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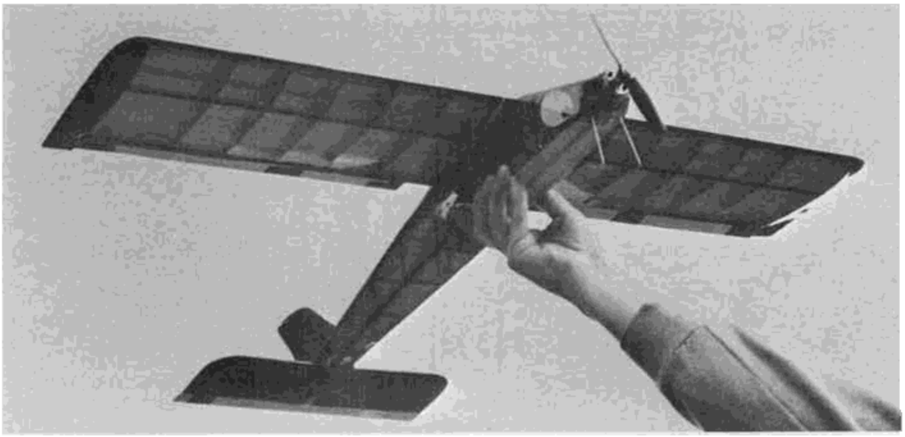

SLICK

By KEVIN FLYNN and JACK HEADLEY . . . Who says electrics can't be good aerobatic machines? The Slick proves that, with careful design, they can perform very well indeed. Uses 2-3 channel R/C, Astro 020.

• The "image" of electric power, up to this date at least, seems to be as a substitute in scale models for those little diesel engines that would never start, or as an auxiliary power unit for sailplanes to use when the wind isn't blowing; in short, anything but the power unit for a pylon racer or pattern ship. But why not? The usual reason is that the weight of the electric system is such that a very light airframe is mandatory to compensate for the power unit, and hence the "sport model" type of design that we see in the magazines.

But it doesn't have to be so, and with a little thought and some care in design and building, aerobatic and even racing electric models are possible, as we found out.

After a year or so of flying the "sport" type of model we decided to look at a more challenging design. To begin with, we'd build an all-out aerobatic model. The following article is concerned with our approach to this design and the results we obtained, which, incidentally, were a little different from our expectations, in more ways than one.

The requirement was to produce an electric powered model which would be fully aerobatic and yet small enough to fly in the local park without the usual noise pollution. We wanted something that would loop from level flight, not from a 1000-foot dive, and do rolls and things; in short, a real aerobatic model. At this stage we both had different ideas as to how this should be done, and without too much arm waving we decided to work independently and decide who was right by having a flyoff! The only ground rule stipulated was that the power unit would be the Astro Flight 020 R/C unit, unmodified, but from then on it was anything goes.

The actual design and construction didn't take too long, and both models were completed at about the same time. A suitable weekend arrived, and it was time for the Great Flyoff. The two models that arrived at the field were as different as chalk and cheese. Kevin brought along the "Slick," a reasonably conventional model with a light but strong structure and three controls (aileron, elevator, and motor on/off). Jack's model was a Delta, with all the structure devoted to the wing surface. This model had only two channels: elevator and ailerons (a mistake, as we will see later). The day couldn't have been better, warm and sunny with zero wind. After a small delay while all the batteries were charged up (two sets of motor batteries plus two sets of quick-charge receiver batteries), the models were buttoned up and the flying commenced.

The Slick was first, and after a few circuits of the soccer fields we use as a flying ground it began to loop and roll (on command, not by accident). It was obvious by the general flight performance that the wing loading was just right, and that the model would become a good aerobatic airplane. Now for the Delta, and what a difference! In a word, its flight performance was rotten. Its best maneuver was a slow descent to the ground, where it proceeded to burn up the motor. A few of these flights, trying different C.G. positions and various elevator settings, used up our supply of 020 motors without achieving any better flights. The Delta was retired to become a future sport model, with a much bigger power unit. All in all, the day was a great success, and the Slick's performance was most gratifying.

