

ELECTRA-LITE



It finally came down to the flip of a coin. I had been wanting to design and build an electric sailplane. Not one that just dragged around the sky with the motor running and then gracelessly staggered back to earth when the batteries went flat. No . . . what I wanted was an agile, lightweight model that flew like an airplane . . . fast, capable of simple aerobatics, yet one that would still thermal in light lift. This would have to be a plane that I could use to chase that "sucker" thermal with . . . the one that leads you hopelessly down wind, allowing only inches of altitude gain for each turn, and then dumps you out in a cold down draft. With the right electric powered sailplane I knew I could beat that "sucker" thermal by turning on the power and driving on home, through whatever down drafts Mother Nature chose to throw at me. As a fringe benefit, of course, I knew that any parking lot, schoolyard, park, or outdoor bowling alley, could serve as a flying field.

But, then again, I really wanted to design a new competition sailplane too. I liked the looks of some of the new F.A.I. sailplanes with their faster airfoils and clean, low drag shapes . . . but I wanted something a little smaller than those planes. That nutty Thornburg fellow was making noises about having a "Hand Launched R/C Sailplane contest" and I really didn't have anything to throw into a "thermal hatsucker" to beat him.

Clearly, I had to deal with the problem. I wanted to build a performing electric glider . . . and I wanted to build a performing contest glider . . . and, just to make matters worse, my wife wanted me to build her a new pigeon coop. So, like I said at the start of all this drive, it

came down to the flip of a coin. Heads . . . I'd build the electric job . . . tails . . . the contest glider . . . and if it landed on its edge . . . well, Charlotte would get her pigeon coop. But I'll be darned if that coin didn't just keep flipping over and over, and back and forth. So along came the Electra-Lite.

With the motor batteries in place, the 93" bird weighs in at a touch over seven ounces per square foot of wing.

Take the battery pack out (the one for the motor!) and the wing loading drops to 5½ ounces per foot. The design utilizes good, clean aerodynamics including a thin, flat bottom airfoil with an aft high point, and a rearward Center of Gravity to give it an excellent speed range. Then I added a pound and a half of lightness, to make sure that the Electra-Lite would thermal with the best of them. (Lightness, incidentally, is one of the few items that is **not** available at your friendly neighborhood hobby dealer.)

Most of you have seen electric powered models that were less than successful. They all tend to be overweight and marginally powered. When my cohort in crime, Tom Yantis, told me that he wanted to fly an electric glider in the upcoming electric championships, I was somewhat less than excited. I reasoned that how could something that weighed a ton thermal? After many gallons of late night coffee at Macdonalds, we discarded most of the available designs as being either too heavy or too flimsy or both. We decided that rather than adapting an existing sailplane to electric power, we would have to start from the ground up.

We weighed the components that we absolutely had to have aboard . . . a three channel radio with light servos and an Astro 05 motor and battery. I knew that a plane with a 7 ounce wing loading would give us the performance that I was looking for. Accordingly, we arrived at a total weight parameter of 40 ounces. This seemed to be as light as we could build a plane without sacrificing too much strength. Naturally, I **never** land on a wing tip . . . but I wanted a plane that I could let my friend fly too! (Note . . . humility is one of my more outstanding traits!) With these figures we were able to come up with the total wing area. The general planform of the airplane was agreed upon, and then we divided up the structural design responsibility.

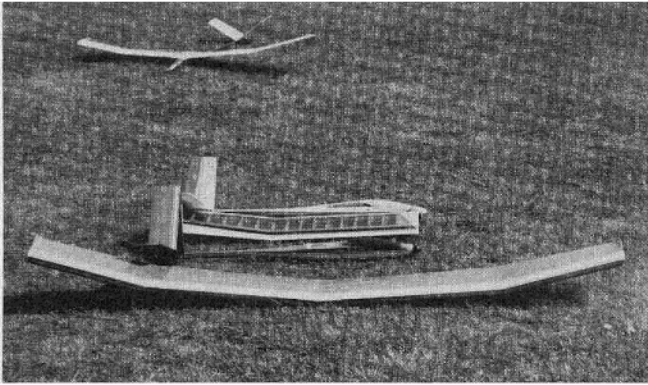
I gave Tom the Astro 05, the radio, and the batteries and told him not to come back until he had it all in a fuselage that weighed less than thirty ounces total. He mumbled something about minimal frontal area and Vee-tails pick their noses up better when they turn, and he stumbled out the door. He was right, of course. Besides, a Vee-tail stays up out of the weeds, and it weighs less too.

I ordered another Big Mac and started giving some serious thought to the wing design. I was only allowed ten ounces total weight so I knew I'd better do my homework and get it right the first time. I figured I had plenty of time. It would take poor Tom at least a month to complete that fuselage.

