

FIREBIRD

Two for one — well almost. Firebird is certainly two airplanes. The flight characteristics of the full span wing and the clipped wing versions could hardly be more different. And all for the price of one very small and simple wing which can be substituted on the spot for the full span wing in forty-five seconds without tools.

So, if it is a lazy Sunday afternoon and you have just enough pep left to fly, slip on the full span wing and relax with a docile, stable, but responsive Sunday flier.

If competition appears you land, refuel, remove the full span wing, slip on the clipped wing and hold your own in any pylon race or three channel aerobatics contest in the aircraft class. Don't let the parasol design fool you. It's a very fast, adroit little bird with the clipped wing.

With the full span wing, Firebird will glide at 15-17 mph and true out at 45 mph at full throttle. With the clipped wing it has

been timed at 61 mph. While on the subject of performance the O.S. Max 10 FSR engine swinging the usual 7/4 propeller gives excellent R.O.G. performance with either wing on a not too smooth sod field. In fact, the prototype has never been hand launched.

With the full span wing any three channel maneuver is easily accomplished. Cruising is comfortable at approximately one third throttle.

With the clipped wing, Firebird is an aerobatic airplane. In a fast roll it performs as though on a tight wire passing through the fuselage centerline with rudder input only.

However, the airplane is very stable in all modes and forgives almost everything but a heavy hand.

When wings are changed no other change is necessary except a possible trim adjustment when airborne which is well within the limits of the trim levers of your transmitter.

The design of the airplane started, as many R/C models designed by oldtimers do, with memories of Heath Parasols, Long Longsters, Corbin Baby Aces, Pietenpol Air Campers, etc. So many shapes got built-in that, at one time, the writer considered naming it a Helocopi using the first two letters of the names of Heath, Long, Corbin, and Pietenpol. Another not too bright idea was to call it a Heathenpol. Any such combination seemed a little "cute" and, after flying the first time with the clipped wing, the name Firebird seemed most appropriate, so that is what it became.

With its small engine, low fuel consumption, and overall low cost combined with outstanding performance and versatility, it would take some doing, in the writer's opinion, to get more practical

flying and fun per dollar than with Firebird.

Construction

Firebird is admittedly over-built in some places to take a "trainer beating" and keep flying.

Most construction is pretty standard with the possible exception of the cabane struts and engine cowling. The wire cabane struts and center section attached to the fuselage by being "fiberglassed in" have proven to be very rigid and almost indestructible.

The aluminum cowling was chosen because, in the writer's opinion, it comes close to looking like the old single curvature cowls of the Heaths and Pietenpols. If you don't subscribe to this, a carved balsa cowling will work just as well.

The finished airplane should weigh somewhere between 30 to 35 oz. The prototype came out at 33 oz. with the clipped wing, and 35 oz. with the full span. These weights are with Futaba radio gear using S-18 servos, a 4 channel receiver, a 500 mah battery pack and, of course, the 2 oz. fuel supply. With smaller radio gear it should be possible to get well under 30 ozs.

The wings and empennage are about as simple as anyone could get and, therefore, are not covered more fully by construction photographs.

Fuselage:

Cut out and mark all necessary parts. Begin assembly by cementing the 1/4" triangular longerons to the side pieces. Note that the top longerons stop and butt against F3 and the bottom at F2. Leave out the top longerons between F2 and F3 at this time. Top longerons between F1 and F2 can be installed. Be sure to make right and left hand sides.

Next cement F2 and F3 to one side and be sure they are square with the fuselage side. When cured, cement to the other side and install the 1/8" ply doubler between F1 and F2 flush with the bottom of the sides. Add 1/4" triangular longerons between F1 and F2 and the 1/8" doubler and sides. Two vertical 1/4" triangular struts at F1 are now added.

The top of the upper longerons define the reference or "waterline" of this airplane. Since the fuselage sides are flat from F1 to F3, they (and the top longeron plane) can be

used to sand the nose frame parts square to these surfaces and epoxy the firewall F1 in place.

Add the 1/16" ply bottom piece between F1 and F2 and assemble and install the access door.

Bend the forward vertical cabane strut assembly using 3/32" music wire to size as shown in the drawing. Important considerations are the fore and aft location of the 3/16" OD x 5/32" ID brass tube and the squareness with the fuselage centerline. Use a simple jig (balsa wood and pins) to hold the tube parallel with the plane of the two side wires and the correct fore and aft position. Solder with Sta-Bright or equivalent. Install in the fuselage by sliding each side up or down until the tube is equidistant from the longerons on both sides, and tack cement.

Follow the same procedure building and installing the aft cabane assembly using 1/16" and 1/32" music wire and a 3/32" OD x 1/16" ID brass tube as shown. When both assemblies have been checked for proper location and squareness "glass in" with 3/8" x 1/4" 2 oz. fiberglass and epoxy.

