Building and Flying the

DUELIST 2/40

☐ COWL
☑ CANOPY
☐ DECAL

Inspected by 15

PICA

INTRODUCTION

The Duellist has been designed as an easy-to-fly and safe-handling twin engined RC model. Combining elegant appearance with simple structure, it is ideal for the modeler who has progressed thru the usual trainers and pattern or sport-type low wing ships. As such, it presents a further level of enjoyment in the RC hobby, and a new accomplishment in flying skills to the builder.

This may be your first twin-engined RC airplane. If so, read and absorb the flying hints carefully . . . each has been learned in the school of experience.

BEFORE YOU START — READ THIS!

Most problems which arise in building kit models are the result of inadequate instructions and/or lack of attention to the instructions. We have provided this booklet in order to have more space for written instructions and diagrams. It's a good idea to read the booklet through, referring to the plans, before actually cutting or gluing anything.

Follow the building sequence given. If you don't, you may run into problems or holdups, which will add to the building time. For example, it is necessary to have most of the wing completed before certain parts of the fuselage can be built. The sequence given has been engineered to allow you to continue work on other parts while glue sets on the previous item.

The following number key index will help you determine completion sequence with various stages of construction:

WORD KEY:

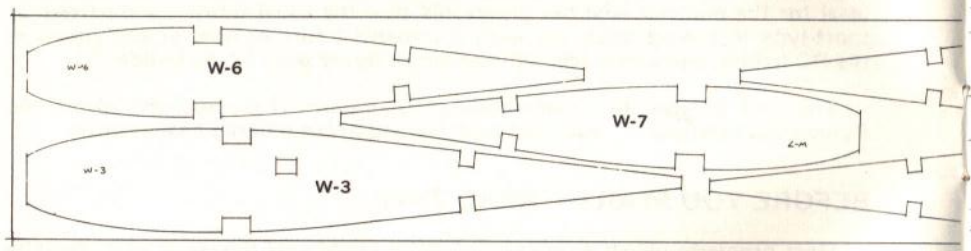
(RLG)	Retract Landing Gear
(F)	Fixed Gear
(FB)	Fillet Base
(LE)	Leading Edge
(TE)	Trailing Edge

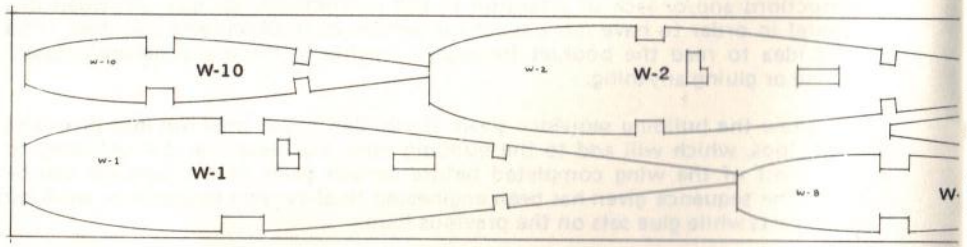
NUMBER KEY:

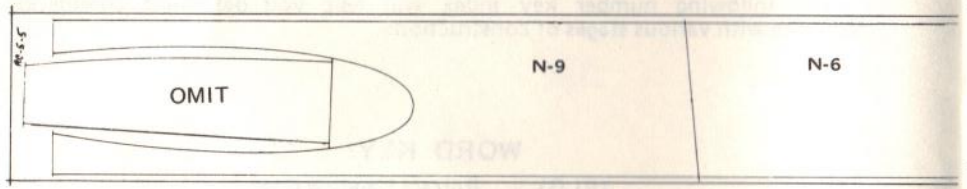
Fuselage:	6B, 25, 26, 27, 28, 36, 38, 39, 40, 41, 42, 43, 44, 46, 48, 52.
Wing:	2, 3, 5A, 5B, 7, 8, 9, 10, 12, 13, 14, 16, 17, 18, 19, 22A, 22B, 23, 24, 29, 30, 31, 32, 34, 35, 37, 47.
Nacelle:	20, 21, 33, 34, 35, 37, 45, 48, 50.
Stab:	11, 15, 49A, 51.
Rudder:	49B.

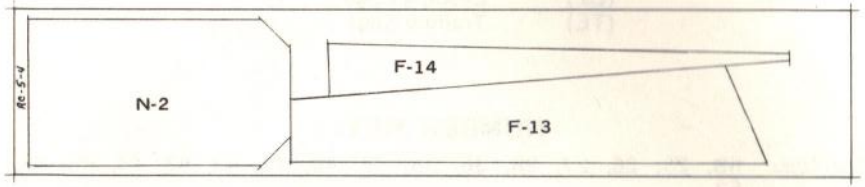
Check each stage as it is completed.

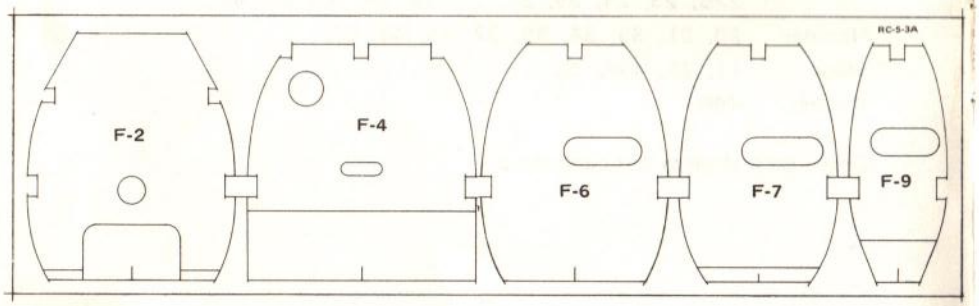
1. Using the diagrams on the facing page, mark out all part-numbers on the diecut balsa and plywood sheets.

