ELECTRIC SHOESTRING

This electric powered sport scale is one of the nicest looking electrics to come along. Easy to construct and a great flying machine.

By Jim Zarembski

The Shoestring is no stranger to readers of R/C Modeler Magazine. In the January 1966 RCM, Carl Goldberg presented a 54" span Shoestring for .19 to .45 glow engines. This design later became a very popular Carl Goldberg Model's kit which was in production for a great number of years. In the June 1972 issue of RCM, Fred Reese published his plan for a Quarter Midget Shoestring. Both of these plans have been very popular with the scratch-building crowd over the years.

I have always liked the Shoestring. I first saw one of the Goldberg kits at a pylon race in the early seventies and fell in love with the yellow and red #16 paint scheme per the full scale Shoestring. Thus, in my search for a new aircraft to try the Leisure 05 and the Astro XL 05 in, I stumbled on to a 3-view of the Shoestring and instantly decided that it was going to fly electric. It is a natural. It is a shoulder wing rather than a low wing so that when the batteries are placed on the cabin floor the model is stable in the air. I had some doubts about a low wing pylon racer after a bad experience with a low wing BD-5 which liked to fly inverted better than it did to fly level. The Shoestring also has built-in cooling air intakes for the electric flight system by making the cheek cowls functional rather than decorative.

After a week on the drawing board, in early March 1981 the plans for the Shoestring were completed. Several prototypes were built and a few minor modifications were made. The result is a nice looking semi-scale pylon racer that will fly the entire Class A pattern. The original models were all powered by the Leisure 05 with 6 cell Sanyo batteries rated at 1.2 ah. The flight duration of this combination is in the seven to eight minute range. One of the advantages of the 6 cell 05 system is that the motor retains almost full rpm's until the last thirty seconds of the powered portion of the flight. The only disadvantage is that it takes about twenty minutes to recharge. The Leisure motor comes in two different winds, at least at the time this article was written. The pattern wind will turn a Cox gray 6/4 prop at 12,000 rpm. The racing wind will turn the same prop at 13,500 rpm. While the Shoestring flies nicely with the pattern wind, the performance is enhanced tremendously with the hotter racing motor.

The Electric Shoestring prototypes have weighed in at a range from 32 to 34 ounces. Radio selection plays a big part in weight control of electric models. The model featured in the photographs accompanying this article used a Futaba FPS-3 radio with three S-20 servos and a 225 ma flight pack. The system weight is about 6 oz. Try to select a radio that will meet or beat this weight.

The other key to a good flying electric model is building the model as light as possible. Wood selection is important but I feel the application of adhesives plays an equally important role in achieving a strong but featherweight air frame. In the last year I have decided that there are only two adhesives for me — Super Jet and 5-Mintue epoxy. I have virtually built a half a dozen models including the Electric Shoestring with this dynamic duo. The result is always a strong light model which can be reproduced quite quickly because with cyanoacrylate and fast curing epoxies you just don't have to wait around for the glue to dry.

ELECTRIC SHOESTRING
Designed By: Jim Zarembski
TYPE AIRCRAFT
Electric Sport Scale
WINGSPAN
37¼ Inches
WING CHORD
7¼" (Avg.)
TOTAL WING AREA
250 Sq. In.
WING LOCATION
Shoulder Wing
AIRFOIL
Flat Bottom 9%
WING PLANFORM
Double Taper
DIHEDRAL, EACH TIP
1/2 Inch
O.A. FUSELAGE LENGTH
28½ Inches
RADIO COMPARTMENT AREA
(L)10" x (W)2⅛" x (H)2"
STABILIZER SPAN
13 Inches
STABILIZER CHORD (incl. elev.)
3⅜" (Avg.)
STABILIZER AREA
70 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
5¾ Inches
VERTICAL FIN WIDTH (incl. rudder)
3½" (Avg.)
REC. ENGINE SIZE
Leisure 05/Astro XL05
FLIGHT BATTERIES REQ'D
6 Cells (1.2 AH)
LANDING GEAR
Conventional (opt.)
REC. NO. OF CHANNELS
3
CONTROL FUNCTIONS
Ail., Elev., Motor On/Off
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa, Ply
Wing ..... Balsa & Spruce
Empennage ..... Balsa
Wt. Ready To Fly ..... 34 Oz.
Wing Loading ..... 19.5 Oz./Sq. Ft.