On a later weekend the winds of spring had finally arrived in our area and we were able to try out the Slick as a powered slope soarer. Here the third servo came into its own, as the motor could be turned on and off as required. It was very easy to climb to altitude with the motor, using the slope wind, then

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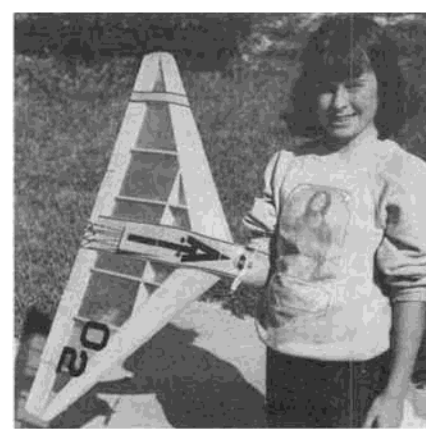
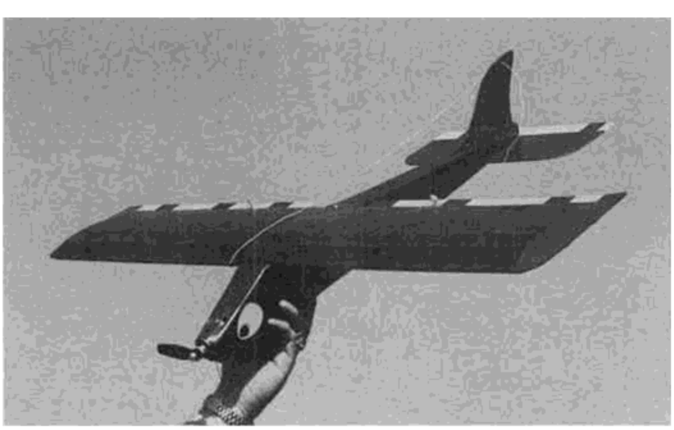
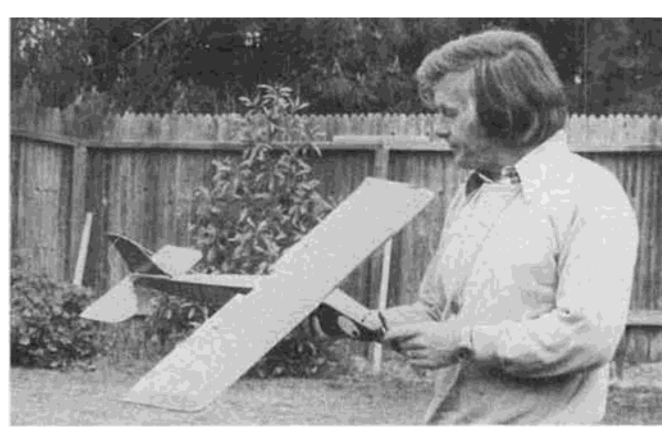


Samantha Headley with her Dad's "Delta Dud". Sad story in text.



'Slick' uses lightweight structure to compensate for weight of electric power system. Third servo recommended for motor on/off .



Slick's designer, Kevin Flynn, is justly proud of his creation. Can be flown almost anywhere; noise is no problem.

switch off and soar around or do aerobatics until all the altitude was used up, then climb up again and repeat the whole thing. With a decent breeze on the slope, flights of fifteen minutes could easily be made.

Before we get into the construction details of the Slick, a few words on the care and feeding of the Astro Flight 020 motor might be appropriate. We've mentioned the use of a third servo as an on/off control; this is very useful to protect the motor from burning up, as the motor can be switched off in case of an uncommanded arrival on the ground (CRASH). However, for more rapid crashes, when you haven't time to use the radio, the fitting of a 10-amp fuse in the battery positive lead is suggested; this will prevent discharging the battery through the stationary motor, with smelly results!