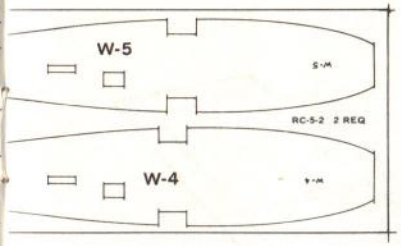


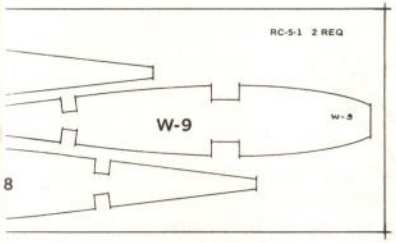


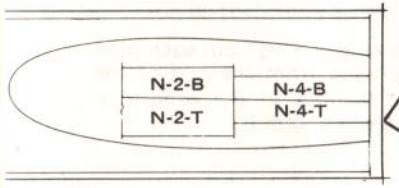


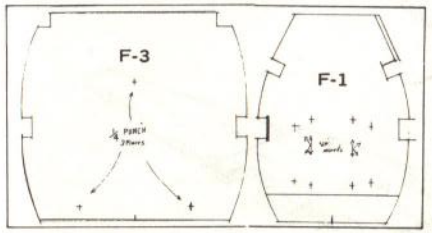


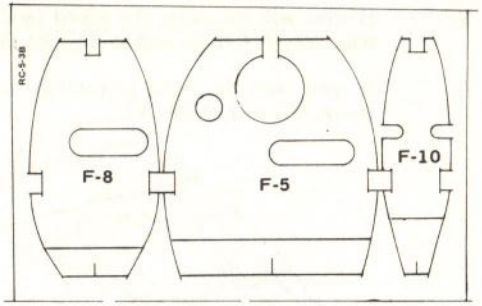


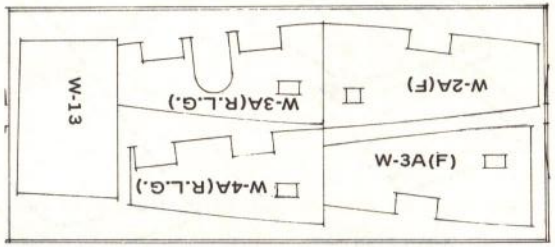


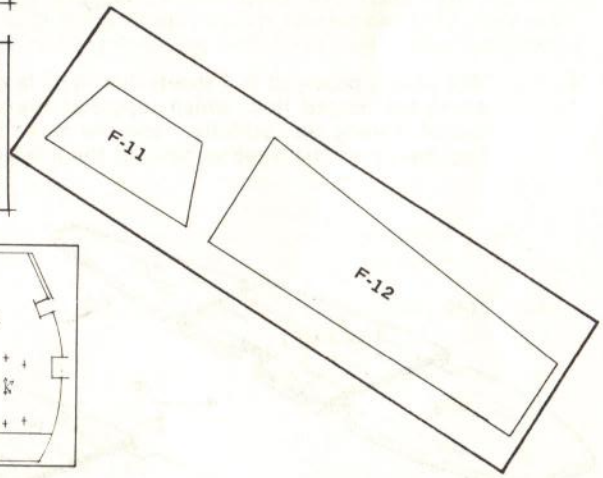


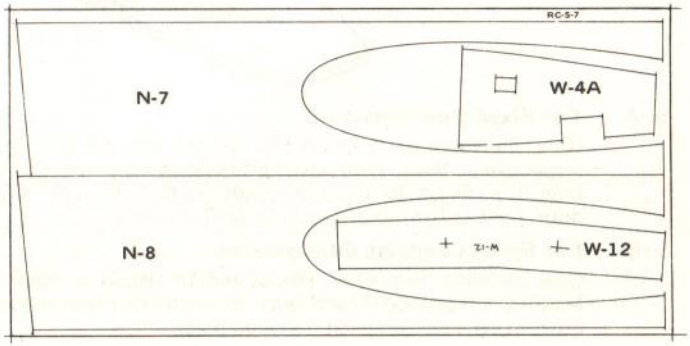






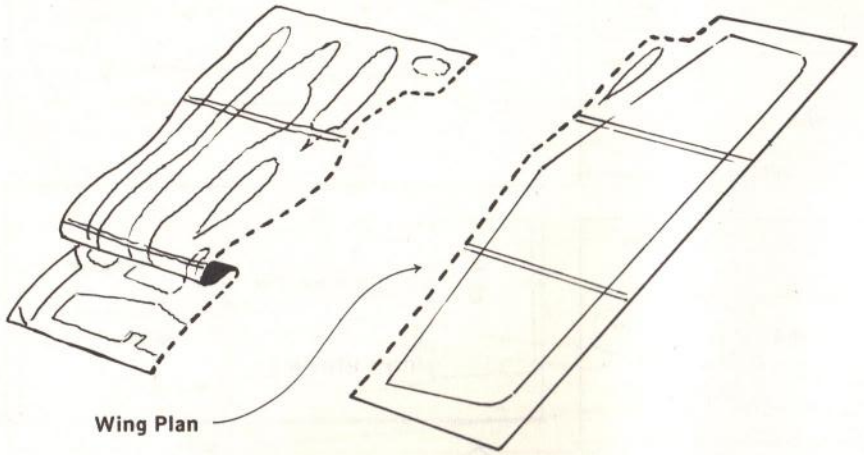






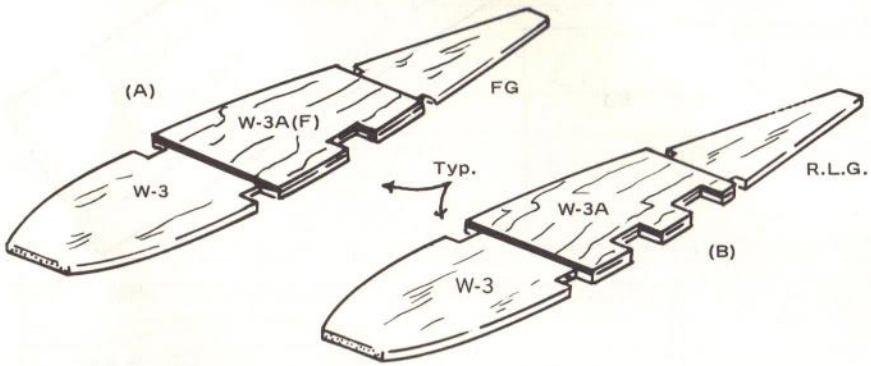
2. If you will be using the fixed landing-gear provided in the kit, discard parts W-3A (RLG) and W-4A (RLG).

3. If you will be using retracting landing gear, discard parts W-2A (F), W-3A (F) and W-4A (F).



Wing Plan

4. The plan is provided in 3 sheets due to its large size. First, cut each plan along the dotted line, which separates the wing from the rest of the model. Lining up carefully, tape the three sections of the wing plan together, then the three sections of the fuselage/tail group.

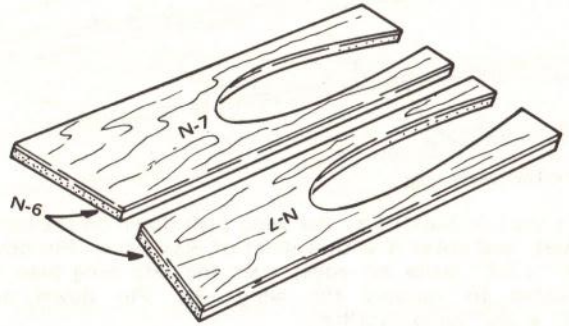


5—A **For Fixed-Gear Version**

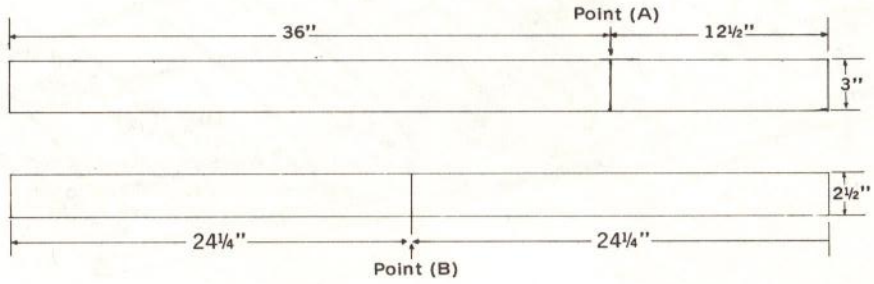
Glue plywood parts W-2A (F), 3A (F) and 4A (F), to ribs 2, 3, and 4 respectively. Make a left-and-right-hand pair of each. Cut landing-gear mount hole in each rib to match plywood parts. F-17, 1/8" x 1½" x 8" nose gear door, used as fixed gear hatch, or retract door.

