

FOUR  
WAY  
CONVERTIBLE

By:  
P. Pavlow Jr.

A .40 or .45 powered sport flyer that will draw comments not only for its "weird" appearance, but for its performance as well. An ideal aircraft for the Sunday flyer or fun-fly events!

If you are looking for something different, something that will elicit all sort of comments from your fellow RC'ers, and also give you many hours of fun filled flying, then the Convertible might be just the plane for you.

As you can see from the picture, the Convertible, as the name implies, can be set up in four different configurations --- as a high wing monoplane, low wing monoplane, high wing "bipe" (main wing on top, stub on bottom), or low wing "bipe" (main on bottom, stub on top). When you first bring your model out to the flying field set up as a monoplane, not too much interest is generated beyond the fact that you've got a new aircraft. But wait until you make that first switch from high to low or low to high and particularly to a "low bipe." Just the fact that you can change configurations is enough to generate a series of questions. The somewhat weird appearance of the low bipe set-up will definitely bring forth responses such as: "Looks like a hat on a goat;" "Where did you get the AWAC?;" "Why don't you fly it with just the stub?" All-in-all, a bunch of good natured ribbing. Once you get the Convertible in the air, however, your fellow club members can't help but be impressed with its performance, especially if you let some of them put it through its paces on their own.

The original thoughts behind the design were to get a model that was (1) easy to construct, (2) gentle enough in flight for a novice, (3) precise enough for most aerobatics. Since I have been in R/C flying (approximately two years), I have noticed that most of the trainers are high wing monoplanes, and that the intermediate and advanced pattern ships are generally low winged. So, why not make an aircraft that could be both? By combining some of the various elements of trainers (thick, constant chord airfoils, wash-out) with intermediate or advanced ships (symmetrical airfoil, zero zero degree settings), the Convertible was born. The addition of the stub wing was an afterthought brought about by curiosity as to what effect the formation of a --- whoa now, I'm getting ahead of myself. Check the Flying Section of this article for completion of the foregoing.

If you build the Convertible, be sure to give it a good testing in all four configurations so that you will know exactly what you can do with it in each set-up. Should you enter into fun-fly

competition, I seriously doubt that the rules would permit changing configurations for different events unless you paid an entry fee for each configuration.

I could not let this presentation go without giving my special thanks to one individual in particular who was extremely helpful to me throughout this entire project. Not only did he offer many useful technical sugges-



#### ABOUT THE AUTHOR

Paul Pavlow, Jr., 66 years old, began modeling with rubber-powered models in late 20's, gas-powered free flight in late 30's, and radio-control in 1981. He has never built from a kit and always designed his own aircraft (except for R/C). After joining the U.S. Navy in 1935 he became an aircraft mechanic. Paul & his wife Louise have been married for 43 years and have four children. He went to naval flight school in 1941 as an enlisted man --- one of the earlier enlisted pilots --- and received a commission to Lieutenant junior-grade in 1943. He flew most all types of naval aircraft (except jets and helos) until his retirement in 1963 as a Lieutenant Commander.

Paul taught mathematics and aerospace in High School from 1963 to 1978. The aerospace course was eventually issued an FAA Air Agency certification as a Private Pilot Ground School. He still holds an FAA Advanced Ground Instructors license. He retired from teaching in 1978.

Paul became interested in R/C building and flying in 1981 as a member of the Corpus Christi Radio Control Club. After three kits and one scratch-built (Neutron Star), he decided to start designing his own again.

tions, but he constantly served as my back-up on the many test flights conducted and, in fact, performed most of the aerobatic testing of the Convertible. My sincerest thanks to Phil Koury, past president, and now president again in '84, of the Corpus Christi Radio Control Club.

Now, let's get on with the construction.

#### Preliminary Notes:

Inasmuch as each modeler usually

has his own personal preferences as to the types of glues, fittings, covering materials, etc., used, substitutions may be made in these areas with no detrimental effects as long as the weight and C.G. limitations are not considerably altered.

All surfaces should be free of dents and dings, and sanded smooth before final covering and finishing.

#### Construction

##### Fuselage:

1. Mark and cut out:
  - a. fuselage sides (2), (1/8" balsa).
  - b. fuselage doublers (2), (1/16" ply).
  - c. formers F1 (1/4" ply); F2, 3, 4, (1/8" ply); F5, F6, F7 (1/8" balsa). (Don't forget dowel holes in F2, and opening in F3 for servo wires.)
  - d. wing saddles (4), (1/8" balsa).
  - e. motor mounts (2), (1/2" maple).
  - f. servo tray rails (2), (3/8" square hardwood).
  - g. F8 (2), (1/8" ply).

2. Mark position of formers on fuselage doublers and sides; motor mount position on doublers; servo tray rails on F3 and F4.

3. Glue wing saddles to fuselage doublers.

4. Glue servo tray rails to F3 and F4.

5. Glue F8 to front of each fuselage doubler.

6. Glue motor mounts to fuselage doublers.

7. Glue F1, F2, F3, and F4 to one doubler. Be sure that formers are aligned and at right angles to doubler. (F1 at right angles to inside edge of motor mount.)

8. Glue other fuselage doubler to F1, 2, 3, 4 completing basic fuselage box.

9. Carefully align and glue fuselage to outside of doubler.

10. Position and glue F5, F6, F7 to fuselage sides, pulling sides together at rear. (Use of a fuselage jig will ensure proper fuselage alignment.)

11. Glue in the triangular balsa fillet at the rear of the fuselage for the lower rudder hinge.

12. Sheet the top from F4 to F7, and the bottom from F4 to tail wheel bracket step with 1/16" balsa (cross-grain).

13. Glue in the 1/4" balsa fillets between F1 and fuselage doublers in the gas tank compartment.

14. Glue 1/4" balsa to front of F8. Sand and round corners accordingly.

15. Cut out and glue in place 1/8" ply bottom pieces between F1 and F2.



**CONVERTIBLE**

Designed By:  
P. Pavlow Jr.

**TYPE AIRCRAFT**

Aerobatic Sport

**WINGSPAN**

Main — 58¾"

Stub — 22½"

**WING CHORD**

10 Inches

**TOTAL WING AREA**

Main — 577 Sq. In.

Stub — 214 Sq. In.