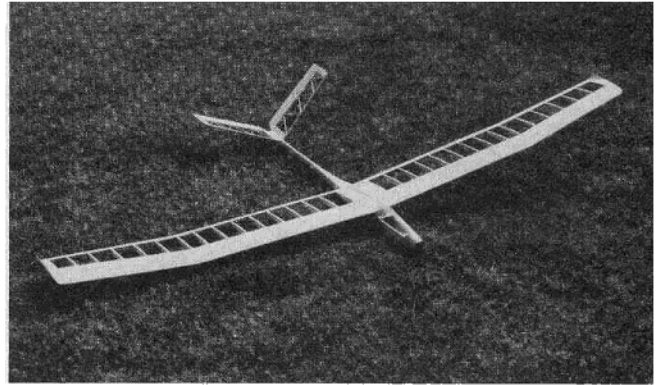
Tom arrived at my front door at nine o'clock the next evening with the finished fuselage in his hand . . . ye



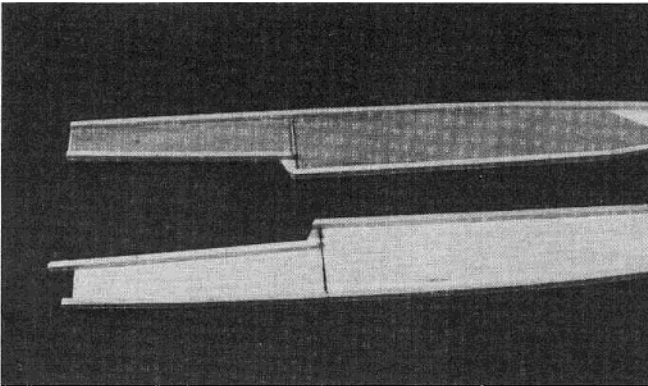
If you want a complete package in a sailplane, this high performance electric powered and contest machine will do the job. A 93 inch span with electric power is a tad over 7 oz. / sq. ft. Remove the motor battery pack and this drops to 5½ oz. / sq. ft. By Larry Jolly.



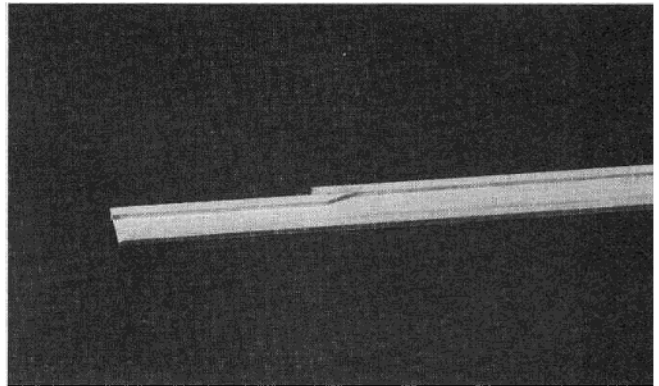
Electra Lite can be built with either one piece or two piece wing.



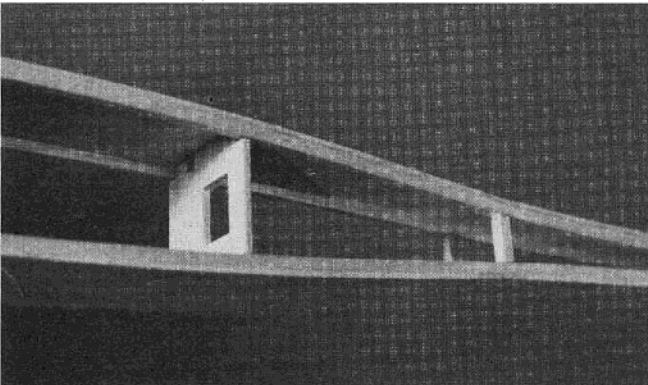
Look out Hugh Hefner . . . a nude view of the Electra Lite.



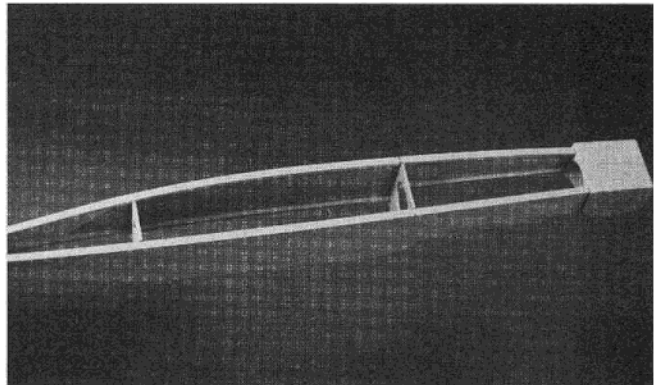
Fuselage sides showing longerons and 1/64 ply doubler (shown on one side only).