Install the longeron sections between F2 and F3, notching around the struts and butting against the frames. Install the 1/16" sheeting between the instrument panel and F3. This is not shown in the photographs.

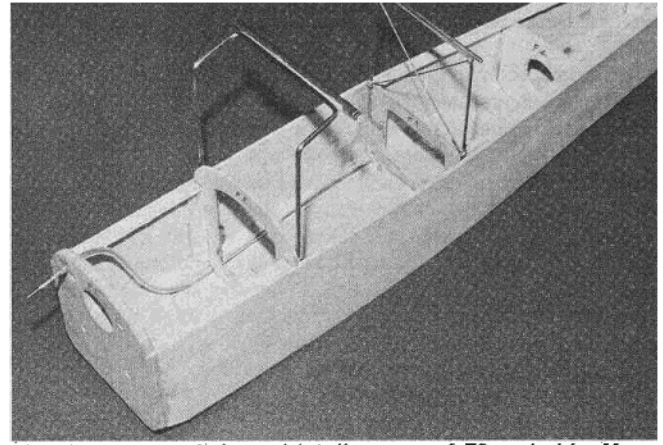
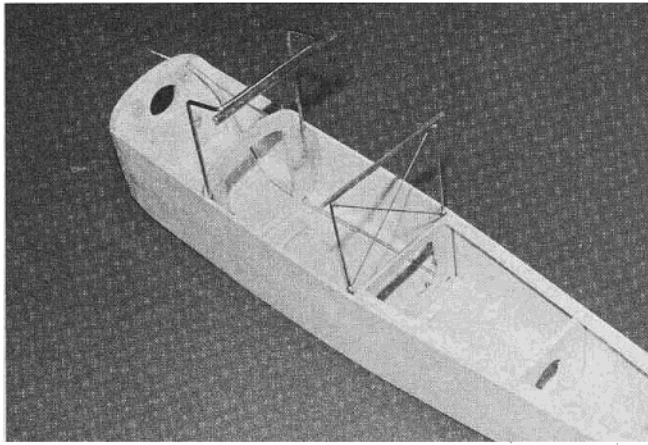
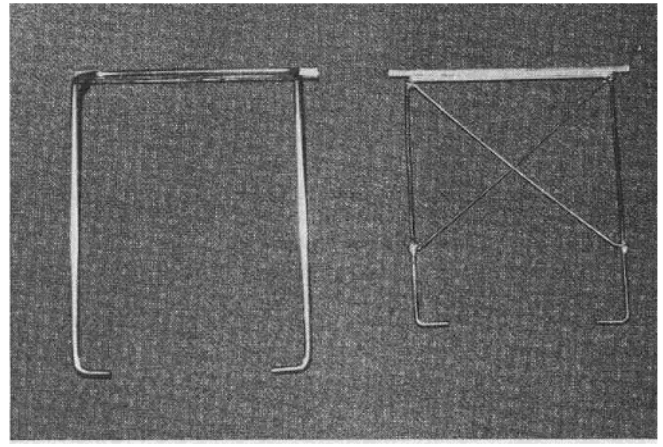
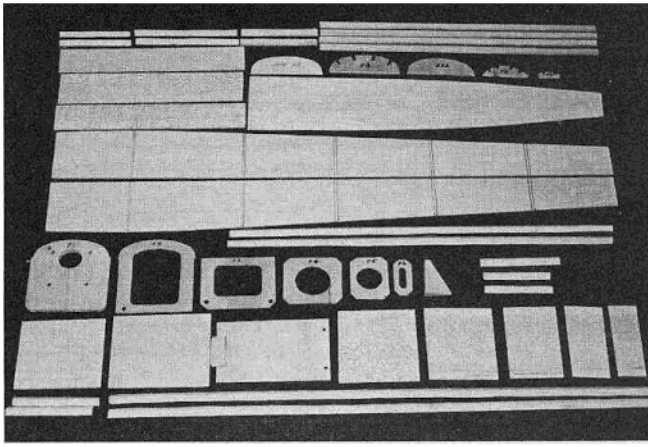
Stop this sheet at the center of F3 to allow for support of the aft planking.

Since a relatively stiff forward section has now been established, the aft end of the fuselage can be drawn together without any appreciable distortion between F2 and F3. Pin the fuselage to your work table on the bottom plan view and draw together, checking alignment, and cementing in the tail skid block. Lightly sand the inside ends of the fuselage sides so that the joined width at the rudder post is 5/32". Some of the longerons will be cut away to accommodate the tail skid block. Add frames F4, F5, and F6. Install the four #4 blind nuts for the engine mount. The throttle cable is the standard Du-Bro nylon sleeve and 1/16" steel cable epoxied in at F1 and F2. Although the bend radii look extremely sharp this assembly works very well.