5—B **For Retract Landing Gear Version**

Glue plywood parts W-3A (RLG) and 4A (RLG) to ribs 3 and 4 respectively. Make a left-and-right-hand pair of each. Cut gear-mount and retract-unit holes in each rib to match plywood parts.

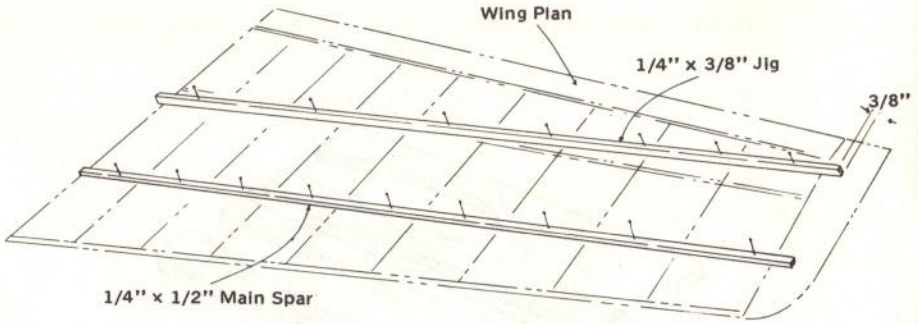


6—A Certain parts are required in double thickness, so two of each are provided and glued together. Join these parts now — they are W-1, N-1, and F-14. Glue N-7 ply doublers to N-6 nacelle sides. Make a LH and RH pair. Repeat process with N-8 ply and N-9 parts. Discard one W-12 piece and drill 1/4" holes thru remaining W-12 and both W-13's at punched locations.



Fuselage Sides

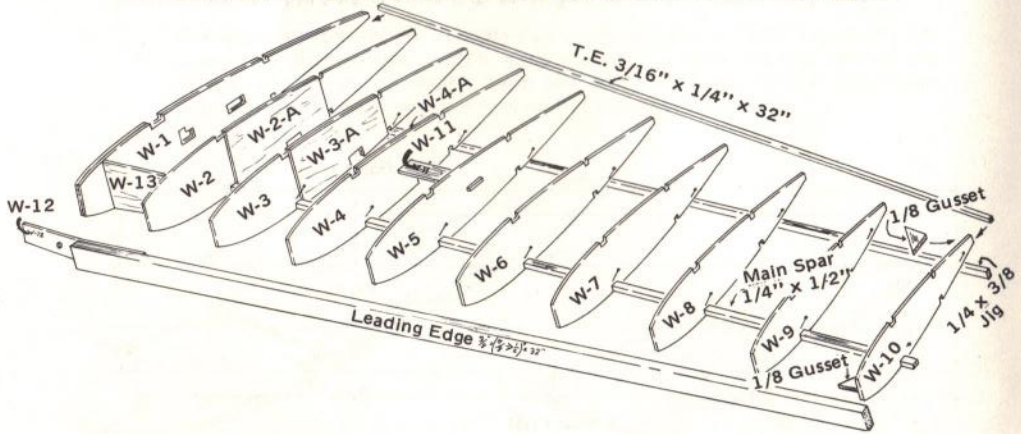
6—B Join 4 pieces of 3/32" sheeting as indicated on Illustration for each fuselage side. Place bottom edge of 2½" x 48½" skin on **Line "C"** and **Line "D"** as a guide for trimming fuselage skin. Line up **point "B"** with side view of plan. Using plan side view, cut out wing seat from **point "B"** to **F-3,** allow approximately 1/8" cut above wing outline. Reinforce joint with a strip of notepaper. Repeat for other side. (Put aside).



7. Let's start to build! Lay the wing plan down on the bench (**flat** bench, please), and cover it with a sheet of wax paper. Pin down the jig-strip (1/4" x 3/8" balsa on edge) over the left wing plan in the position indicated to support the wing ribs. Pin down one main spar (1/4" x 1/2" balsa, laid flat).

8. Pin ribs W-1 thru W-10 to spar and jig (Do Not Glue); glue in ply part W-11 as you go. Glue in ply W-13, leaning the doubled center rib W-1 to meet W-13.

9. Glue ply dihedral brace part W-12 to one tapered L.E. at wide end. Center carefully. Glue L.E. in place to all ribs. Align ribs at top and bottom exactly. Glue gusset at tip rib. Glue T.E. (3/16" x 1/4") strip to all ribs, and gusset at tip. Now glue rib joints at bottom main spar.



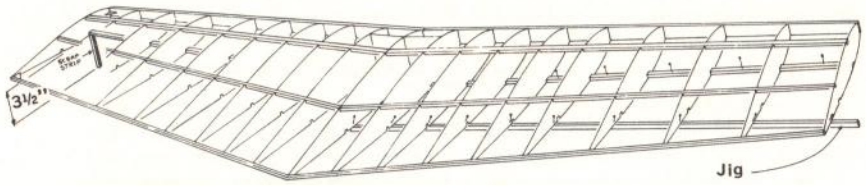
10. Glue top mainspar and top rear spar (1/4" x 1/4") to all ribs. Slide servo rails in place and glue; space the rear rail to suit your servos.

11. While this assembly sets up, find the stab L.E., cut two diagonal pieces out of (5/16" x 2½" x 12"), and glue to main stab piece (5/16" x 3¾" x 27"). Mark exact outline of stab on wood using plan as a guide, and trim to plan-view shape.

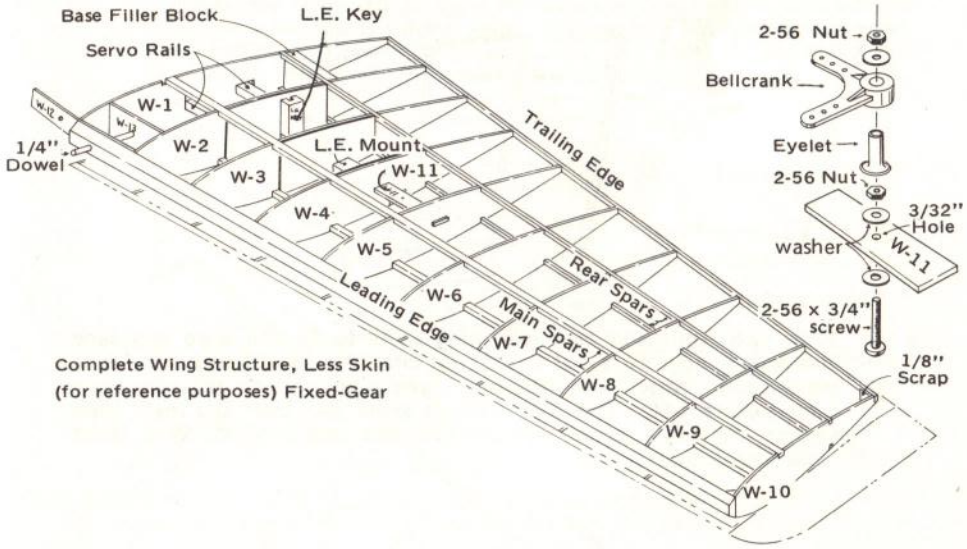
12. Lift structure of left wing from plan. Repeat instruction #7 exactly for the right wing.