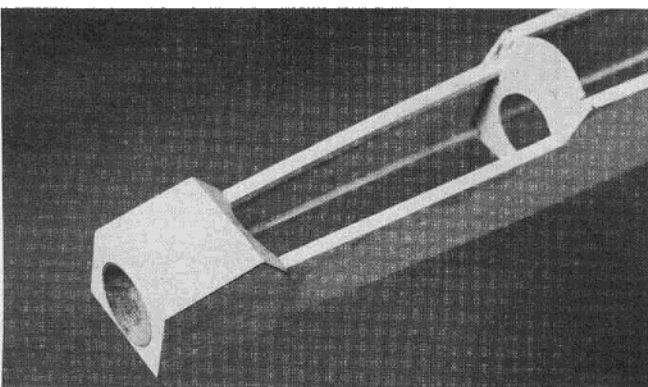
Fuselage tail detail showing longeron installation.



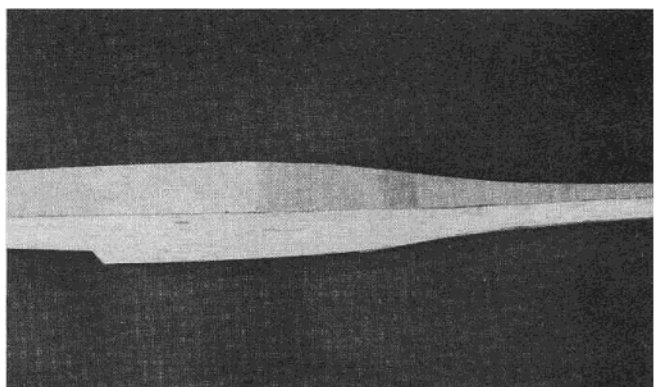
Fuselage detail showing bulkhead and cross brace. Note notch for NyRod tubing.



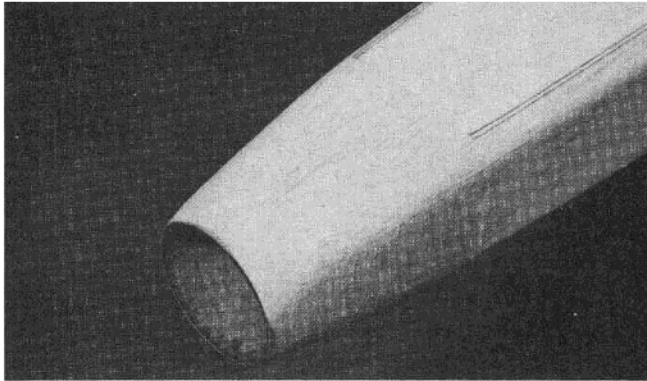
Fuselage ready for top and bottom sheeting.



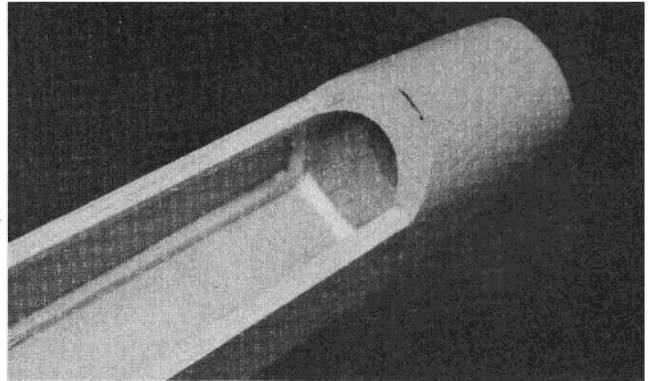
Noseblock detail. 1/64 plywood liner for motor has been installed.



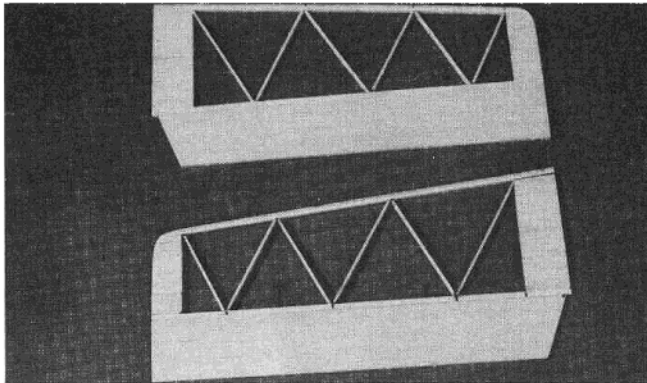
Cross grain bottom sheeting installed.



