

PRESCOTT



The Prescott Pusher began life in early 1980 as a marketing concept. How could I and countless others afford our very own aircraft? Certainly "pay as you go" is an American way of life and why not "pay as you build" your own aircraft. Thus, an aircraft purchase plan was outlined to allow a modest down payment and provide a method of monthly payments. Because a kit manufacturer, with the high cost of money, cannot become the banker, shipment of subsequent kits can only be made after receipt of payment.

The next task was to design an aircraft that could be tailored to this marketing concept. Some initial design goals included: sufficient payload capability to handle 95th percentile adults, a

range of 1000 statute miles, lowest possible cost while maintaining a high quality of design, simplicity of construction tailored to the average homebuilder, development of the airframe with a proven powerplant and, finally, provide maximum performance with the power specified. That is quite a tall order, but attainable with careful planning and innovation.

One of the first steps in any aircraft design is to establish the basic configuration. It is safe to say that, as designers, we have squeezed almost the last ounce of efficiency from tractor configured aircraft. Therefore, many designers are realizing additional efficiency can be obtained by utilizing a pusher design concept. The Prescott Pusher posed some interesting design challenges that included weight control, structural configuration, and engine cooling.

Early in the design, I decided not to accept the challenges associated with a mid-engine aircraft and the six to eight foot drive shaft that the mid-engine dictates. This one decision narrowed the possibilities for the configuration and what resulted was the aircraft as presented here.

It is interesting to note that the Prescott Pusher was originally conceived as a two-place aircraft. However, a look at the homebuilt market, revealed a very crowded arena. What was also apparent was the lack of a four-place transportation aircraft --- so back to the drawing board. I stretched the fuselage to accommodate four, increased the horsepower, and enlarged the aircraft to accommodate the higher take-off weights.

PUSHER

Tired of the ordinary? This unique aircraft will stand out in the crowd at your R/C flying field



By Tom Prescott

1/5 Scale Model S=0.200

Fuselage			
Prototype		Model	
Length	20.28 ft.	4.06 ft.	48.72 in.
Height	9.67 ft.	1.93 ft.	23.21 in.
Width	3.67 ft.	0.73 ft.	8.81 in.
Wing			
Span	30.00 ft.	6.00 ft.	72.00 in.
Root Chord	4.67 ft.	0.93 ft.	11.21 in.
Tip Chord	3.00 ft.	0.60 ft.	7.20 in.
Area	113 sq. ft.	4.63 sq. ft.	666 sq. in.
Horizontal Stabilizer			
Span	11.00 ft.	2.20 ft.	26.40 in.
Root Chord	3.33 ft.	0.67 ft.	7.99 in.
Tip Chord	2.17 ft.	0.43 ft.	5.21 in.
Area	29.3 sq. ft.	1.21 sq. ft.	174.37 sq. in.

Model Weight = 2250 (0.21) (to third power) = 18.0 lbs.
 Model Power Equiv. = 180 (0.2) (to third power) = 1.44 hp
 Wing Loading = 19.9 (0.2) = 3.98 lbs./sq. ft.
 Model Velocity = 195 (0.2) (to one-half power) = 87.21 mph

In looking back over my early notes, I discovered under the design philosophy Item 8 which read, "model design and test." This philosophy has taken two roads. First, a one-fifth scale model was tested in the Wichita State University 7 x 10 foot low speed wind tunnel in November of 1983. This wind tunnel model was constructed using many R/C modeling techniques. Prescott Aeronautical realized significant savings by using this design approach. But the wind tunnel model is a story of its own, so back to the R/C model.

PRESCOTT PUSHER

Designed By:

Tom Prescott

TYPE AIRCRAFT

Stand-Off Sport Scale

WINGSPAN

72 Inches

WING CHORD

11.2 Inches (Root)

7.2 Inches (Tip)

TOTAL WING AREA

666 Sq. In.

WING LOCATION

Low Wing

AIRFOIL

NLF (1) - 0215F

WING PLANFORM

64.3% Taper Ratio

10.3 Deg. Sweep

-1.5 Deg. Washout

2.0 Deg. Incidence

DIHEDRAL EACH TIP

1.9 Inches

O.A. FUSELAGE LENGTH

48 Inches

RADIO COMPARTMENT SIZE

(L) 12" x (W) 8" x (H) 6"

STABILIZER SPAN

26.4 Inches

STABILIZER CHORD (incl. elev.)

8 Inches

STABILIZER AREA

174 Sq. In.

STAB. AIRFOIL SECTION

NACA 66,-012

STABILIZER LOCATION

"T" Tail

-1.5 Deg. Incidence

VERTICAL FIN HEIGHT

8.5 Inches

VERTICAL FIN WIDTH (incl. rud.)

10.9 Inches (Avg.)

REC. ENGINE SIZE

.60-.90 Cu. Inc.

FUEL TANK SIZE

16 Oz.

LANDING GEAR

Retractable

REC. NO. OF CHANNELS

6

CONTROL FUNCTIONS

Ail., Elev., Flaps,

Gear, Rud., Throt.

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	.....	Balsa & Ply
Wing	.....	Foam, Balsa & Ply
Empennage	.....	Foam, Balsa & Ply
Wt. Ready To Fly	.....	288 Oz. (Scale)
		208 Oz. (Recommended)
Wing Loading	.....	62.2 Oz./Sq. Ft. (Scale)
		44.9 Oz./Sq. Ft. (Recommended)

The one-fifth scale radio control model was flown in February of 1984. The model was scaled using Reynold's modeling techniques. The scale factors derived are shown on chart.

