

# FIRE ARROW

By Paul F. Denson

Resembling one of the crop dusting planes, this design by Paul Denson is a fun-fly dream. Flies slow and easy on low throttle, open it up and watch it move out.



**R**ecently, we retired here in the Valley of the Sun where agriculture seems to be the mainstay of most everyone's existence. We find flying our model aircraft to be quite a different proposition than we had in the past. When we go out to the field, we seem to be flying amongst a large bevy of full sized yellow airplanes. Everywhere you look, the sky is full of them as they swoop low over a field of cotton with a white mist fogging from the trailing edge of the wing. These planes travel at full speed across a field just inches above the crops then pull up sharply at the edge, clearing the ever present power lines by an unbelievably small margin. Then with a hard left, a quick roll to the right, back over the power line they go out across the field unloading their seemingly inexhaustible supply of insecticides.

Our flying field is completely surrounded by these cotton fields and we, quite often in the summer and fall, have these planes using our airspace in which to do their turns, so we reluctantly bring our models down to the runway and stop to watch the fantastically skilled flying of our neighbors in their yellow painted crop dusters.

It has been intimated that the Fire Arrow faintly resembles some of these low wing crop dusters, actually it began in our mind as an idea gleaned from the pages of "The Lightplane Since 1909" wherein there lies a plane called the Edmonds G-1 Flying Scooter. The Fire Arrow was never intended to be a scale model, we just like the Scooter's canopy design. One thing led to another and a plane appeared on the drawing board.

History told of a bird that rose from the ashes of another, the movie told of a plane that rose from what was left of another, this plane rose from ideas gleaned from hundreds of kits we have built and thousands of pages of reference material we have read over the past forty years or so. From all of this, we decided to call our new re-creation Phoenix, then a friend informed us that a city already had that name firmly claimed. Well, never to be daunted, we took another tack. The bird that rose from the ashes was called the Fire Bird, that is a fantastic name for a plane. Same person informed us that Pontiac had that name sewed up on one of their sports cars. How about other words with "fire" in them. Fire Fox came to mind; sorry, that is the subject of a couple of books concerning a Russian jet fighter. Turn it around and you have Fox Fire; had to look that one up in the dictionary. Fox Fire is that stuff in rotten tree stumps that glows in the dark, way out in "Old Dismal Swamp."

Sounds good, but hardly a name for such a clean fresh airplane as this.

Finally, the name Fire Arrow came to mind and we are sure the name will show up on something or another, so until it does, we like the name and the decorations down the side of the fuselage. Fire Arrow it will be. Now if you've a mind to paint your plane

sheet. All formers but the firewall are also cut from this material. It was our intention to include balsa cheeks on both sides of the engine so the sides could be rounded to blend into the spinner. This, however, did not materialize; the muffler took up so much room we could use a cheek only on the left side. As it finally turned out, this cheek piece acted just as a doubler, when we ran both sides from the spinner back to the tailpost. If you desire to mount your engine upright instead of horizontal then there should be more than enough room between the two 3/8" cheek plates for the engine.

We cut the canopy sides from two pieces of ply rather than one because of the difficulty of edge sanding the acute angle. It is easier to sand the edges before gluing than it would be afterwards.

The 3/16" square spruce longerons are glued top and bottom to each side; make two sides, one right and one left. Add all vertical spacers. Install formers F-1 and F-2 on the right fuselage half, making sure they are at right angles to the sides. Mount the left side above the right and glue in place and add any cross braces. To facilitate bending the sides to meet at the tail, we cut notches in the longerons just aft of the 3/16" vertical spacers. Then with a ruler and a No. 11 X-Acto knife, we scored a vertical line in each side so the ply would fold sharply when the two sides were brought together for gluing. The score was then strengthened with Jet CA. All holes for the engine mount, fuel lines, and pushrods were predrilled in the firewall which was then installed. Also at this time, while you can get at it, install the 3/8" triangular stock behind the firewall. The cabin former F-2A is mounted at the proper angle and allowed to dry thoroughly. Before the cabin sides are installed, it is necessary to bevel the bottom edges so they will fit flush with the top edge of the fuselage. Glue the instrument panel F-1-A in place, then add the cowl cheeks between the instrument panel and the firewall. Notch the cabin top to fit between the two cabin sides and glue in place. The 3/16" square canopy uprights are cut to length, beveled and glued in place. We drove pins down through the top into the upper ends of the uprights; these were CA'ed in place, the excess pin was snipped off and filed smooth. The canopy is apparently very strong because we used it as a handle until the windscreen was installed. Making sure we could remove the fuel tank through the hole in Former F-1, we installed the 3/16" cowl top cross grain. Then we covered the bottom of the fuselage forward of the wing using

