Aviafiber

By Howie Applegate

Looking for something a bit different? Try this a Sport-Scale Swiss Canard foot launched hang glider for two channel R/C.

Bored with the routine? Tired of the hum-drum? Here is a unique and interesting glider in the two meter class. I first spotted a picture of this aircraft in the October 1979 issue of *Soaring Magazine*. A further search in later issues produced a three view drawing and specifications.

This canard configuration is a Swiss design foot launched hang glider. It spans some 44 feet, is built of fiberglass over foam, and weighs about 98 pounds. The pilot stands inside the cockpit (the canopy slides back) with his legs sticking out of the bottom of the fuselage. The pilot runs to gain speed. When airspeed is attained, he pulls himself inside and lays on a dolly. Pitch control is maintained by the pilot sliding forward and aft, changing the C.G. of the plane. Directional control is attained using ailerons mounted externally beneath the main wing. Speed control is achieved by utilizing split venom type flaps on the Vee Wing mount.

I took certain liberties with the model to make building a reality. I decreased the aspect ratio of 20 to approximately 14. I eliminated the ailerons and used the Vee wing mount flaps for directional control. I eliminated the sliding pilot for a standard elevator hookup. Then I built a simple hand launched glider to the same proportions as the model to test performance. I found that I had to add some dihedral to the flat wing to get proper steering.

You must realize that this HL Glider was free flight, and it is possible that with the R/C model, proper steering and stability could have been maintained. The magazine article also stated that a power package was intended for the aircraft, so I assumed the natural location for an engine would be behind the wing mount. Let's get onto building.

Horizontal tail

The horizontal tail is very conventional. Its flat bottom makes it possible to build directly over the plans. If 1/16 × 1/2 hard balsa is not available for the leading edge, use a piece of 1/16 sheet 1/2 wide and glue a piece of 1/4 × 1/2 on top of it. The lower center section saddle is 1/16 thick sheet and should be added before the ribs go into place. Glue the ribs directly to the leading edge piece, then secure the 1/8 × 1/4 spar to the back end of the ribs.

The upper center section and spar cap is 1/16 sheet. Cap the remaining ribs with 1/16 × 3/16 strips on the top chamber only. The diagonal tip members are 1/8 × 1/4 balsa. The elevator is 1/4 × 1 1/4 balsa, taper as shown on drawing. The tips and outboard trailing edge are made of scrap balsa; sanded to contour.

The two elevator sections are joined with a piece of 1/16 dia. music wire. Slip a 1 1/2 length of gold-n-rod inner tube over the wire before bending. Epoxy the inner tube to the rear spar after installing elevator hinges. This tube will prevent the horizontal tail hold-down rubber bands from binding the elevator joining-wire movement.

Wing mount

The wing mount is the most important part of this airplane and it also may be built directly over the plans. The lower surface is 1/32 thick hard balsa, pin it to the plans, then add the 1/8 ply WM 1 and the ribs. Add the rear 1/8 × 1/4 spruce spar, the 3/16 square balsa leading edge and the upper 1/8 × 1/4 spruce top spar. Make the flaperon hinge blocks from scrap balsa. Before finishing the wing mount, build the flaperons. The lower surfaces are 1/32 hard balsa sheet. The leading edge is 3/16 × 1/4 balsa. The hinge blocks and horn mounting seats to be made from scrap balsa. Before installing the 1/16 sheet balsa upper coverings to either the wing mount or flaperons, inlet the spars and hinge blocks for the hinges. Use a manicuring emery board or a fine file, as the hinges are to be installed under lower surface of the balsa skins. Join both halves of the wing mount together using the D1 & D2 joiners.

Now, bevel the top of the wing mount leading edge and top of flaperon spar. You may want to install the hinges before adding the upper skins. If you do, bevel the flaperon leading edge before this operation. It will be easier to cover the wing mount and flaperons if you install the hinges after covering. Now,

contact cement the 1/64 ply doubler to the lower inboard sections. Secure the 1/16 medium balsa upper skins to both the wing mount and flaperons.

Wing

The wing is a three piece assembly consisting of a center section with plug-in outer panels. Construction is straight forward using standard techniques. The center section has three 1/16 ply ribs at each outboard end. The outer panels have two ply ribs at the inboard ends. The lower skins of all panels are 1/32 thick balsa and lower trailing edges are 1/16 thick medium balsa.

