

# Messerschmitt

# ME109G



The ME-109 was the standard by which all other fighters of WWII were judged. It served the Luftwaffe in almost every capacity, from interceptor to night-fighter to ground attack and photo reconnaissance. The ME-109 was produced in greater numbers than any other plane (approximately 30,000) and remained in use by some countries until 1967. The G (Gustav) version was the result of the need to upgrade the 109 series to better combat the newer Allied fighters appearing over the skies of Europe. The ME-109G included better armament and more horsepower than the previous E versions.

The ME-109G was armed with two MG 131 13mm cowl mounted machine guns and either an MG151 20mm or Mk 108 30mm cannon firing through the spinner. It could also be armed with 50 pound or 250 pound bombs, 20 or 30mm underwing cannons, or external drop tanks to extend the notoriously short range of the ME-109 fighter series.

The Gustav was eventually fitted with the Daimler-Benz DB605 series engine, the most

powerful engine to be fitted to the 109s. The DB605 was an inverted Vee, 12 cylinder liquid cooled engine producing 1,475 horsepower at takeoff. This gave the Gustav a top speed of 386 MPH.

In the hands of an experienced pilot the Gustav was a formidable weapon. Many of the top scoring aces of Germany got most of their kills flying the ME-109. As the war continued, however, the shortcomings of the series showed up, such as difficult takeoff and landing traits that in the hands of less skilled pilots proved sometimes fatal. Most later modifications to the 109 series were attempts to tame these shortcomings, but the Gustav was still flown in combat right up to the end of the war.



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Thank you for purchasing the ME109G from Skyshark R/C. 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 lowering 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.

### **Plastics and Fiberglass**

The cowl is accurately reproduced in fiberglass. The exhaust stacks, cannon bulges are reproduced from plastic. The canopy is accurately reproduced in clear plastic, and is molded in one piece.

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

### **Engine Options**

Engine choices range from .60 to .75 2-strokes, or .60 to 1.00 4-strokes. We mounted our engines inverted - this allows adequate cooling for the cylinder head. Since the tail surfaces on the 109G are scale, using anything over the recommended engine size may lead to stability issues. Scale exhausts can be fabricated.

### **Electric Options**

Electric conversion on a kit this size is very easy and straightforward. You will simply need to plan for a battery hatch in order to save having to remove the wing for battery changes. There is plenty of room in the cowl for any size motor and ESC.

### **Retract Options**

Retract installation is shown on the plans and explained in these instructions for Springair retracts. The Springair Part Number 704 retract is an 85 degree unit which works well with the ME109G. Of course, you are free to use any retract you wish. Scale wheel size is 4" with a maximum width of 1". We were not able to find scale wheels for this plane so we substituted the Robart 3.5" scale wheels.

### **Flaps**

The flaps can easily be made fully functional. All the servo reinforcements are included in the kit, as well as instructions of how to build and actuate the flaps.

### **Cockpit Detail**

A fully detailed, fully researched laser cut and engraved cockpit is included in the kit. It will be installed once the fuselage is framed and sheeted.

### **Scale Accuracy**

Our intention with this kit is to preserve scale outline and accuracy as closely as possible. There is both a benefit and cost to this. The benefit is that this kit is the first and only ME109 in this scale that truly represents the full scale airplane. The cost of reproducing true scale, however, means that you have a kit which will require more attention to detail and in some areas and will challenge your building skills to a greater degree. This does not mean that this is a difficult kit to build but the kit is not designed for beginning builders. We have merged modern engineering design principles into conventional building methods. A few areas that are unique to the ME109 such as the landing gear placement and the shape of the rear fuselage presented design challenges to provide the builder with a workable construction process.

## **Information for Scale Competition**

If you intend to compete in scale events, this kit is a viable contender with Relatively little additional detailing.

### **Scale Information:**

99.9% accurate scale outlines, wing planform, control surface and stabilizer sizes and shapes, scale gear location, scale tailwheel location and fuselage shape and profile.

We have provided the parts required to build the G-6 version of the ME109. You may build the F and all G versions except the G-10 with the parts provided in this kit.

***A few areas of the model do deviate slightly from true scale, such as:***

The cockpit is as close as possible to the G but variants of the G have slightly different cockpit configurations. Refer to your scale documentation for any differences.

The wing/flap junction has been simplified for ease of building, though the flap separation point is scale. Also, the very complex inner and outer flap/radiator outlet has been simplified. We have duplicated the scale flap setup and have determined that it serves no purpose other than looking "cool", and adds a lot of unnecessary weight.

Most 3-views and plastic models show a scallop shape under the fabric covering of the control surfaces. We initially attempted to duplicate this but the detail did not show up after covering and added unnecessary weight and building complexity.

Panel lines, rivets and additional small detail items are left up to the individual builder. There are countless sources of this type of added detail available from print, internet and other sources.

### **Variant Differences:**

#### **All F variants:**

1. No cowl gun bulges
2. The lower quadrant canopy window is clear, same as the E-versions.
3. The wheel well openings are circular, rather than notched.
4. Early F variants had a smaller chin oil cooler.
5. No upper wing wheel bulges.

#### **G-1 thru G-4 Variants:**

1. No cowl gun bulges
2. All G variants have no lower quadrant canopy pane. This should be painted over.
3. The parts supplied in the kit for the wheel well openings are correct for all G versions.
4. Early versions did not have upper wing wheel bulges, later versions did.

#### **Early G-5 and G-6 Variants:**

1. The kit was modeled for these variants.

#### **Late G-5, G-6 and G-14 Variants:**

1. We offer an accessory kit that provides the parts to model these variants.

## **General Building Information**

The ME109G can be built by a person with average building skills. 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!

The Wing Section building steps are shown for both Fixed Gear and Retract installation. Decide which gear installation you want to go with, and use the appropriate building section.

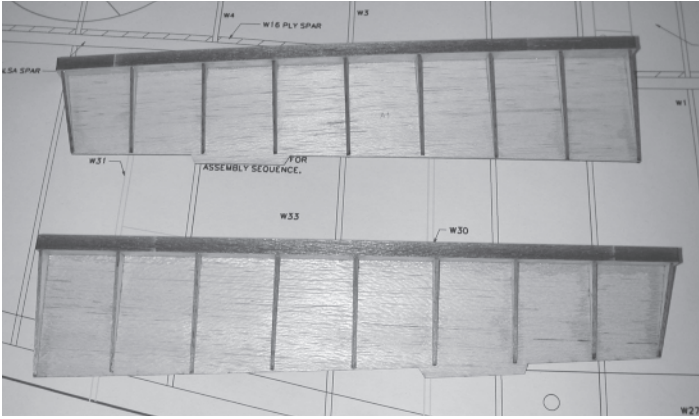
Some hardware and a motor mount are not included in the kit. There are so many choices for quality hardware that these choices are left to the individual preferences of the builder, rather than include something in the kit that you'll probably throw away anyway. A vibration-dampening motor mount is recommended for use regardless of engine choice, so select a mount suited to your particular engine.

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 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 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 shall have no liability for any and all additions, alterations, and modifications of this product.

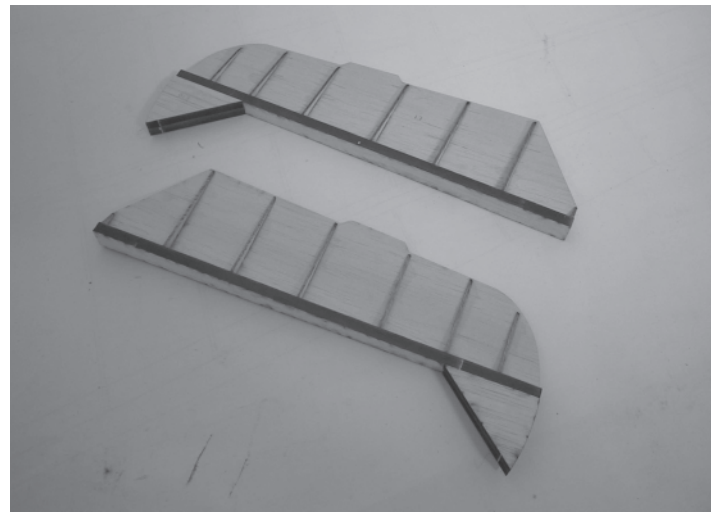
Having said that mouthful, turn the page and start building the best airplane on the market!



## Ailerons

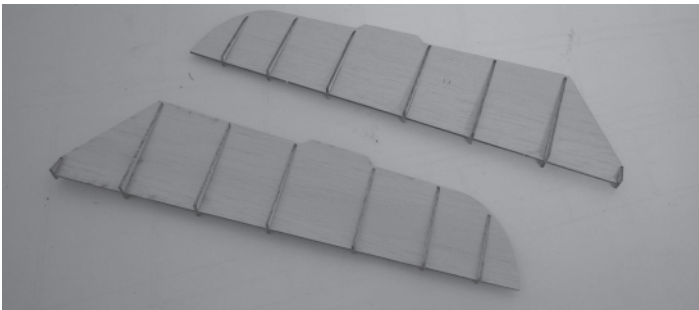


- ☐ 1. Glue A2 into the inner slot in A1.
2. Slide A3 thru A9 ribs into their slots in A1.
3. Glue A10 into the outer slot in A1.
4. Align the aileron assembly onto A11 and glue in place.
5. Glue ribs A3 thru A10 to A1 and A11.
6. Repeat for the opposite aileron. Set these assemblies aside for now.