13. Place the built left wing in position on plan, glued to right lower mainspar and with wing jig in position (center W-1 rib, supported by jig). Support left wing tip rib at mainspar with a scrap strip cut to 3½" high.

14. Repeat instructions 8, 9 & 10 for the right wing panel, except that the L.E. ply brace W-12 is already in position. Make good, close fitting joints. Leave assembly to set thoroughly.



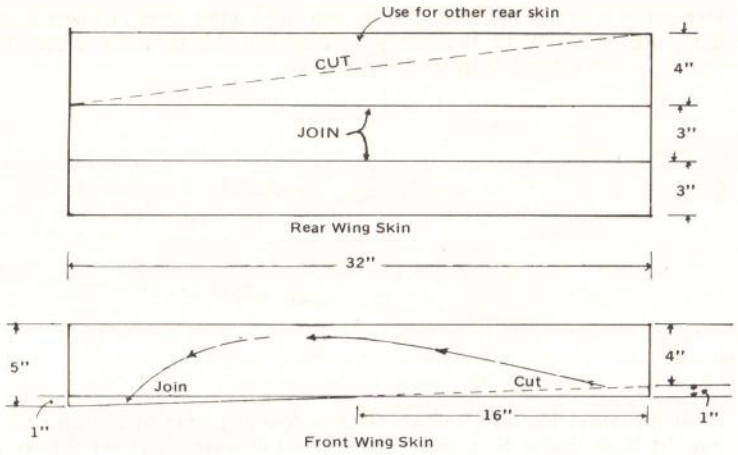
15. Drill elevators for wire joiner. Groove leading edge of elevator so wire can fit flush (refer to plans). Look along elevators and see if they align with each other. If not, remove elevators and twist wire slightly to accomplish perfect alignment. When satisfied, glue wire joiner firmly to both elevators.



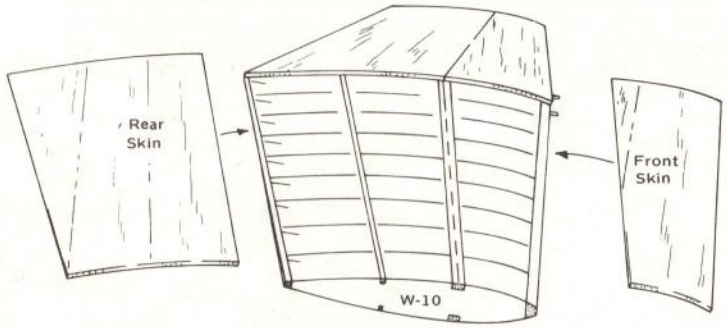
Complete Wing Structure, Less Skin
(for reference purposes) Fixed-Gear

16. Remove wing from plan. Glue bottom rear spars into ribs. Add landing gear mounts (and key blocks if building fixed-gear version). Measure positions and drill 3/32" hole thru W-11 parts for throttle bellcrank pivot screws. Assemble bellcranks as shown.

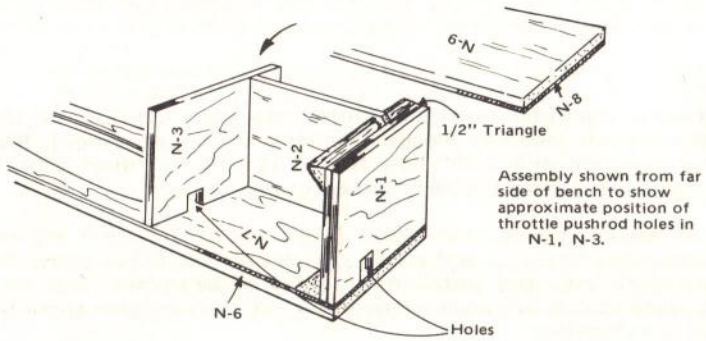
17. Cut basswood wing filler blocks (1-1/8" x 1/2" x 2-7/8") and glue in place. Drill thru L.E. and install 1/4" dowels (use F-3 as guide). Mount servos to rails and install throttle rod to bellcranks. Test for free movement. Cut two small scraps of 1/4" sq. strip and glue across W-1 to tie spars together.



18. Join sheets to make wing skins as illustrated. Leave to set. While waiting, plane and sand the L.E. and T.E. pieces to follow the rib contour, top and bottom, (see wing section on plan).



19. Trim two front and two rear wing skins to fit the wing and sand thoroughly **now** on a flat board; not later after gluing in place. Using balsa-wood cement not (aliphatic type glue), attach skins to wing undersurface only. The fore and aft skins join over the main spar. Center joints are made directly over the center of rib W-1. Make close-fitting joints!



20. Now begin working on the nacelles. **This operation requires close attention to instructions and diagrams!** Find the nacelle side assembly N-6/7 which will lay down with its plywood side facing you, when placed over nacelle side-view on plan. Mark location of bulkheads and N-2 tank shelf. Trim N-2 to Plan, glue N-1, ½" triangle, N-2 and N-3 in place respectively. (Note position of notches in N-1 and N-3). Find the correct N-8/9 side (plywood face in) and glue to previous assembly. Mark this entire unit "LEFT NACELLE". (Check positioning of nacelle sides with L.E. of wing plan).

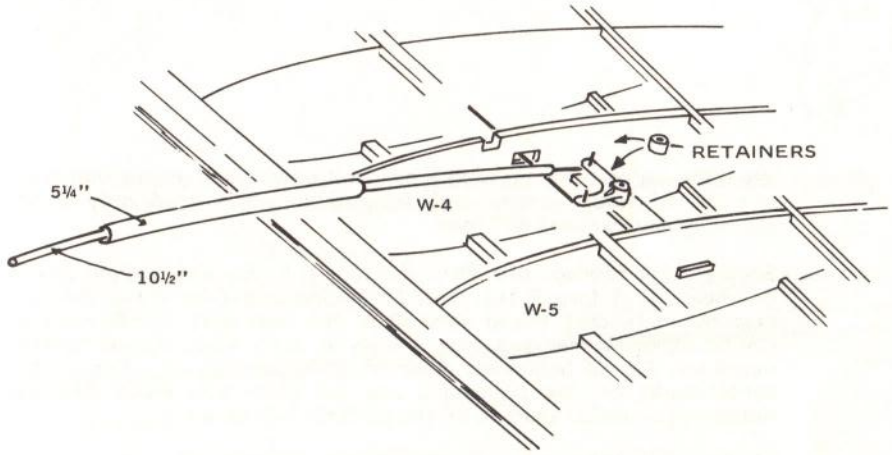
21. The right nacelle is similar, but with one important difference — this time lay down the N-8/9 side first and mark it out. Glue N-1, 2 & 3 to this and add the N-6/7 side to the assembly. Mark this unit "RIGHT NACELLE". (Follow sequence of #20).