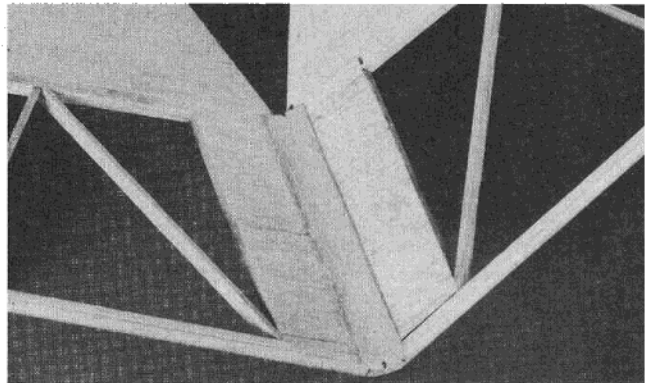
Sand noseblock to within 1/32" of plywood liner.



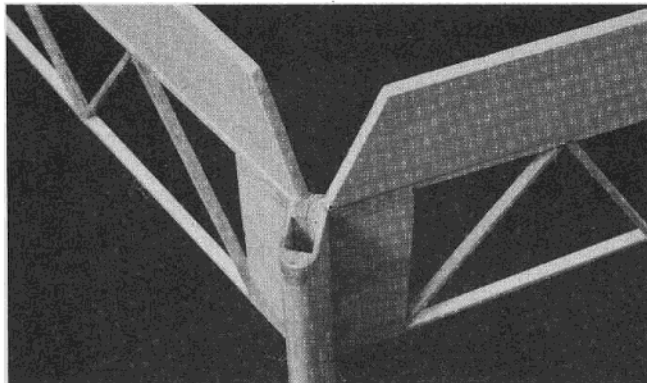
Noseblock after shaping and sanding.



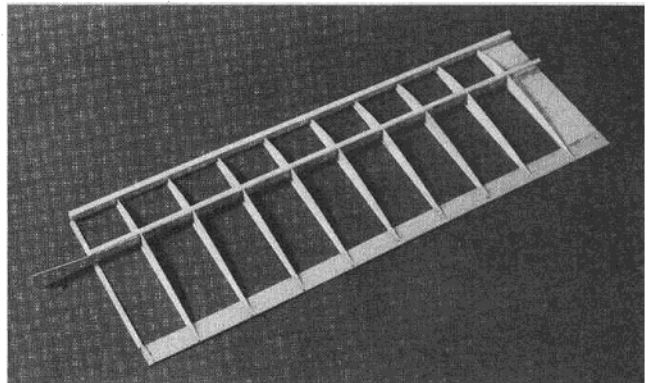
V-tail sections ready for joining.



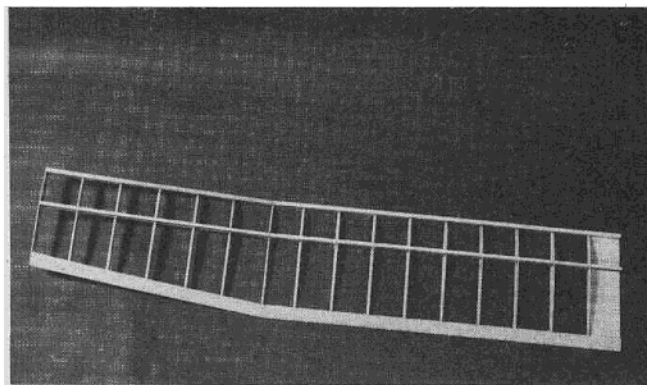
Triangular joiner strip is sanded to concave cross-section.



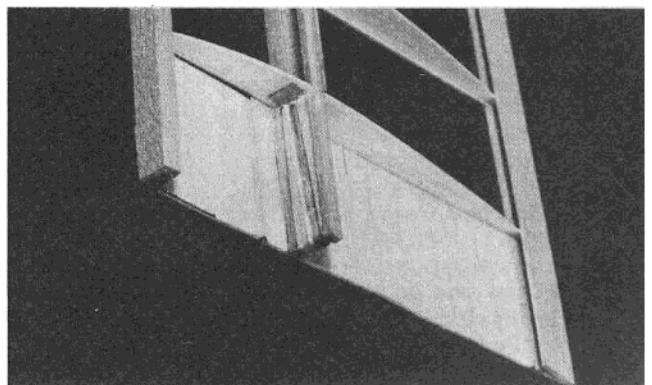
V-Tail assembly in place on fuselage.



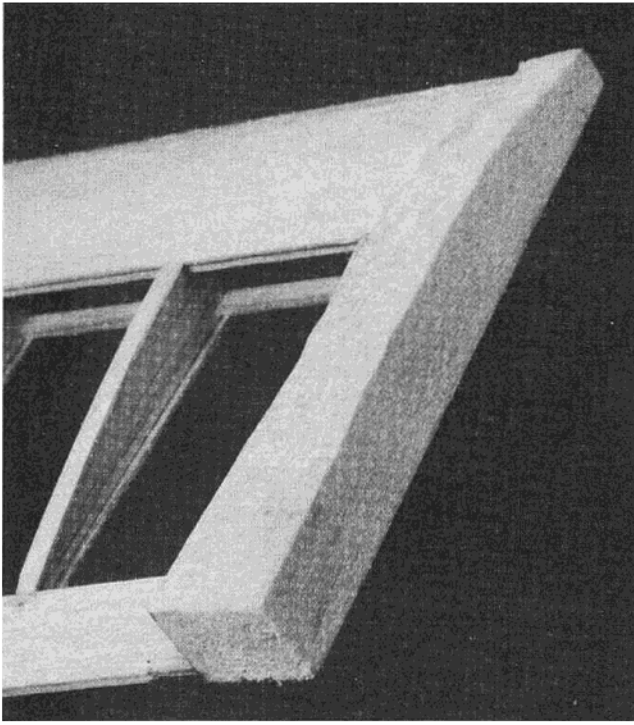
Inboard wing panel with shear webs and plywood polyhedral joiner.



