

# JUNKERS JU-87 STUKA



Universally known as perhaps the most effective dive bomber ever flown, the Stuka (a contraction of the word “Sturzkampfflugzeug” or diving battle aircraft) was born of a generation of aircraft rendered obsolete before the advent of WWII. Design work began in 1933, and the prototype first flew in 1935. Tested in combat first in the Spanish Civil War, the Stuka proved its worth. The -B model grew out of shortcomings defined in this conflict, and cemented the profile of the Stuka that would terrorize a continent only a few years later. The Stuka flew in all theaters in WWII, enjoying great success in the early battles in Poland Scandinavia, and Russia. Only the Battle of Britain would humble the mighty Stuka, showing that it couldn't succeed against determined fighter opposition.

The Stuka has a wingspan of 45 feet 3 inches, a length of 36 feet 3 inches, a maximum weight of almost 9,500 pounds, and could carry a variety of bombs to a maximum of 2,200 pounds. The Stuka is powered by a water-cooled, 12 cylinder inverted-vee Junkers Jumo 211 engine producing

1,200 horsepower. Crew consisted of the pilot and a gunner firing a 7.92 mm MG 15 machine gun. Forward firepower included two 7.92 mm MG 17 machine guns mounted in the wings. Later models were outfitted as tank destroyers, firing 40 mm cannons mounted in pods under the wings.



## **Skyshark R/C Corporation**

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Thank you for purchasing the JU-87 Stuka from Skyshark R/C Corporation. For the first time, R/C enthusiasts have a choice in scale aircraft designs. Our goal, through computer technology and state-of-the-art production techniques, is to offer aircraft which in the past have not been modeled simply because they weren't popular enough to justify mass production. Our production techniques allow us to produce aircraft which, though not as popular and well known as P-51s and P-47s, still offer historical significance (good or bad!), Good looks and flying characteristics, and a uniqueness that is sure to turn heads wherever you take your airplane!

***Your airplane has many unique features in its design:***

### **CAD Design**

CAD design allows strength to be built into the airplane without sacrificing weight. Accurate parts design and placement ensures a perfect fit.

### **CAD Drawn Plans**

The plans in this kit are not copied from a master set! They are originals drawn directly from the CAD program where the airplane was designed. We do this because it allows us to use color, which helps you better visualize the various components of the airplane, and we can use better quality paper, which greatly reduces the possibility of shrinkage. Since you're going to build directly on the plans, they ought to be the proper size! Also, parts placement is guaranteed to be accurate, so you can build a better, straighter model.

### **Laser Cut Parts**

The same program that generates the design and plans also drives the laser, so every part is reproduced exactly as it was designed. Laser cutting also allows us to fit more parts on each sheet of wood, reducing the waste, and low-

ering the cost to you. Since laser cutting does not have the same limitations that mechanical cutters do, small and hard-to-produce parts are simply a computer file away, so you get a more accurate airplane.

### **Plastic and Fiberglass**

The cowl is accurately reproduced in high quality fiberglass. The canopy is accurately reproduced in clear plastic, and the wheel pants are reproduced in heavy duty styrene plastic.

### ***A Word About the Building Options***

### **Engine Options**

Many parts of the country (and the world) sit at higher elevations. At 7200 feet, a .40 size airplane will barely fly with a .40 engine. The engine size range of .45 to .61 for this kit is designed to compensate for engine performance loss due to elevation. Below 3500 feet in elevation, a good .45 will fly the Stuka with authority. Above 3500 feet, a larger engine will help return the airplane to sea level performance.

### **Retract Options**

Right!

### **Flaps**

The flaps can be made functional. A linkage arrangement is shown on the plans, explained in this manual, and some required parts are provided. The scale offset hinging system makes functional flaps as easy as adding a servo! Some adjustment of the flaps will be required whether the flaps are functional or not; remember, the surfaces are airfoils, and need to be set for optimum flight performance.

## **General Building Information**

The Stuka can be built by a person with average building skills. It is designed for someone who has built a trainer or low wing sport plane. No unusual building techniques are required, although more difficult areas are explained in detail where necessary. Certain steps in the building process must be followed as depicted, or you might find yourself digging back into the structure to redo something. These areas are outlined when necessary.

Occasionally hints will be included at certain building steps. These are not required for completion, rather they are tips intended to ease a particular process.

The laser does not cut through the wood, it burns its way through. As a result of this, occasionally there will be scorching on the surface of the wood. This is normal, and is only a surface discoloration, and does not affect the wood in any other way. Similarly, the laser settings are optimized for wood density averages, so occasionally, due to variations even in individual sheets, some areas might not cut through completely. This is apparent mainly with the plywood. Simply use care in removing the parts from the sheets; most of the time, the parts will literally fall out of the sheets!

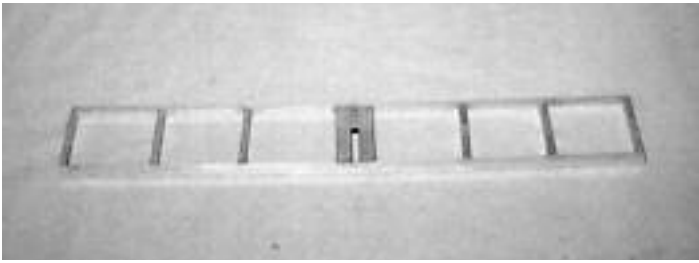
Hardware and a motor mount are not included in the kit. There are so many choices for quality hardware that these choices are left to the individual preferences of the builder, rather than include something in the kit that you'll probably throw away anyway. A vibration-dampening motor mount is recommended for use regardless of engine choice, so select a mount suited to your particular engine. The decals provided are fuel-proof but still should be clear-coated to insure that fuel doesn't soak underneath them.

This aircraft is not a toy. It must be flown in a responsible manner according to the rules set forth by the Academy of Model Aeronautics. The builder assumes the responsibility for the proper assembly and operation of this product. Skyshark R/C Corporation shall have no liability whatsoever, implied or expressed, arising out of the intentional or unintentional neglect, misuse, abuse, or abnormal usage of this product. Skyshark R/C Corporation shall have no liability whatsoever arising from the improper or wrongful assembly of the product nor shall it have any liability due to the improper or wrongful use of the assembled product. Skyshark R/C Corporation shall have no liability for any and all additions, alterations, and modifications of this product.

Having said that mouthful, turn the page and start building the best airplane on the market!

## **Notes:**

## Horizontal Stabilizer Assembly

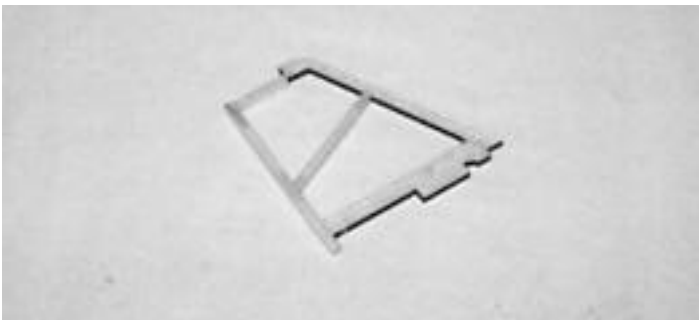


1. Pin S1 to the board. Cut the stab leading edge from  $3/8 \times 1/4$  balsa stock and pin in place. Cut the stab trailing edge from  $1/4 \times 1/4$  balsa stock and pin in place. Glue all the pieces.
2. Cut the stab stringers from  $1/4 \times 1/4$  balsa stock and glue in place.



3. Sheet the top of the horizontal stabilizer using a piece cut from  $1/16 \times 4 \times 36$  balsa sheet.
4. Cut a slot in the sheeting to match the slot in S1. This will align the vertical stab during assembly.
5. Sheet the bottom of the horizontal stab.
6. Sand the leading edge to shape and sand all the edges smooth.

## Vertical Stabilizer Assembly

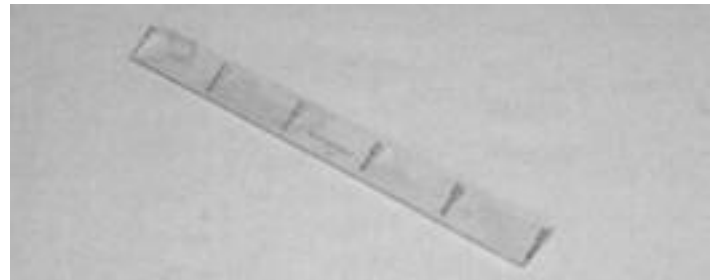


1. Pin S2 and S3 to the board. Cut the stab trailing edge from  $1/4 \times 1/4$  balsa stock and pin in place. Glue all the pieces.
2. Cut the stringer and top support from  $1/4 \times 1/4$  balsa stock, pin in place, and glue.

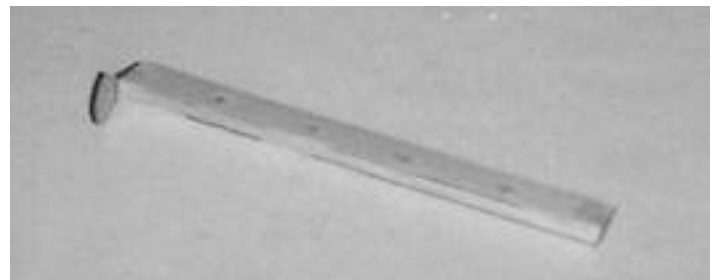


3. Sheet both sides of the vertical stab. So not sheet the tab on S2.
4. Sand the leading edge to shape. Sand all the edges smooth.

## Elevator Assembly

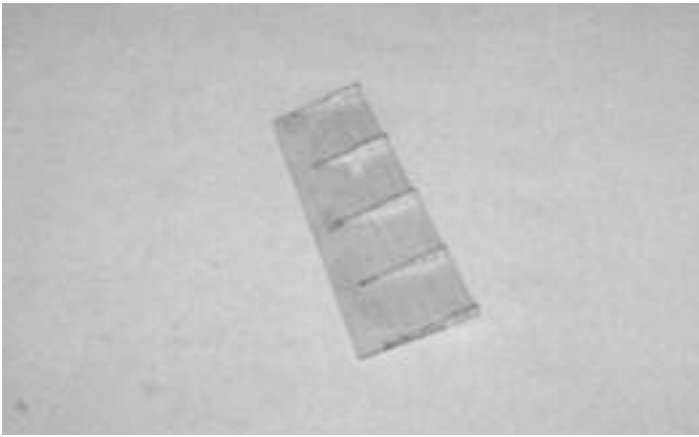


1. Glue E2 into the slot in E1. Guides for the rib are etched into E1 for reference.
2. Repeat for E3, E4, E5, E6 and E7. See Figure 5.
3. Bevel the trailing edge of E1 to match the taper of the ribs.
4. Fill the inboard space between ribs E2 and E3 with scrap balsa and sand even with the ribs. This will provide strength for the elevator joiner wire and control horn mount.