The 1/5 scale R/C model, as tested, weighed 17.5 lbs. without fuel; and, therefore, was over

scaled gross with full fuel. It was powered by a Rossi 90. The control functions included ailerons, elevator, rudder, throttle, retracts and flaps. It should be noted that the normal cruise flap setting will be -10 degrees. Also, a unique data downlink system was developed to record airspeed, angle of attack, angle of sideslip, and all control positions. Again, the downlink system is a story all to itself.

Model Construction

Fuselage:

The fuselage is designed to be constructed upside down on a flat building surface. Start construction with the rectangular center section. A centerline drawn on the building board will help with alignment. Also, four support blocks were nailed to the board to keep this section square. Install F-3, F-4 and the triangular stock. After the assembly has dried, install F-3a and F-4a.

Move rearward with the next section and install the firewall F-5. **Note:** The engine is installed with 1.5° downthrust and no sidethrust. As a matter of convenience, before installing F-5, locate and install the engine mount using blind nuts. Also, predrill holes for the fuel tubing, throttle cable, and rudder pushrod as noted on the plans.

Install F-5a with the engine and mount installed. Complete the aft section assembly and locate F-6. Now that the aft section is complete, turn the section right side up and reposition over centerline. Now install the forward section and F-2. When dry, install F-2a. To complete the forward section, F-1 is installed.

It should be noted that on the prototype model an additional bulkhead was added to mount the nose gear. Originally, a forward retracting nose gear was planned but has since changed to aft retracting for structural and C.G. reasons. As with the engine, it is recommended that the nose gear be installed on F-2 prior to its final installation. Next, install the nose gear floor made of 1/8" poplar

plywood and the 1/4" balsa triangle supports. The nose gear retract servo should be installed at this time and the linkage completed. Place the partially completed fuselage aside for now and begin construction of the vertical fin.

Vertical Fin:

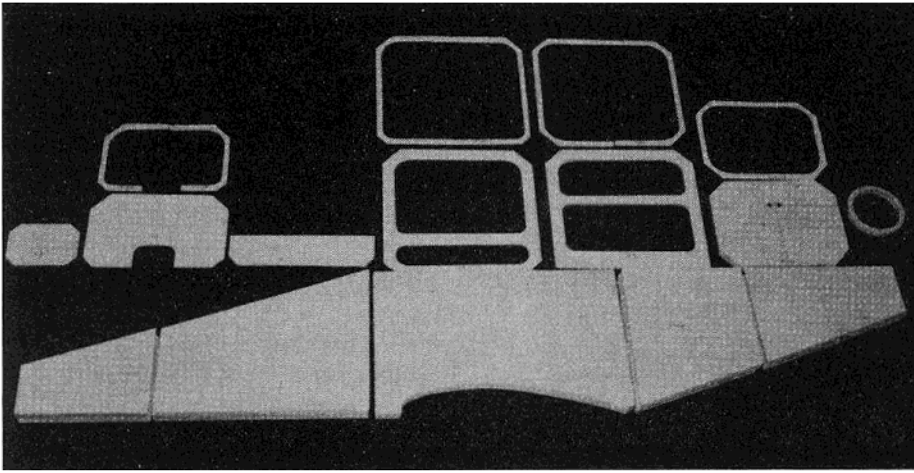
Make all the required parts for the vertical fin including VFJ-1 through VFJ-4. These vertical fin building jigs are laid out on the building board at their respective positions. Once these jigs are secured in position, the vertical fin is constructed in sequence from one side to the other. It should be noted that the elevator bellcranks are installed during this sequence. See plan details for construction method used on bellcranks. Start construction with the left skin properly located on building jigs.

Next install and glue to skin the main spars and ribs. **Note:** Do not forget the rib holes that allow the pushrod to be installed between bellcranks. (On the fiberglass fuselage model these bellcranks were eliminated and a straight pushrod was used between the elevator servo and elevator.) After this assembly has dried, the right side skin is glued in place. At this stage the rudder and 1/4" sheet balsa forward section of fin were completed.

Horizontal Stabilizer:

Standard foam core construction was utilized on the horizontal. First cut the cores using the stabilizer templates. The core blocks are used to complete the assembly. Lay lower skins in the blocks first and paint with Formula II epoxy. Next install the cores. **Note:** On the prototype model a 1/8" poplar spar was added because of the expected higher scaled weight. On later models the spar has been eliminated. Install the balsa center section filler.

Next, epoxy the top skin and install. Weight the two assemblies down on a flat building board and allow to dry overnight. After the assemblies have dried, carefully align and epoxy halves together. Install the 1/2" by 1/2" balsa

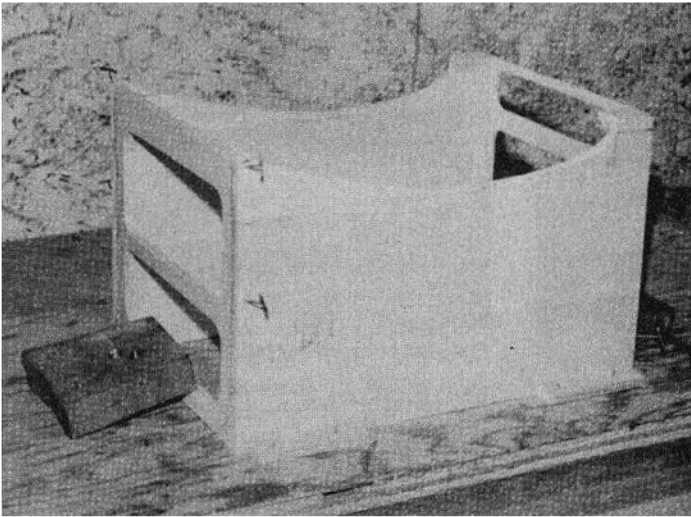


Fuselage bulkheads and sides.