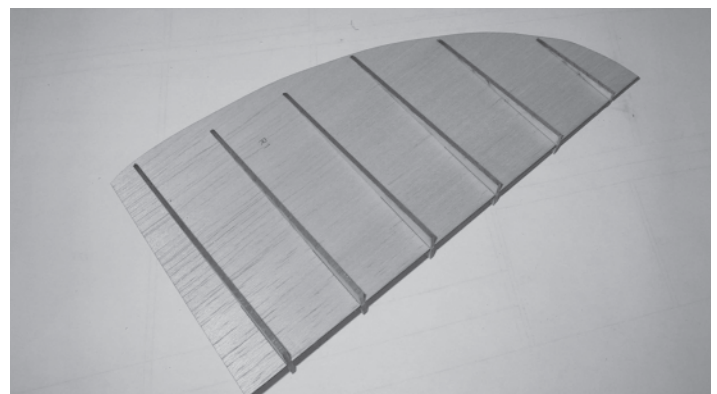
- ☐ 3. Align the elevator assembly onto E9 and glue in place.
4. Glue two E10s together. Align and glue the E10 counter balance to the front of E9.
5. Repeat for the opposite elevator. Set these assemblies aside for now. The elevators will be final shaped with the stab.

## Elevators

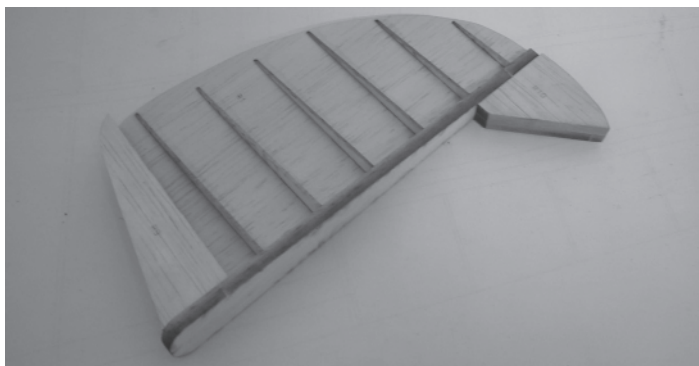


- ☐ 1. Glue E2 to the inner slot in E1.
2. Slide E3 thru E8 into the slots in E1.

## Rudder



- ☐ 1. Slide R2 thru R7 into the slots in R1.
2. Align this assembly onto R8 with the top of R1 even with the top edge of R8, and glue.
3. Glue the ribs to R1.

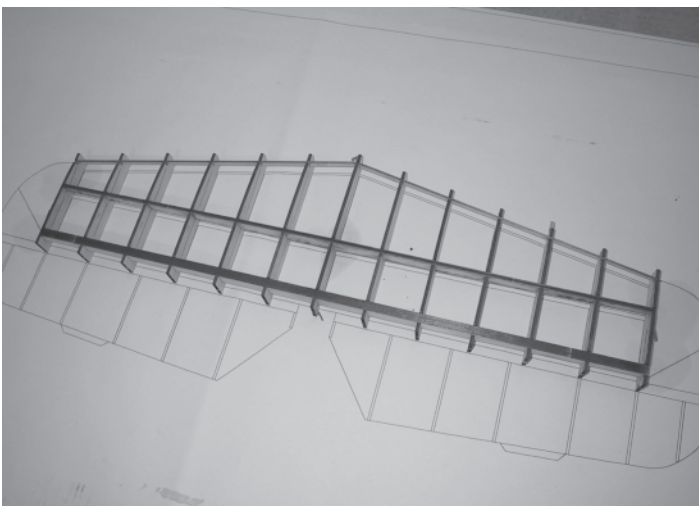


- ☐ 4. Glue 4 R9s together. Glue the R9s to the bottom of the rudder assembly.
- 5. Glue two R10s together. Glue the R10 counter balance to the front of R8.
- 6. Set this assembly aside for now. The rudder will be final shaped with the fin.

## Horizontal Stabilizer



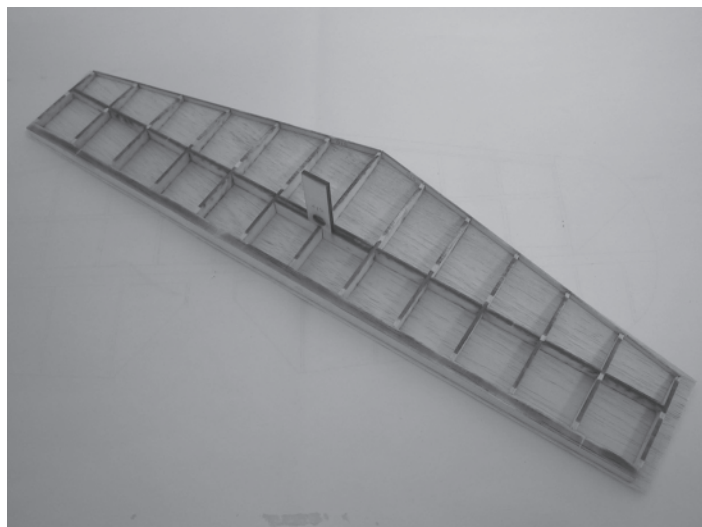
- ☐ 1. Slide S1 thru S6 into the slots in S8Ply Spar.



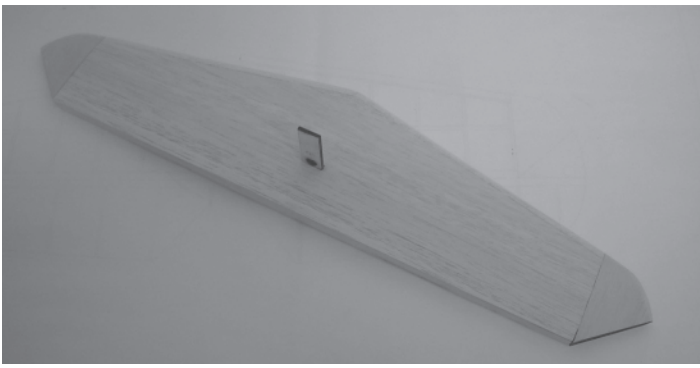
- ☐ 2. Carefully turn this assembly over and align on the plans. Pin the ribs in place.
- 3. Slide S7 ribs onto the ends of S8 and align. When you're satisfied with the alignment, glue the ribs to the spar.

**Note: The S12 Ply Stab Jig will mount to the back side of the S8 Ply Spar between the S2 ribs. When gluing S1 and the S2s, apply glue to the front part of the rib/spar joints only, so S12 will have a tight fit.**

- 4. Slide S9 into the rear slots in the rib jigs and glue in place. **Be sure not to glue the rear tabs to S9 - they will be removed later.**
- 5. Slide the S10s into the front slots in the rib jigs, align and glue in place. **Do not glue the front tabs to S10 - they will be removed later.**



- ☐ 6. Cut a 1/16 x 4 x 36 balsa sheet to 17". Make a small mark on the front edge of the center of this sheet. Cut a 4" long by 1" wide sheet from 1/16 balsa sheet and edge glue this to the center of the 17" sheet. Make two sheets.
- 7. Using your hobby knife, carefully remove the jig tabs in front of S10 and behind S9. It is only necessary to remove 1/8" or so of the tabs - they will prevent the sheeting from laying flush along the edges.
- 8. Sheet the top of the stabilizer.
- 9. Pull the stab from the board and carefully break off the jigs from the ribs. Lightly sand the ribs as necessary. Trim the sheeting along the stab leading edge, trailing edge, and tips.
- 10. Slide the S12 Ply Stab Jig into place between the S2 ribs behind and against the spar. Trim as necessary for a good fit and glue in place.
- 11. Using the remaining sheet made previously, mark the centerline of this sheet and measure 1.6 inches up from the trailing edge. Check this measurement against your stab assembly. At this point, cut a slot for S12 to pass through.

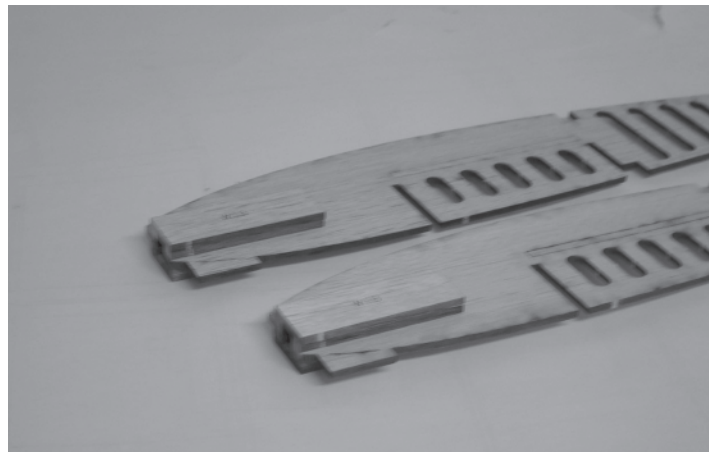


- ☐ 12. Sheet the bottom of the stabilizer.
- 13. Trim and sand the sheeting at the leading edge, trailing edge, and the rib ends.
- 14. Cut a leading edge for each side of the stab from 3/8 x 1/4 balsa. Glue these in place. Sand the ends flush with the ribs.
- 15. Glue two S11s together. Glue this assembly to the end of the stab. Repeat for the opposite side.
- 16. Sand the S11s flush with the stab sheeting and leading edge. Sand a round airfoil shape to the stab leading edge. Set this assembly aside.