5. Note that all E1s are marked for location. Glue the respective E1 to the previous assembly, aligning all the ribs into the slots.
6. Cut the elevator leading edge from  $1/4 \times 1/4$  balsa stock and glue into the channel in the elevator assembly. Make sure the edges of E1 attach firmly to the leading edge. Sand all edge smooth.
7. Glue the elevator horn to the end of the elevator assembly.
8. Repeat for the remaining elevator.

## Rudder Assembly

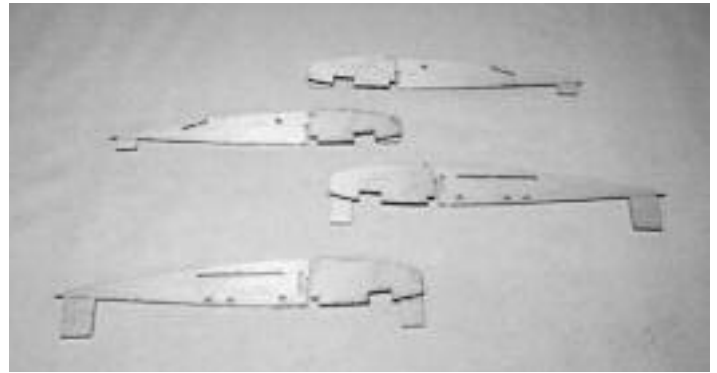


- 1. Glue R2 into the slot in R1. Repeat for R3, R4, R5, and R6.
- 2. Bevel the edge of R1 to match the contour of the ribs.
- 3. Fill the open bay between R2 and R3 with scrap balsa. Sand to match the ribs.
- 4. Glue the remaining R1 to the assembly.

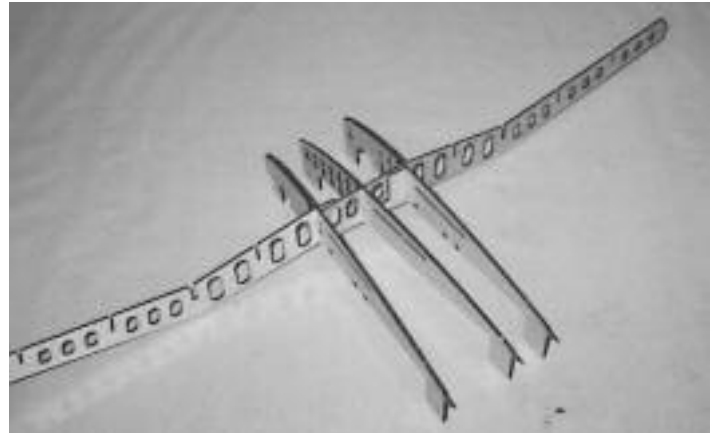


- 5. Glue two R8s together, then glue to the bottom of the rudder assembly.
- 6. Cut the rudder leading edge from 3/8 x 1/4 balsa stock, and glue in place. Note that the leading edge extends to the bottom of R8s and the upper edge of the built-up portion of the rudder assembly.
- 7. Glue two R7s together, and glue to the top of the rudder assembly. The rudder horn may be reinforced by soaking it with thin CA. Sand R7 and R8 to match the taper of the rudder.

## Center Wing Section



- 1. Epoxy W2A to W2. Make a right and left side (be careful here; it's easy to make two left sides!)
- 2. Epoxy W4B to W4. Make a right and left side. Repeat the "be careful" part.

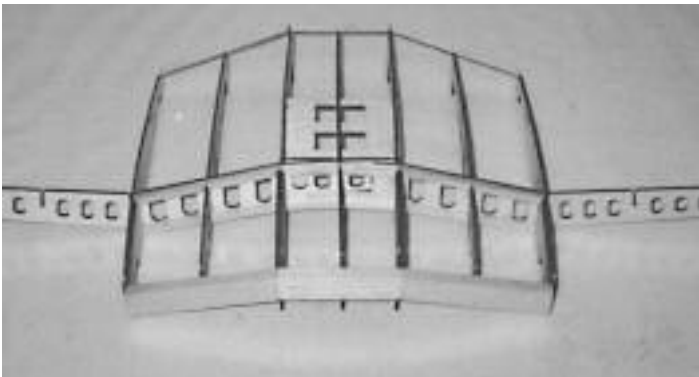


Note: The first part of assembling the center wing section should be accomplished by interlocking the pieces only. Do not glue them until the instructions say.

- 3. Slide W1 into the slot in W14. (There is an extra W1 in the pre-cut sheets; discard this piece.)
- 4. Slide W2 (with W2A facing outward) into its slot in W14. Slide W13 under W14 and insert the tab into the slot in W2.
- 5. Slide the other W2 into the slot in W13 and insert the tab on W14 into W2. Align this assembly to the board and pin in place.



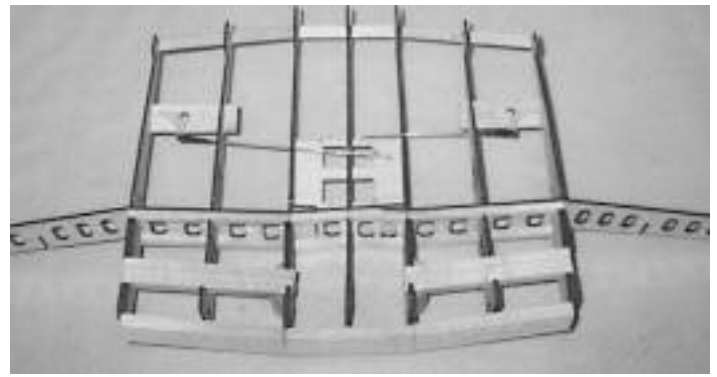
- 6. Slide W22 Ply Servo Tray into the slots in W1 and W2. Slide W3s in place and pin to the board.
- 7. Slide W4s (with W4Bs facing inward) in place and pin to the board.
- 8. Glue all the pieces at this time. Add tri-stock to the corners of W13 and W14 and W2 and W4.
- 9. Glue W15 to the trailing edges of W1 and W2.
- 10. Glue W16 to the trailing edges of W3 and W4,



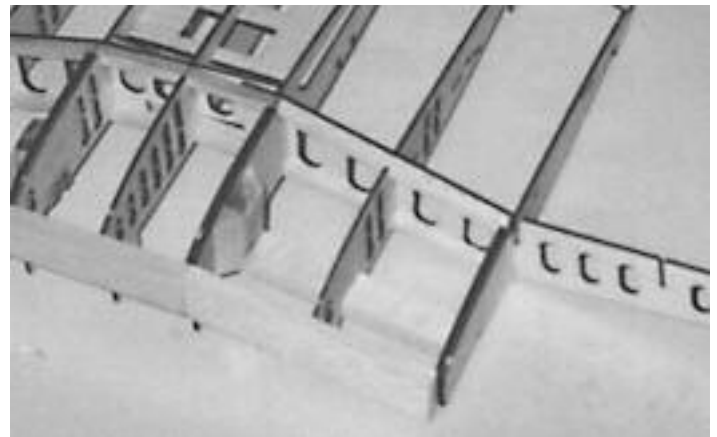
- 11. Cut the balsa spars from  $\frac{1}{4} \times \frac{1}{4}$  stock, and glue in place. Add  $\frac{1}{4} \times \frac{1}{4}$  spacers to W22 for the servos to mount to. Add the mounts for the flaps on top of W22, and the mounts for the ailerons on the bottom of W22.

Note: The spar in this case is not for structural strength, its for attachment of other pieces.

- 12. Cut the leading edge pieces from  $\frac{3}{8} \times 1 \times 18$  balsa stock, and glue in place. Glue the center piece first, followed by the outer pieces. Leave at least  $\frac{1}{16}$ " overlap of the leading edge with the ribs for the sheeting to but against.



- 13. Unpin the assembly from the board and turn it over. Cut the bottom balsa spars from  $\frac{1}{4} \times \frac{1}{4}$  stock and glue in place.
- 14. Cut the Maple Gear Blocks to size and epoxy into the slots in W2, W3 and W4. Relieve the slots as necessary to allow the gear block to fit flush.
- 15. Epoxy the Maple Gear Block Anchors to the gear blocks and W2A.

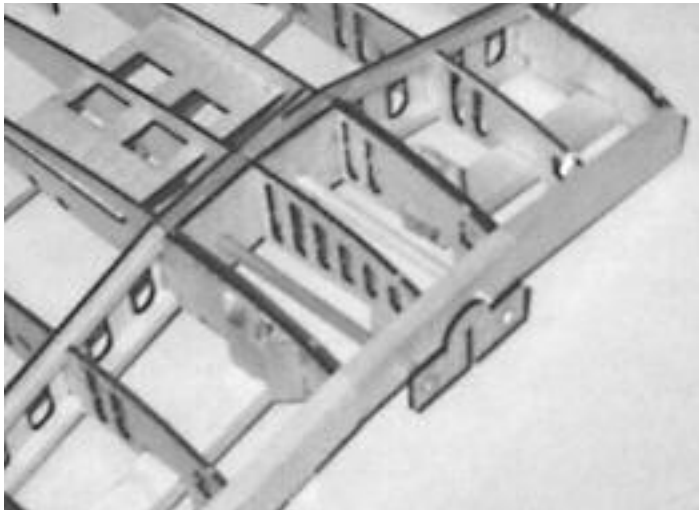


- 16. Add tri-stock to the sides of the gear blocks for support.

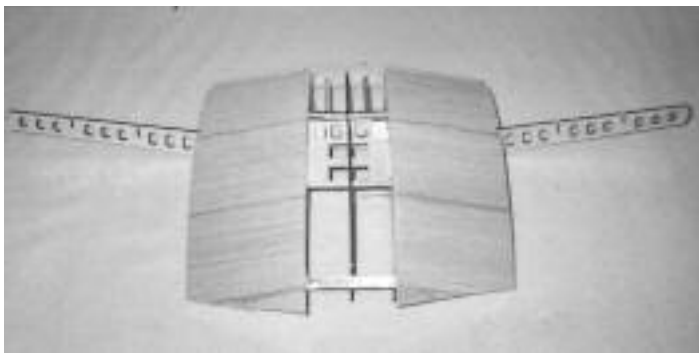


- 17. If you plan to add functional flaps, drill a hole in W19 at the "+" and slide W19 into the slots in W3 and W4. Align flush with the edge of W4.
- 18. Install bellcranks to W19 (on the bottom), with the "L" facing outward. Add the pushrods for the servo linkage.

