Electric Decathlon

This Electric Decathlon will turn in the full aerobatic routine that Duane Cole's did.

By Floyd Manly

My introduction into electric flight was about 10 years ago when I did a product review for a magazine on one of the then available kits. To say that I was **not** impressed is a gross understatement. It was a toy, like a Cracker Jacks prize, in the sense that a grown man was embarrassed to admit that he played with it. I tried to write glowingly about something that I was eager to get rid of, and failed miserably. The review was never printed.

That was almost 10 years ago, and I harbored these impressions about electric flight until I happened to see a Graupner UHU performing at a fun-fly. The very next week, I saw a Great Planes Electro-Streak being put through its paces! Wow, these were electric birds that FLEW . . . with capital letters! Not just floating around like overstuffed sea gulls, but flying like hungry eagles. I had to buy one of each. That started the old juices flowing again. The enthusiasm was back, and I was having **fun** again. After all, the real secret to staying young is being too busy to think about it.

I first heard the axiom "The man who dies with the most toys . . . wins" from Dave Platt. You know him. He's one of our leading R/C Scale builders, and a kit manufacturer, who also "plays" with rubber power free flight aircraft, because they're fun! It's important that this hobby be fun! A magazine editor recently told me that model aircraft once got to be a drag for him. He cured his doldrums by starting on a model that was so completely different than anything he'd ever worked on that he had to learn a whole library of new stuff, just to get current on the latest technology. He found he was having fun again.

Electric power is doing that for me. I pulled all my old issues of R/C magazines, and re-read again everything I could find on EP. I wrote to almost every supplier and manufacturer to request information. It was when I began looking for available models to build, that the fog started to lift, and I saw that there just wasn't really that much to be had. Sure, a couple of floaters and trainers are here, but nobody had much of a selection of hairy chested aircraft.

It was at a full size air show on the 4th of July that world famous aerobatic performer, and entertainer, Duane Cole, put in a dazzling performance with his full size Decathlon. The decision was made, right there and then in the hot Arkansas sun, to have a Decathlon, and to make it Electric. Not the floating 05 size (as they call them) but a full throated Astro 40 geared Cobalt!

More research and a couple phone calls to the Guru of electric flight, Bob Boucher at Astro Flight, led to the size and weight design parameters of the Decathlon-E. Existing fuel powered versions of this aircraft were just too heavy, and slightly smaller than what I calculated necessary for optimum performance, so sketches were made of the outline and major structural components, and work was started. The vital statistics worked out as follows: Wingspan is 73", with a chord of 11". Ready to fly weight scaled in at 7 lbs. 4 oz., so we came up with a wing loading of 20.83 oz./sq. ft. Not too bad! It should be light enough to stay up with less than full power, yet be heavy enough for penetration into aerobatics.

ELECTRIC DECATHLON

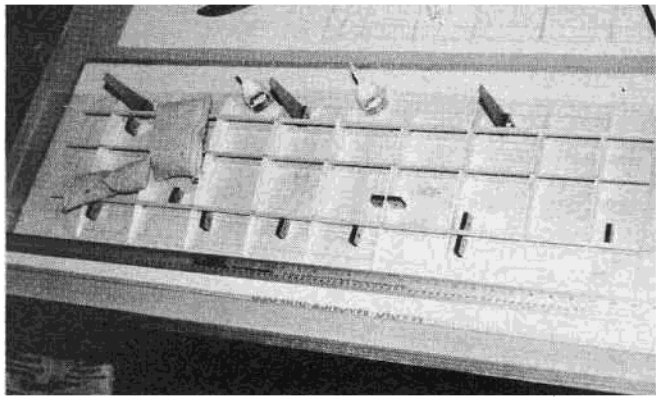
Designed By:
Floyd Manly
TYPE AIRCRAFT
Sport Scale
WINGSPAN
72 Inches
WING CHORD
11¼ Inches
TOTAL WING AREA
810 Sq. In.
WING LOCATION
High Wing
AIRFOIL
Flat Bottom
WING PLANFORM
Constant Chord
DIHEDRAL EACH TIP
2¼ Inches
OVERALL FUSELAGE LENGTH
48¼ Inches
RADIO COMPARTMENT SIZE
(L) 18" x (W) 4½" x (H) 4½"
STABILIZER SPAN
23½ Inches
STABILIZER CHORD (incl. elev.)
4¼ Inches (Avg.)
STABILIZER AREA
147 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top Of Fuselage
VERTICAL FIN HEIGHT
8 Inches
VERTICAL FIN WIDTH (incl. rud.)
10 Inches
REC. MOTOR SIZE
Astro geared 40 cobalt
BATTERY SIZE
18 Sub-C batteries
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Rud., Elev., Ail., Motor Control
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa, Ply & Spruce
Empennage	Balsa & Ply
Wt. Ready To Fly	116 Oz. (7 Lb., 4 Oz.)
Wing Loading	20.6 Oz./Sq. Ft.

