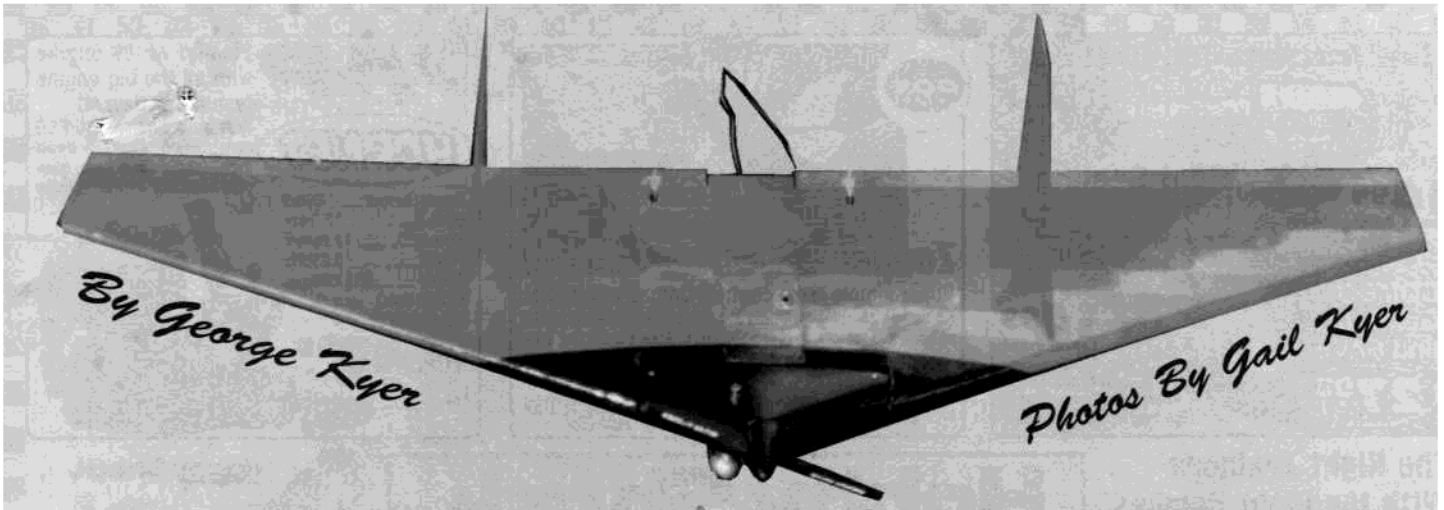


By George Kyer

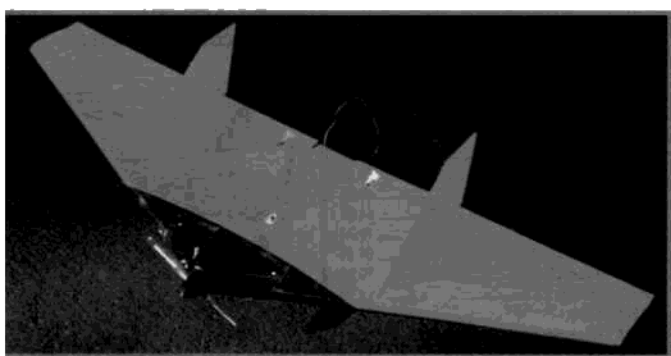
Photos By Gail Kyer

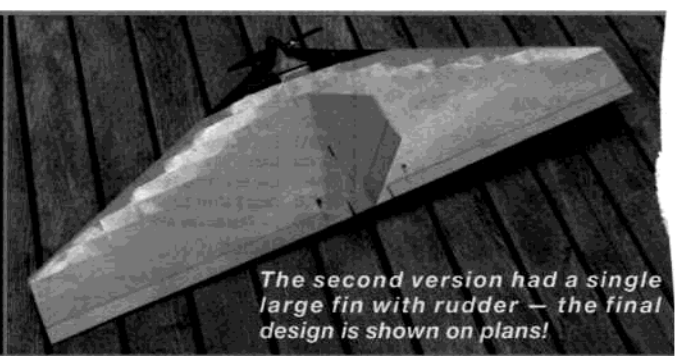
DELTAMITE

.10 Powered Flying Wing

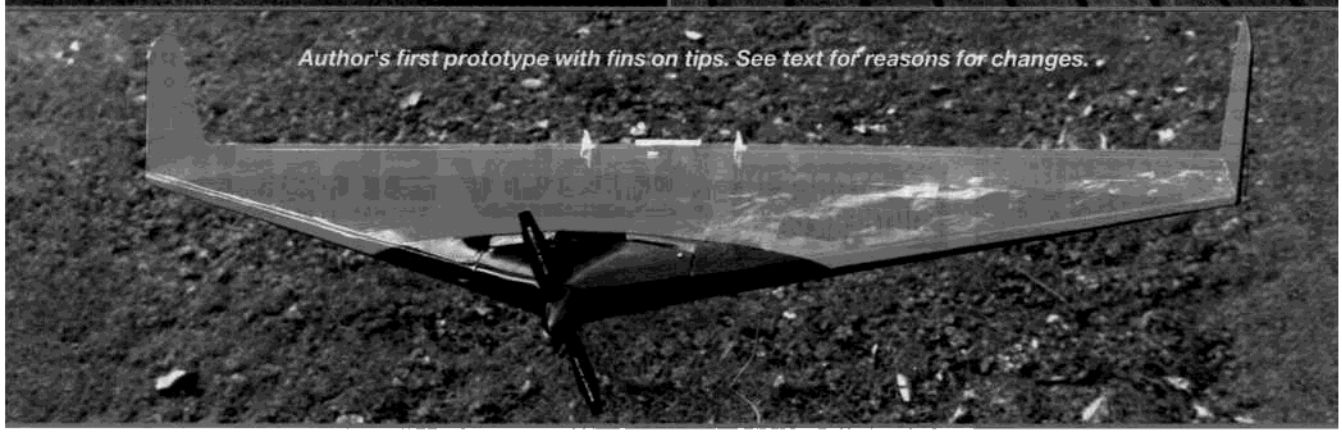
I have always been fascinated by delta wing and flying wing aircraft. I have also been a modeler for over 40 years and, during that time, have casually noted any models of pure flying wing planform. They have been few and far between, and those few that have been published always have the engine hanging out in the breeze, thus spoiling the aesthetic qualities of a pure flying wing. In 1993, I decided to design a model that would meet my requirements of a pure flying wing with a cowled engine. Since I like small models, I decided on basing the design on my trusty O.S. .10 FSR. I used Chuck Cunningham's design parameters and the *RCM Illustrated Plans Guide* for a design that would have a similar planform, but came up empty. (I recently saw ads in *RCM* for this type model, but none were readily available when this design was hatched.) The designs closest to my idea were those by Laddie Mikulasko and Bill Evans. Having exhausted my reference library, I decided to design the model scientifically. I got out a sheet of drafting paper, drew a fuselage centerline and firewall on it, set the engine on it, and drew the wing leading edge so that it would enclose the engine. The maximum sweep I could get was 25°.

My main concern was the wing airfoil and C.G. location. I had no idea





The second version had a single large fin with rudder — the final design is shown on plans!



Author's first prototype with fins on tips. See text for reasons for changes.

Launch with a slight nose-up attitude.

what would work on a flying wing. Again, I relied on my vast grasp of aeronautical science and made the wing leading edge thick enough to enclose the engine and created the remainder of the airfoil with my old reliable French curve. Locating the C.G. was the next problem. I used Chuck Cunningham's method for locating the C.G. on a delta wing, which was the closest configuration for my flying wing that I could find. As it turned out, I either miscalculated the C.G., or the delta wing configuration does not directly apply to a flying wing because my initial C.G. was too far aft. I found this out on my first test flight. I confirmed that the structure was very robust.