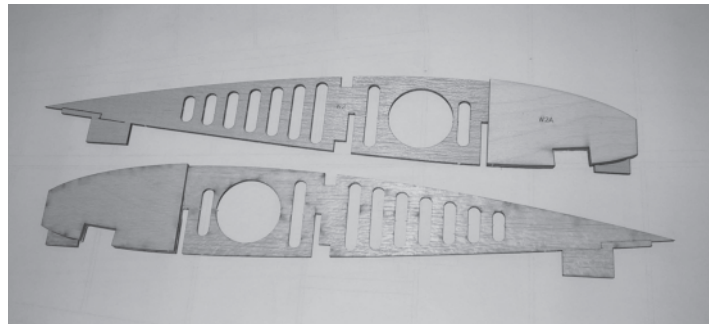
## Wing Construction - Fixed Gear

### Wing construction notes:

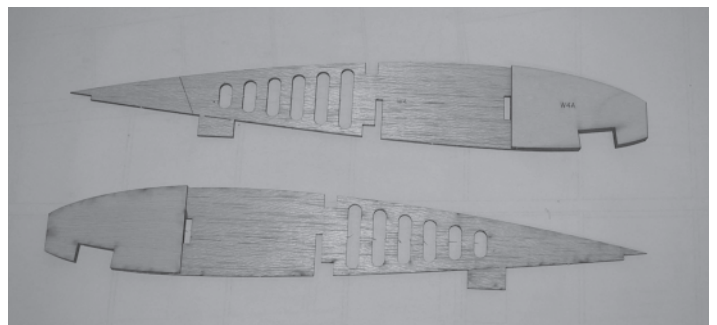
1. There are four possible wing construction combinations - fixed gear without flaps, fixed gear with flaps, retract gear without flaps, and retract gear with flaps. We have separated construction steps into the two most popular combinations, fixed gear without flaps, and retracts with flaps. If you wish to add flaps with fixed gear, study the Wing Construction (Retracts) section and note the changes for adding flaps.
2. The ailerons are actuated by separate servos in each wing. A single servo and bellcrank arrangement was not possible due to the scale gear location and main spar location. The servos will mount to the W10 wing rib and ply doubler and will be completely enclosed in the wing and accessible through a hatch. See the opening section of this manual for the lowdown on this construction technique.



- ☐ 1. Glue W1A to W1, aligning the slots.
- 2. Glue W1B on top of W1A.
- 3. Turn W1 over and repeat with W1A and W1B. This will create a pocket for the wing dowels. Repeat for the remaining W1.

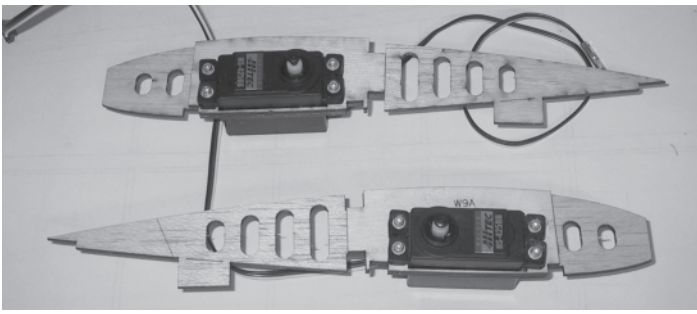


- ☐ 4. Epoxy W2A to W2. Repeat for the remaining W2. Make a left and right side.



- ☐ 5. Epoxy W4A to W4. Repeat for the remaining W4. Make a left and right side.

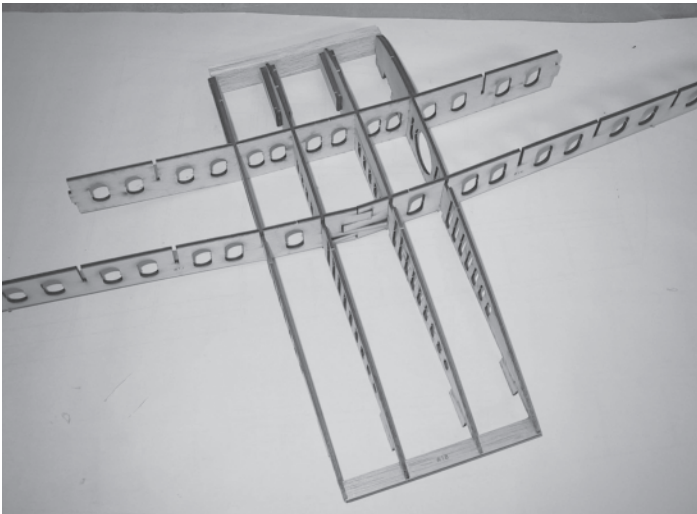




- ☐ 6. Epoxy W10A to W10. Repeat for the remaining W10. Make a left and right side.

7. Mount the aileron servo onto W9 and mark and drill small pilot holes for the screws.

8. Mount the servos to the ribs. Note that the servo arm will be located to the rear. Use hex head or button head #2 screws to mount the servos - this will allow servo removal using an Allen wrench if necessary after wing construction.



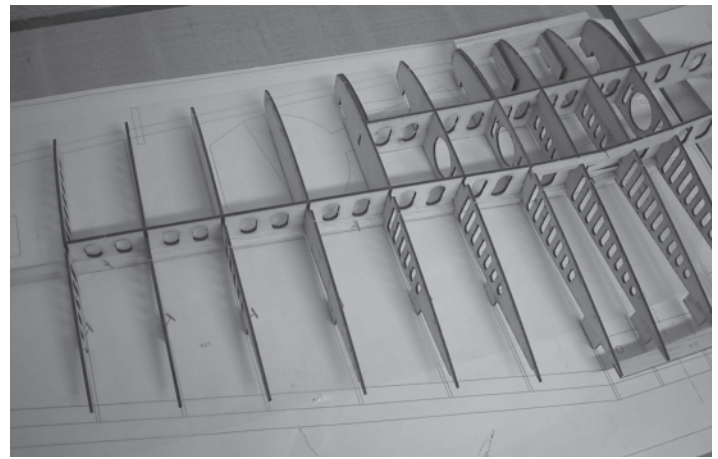
- ☐ 9. The wing center section will be assembled prior to pinning to the board. Do this by sliding both W1s into the center slots in W15. Then fit W16 and W17 together and slide into the slots in W1s. Slide W2s into the next slots, making sure that W2As face out-board. W16 and W17 are not left or right pieces, they can fit either way, but note that W16 and W17 are angled forward.

10. Align the center section with the plans and pin to the board. Glue all the pieces.

11. Cut a leading edge piece from 3/8 x 1 balsa and glue to the front of the ribs. Align so that there is a 1/16" ledge at the rib faces.

12. Glue W18 to the rib trailing edges.

13. Select 4 1/4 x 1/4 balsa sticks to use as spars. Cut a section from each one as a spar section between W2 and the wing center. Glue the top spars in place. Pull the center section from the board and glue the bottom spars in place.

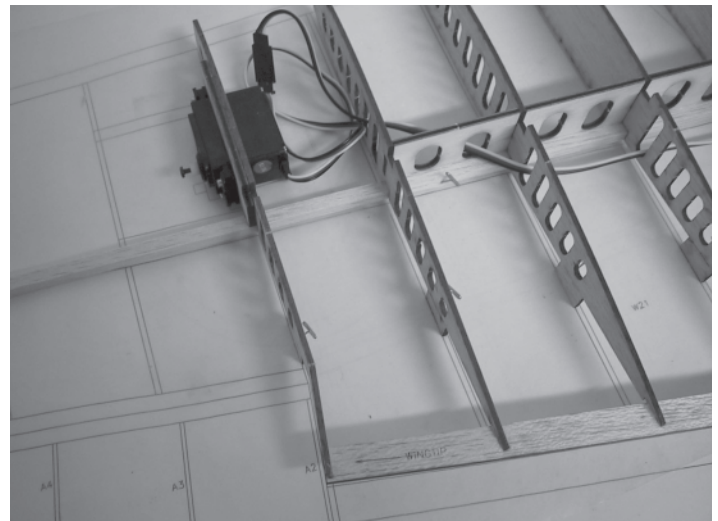


- ☐ 14. Using one of the previously cut spars, align and glue a 1/4 x 1/4 balsa spar to the left wing panel ply spar.

*Hint: Slide W7 rib into its slot in the spar to use as a guide for aligning the balsa spar. After gluing the spar, remove the rib.*

15. Align the wing center section at W2 on the plans and pin in place.

16. Slide ribs W3 thru W8 into their slots in the ply spar. Align and pin the ribs in place and glue.

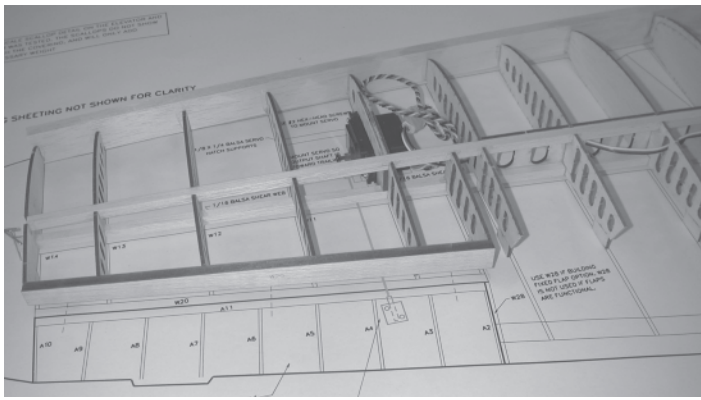


- ☐ 17. Score rib W9 at the vertical engraved line (not the angled line - that's for flap spar alignment) at the trailing edge and carefully bend the rib trailing edge to match the angle on the plans.