CONSTRUCTION

Fuselage:

Begin the fuselage by cutting out all of the fuselage formers and the fuselage sides. Use Super Jet to cement the 1/4" balsa triangular stock to the top of the fuselage sides and the wing hatch. Note that although the wing hatch has been cut into the two fuselage sides, the addition of the triangular stock will temporarily fuse the hatch sides in place.

Pin one of the fuselage sides over a piece of waxpaper and epoxy formers B and D along with the wing hold-down support in position making sure that they are 90° upright. When the epoxy sets up, add the other fuselage side to the assembly using another batch of 5-minute epoxy. Next, epoxy former A in place and use Super Jet to add former E and to cement the two fuselage sides at the rear of the model.

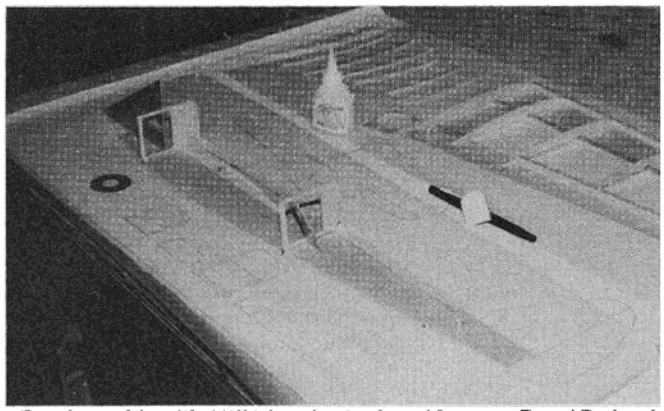
At this point the 3/32" balsa fuselage top and bottom sheeting can be added. If you are going to use landing gear, make a landing gear mounting plate from 3/32" plywood and epoxy it in place.

The next step is to form a nose block. Begin by wrapping 1/64" plywood around the motor two times. When you have a good tight fit, unroll the ply to a little more than one time around the motor and add several beads of Super Jet to the plywood that will form the tube. Reroll the tube, let it set up for about 30 seconds and remove the motor. Be sure that during this process you don't permanently cement the motor in the tube. Epoxy the motor tube in the nose block and then cement the nose block assembly on the front of the fuselage.

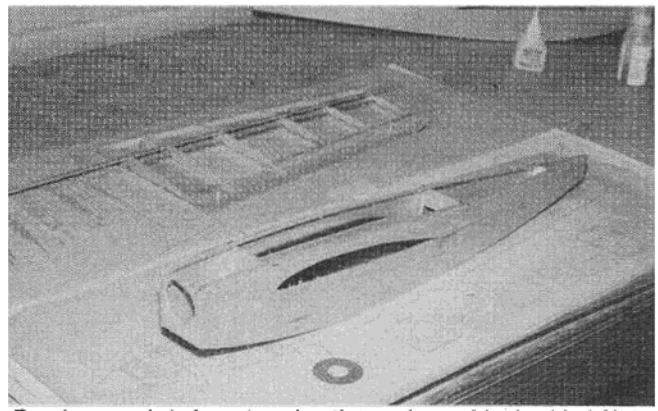
To complete the fuselage, sand the top of the model including the hatch to a rounded cross section. You can carve and sand the nose so that only the 1/64" plywood tube is left at the very tip of the Shoestring. This will be a perfect match-up with the 1½" Goldberg spinner selected for the prototype. Use a small razor saw to cut the hatch away from the rest of the fuselage using the cuts originally made in the sides as a guide.

The hatch must then have former C epoxied in position and requires fiberglass reinforcement both inside and outside at the rear where the wing hold-down bolt goes. Drill the hole for the bolt and, after tapping the hole, assemble the hatch to the fuselage for final sanding.