If you're interested in making your own Slick, the following construction notes will be helpful. The model can easily be made in a week of evenings by using one of the instant glues, such as Hot Stuff or Zap, but the first step is to select the appropriate wood, so take some care in getting strong but lightweight balsa for the basic framework. Do not get carried away by adding little strengthening pieces here and there, or using an elaborate finishing scheme, as weight is very important for this model. Keep it light so that you can get the most performance.

WINGS

Begin the wing construction by cutting out the required number of ribs from 1/16 sheet, then assemble them into a stack and sand to an even contour. While still in this stack, mark the positions of the various spars and the leading and trailing edges, then saw out these slots. Select a couple of ribs from the stack and cut away a further 1/16 inch all round; these become the center section ribs. Assembling the wing is a bit of a nuisance, due to the symmetrical airfoil and having not much to locate on the plans. Our approach is to use a shim near the trailing edge, located such that the ribs are held horizontally. A length of 1/4 square will do for this, so first pin the lower main spar to the plans, then add a couple of ribs. Move the 1/4 sq. shim around until the ribs are level, then attach it firmly to the building board. Now cement all the ribs to the lower main spar, and pin to the shim. The remaining spars and leading and trailing edges can now be glued into place. When dry, remove from the plans and reverse so that the remaining trailing edge strip can be cemented on. Add the 1/16 sheet webs between the spars, and then the sheeting in the center section.

Don't forget to make the wing dowel anchorage before closing up the center section; this is made from a strong piece of 1/4-in. sheet. The wing tips can now be cut out and glued into position, together with the scrap pieces of 1/16 sheet which add a little stiffness.

Sand all over, then install the aileron control cable (.030-in. is suitable) and the aileron servo. (This servo is actually sealed in the wings by the covering, so make certain it's working OK before finally adding the Monokote.) The ailerons are cut from some good quality 3/32 sheet and attached to the wings with Monokote hinges. The control horns, made from scraps of 1/16 ply, are epoxied to the ailerons, and instead of using the usual control couplers, the cable is attached directly to the horns.

First tin the outer end of the cable with solder, then bend at a right angle and insert into the control horn. A further blob of solder holds this cable in place.

Take a little care when doing this coupling, and be sure to bend the cable such that both ailerons come out level. The wings can now be covered, but don't forget to run out the servo pigtail first!

FUSELAGE

This item is built in the classic rubber model fashion (if you're old enough to remember that), with two side frames consisting of 3/16 square strips and some pieces of 1/8 sheet. Join these two sides together with 3/16 square spacers, then at the front with the motor frame. As this frame is rather skimpy, it's made of a lamination of balsa and plywood sheets. The fuselage in front of this frame has a 3/16 sheet floor. The motor frame is the only frame in the fuselage, and this is quite deliberate, as a free flow of air is required through the body for cooling purposes.

Install the 1/16 sheet fuselage floor, then the motor battery cage, made from 3/16 square hardwood strips. The various anchor points for the servos are now made and attached.

The motor tube is made from 1/16 sheet balsa, wrapped wet around the motor itself. When this is dry, glue the ends together, then install into the motor frame. The fuselage longerons are trimmed slightly to allow the motor tube to fit neatly in place, and this is shown on the plans as Section AA.

Cover the top of the fuselage between the wing and the motor tube with 3/32 sheet, cut into strips 1/4 inch wide at the front end. This makes the fairing from the rectangular shape at the wing station to a roundish shape at the nose. A general sanding in the nose region will help to produce this shape. Cooling holes for the battery airflow are cut into this top fairing.

The wing is attached to the body with a dowel at the front end and a single 6-32 screw at the trailing edge, so the attachment items can now be made and installed.