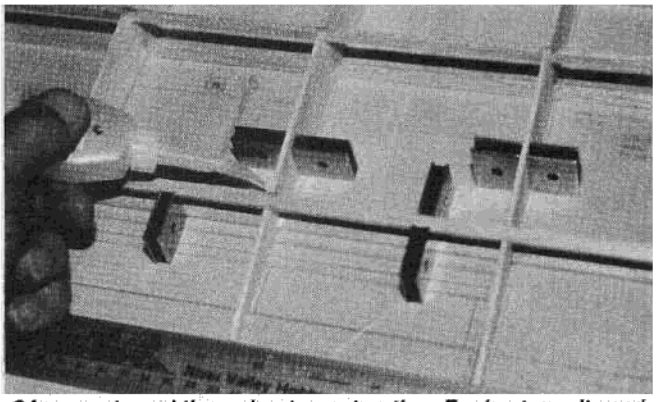
CONSTRUCTION

Wing/Stab:

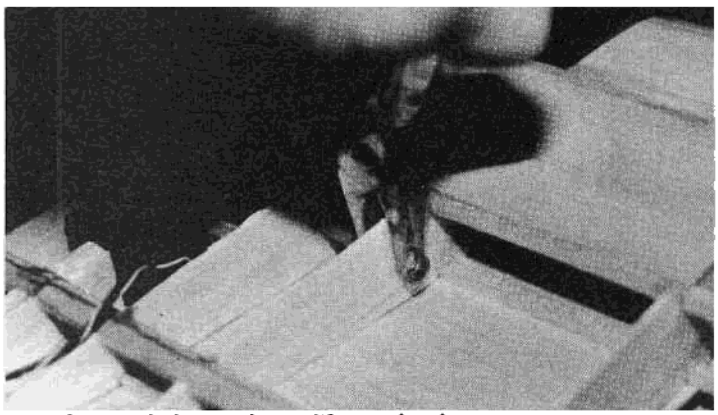
Your job will be much easier if you take the time now to make yourself a rib template. Cutting one from thin aluminum, if you have any, is best. If not, make the template from 1/8" plywood. After sanding it to the final shape, coat its edges with CA glue. The CA hardens the wood so your knife won't shave off slivers as you cut each rib. Other modelers may be able to stack 15-25 ribs and cut them altogether on a band saw, but I've never had any success with this method. I've always finished up with some weird tapered shapes. I cut each rib separately, **then** I stack them for sanding down to final shape. Sort out



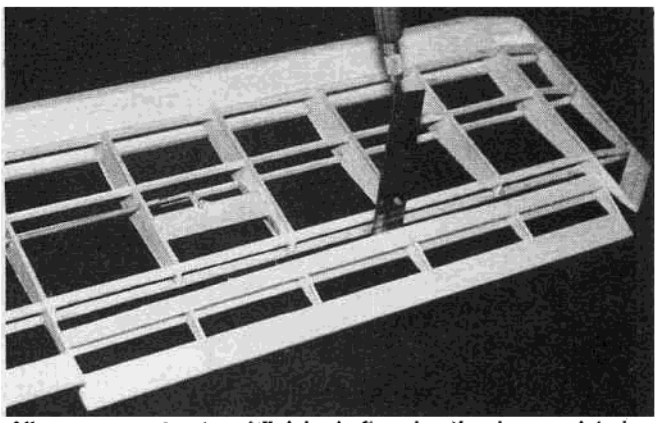
The wing is built directly over the plans. Choose your wood carefully.



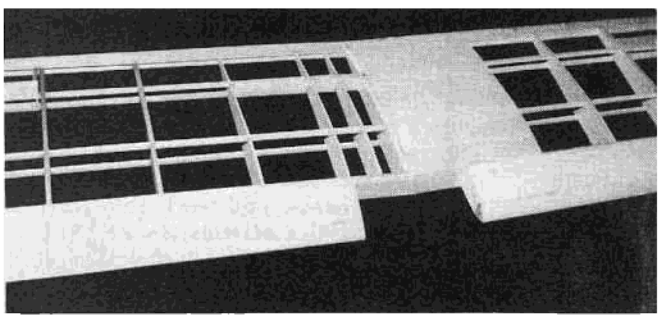
CA cement used throughout construction. For best results and the strongest structure, ensure that all parts fit snugly prior to gluing in place.



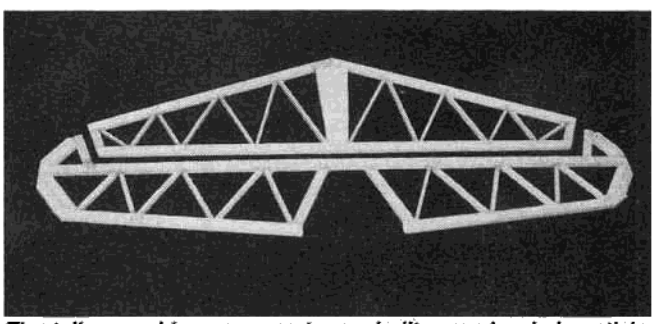
A paper hole punch used for pushrod access.