The cross bracing from F1 to the tops of the vertical cabane struts is simply bent 1/16" music wire formed so the pieces will lie in place against the firewall F1 and the top of the longerons and line up with the bend in the vertical strut. Wrap with a few turns of very fine copper wire and solder. "Glass" in the forward wire tabs with 2 oz. fiberglass cloth and epoxy cement at F1. As the drawing shows, add a turn of fine wire

This two-in-one parasol design can give you a relaxing day of flying. Put the clipped wing on and you have an aerobatic airplane.
By Joseph M. Mergen





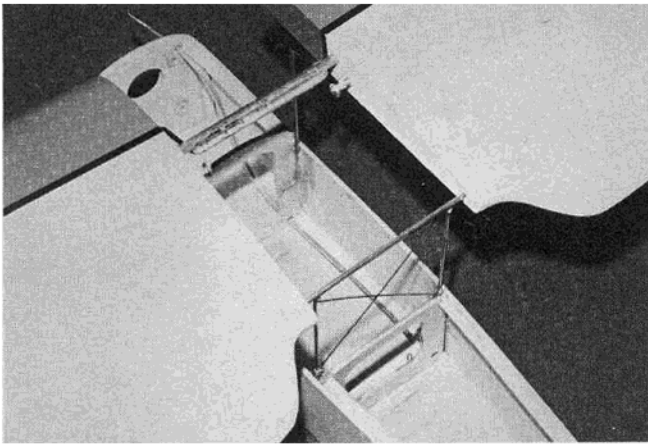
View showing forward cabane struts "glassed into" corner of F2 and side. Also see engine mount blind nuts and throttle cable installation.

Aft cabane struts "glassed into" corner of F3 and side. More detail of throttle cable. Note slight inward and downward angle of forward end of throttle cable tube at F1.

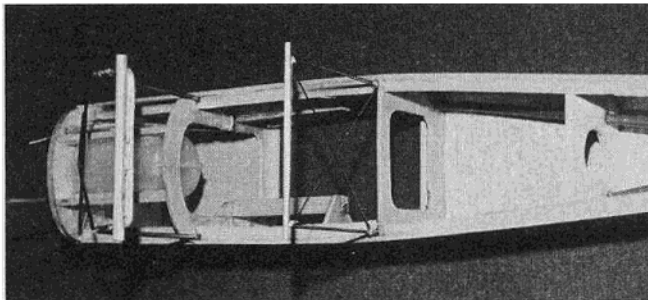
Bill Of Materials

- | | | |
|--|--|--|
| (4) — 3/32" x 3" x 36" balsa — ribs, fuselage sides | (1) — 1/4" x 5/16" x 6" pine — servo rails | (2) — 2 1/2" dia. Golden Age or Vintage wheels |
| (5) — 1/16" x 3" x 36" balsa — wing and fuselage planking, spar webs | (1) — 1/16" x 3" x 12" plywood — fuselage bottom, door | (2) — #2 x 1/4" screws — access door |
| (1) — 1/8" x 3" x 36" balsa — empennage, F4, F5, F6 | (1) — 3/16" x 3" x 4" plywood — F1 | (13) — #0 x 1/4" flat head screws |
| (2) — 1/8" x 1/4" x 36" balsa — stringers | (1) — 1/4" x 1/4" x 4" hardwood — cowl mounts | (8) — #4-40 x 1/2" bolts — engine mount, engine |
| (3) — 1/4" x 36" balsa triangular stock — longerons, braces | (1) — 3/32" dia. x 12" music wire — front cabane | (1) — 1/16" Du-Bro nylon/steel throttle cable assembly |
| (2) — 1/4" x 3/4" x 36" balsa — trailing edge stock or strip | (1) — 1/16" dia. x 36 music wire — rear cabane, cross struts, tail skid, carry over wire | (1) — 3/16" dia. x 30" NyRod — elevator, rudder pushrods |
| (1) — 3/16" x 3/4" x 12" balsa — spar gusset | (1) — 1/32" dia. x 12" music wire — rear cabane, cross wires, clips | (3) — #2 x 1" threaded control pushrods |
| (3) — 1/4" x 3/8" x 36" balsa — leading edge, etc. | (1) — 3/16" OD x 5/32" ID x 12" brass tube — wing carry over | (2) — Small nylon horns — elevator, rudder |
| (1) — 1/2" x 1 1/2" x 8" balsa — tail skid block, wing block | (1) — 3/32" OD x 1/16" ID x 6" brass tube — wing carry over | (2) — #2 x 4" threaded control pushrods |
| (1) — 1" x 18" balsa triangular stock — wing tips | (1) — 5/32" dia. x 10" music wire — wing carry over | (1) — 2" x 4" x .020 windshield material |
| (1) — 3/4" x 18" balsa triangular stock — wing tips | (1) — 2" x 3" x 2 oz. fiberglass cloth — strut mounts | (1) — 2 oz. Sullivan round fuel tank |
| (1) — 3/16" x 2" x 2" balsa — fairing | (1) — .010 dia. x 24" soft wire — wrap for soldered joints | (1) — 12 sq. ft. MonoKote (as desired) |
| (4) — 3/32" x 3/16" x 48" spruce — spar caps | (1) — #B105-2 Halco landing gear | (3) — Small nylon clevises |
| (1) — 1/8" x 1/4" x 12" spruce — rudder post, etc., reinforcer | (3) — #6 x 1/2" nylon screws — landing gear retaining | (1) — 6" x 8" x .010" or .015" aluminum sheet — engine cowling |
| (1) — 3/32" x 6" x 12" plywood — frames, ribs | (4) — #4-40 blind nuts — engine mounts | (1) — 5" fuel line |
| (1) — 1/8" x 3" x 4" plywood — doubler | (2) — 2" Sig aluminum engine mounts | (1) — #2221 x 3" aluminum arrow shaft — for muffler extension |