## FIRE ARROW

Designed By:

Paul F. Denson

TYPE AIRCRAFT

Sport — Fun Fly

WINGSPAN

65 Inches

WING CHORD

10 3/4 Inches

TOTAL WING AREA

699 Sq. In.

WING LOCATION

Low Wing

AIRFOIL

Flat Bottom

WING PLANFORM

Constant Chord

DIHEDRAL EACH TIP

2 Inches

O.A. FUSELAGE LENGTH

46 Inches

RADIO COMPARTMENT SIZE

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

STABILIZER SPAN

20 Inches

STABILIZER CHORD (incl. elev.)

6 Inches (Avg.)

STABILIZER AREA

120 Sq. In.

STAB. AIRFOIL SECTION

Flat

STABILIZER LOCATION

Top of Fuselage

VERTICAL FIN HEIGHT

6 Inches

VERTICAL FIN WIDTH (incl. rud.)

5 Inches (Avg.)

REC. ENGINE SIZE

.20-.30 2-stroke

.40-.45 4-stroke

FUEL TANK SIZE

6 Oz.

LANDING GEAR

Tricycle

REC. NO. OF CHANNELS

4

CONTROL FUNCTIONS

Rud., Elev., Ail., Throt.

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage ..... Balsa, Ply, Spruce

Wing ..... Balsa, Ply, Spruce

Empennage ..... Balsa

Wt. Ready To Fly ..... 69 Oz. (4 Lbs. 5 Oz.)

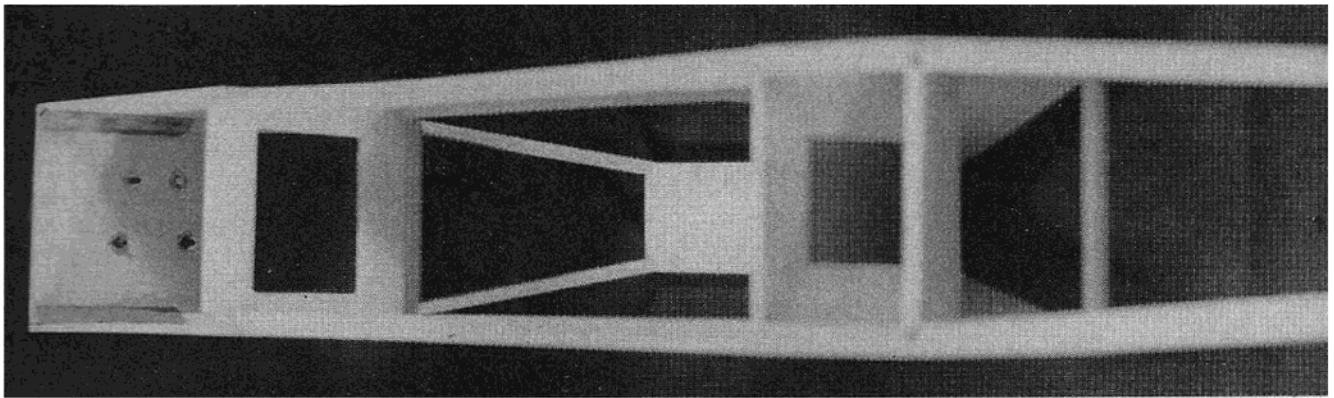
Wing Loading ..... 14.2 Oz./Sq. Ft.

yellow and scream down the runway trailing a cloud of white smoke, go ahead; however, keep your cotton dustin' plane off our plantation.