18. Glue W9 in place.

19. Align and glue W19 Trailing Edge into the slots in the rib trailing edges from W2 to W9.

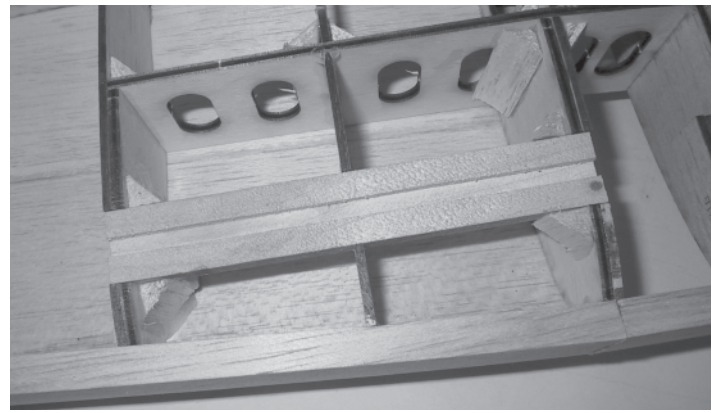
20. Run the servo leads through the holes in the ribs and spars.



- ☐ 21. Align and glue ribs W10 thru W14 in place.
- 22. Glue a  $\frac{1}{4} \times \frac{1}{4}$  balsa top spar to the ribs.
- 23. Align and glue the W20 Aileron Spar to the ribs from W9 to W14.
- 24. Sand the end of a  $\frac{3}{8} \times 1$  balsa leading edge to match the angle at W2, trim to length at W14 and glue in place.
- 25. Sand the top of W20 Aileron Spar to match the rib camber.



- ☐ 26. Cut three  $\frac{1}{16} \times 4 \times 36$  and one  $\frac{1}{16} \times 3 \times 36$  balsa sheets to 29". Edge glue these sheets.
- 27. Trim the sheeting to match the leading edge sweep angle.
- 28. The center section will not be sheeted until both outer wing panels are finished. Align the sheeting at rib W2 so as to minimize overlap and sheet the left wing panel.
- 29. Pull the wing from the board. Measure .5 inches aft of W19 and trim the sheeting trailing edge.
- 30. Trim and sand the sheeting at the tip, aileron bay, and flush with W2.
- 31. Bevel sand the sheeting at the trailing edge to match the rib lower camber.



- ☐ 32. Sand the "feet" off of the ply spar on the left wing panel.
- 33. Trim the gear block to fit from W2 to W4.
- 34. Trim the gear block anchor to fit under the gear block at W4. Epoxy the gear block and gear block anchor in place.
- Hint: Tri-stock may be added as shown to strengthen to gear block, and tri-stock may be added to the inner rib/spar joints for added strength.*
- 35. Carefully drill a  $\frac{3}{16}$ " hole in the gear block to match the slot in the gear block anchor at W4. Try not to drill through the wing sheeting!
- 36. Use leftover  $\frac{1}{16}$  balsa sheeting to make shear webs. Add shear webs to spars between W9 thru W14.
- 37. Glue  $\frac{1}{8} \times \frac{1}{4}$  balsa pieces into the slots in W9 and W10 as servo hatch supports.

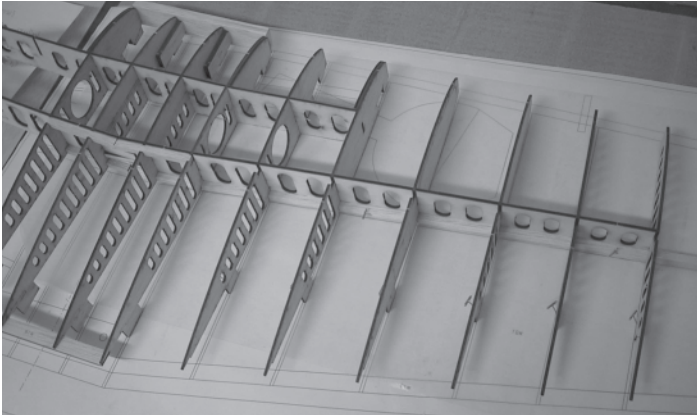


- ☐ 38. Cut three  $\frac{1}{16} \times 4 \times 36$  and one  $\frac{1}{16} \times 3 \times 36$  balsa sheets to 29". Edge glue these sheets.
- 39. Trim the sheeting to match the leading edge sweep angle.
- 40. The center section will not be sheeted until both outer wing panels are finished. Align the sheeting at rib W2 so as to minimize overlap and sheet the left wing panel bottom.
- 42. Trim and sand the sheeting at the tip, aileron bay, trailing edge and flush with W2.



43. Cut the sheeting from the gear wire slot.

44. Before opening up the servo hatch area, consider your finishing choices. If you plan to use a film covering, you may open the hatch area now. If you plan to fiberglass, wait until after wet sanding (to prevent water from entering the inner wing structure) to cut the hatch opening.

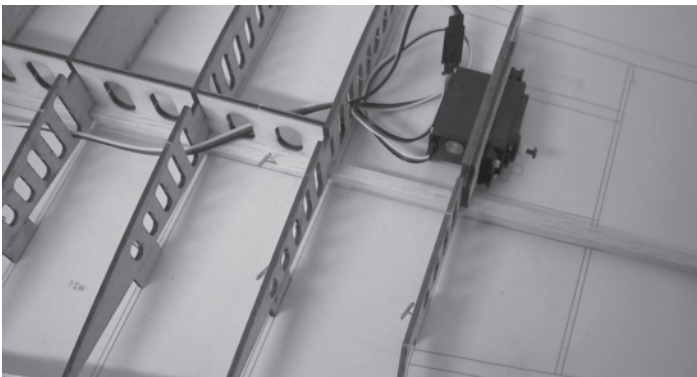


- ☐ 45. Using one of the previously cut spars, align and glue a  $\frac{1}{4} \times \frac{1}{4}$  balsa spar to the right wing panel ply spar.

*Hint: Slide W7 rib into its slot in the spar to use as a guide for aligning the balsa spar. After gluing the spar, remove the rib.*

46. Align the wing center section at W2 on the plans and pin in place. Block the left wing up to relieve the bending stress during construction.

47. Slide ribs W3 thru W8 into their slots in the ply spar. Align and pin the ribs in place and glue.

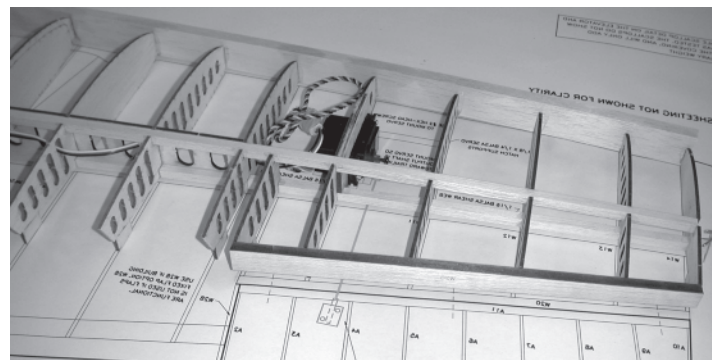


- ☐ 48. Score rib W9 at the vertical engraved line (not the angled line - that's for flap spar alignment) at the trailing edge and carefully bend the rib trailing edge to match the angle on the plans.

49. Glue W9 in place.

50. Align and glue W19 Trailing Edge into the slots in the rib trailing edges from W2 to W9.

51. Run the servo leads through the holes in the ribs and spars.



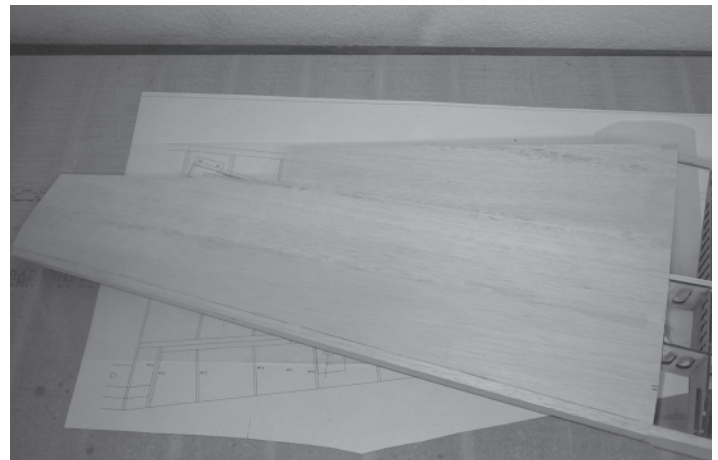
- ☐ 52. Align and glue ribs W10 thru W14 in place.

53. Glue a  $\frac{1}{4} \times \frac{1}{4}$  balsa top spar to the ribs.

54. Align and glue the W20 Aileron Spar to the ribs from W9 to W14.

55. Sand the end of a  $\frac{3}{8} \times 1$  balsa leading edge to match the angle at W2, trim to length at W14 and glue in place.

56. Sand the top of W20 Aileron Spar to match the rib camber.



- ☐ 57. Cut three  $\frac{1}{16} \times 4 \times 36$  and one  $\frac{1}{16} \times 3 \times 36$  balsa sheets to 29". Edge glue these sheets.

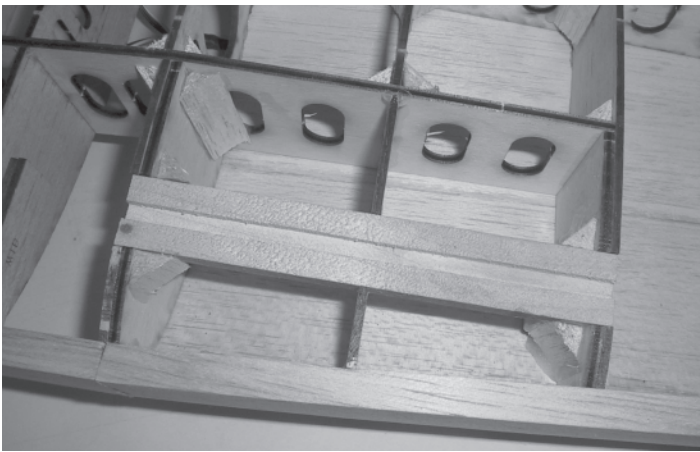
58. Trim the sheeting to match the leading edge sweep angle.