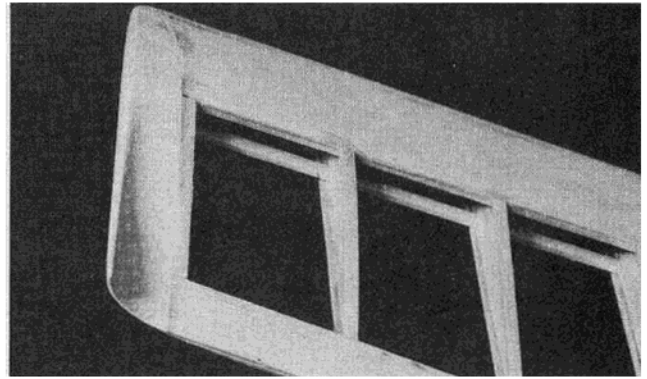
Nearly completed panel ready for top sheeting and root cap.



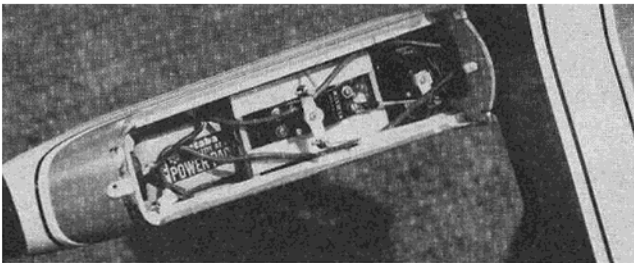
Center section detail showing brass tube and dihedral shims.



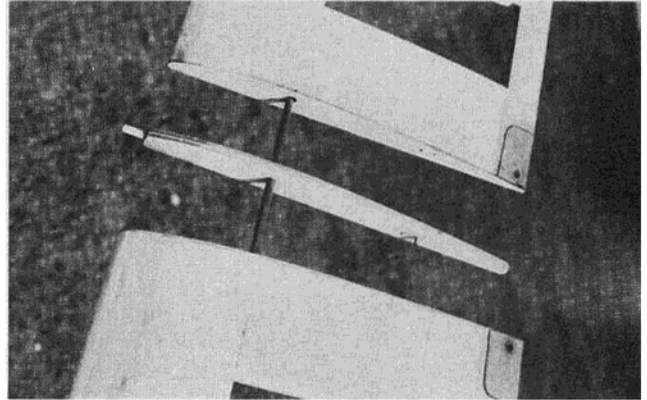
Tip block carved to rough shape, ready for Hoerner upsweep.



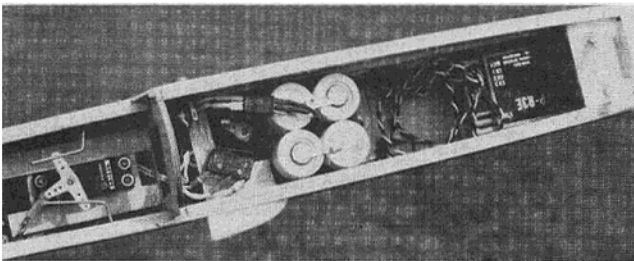
Finished Hoerner tip.



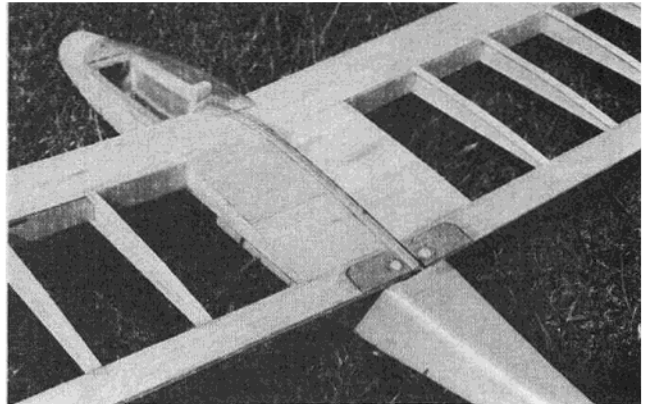
Radio installation. Sliding tray for rudder servo. Wing locating dowel comes thru bulkhead to secure rear of canopy.