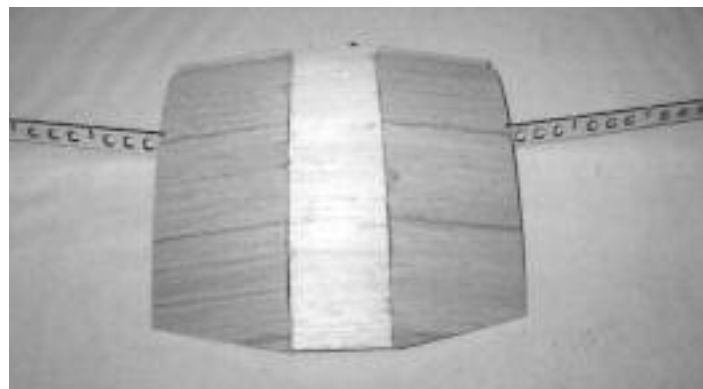
19. Glue W21 Dowel Guides to the top and bottom spars as indicated on the plans. Install so that the arrow faces up and inward. This will properly align the hole for the dowel.
20. Slide F23 onto W1. This will provide a guide for drilling the holes in the leading edge for the dowels. Mark the holes, and drill or bore  $\frac{1}{4}$ " holes in the leading edge. Remove F23.



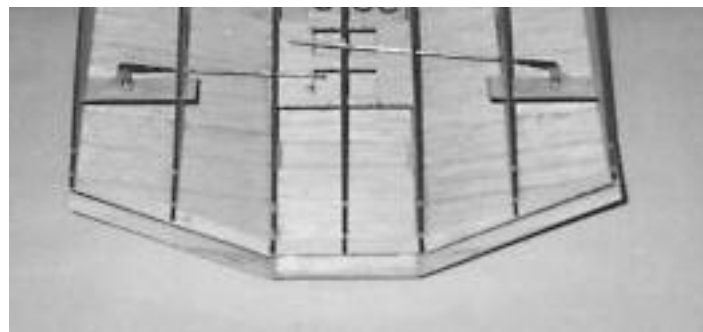
21. Cut the dowels to size (approximately  $\frac{5}{8}$  to  $\frac{3}{4}$ " should extend from the leading edge) and slide them into the wing. Slide F23 onto the ends of the dowels to align them. Epoxy the dowels in place (DO NOT epoxy F23 in place! You'll need it later) Remove F23 and set it aside.



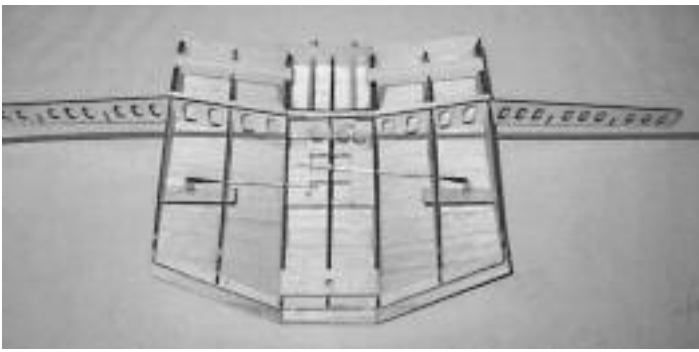
22. Sand the top of the center section smooth. Bevel W2A to match the angle of the ribs.
23. Cut three 5" section from sheets of  $\frac{1}{16}$  x 4 x 36 balsa, and cut one 5" section from  $\frac{1}{16}$  x 3 x 36 balsa. Edge glue these sheets.
24. Trim the sheet to fit the outer panel of the center section. Trim the leading edge to fit, but allow a slight overlap on the edges; this will be trimmed later. Allow for at least  $\frac{1}{2}$ " overlap of the trailing edge. Sheet the angled section. Repeat for the other side.



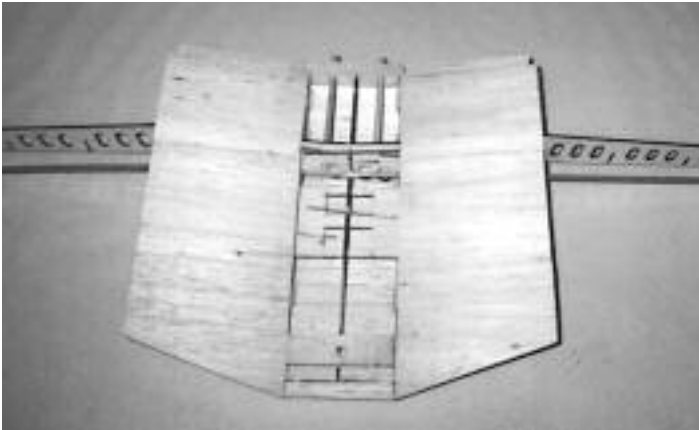
25. Trim and sand the sheeting, and carefully trim the sheeting flush with the inside edge of W2.
26. Cut three  $3\frac{1}{2}$ " pieces from  $\frac{1}{16}$  x 4 x 36 balsa sheet, and one  $3\frac{1}{2}$ " piece from  $\frac{1}{16}$  x 3 x 36 balsa sheet. Edge glue these sheets. Sand the edges until the sheet lays in the slot between the other sheets.
27. Cut short pieces from  $\frac{1}{8}$  x  $\frac{1}{4}$  balsa stock. Glue these pieces to W2, aligning them with the edge of the rib. These pieces will form an edge for the sheeting to lay on.
28. Sheet the center of the wing section.



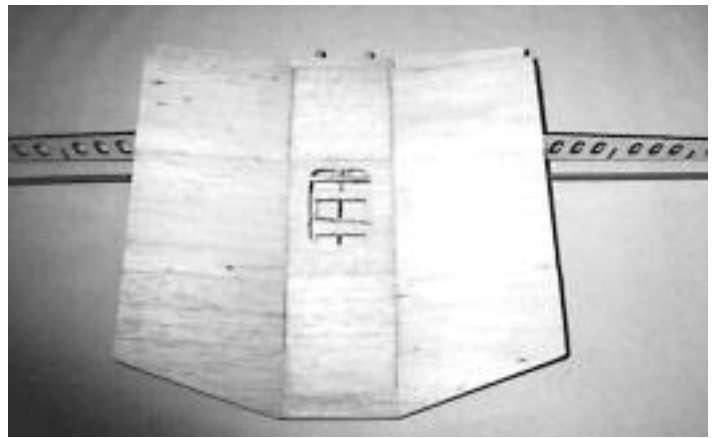
29. Remove the wing from the board. Remove the tabs on the ribs.
30. The trailing edge extends  $\frac{1}{2}$ " past W15 and W16. Mark this location and trim the trailing edge sheeting. Bevel the sheeting to match the lower rib camber.
31. If you are building the fixed flap option, add a  $\frac{3}{8}$ " maple block to W4 in the location shown on the plans. Glue it flush with the bottom of W4, and sand to the angle of the ribs.
32. Mark the locations of the flap pushrod exits.



- 33. Cut slots in W1 and W2s for locating W23 Ply Holddown Plate. The location for W23 is shown on the plans. Glue W23 in place. Drill a small pilot hole through W23, W1 and the top sheeting to locate the holddown bolt position.
- 34. If you use the Gold-N-Rod pushrod option, do the following: Cut the red 48" housing into two 17" lengths. Cut the yellow pushrod into two 19" lengths. Assemble the pushrods and the Dubro Aileron Ball-Link Connector into one continuous pushrod. Slide the pushrod through the holes in the ribs and center in the wing. Slide the housings over the pushrod until 1/8" extends past W2. Glue the housings to the ribs, but leave the housings at W2 free to "float".

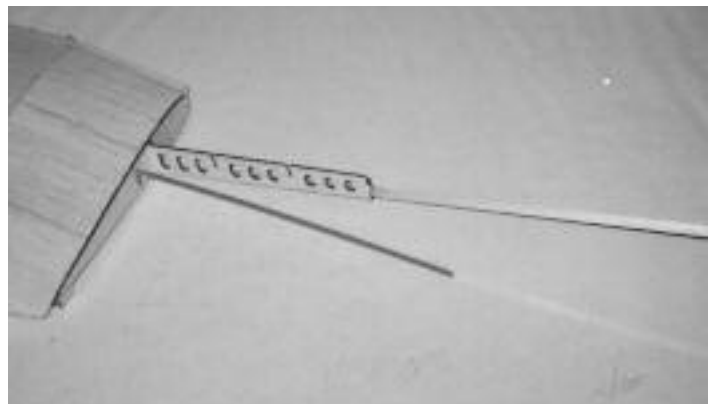


- 35. Using the same technique as the top sheeting, cut 5" sections of 1/16 x 4 x 36 balsa sheets and 5" sections of 1/16 x 3 x 36 balsa sheets and edge glue. Sheet the outer sections of the center section.
- 36. Trim the sheeting flush with W2, and trim and sand the trailing edge even with the top sheeting.

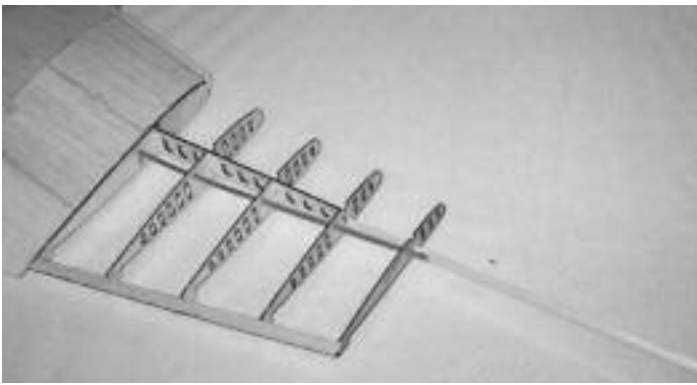


- 37. Add 1/8 x 1/4 spacers to W2 to support the bottom center sheeting, just as you did with the top.
- 38. Cut three 3 1/2" sections from 1/16 x 4 x 36 balsa sheet, and a 3 1/2" section 1" long from spare 1/16" sheeting. Edge glue these pieces.
- 39. Sand the edges of this sheet to fit snugly in the center section. Glue the sheet in place.
- 40. Trim and sand the sheets at the trailing edge, W4, and the joined edges.
- 41. Cut both the top and bottom sheets as shown to allow for servo fit.
- 42. Cut out the slots for the flap linkage.
- 43. Cut out the slots for the wire gear legs.