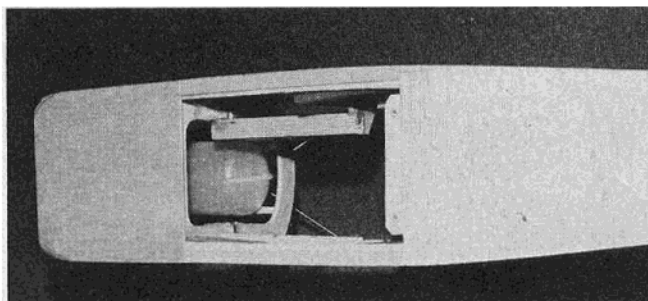
Epoxy, cyanoacrylate, aliphatic cements, Sta-Brite solder, foam wrap for RX and battery as required



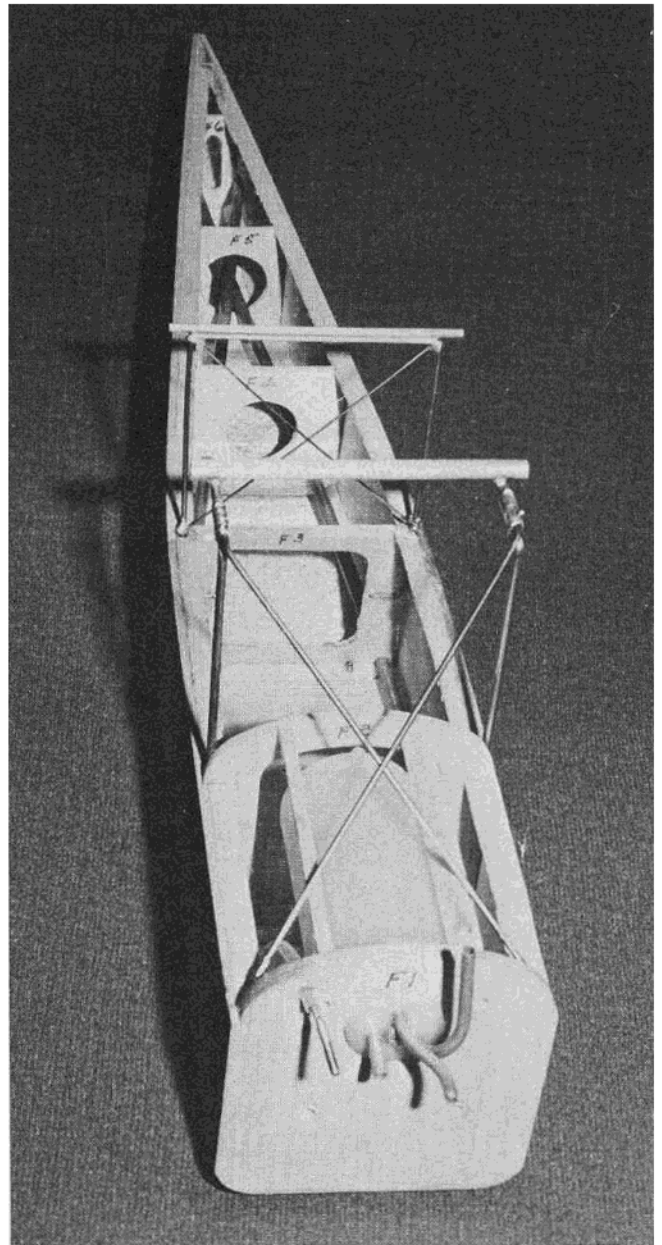
Wings are attached and wholly supported by cabane wires and are not dependent on any wood parts of center section for strength or position.