Start by pinning down the 1/32 balsa lower skins and 1/16 balsa lower trailing edges and 1/8 × 1/4 hard balsa spars. Add the lower 1/16 balsa panels to the outer bays of both the end panels and the center section.

Using the ribs setting template, glue the outer panel inboard plywood ribs in place (this will insure proper dihedral).

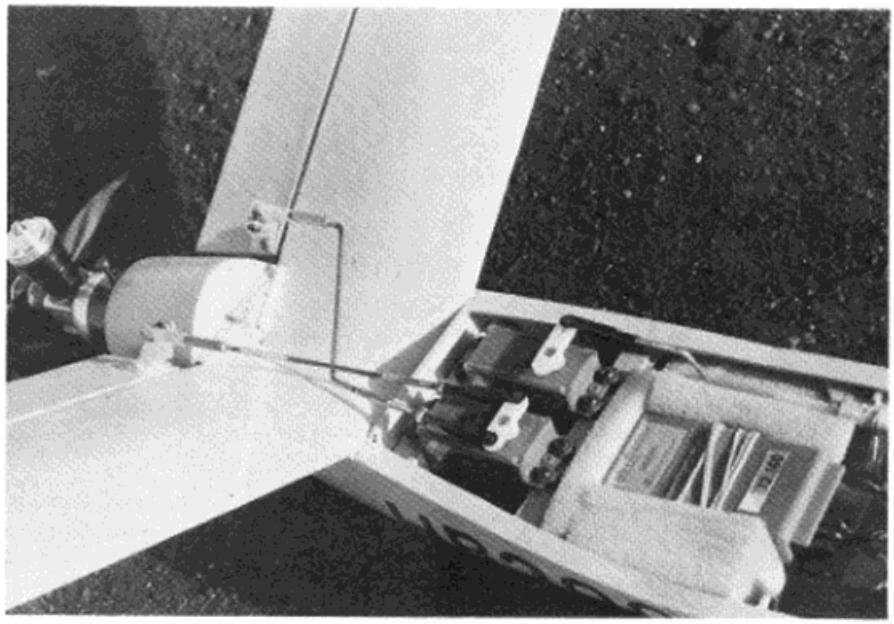
Next, install the 1/8 × 1/4 hard balsa upper spar. The wing center section has 1/16 balsa (grain vertical) shear webs; each end has the first bay done in 1/32 ply. The outer wing panels have the first inboard bay done in 1/32 ply and the next two bays have 1/16 balsa shear webs. Add the 1/16 hard balsa upper trailing edges and the wing locating pin balsa blocks. The wing joiner wires may be installed at this time. The 1/8 diameter wires slip into 1/8 inside diameter aluminum or brass tubing 2 inches long. Apply a thin coat of vaseline or auto wax to the wing wires and slip the tubes over the wires. Insert the tubes into the plywood ribs of the center section and outboard panels. Block up the two outer panels to the proper dihedral and insert scrap balsa wedges on both top and bottom of the tubes. At this point you may have to do some tweaking with the holes in the plywood ribs to get proper alignment and dihedral. A rattail needle file will do the job. When you are satisfied with this alignment, epoxy everything into place using a 1/32 ply outer cap to the outside of the tubes. The 1/8 hardwood dowel wing aligning pins can be installed to the center section after the epoxy cures. Do not put on the upper leading edge skins yet.

Wing center section

This next step is somewhat critical, so care must be taken to get proper alignment. The wing mount has 1/8 ply gussets to hold the tie down plate nuts. These gussets must be sanded or filed to the proper length and bevel to fit between the two 1/16 ply ribs at the outboard center section bays. When proper fit is achieved, set the wing mount in position (make sure the leading edges of both the wing mount and center section are parallel to each other). Mark the tie down holes from the wing mount onto the 1/8 ply gussets. Now drill the gussets and install the plate nuts. The gussets can now be epoxied into the wing center section 1/16 ply ribs. A sheet of saran wrap can be inserted between the wing mount and the center section to prevent unintentional gluing of the two parts together. After the epoxy has cured, the upper leading edge skins (1/16 medium balsa) can be installed.

PHOTOGRAPHY: HOWIE APPLEGATE

Author with two models of the Aviafiber 2FL **(above)**. The big 'un is Howie's R/C ship and the little model is a hand launch glider he built to check design development. Canopy removed to show radio installation **(below)**. Installation features EK radio. Neat installation is a must. Plan pushrods carefully. It'll pay off.