## CONSTRUCTION

### Fuselage:

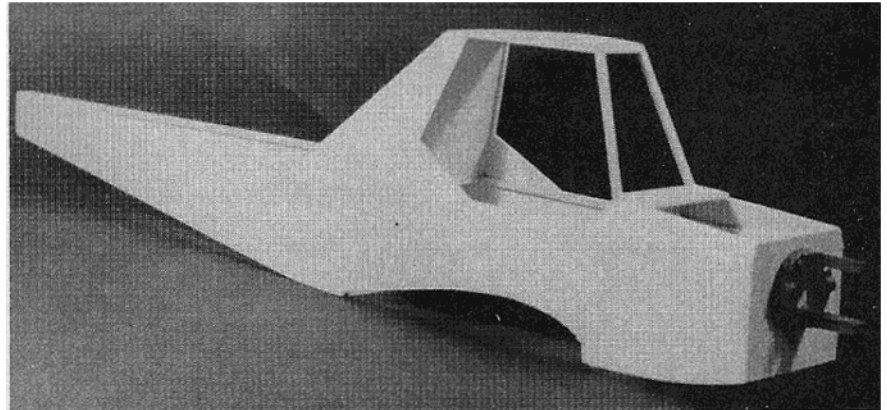
We would suggest that your first task would be to kit the plane. The two sides are made from Sig Lite-Ply; we used every bit of a 1/8" x 12" x 36"



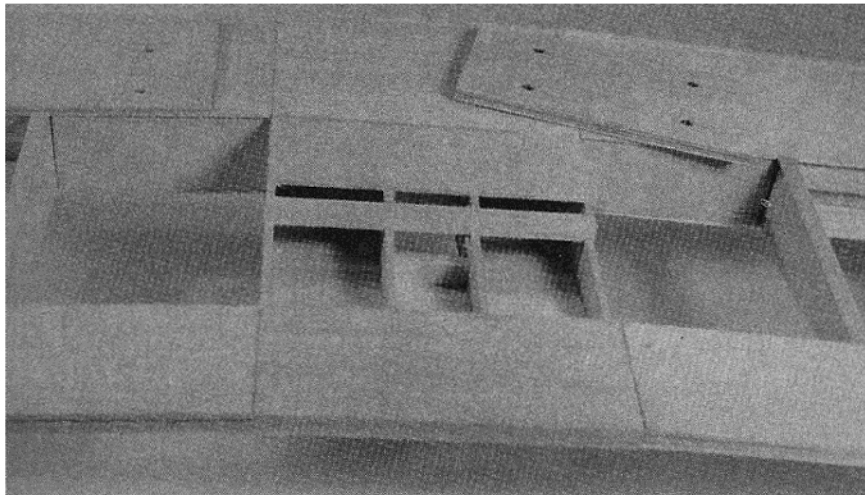
**Bottom view of fuselage — install blind mounting nuts for engine mount at this time.**

the same stock.

At this time, the engine with muffler and front landing gear were temporarily installed in the nose and everything was checked as to fit. We needed to make a hole in the right fuselage side for the head of the engine. This was enlarged until we were able to slip the engine in from the bottom which will be left open. Shape the top 3/8" balsa block which fits between the fuselage sides and above the engine. Drill holes for the needle valve and a view into the throttle venturi. We found it necessary to remove the needle valve while making



**Fuselage nearing completion, still lacks top and bottom sheeting.**



fuselage sides and at the same time to Former F-2. Add the fuselage top sheeting and the sheeting on the back of the canopy.

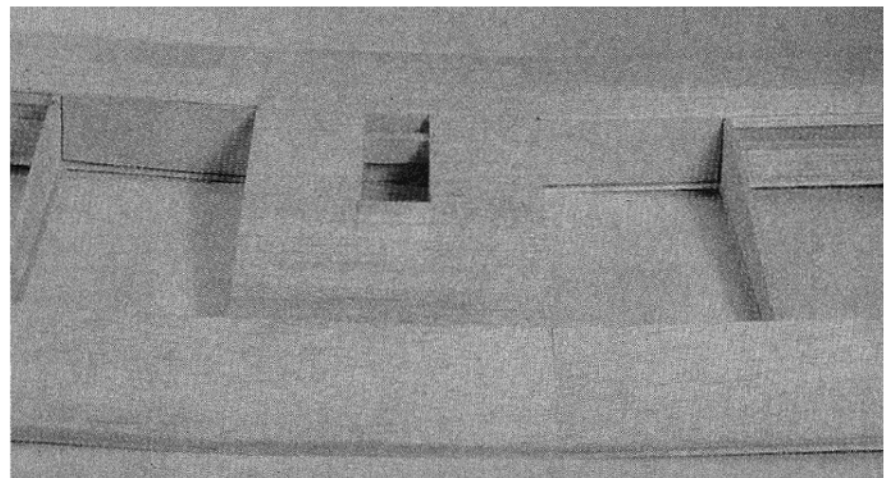
We used the servo tray that came with the radio, so it was necessary to add cross braces for holding this tray. Mount your servos as shown on the plans, leaving space at the rear of the radio compartment for the aileron horns. You need as much room forward of the servos for mounting the receiver and battery as you can get. There is room under the tank for your