59. The center section will not be sheeted until both outer wing panels are finished. Align the sheeting at rib W2 so as to minimize overlap and sheet the right wing panel.

60. Pull the wing from the board. Measure .5 inches aft of W19 and trim the sheeting trailing edge.

61. Trim and sand the sheeting at the tip, aileron bay, and flush with W2.

62. Bevel sand the sheeting at the trailing edge to match the rib lower camber.



- ☐ 63. Sand the "feet" off of the ply spar on the left wing panel.

64. Trim the gear block to fit from W2 to W4.

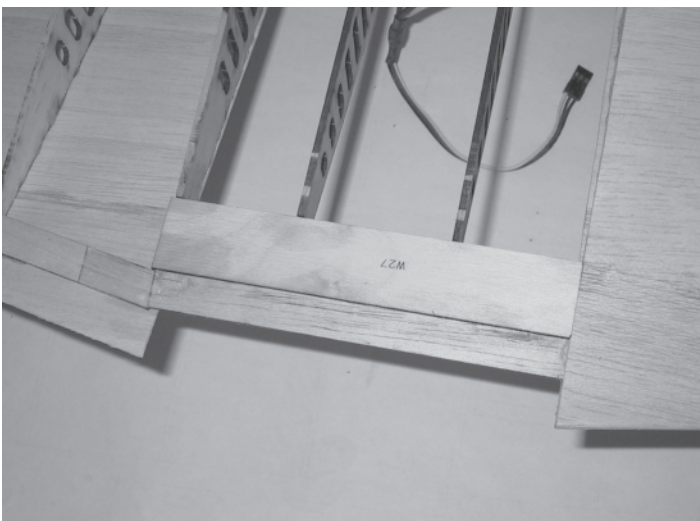
65. Trim the gear block anchor to fit under the gear block at W4. Epoxy the gear block and gear block anchor in place.

*Hint: Tri-stock may be added as shown to strengthen to gear block, and tri-stock may be added to the inner rib/spar joints for added strength.*

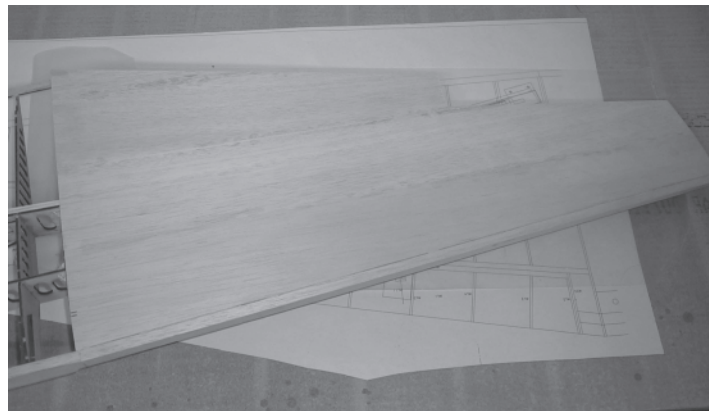
66. Carefully drill a 3/16" hole in the gear block to match the slot in the gear block anchor at W4. Try not to drill through the wing sheeting!

67. Use leftover 1/16 balsa sheeting to make shear webs. Add shear webs to spars between W9 thru W14.

68. Glue 1/8 x 1/4 balsa pieces into the slots in W9 and W10 as servo hatch supports.



- ☐ 69. Relieve the slots in W1 and W2, slide the W27 Ply Holddown Plate in the left side W2 and sheeting, align and glue.



- ☐ 70. Cut three 1/16 x 4 x 36 and one 1/16 x 3 x 36 balsa sheets to 29". Edge glue these sheets.

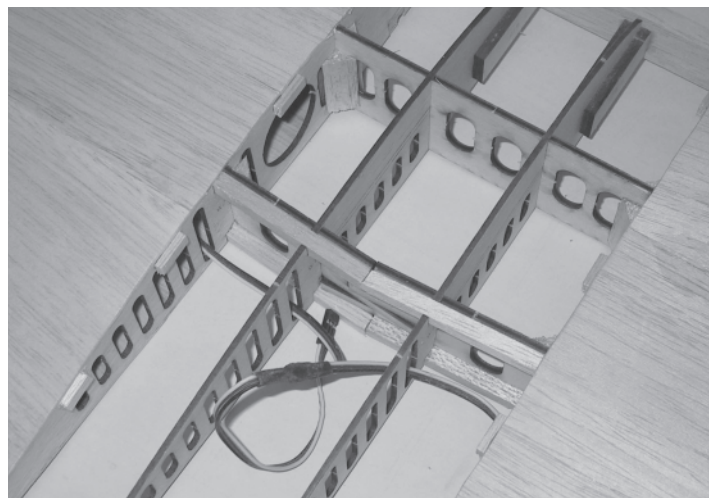
71. Trim the sheeting to match the leading edge sweep angle.

72. The center section will not be sheeted until both outer wing panels are finished. Align the sheeting at rib W2 so as to minimize overlap and sheet the right wing panel bottom.

73. Trim and sand the sheeting at the tip, aileron bay, trailing edge and flush with W2.

74. Cut the sheeting from the gear wire slot.

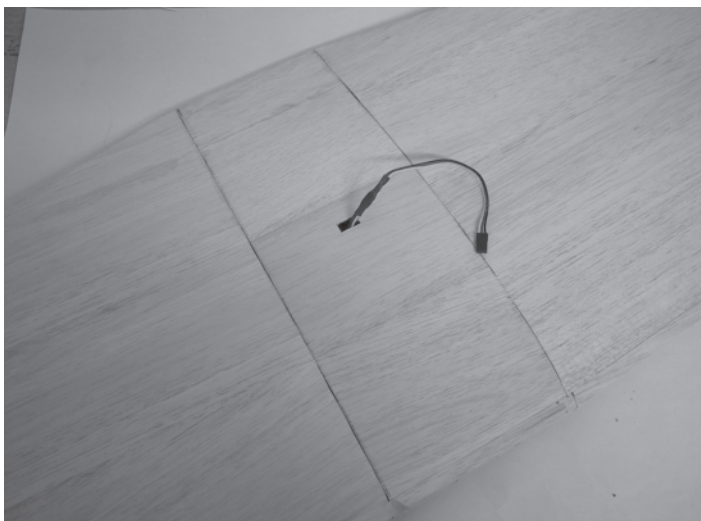
75. Before opening up the servo hatch area, consider your finishing choices. If you plan to use a film covering, you may open the hatch area now. If you plan to fiberglass, wait until after wet sanding (to prevent water from entering the inner wing structure) to cut the hatch opening.



- ☐ 76. Cut short (1/2") pieces of 1/8 x 1/4 balsa and glue along the inner edge of both W2s, top and bottom. The balsa pieces should be even with the edge of W2, not the sheeting. These pieces will act as stops for the center section sheets.

77. Locate and drill 1/4" holes in the leading edge for the dowels. You may insert the dowels now, but it will be easier to shape the leading edge first then insert the dowels.





- ☐ 78. Using the leftover 1/16 x 7" sheets from the wing sheets (you kept them, right?), Edge glue three 4" and one 3" sheets. Repeat this process to make top and bottom sheeting.

79. Trim the sheets to fit between the outer wing panels and sheet the top center section. Cut a slot in the sheet to allow for the servo Y-harness. Trim the trailing edge to match the outer panels and bevel sand the sheet to match the rib camber.

*Hint: To make trimming these sheets easier, dry fit the sheet to the wing and mark along the W2 ribs. Do this for the top and bottom sheets and cut along the marks.*

80. Sheet the bottom center section.

81. Trim the sheeting at the trailing edge.

82. Sand the leading edge to shape.

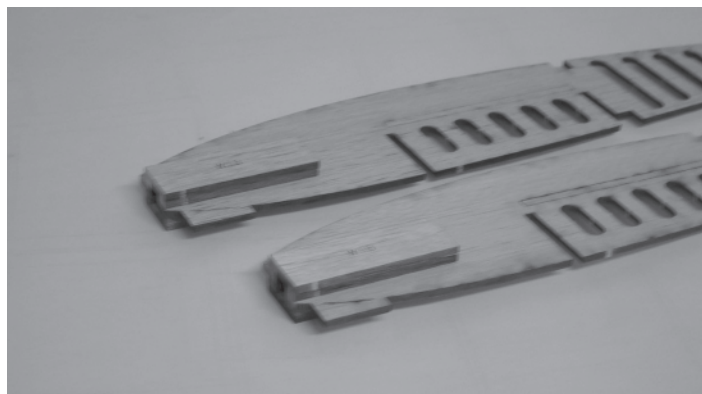
83. Glue the wingtips in place and sand to shape.

## Wing Construction - Retracts

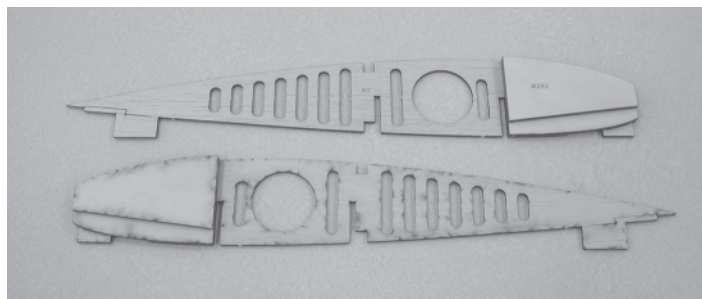
### Wing construction notes:

1. There are four possible wing construction combinations - fixed gear without flaps, fixed gear with flaps, retract gear without flaps, and retract gear with flaps. We have separated construction steps into the two most popular combinations, fixed gear without flaps, and retracts with flaps. If you do not want functional flaps, study the Wing Construction (Fixed Gear) section and note the changes.