Forward cross struts "glased" to F1 and top longerons. Keep ends at F1 "in" enough to avoid interference with front cowl sheeting. Note servo rails.



View showing access hatch and servo rails from the bottom. Be sure NyRod elevator and rudder sleeves extend 2" forward of F3 as shown.



Forward crossed cabane struts wrapped and soldered to vertical struts. Fuel tank and forward stringers added. NyRod tubes in place. Note tubes are crossed. Vertical tube in fuel tank is optional filler.

each way at the intersections of the crossed wires of the forward and aft cabane systems and apply a small drop of solder.

Small elevator and rudder NyRod sleeves are installed through holes in F3 and F4. The aft exits through the fuselage sides should be just ahead of F6 and approximately 5/8" from the bottom of the fuselage on both sides. Let the forward end extend 2" ahead of F3 to prevent pushrod interference with the RX foam wrap. Sand tubes and epoxy cement at F3, F4, and the aft exit point. Sand flush at exit later. Note that the tubes are crossed to permit use of right hand servos.

The front stringers and fuel tank are installed next. Be sure to seal the front flange of the tank at F1 with silicone or epoxy.

The servo rails are now epoxied in place to accommodate your servo brand.

The fuselage is completed by adding the instrument panel, F2A, and the front cowl sheeting, carving the cockpit and adding the tops of F3, F4, F5, and the 1/4" x 1/8" stringers.

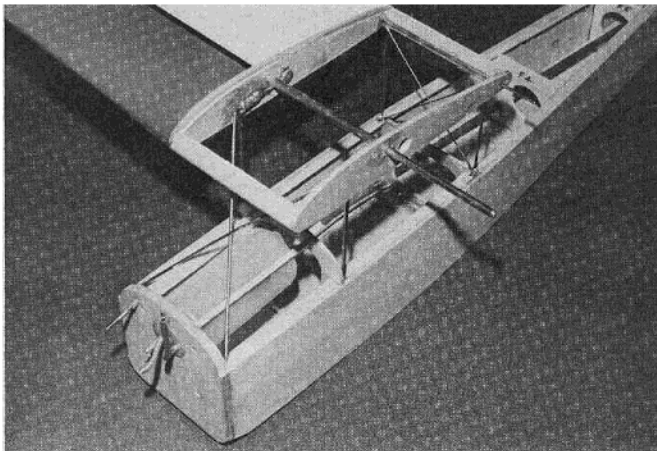
Next shape (6) W1, (4) W2 and (2) W2A ribs together, drilling the 3/16" and 3/32" diameter holes for the brass tubes at the same time using the lower flat surfaces of the ribs for reference. Two of the W1 and two W2 ribs are for the second wing. Use two W1 and two W2A ribs to form the center section. Add the 3/32" x 3/16" stiffener, leading and trailing edges and planking. Drill the 5/16" holes through W1 and W2A on each side as shown. The flat bottoms of the center section ribs should be parallel to and equidistant from the top longeron.

The Hallco B 105-2 landing gear should be reworked by flattening the two center

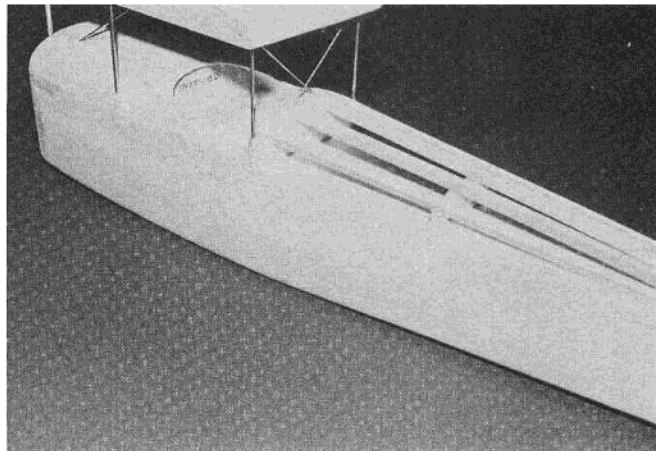
bends and rebending at a 3" width to match the fuselage, drilled as shown and attached with nylon screws. Install 2 1/2" William Brothers Golden Age or Vintage wheels.