After completing the model, I took the mandatory "before" photos and departed for my pasture airfield. I checked everything and launched it with much trepidation. To say it didn't fly off the drawing board is an understatement. It went straight up about 20 feet, did some indescribable maneuvers, and came straight down. I had no control. Luckily, all it did was tear off a wingtip fin. I shakily gathered up the remains and took them to my workshop for repairs. After mentally reconstructing the disaster, I concluded I had an aft C.G. problem. I moved the C.G. forward by scientific guestimation.

On the second flight I had positive elevator control but the model veered to the right on launch and I didn't have enough lateral control to completely level the wings. Another crash resulted and another fin torn off. My response to this latest tragedy was to enlarge the fin area by adding a third fin to the fuselage centerline.

I was euphoric on the third flight when it took off like a homesick eagle. However, on a low pass I noticed the model "searching" around the vertical axis and made a mental note to add even more fin area. Then, when I retarded the throttle for landing, all hell broke loose when the nose pitched up. I added power and it flew well again, but every time I reduced power the nose would pitch up. To say I was confused is putting it mildly. While I was trying to get the thing on the ground in one piece, a tree solved the problem for me. More wingtip repairs, but this time I removed the tip fins and made one large fin on the centerline. To correct the pitch-up, I changed the engine thrust line from 0° to +3° (upthrust).

On the next flight, the model climbed gently in a straight line, but I was aghast when the model did not respond to control inputs. I had forgotten to turn on the receiver switch! I repaired the torn-out firewall and changed the large centerline (it looked like a shark) to two fins of equal area mounted midspan. It has flown well since these changes were made.

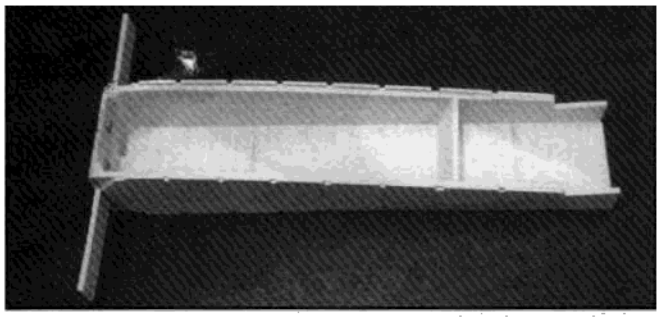
I am only relating these mishaps to assure those who are interested in building this airplane that it is well-tested and, if they encounter any trim problems, my experience may help solve them. Before you select this model for your next project, be advised you will need a small receiver and servos and an aileron/elevator mixer on your transmitter. It is also not a beginner's model to fly. It flies with straightforward characteristics, but will swap ends if overcontrolled. If you are hamfisted, you will have your hands full.