2. The ailerons and flaps are actuated by separate servos in each wing. A single servo and bellcrank arrangement was not possible due to the scale gear location and main spar location. The aileron servos will mount to the W10 wing rib and ply doubler and will be completely enclosed in the wing and accessible through a hatch. The flap servos will mount to the W5 wing rib and ply doubler. Note that the flap servos will be mounted in the same direction for proper actuation. See the opening section of this manual for the lowdown on this construction technique.

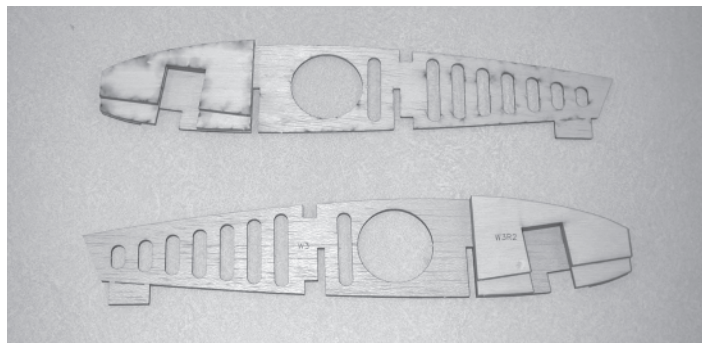


- ☐ 1. Glue W1A to W1, aligning the slots.  
2. Glue W1B on top of W1A.  
3. Turn W1 over and repeat with W1A and W1B. This will create a pocket for the wing dowels. Repeat for the remaining W1.



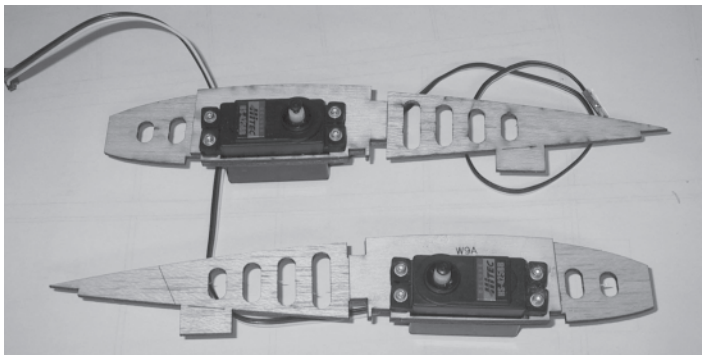
- ☐ 4. Epoxy W2R1 to W2. Repeat for the remaining W2. Make a left and right side.  
5. Epoxy W2R2 to W2R1, aligning the upper edge to properly position the part. Repeat for the remaining W2.

**Note: W2R1 is designed to reinforce the wing structure surrounding the retract area. W2R2 is designed to provide a "shoulder" for the retract plate to sit on and to properly set the retract plate geometry. We feel that this retract mounting method provides much more inherent strength than a "rail" mounting method because it spreads impact loads over a much greater area, rather than concentrating them at the ends of the rails.**



- ☐ 6. Epoxy W3R1 to W3. Repeat for the remaining W3. Make a left and right side.  
7. Epoxy W3R2 to W3R1, aligning the upper edge to properly position the part. Repeat for the remaining W3.





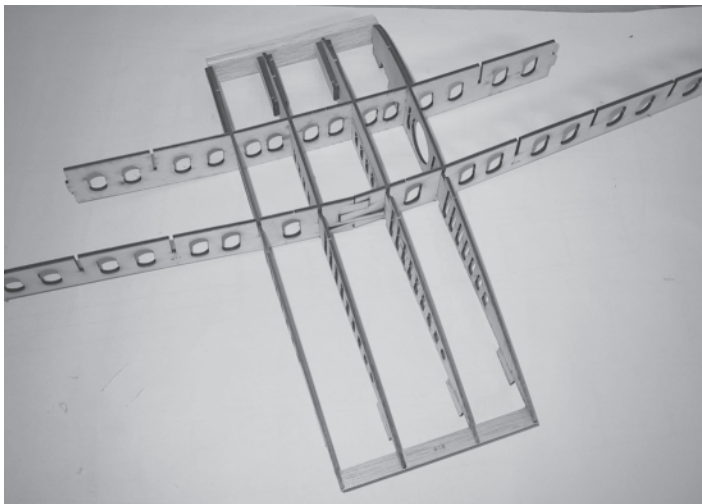
- ☐ 8. Epoxy W10A to W10. Repeat for the remaining W10. Make a left and right side.

9. Mount the aileron servo onto W10 and mark and drill small pilot holes for the screws.

10. Mount the servos to the ribs. Note that the servo output shaft will be located to the rear. Use hex head or button head #2 screws to mount the servos - this will allow servo removal using an Allen wrench if necessary after wing construction.

11. Both left and right side flap servos must face the same direction for proper flap actuation. Epoxy W5A to W5. Repeat for the remaining W5A and W5, but make two identical pieces, NOT a left and right side.

12. Mount the flap servos as you did with the aileron servos, except to mount the servos with the servo output shaft towards the front.



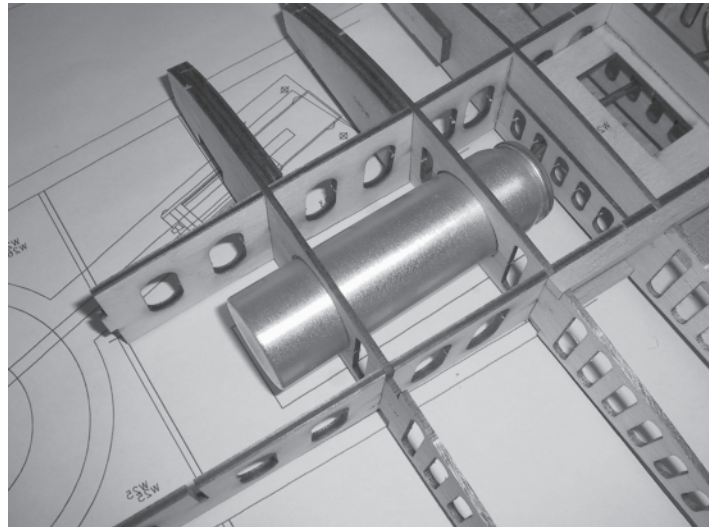
- ☐ 13. The wing center section will be assembled prior to pinning to the board. Do this by sliding both W1s into the center slots in W15. Then fit W16 and W17 together and slide into the slots in W1s. Slide the W24 Servo Tray into the slots in W1s. Slide W2s into the next slots, making sure that W2R/W2R2s face outboard. W16 and W17 are not left or right pieces, they can fit either way, but note that W16 and W17 are angled forward.

14. Align the center section with the plans and pin to the board. Glue all the pieces.

15. Cut a leading edge piece from 3/8 x 1 balsa and glue to the front of the ribs. Align so that there is a 1/16" ledge at the rib faces.

16. Glue W18 to the rib trailing edges.

17. Select four 1/4 x 1/4 balsa sticks to use as spars. Cut a section from each one as a spar section between W2 and the wing center. Glue the top spars in place. Pull the center section from the board and glue the bottom spars in place.



- ☐ 18. If you are installing functional flaps, cut the rib trailing edge pieces off of ribs W3 thru W8 at the engraved line.

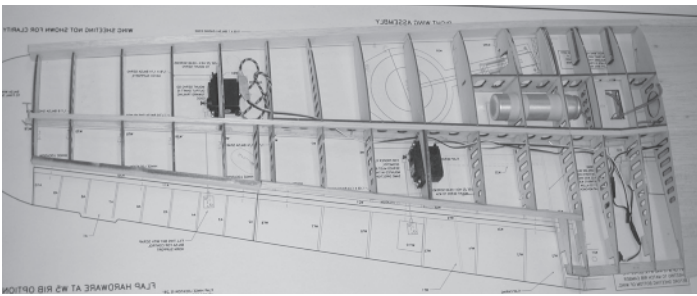
19. Glue one of the 1/4 x 1/4 balsa spars to the left side Ply Spar from W2 outboard. You may temporarily slide W7 rib into the spar to aid alignment of the balsa spar.

20. Align the wing structure to the Left Wing Construction area of the plans and pin in place. Note that the balsa spar will not lay flat on the plans toward the wingtip.

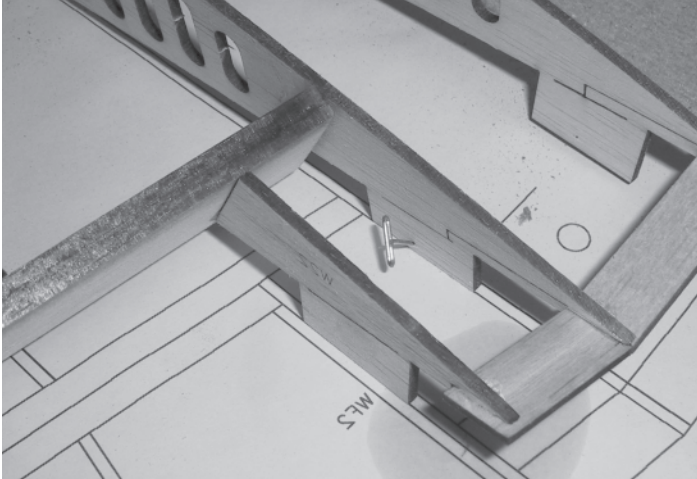
21. Slide W3 into the slots in the Ply Spars and glue. Make sure that the retract supports face inboard.

22. If you are using Springair retracts, prepare the air tank by adding a 3" piece of air line to the tank. Slide the tank into the holes in W2 and W3 and glue.