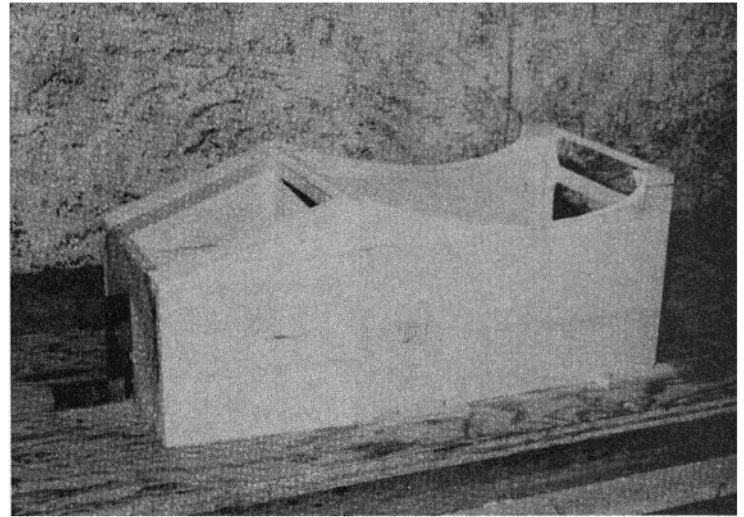
and sand the completed assembly to final shape. Now install the 1/4" hardwood dowel and fiberglass the center section, both top and bottom. Temporarily install hinges and control horn (see plan sheet #2 for horn details).

Wing:

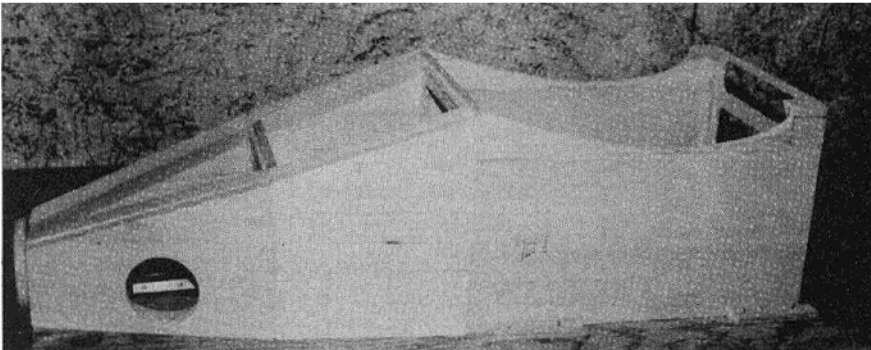
The wing construction again utilizes standard foam core techniques. The plan details show the right side as constructed on the prototype model and the left side as later constructed on subsequent models. The



Fuselage center section.



Fuselage aft section added to center section.



Fuselage engine section and mount.

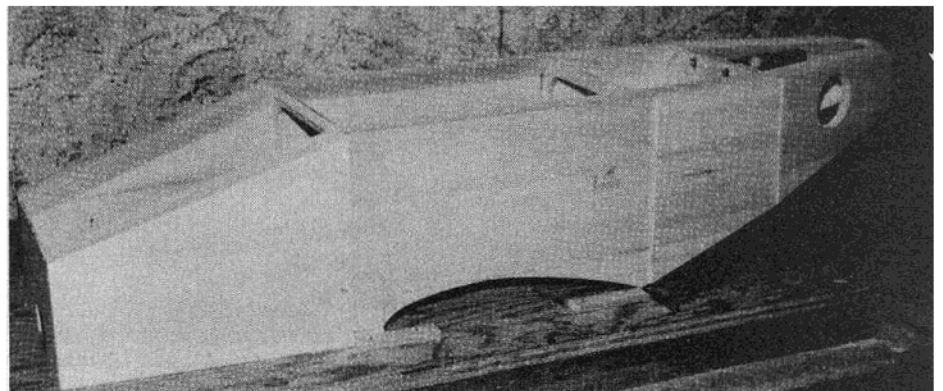
significant difference is the location of the main gear.

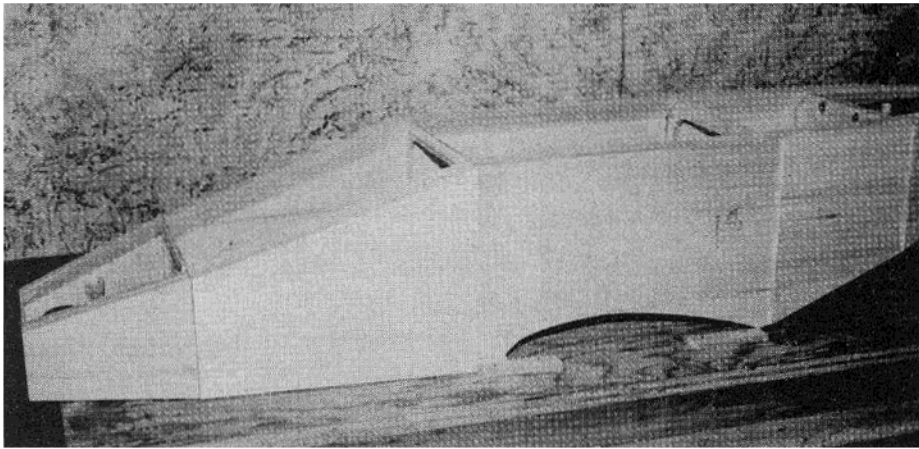
The real aircraft has the main wheel located at fuselage station 244 extended, and retracts to fuselage station 257.4. (The fuselage nose tip is station 92.) This aft location creates an installation problem for commercially available retracts. For the prototype model a special set of retracts were machined. These retracts were constructed