Fuselage

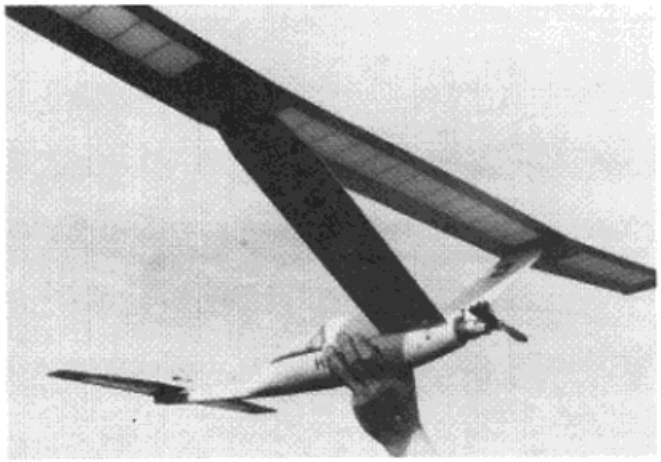
The fuselage, or rather the pod and boom, is built in one piece with a removable canopy section. The boom is also the keel for the pod, made from a piece of 1/2" thick hard balsa with 1/32 ply doublers on each side. After laminating the balsa and plywood with contact cement, cut to the outline shown on the plans. Cut a channel on the top edge of the boom to provide for the Gold-n-Rod elevator control push rod. Cut out and notch all the bulkheads and firewall using plywood (thickness specified on plans).

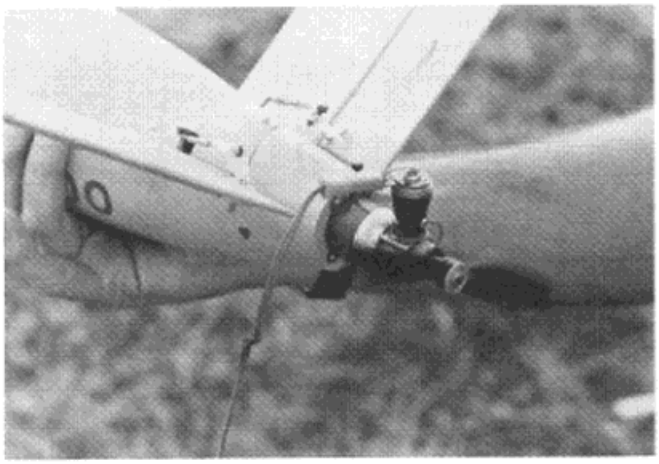
Install all the bulkheads and canopy saddle. If you are going to use an engine, locate and install plate nuts to the firewall. Cut the forward pod fairing blocks from soft balsa to outline only and glue into place. The wing saddle should agree with the wing mount dihedral before being epoxied into place. Do not epoxy the horizontal tail saddle into place yet; wait until final sanding as alignment is critical.

The entire canopy section is framed in balsa; both the pod and canopy section are to be planked with 1/8 thick medium balsa (width as required). Ambroid Cement is ideal to use with planking, as it does not set up too fast and sands extremely well. Do not completely plank the area of the canopy section where the wing goes, as it may be easier to do this after the wing mount is epoxied to the wing mount saddle.

Sand all wing, wing mount, and horizontal tail leading edges to cross section shown on plans. Sand tips and trailing edges also as shown. The wing hoerner tips are airfoiled in shape and rounded on the outside ends. They are bevelled on the inboard ends to give them the drooped look. The boom is basically flat sided with rounded top and bottom. Some of the 1/32 ply will disappear when rounding the edges of the boom. A wood rasp will be of help with the initial roughing operation.