The aluminum engine cowl is begun by adding the attaching blocks to F1 and installing the engine, less muffler. Laminate two pieces of 3/32" plywood to form the 3/16" engine nose ring NR2 and NR3. One piece should be bored to have a tight fit on the engine nose and the other a clearance hole for the propeller flange. Shape to clear the carburetor when the front face of the nose ring is 1/4" aft of the propeller flange face. Both pieces should be slightly oversize so they can be tapered to line up with the outside contour of F1. Press the nose ring on the engine nose in the correct fore and aft location.

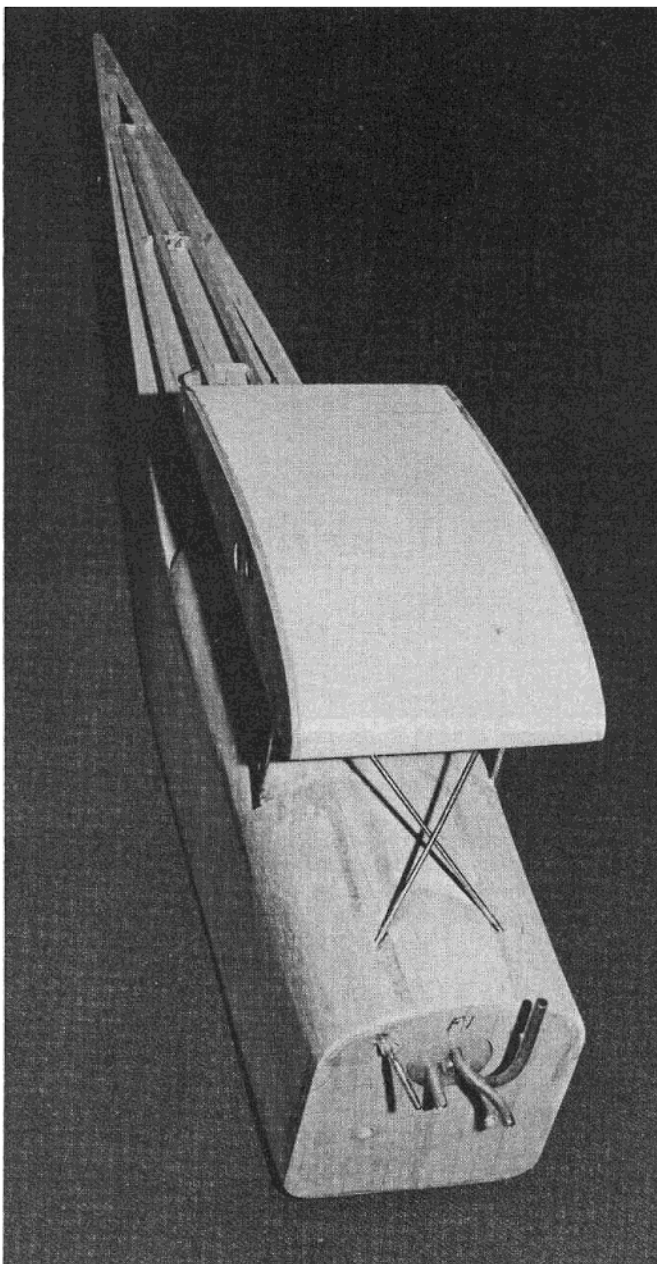
Trace the cowl pattern on the drawing on



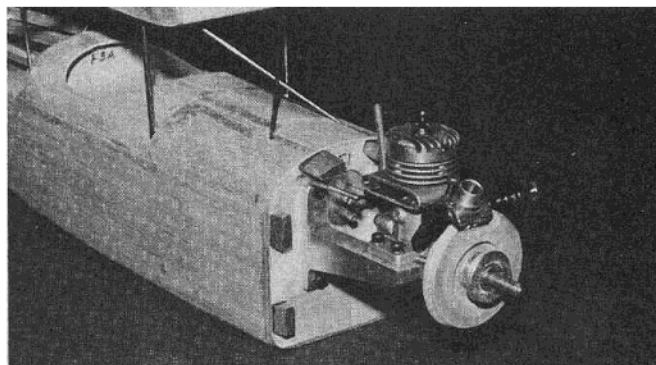
Center section ribs, leading edge, trailing edge, and wing carry-over wires in place. Wing retaining clip shown just aft of front carry-over tube.



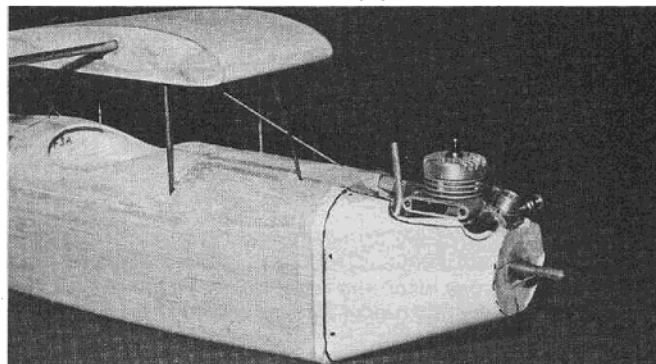
Finished and rough sanded fuselage.