**WING LOCATION**

High or Low; or Semi-Bipe

**AIRFOIL**

Symmetrical

**WING PLANFORM**

Constant Chord

**DIHEDRAL EACH TIP**

1/2" on Main

No dihedral on Stub

**O.A. FUSELAGE LENGTH**

39 Inches

**RADIO COMPARTMENT SIZE**

(L) 9½" X (W) 3-3/16" X (H) 1¾"

**STABILIZER SPAN**

21½ Inches

**STABILIZER CHORD (incl. elev.)**

6¼" Avg.

**STABILIZER AREA**

124 Sq. In.

**STAB AIRFOIL SECTION**

Flat

**STABILIZER LOCATION**

Top of Fuselage

**VERTICAL FIN HEIGHT**

8¼ Inches

**VERTICAL FIN WIDTH (incl. rud.)**

6¼" Avg.

**REC. ENGINE SIZE**

.40 or .45

**FUEL TANK SIZE**

10 Oz.

**LANDING GEAR**

Conventional

**REC. NO. OF CHANNELS**

4

**CONTROL FUNCTIONS**

Rud., Elev., Throt., All.

**BASIC MATERIALS USED IN CONSTRUCTION**

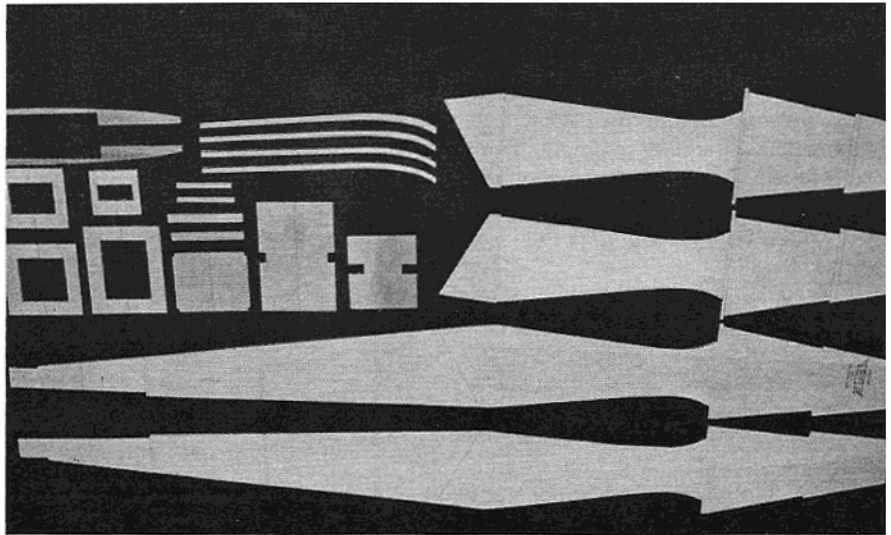
Fuselage	.....	Balsa & Ply
Wing	.....	Balsa, Ply, & Spruce
Empennage	.....	Balsa
Wt. Ready To Fly (Mono)	.....	92 Oz.
Wing Loading (Mono)	.....	23 Oz./Sq. Ft

16. Cut and glue in 1/8" balsa floor between F2 and F3.

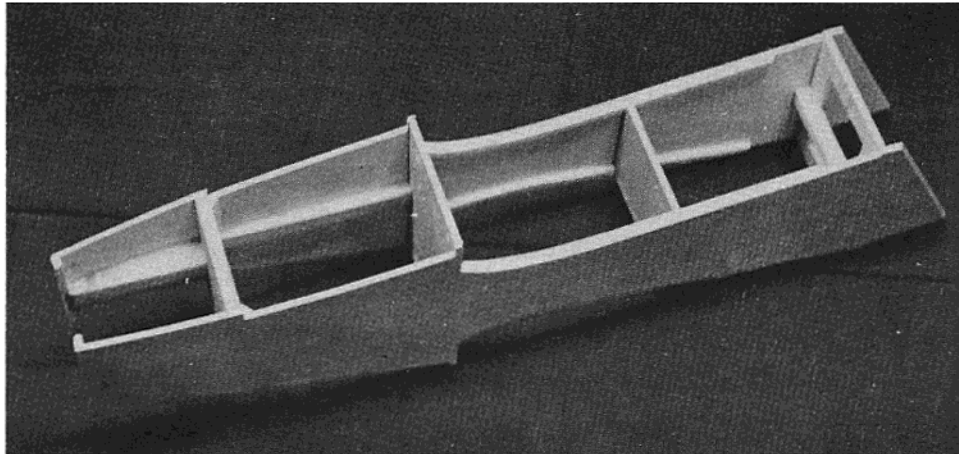
17. Cut and fit 1/8" ply servo tray. Mount on rails with #2 wood screws.

18. Cut, shape, and glue in 3/8" maple wing blocks, top and bottom.

19. Cut and shape the 1/4" balsa gas tank compartment hatch. Stiffen on the underside with scrap 1/8" ply



*Basic fuselage parts.*



*Fuselage inner box.*

strips.

20. Glue small pieces of 1/8" ply in the four corners of the tank compartment to receive the hatch hold-down screws.

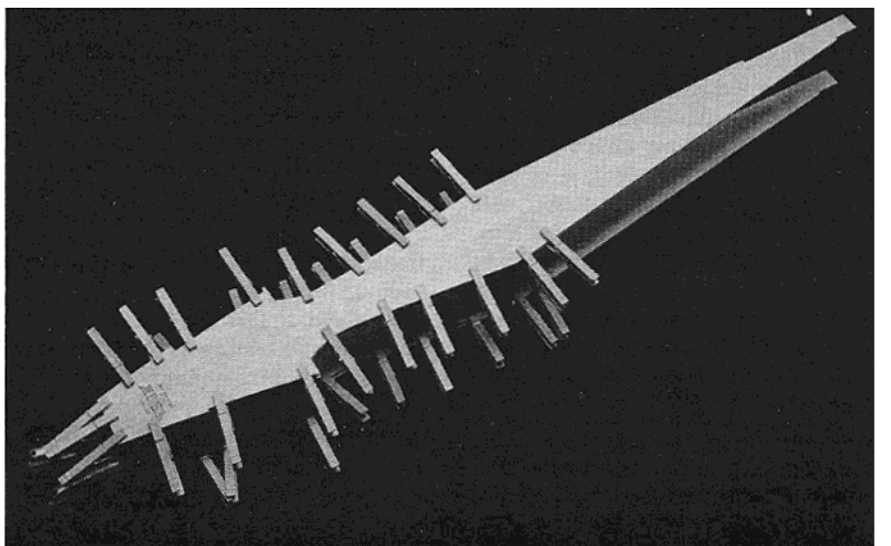
21. Cut and glue in the 1/8" ply tail wheel bracket plate.