leading edge. Mark the elevator centerline and saw this section from assembly. Saw an additional 3/8" from the horizontal and install the 3/8" balsa closeout. Also, saw an additional 1/4" from the elevator. The balsa hinge fillers should now be installed under the upper skin at each hinge location. Closeout the elevator with a 1/4" balsa sheet.

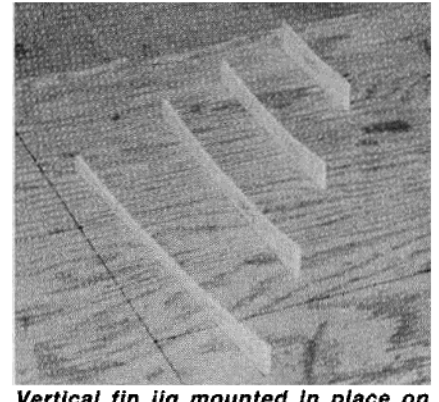
Next glue the balsa tips in place

Fuselage forward section.

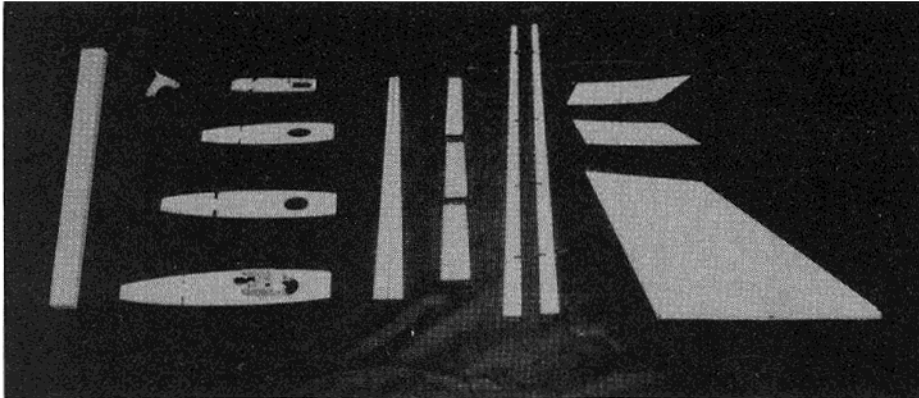




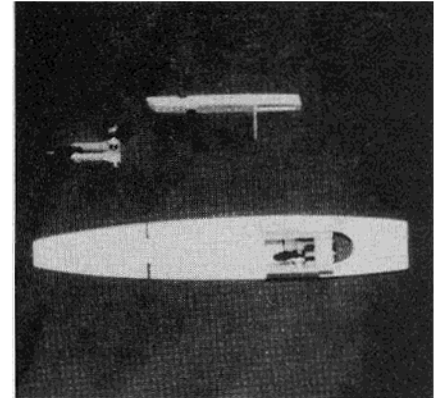
Fuselage nose section installed — set this assembly aside.



Vertical fin jig mounted in place on building board.



Vertical fin parts.



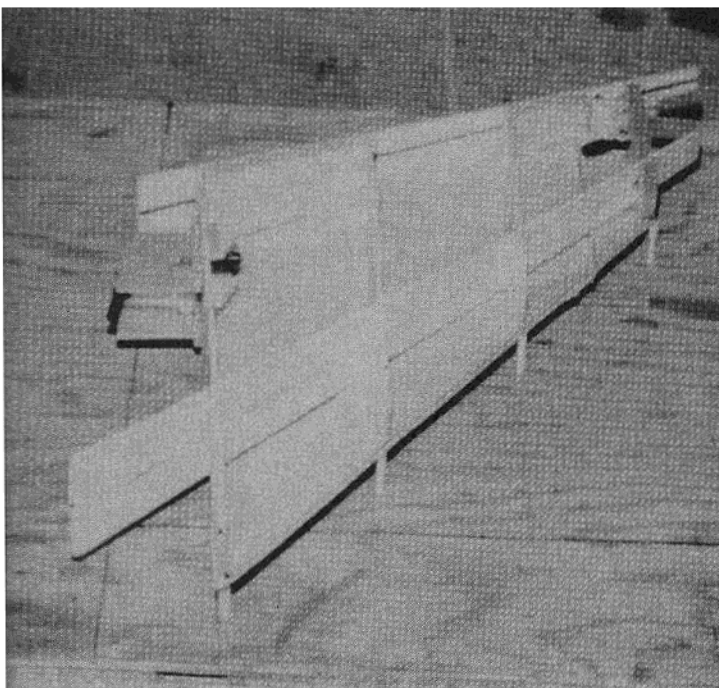
Elevator bellcrank detail.

similar to the mechanism used on Robart 1/2A retracts to keep the overall height to an absolute minimum. These retracts were very expensive to build (trunion blocks alone cost \$60.00 each to machine) but worked satisfactorily. The gear location,