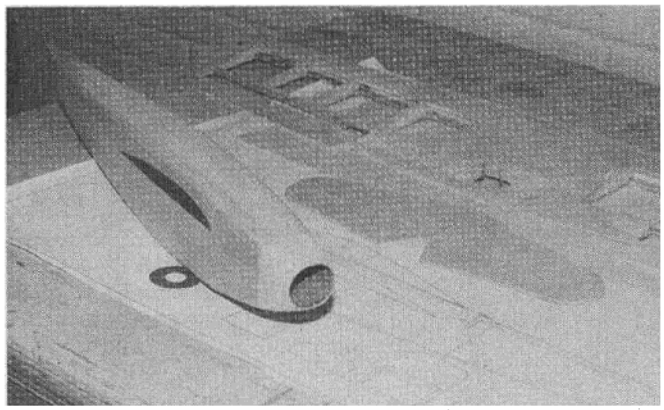
Some of the original models flew without gear. The model featured in



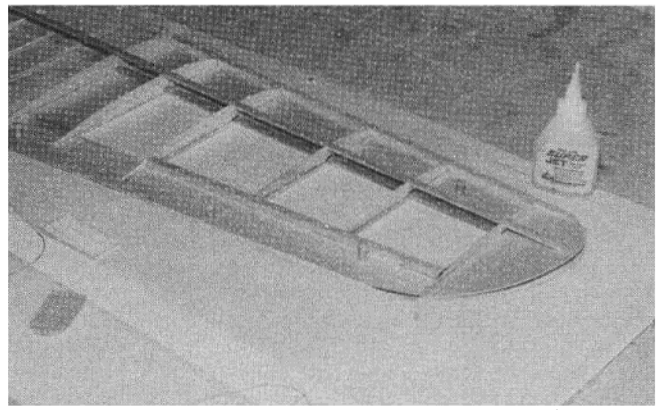
Fuselage side with 1/4" triangle stock and formers B and D glued in place. Note triangles used to properly align formers.



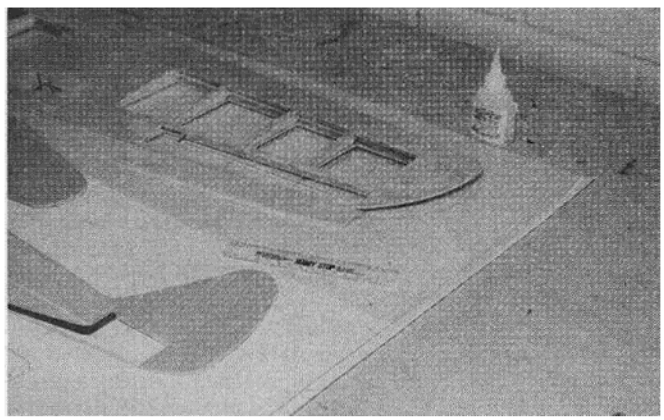
Fuselage ready to have top sheeting and nose block added. Note wing started in background, also another Shoestring fuselage.



Fuselage completed and sanded. Motor tube is installed ready for equipment installation.



Right wing panel with bottom tip piece installed. Jim builds aileron as part of wing then cut out after completion.



Completed wing with aileron linkage installed and aileron ready to hinge in place.

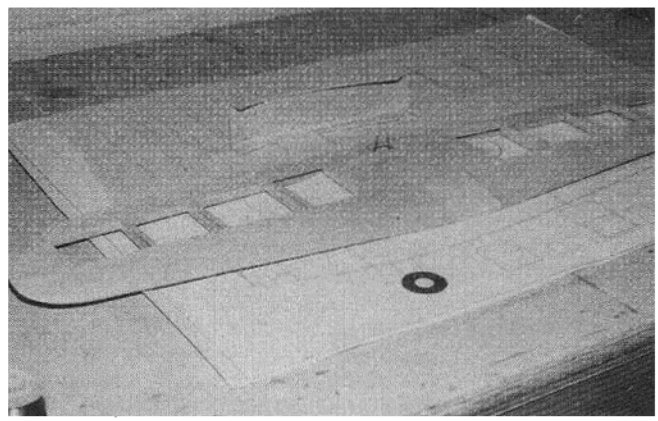
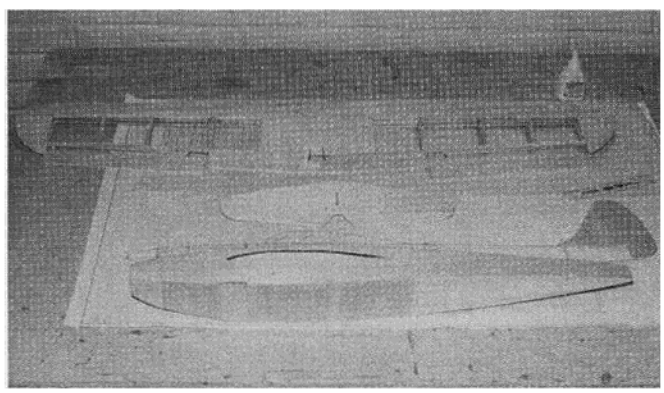
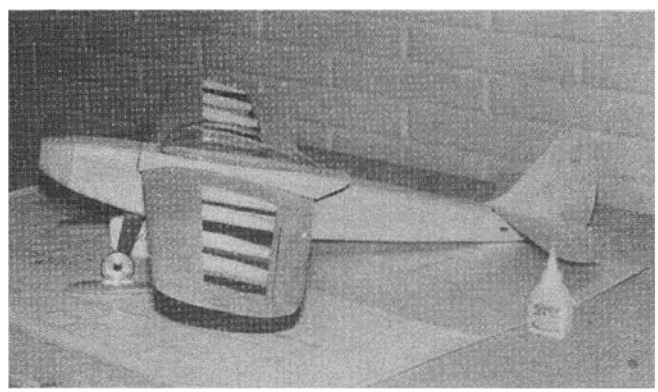