22. Glue in the 1/8" balsa sheet between F7 and rear of fuselage flush

with top edges of fuselage sides to provide maximum gluing surface for stabilizer.

23. Cut out rudder and elevator pushrod openings on both rear sides of fuselage.

24. Cover fuselage with MonoKote or covering of your choice, leaving bare wood for gluing on empennage.



*Fuselage sides being assembled to inner box.*

### Wing:

25. Cut, shape and sand all ribs. (Gang-sanding using metal templates will ensure identical ribs.)

26. Sand the 3/8" x 1 1/2" balsa trailing edge to a knife edge at the back. Do not decrease the 3/8" dimension.

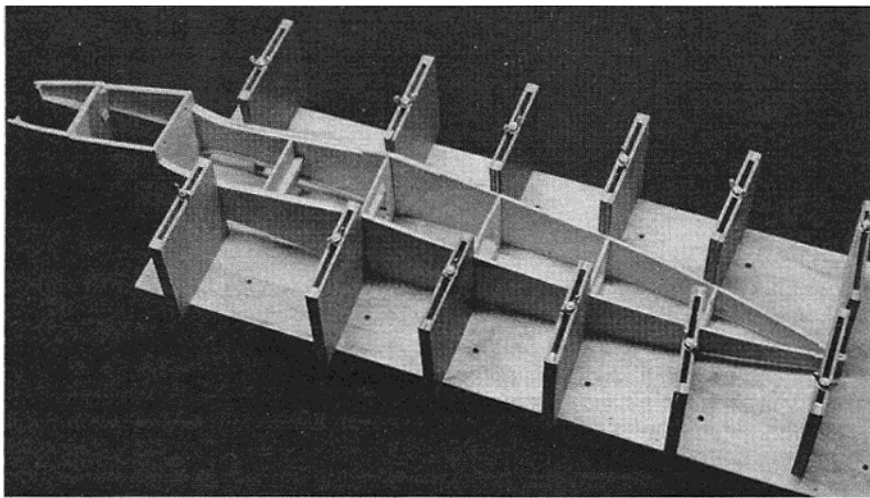
27. Mark the rib positions on the T.E. and bottom rear sheeting.

28. Glue the T.E. to this balsa sheet with the rear edges even.

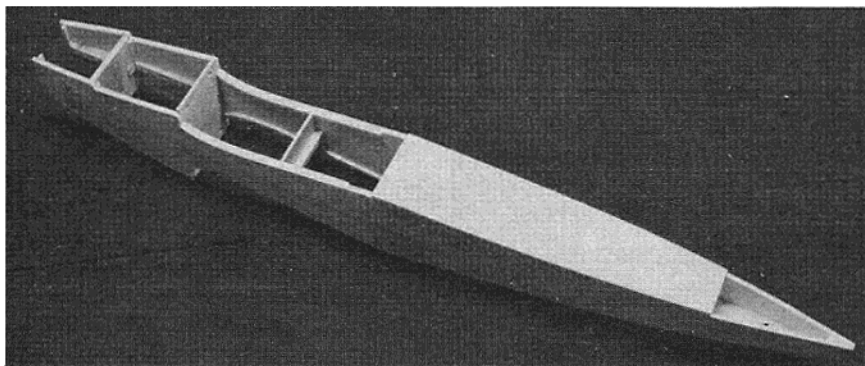
29. Glue the 1/8" square balsa spar to the sheet with the front edges even.

30. Lay a piece of waxpaper over the wing plans and work directly on the plans.

31. Pin the 1/4" x 3/8" hardwood spar in position on plans using 1/16"



A simple jig assures a straight fuselage. Jig shown is built from RCM Flight Training Course Vol I.



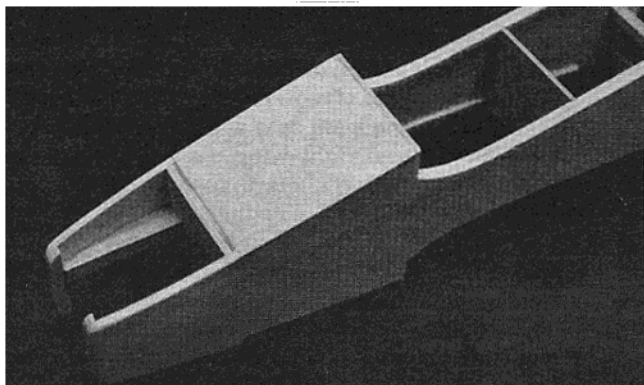
Fuselage structure assembled with aft upper and lower crossgrain sheeting.

balsa scraps under spar to allow for eventual sheeting. If wash-out is desired, pin wing root end of balsa sheet with T.E. flat on plans and raise wing tip end at rear 7/16" with balsa block. If no wash-out is desired, pin sheet flat on plans along entire length.

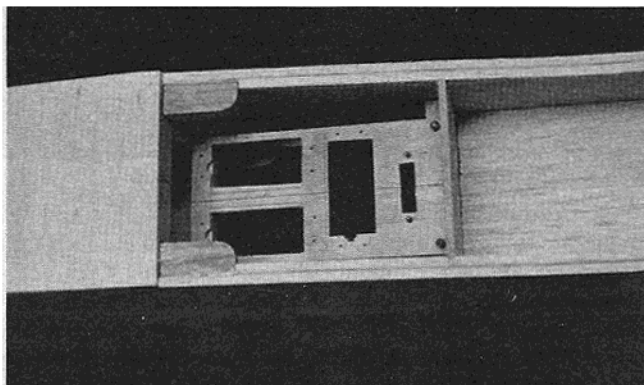
32. Glue wing ribs to T.E., bottom sheet, and spar.