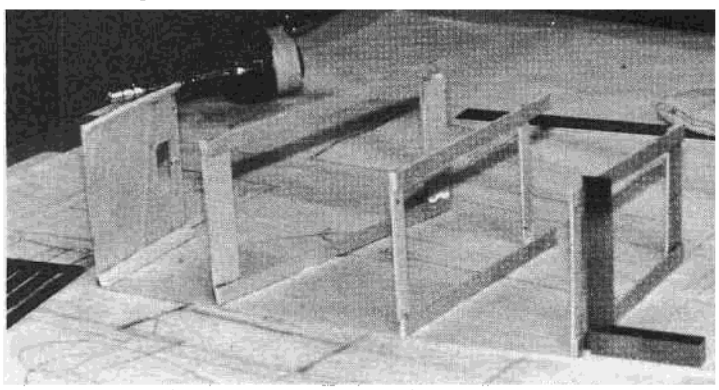
Ailerons are cut out and finished after sheeting is completed.



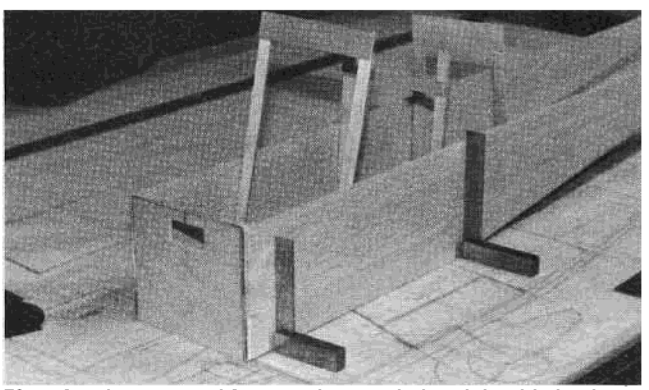
Wing panels are joined together using plywood dihedral braces. When cement has cured, add the top and bottom center section sheeting.



The tail assembly components are built up using balsa stick material. Choose your wood carefully to keep the weight down.



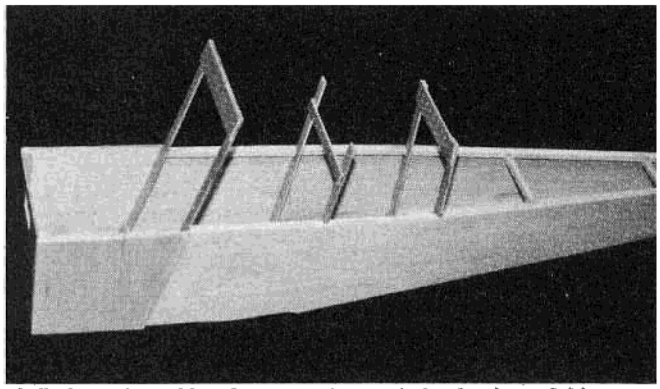
Formers F-1, F-3, F-4, and F-5 are all made from 1/8" plywood (see plans). Be sure that formers are glued square to fuselage side.



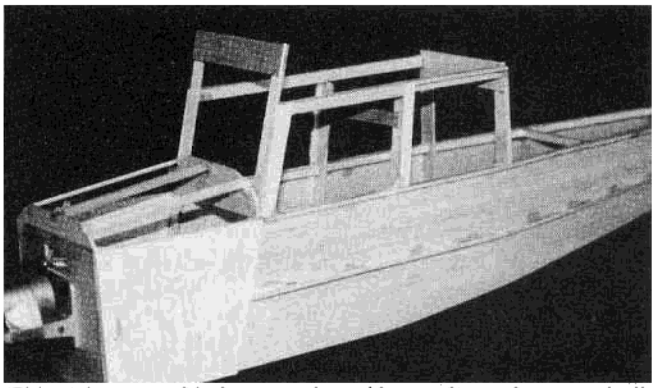
Place fuselage assembly over plans and glue right side in place. Again, ensure that assembly is square.

the cut ribs according to wood hardness, so you don't end up with all the soft ones on one side. Cut the ones you'll need for the aileron servo bay, and punch out the ones you'll need the aileron rod to pass through. The ailerons will be cut loose and finished after the wings are built. Lay out the wing bottom stringers, and glue the ribs in their proper spacing. Leave that last tip rib off for now.