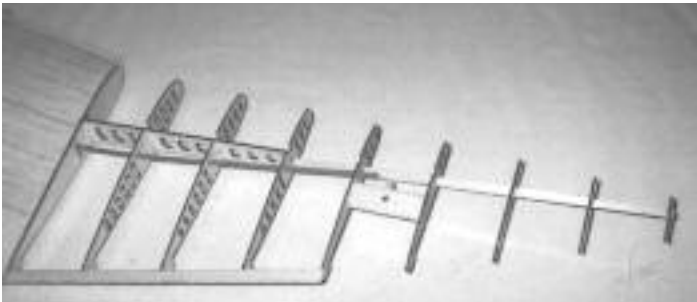
## Right Wing Panel Assembly



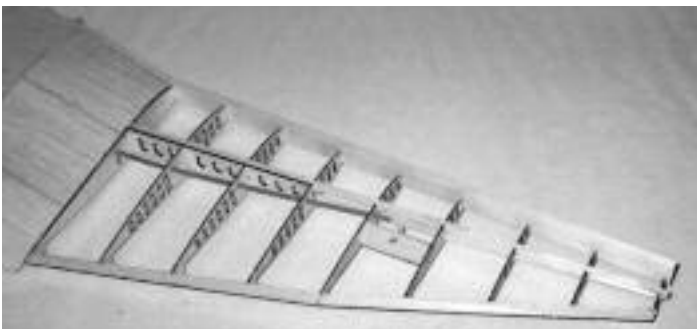
- 1. Slide W4A into the slot in the Ply Spar and align with W4 (they're the same size). Glue in place. For the fixed flap option, glue a maple block to W4A as shown on the plans.
- 2. Cut two 24" lengths from 1/4" x 1/4" balsa sticks. Glue one of these spars to the Ply spar, aligning it with the bottom edge, and fitting it into the slot in W4A.



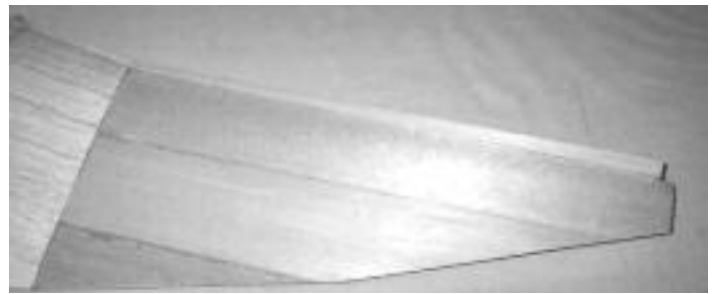
- 3. Thin the outer 4" of the balsa spar to allow the fit of the last two ribs. Thin to 1/8".
- 4. Slide W5, W6, W7, and W8 onto the Ply Spar, align, and glue.
- 5. Glue W17 to the trailing edges of the ribs.



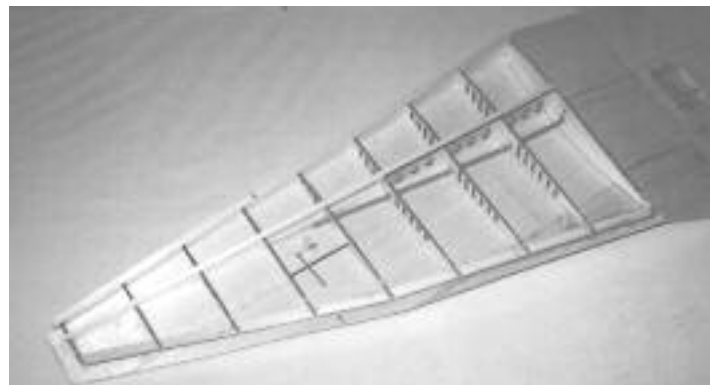
- 6. Drill a hole in W20 and assemble the bellcrank to it.
- 7. Slide W20 into the slot in W8 (the bellcrank will be on the bottom of W20) and cut the pushrod housing and pushrod to size. Attach a clevis to the pushrod and the bellcrank and align the assembly.
- 8. Slide W9 in place, slide W20 into the slot in W9, and glue all the pieces.
- 9. Glue W10, W11, and W12 in place.



- 10. Glue W18 against W17 and to the trailing edges of W9 thru W12. Glue the remaining 1/4 x 1/4 x 24 balsa spar in place. Thin the outer 4" to 1/8" to fit in W11 and W12.
- 11. Cut the 3/8 x 1 x 36 balsa leading edge to length, and glue in place. Cut scrap 1/16" balsa for shear webs and glue in place (see plans for location).



- 12. Select two 1/16" x 4" x 24" sheets. Cut a 1/16 x 3 x 36 balsa sheet in half. Edge glue the two 4" sheets and one 3" sheet to form the top sheeting.
- 13. Trim the leading edge to fit, and sand the inner edge to match the center section sheeting. Sheet the top surface of the right wing panel.



- 14. Mark a point 9/16" perpendicular to W17 at W8. Mark another point 11/16" perpendicular to W18 at W12. Connect these points and the trailing edge of the center section. Trim the top sheeting to match these lines.
- 15. Remove the tabs on the rib bottoms, and bevel the top sheeting trailing edge to match the bottom rib camber.
- 16. Mark the location of the exit point of the aileron linkage so the slot can be cut after sheeting.



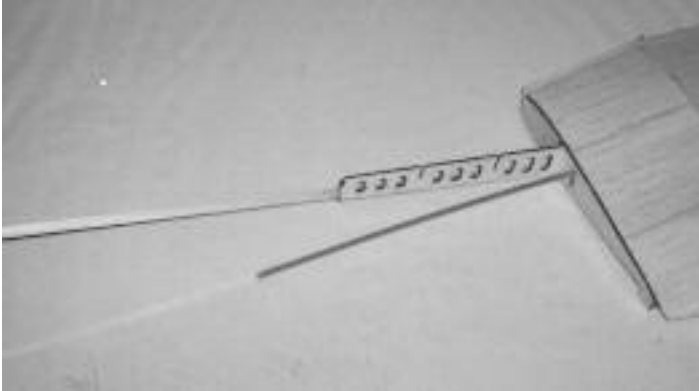
- 17. Select two 1/16" x 4" x 24" balsa sheets. Edge glue these two pieces and the remaining 3 x 18 sheet to form the bottom sheeting.
- 18. Trim the sheeting to fit the leading edge, and sand the inner edge to match the center section sheeting. Sheet the bottom of the wing panel.

19. Trim the trailing edge to match the top sheeting and the center section sheeting.

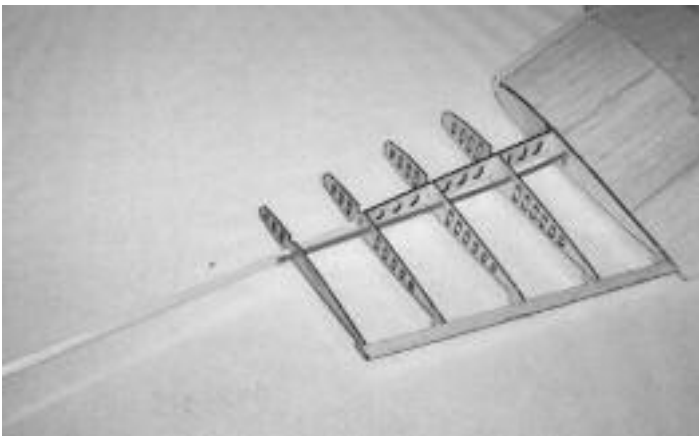
20. Glue on the wingtip. Sand to shape.

Note: the slots in the trailing edge in the picture will be cut later.

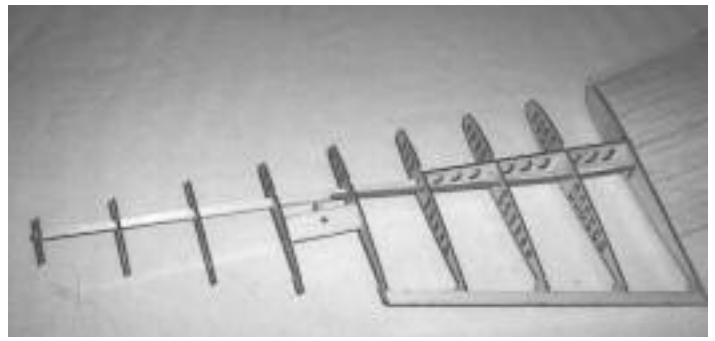
## Left Wing Panel Assembly



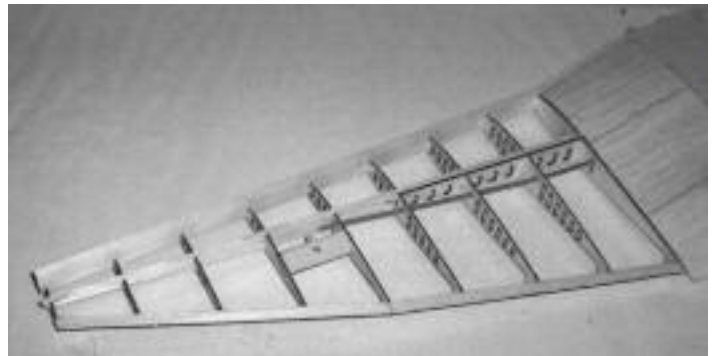
- 1. Slide W4A into the slot in the Ply Spar and align with W4 (they're the same size). Glue in place. For the fixed flap option, glue a maple block to W4A as shown on the plans.
- 2. Cut two 24" lengths from 1/4" x 1/4" balsa sticks. Glue one of these spars to the Ply spar, aligning it with the bottom edge, and fitting it into the slot in W4A.



- 3. Thin the outer 4" of the balsa spar to allow the fit of the last two ribs. Thin to 1/8".
- 4. Slide W5, W6, W7, and W8 onto the Ply Spar, align, and glue.
- 5. Glue W17 to the trailing edges of the ribs.