33. Glue in top spars.

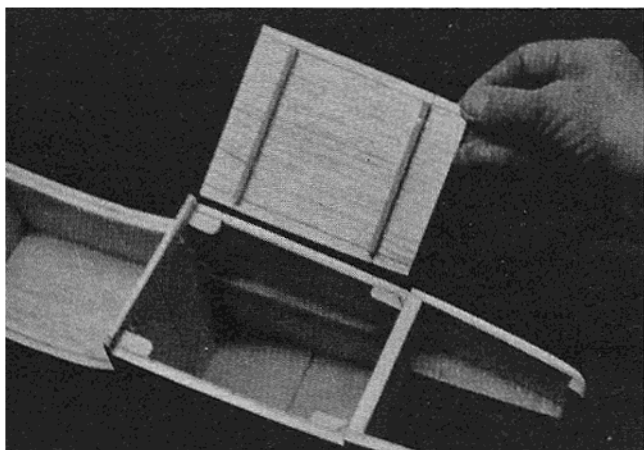
34. Glue 1/2" triangular leading edge to ribs.



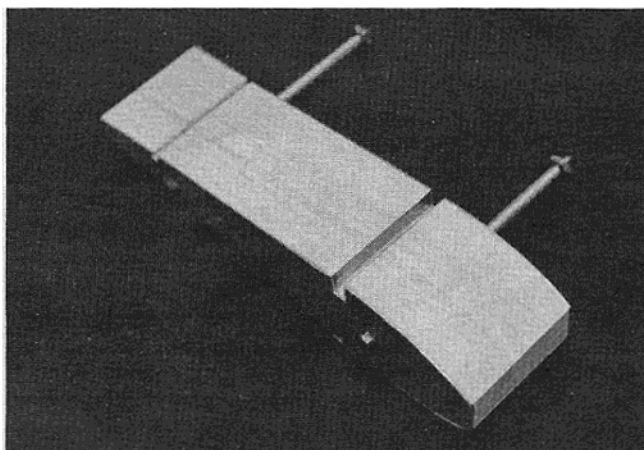
The 1/8" ply has been added to fuselage bottom forward of wing cut-out.



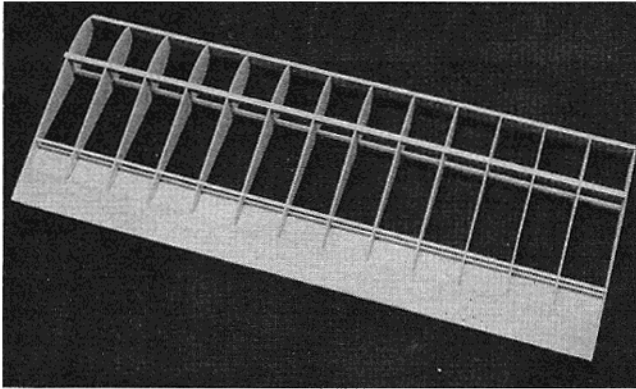
Wing screw blocks, servo tray installation and radio compartment floor are shown in this photo.



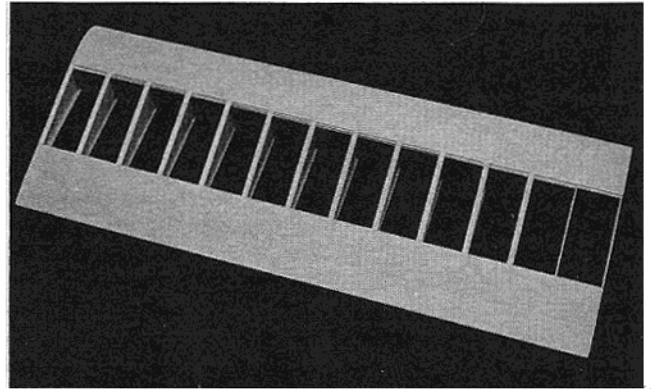
Stiffeners on gas compartment hatch are seen here. Note 1/8" ply corner pieces for hatch retaining screws.



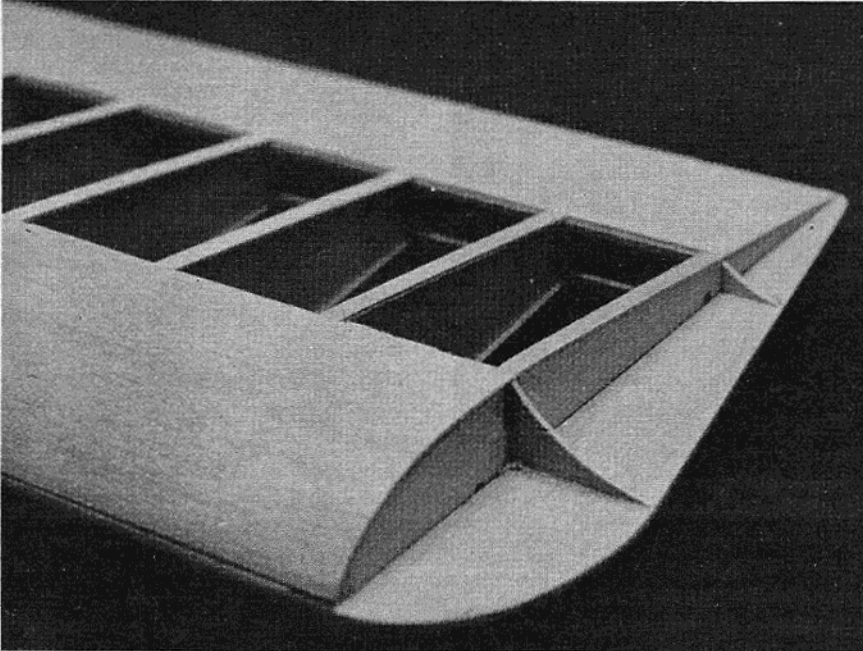
An easy way to make ribs is to sandwich a stack of balsa between two identical sheet metal templates and sand to shape.



*Leading edge, spars, trailing edge, and rear sheeting are shown assembled for a left wing panel.*



*All sheeting, cap strips, and spar webbing has been installed.*



*Left wing tip details.*

35. Cut and glue in the 1/16" balsa vertical shear webbing except between W1 and W2.

36. Finish sheeting the rest of the wing panel.

37. Shape and sand the leading edge of wing.

38. Glue capstrips on all ribs except W2 and adjacent W1.

39. Cut out W7, W8, and W9. Glue into position on left wing tip.

40. Mark and cut out aileron from trailing edge. Bevel the inside edge to provide clearance for up and down travel. Glue hinges in aileron and pin with round toothpicks.