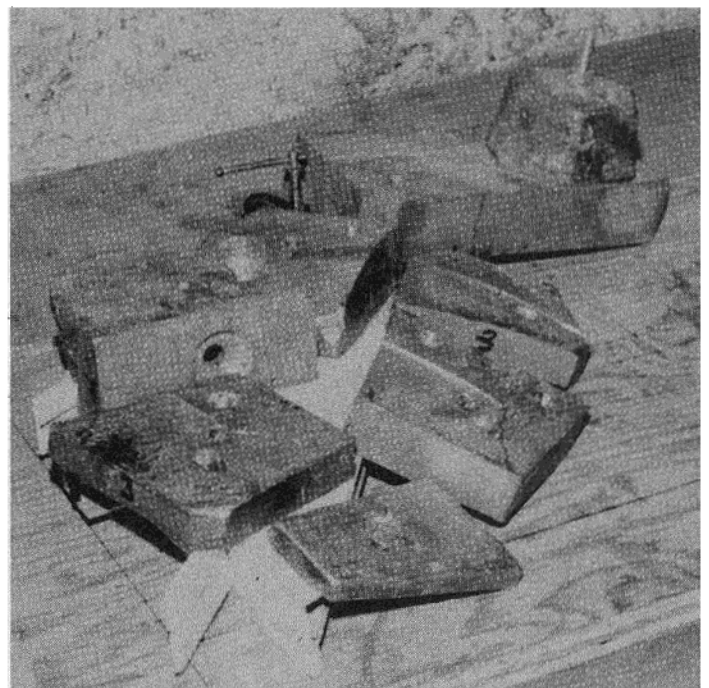
as shown on the left side, has been flown on subsequent models and works quite well if an exact scale is not desired.

Cut the foam cores as illustrated on the plans. **Note:** The cores are cut with the dihedral and $1\frac{1}{2}^\circ$ of washout. They are also cut using a

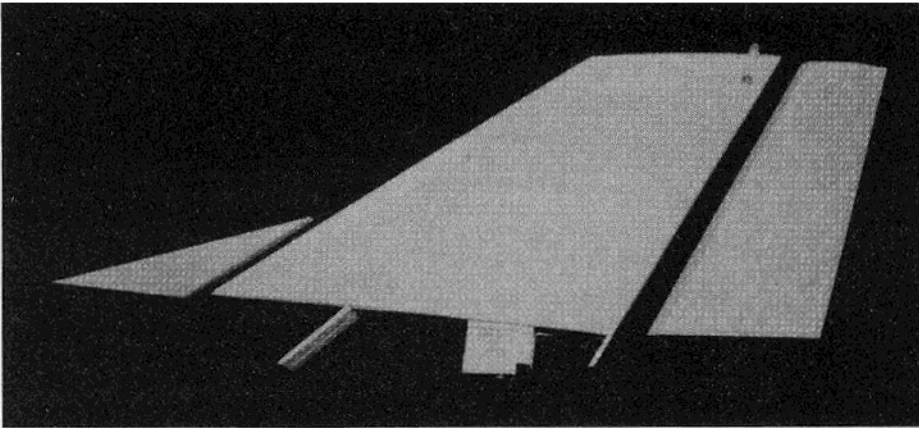
36" length block and later trimmed to final span. After cores are cut, use a soldering iron as a cutter to slot spar, retracts, bellcranks (if used) and balsa mounting blocks. Assemble four each $1/16$ " balsa skins. Lay the lower skin in the bottom of core



Vertical fin left side, ribs and bellcrank installed.



Vertical right skin held down to dry.

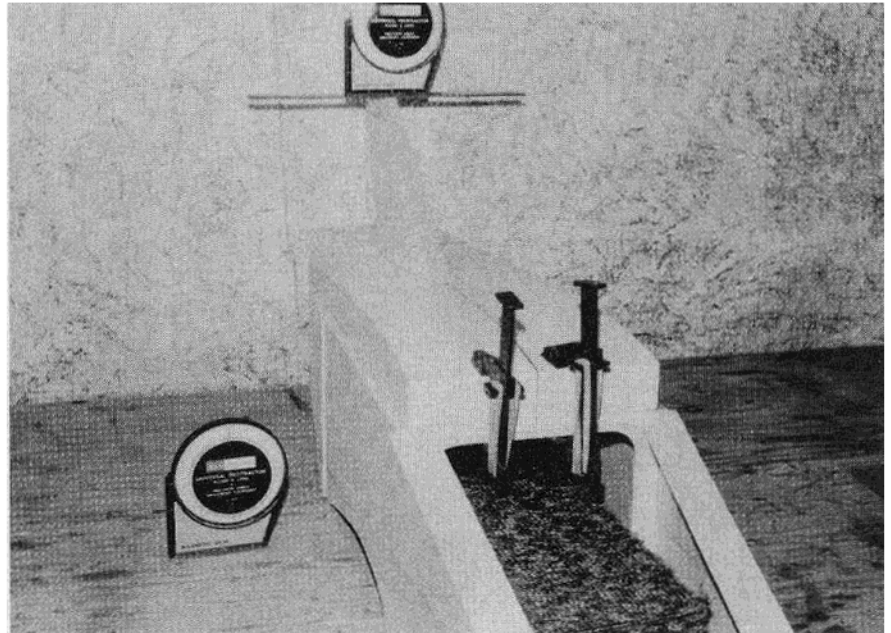


Completed vertical fin and rudder.

block and coat with epoxy (Formula II).