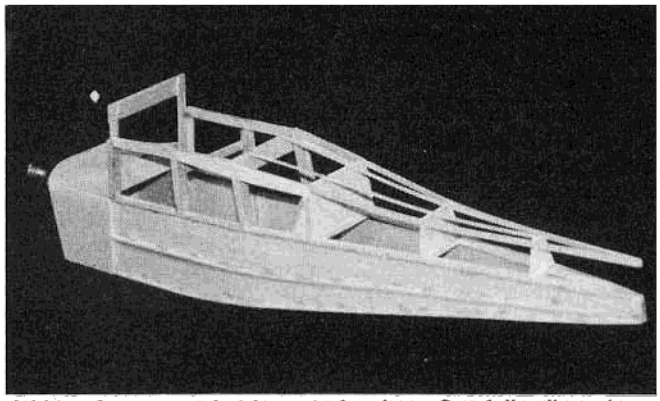
A deviation from scale is that the E-D wing was designed with only two sections instead of three, with a flat center section over the cabin. It's



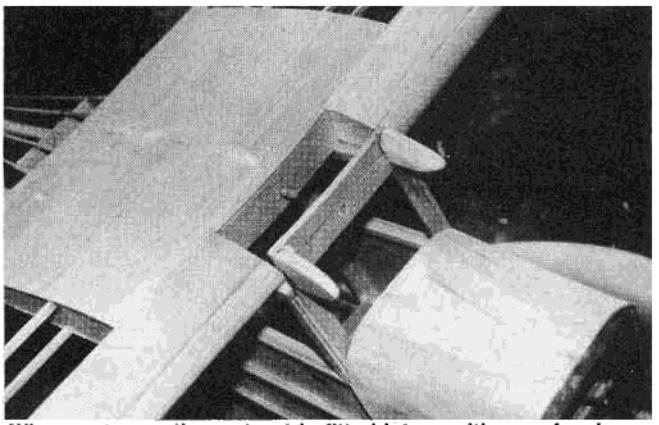
Pull aft section of fuselage together and glue in place. Add cross braces and check alignment to ensure that structure is true. Balsa doublers also glued in place on nose section.



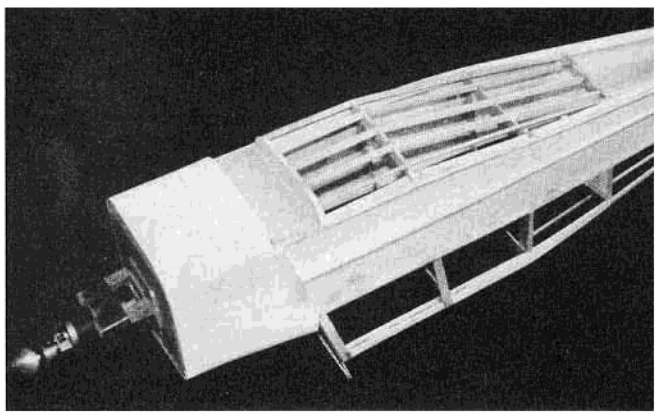
Side stringers, cabin framework, and forward nose framework all glued in place. Motor mount has also been bolted in place on the F-1 firewall.



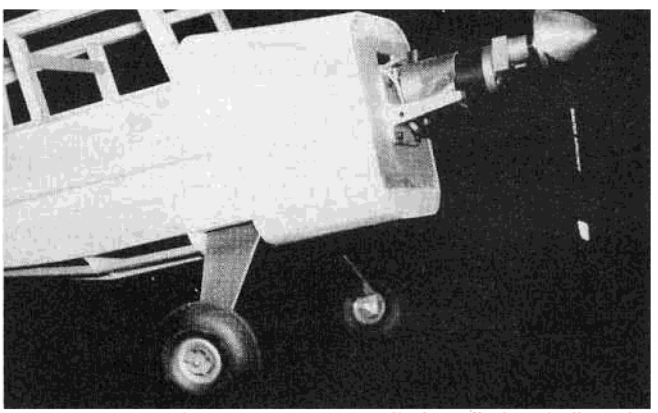
Add top formers and stringer to fuselage. Carefully align when gluing in place. Also, add top sheeting to nose section. Do not install bottom formers or stringers until the wing alignment/installation is complete.



Wing center section cut-out is fitted into position on fuselage, and drilled for wing dowel and wing mounting bolts.



Bottom formers, stringers, and lower nose block all glued in place.



Landing gear and motor are temporarily installed and aligned.

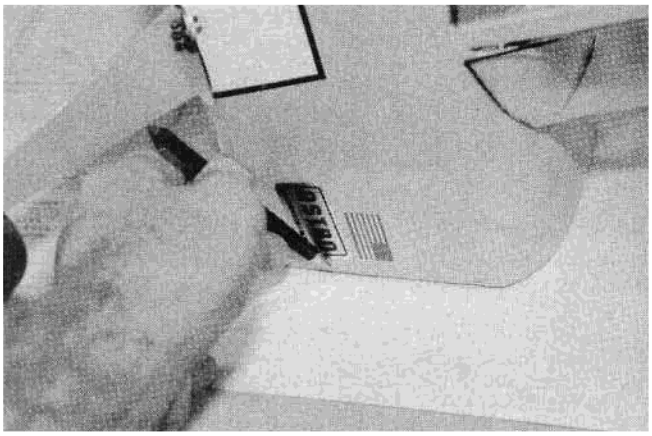
easier and lighter this way.