22. a) **For Fixed-Gear Version**

Using a 5/32" bit, drill down the landing gear key block and continue thru the gear mount and bottom wing skin, both wings. Cut skin away over the groove in the gear mount, and using the retainers supplied, fasten the landing struts to the wing. When satisfied that the installation is correct, remove the gear and set aside to be re-installed permanently after the model is completed and painted.

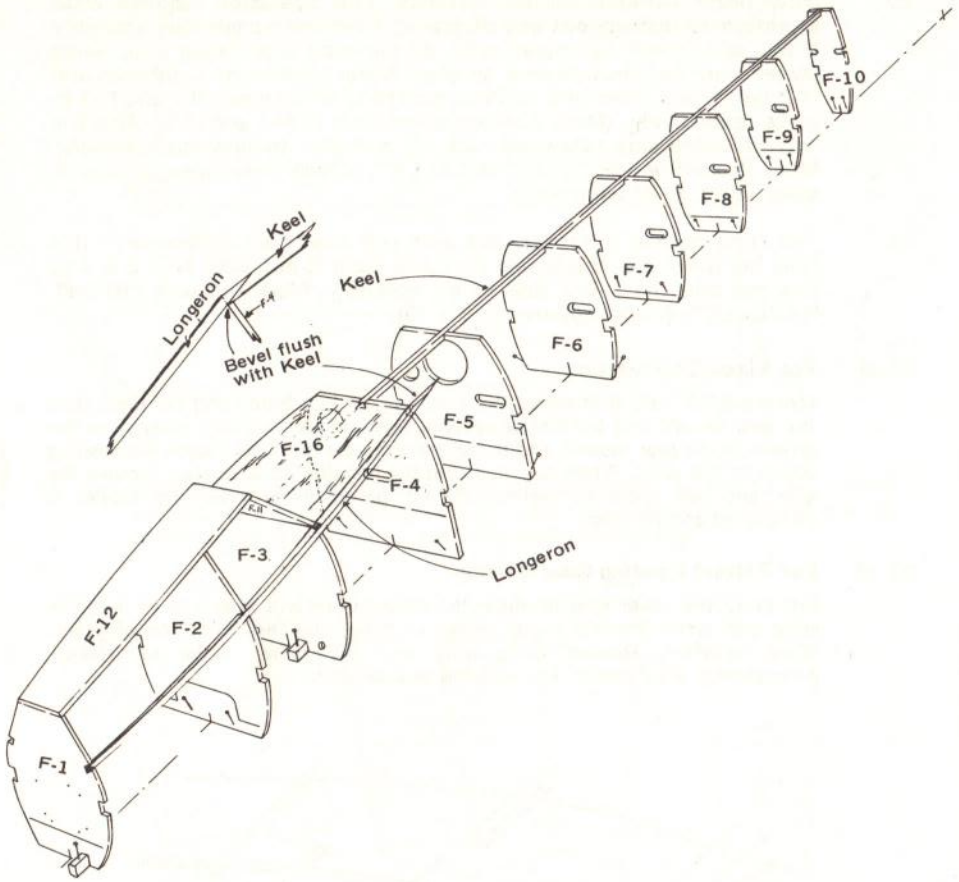
22. b) **For Retract Landing Gear Version**

Cut away the lower skin to allow the retract-units and wheels to fit into the wing and screw them in place. Install air tubes and test operation of gears. When satisfied, remove units only and set aside to be re-installed permanently after model is completed and painted.



23. Referring to plans and diagram, make throttle pushrods and attach to bellcranks. Note that the pushrod lays against rib W-4 (left wing) and rib W-5 (right wing).

24. Lay the forward top wing skin in position and cut slot for throttle pushrod. Glue skin to wing. Lay jig-strip (1/4" x 3/8") in position over left wing plan. Place wing on plan, supported by jig, and hold firm with weights, etc. Now glue the rear skin. Leave weighted down while setting.

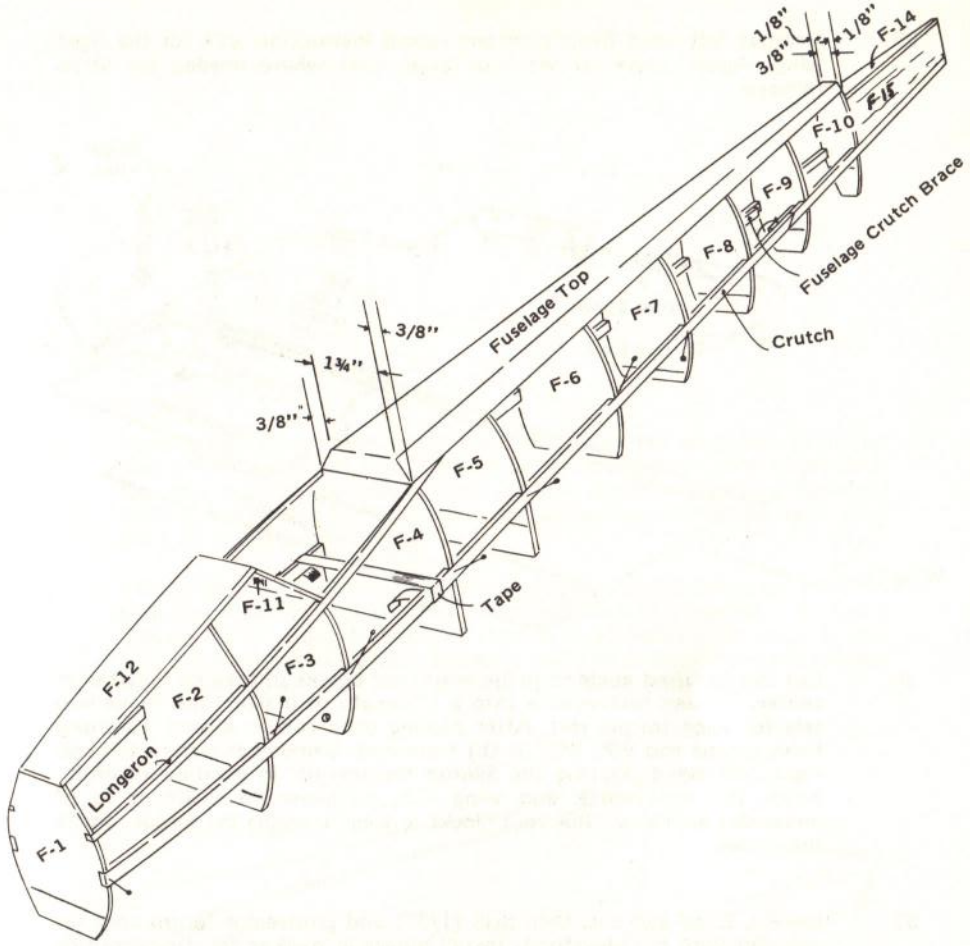


25. We think we've come up with a new and unique system for building a streamlined body simply and accurately: you'll need only a **flat** building board at least 48" long.