Fin and tailplane are both made from 3/32 sheet and can now be cut to shape and attached. Note that the fin fits into a slot in the top of the rear fuselage, this slot being made with strips of 1/8 square cemented between the longerons. The elevator is also made from 3/32 sheet, and attached to the tailplane with Monokote hinges. Sand all over, then attach the landing gear, which is really just a pair of whiskers to hold the model off the ground, but does provide a little protection for the motor, preventing the dreaded prop-shaft bending. At the rear another small skid is cemented under the tailplane, this being made from a scrap of 3/16 square hardwood.

MOTOR INSTALLATION

The motor is held in a tube made from 1/16 sheet balsa, by means of a good push fit. This has the advantage that if by some mischance the motor comes into contact with the earth, it gets pushed back into the nose without too much damage. If you've made the fit too slack, wrapping the motor with a layer or two of Scotch tape helps. The motor needs a flow of cooling air through it, so be sure to line up the exit slots in the motor with those in the tube.

The motor battery is another item that needs cooling, by means of the slots cut in the upper cowl. The battery is located only by four 3/16 hardwood cross braces, so that most of its surface area is exposed for cooling. The battery should be a good fit in this cage, but not too tight, so that it can be replaced easily.

RADIO AND INSTALLATION

The requirements for the radio can probably be summed up by the statement that if it will fit in the model, it's OK. As you can see from the plane, the fuselage is none too big. It doesn't have to be, as there are plenty of small radios around these days, and any of the miniature rigs such as Kraft with KPS-18's, Cannon, the Ace with Mini servos, or the Futaba with S-20's, should be satisfactory. A small battery pack also helps; a 100 ma quick charge is suggested.

Installation is usually a matter of personal preference, but the plans show a typical arrangement. The aileron servo is mounted in the wings and is sealed in with the wing covering. In the fuselage, the battery pack and the two servos are all mounted with servo tape onto attachment plates, which consist of 1/32 ply and 1/16 balsa laminations. Item P1 shown on the plans is a typical attachment plate. Give the ply a couple of coats of clear dope to increase the stickability of the servo tape. These plates are attached to the fuselage uprights where convenient. The battery pack is attached to the fuselage floor. Pack the receiver in foam rubber and place between the battery pack and the motor battery.

FINISHING AND FLYING

Covering is a matter of personal choice. Do you like to fly, or patch holes? If you're the former type, then cover the model with one of the lighter plastic films; if the latter, then use tissue and dope, but be prepared to fix a few holes in the covering now and again. The model is really so small that the plastic covering is worth the small weight penalty, for the increased durability.

When everything is finished, check the C.G. location, which must be almost correct if you've kept the original equipment layout (you did, didn't you?). Charge up the motor battery, then hand launch the model smartly. It should climb away strongly, and from then on it's all yours. Start flying with the recommended props, then try a couple more of slightly different sizes, and use the best of these for future flights. About the only other hint to offer is to use one of those small clockwork alarms to keep track of the motor run time, so that you're not too far from home base when the juice runs out.

FOR SUPER FLIERS

If you're one to pack a lot of flying into a single session, you might be interested in the multiple battery approach worked out by Kevin. Here you have to have a couple of extra sets of motor batteries (now you will see why the battery in the Slick is easily removable); the idea is to switch batteries after every flight. With three sets of batteries, one can be in the model, one cooling down after a flight, and one on charge. With this system almost continuous flying is possible, but don't forget to look at the receiver battery occasionally and make sure that it also is charged up now and again.

WHAT'S NEXT?

After noting the speed of the Slick, a model not really designed for racing (in fact it's a bit of an Ugly Slick), and imagining a few refinements such as a thinner wing and a spinner, and in general cleaning up the design, it was easy to see the possibilities of making a pylon racer of about the same size and shape. Further thoughts suggested that using a twin 020 system would get even better results, as the model weight would increase only by about 6-8 oz., with a little increase in model size, but the power level would increase 100%! Wow!! In addition, with the motors mounted on the wings, the possibility of burnt-out motors and bent motor shafts would be reduced considerably, and so the twin pylon racer seems eminently practical. ●