You can add the front and rear bottom sheeting by slipping these carefully under the wing, and gluing them in place. Now you can add the sub-trailing edge, sand it to the proper shape, then add the top sheeting. All this should put you pretty close to adding the tip ribs and plates prior to cutting out the ailerons. I find the easiest way is to use an X-Acto saw blade with its stiff-back removed. Cut, sand, and hinge the ailerons, add the linkage and bell cranks, etc. Add the strut attaching points, then join the wing. This is about as far as we can go on the wing until we have a fuselage to fit it to, so set it aside and start building up the tail feathers.

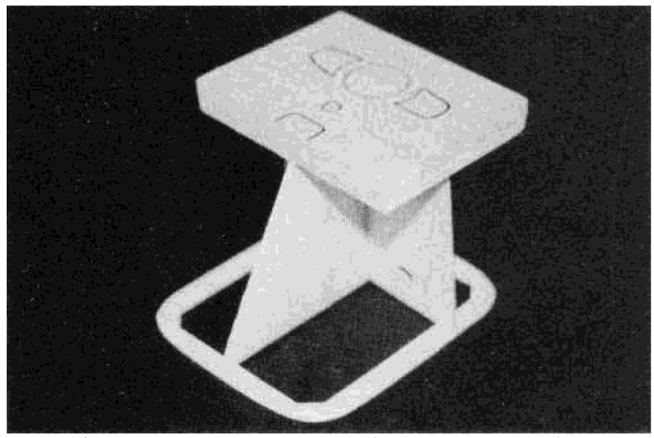
Fuselage:

When you have the tail surfaces ready for covering, we can begin work on the fuselage. You'll need to splice some 3/16" x 3" wide planks in order to cut the fuselage sides to shape. Then cut and assemble all the ply formers and the firewall. Note that F-2 is double thickness laminated. The bottom of the fuselage is flat, until the bottom formers and stringers are installed, so we can work directly over the plans to align the sides while the main formers are being glued into place. After the tail is drawn together the side stringers can be added. These really stiffen the sides. Add the plank doublers on each side of the nose section. Work carefully while adding the upper aft fuselage formers and stringers. Finish the tail section by building up the horizontal stabilizer platform with vertical grain sheeting. Follow the plans to complete the cabin area and wing platform. Leave the bottom stringers and chin plate off until the wing is set and aligned.

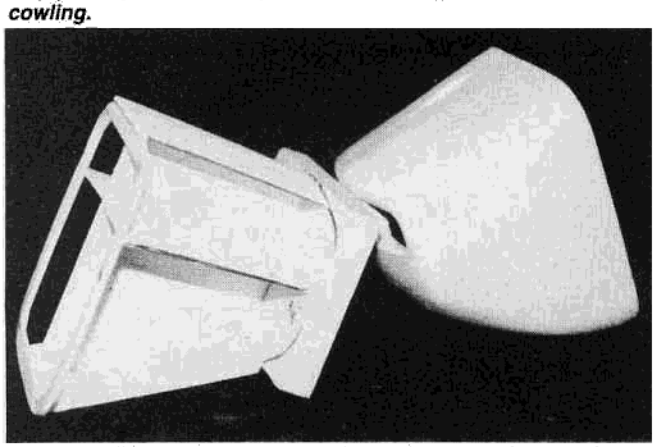
Set the wing onto the fuselage saddle and check its alignment carefully before drilling the necessary holes for the dowel and wing bolts. Now you can fiberglass the wing



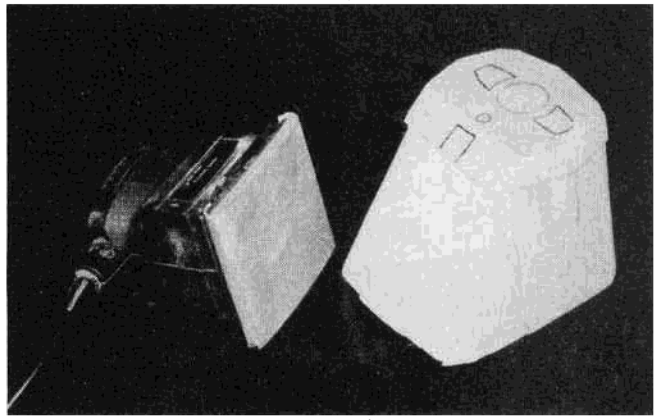
Begin cowl by making outline on stiff paper. Then, transfer shape to plywood, and allow for the 3/32" balsa used to cover the cowling.