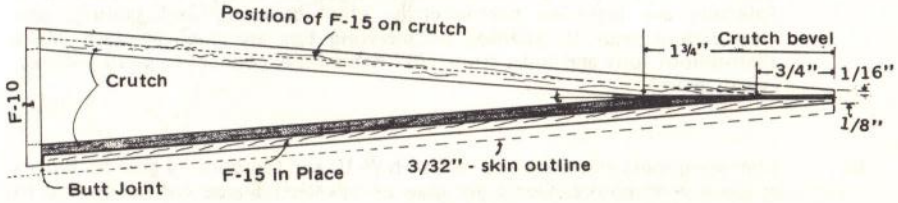
Separate the fuselage plan-view and tape it to the bench. Find all the bulkheads (F-1 thru F-10). Drill 1/8" holes in F-1 for either the nose gear nylon bracket (fixed version) or the nose unit (RLG version). Check fit of former F-3 over dowels on built wing. Adjust holes if necessary. Pin all bulkheads down to the plan. Carefully line up the center-marks on the bulkheads and the plan; also make sure the numbers you earlier marked on the parts all face forward.

We found it difficult to pin thru the ply bulkheads F-1 and F-3, and solved this by gluing a small scrap of balsa flush with the lower edge of the bulkheads temporarily. (see diagram).

26. Find a strip of 1/4" sq. x 27" for the keel piece, and mark location of bulkheads F-4 thru f-10 on it using the side view as a guide. Glue this piece into the bulkheads and line up the marks properly, add 1/4" sq. longeron between F-1, (F-4, F-5) trim to plan. F-16, (4" x 5½" x 1/8"), draw shape betwee longerons, F-11 and fuselage top, as indicated on plan view. Glue pieces F-16, F-12 and then F-11 in place.

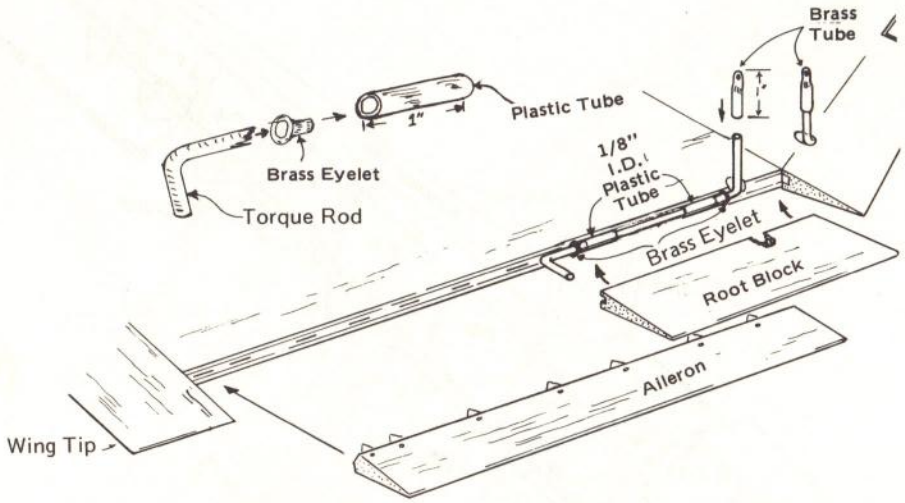


27. Mark out the fuselage top (tapered 1/2" sheet) carve and sand, beveling its sides as shown in diagram. Glue in place.



28. Join four pieces of 3/16" x 3/8" strip to make two 48" long parts for the fuselage crutch. (see side view). Glue a small extra piece to back up and strengthen the joint. Bevel rear end of each piece to fit together (1/8" thick, see plan view) and glue into all bulkheads. Hold pieces into slots with pins and tape in several places along fuselage, as shown. Glue F-15 to top of crutch; (F-15, 8¼" long, tapered from 1-13/16" to 1-9/16") butt end glue to F-10. Taper both F-15 sides to match crutch to 1/8" (see top view of plan). Now glue F-14 on top of F-15's, be sure to have a FLAT platform for stabilizer. Give all this a chance to set up, and return to the wing.

29. Remove left wing from plan and repeat instruction #24 for the right wing. Again, leave to set. Cut away skin where needed for servo removal.

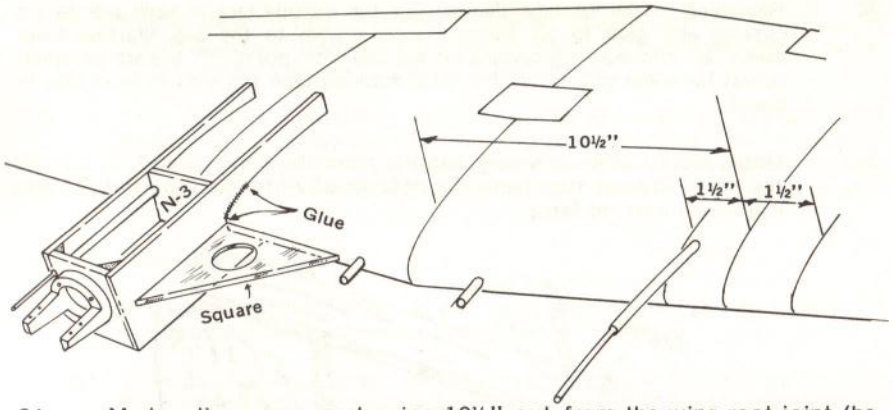


30. Cut the required angle into the wing root blocks so they fit together at center. Insert brass eyelets into a 1" length of plastic tube, make two sets for each torque rod. After placing onto rod as shown, carefully bend torque rod 90°, 1/2" (I.D.) from end. Remember make a left and right side bend. Placing the aileron torque-rods in position carefully notch the root block and wing T.E. to allow them 30° or so of movement each way. Glue root blocks to wing, trapping the torque-rods in the groove.

31. Bevel L.E. of ailerons, then drill (1/8") and groove for torque-rods (as you did with the elevators). Install hinges in marked locations: notice the two close hinges at the aileron tip. Retain hinges with toothpicks. Cut slots in wing T.E. and slip ailerons in place. Retain **temporarily only** with a pin thru a couple of the hinges. **Do not glue** to torque-rods. Ailerons are installed permanently after covering and sealing, and immediately prior to painting before wing tips are glued in place. Make aileron-horn tops and links from 1/8" Brass tube, connect to servo and test. (see diagram).

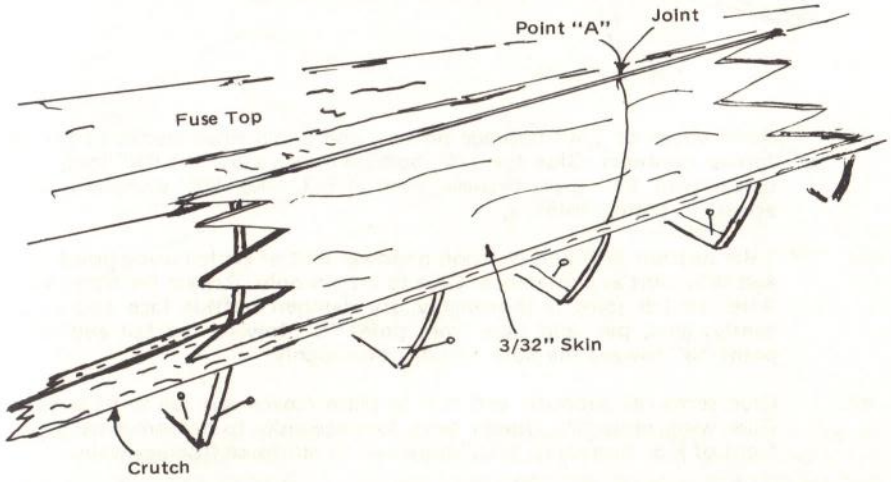
32. Trim wing spars and skins level with rib W-10 and temporarily glue tip blocks in place with epoxy. Don't get glue on ailerons! Shape entire wing tip to correct airfoil and sand smooth.