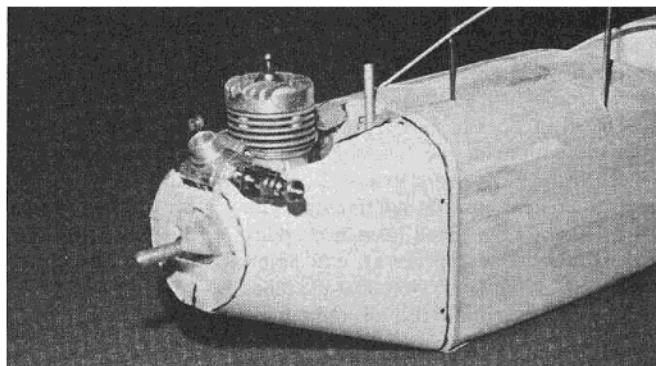
Finished and rough sanded fuselage and center section.



NR2 and NR3 pressed onto engine nose and cowling blocks mounted on F1. Cowling pattern can now be fitted. Note blocks are off-set thickness of cowling material for smooth joint.



Oversize vellum pattern taped to nose ring and F1 blocks. Note pattern has been marked at F1, to clear the muffler, and that the centerline at the bottom of NR2 has been defined.



Left side of pattern marked at F1, needle valve, NR2, and showing cylinder clearance.

vellum or other stiff paper approximately 1/8" oversize. Cut out and tape over the blocks on F1 and the nose ring and establish a bottom centerline. Adjust and trim until satisfied with the fit and then use as a pattern to cut out the aluminum cowl.

Starting at the bottom centerline, shape the cowl up to the top longerons and the centerline of the nose ring. Install two screws at each side of F1 and one on the bottom and each side of the nose ring. Remove cowl and engine. Reinstall the cowl and finish forming and fastening as shown. Trim at F1 and the forward face of the nose ring.

Reinstall the engine and cowl and mark around the engine and muffler boss.

Remove the cowl, trim and sand the front face of the cowl and nose ring flush and install nose ring NR1, sanding to shape. Seal and prime NR1 and, after roughing up the aluminum with fine sandpaper, spray paint with polyurethane. For a fast dry and tough finish, bake between 150°F. and 200°F. for one half hour. The small piece of cowl behind the cylinder is cut to size, joggled to match the edges of the main cowl and finished in the same manner.

Empennage:

The stabilizer, elevators, fin and rudder, are cut from medium hard 1/8" sheet balsa. Note that both the elevators and the fin are reinforced with 1/8" x 1/4" spruce strips.

Regular small nylon hinges can be used, however, the writer was very successful using the covering material (in this case, MonoKote). To do this, sand a 120° included angle wedge on each piece at each hinge line and iron the material into the groove on each side until the MonoKote touches and adheres to itself. A very strong, flexible, gapless hinge is then formed and has been very satisfactory on this and another of the writer's airplanes. When covering the fin, leave about a 1/16" flap at the stabilizer edge and rudder post. Leave a similar flap on the sides of the fuselage where the stabilizer is mounted. After stripping the stabilizer where it joins fuselage and fin, and epoxying in place, these flaps can be sealed down to give a smooth and strengthened joint.

Assuming the fuselage is covered, go to the forward section and seal the cowl, where the cabane struts come through, with epoxy, Epoxolite or other fuelproof material.

The radio installation will vary according to makes. Futaba components were used in the prototype and are shown on the drawing. The aircraft will balance at the fore and aft C.G. location shown with these components so arranged. Switch and charging jack can be located just aft of F3.

An aluminum tail pipe about 3" long will keep the cockpit dry. A #2221 arrow shaft can be press fitted on the O.S. 10 muffler outlet without machining.

Wings:

The writer usually begins building rectangular planform wings by rough cutting all similar ribs and then stacking them and shaping all at once with a plywood

master on each end of the stack to maintain absolute consistency.

Build the full span wing first over the plan. Start by pinning the lower spar capstrip to your work surface. (Don't forget the waxpaper.) Cement all the W4 ribs and W2 in place. Cement the leading and trailing edges in place as well as the top spar cap. Shim the leading edge up until flush with the bottom of the ribs (about 3/32"). Note that ribs W1 and W3 are left out at this time. Add the 3/16" tapered block between the two inboard W4 ribs as shown. Next add the spar webbing. The webbing between W2 and the first W4 rib is 1/16" plywood epoxied in place. Install only the leading edge side at this time and fit the forward end of W3 in place and cement. The triangular balsa tip can be added and rough carved. Also add the 1/2" block at the trailing edge. Build the opposite panel to this point.