41. Temporarily install aileron on wing.

42. Cut W10 and install bellcrank. Install pushrod and horn on aileron.

43. Align W10 between ribs to give best freedom of movement between bellcrank and ailerons. Glue in place.

44. Glue in a piece of 1/16" balsa sheet (slotted for aileron pushrod) on bottom between ribs holding W10.

This completes the left wing panel for now. The right wing panel may be constructed the same way except for reversing the position of W2, W10, aileron, and wing tip. (Photo #25 shows right wing panel construction using a wing jig.)

**Center Section:**

45. Cut T.E., spar, and W5 to at least 1/16" wider than fuselage at wing position to provide clearance for wing to seat in saddle.

46. Cut bottom sheeting to cover area of center section from T.E. to half the main spar width, and area of left and right wing panels between W1 and W2. Mark position of ribs and spars on sheeting.

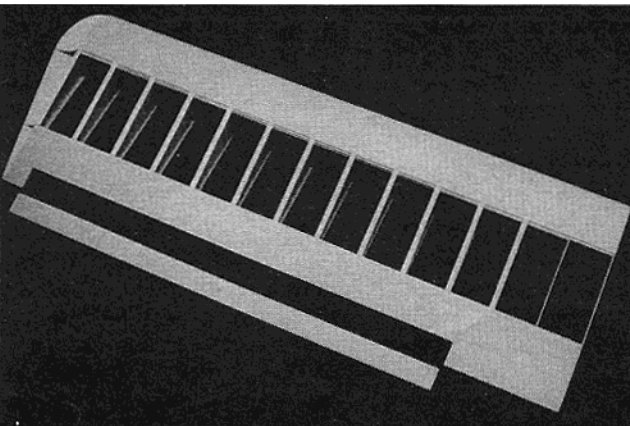
47. Glue rear bottom spar to sheet.

48. Glue W3 (both) to main bottom spar.

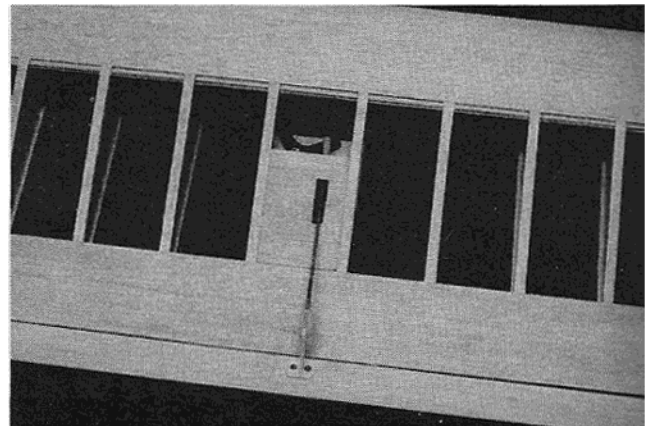
49. Glue W3 and spar to bottom sheet.

50. Glue in T.E., spars, and W5.

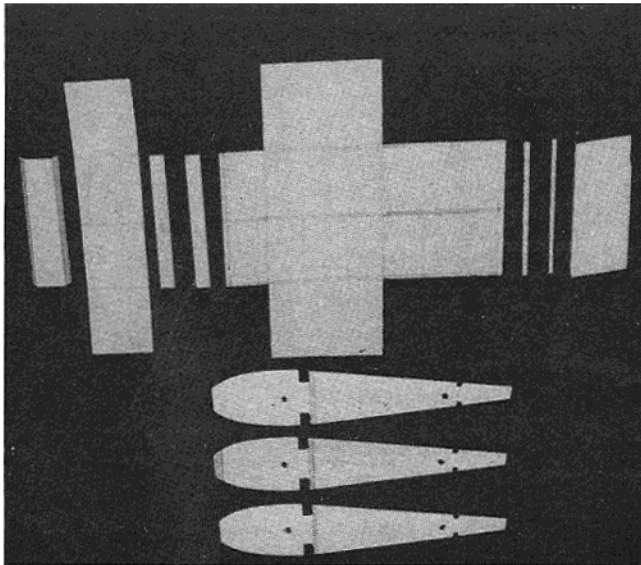
51. Cut W3 and W4 at rear of main spar and epoxy in W6.



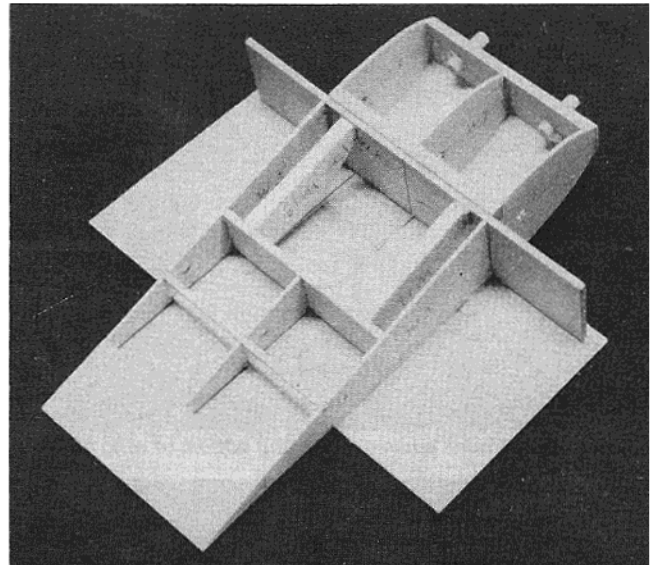
*Aileron has been cut from trailing edge of wing panel.*



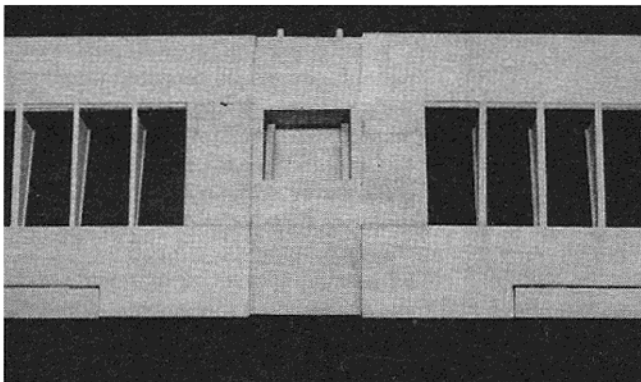
*Aileron controls have been installed in this photo.*



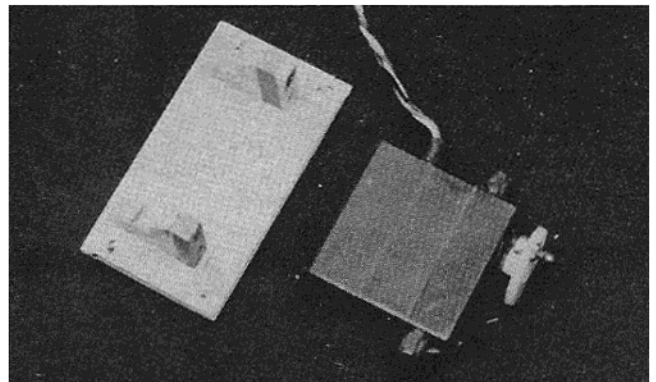
Parts required to start center section construction.