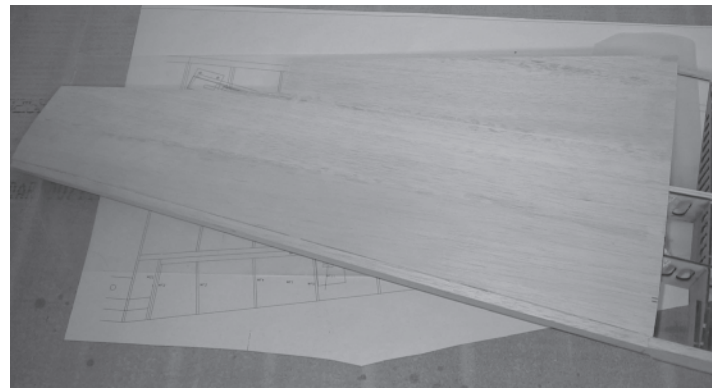
**Note: Since Springairs only use air to bring the gear up, they have a smaller air requirement, thus smaller air tanks. Most other retract air tanks will not fit inside the wing structure and will have to be mounted in the fuselage.**



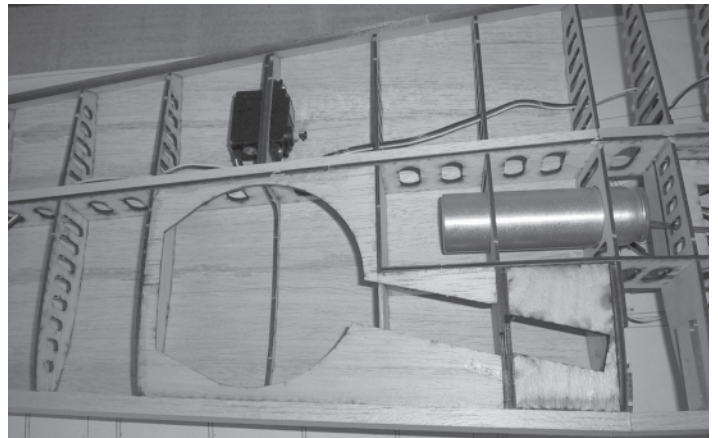
- ☐ 23. Slide W4 into the spar slots and glue.
24. Slide W5 into the spar slots and glue. Thread the servo leads through the rib holes to the center.
25. Slide W6, W7, and W8 into the spar slots and glue. Glue the W9 half rib in place.
26. Glue the left side W10 (output shaft facing towards wingtip) to the balsa spar. Attach a servo extension to the lead and thread through the holes in the ribs.
27. Glue ribs W11 thru W14 to the balsa spar.
28. Glue the upper  $\frac{1}{4} \times \frac{1}{4}$  balsa spar into the slots in the ribs.
29. Sand the end of a  $\frac{3}{8} \times 1$  balsa leading edge to match the angle of the center section leading edge. Glue the leading edge to the ribs.



- ☐ 30. Trim W21 Flap Spar so it fits against ribs W3 thru W8 and between W2 and W9. Align W20 Aileron Spar with ribs W9 thru W14 and glue in place.
31. Align W21 so that the bottom edge of the spar is even with the bottom edge of the ribs, glue the spar in place.
32. Align W22 on the plans and glue to W21 Flap Spar.
33. Cut W19 at the engraved line and glue to W22 and W2.
- 33A. Bevel W21 and W22 flush with the upper rib camber.



- ☐ 34. Cut three  $\frac{1}{16} \times 4 \times 36$  balsa sheets to 27". Edge glue these sheets. Edge glue one of the leftover 9" sheets to the bottom corner. Sand the sheets. Make three additional sheets in the same manner for the rest of the wing surface.
35. Align the sheet on the wing structure so that the end slightly overlaps the W2 rib. Mark the point at the tip for the leading edge of rib W14 and trim the sheet to match the leading edge taper.
- Note: The outer wing panels will be sheeted prior to sheeting the center section. The outer wing sheeting will be trimmed flush with W2.**
36. Sheet the upper left wing panel.
37. Remove the wing from the board. Measure .5 inches aft of W19 and cut the trailing edge sheeting at this line. Bevel the edge of the sheeting to match the lower rib camber.
38. Trim the sheeting at the tip, the aileron bay and the flap bay.



- ☐ 39. Remove the left side rib jig tabs. Make sure the tabs on the right side stay secure.
40. Sand the "feet" off the ply spars.
41. Add  $\frac{1}{16}$ " balsa shear webs to the spars outboard of W8 to the tip. Align the grain of the wood vertically.
42. Epoxy W23 retract plate into the cavity between W2 and W3.

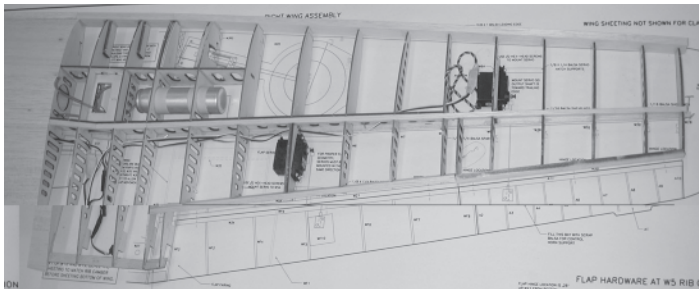


43. Remove the wheel well cutout from rib W5. Trim the W4 and W5 ribs at the engraved lines.
44. Fit W25 and W26 wheel well patterns flush with the spars and ribs between W3 and W6, and glue in place.
45. Add  $\frac{1}{4} \times \frac{1}{8}$  balsa sticks to the cutouts in W10 and W11 as servo hatch supports.
46. Add  $\frac{1}{4} \times \frac{1}{8}$  balsa sticks in the same manner to rib W5 and either W6 or W4 (corresponding with servo location) to act as hatch supports. These should fit between the ribs and butt against the spar & W21.
47. You may mount and test fit the retract unit now, or you may wait until after wing construction, but run a length of air line from the retract bay to the W24 Servo Tray area now.
48. Bevel W20 & W21 to match the lower rib camber. Lightly sand down any high spots on the wing structure.
49. Align one of the (previously made) wing sheets with the wing surface, trim the sheet to match the leading edge taper, and sheet the lower wing surface.

*Hint: Mark the servo bays during sheeting to more easily find them later.*

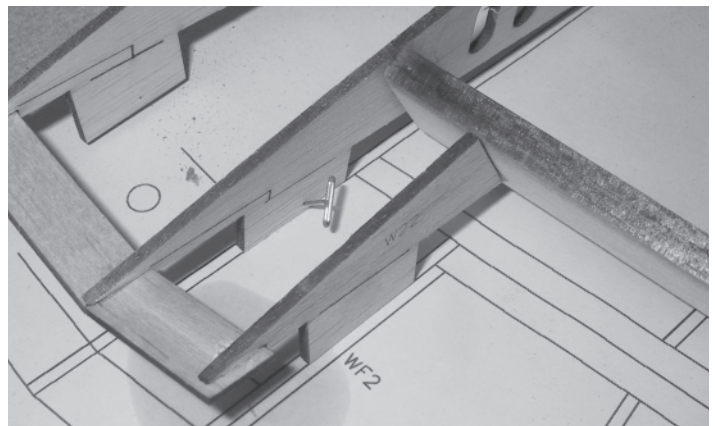
50. Trim and sand the sheeting at the wingtip, aileron and flap bays, and at the W2 rib.

**Note: We prefer as a building and finishing technique to leave the wing closed (hatches and wheel wells not opened up) if you are fiberglassing the wing. This will prevent water from wet sanding from entering the wing interior.**

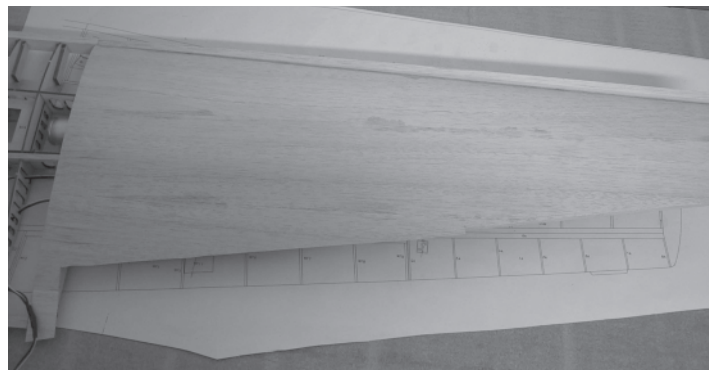


- ☐ 51. If you are installing functional flaps, cut the rib trailing edge pieces off of the right side ribs W3 thru W9 at the engraved line.
52. Glue one of the  $\frac{1}{4} \times \frac{1}{4}$  balsa spars to the right side Ply Spar from W2 outboard. You may temporarily slide W7 rib into the spar to aid alignment of the balsa spar.
53. Align the wing structure to the Right Wing Construction area of the plans and pin in place. Note that the balsa spar will not lay flat on the plans toward the wingtip.
54. Slide W3 into the slots in the Ply Spars and glue. Make sure that the retract supports face inboard.

55. Slide W4 into the spar slots and glue.
56. Slide W5 into the spar slots and glue. Thread the servo leads through the rib holes to the center.
57. Slide W6, W7, and W8 into the spar slots and glue.
- 57A. Glue the W9 Half Rib in place
58. Glue the left side W10(output shaft facing towards wingtip) to the balsa spar. Attach a servo extension to the lead and thread through the holes in the ribs.
59. Glue ribs W11 thru W14 to the balsa spar.
60. Glue the upper  $\frac{1}{4} \times \frac{1}{4}$  balsa spar into the slots in the ribs.
61. Sand the end of a  $\frac{3}{8} \times 1$  balsa leading edge to match the angle of the center section leading edge. Glue the leading edge to the ribs.