Insert the 5/32" carry-over wire in the center section tube and slip the 3/16" brass tubes into the spar cavities through the holes in W2. Be sure to seal the outboard end of the tube with a short (1/8") balsa plug before putting in place.

The fuselage and wings should now be mocked-up by blocking up to obtain the proper incidence (the bottom surface of the center section rib is the reference), dihedral, and squareness with the fuselage. If necessary, sand the face of W2 to fit well against the center section rib. Tack cement the 3/16" dia. wing tube to the 1/16" plywood web of each panel.

Remove one wing without disturbing the incidence of the other. Sharpen a piece of 1/16" music wire and, with the center section tube as a guide, drill a hole to W3 in the 1/2" block for the aft carry-over wire.

Repeat the process on the other wing. Now assemble both wings using the 1/16" carry-over wire at the rear and, of course, the 5/32" wire forward to be sure of alignment.

Remove the wings, drill out the 1/16" holes to 3/32" and install the 3/32" tubes cementing with epoxy (plug the ends to keep from filling up).

Secure the 3/16" tubes by filling the cavity with a mixture of epoxy and micro-balloons, adding the aft 1/16" plywood webs and the aft section of rib W3. Next plank the wing, add W1 and rough sand.

Assemble both wings to the center section and finish sanding the leading edges, trailing edges, and planking, to obtain a smooth consistent set of surfaces.

The clipped wing is built in the same manner. Note that the outboard sections have a thickness ratio of approximately 8% as compared with the 12% Clark Y of the full span wings and center section. To accomplish the transition between the 8% clipped wing and the 12% center section, the W1's are the same for both wings and a transition rib WC3 is used to help form the taper. A little more care must be used in sanding in the clipped wing to conform with the already finished center section. Cover

FIREBIRD

Designed By: J.M. Mergen

TYPE AIRCRAFT

Sunday Sport & Super Sport

WINGSPAN

51" & 30"

WING CHORD

7 1/2"

TOTAL WING AREA

370 Sq. In & 212 Sq. In.

WING LOCATION

Parasol

AIRFOIL

Clark Y & Mod. Clark Y

DIHEDRAL EACH TIP

4° Each Panel

O.A. FUSELAGE LENGTH

28 3/4 Inches

RADIO COMPARTMENT AREA

(L)7 1/4" x (W)2 3/4" x (H)2 1/4"

STABILIZER SPAN

14 Inches

STABILIZER CHORD (incl. elev.)

4 Inches (Avg.)

STABILIZER AREA

54 Sq. In.

STABILIZER LOCATION

Top of Fuselage

VERTICAL FIN HEIGHT

5 Inches

VERTICAL FIN WIDTH (incl. rudder)

4 1/8 Inches

REC. ENGINE SIZE

.10 Cu. In.

FUEL TANK SIZE

2 Oz.

LANDING GEAR

Conventional

REC. NO. OF CHANNELS

3

CONTROL FUNCTIONS

Rud., Elev., Throt.

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage Balsa, Ply

Wing Balsa, Ply

Empennage Balsa & Spruce

Wt. Ready To Fly (Full Wing) 35 Oz.

(Clipped Wing) 33 oz.

Wing Loading (FW) 13.6 Oz./Sq. Ft.

(CW) 22.4 Oz./Sq. Ft.

the wings as you have the fuselage and pick the graphics you desire.

This completes the airplane except for windshield and tail skid which are shown on the plans.

The prototype turned out to be red and black since those are the colors of a Firebird, otherwise known as a Scarlet Tanager. A Scarlet Tanager doesn't have a white wing but this just appealed to the writer and that's the way it turned out.

Flying:

From experience it seems desirable to start with about plus or minus 5/16" rudder travel and between plus or minus 5/16" and plus or minus 3/8" elevator travel.

Unless you are an expert pilot, don't start with the clipped wing. Feel out the machine with the full span wing and when you have had lots of practice try the clipped wing for a real thrill. When this configuration is mastered, increase the rudder sensitivity to plus or minus 1/2" and look alive. You will have a real performer on your hands. Have fun.

Addendum:

Since this was a fall project, a very simple set of skis were worked out as shown in the photographs. These are designed for 10 sq. in. per pound and work very well on everything but very light powder snow. The dimensions are 1 1/2" x 8" using 1/16" ply bottoms with 1/8" plywood webs. A single piece of 1/32" music wire holds them up about 10° nose high and allows the skis to run flat with the tail on the snow. A coat of epoxy cement on the bottom works very well. Try them next winter.



From RCModeler June 1981