Wing joiner detail. Note rear alignment pin and front locating dowel.



Detail showing motor battery installations and micro switch "throttle."



Rear wing hold-down bolt detail.

gads! I hadn't even cleaned the pigeon droppings off my work bench. (Maybe Charlotte really did need that pigeon coop!) With much muttering and swearing on Tom's part I got the wing finished in the next week and the first prototype flew . . . and flew great! Our design parameters worked out perfectly. The low frontal area and bolt-on wing made for a very clean flying bird that the Astro 05 hauled around with little difficulty. The Vee-tail turns the plane like it was on rails, and the very low wing loading makes it thermal with the hawks. So much for the esoteric B.S. The Electra-Lite is a darned honest airplane

that will please even the most critical among you. If you get started now . . . you might have it up in the third thermal to pass through on Sunday morning.

CONSTRUCTION

Remember . . . build it light. Pick strong, straight, lightweight wood. And don't add additional structure. You'll just add weight that destroys performance. Since the prototype was built, there have been a dozen more built. I personally have mangled two Electra-Lites; one when I got a case of dumb-thumbs in a crowded area and managed to come into direct frontal contact with a **very** well built warehouse; total damage was the

elimination of everything forward of the front bulkhead. To date we have never broken a tail boom, empennage, or wing. These crashes showed us that the plane has greater than adequate strength . . . but remember, the Electra-Lite won't knock down an industrial strength building . . . no matter how fast you get her going.

Wing:

Let's build the wing first. If you're like me, this is what will hold you up. I find it easier to cut out all the parts before starting assembly. Speaking of glue, I highly recommend the use of one of the cyanoacrylates for the majority of the

construction. If you find a joint that you don't want to trust to Zap or Hot Stuff, go ahead and use your favorite white glue or model cement.

Make up plywood templates of the rib shapes and cut out the ribs from medium hard 1/16" sheet balsa. Pick some good hard 3/8" x 1/4" for the leading edge. Pin the 1/16" x 1" trailing edge and 3/8" x 1/4" leading edges in place on the plan. Cut and cement in place the 1/16" x 1/4" capstrips and the center sheeting (bottom only). Put the bottom spar in place and cement in position all R2 ribs except the rib at the polyhedral break. Now cement the top spar and top 1/16" x 1" trailing edge in place. I usually put the shear webs in at this point. Note that the grain direction is vertical.

Now is the time to decide if you're going to build a one piece or two piece wing. We've built the Electra-Lite both ways. The one piece is a nuisance to transport but saves three ounces of precious weight. Most of you will elect to build the two piece version as shown on the plans. The one piece wing is built the same way except for substituting two 3/32" plywood dihedral braces for the brass tubes and shims. Cut the dihedral shims from scrap 1/4" balsa; place the brass tubes in place between the shims and epoxy this assembly between the spars. Cut out the 3/32" plywood doublers and epoxy them in place, noting the location shown on the plans.

The tip panels are built in the same way, except that there are no shear webs. When the tip panels are complete they are joined to the center panels by blocking up the tips 3" above the bench and sanding the polyhedral joint to the proper angle. The tip is glued to the center panel with plenty of epoxy. Now the 1/16" ply dihedral braces can be added, as well as the final rib at the dihedral joint.

With the center panel pinned down, glue the 1/16" top sheeting and capstrips in place. When the glue has dried, pin the tip panel flat and repeat the process. At this point the soft balsa wing tip block can be glued onto each wing panel. Block up the center panels 1 1/2" (measured at the polyhedral break) and sand the root to the correct angle.

The 1/4" plywood center rib (R1) should now be drilled for the 3/16" wing rod and the 1/8" positioning dowel. Insert the wing rod and slide the wings onto the rod, checking that there is no gap between the wing root rib and R1. Epoxy the 1/16" root cap ribs (R1A) to the wing roots.

Now sand everything smooth and to the right shape. The tip is very simple. I sand the block to the rough shape, then I take a broken tail boom from a Schluter Heli-Boy helicopter, wrap it with 80 grit sandpaper, and use the resulting tool to shape the concave portion of the wingtips. This technique works quite

easily and the resulting wing tip looks great. (If you don't have any broken Heli-Boy tail booms laying around, contact Craig Hall . . . he's got dozens of them that he'll part with real cheap!)

Right about now, you probably think something is missing . . . so go ahead and build the other wing just like you did this one . . . and make sure you've got one left and one right.

you may have problems with the fuselage wanting to warp when you pull the sides in to get that sexy tapered look in the tail boom. Also, if you use 48" sticks, you'll only need four. For former F-1 you'll need a piece of 1/8" ply. For F-2 you'll need a piece of 1/8" balsa 2" x 2-3/16" with the grain cross-wise, not up and down! The fuselage doublers and motor tube are made of 1/64" ply. You can get by with a 12" x 12" sheet for the whole affair.