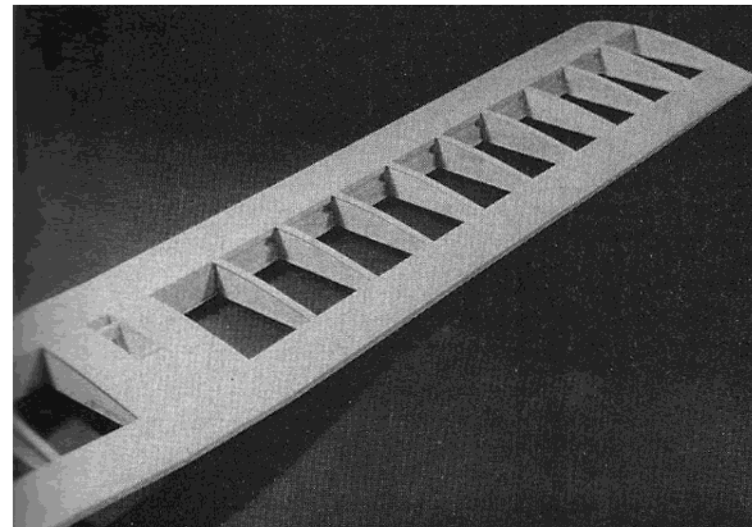
**3/16" ply landing gear mount to be epoxied to wing center section bottom.**

these temporary fittings. Do not cut the holes too large to begin with, you can enlarge them as necessary. Some hollowing of the underside of the block was necessary as the engine mount stuck up too high. Sand the whole area and give a coat of 5-minute epoxy to fuelproof it.

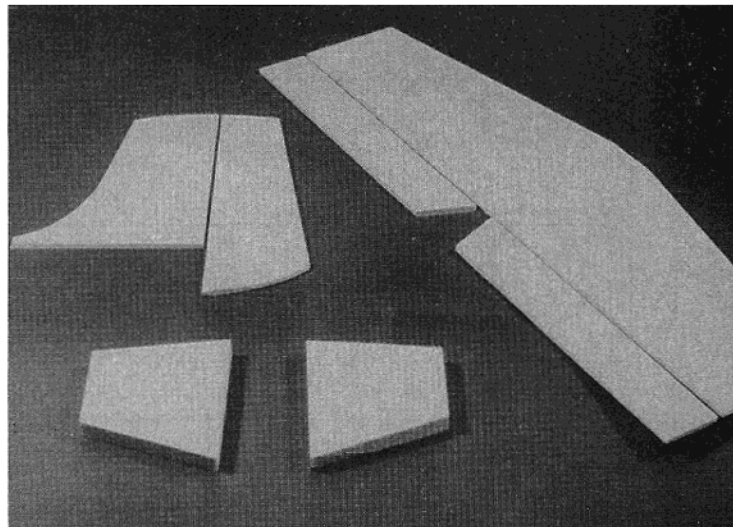
Add the wing saddle doublers made of 3/16" balsa then the 1/4" ply wing bolt anchors. Be sure and cut away enough of the wing saddle doubler so the anchors will attach directly to the