Next, install the 1/8" poplar plywood spar and balsa mounting blocks. Also install bellcranks, if used, and the plywood retract mounting plate. These items should be coated with epoxy before installing. Place the core on top of the lower skin. Epoxy the top skin and core. Weight the assembled blocks down on a flat surface and allow to dry overnight. When dry, mark the proper location of flaps and ailerons, and saw panels from tip to center section. Cut an additional 1/4" from the panels and install the 1/4" balsa closeout.

Install the 3/32" music wire and 1/8" brass bearing with the center section trailing edges if bellcranks are not used. Install the 1/8" by 1/2" balsa hinge support under the top skin of the flaps and aileron. Complete the closeout by installing the 3/32" balsa face. Return the wing panels to the foam blocks and epoxy halves together. When dry, epoxy in place



Fuselage shaped block installation — vertical fin alignment critical.

the 1/2" leading edges. Temporarily install hinges and horns in aileron and flaps. Epoxy in place the all-balsa wing tips. **Note:** The original prototype had full chord tips as shown on the plans. The final full scale

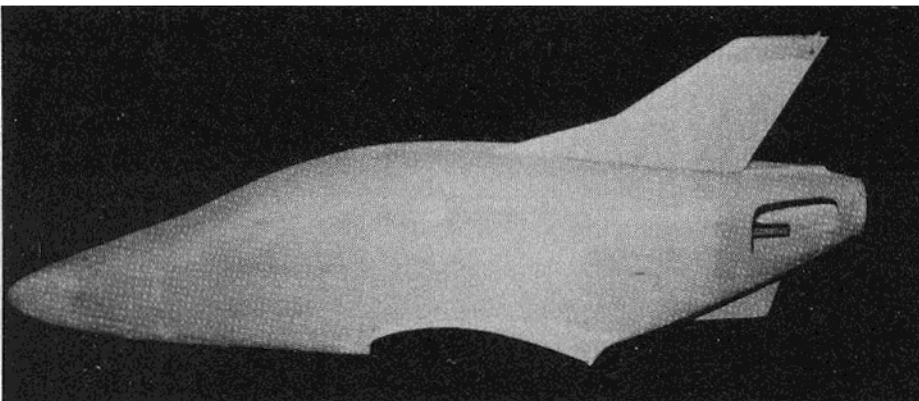
downward canted winglet's shapes are also shown on plans. Make cut-outs for servos and fiberglass center section of wing.

Now that the wing and horizontal and vertical fin are complete, the fuselage construction is continued. Cut to shape the four 2" by 4" balsa top blocks. To conserve weight, it is important to hollow these blocks as much as possible as shown on plans. Install the two aft blocks first and the vertical stabilizer at the same time. Proper alignment

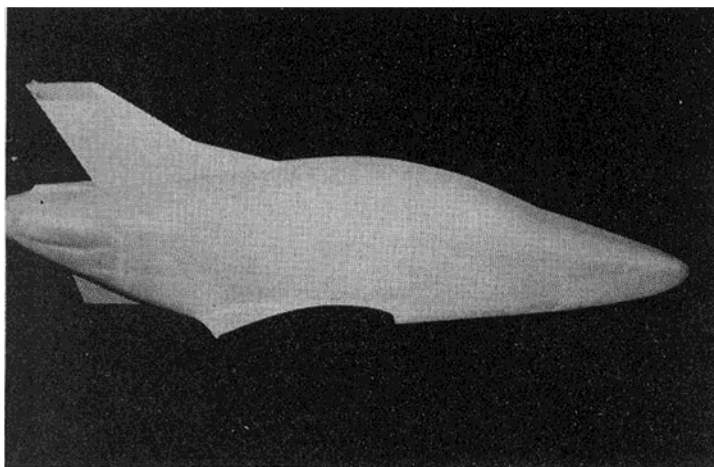
is important. Next install the two forward upper and lower blocks. Install the nose block. At this stage the wing mounting hardwood blocks were installed and the wing mounting is completed. After the wing is bolted in place, then the wing fillets can be installed and shaped. Remove the wing, install the sub-fin and cheek cowl block. Sand to final contours. With the wing installed to insure proper alignment, glue the horizontal stabilizer in place.

Finishing:

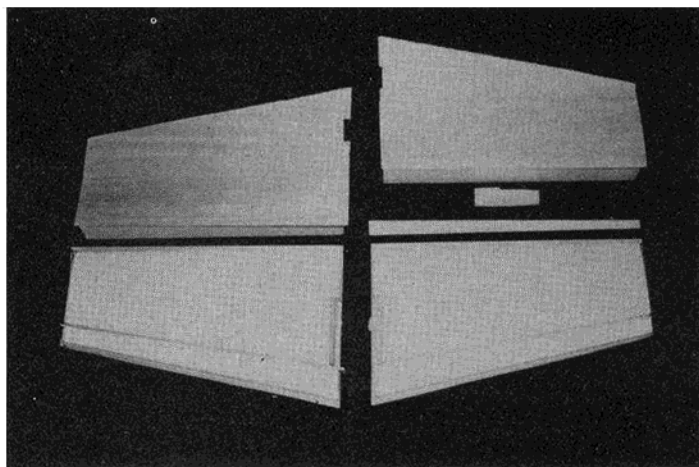
The prototype model was covered with 1/2 oz. fiberglass cloth and painted with Super Poxypaint. Subsequent model wings and stabilizers were covered with Super MonoKote and then painted with clear Super Poxypaint. The