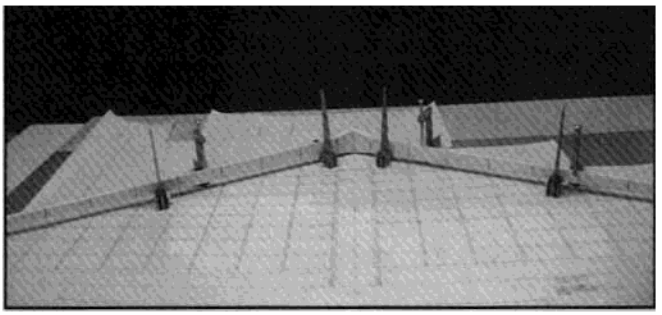
DELTAMITE

Designed by:
George Kyer
TYPE AIRCRAFT
Delta Flying Wing
WINGSPAN
41 Inches
WING CHORD
7-1/4 Inches (Avg.)
TOTAL WING AREA
295 Sq. In.
WING LOCATION
NA
AIRFOIL
Semi-Symmetrical
WING PLANFORM
Delta — 25° Sweep
DIHEDRAL, EACH TIP
0
OVERALL FUSELAGE LENGTH
13-1/2 Inches
RADIO COMPARTMENT SIZE
(L) 9-1/2" x (W) 3-1/4" x (H) 1-1/2"
STABILIZER SPAN
NA
STABILIZER CHORD (inc. elev.)
NA
STABILIZER AREA
NA
STAB AIRFOIL SECTION
NA
STABILIZER LOCATION
NA
VERTICAL FIN HEIGHT
5-1/2 Inches (x-2)
VERTICAL FIN WIDTH (inc. rud.)
6-1/4 Inches (Avg.)
REC. ENGINE SIZE
.10 2-Stroke
FUEL TANK SIZE
2 Oz.
LANDING GEAR
NA
REC. NO. OF CHANNELS
3
CONTROL FUNCTIONS
Throttle & Elevons
C.G. (from L.E.)
5-1/4 Inches (at Fuselage)
ELEVATOR THROWS
3/16" Up — 3/16" Down
AILERON THROWS
3/16" Up — 3/16" Down
RUDDER THROWS
—
SIDETHRUST
2° Right
UPTHRUST
3°

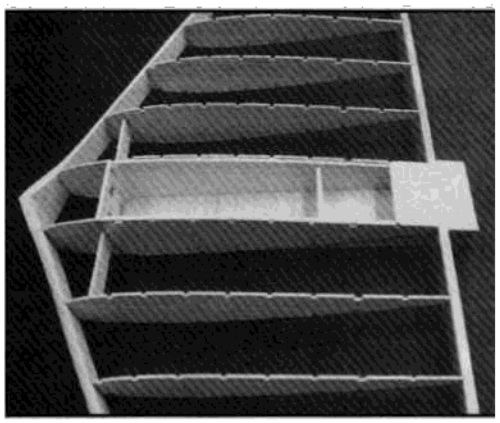
BASIC MATERIALS USED IN CONSTRUCTION

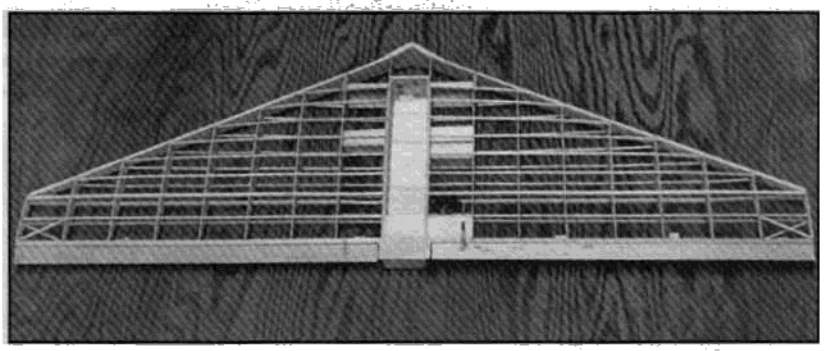
Fuselage	Balsa & Ply
Wing	Balsa
Empennage	Balsa
Wt. Ready To Fly	22 Oz. (1 Lb. 6 Oz.)
Wing Loading	10.6 Oz./Sq. Ft.