Now we can start gluing all of the pieces together. Cut the fuselage sides as shown on the plan, then begin gluing the longerons on. I seldom do this over the plan, because it hides the pretty pictures, but you can if you want to.

Pin the fuselage sides down and start tack gluing the longerons on at the nose. Work toward the tail, bending and gluing as you go (with one of the super glues, this goes real fast). Mark the location of F-1 on the inside of the fuselage. Glue doublers D-1 and D-2 in place, leaving a 1/8" gap along the line where D-1 goes. Be very careful that the F-1 doubler will go in straight and line up evenly on both sides of the fuselage. An easy way to glue the doublers in with Zap, etc., is to first glue them along the F-1 gap. Peel the doubler back and run some Zap onto the wood ahead of the doubler. Lay the doubler down on the fuselage side and rub it down with a couple of paper towels. Be sure to use wadded paper towels. The towel will soak up any excess glue that comes out around the edges. Do it this way until the whole doubler is glued down and you won't glue your fingers down. You could use a little Titebond for the doublers. It will be a little easier, but will take longer and may cause warps in the fuselage sides.

Join the fuselage sides by lining up the F-1 gaps with the fuselage sides upright and facing each other. Rubber band the tail together at the empennage saddle. Spread the fuselage sides apart at the nose and insert F-1 into the F-1 gap. When everything is straight, Zap F-1 into place. Now Zap F-2 into place. Make sure everything still lines up and glue the tail boom sides together at the point indicated on the plan. Using a modelers clamp (Kraft, X-Acto, etc.), pull the fuselage sides together at the point where the 3/16" x 3/16" balsa braces go across the fuselage behind F-2. Lightly epoxy the braces in place.

Now comes the fun part . . . we're gonna make a noseblock. Take the block and drill a 1 1/2" diameter hole through it (before shaping the outer dimensions). You'll probably never find a hole saw that will go all the way through, but most hardware stores carry ones that will go 1 1/2" deep. Drill a pilot hole all the way through the block and cut the hole half way through the block, then turn it over and cut the rest of the hole from the other side. Now make the

ELECTRA LITE

Designed By: Tom Yantis & Larry Jolly

TYPE AIRCRAFT

High Performance Elec. Moto-Glider

WINGSPAN

93 Inches

WING CHORD

9 1/4" root — 7 1/2" tip

TOTAL WING AREA

818 Square Inches

WING LOCATION

High Wing

AIRFOIL

Flat Bottom

WING PLANFORM

Constant Chord center panel

tapered tips

POLYHEDRAL, EACH TIP

3" center panel — 3" tip

O.A. FUSELAGE LENGTH

45 1/8 Inches

RADIO COMPARTMENT AREA

(L) 10" x (W) 2 3/8" x (H) 2 1/2"

STABILIZER SPAN (V-Tail)

27 1/2 Inches

STABILIZER CHORD (Incl. elev.)

5 3/4 Inches

STABILIZER AREA

158 Square Inches

STAB AIRFOIL SECTION

Flat

STABILIZER LOCATION

Top of Fuselage

STABILIZER DIHEDRAL

22" between tips

REC. ENGINE SIZE

Astro 05 electric

REC. FUEL TANK SIZE

NA

LANDING GEAR

NA

REC. NO. OF CHANNELS

2-3

CONTROL FUNCTIONS

Rud., Elev., (V-tail) motor cut-off

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	.....	Balsa & Ply
Wing	.....	Balsa, Ply & Spruce
Empennage	.....	Balsa & Spruce
Weight Ready-To-Fly	.....	40-43 Ounces
Wing Loading	.....	7-7.8 Oz./Sq. Ft.

Fuselage:

Okay . . . now we get to the easy part . . . building the body of this bird. Cut the two fuselage sides out of two similar pieces of 1/16" x 3" x 48" medium weight, "C" grain balsa. For the longerons (stringers) use the straightest, moderately soft 3/16" x 3/16" x 48" balsa sticks that you can find. If you use too hard balsa longerons,

ply motor mount tube. Cut a piece of 1/64" ply 1 1/8" wide and long enough to go around the motor twice. The grain on the outside of the ply should run in the same direction as the motor shaft. To make the tube, wrap a piece of waxpaper around your Astro 05 motor. Now wrap the ply around the motor, gluing it to itself with Zap.

Remove the finished tube from the motor and glue it into the noseblock hole with epoxy or Zap. Now cut the side view profile of the noseblock. Pull the front fuselage sides together around the noseblock and glue. Now install the outer sections of the pushrod tubes. If the tubes cross, you'll have to use a reversed servo for rudder. The forward part of the fuselage floor is 1/16" ply and can be added at this time, as well as the rest of the 1/16" balsa top and bottom crossgrain sheeting. When the sheeting is in place, the whole business can be sanded to a slightly rounded cross section. Oops, I almost forgot. Use micro-balloons and Zap to make fillets around the nose and F-1.