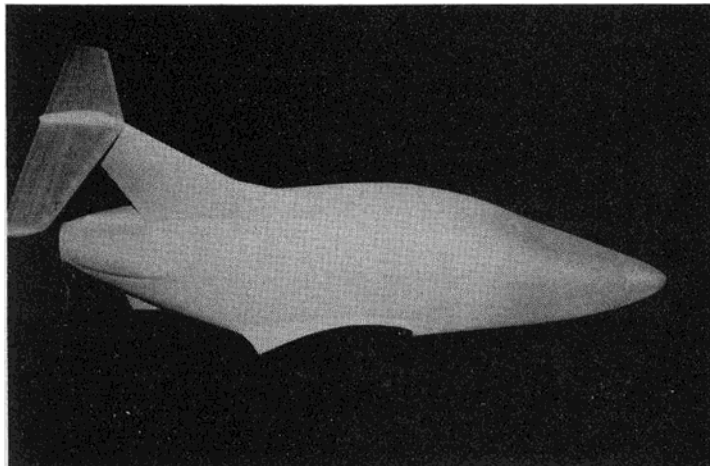
Finished fuselage, left side.



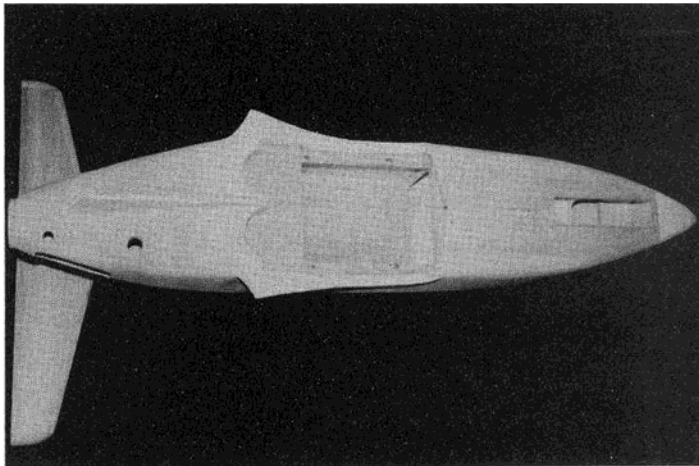
Finished fuselage, right side.



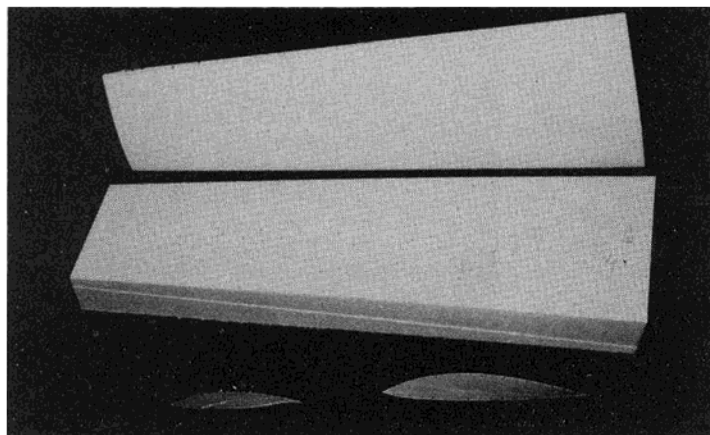
Horizontal cores, skins and spars during final gluing sequence.



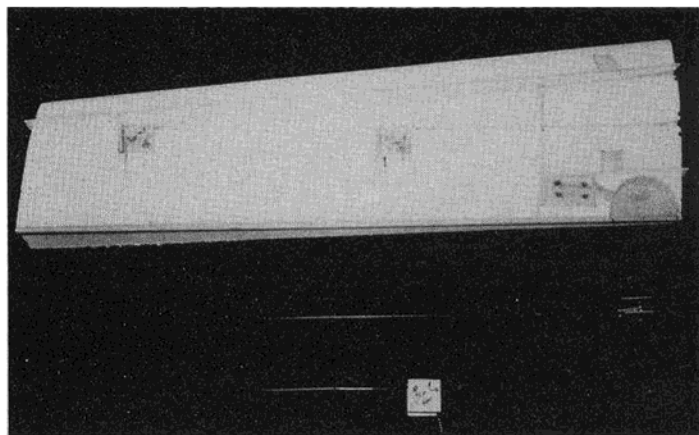
Horizontal stabilizer installed.



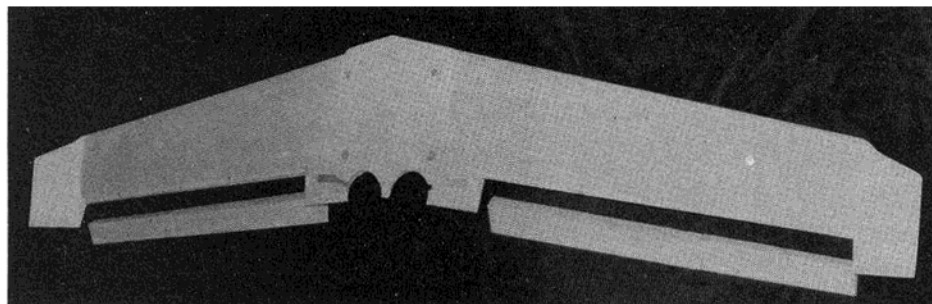
Completed fuselage, bottom view.



Wing form core blocks and templates.



Wing assembly — install gear mount, bellcranks and spars before final gluing of panel.



Wing final assembly, bottom view.