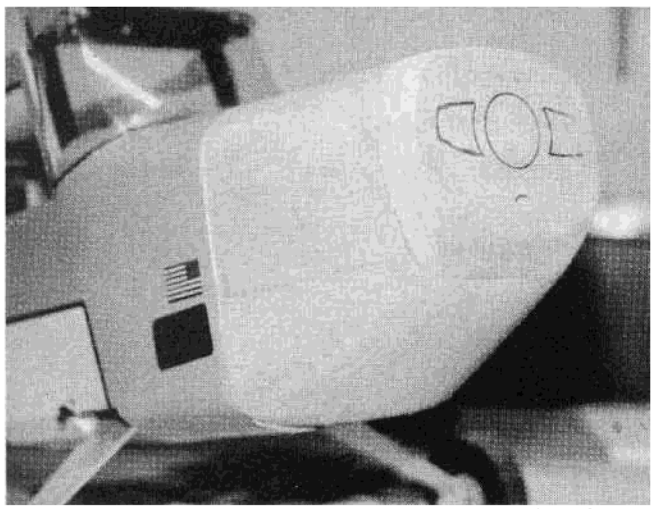
Nose block and rear cowling frame glued to support crutch. Nose block is made up from three laminations of 1/4" balsa sheet.



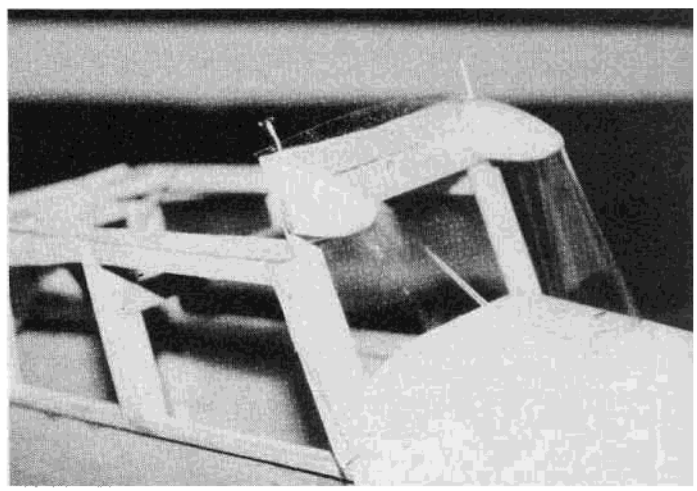
Trim nose block to approximate shape shown on plans, and start adding the 3/32" sheeting to the top and sides.



The "chin" or bottom of the cowl is made up from two laminations of 1/4" balsa sheet. The assembly is then shaped to follow the contours shown on plans.



After shaping is complete, remove crutch and open the holes in the nose block.



Windshield cut to size and being fit to fuselage.

center section. Finish the fuselage bottom and landing gear plate.

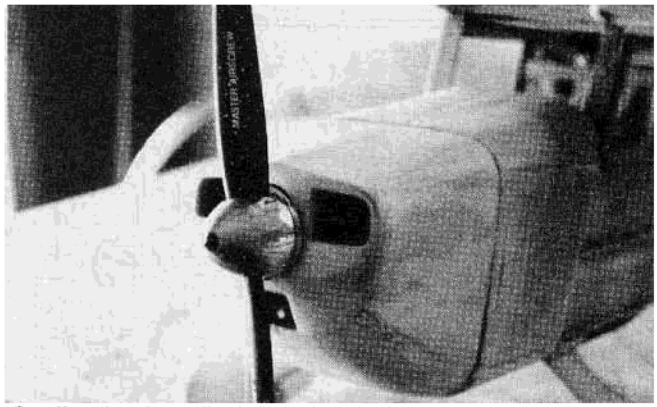
Cowl:

You can easily make up a lightweight balsa cowl. First, trace the outline of the size you'll need on some stiff paper, then cut the template 3/32" (or 1/8" depending on the wood you'd rather use) smaller than the outline. Make up a former from 1/8" ply that you've cut into 1/2" wide strips. Add gussets in the corners. Now make up a nose piece from three laminated sheets of 1/4" balsa that you've cut to the approximate shape.

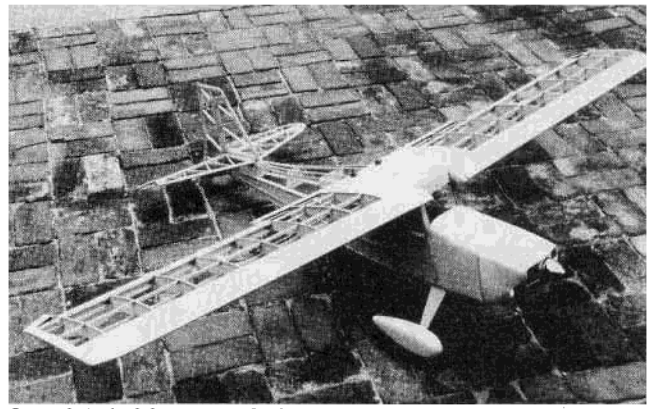
An X-crutch is used to temporarily hold the back former and the nose in relation to each other while you add the top and side sheeting and the bottom 1/4" balsa plank. Be sure you allow for the thicknesses of the former and the nose when you cut the crutch pieces. Glue the sheeting to the **back** of the nose, and the **outside** of the 1/8" ply. The "chin" of the nose piece is compound curved so you'll have to build it up with a couple thicknesses of 1/4" sheet.