Wing center section assembly details.



Outer wing panels have been assembled to center section.



Aileron servo mount. Locate mounting posts to fit your servo.

52. Sheet the remaining portion of the bottom from spar to W5.

53. Align the center section on the fuselage and mark the location of the 1/4" dowel holes from the gas tank compartment.

54. Drill holes and epoxy in 1/4" dowels. Be sure center section is aligned properly.

55. Cut and glue in W11. (Remove W4 between W11 and W6.)

56. Cut and glue in W12 (2) with longest side flush with top edges of W6

and W11.

57. Measure 5/16" from W3 (both). Mark out space between these points and between W6 and W11 to be cut out later for aileron servo access hatch.

58. Place a 1/2" block under center section (top-side down) and epoxy each wing panel to center section. (Alternate method: Lay center section flat on straight surface and place 1/2" blocks under wing tips.)

59. Finish sheeting top of wing with continuous sheet between W1 left and

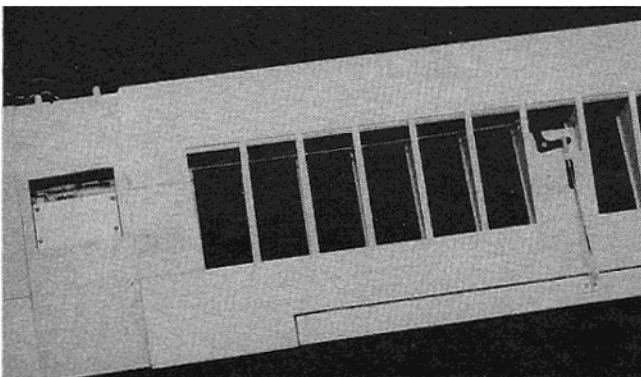
W1 right.

60. Cut out bottom sheeting between W6 and W11 for aileron servo hatch.

61. Cut vertical slot in W5 front for aileron servo wire.

62. Construct the aileron servo mounting assembly, as per aileron servo detail, to fit the servo being used.

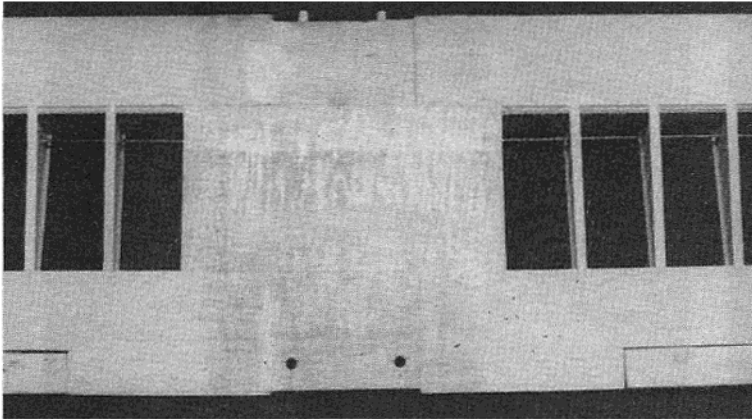
63. Mount servo in wing with servo wire fed through leading edge of wing (W5).



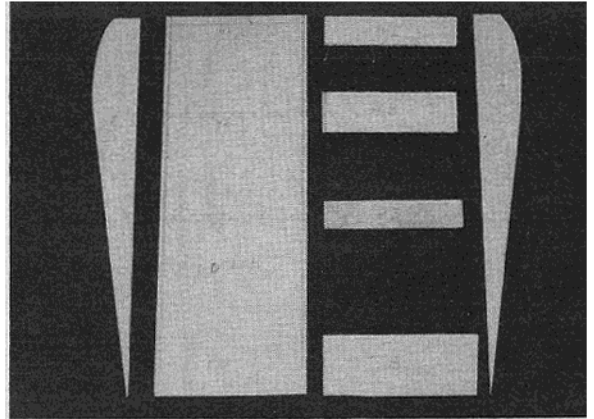
Aileron control installation completed.



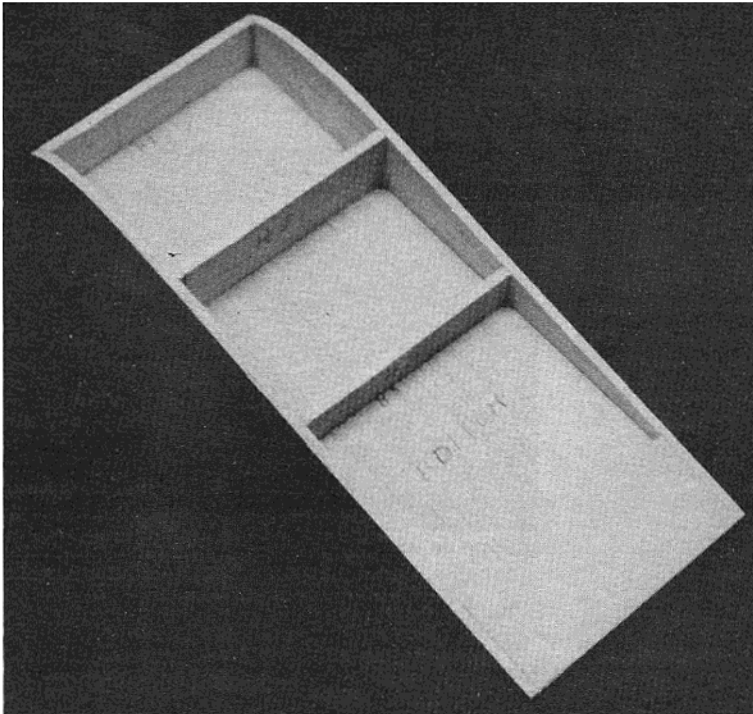
Maple blocks are drilled and tapped for wing mounting bolts.



