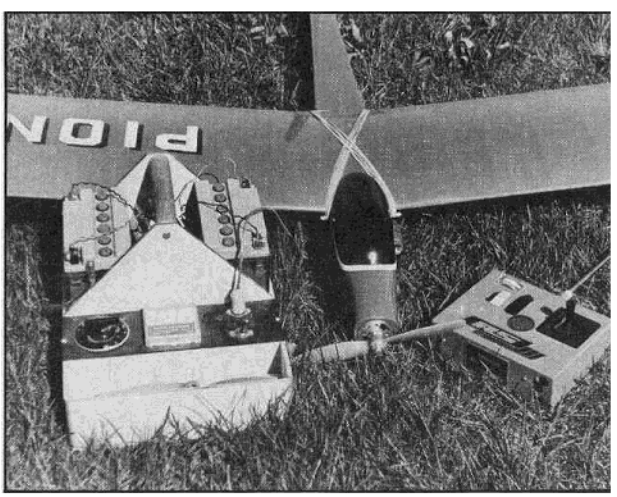
Next epoxy formers C, D, and F, to the two fuselage sides. When the epoxy is set, add the nose section, the canopy, formers G and H, and the tail block. Select and cut to shape a length of poplar plywood to form the forward fuselage bottom. Cut a hole in this piece for a motor exhaust cooling exit. Cement it in place along with the 1/8" balsa fuselage top and bottom. Make sure you add the pushrods to the tail feathers before you add the fuselage top.

Use an X-acto #26 blade to carve the canopy and nose piece. When satisfied, sand the fuselage complete for finishing. I used MonoKote on the entire fuselage except the canopy which was surfaced with two coats of finishing resin and spray painted with one coat of Testors PLA plastic model enamel — gloss black.

To complete the fuselage, drill the hole for the prop stop rod, add the wing hold-down dowels, and either fabricate two balsa vents of at least 1/2" square area for cooling, or purchase two vacuum formed inlets from Astro Flight for 49 cents per pair plus 50 cents postage.



The Pioneer 15 - - - all framed up and ready for covering.



The whole package – sailplane, radio, and Astro rapid charger.

These can also be painted with PLA enamel.

The rudder assembly can be cut, sanded, covered and epoxied to the fuselage at this point. Make sure to add the 1/4" triangular braces for rigidity during flight.

Motor Installation:

The Astro 15 recommended wiring diagram is used in this model along with the Astro Flight SPDT switch and charging jack (Astro Flight #4003 Switch Harness). However, because of the design of the prop a stop mechanism, an SPDT Roller Lever Switch is used to actually turn on and off the Astro 15. The Astro Flight switch is operated by hand to place the system in charging or flying mode. I have been using an Archer #175-1101 SPDT Roller Lever Switch rated 10 amp. @ 125V AC. This is available at any Radio Shack store as are the capacitors, resistors and voltage regulator. Be sure to break-in the motor for one hour on a 12 volt battery without the propellor to seat the brushes.

Radio Installation:

Any 3 channel system can be used. However, be sure to check for chatter or interference from the electric motor system. I use about ±20° up and down elevator and ±30° rudder to assure full control.

Charging:

Use the Astro Flight field charger with two 12 volt motorcycle batteries for charging. I use batteries rated at 9 amp. Follow the instructions and you'll be ready to fly in 15 minutes. Note that the first few charges of a fresh battery will not be at capacity. You will notice your motor run duration increase until it levels off at 5½-6 minutes after about 15 cycles.

Flying:

Check the radio with the motor on. Once this is done, gently hand launch into the wind with the motor on. Let the model climb on its own and go easy on the elevator so you don't stall it. The climb should be quite fast with a slightly nose-up attitude. Circle up to your desired altitude looking for thermals on the way up. Shut off the motor at the apex and you're on you own.

I'm sure you'll be hooked on electric soaring! □

From RCModeler Sep. 1977