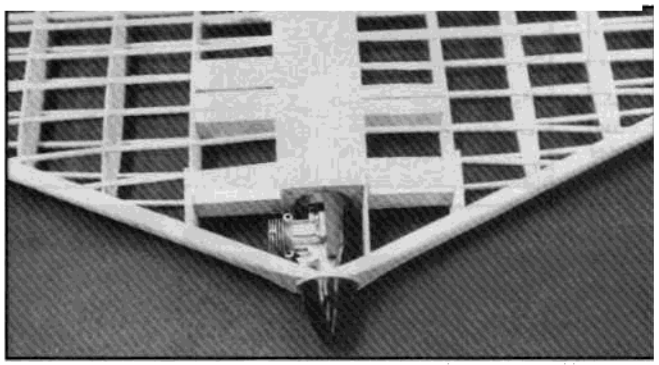


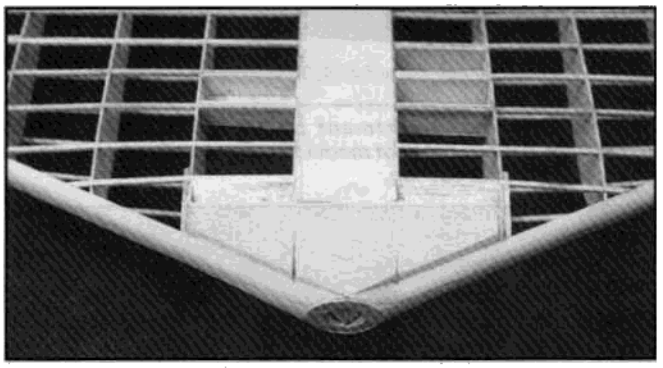
LEFT: Basic fuselage box with firewall and W1 ribs glued in place. RIGHT: Wing leading edge in place over plans.





LEFT: Leading edge, trailing edge, and ribs assembled and ready for 1/8" sq. spars. ABOVE: The basic structure is almost complete at this point. Vertical fins are glued in place after covering. Note: Plans show correct locations for all components.





LEFT: Engine mounted so leading edge could be trimmed for cowl construction. RIGHT: Styrofoam blocks added so cowl could be shaped.

CONSTRUCTION

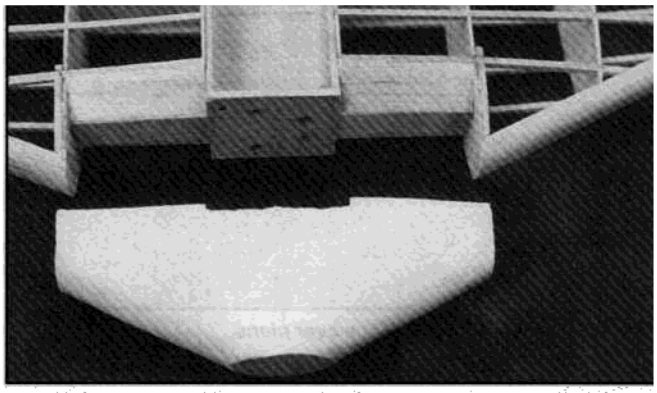
Construction is straightforward. I used contest grade balsa for all balsa parts except for the 1/8" sq. stringers which are medium grade. Make yourself a "kit" by cutting out all the various parts. The only quirky thing is the leading edge (LE). Drill for the engine mount, fuel lines, and throttle in the firewall. Install engine mount blind nuts. Mark alignment lines on the fuselage sides and W-1.

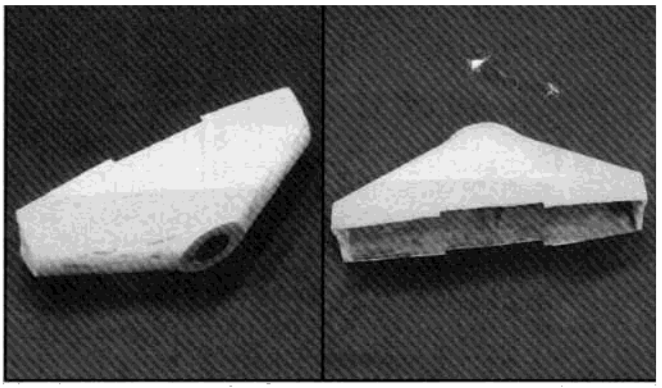
Fuselage:

Begin by building the fuselage box over the plans. Protect the plans with waxed paper. Use triangles to ensure that the sides and rear are square. The front of the sides have +3° upthrust so don't square the firewall. Right thrust is obtained by putting a washer under each left engine mount bolt when the engine is mounted. Fit the 1/16" balsa top even with the sides, but don't glue at this time. Glue W-1 to the fuselage sides using the alignment marks for accurate positioning. Everyone has their own preferences for adhesives. Here are mine: I use thin CA glue for small areas with snug-fitting parts already positioned, such as the wing stringers in the rib notches. I don't like thick CA glues because they always seem to set up before I can get the part in position. I use sandable aliphatic resin glues (Titebond, Gluit, etc.) where there is a little "slop" in the parts' fit or where you have to adjust the part for a proper fit. I resist using epoxy because it is too heavy and messy.