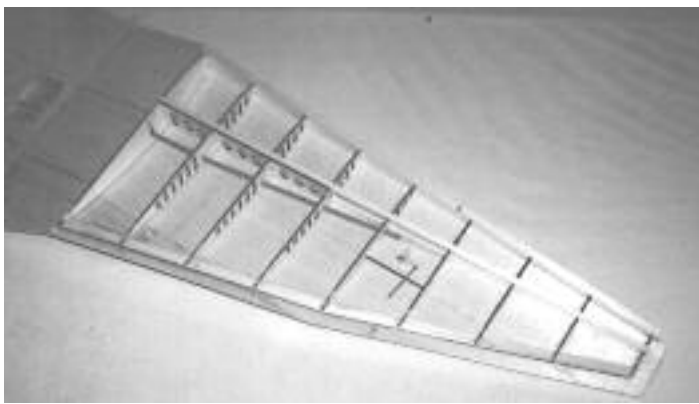
- 6. Drill a hole in W20 and assemble the bellcrank to it.
- 7. Slide W20 into the slot in W8 (the bellcrank will be on the bottom of W20) and cut the pushrod housing and pushrod to size. Attach a clevis to the pushrod and the bellcrank and align the assembly.
- 8. Slide W9 in place, slide W20 into the slot in W9, and glue all the pieces.
- 9. Glue W10, W11, and W12 in place.



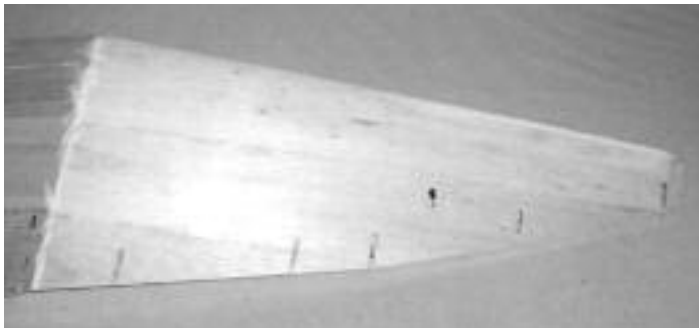
- 10. Glue W18 against W17 and to the trailing edges of W9 thru W12. Glue the remaining 1/4 x 1/4 x 24 balsa spar in place. Thin the outer 4" to 1/8" to fit in W11 and W12.
- 11. Cut the 3/8 x 1 x 36 balsa leading edge to length, and glue in place. Cut scrap 1/16" balsa for shear webs and glue in place (see plans for location).



- 12. Select two 1/16" x 4" x 24" balsa sheets. Cut a 1/16 x 3 x 36 balsa sheet in half. Edge glue the two 4" sheets and one 3" sheet to form the top sheeting.
- 13. Trim the leading edge to fit, and sand the inner edge to match the center section sheeting. Sheet the top surface of the right wing panel.



- 14. Mark a point  $9/16$ " perpendicular to W17 at W8. Mark another point  $11/16$ " perpendicular to W18 at W12. Connect these points and the trailing edge of the center section. Trim the top sheeting to match these lines.
- 15. Remove the tabs on the rib bottoms, and bevel the top sheeting trailing edge to match the bottom rib camber.
- 16. Mark the location of the exit point of the aileron linkage so the slot can be cut after sheeting.



- 17. Select two  $1/16$ " x 4" x 24" balsa sheets. Edge glue these two pieces and the remaining 3 x 18 sheet to form the bottom sheeting.
- 18. Trim the sheeting to fit the leading edge, and sand the inner edge to match the center section sheeting. Sheet the bottom of the wing panel.
- 19. Trim the trailing edge to match the top sheeting and the center section sheeting.
- 20. Glue on the wingtip. Sand to shape.

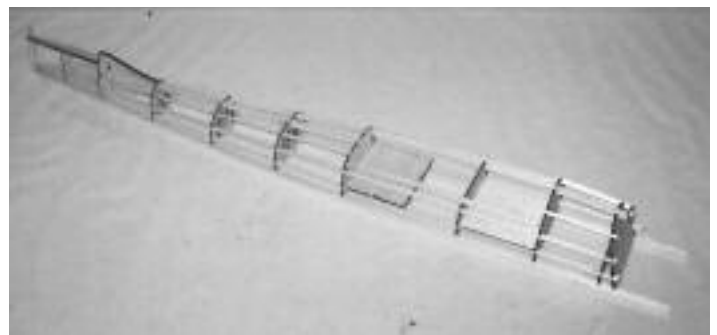
Note: the slots in the trailing edge in the picture will be cut later.

The remainder of wing construction will be accomplished after fuselage assembly.

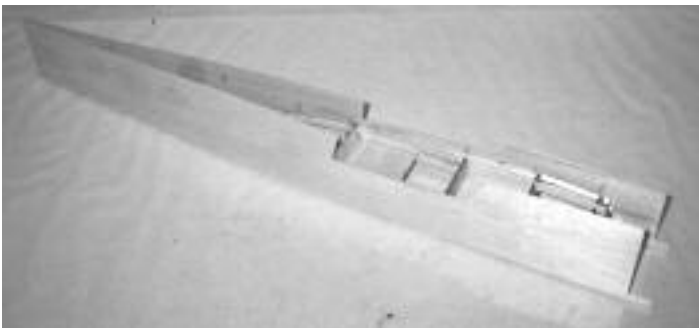
## Fuselage Assembly



- 1. Pin two  $1/4$  x  $1/4$  x 36 balsa spars to the fuselage top view as shown. Cut a  $1/4$  x  $1/4$  balsa stock for a fin post. Glue in place. Bevel the ends of the spars to fit at the fin post.
- 2. Bevel the top edge of F2A to match the angle of F1A. Glue F2A in place.
- 3. Using the fuselage angle gauge provided, set F1A in place and set the angle. F1A will rest against F2A. Glue in place.
- 4. Glue the bulkheads F3A through F10 in place.
- 5. Add  $1/4$  x  $1/4$  balsa keels between F1A and F3A, and between F5A and F8A.
- 6. Glue F12 in the slots in F8A and F9A.
- 7. Align F11 with F9A and the fin post, resting on F10. The top edge of F11 will align with the bottom of the notch in F9A. Glue in place.



- 8. Add  $1/8$  x  $1/4$  balsa stringers to the fuselage, starting with the bottom row first. Add the stringers simultaneously to each side; this will help keep the fuse straight. Bevel the stringers that attach to the fin post.
- 9. After the bottom row is in, add F21 and F22 Cockpit Floors. Note that F22 butts against F5A.
- 10. Continue adding stringers, noting that the third row stops at F10. This row will also twist as you lay it in the grooves. Also note that this row does not extend between F3A and F5A.

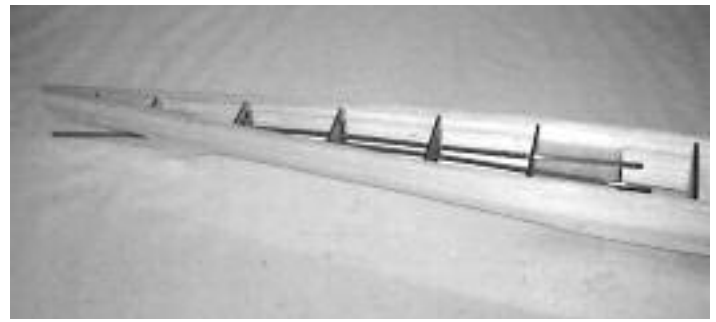


- 11. Add a stringer between F3A and F5A, fitting in the slot in F4A. This stringer is for locating the sheeting only. Attach it level with the other stringers, butting against F3A and F5A.
- 12. Sand F11 to match the contours of F9A and F10 and the fin post. Sand any high spots from the fuselage structure.
- 13. Pin short pieces of 1/8" balsa scrap to the edges of the fuse at the 1/4 x 1/4 spars. This will elevate the sheeting by 1/8" to allow the bottom sheeting to attach.
- 14. Using 1/16 x 4 x 36 balsa sheets, sheet the fuselage. Pick matched density sheets to prevent warping, and sheet both sides of the fuse at the same time.

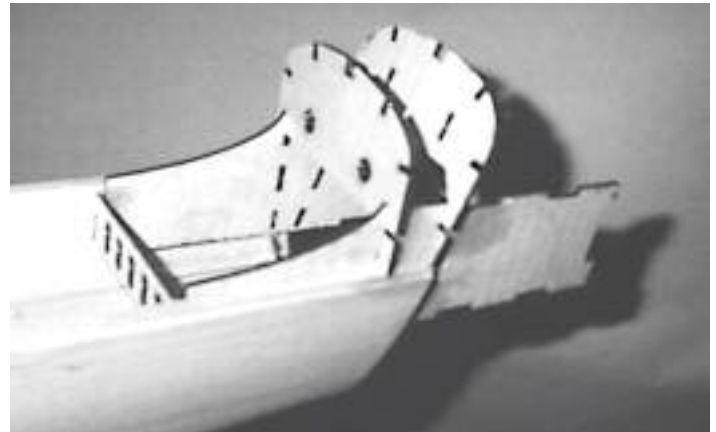


This will keep the fuse from warping. Work slowly, starting at the center, moving fore and aft, side to side. Glue the sheeting one stringer section at a time, working up. After gluing to the second row of stringers, cut the balsa away from the cockpit area (you don't have to be precise, this just relieves the stress in the sheets). Wetting the sheets with water or a water/ammonia mix will help the sheeting conform to the fuse. Trim the sheeting as you get to the top, to butt the sheets together. Trim away the sheeting at the aft end as you finish sheeting around the fin post, F10, F9A, and F8A. This area is difficult, and the sheeting may crack as it tries to conform to this area. Glue the cracked areas and continue. This area will be smoothed with light-weight filler later.

- 15. Trim the sheeting at the cockpit area by placing the canopy in position and marking its edges. Try to leave at least 1/8" of the sheeting overlapping. Trim and sand the sheeting flush with F1A and the fin post/F11 area.



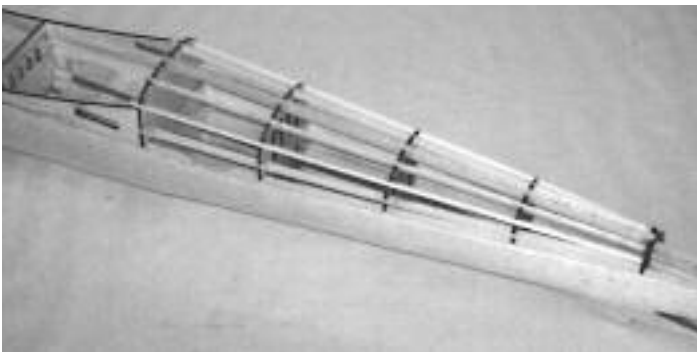
- 16. Add the pushrods by feeding the housings through the holes in the bulkheads. A slight amount of the stringer near F9A will have to be relieved to allow the housing to pass through. Cut a hole in the sheeting between F9A and F10 to allow the pushrod to pass through.
- 17. Glue the housings in place. The pushrods may be added later during control surface installation.