**Top view of completed wing center section.**

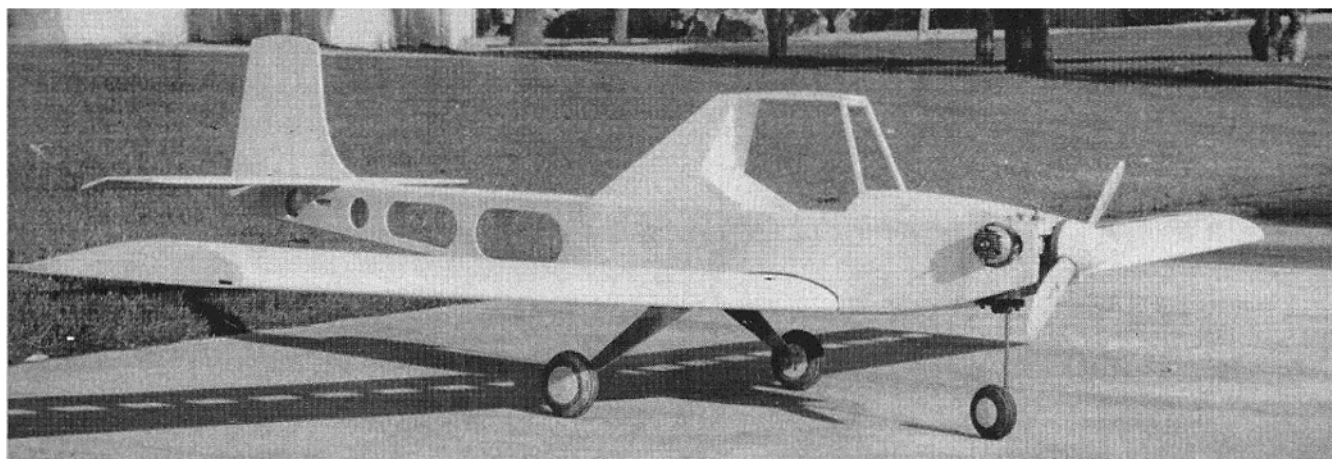




Ailerons to be added — this will complete the wing structure.



Tail surfaces cut from 3/16" sheet balsa.



Completed model with all parts in place — pick out your color scheme and cover it. Your choice of material.

battery but it is kind of difficult to get to if you intend removing the battery occasionally.

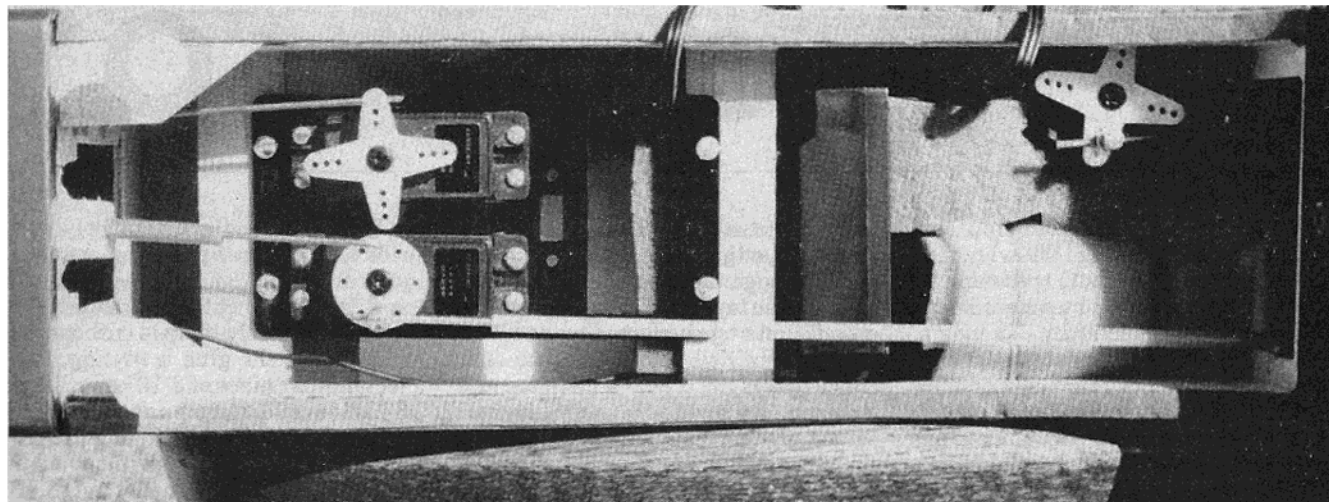
When the radio was installed we worked out the arrangements for the various pushrods. These were installed temporarily then removed until the fuselage was covered. The

rudder, fin, stabilizer and elevator were cut from 3/16" stock; the pieces were glued together, sanded, hinged and covered then set aside until later.