When all the sheeting is in place, break out your trusty X-Acto and carve them down to the general shape. Then start with 80 grit paper and progress down to the finer stuff as you get closer to the finished look.

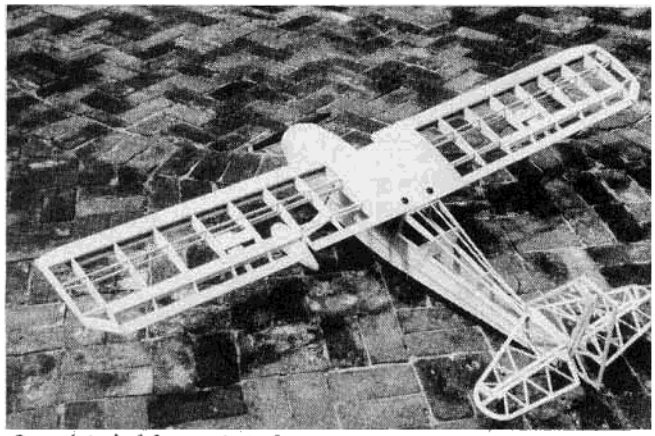
Remove the X-crutch. Cut the opening for the prop, etc., then gouge



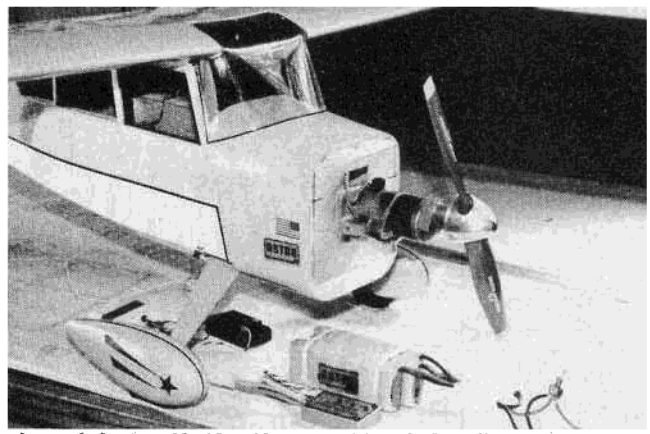
Cowling is given final fitting and alignment with motor and spinner in place.



Completed airframe ready for covering and radio installation.



Completed airframe, top view.



Geared Astro .40 13 x 10 prop, 18 sub-C cells, Astro speed control switch, and charge plugs.

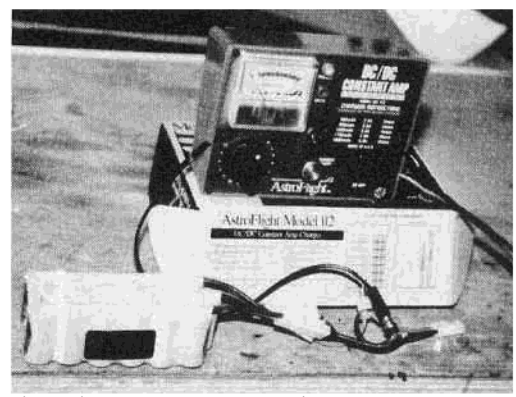
out as much of the internal wood thickness as you can. A thin coating of epoxy resin inside will add greatly to the strength of the cowl shell. Paint or cover it with iron-on coating.

Motor/Radio Installation:

The servos, pushrods, and switches can be installed per the plans at any time, but you'll notice that we haven't glued down the motor battery pack yet. Those 18 sub-C cells weigh **32 ounces**, and they need to be located only after everything else is completed. By the time you add up the weights of the speed control, harness, switch, and the battery box, you'll have the heavy items that can change the C.G. by their final locations. All these items are going to come up to over 3 pounds, so you want to hold them out until the very last. Your final locations may vary slightly from the plans. Even though you won't have to bag your receiver for protection against seeping fuel, you'll still need to foam wrap it and your speed control, to cushion them from vibration. They're electronic devices, and must be protected. Wrap your radio battery too.

Speed controls are becoming available for many-cell aircraft. Astro has a new 35 amp one that is completely prewired, in a heat sink box, and ready to plug in for use. Jomar also has what they call their "1990" SM-4 controller that's rated for 6 to 28 cells. It comes prewired with Sermos connectors, but you need to supply the radio connector, and build a heat sink. I'd get into real trouble if I start comparing one brand to another, performance-wise, so I'm just going to tell you to look into **both** before you buy, and you'll be happy with **either** one you buy.