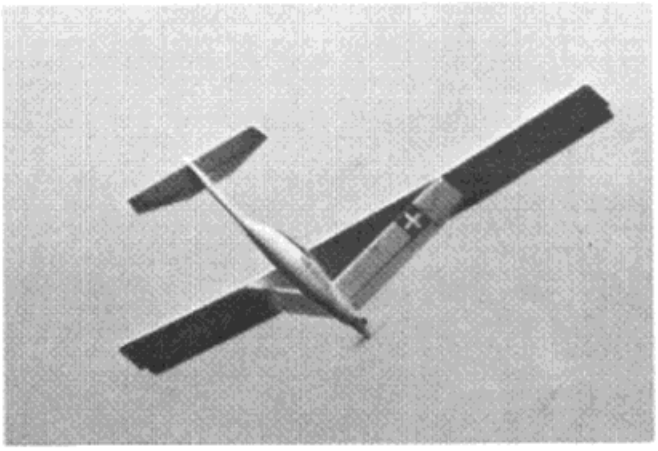
After final sanding of the pod and boom is complete, epoxy the wing mount on its saddle. When the epoxy has cured, attach the wing center section to the wing mount and tack glue the horizontal tail saddle into place. Temporarily attach the horizontal tail to the





Aviafiber 2FL ready for flight (**above**). This view of plane held aloft shows unusual design, as well as control surfaces and engine installation. The Aviafiber in flight (**below**). This may be the most unusual "hang glider" ever. If you want to draw a crowd at the flying field build one of these.

Cox reed valve .049 is used to power the Aviafiber 2FL (**above**). Also, note use of ball links to hook control rods to control horns. Author launches 2FL (**below**). Canard design takes to the sky with nose high and engine honking. This is a plane you don't see at every scale contest! It's different.



boom with a rubber band. Turn the entire assembly upside down with the wing center section resting on a flat surface. Block up the pod and boom so the bottom surface of the horizontal tail is nearly level. Measure from the table to the outboard intersection of the elevator at each end of the horizontal tail.

If everything is level, epoxy the tail saddle to the boom. If not, adjust the saddle/boom seat until a level condition is attained.

The canopy section may be reinstalled at this time and the final fitting of the planking around the wing mount can be done.

If you are not going to use an engine, the rear fairing block can be carved from soft balsa and glued to the firewall.

Final assembly

When final sanding is completed, the covering may be applied. The original model was covered with silkspan over all the wooden sheeted and planked areas. The wing and tail was covered with Microlon. The entire model got two coats of clear dope before covering, and four coats after.

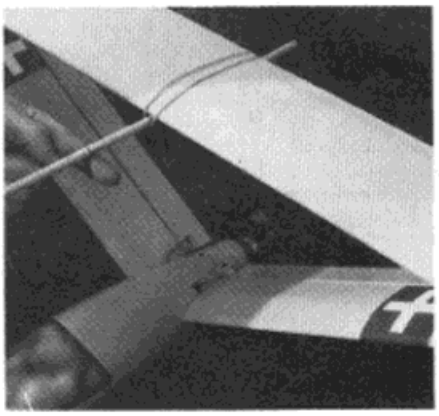
The radio should be installed before final painting, as some cutting will be required in the canopy section to clear the flaperon push rods. The radio components should be installed approximately as shown on the plans, so proper balance of the model can be accomplished without the addition of large balance weights.

The flaperons are rigged for rudder control only (the left surface is to deflect down, and the right surface up for a left turn). The elevator must deflect trailing edge down to bring the model nose up.

Your servo rotation will determine whether the flaperon push rods will cross over each other, so you must be the one to determine push rod installation. When you are satisfied with the radio installation, add the final detail parts, tow hook assembly or the belly skid if you are going to fly with the engine or slope soar.

Install the canopy hold down hardware, then touch up any raw wood areas.

Spray the entire model white, then follow with one or two coats of yellow (not Cub Yellow). The Swiss crosses are white with a red background; the numerals HB3000 are also red. The canopy can be painted black or airbrushed white mottled over black (keep the areas of the window frames black), then add a few streaks of black over the white.



How to balance an Aviafiber. Howie attached a dowel to wing with rubber band, marked balance point on dowel and proceeded normally. Normally?

Balancing and flying

The balance of this airplane is no more critical than any other model, although a canard configuration may be a bit more squirrely when nose light (wing heavy) than the conventional tail heavy airplane. Use a piece of ¼ diameter dowel about a foot long as a balance beam. Secure it to the bottom of the wing center with rubber bands (parallel with the center line) and balance the model at the distance forward of the leading edge as shown on plans. My model with engine required less than ½ oz. of lead up front.

After balancing, a few test glides are recommended just to get the feel of the stick. Canards are very sensitive to elevator, so do not overcontrol. Canards, on the other hand, are very forgiving in their stall characteristics, as the canard (horizontal tail) stalls before the wing. Whether you choose tow-line, slope, or power, you will really enjoy flying this machine.