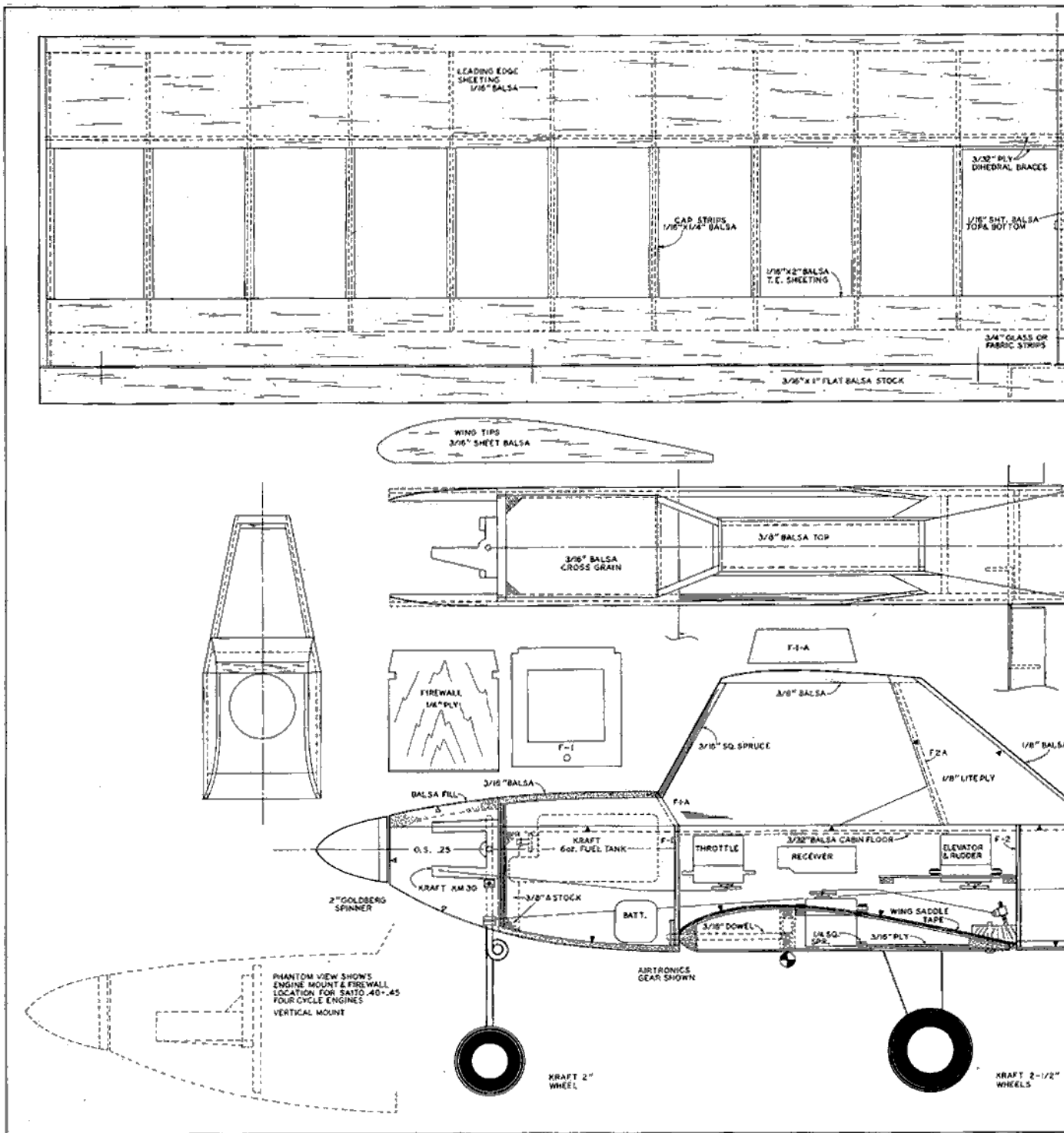
**Wing:**

The wing is not difficult to build but it is rather complicated, therefore, we will go into more detail here. After you

have kitted the wing, spread your plans out in such a way that you can build the two outer panels at the same time; later we will work on the center section by itself. Lay down the trailing and leading edge sheeting. Pin in place, then cut and glue all bottom capstrips. Add the leading edge and



Looking into wing saddle at radio compartment. Rudder and elevator servos toward rear — throttle servo in front.