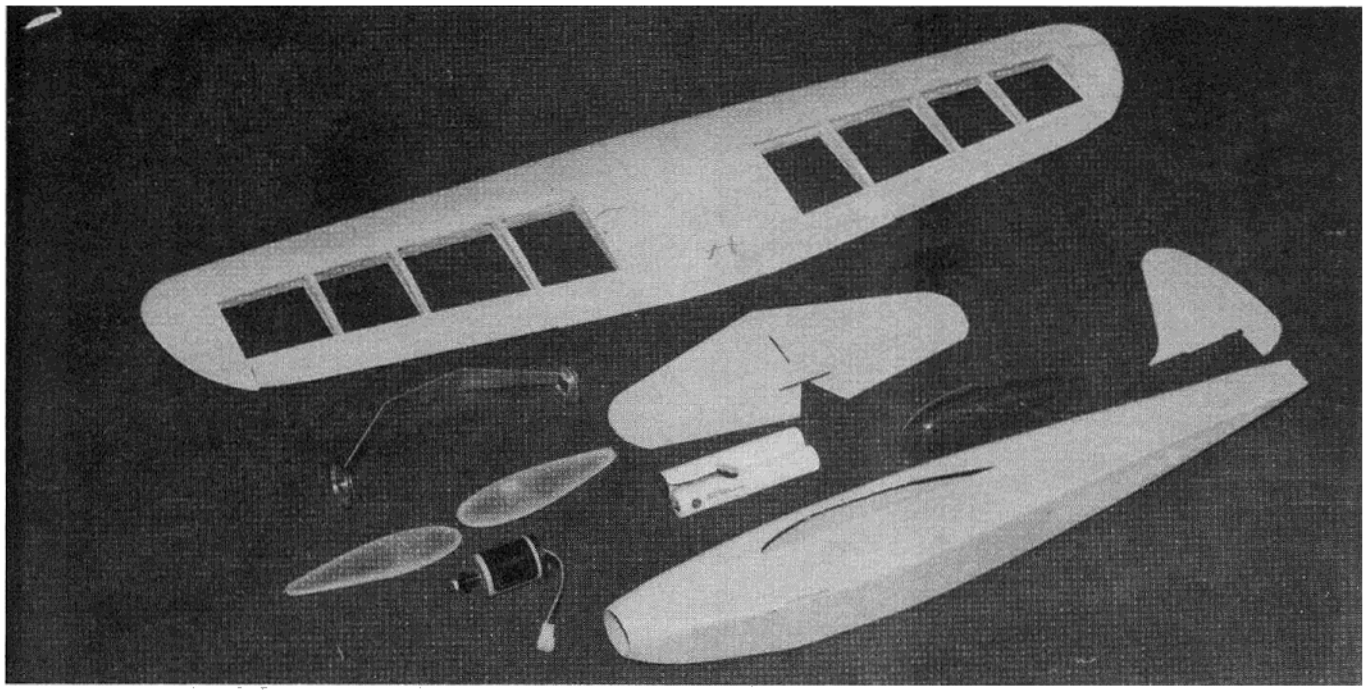
Photo shows top wing cover hatch minus former C along with completed wing.