- 18. Slide F14 into the fuselage and locate the tab into the slot in F3A.
- 19. Slide F2B onto F14; concurrently, slide F1B onto F14. Lock the tabs and slots into each other and glue all the pieces.

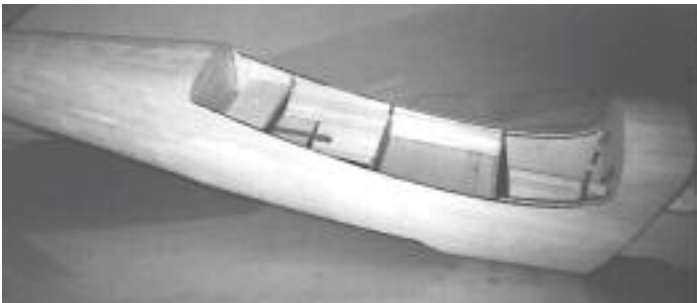


- 20. Glue F3B, F4B, F5B, F8B, F7B, and F8B in place.
- 21. Glue F13 into place against F5B, F2B, and the balsa spar.
- 22. Add 1/4 x 1/4 balsa keel pieces to the slots in F1B and F2B, and the slots in F5B though F8B.



23. Add 1/8 x 1/4 balsa stringers to the lower fuse half. Add short segments to F1B and F2B. Add the stringers from the spar to the keel, simultaneously to prevent fuse twisting. The stringers butt against F9B.

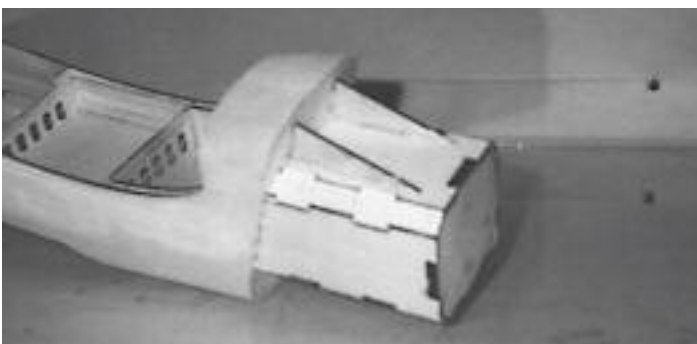
24. Trim and sand the stringers even with F9B, F5B, F2B, and F1B.



25. Slide F24 Ply Holddown Plate into the slots in F13 and epoxy in place.

26. Using 1/16 x 4 x 36 balsa sheets, and using the same techniques as with the top sheeting, sheet the bottom half of the fuselage.

27. Trim and sand the sheeting at F9B and F1B. Trim and sand the wing saddle area flush with F13, F5B, and F2B.



28. Place the wing in the wing saddle and center and align the leading edge with the fuselage (the dowel holes in F2B are cut oversize to allow adjustment). When centered, mark the location.

29. Working through the open area in the front of the fuse, slide F23 onto the dowels and epoxy to F2B (NOT the dowels!). Hold the wing in it's aligned position while the glue sets.

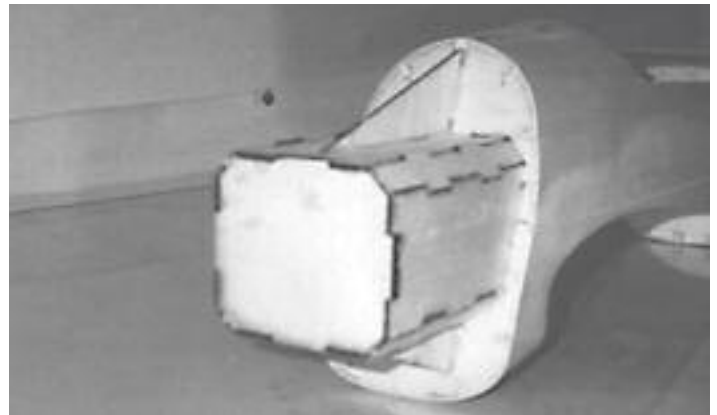
30. Align the trailing edge of the wing with the fuselage and mark it's location. Drill a hole through the wing center section (corresponding with the pilot hole you drilled earlier) and through F24. Tap the hole in F24 for your wing holddown bolt. Remove the wing from the fuselage.

31. Slide F15 into position, inserting the tabs on F1A and F2A into the slots. Epoxy in place.

32. Trim F16 to clear F23 and the dowels and epoxy to F2B and F1B.

33. Bevel the edges of F17 to fit into the slots in F14 and F15. Epoxy both pieces in place.

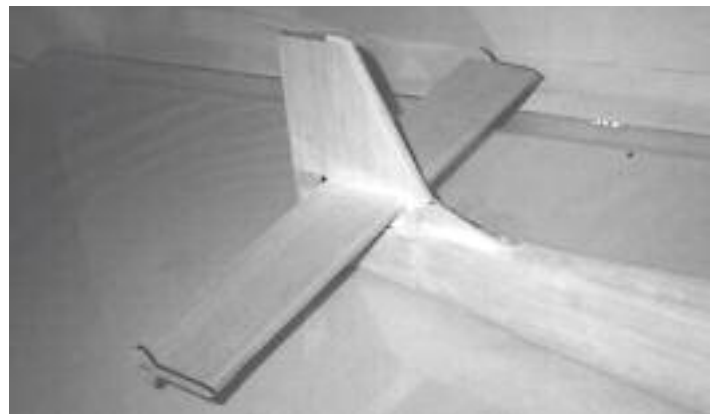
34. Bevel the edges of F18 to fit into the slots in F14 and F16. Epoxy both pieces in place.



35. Epoxy the firewall in place.

36. Slide the tabs on F19 into the slots in F15 and F1A and glue in place.

37. Slide the tabs on F20s into the slots in F16 and F1B and glue in place.



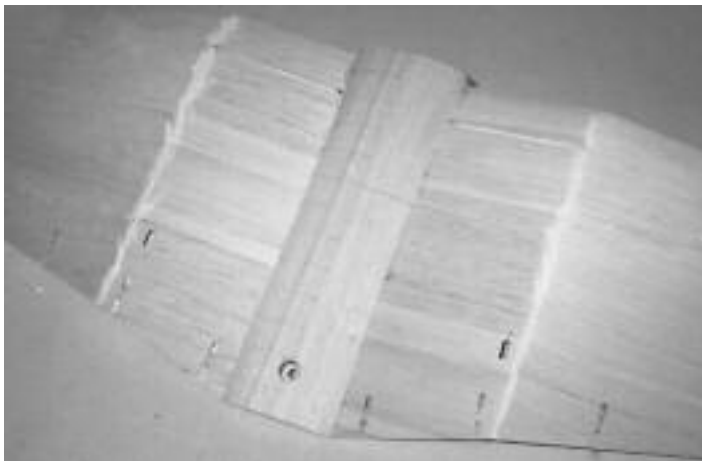
38. Center and align the horizontal stab onto F11. Align the stab with the fuselage, check for level, and epoxy in place.

39. Slide the tab on the vertical stab into the slot in the horizontal stab and epoxy in place.

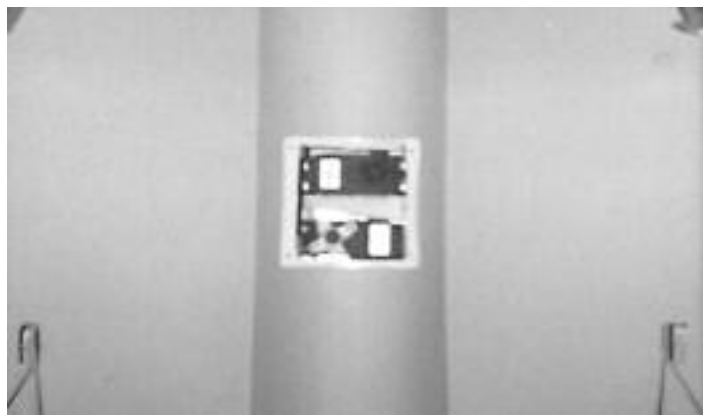
40. Using the elevator assemblies as a guide, glue the stab horns onto the ends of the horizontal stabilizer.
41. Fill the aft fuselage area with lightweight filler to fill any gaps and smooth the surfaces.



42. Glue the balsa tail block to the aft lower fuselage and sand to shape. Fill any gaps with lightweight filler and sand smooth.



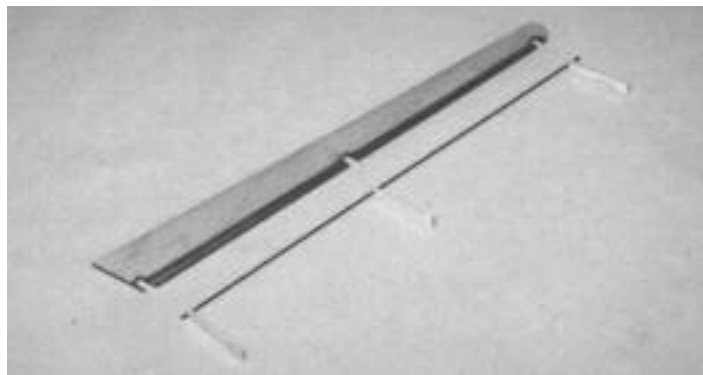
43. Mount the wing to the fuselage. Glue F2C to the leading edge, aligning it with F2B.
44. Glue F5C to the trailing edge, aligning it with F5B.
45. Cut a 1/4 x 1/4 balsa keel to size and glue to F2C and F5C.
46. Slide F3C and F4C under the keel until they're snug with the wing and the keel. Do not bow the keel, it should be straight.
47. Glue the pre-cut 1/16" belly pan panels in place, one side at a time, and work the panel along the stringers and glue to the wing sheeting. Trim and sand the ends. Cut a hole to allow access to the wing holddown bolt.



48. Cut an access hole in the belly pan for servo access. Cut a hatch cover (plastic cover provided; cut to size) for the hole.
49. Locate the screw holes for the cover. Glue hardwood screw supports behind the skin and mount the hatch cover.