*Glass cloth has been applied to top and bottom of wing center section.*



*Parts required to start assembly of hatch.*



*Hatch assembly prior to installing dowels and top sheeting.*

64. Install 1/16" wire push-pull rods in both wing panels. Attach to servo with DuBro #183 dual take-off ball link. Adjust rods to provide aileron travel of 1/4" up and down.

65. Cut and fit the aileron servo hatch. Hold in place with four #2 wood screws. (See step 20.)

66. Place wing in position on fuselage & drill and tap wing and mount-

ing blocks for 1/4-20 nylon bolts — top and bottom.

67. Fiberglass the top and bottom at least 1 1/2" both sides of the wing center section joint using 2 oz. fiberglass cloth.

68. Remove ailerons from wing panels; cover ailerons and edges of wing aileron cavities with covering material and reinstall ailerons, gluing and pinning hinges in wing.

69. Cover wing with MonoKote or material of your choice. Be sure to seal the gap between aileron and wing with a strip of covering material on top surface only.

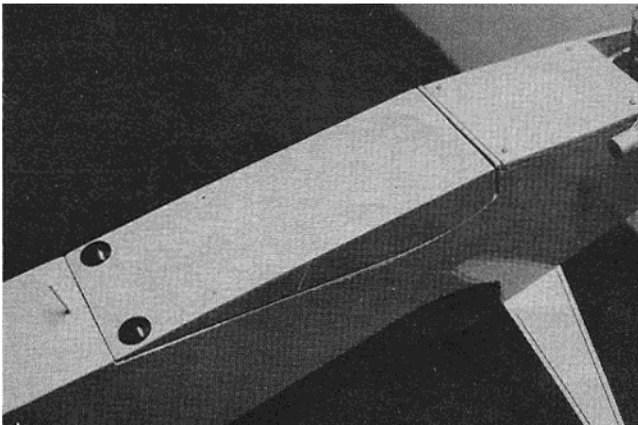
70. Cut out H1, H2, H3, T.E., bottom sheet, and sides.

71. Mark position of H1, 2, 3, and T.E. on bottom sheet.

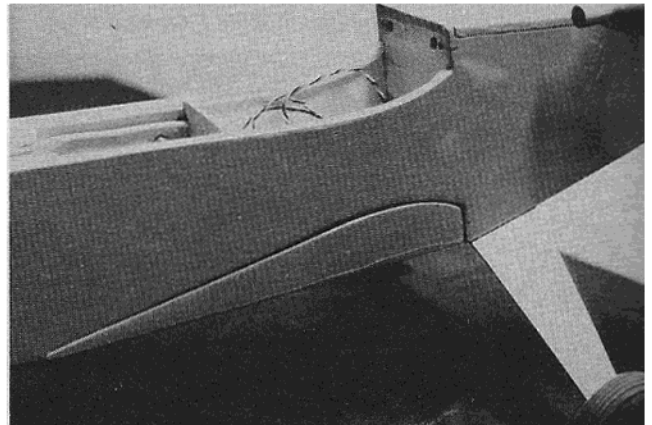
72. Glue all parts to bottom sheet.

73. Sheet the top of the hatch except for approximately 1" at the front end to permit gluing in the two dowels.

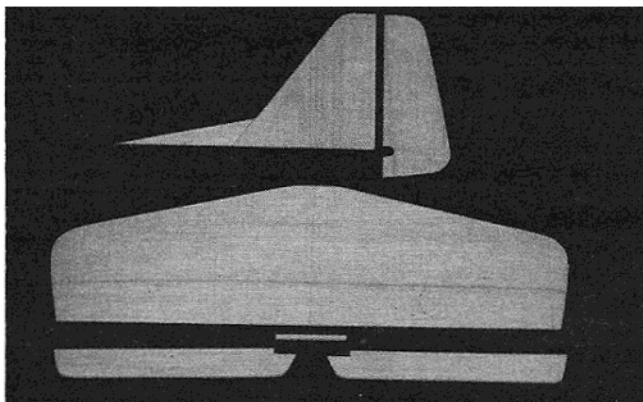
74. Position the hatch on fuselage & carefully mark the dowel holes for both upper and lower fuselage positions. (Because of the difficulty in getting a precise matching of holes for wing fit and hatch fit, I find that a separate pair of 1/8" dowel holes for the hatch to be a simpler method.)



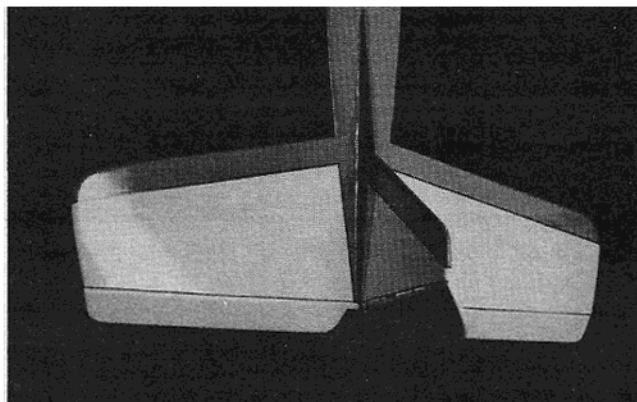
*Hatch in position on top of fuselage.*



*Hatch in position on bottom of fuselage.*



Parts required for tail surfaces.



Fillet formed at junction of surfaces adds strength.

75. Install the hatch dowels and finish sheeting the remainder of the hatch top.

76. Place the hatch in position either top or bottom and, from the opposite side, go straight through the wing mounting block holes with a pointed rod and mark the hole positions on the hatch. Drill out to accept a 1/4-20 wing bolt.

77. Cover the hatch with appropriate covering material.

Hatch shown in top position.

Hatch shown in bottom position.

#### Empennage:

78. Cut out all parts of the tail section from 1/4" balsa sheet. Round the edges of all surfaces as shown on the plans.

79. Lay elevators on a flat surface and glue the 1/4" dowel to each elevator. Use a straightedge along the hinge side of elevators to ensure straight alignment.