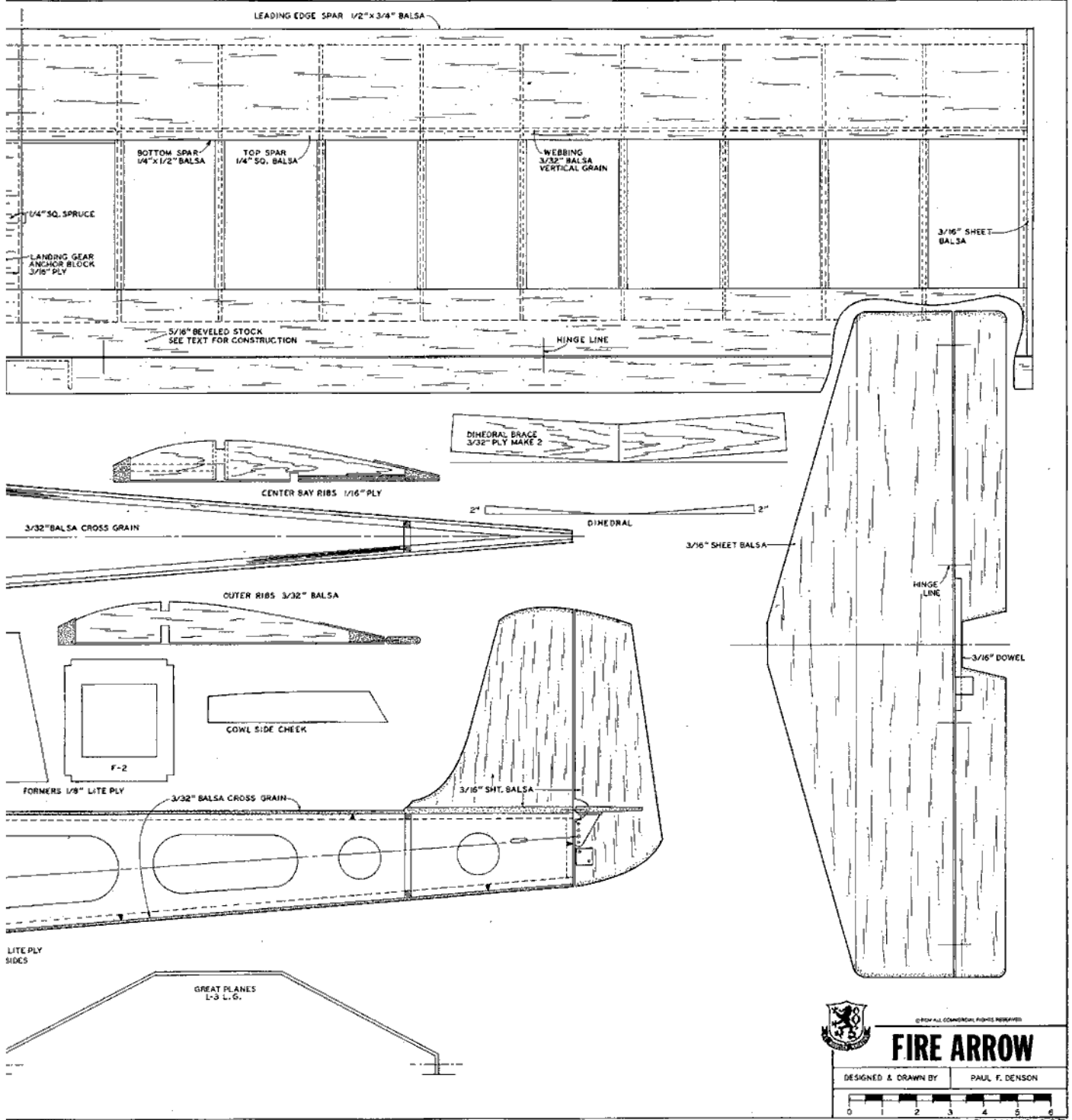


the triangular fill stock atop the trailing edge sheeting. We were not able to find 5/16" stock, therefore, it was necessary to build up a standard to the thickness necessary. We took a strip of 1/16" x 1" sheet balsa and glued it to the bottom of the standard 1/4" x 1" trailing edge stock. Sand slightly and install. The ribs were glued in place between this stock and the leading edge. Do not glue the two innermost ribs of these panels.

The center section of the wing is an

entity in itself. Lay down the bottom leading edge sheeting, then the trailing edge sheeting which is only as wide as the tapered stock which will be glued to its top surface. To one of the 3/32" ply dihedral braces, glue spar stock across the center section top and bottom. Epoxy the other dihedral brace on top sandwiching the spars in-between. When this has cured, epoxy the sandwich in place on the back edge of the leading edge sheeting.