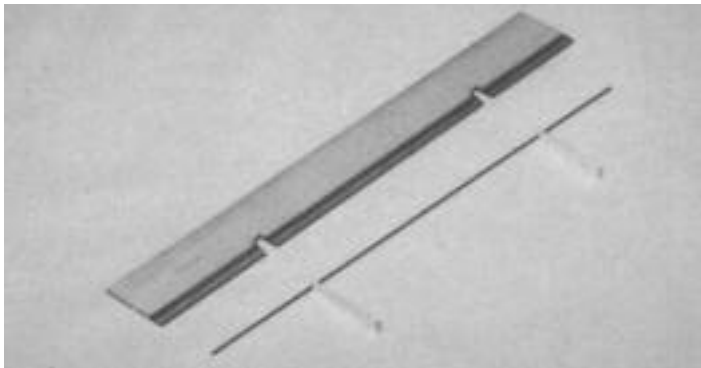
## Flaps & Ailerons

The flaps and ailerons are built up with a hinging system that closely approximates the full-size airplane's offset control surfaces. Building these assemblies is not difficult; however, care should be used to prevent getting the parts mixed up, crossed, or backward during assembly. Once an assembly is glued together, it's permanent. A method that works is to work only with the parts needed for a particular control surface at one time; that way, you won't have 50 pieces laying on your work bench at once.



1. Remove two AH-1 hinges from the parts tree. Carefully sand the edges smooth and scuff the sides with sandpaper. Epoxy the hinges together, making sure they're aligned. Repeat this procedure with two AH-2s, and again with two AH-3s.
3. Note that the aileron halves are marked top and bottom and side to side. Start with the left bottom aileron half. Cut a piece from the 1/16" wire provided to fit in the channel in the aileron.
4. Slide the hinges onto the wire with the slots facing up.

4. The hinges will set at an angle, so carefully, using a 1/16" drill bit, drill the hole in the hinges to an angle (it helps to hand drill this). Work until the angle matches the slots in the aileron.
5. Center the hinges with the slots in the aileron (AH-3 at the tip, AH-2 in the center, AH-1 at the base) and with the slots in the hinges facing up (it helps to have the wing handy for reference).



6. Lay the hinge/wire assembly into the channel in the aileron, and epoxy the "top left" aileron half to the bottom, trapping the wire. Clean the epoxy from the hinge slots, and place the aileron on a flat surface (it helps to add weight for pressure to the assembly) and let the epoxy cure.

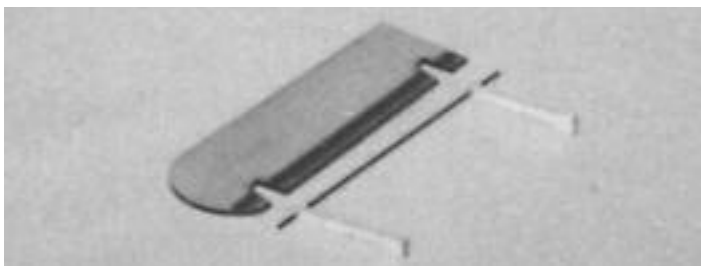
7. Repeat the procedure for the right aileron, starting with the bottom right half. If you always start with the bottom half, the slot in the hinges always faces up.

8. Build the outer flap section the same as the ailerons, starting with the bottom left half.

9. Epoxy two FHs (flap hinge) together. All the flap hinges are the same, and use the same assembly techniques as with the aileron hinges. Make two hinges.

10. Angle drill the hinges to match the slots in the flap, and cut the 1/16" wire to fit. Slide the hinges onto the wire, and epoxy the "top left" half to the bottom. Remember, start with the bottom half and the hinge slots face up!

11. Repeat the procedure for the right side flap section.

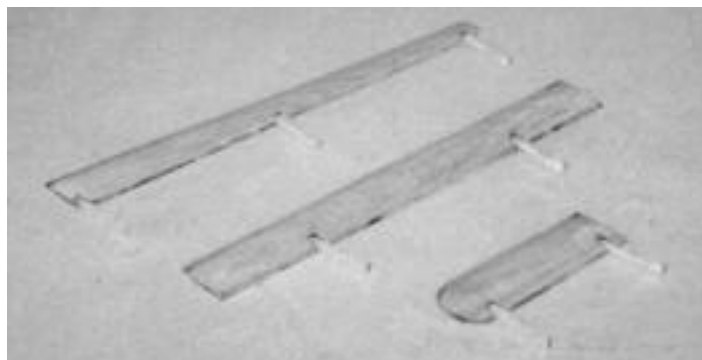


12. Same techniques again for the inner flap section, start with the bottom left half.

13. Same hinge assembly techniques, glue two FHs together, and make two hinges. Cut the 1/16" wire to fit, and slide the hinges onto the wire.

14. Epoxy the "top left" half to the bottom, trapping the wire/hinge assembly.

15. Repeat for the right side flap section.



16. Trim and sand the edges of the control surfaces to remove excess epoxy. Carefully remove any excess epoxy buildup in the hinge slots.

17. Sand the aileron and flap sections to an airfoil shape (shown on the plans). You don't have to be exact here, we even tested an airplane with square control surfaces, but I don't recommend that; it's a scale airplane, after all!



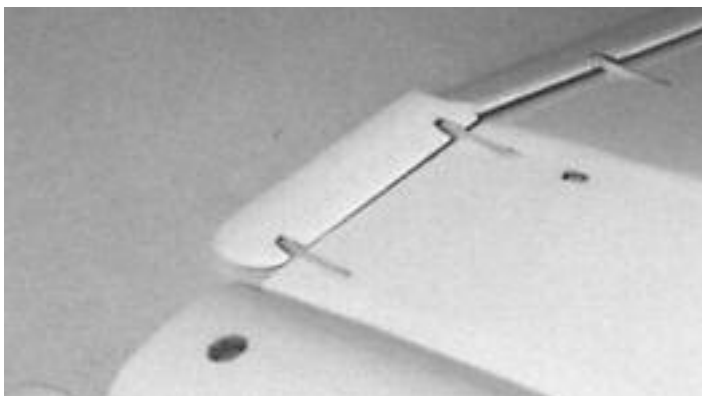
18. Since mounting the control surfaces can be considered a final assembly item, I recommend covering the wing and control surfaces before attaching them to the wing. Here we go:

19. Locate and cut slots through the wing sheeting (CAREFULLY! That's my favorite word!) Flush with the respective ribs. See plans for hinge/rib relationships. Trim the slots and test fit the aileron/hinge until the hinges slide into the slots and lock into W18 (for the ailerons, W17/W16 for the flaps). Trim the slots in the hinges to allow for the angle. Note that the ailerons and flap sections cannot be reversed; each is specific.



Test fit each control surface, and trim until, with the hinges locked in place, the control surface pivots freely and doesn't interfere with the wing.

- 20. Starting with the ailerons, epoxy the hinges in place. Don't go overboard, but don't skimp with the glue.



- 21. Bevel the edges of the outer and inner flap sections to allow a flush seam, and epoxy the outer flap section in place. Verify that the flap and aileron ends are even.

- 22. The inner flap section hinges do not attach to ribs. Locate the slots by test fitting and comparing with the outer flap. Maintain the same distance with the wing trailing edge, and epoxy in place.



- 23. Mount the control horn for the aileron directly aft of the linkage, and mount the horn on the aileron so that the screws do not interfere with the wire trapped inside. Connect the aileron linkages and adjust.

- 24. Each flap section uses its own control horn. Do the following for fixed flaps:

- 25. Locate the position of the maple blocks either side of W4. Mount the control horns on each flap section and gauge the angle to the block. Drill the block at that angle, and install pushrods into the blocks. Connect with clevises to the control horns. We will adjust them in a moment.

### Functional flaps:

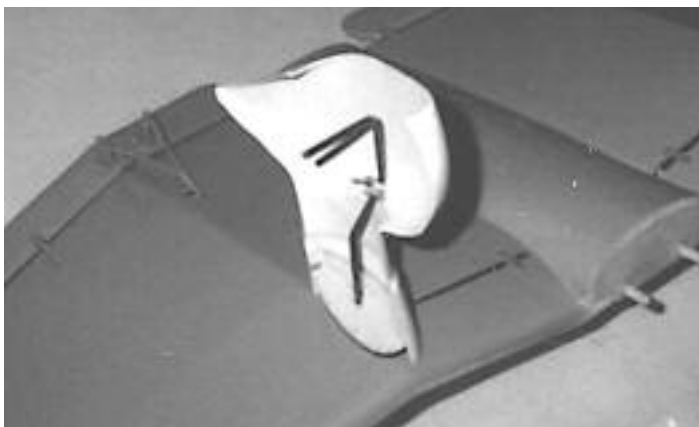
Mount the control horn for the inner flap section. Connect the bellcrank and control horn for the inner flap section with a pushrod and clevis. Mount a control horn to the outer flap section at an angle pointing slightly aft of the bellcrank linkage. Attach a clevis and pushrod to the control horn and bend the pushrod until it is parallel to the inner flap pushrod. Mark this location, remove both pushrods, and solder them together. (Scuff the pushrods with sandpaper; find a piece of old automotive wire, and peel off the insulation and save a few strands of the wire. Wrap the pushrods with the wire and then solder; the joint will outlast the airplane!)

Now let's adjust everything: using the W4 (flap) and W8 (aileron & flap) incidence gauges provided, start with the ailerons. Connect the pushrod and servo and center the servo. Mount the W8 Incidence Gauge to the wing (top) at the inner end of the aileron and adjust the aileron to match the gauge (if your aileron doesn't quite match the contours of the gauge, that's OK. Eyeball it, because this is preliminary) repeat for the other aileron. Connect and center the flap servo. Use the W4 Incidence Gauge to set the outer flap section. The flap and aileron should be even with both centered. Adjust the inner flap section to match the outer.

## Final Assembly



- 1. Glue F25 Cockpit Bulkhead to the top of F4A and angle it to match the rear of the forward sliding canopy.
- 2. Finish the interior as you wish. An instrument panel is provided on the 3-view drawings; cut it out, and glue it to the back of the pre-cut balsa panel, and glue in place. Add pilot figures, etc., to suit. A rear machine gun may be added. Note that a portion of the rear cockpit floor is relieved to allow the servos to fit. You may build up this area with scrap balsa if you desire.
- 3. Glue the canopy in place.



4. The wheel pants may be mounted either as a permanent installation or removable for flight. To mount them permanently, do the following:
5. Mount the gear leg into the slot in the wing. Slide F27 onto the wire. Slide the wheel onto the wire and position the inside half of the wheel pant to the wire. Mark the position where the wire meets the plastic. Check for wheel clearance. Bolt the wheel pant to the gear leg using a gear strap. Epoxy F27 to the wheel pant. Place the outside half against the inner half and check for clearance. When satisfied, permanently mount the wheel, and glue the wheel pant halves together. Paint to match your color scheme. The down side to permanently mounting the wheel pants is that access to the wheels is impossible.

Removable wheel pants can be accomplished by adding blocks to the inside edges of the wheel pants. Drill through the blocks and screw the wheel pants together. Add the gear strap to mount one half to the gear leg, and cut F27 in half and glue to each wheel pant half to locate to the gear leg. Paint to match your color scheme, and remove for flight.