A word is warranted here about the connectors you use. The Astro components come prewired. I found these to be every bit as good as the highly touted Sermos connectors, as long as both brands were new. But, it was not too long before the stock brand showed why people quickly change over to the Sermos. These just did not start to show the power loss and intermittent running that the **pin** connectors did, and in fact, the Sermos seemed to improve with age. The trade-off, of course, is the price. At over three bucks a pair, the cost of the Decathlon-E went up another $15.00. A small price to pay . . . for the performance received, when you consider the list price of the Astro geared 40 power system. Including the charger required to juice up those 18 sub-C cells, you have just about the money for an imported fuel .40, a power panel, starter and battery, fuel



Astro Flight Model 112 Charger used to charge the 18 cells. This unit will handle up to 24 cells.

pump, a half dozen glow plugs, and maybe enough fuel for a couple of seasons.

What you **don't** get is a carburetor that needs adjustments almost every flight, "flame-outs" right after lift off, or gunky aircraft that drip all over the back of your van. What you should be hearing from this, is that the initial cost may be high, but the benefits soon overcome the sticker shock.

Performance:

We got just about what we expected. After breaking in (read: seating the brushes) for about 30 minutes of 50% power, we let everything cool down,

From RCModeler May 1990

then charged the 18 Sub-C batteries for 15 minutes with the Astro 112 DC/DC Constant Amp charger attached to an auto battery. Using our trusty torque meter, tachometer, and stopwatch, we tested the combination as set up in the aircraft. The first 20 seconds showed a burst of power up to 6,600 rpm and 4½ lbs. of static thrust when swinging a 13 x 8 prop. (As a comparison, my 05 with 7 C-cells shows 1.5 lbs. with a 7 x 6 prop.) The Astro then settled in at 6,400 rpm and 4+ lbs. torque. It held this for about 5½ minutes, then started coasting down. I chopped the throttle for as long as it would have taken me to set up my final, then opened up again to get a short burst that would have gotten me over the fence if I had needed to. All this comes down to mean that the performance is there, but it's got to be handled differently.

The Electric Decathlon can be taxied, from the pits to the runway and still take off, but it will use that extra little boost of power that could be used to climb to altitude more quickly. If you fly from a hard top runway, you may hardly notice the difference. On grass, I advise hand carrying the plane to the point of take off.

Covering:

I forgot something that I'd learned a long time ago about how to cover an aircraft economically. This time I started cutting up the roll of MonoKote to do the elevator, ailerons, and stabilizers. Then I did the wings, but when it came time to do the fuselage I found that I had a whole pile of pieces but none were large enough. I had to buy another roll just to finish. Now I have a 3/4 roll and a box of odd size pieces left over. You're saying; "Dummy, **everybody** knows you cut the wings from one roll, cut the fuselage from another, then do the small areas with the pieces that are left over. Sure, **now** you tell me! The cowl can be done by using small enough pieces to cover the compound curves without wrinkling. Think of it as though you were bending metal, and you'll start to see a series of "panels." Touch up the bare wood around the vents with yellow paint, and you'll have a finish good enough for stand-off scale.

Flying:

We checked out the ground handling by running the Decathlon back and forth across our grass field. She tracks easily if you have a little toe-in, and she turns nicely. This check also ran our batteries down to full depletion, which is a good habit to practice to prevent building in a memory of partial power. I got a little careless with the elevator and let her nose over. 13 x 8 wooden props, whether they're Master Airscrew or Zinger ain't cheap. That was a $3.00 "aw-shucks!" If somebody has a glass filled nylon prop in my size, I'd like to hear from him. (Note: Master Airscrew has a **4-stroke** 13 x 8, but it was not tried before this article was written.)

When we worked up nerve to attempt a take-off, we found that she just couldn't quite make it. She wouldn't develop enough speed to get airborne from our grass field that admittedly needed mowing. We broke our last 13 x 8 prop! A trip to the local hobby shop revealed that we had used his entire stock (3) of props that size, but that he did have **one** 13 x 10. The sun was still shining, so we headed back out to try again. This time the Electric Decathlon became airborne about 2/3rds down the runway, rose quietly (compared to a fuel drinker), and climbed over the soybeans.

I'm accustomed to flying fireballs that can be vertically hand launched. The E-D has to be **flown** with the elevator, ailerons, and rudder --- not the throttle. You can't hang it on its prop, and head for the clouds. It must be worked up to altitude, then flown with the same finesse of power as a full sized Decathlon. Loops from level are available for only the first two or three minutes of flight time. After that, a shallow dive to gain speed is needed. By judicial use of the throttle, i.e., 3/4 power for everything except when it was needed to get over the top, we were able to get seven minutes of purposeful flying into almost all of our flights. Two touch and go's were available at the first 3-5 minutes, but a third attempt clipped the corn.

If I need to describe to you what a full size Decathlon can do, then you don't need to build this one. This Electric Decathlon **will** turn in the full aerobatic routine that Duane Cole's did! If you want that, in an electric . . . then you got it. □