You will need six 1/16" ply wing ribs. Cut the front portion of the rib off just ahead of the spar notches, trim and fit forward of the spar box. At the rear, install only the two outboard ply ribs. While the glue is setting, cut a rectangular piece of 3/16" aircraft ply 3" wide and long enough (4-1/16" approx.) to fit between the two outboard ply ribs. This piece of ply should come in contact with the forward edge of the bottom sheeting and the forward edge of the tapered



stock; epoxy in place. By now, the center section of the wing should be set up and strong enough to remove from the building board and turn over. Install the short hardwood (1/4" sq.) spar epoxying it to the front of the landing gear mounting block. This should fix the landing gear block to the wing strong enough that it should survive all but the hardest (crash) landings without being stripped out. Drill holes and insert blind mounting nuts which will be used to secure the

landing gear. Insert the rear center part of the wing ribs, cutting away as necessary for the landing gear block. Also arrange for the installation of the aileron servo. Using 1/16" balsa sheeting, cover the top and bottom of the center panel. Pin the center section of the wing in place over the plans, slide the spars of each outboard panel in-between the dihedral braces and prop up each wing tip two inches. When ready, epoxy the spars in place. The inboard ribs double against the

outer ply ribs of the center section; epoxy. Add the top sheeting to the whole wing. Glue the 3/16" balsa wing tips in place.

The aileron horns are installed with a slight amount of forward rake, this will allow more rearward movement before they hit former F-2. Not only that, but the forward rake will do away with most down aileron, this differential movement is beneficial, so the "big kids" tell us. Be sure the long part of the aileron horns are in line

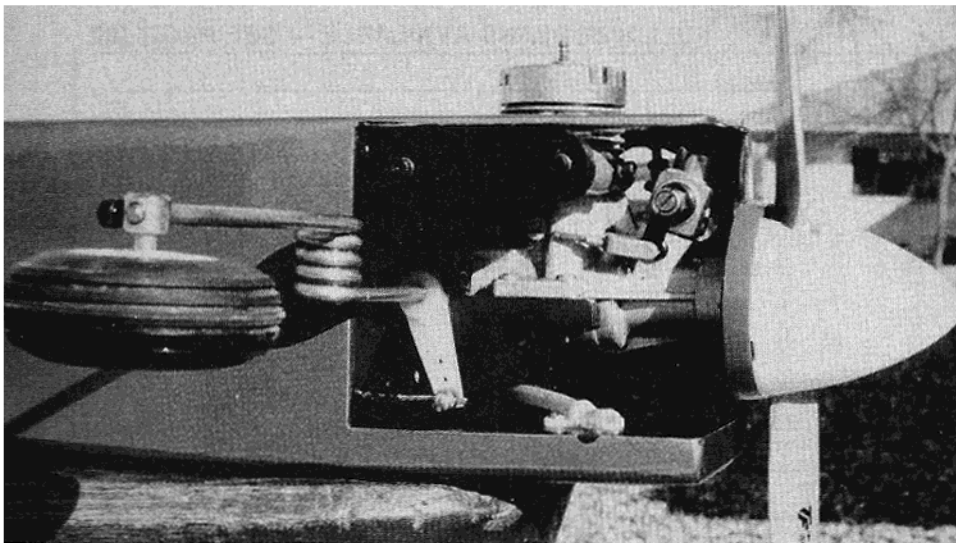
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**FIRE ARROW**

DESIGNED & DRAWN BY PAUL F. DENSON

0 1 2 3 4 5 6

PLAN NO. 963



Bottom view of engine compartment. Nose gear leg goes through engine mount. Bottom could be closed in.

with the outer panel of the wing. The part of the aileron horns within the center section of the wing are not covered over with trailing edge stock as is standard, so we put strips of glass cloth over them so they would be bonded firmly to the wing. No glass was used on the wing center section joints because we felt the engineering of the dihedral braces was sufficient for all we would ask of this plane. Hinge and temporarily attach the ailerons.

Drill a 3/16" hole in the leading edge of the wing for the wing hold-down dowel; drill it deep enough that it penetrates the front dihedral brace. Epoxy it in place. Using 1/16" cross grain strips as a replacement for the rubber wing saddle tape, put the wing in place in the fuselage and mark the hole in former F-1. Drill the hole through the former and doubler.



Insert the wing in place, drill holes for the hold-down bolts, remove the wing and tap the anchors with a 1/4"-20 tap. We used Kraft wing mounting tape. If you use another brand, be sure and shim the wing with balsa equal to the thickness of your mounting tape before marking the hole in former F-1.

After making sure we could later install the pushrods to the rudder and elevator, we sheeted the bottom of the fuselage back of the wing. The fuselage was then rounded, sanded thoroughly, blown, wiped clean of sawdust and covered. The empennage was added to the fuselage making sure everything was square. Cover the wing, add the wheels, stick the wing mounting tape in place and mount the wing. Turn the plane over and place it on its wheels, move back and take a long look. Is everything square? Does the wing align perpendicular to the