All assemblies completed and sanded to shape. Next step is to install radio and the final covering.



Getting some bench flying time in as we all do at this stage. Note hatch has some more fitting to be done.



All the major components for complete model minus the radio equipment.

the photos has the small Prather aluminum wheels installed in Quarter Midget wheel pants.

Cheek Cowls:

The original full scale had very rounded cheek cowls. For the electric version, the cowls were made by cutting two pieces of 1/16" balsa and two pieces of 1/4" balsa to the pattern of the cowls shown in the side view of the fuselage. Stack the two 1/4" pieces and cut out the dotted portion to form the air inlet. Next, make a pair of cheek cowls by cementing the 1/16" outers with the 1/4" inners. Use scrap balsa to fill in the void at the front of the fuselage and sand to a streamlined shape.

Wing:

The wing is made of three pieces: a right wing panel, a left wing panel, and a center section. Cut out the wing ribs and wing tips to prepare for assembly. Build each wing panel by pinning the bottom 1/16" wing skins in place over the plans. The plans have extensions of the sheeting shown as an aid in cutting these pieces out. Cement the bottom 1/16" x 1/4" rib caps in place and add the leading edge, the trailing edge, and the spruce lower wing spar. Finish each panel by cementing the wing ribs in position, adding the top wing spar and shear webs, and cementing the 1/16" sheeting to the top forward portion of the wing. Assemble the three panels with epoxy making sure that there is 1/2" dihedral under each wing rib W-6. Install the aileron linkage and complete the sheeting of the top of the wing by adding 1/16" balsa at the center section and the rear. Cement the top wing rib caps in place and complete the wing tips by cementing the one piece lower wing tip in place and then filling in the top of the tip with 1/16" balsa sheeting.

The ailerons are simple assemblies consisting of a 1/4" leading edge, four formers, and a 1/16" top and bottom. Before you add the top sheeting you must sand the top of the aileron sub-assembly to conform with the wing. In fact, I built the ailerons on the prototype as part of the wing, making sure that I marked the cut line. After completing the wing, I used the jig saw to cut the ailerons out.

To complete the wing, cut away a 1/4" slot between the two innermost wing ribs at the center of the wing. Align the wing and epoxy the 1/4" diameter wing mounting dowel in place. Next fiberglass the center of the wing as shown on the plan. Sand complete for covering.

Stabilizer:

The stab and elevator are cut from 3/32" balsa sheet. Cement the two elevator halves together and sand the entire assembly to prepare for covering.

Rudder:

The model shown did not have an operating rudder. If you intend to install a rudder servo, you can break the rudder as shown in the side view; otherwise, the rudder needs only be cut out and sanded to a streamlined cross section to prepare it for covering.

Final Assembly:

The Shoestring can be covered using your favorite iron-on covering material. I used MonoKote on the prototype. The scale paint scheme was cut out of the same material and was ironed on over the base color with the sealing iron set at low. Of course you can use any color scheme you desire but I like the red and yellow Number 16 on the ground and in the air.

Equipment Installation:

The plans show the installation of a lightweight Futaba FPS-3 radio with three S-20 servos and a 225 ma radio battery. These were screwed into hardwood servo mounting rails. The motor system battery is simply servo taped to the floor of the model so it will balance as shown in the plan. The antenna was run out the side of the model and was threaded through a 1/16" diameter hole in the tail feathers.

Be sure to range test your radio with the motor on before you attempt to fly. You should also follow the manufacturer's instructions as to the proper way to break in your new motor.

Flying:

The Electric Shoestring will ROG from a paved runway. It is recommended that you hand launch the model if you are flying from a grass flying field. A firm toss into the wind and the Electric Shoestring will take to the air. At cruising altitude you can do just about anything with this bird that doesn't require the use of the rudder. Unfortunately, with the flat bottom airfoil inverted, flight is quite slow. However, the graceful glide down after the motor is turned off makes me quite pleased in the selection of this airfoil.

At the flying field the Electric Shoestring will draw a lot of attention, and the best part is the terrific flying performance made possible by a new generation of 05 motors with flight times in the eight minute range. Electric power is finally coming of age. □

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