33. Returning to the nacelles, mark the positions of the motor mounts onto N-1's and screw both in place. Fit a prop to each motor and screw motors to mounts; (Be sure thrust lines are exact) attempt to maintain a distance of 3½" to 3¾" from the front of N-1 to the rear face of the prop. With small engines you may only get a 3" or 3¼" distance. This is O.K. so long as both are the same. Use plan as a reference to locate Throttle pushrod holes on N-1, N-3, and drill holes.



34. Mark a line across each wing 10½" out from the wing root joint (be sure center reference line is perfectly square with leading edge) both top and bottom surfaces. These are the center-lines of the nacelles. Mark a shorter line 1½" out from each center line, extending back from the L.E. about 2 or 3 inches.

35. Taking the LEFT nacelle first, place on wing, insert the nylon pushrod thru the holes in N-3 and N-1. Glue bulkhead N-3 against L.E.; use a triangle to ensure that front of nacelle sides make a 90° angle to the L.E. Glue sides to wing skin, **but only to 1"** or so back from the leading edge. Leave to set and repeat process for RIGHT nacelle.

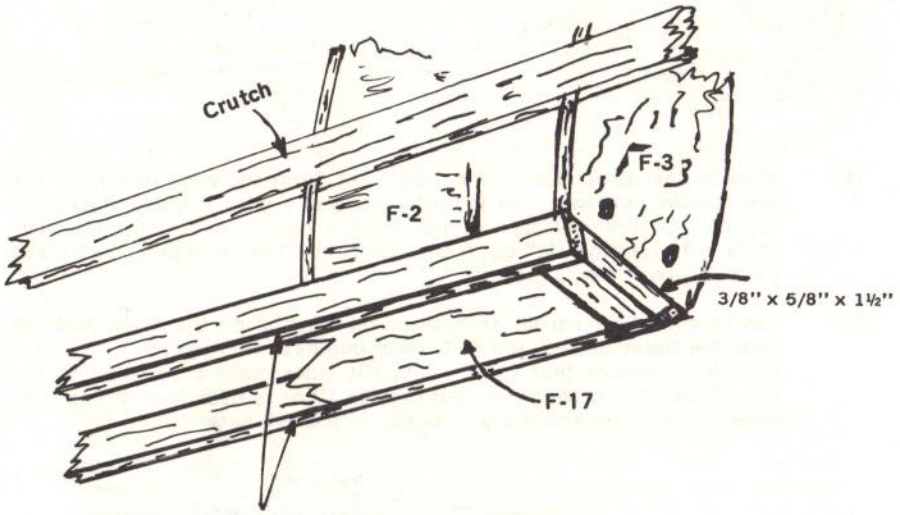


36. Cut a hole in each side (3" x 48½") through F-15 and fuselage skin for pushrod exit. Spread glue along the upper half of crutch **only.** Place side over the pushrod ends; carefully line up upper fuselage skin, **point "A"** at joint, pin firmly to crutch. Align the bottom edges properly with existing construction, leaving any excess height along the top edge. Leave to dry well.

37. Using the top-view of the nacelles on the plans, mark the positions of formers N-4 (T & B) and N-5 (T & B) onto the wing skin. Pin and glue all formers, carefully centering each one. Bring nacelle sides in and glue to formers and wing skin.

38. Returning to the fuselage, dampen the top outside face of each side to aid curving and glue to all formers from crutch to the top, starting from point "B" and working toward the tail and from point "B" toward the nose; repeat for other side when dry. (Use masking tape and pins to hold skin in place).

39. Unpin the fuselage assembly and lift from the bench. Carefully cut off the partly die-cut tabs from the bottom of all formers (except F-3 and F-6 which have no tabs).



40. Bevel edges of 1/4" fuselage bottom and under nose blocks to follow former contours. Glue the 1/4" bottom in place and the 8¾" long nose blocks with 1¾" space between them at F-3. Glue 1/2" triangle support across F-3 bottom front.

41. Take bottom skin and position on lower half of crutch using **point "B"** and skin joint as a reference. Glue to crutch only. Repeat for other side. After crutch joint is thoroughly dry dampen outside face and curve gently; glue, pin, and tape from **point "B"** toward the tail and from **point "B"** toward the nose. Let dry thoroughly.

42. Glue servo rail supports and rails in place (space rear rail to fit servos). Glue wing mounting blocks onto fuselage side, to bottom crutch and front of F-5. (use scrap 1/16" plywood to reinforce fuselage wall).

43. Slip tubes on each end of air tank (RLG VERSION ONLY) and glue in tank with silicone adhesive. Install "Monitaire" and 4-way valve. The Monitaire can be fitted to F-16 so it can be viewed thru the canopy.

44. Bolt nosegear unit (RLG) or nylon bracket and nose strut (fixed) to F-1. (FIXED) F-17, (1¾" by 8¼" by 1/8") tapered to fit cavity. Install servos, make all pushrods and test nosewheel steering. Test retraction if building RLG version.

45. Glue blocks D, C, B, & A to nacelles. Mount props and spinners to engines. Glue cowl bottom and sides to nacelles, shortening if necessary

to give about 1/16" clearance for spinner. Draw a ring on cowl fronts to match spinners. Remove motors and **lightly** tack-glue hatches in place. Glue cowl tops between sides (not to hatches).

46. Trim fuselage side panels along top edge of longerons and glue F-13 parts in place. Shape and sand rounded contours along entire bottom of fuselage. By now F-13 parts will be set and you can shape the fuselage top to contour. Shape noseblock and canopy fairing block and glue in place.

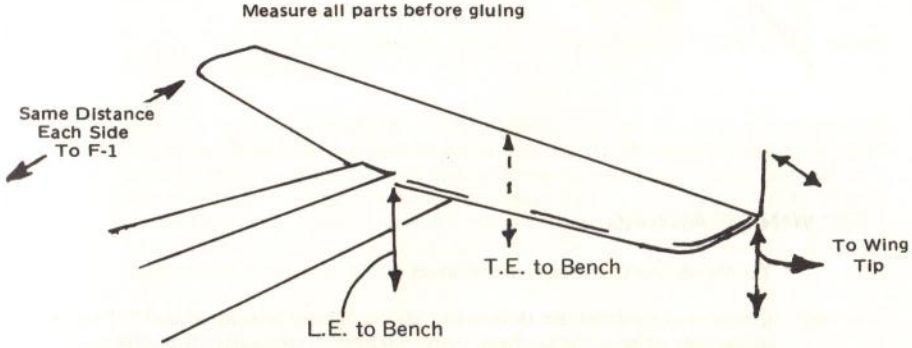
47. Mount wing as follows:

a) Engage dowels into holes in F-3 and sand or trim fuselage sides to fit wing airfoil closely. Pin wing in position.

b) Turn upside down, mark and drill holes thru wing and right on thru the hardwood blocks in the fuselage. Use a #26 or a 9/64" drill. Remove wing.

c) Tap out holes in fuselage blocks with 8-32 thread-cutting screw supplied. Drill out holes thru wing to #18 or 11/64". Screw wing in place with 8-32 nylon screws.