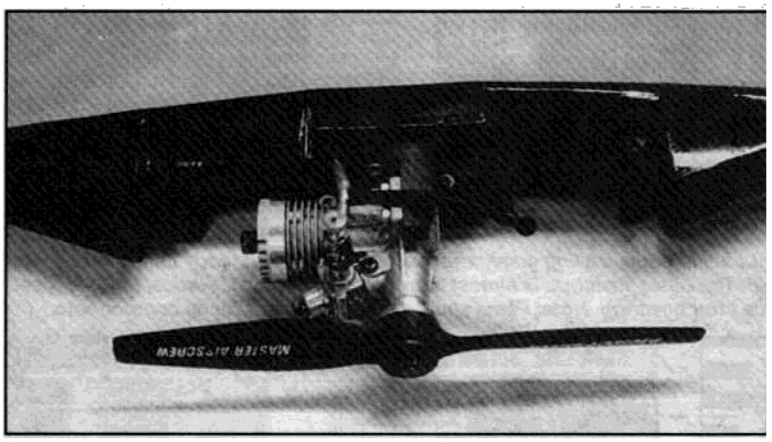
Wing:

Shape the trailing edge (TE) before assembly. Be sure the rib slots in the TE and LE are slightly less than 1/16" wide so the ribs fit snugly. The wing will stay rigid on the building board and allow more accurate construction. Lay the LE over the plans and prop up each tip 5/8". Hold in place with square blocks or triangles. Also put the TE in position using the rear of the fuselage to key the center portion of TE. Equalize each tip above the building board, this should be 11/16". Insert the ribs and adjust as necessary to get the wing aligned. You will appreciate a tight fit in the LE and TE for this step. Glue ribs and spars in position. Trim the two outside W-4 ribs to fit with 1/8" scrap spacer between the inside W-4's on each side. The fin fits between the two W-4's on each side of the wing. Add the top 1/8" sq. balsa stringers and glue in place. Turn the whole assembly over and glue stringers to the bottom when the top is dry. Fit 1/16" balsa sheet between W-1 and W-2, angling from the "tabs" on the firewall to the first stringers on the top and bottom and each side for cooling channels. Also, fit 1/16" sheet to the inside of the stringers on the wing bottom where the finger holes for launching are located. Glue triangular stock firewall reinforcements in place.

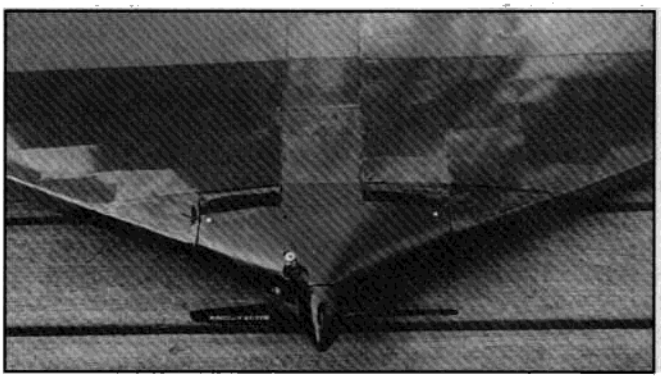


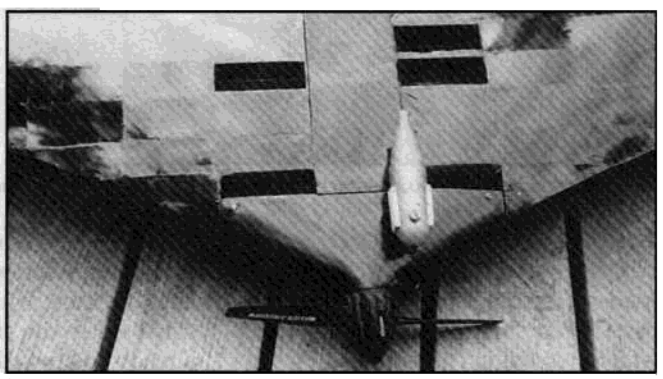


LEFT: The male mold, ready to begin making the cowl. RIGHT: Completed cowl removed from male mold, ready for sanding and holes for engine access.