6. Locate the cowl to the fuse and mark the screw locations. Gluing a piece of carbon fiber or aluminum to the cowl at the screw hole will add strength to this area and will prevent cracking.

The remainder of the construction consists of attaching the rest of the components to the airplane. Most of this is builder's choice, and individual tastes, styles, and component selection, so any detailed descriptions would be impossible. The remainder of assembly is described in general terms only.

### **Engine installation**

Measure and mark the center horizontally and vertically of the firewall; this will be the centerpoint for motor mount installation. Install the motor mount and engine of your choice. The photos of the airplane are shown with a .61 installed inverted, completely enclosed. Inverted engine installation causes it's own set of problems, so the flat firewall allows the engine to be installed pointing any direction that suits you (side mounted with a Pitts-style muffler will hide most of the engine/muffler and exhaust system).

### **Servo and Receiver installation**

3/8" maple blocks are provided for servo rails. Mount these as shown on the plans and mount the servos. Mount the receiver and connect the components. The battery may be mounted in a location that will aid in balancing the airplane.

### **Covering**

Cover the airplane with the covering of your choice. The covering choices are too numerous to mention, but the airplane shown in the photos was covered with film, painted, and clear-coated. It is recommended that the airplane and control surfaces be covered separately.

### **Control Surfaces**

Locate the control arm positions, and install the control arms. Final sand the control surfaces. Locate the hinge points (hinges and other hardware are not provided in the kit because everyone has his own preferences. Rather than put in stuff that most of you will throw away, we left it out to keep the kit price down) and install the hinges and control surfaces. Use at least three hinges per control surface for best results. Connect and adjust the pushrods.

### **Fuel Tank and Throttle Cable**

After deciding which direction the engine will point (up, down, or sideways) drill holes for and install the throttle cable. Mount the fuel tank of your choice, and connect the lines.

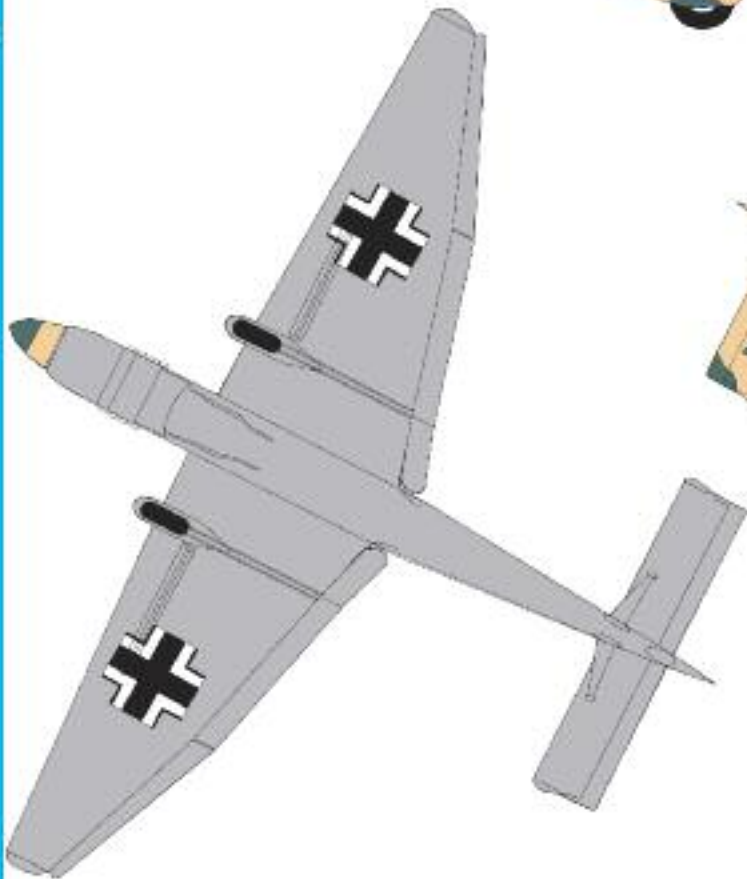
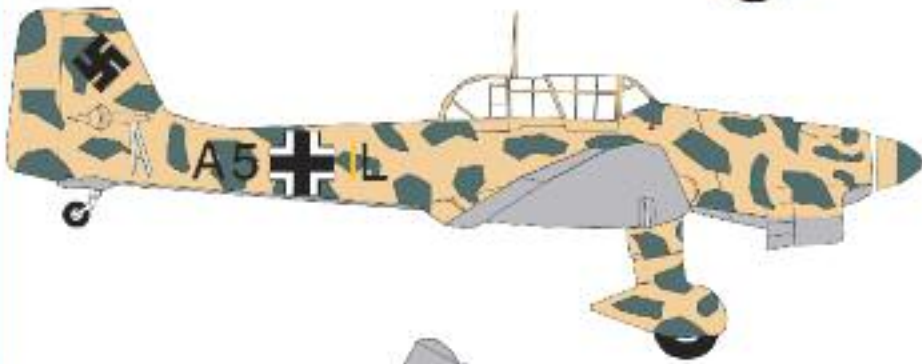
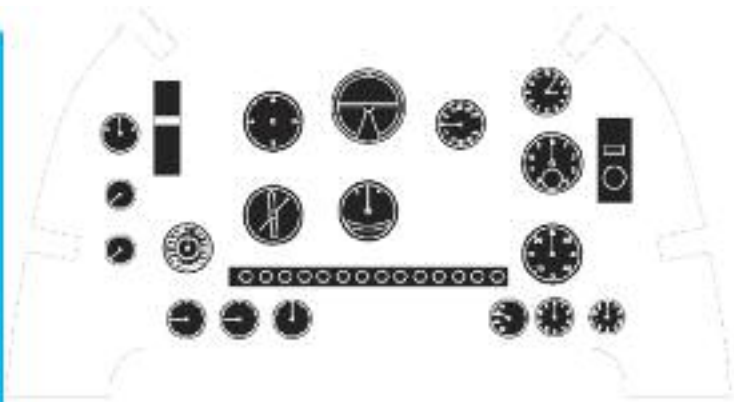
### **Control Throws:**

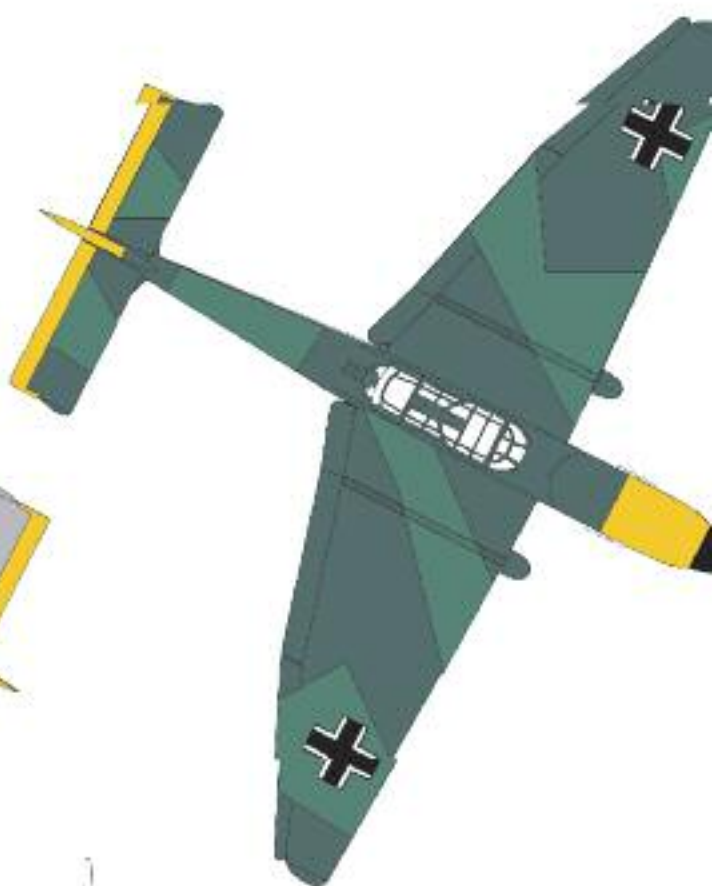
Ailerons: 7/16" up & down  
 Elevator: 7/16" up & down  
 Rudder: 5/8" left & right  
 Flaps: 3/4" down

### **Flying**

The Stuka is a very stable flyer, but approach the first few flights with caution; it will take several flights to "dial in" the flap and aileron incidences, so as you make changes, make them gradual and incremental. Large adjustments may create the opposite effect you were intending!

The rest is up to you! Fly and enjoy!

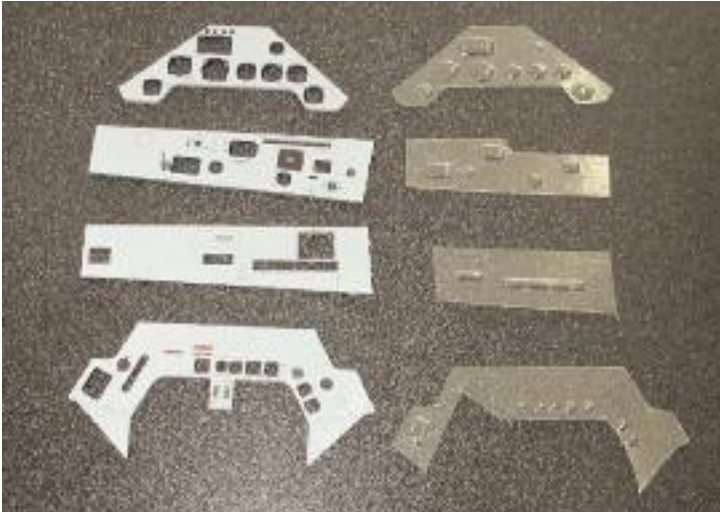




# ***Skyshark R/C***

## ***Gauge Face Assembly Instructions***

Paper gauge faces are located on the 3-view drawing that are included with the instruction manual.



1. After painting the laser-cut cockpit parts, cut the clear plastic gauge inserts to size. Be sure to cut away any areas where stringers will attach or notches where levers will be inserted.



2. Using a small amount of medium CA, attach the clear gauge insert to the back of the panel so the protruding lenses fit into the laser cut holes.



3. Color any necessary parts of the paper gauge panel and apply glue to the front of the paper. **DO NOT USE CA** for this step (the fumes from the CA will cloud the gauges). We use a Scotch glue stick for our prototypes.



4. Apply the paper to the back of the panel so the gauges line up with the laser-cut holes and allow to dry.