48. Cut eight pieces of 1/2" triangle about 2" long and glue inside all corners of nacelle cowling, level at front.

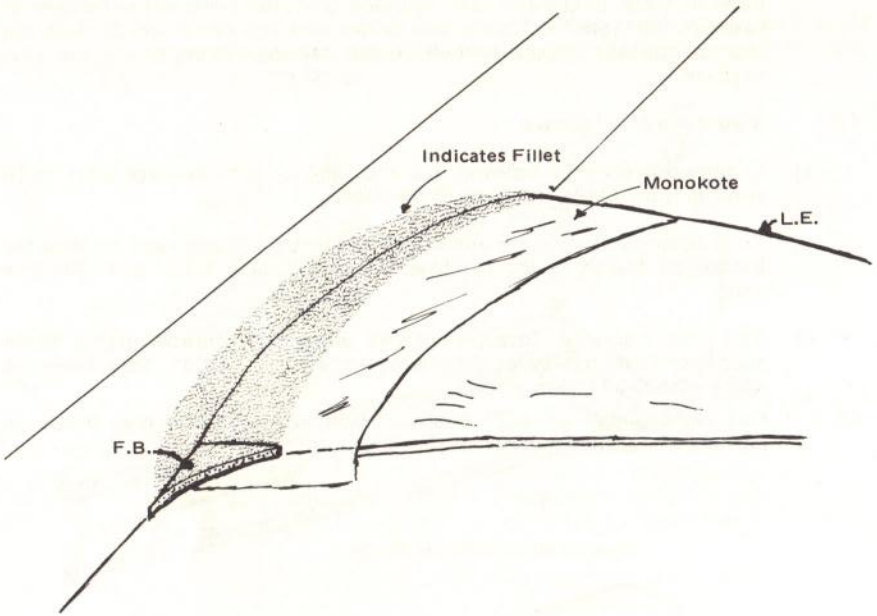


49A. While wing is still mounted on fuselage, sand elevators and hinge to stab, sand stab L.E. to rounded cross-section and place whole tail assembly onto F-14, sighting from front and top to ensure it looks true and level, (see stab illustration) measure, pin and glue.

49B. Glue parts R-1, R-2 and R-5's together. Glue parts R-3 and R-4 together. Glue to fuselage (see plan view).

50. Using a long-bladed knife, carve the nacelle blocks to section shown on plan. Remove hatches and mount motors again, trimming away cowl top piece to allow clearance around motor and throttle. Also, trim away hatch where necessary to clear motor and finalize hatch mounting with dowel peg at rear; and screw fastening through ¼ dowel at front. Complete throttle couplings and test.

51. Glue elevator filler in place, then sand fin to fit and mount to fuselage. Sand rudder, and hinge to fin.



52. WING FAIRING

To make fillets proceed as follows:

a) Cover wing center section with Super Monokote to about 5" each side of center joint, top surface only. DO NOT use substitute film; the heat generated in this process will wrinkle other brands, spoiling the job.

b) Screw wing to fuselage.

c) Glue fillet base F.B. (1/8" scrap) to fuselage. (Sample bottle of Fillit supplied).

d) Mix a **thick** Micro-balloons filler and apply liberally to the wing/fuselage junction as shown. Allow 2 hours to completely harden, then remove wing screws and knock wing free from fuselage. Remove Monokote from wing and shape fillet with coarse sand paper.

e) When wing is screwed to fuselage, fillet will fit precisely. Carve and sand fuselage bottom behind fillet to proper shape. Sand entire fuselage carefully.

(For added looks and **stream lining,** you may fair in the nacelles and wing joints).

COVERING

We highly recommend covering the model with fiberglass cloth and resin covering materials. A very detailed leaflet on this method is available from K & B Mfg.

As a strengthening factor, if you do not cover model with resin and fiberglass cloth, reinforce center section of wing with a 6" wide strip of 4 oz. fiberglass cloth.

FLYING:

THE FOLLOWING STEPS HAVE BEEN DEVELOPED FROM THREE PROTOTYPE MODELS OF THE DUELLIST 2/40.

1. Set up the Duellist control surfaces as you would a pattern Sunday flyer.

2. Regardless of anything else, both engines must be thoroughly dependable before your initial trim out flight. They do not have to be in perfect sync at all throttle settings. Set them up so that you have at least two sync settings, one at approximately 1/3 throttle, and the other at approximately 2/3 throttle. You can accomplish this with mechanical adjustments of the linkage.

   If you find you have excessive aileron tip vibration or flutter check engine thrust lines and alignment.

3. Ground and air **handling** characteristics of the Duellist are excellent. For your first flight, have someone hold onto the model, rev up engines to 1/2 or 2/3 speed. When engines are in sync start your takeoff roll, when model breaks ground correct for a low wing with aileron correction only. With one engine out (either engine) if you're not flying at half throttle, cut back to half throttle or advance to half throttle, again correct with ailerons only.

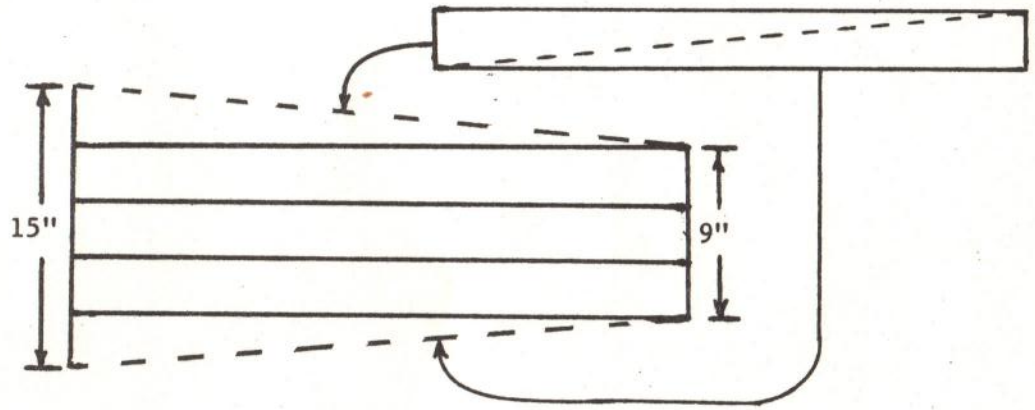
4. The Duellist is a very gentle twin with no bad habits assuming that your building technique and engine alignment have been correct. You will find it a thoroughly enjoyable model.

Enjoy Flying

Morten Tanger

RC-5 UPDATE

1. The 4" wing skins are being replaced by 3" skins. Use the diagram below in place of drawing on Page 10, Step #18. Cut two 3" x 36" as shown below, and glue to front and rear of 9" center skin.



2. Nose blocks are now two 2" x 3-1/4" x 5-1/2" pre-shaped balsa blocks. Glue together before Step #46.

PICA