80. Measure and cut the slots for hinges on all tail surfaces. Glue and pin hinges in place on rudder and elevator using round maple toothpicks.

81. Cover the hinge edges of the sta-

bilizer and vertical fin with covering of your choice.

82. Cover the rudder and elevator.

83. Attach elevator to stabilizer, and rudder to vertical fin. Glue and pin hinges.

84. Cover remainder of tail section leaving bare wood where needed for gluing.

85. Epoxy stabilizer to fuselage. Be sure to check alignment between stabilizer and wing.

86. Epoxy vertical fin to fuselage and stabilizer. Align with a right triangle. (Be sure to glue lower hinge to fuselage rear.)

87. Lay in a small fillet between stabilizer and rudder, and fuselage and dorsal fin. When dry, sand and cover with scrap covering material.

88. Bend & form the tail wheel 1/16" music wire. Insert through 1/16" collar and tail wheel bracket before making 90° bend to engage rudder.

89. Cut a groove in bottom of rudder to receive tail wheel wire.

90. Mount tail wheel assembly to fuselage and epoxy the wire to the rudder. (A baking soda filler topped with

CA glue makes a firm, strong bond.)

#### Final Wrap-Up:

91. Install landing gear using #6 round head wood screws.

92. Drill holes in F1 for fuel lines and in F1, F2, and F3 for throttle cable.

93. Install radio equipment and push-pull rods as shown on plans.

94. Install gas tank.

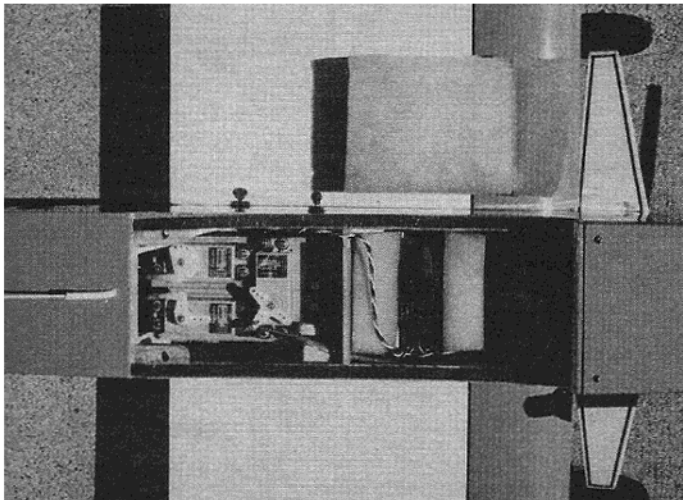
95. Install engine using 4-40 socket head bolts with blind nuts. Different engines may be accommodated by securing to an auxiliary mounting plate, cut from 1/8" ply, which is then bolted to the main mounts.

96. The stub wing, if desired, is constructed in the same manner as the main wing, but as one continuous section, five ribs each side of centerline; no dihedral, and elimination of ailerons, W6, W11, W12, and shear webbing. Wing tips are as shown on plans.

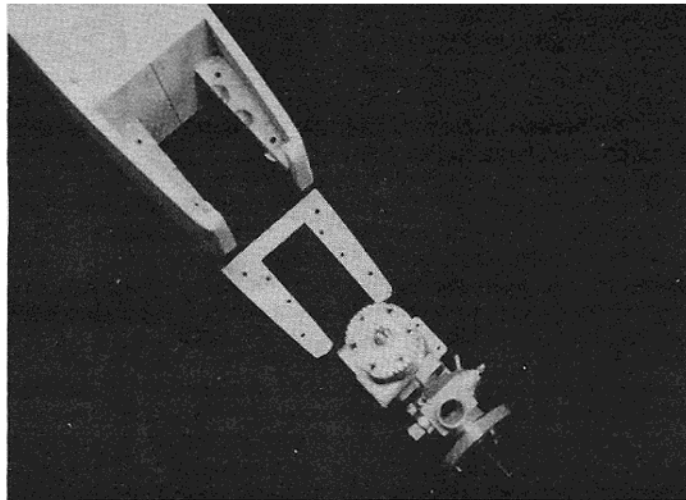
#### Flying:

For the first flight, you can't go wrong using the control throws as used on the prototype; ailerons — 1/4" up and down; rudder — 1/2" right and left; elevator — 5/16" up and down.

View showing radio installation. Foam block goes between receiver and hatch.



K & B .40 engine with auxiliary mounting plate.



These may be increased or decreased to suit your particular desires and flying ability.

Take-offs in all four configurations are smooth and comfortable once you get used to the usual "tail dragger" tendencies. However, in the "high bipe" (main wing on top, stub on bottom) or "low bipe" (main on bottom, stub on top) configuration, be prepared for a large increase in elevator sensitivity. For comparison, in the monoplane configuration, loops are fairly loose and gentle (not too tight) with full up elevator; spins, with throttle off, are not spins, but rather lazy, vertical barrel rolls. (Spins are okay with part throttle.) In the high or low "bipe" configuration, however, the same amount of elevator makes a loop about 1/3 the diameter of the foregoing, and a spin winds up like a corkscrew. I'm not about to get involved in what might develop into a controversial "hassle" as to the theory behind this increase in sensitivity except to say that if you take a close look at the side view of the fuselage plans, you will notice that in the "bipe" configuration you have a perfect venturi formed by the main and stub wings. Now, the rest of you RC'ers take it from there. (Stand by, Ken Willard.) With the zero zero zero degree (thrust, incidence, stabilizer) settings, inverted flight requires only the smallest amount of down trim.

Slow flight characteristics and landing attitude are great. The generous wash out (if used) permits throttle off, full up elevator flight with no tendency to fall off to one side, but rather a center stall, mushing type of flight. This makes for nice nose high, 3-point landings.

The low wing configuration permits very high speed turns on the ground with little danger of the A/C flipping over, making it an ideal model for the taxi, obstacle course events at a fun-fly. My "ace" test-pilot, Phil Koury, wore the tread off the left wheel making continuous high speed, 360 degree, full right rudder turns on the ground with full throttle. At no time did a wing tip touch the ground. (Wing tip skids are recommended, however.)

As the old commercial used to say, "Try it, you'll like it."

Happy landings!

**From  
RCModeler  
Sep. 1984**