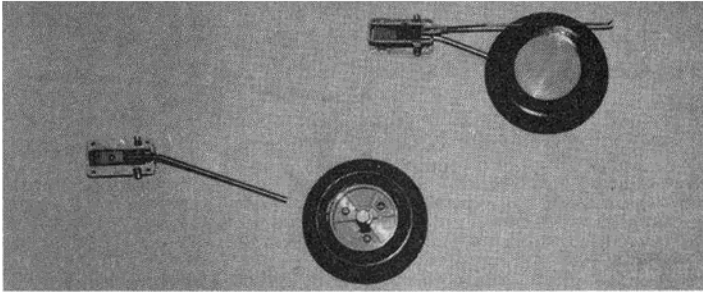
key is to use the lightest possible finish to keep the model weight as low as possible. Nose weight will be required to properly balance

the airplane.

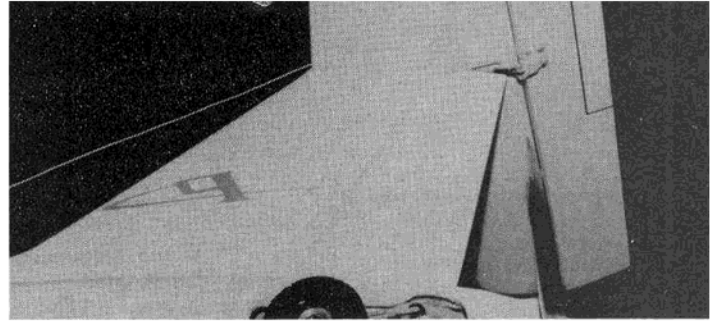
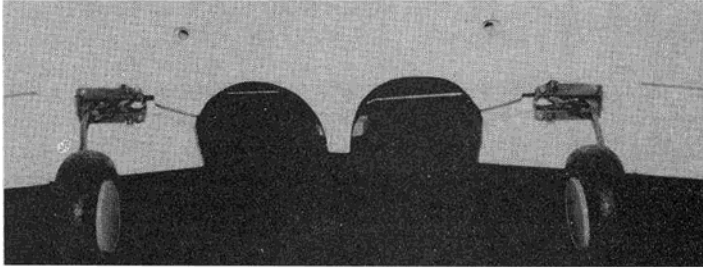
Flying:

This R/C model is a dream to fly. It's flight characteristics are

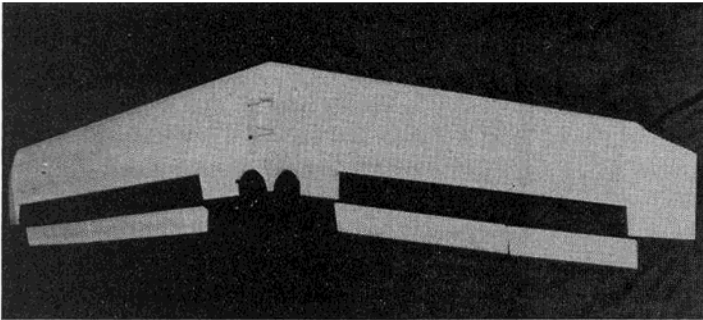
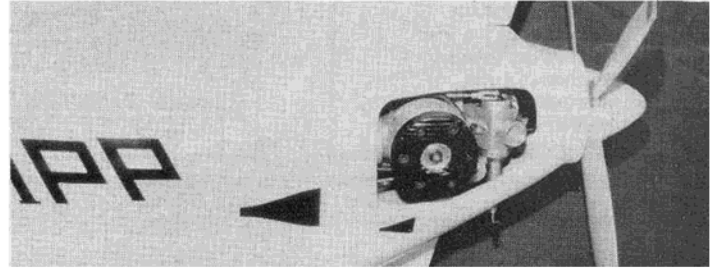
similar to a finely tuned pattern aircraft. It completes loops, rolls, knife-edge flight, stalls and spins with the greatest of ease. The model has been flown with the C.G. limits as shown on the plans (and further aft than the limit) but prefers the more forward positions. About 1/4" aft of the forward limit seems ideal. The model has been flown with a Rossi 90 and an O.S. Max 108. The 108 is way too much power and a strong 60 is more than adequate. Both two bladed and four bladed



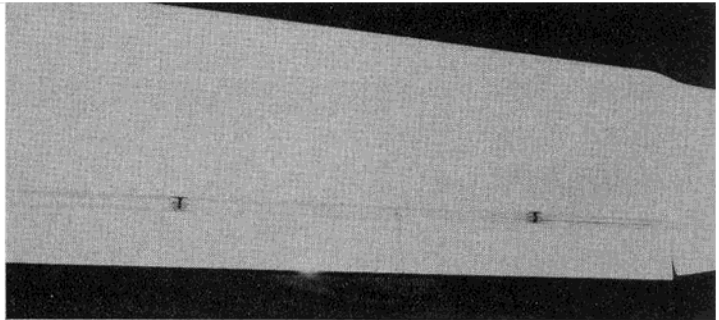
ABOVE: Custom built retracts for scale location — C.G. recommended for Stand-Off Scale. **BELOW:** Scale retract location.



ABOVE: Elevator horn detail. **BELOW:** Rossi power with four bladed propeller.



Wing final assembly, top view.



Aileron/flap horn detail.

propellers have been used. The four bladed propeller (made from two two-bladed Zingers), works extremely well on this aircraft. The added disc area creates a bit more drag at low throttle settings

to help slow the model down for landing. The landings are a beauty to behold with and without flaps.

If you are looking for that aircraft that has pizzazz, looks

fantastic, and is capable of that "airshow demonstration," the Prescott Pusher is for you. Build this 1/5 scale R/C model and then branch out to the real thing, also in kit form. □

**From
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