Tail:

With the wing & fuselage constructed, it should almost look like an airplane. If you're not too tired we can still finish the tail before lights out! Start the tail construction by laminating a 3/32" x 3/16" balsa strip to a 3/32" x 3/16" spruce strip. Zap works real well here. Pin down your leading

edge spruce. Pick some good hard 3/16" square for the trailing edges and pin them down. The rest is easy. Fill in the solid areas with 3/16" sheet, noting the grain direction. The rest is 3/32" x 3/16" balsa strips. When dry, you can sand the leading edge to a rounded cross section, as well as the tips. Block each stab tip up 13" and sand the root to establish the dihedral angle. Pin one side flat and block the other side up until the distance between the tips is 22 1/2". Epoxy the stabs together at this angle. Cut two elevators from the softest 3/16" balsa you can find and sand to shape.

Final Assembly:

Place the wing on the fuselage and carefully align the two. It helps to have two people for the next step. While one person holds the wing and fuselage in proper alignment, the other one drills a 1/8" pilot hole through F-1, into the plywood center joiner. Remove the wing and drill the center joiner to accept the 3/16" alignment dowel. Carefully open up the hole in F-1 to 3/16". Make sure that the 1/32" ply screw hold-down doublers are in place on the wing. Now put the 1/16" trailing edge alignment pin into the center rib, aligning the two panels. Put the wing assembly back on the fuselage and drill for the 10-32 nylon wing hold-down bolts and tap the plywood wing mount.

Next comes the canopy. There are a few ways to attack this problem. You can carve a mold from balsa and pull your own, using the hot oven method, or you can try adapting an existing commercially made canopy. A clear, molded canopy for the Electra-Lite is also available from Midnite Model Supply. See the end of this article for details.

Once you have your canopy, build up the supporting structure as shown on the plans. There are several ways to attach the canopy. The one shown works well. It consists of a pin anchored to the front canopy support and uses the wing hold-down dowel to secure the rear of the canopy, keying the assembly into place.

Prepare the tail assembly for attachment to the fuselage by sanding the bottom of the tail assembly until it aligns properly with the fuselage. It's all downhill from here (thermals excepted!). Carefully sand the entire model. I prefer Super MonoKote for covering and sincerely recommend it. The lower temperature films should not be used, at least not on the wing. They simply don't provide the necessary strength. Once the model is covered, hinge the elevators and epoxy the tail to the fuselage ... careful alignment here ...

please!

The Electra-Lite will accept most three channel radio systems ... but the smaller the better. With larger servos you'll have to be more careful in planning your radio installation. The sliding servo tray was chosen because of its simplicity and reliability. An added bonus is that it can be built from wing spar scraps. Check the plans and build the tray to fit your servos. There are several commercially available mixers that may also be utilized in place of the tray.

The Vee-tail shouldn't scare you. Remember ... both flippers move up for up elevator, down for down, and both move as **rudders** to turn. Both go left for a left turn (when viewed from the rear) and right for a right turn. There should be about 1" total deflection (from stop to stop) for any given control input.

Flying:

This is the part I like best, so does the Electra-Lite. Before flight, check the balance point and make sure it matches that shown on the plans. I like to start test flying with a few hand launches. It lets you get a feel for the airplane without getting too high or far away in case of problems. The Astro 05 seems to like a Cox Gray 6/4 prop the best. Charge up your batteries and make sure that the motor shut-off works properly. Also, make sure there is no radio interference with the motor running. When all is well, turn on the motor, take a few steps into the wind and heave her into the air. You'll soon find you have a very versatile airplane. The Electra-Lite will climb to about a thousand feet on a full charge. The 7 ounce wing loading gives a very good glide. She thermals quite well, in fact, Electra-Lite won 1st and 5th place in the 1979 Electric Championships. You'll also find that she's very aerobatic; and if you put the nose down she'll move out. Electra-Lite also took fourth place in the First Ever Electric Pylon race held on March 6, 1979, competing against planes half her size designed specifically for speed. The Electra-Lite will enable you to fly almost anywhere, since you don't need a high-start or winch. Speaking of winches, take the motor batteries out and bolt on an Airtronics adjustable towhook and you've got a darned competitive "regular" glider. In short, if you've thought about electric flight, but never tried it ... this is the plane for you. Special thanks to Craig Hall for turning my chicken scratches into workable plans ... and my apologies to those four brave souls who built Electra-Lites before there were any plans. Canopies for the Electra-Lite are available for \$2.25 plus postage, and a semi-kit consisting of wing ribs, drilled nose block (for the Astro 05), and canopy for \$10.00 plus postage. Both available from Midnite Model Supply, 17321 Breda Lane, Huntington Beach, California 92649. □

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