ABOVE: Engine compartment painted and sealed, ready for cowl installation. RIGHT: Front of model showing cooling holes. These were later enlarged for better cooling.





LEFT AND RIGHT: Top and bottom views of cowled-in engine on finished model.

Use the plans for bending the elevon torque rods from 1/16" music wire and 3/32" brass tubing for bearings. Solder 3/32" brass tubing on the clevis end of the rod and flatten the tubing for the 1/16" hole where the clevis will fit. Be sure you make a right and left one. Fit the torque rods to the elevons and slot the elevons and TE for hinges.

Final Construction:

Add the top fuselage sheeting and trim the length to fit between the front of the firewall and rear fuselage. Cut the sheeting 3" from the firewall and glue in place. The rear portion will be the hatch and hinged at the front with covering material. The rear is secured with a small screw and a hardwood block cemented to the fuselage rear. Sand the front apex of the LE flat to within about 1/16" of the rear of the apex. Cut a hole large enough to accept the drive shaft of your engine. Remove the head of your engine, mount the engine to the engine mount, and secure the assembly to the firewall. Enlarge and center the hole to accept the engine front. Be sure the hole is not larger than the spinner diameter and is parallel with the rear of the spinner. Remove the engine and mount and add the C parts. Fill the area between the C parts tightly with white foam and glue in place. Do not glue to firewall. Sand the LE to shape and blend the front end into the airfoil. Sand the whole airframe. Cut the LE at C-3 on both sides with a razor saw and remove the LE and foam as a unit. This will be your male cowl mold. Remove about 1/32" from the mold surface to compensate for the material you choose to make the cowl. I made mine from brown paper bag strips and diluted Titebond in a form of paper maché. Fiberglass or epoxy are also possibilities. Be sure you wrap the mold tightly in plastic wrap before making the cowl. Trim the cowl for a snug fit and cut holes for cooling, needle valve, etc. Glue four small hardwood blocks to the firewall for cowl attachment points.

You will need a remote glow plug

The author preparing for another flight.

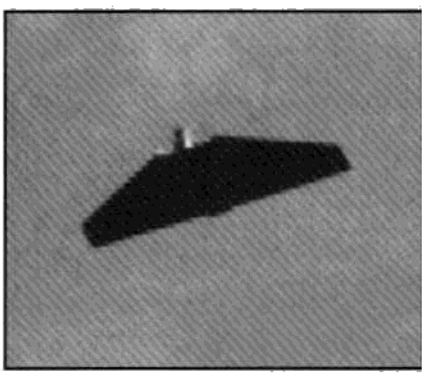
connector for your cowled engine. I made one from a Deans External Charge Connector and a 3/32" wheel collar. File the chromeplating off the collar and solder a wire to the bare brass. Solder the other end to the charge connector. Solder another wire on another pin on the charge connector and connect the other end to the engine. Slip the collar over the glow plug (don't let it touch the engine proper) and tighten the set screw. Mount the charger connector in a convenient fuselage location.

Vertical fin construction is conventional, using 1/8" x 1/2" balsa sticks or lightweight 1/8" sheet with lightening holes. I covered my model with neon red UltraCote on the top and black on the bottom. Be sure and use contrasting top and bottom colors to reduce orientation confusion during flight. The delta planform is confusing enough.

Set up the model as shown on the plans. Be sure to set the elevon reflex as called out, then set the max elevon throw at 3/16" up and down, and be sure the C.G. is as shown or slightly forward.

Launch it at a slightly positive angle and it should fly right out of your hand. Have fun, and enjoy your unique model.

✈



Be careful when getting used to a flying wing, they have a very different silhouette at different angles!