- ☐ 62. Trim W21 Flap Spar so it fits against ribs W3 thru W8 and between W2 and W9. Align W20 Aileron Spar with ribs W9 thru W14 and glue in place.
63. Align W21 so that the bottom edge of the spar is even with the bottom edge of the ribs, glue the spar in place.
64. Align W22 on the plans and glue to W21 Flap Spar.
65. Cut W19 at the engraved line and glue to W22 and W2.
- 65A. Bevel W21 and W22 flush with the upper rib camber.

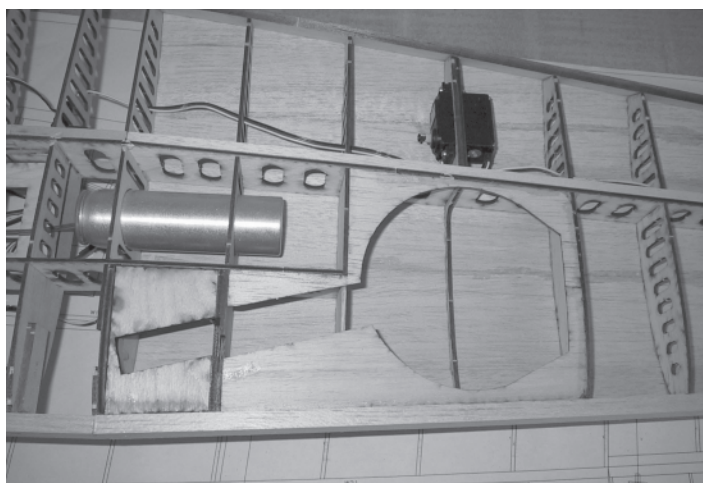


- ☐ 66. Using one of the previously made wing sheets, align the sheet on the wing structure so that the end slightly overlaps the W2 rib. Mark the point at the tip for the leading edge of rib W14 and trim the sheet to match the leading edge taper.

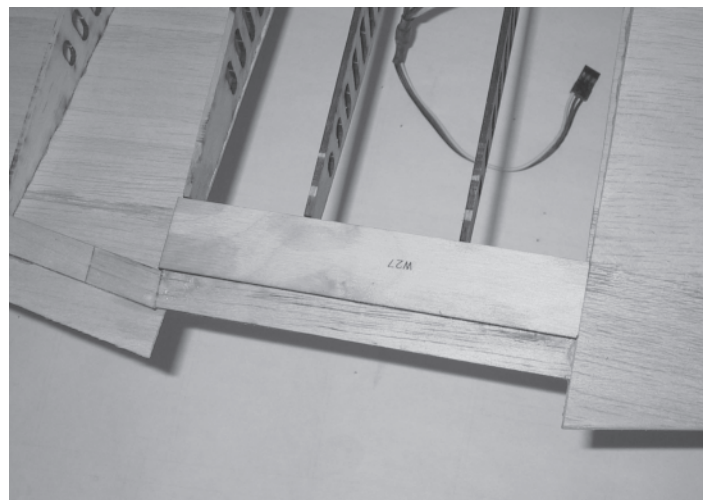


**Note: The outer wing panels will be sheeted prior to sheeting the center section. The outer wing sheeting will be trimmed flush with W2.**

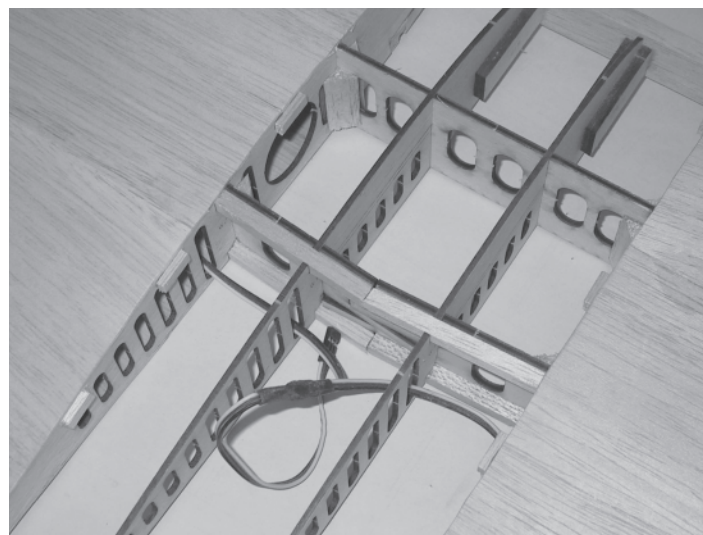
67. Sheet the upper right wing panel.
68. Remove the wing from the board. Measure .5 inches aft of W19 and cut the trailing edge sheeting at this line. Bevel the edge of the sheeting to match the lower rib camber.
69. Trim the sheeting at the tip, the aileron bay and the flap bay.



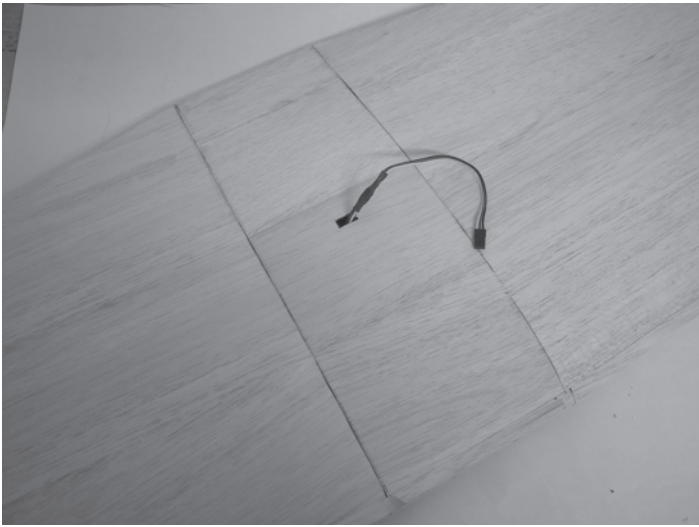
- ☐ 70. Remove the left side rib jig tabs. Make sure the tabs on the right side stay secure.
71. Sand the "feet" off the ply spars.
72. Add 1/16" balsa shear webs to the spars outboard of W8 to the tip. Align the grain of the wood vertically.
73. Epoxy W23 retract plate into the cavity between W2 and W3.
74. Remove the wheel well cutout from rib W5. Trim the W4 and W5 ribs at the engraved lines.
75. Fit W25 and W26 wheel well patterns flush with the spars and ribs between W3 and W6, and glue in place.
76. Add 1/4 x 1/8 balsa sticks to the cutouts in W9 and W10 as servo hatch supports.
77. Add 1/4 x 1/8 balsa sticks in the same manner to rib W5 and either W6 or W4 (corresponding with servo location) to act as hatch supports.
78. You may mount and test fit the retract unit now, or you may wait until after wing construction, but run a length of air line from the retract bay to the W24 Servo Tray area now.



- ☐ 79. Remove the cutouts from the trailing edges of W1 and W2 for the W27 Wing Holddown Plate. Slide W27 into the slots (and under the left wing sheeting) and glue in place.
  80. Lightly sand down any high spots on the wing structure.
  81. Align one of the (previously made) wing sheets with the wing surface, trim the sheet to match the leading edge taper, and sheet the lower wing surface.
- Hint: Mark the servo bays during sheeting to more easily find them later.*
82. Trim and sand the sheeting at the wingtip, aileron and flap bays, and at the W2 rib.



- ☐ 83. Cut short (1/2") pieces of 1/8 x 1/4 balsa and glue along the inner edge of both W2s, top and bottom. The balsa pieces should be even with the edge of W2, not the sheeting. These pieces will act as stops for the center section sheets.
84. Locate and drill 1/4" holes in the leading edge for the dowels. You may insert the dowels now, but it will be easier to shape the leading edge first then insert the dowels.



- ☐ 85. Using the leftover 1/16 x 7" sheets from the wing sheets (you kept them, right?), Edge glue three 4" and one 3" sheets. Repeat this process to make top and bottom sheeting.

86. Trim the sheets to fit between the outer wing panels and sheet the top center section. Cut a slot in the sheet to allow for the servo Y-harness. Trim the trailing edge to match the outer panels and bevel sand the sheet to match the rib camber.

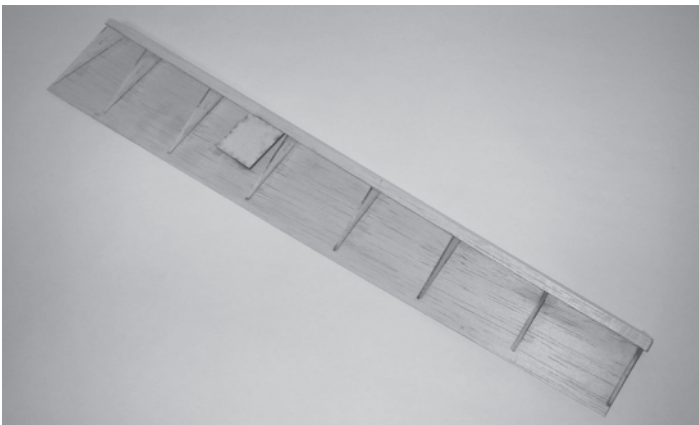
*Hint: To make trimming these sheets easier, dry fit the sheet to the wing and mark along the W2 ribs. Do this for the top and bottom sheets and cut along the marks.*

87. Sheet the bottom center section.

88. Trim the sheeting at the trailing edge.

89. Sand the leading edge to shape.

90. Glue the wingtips in place and sand to shape.



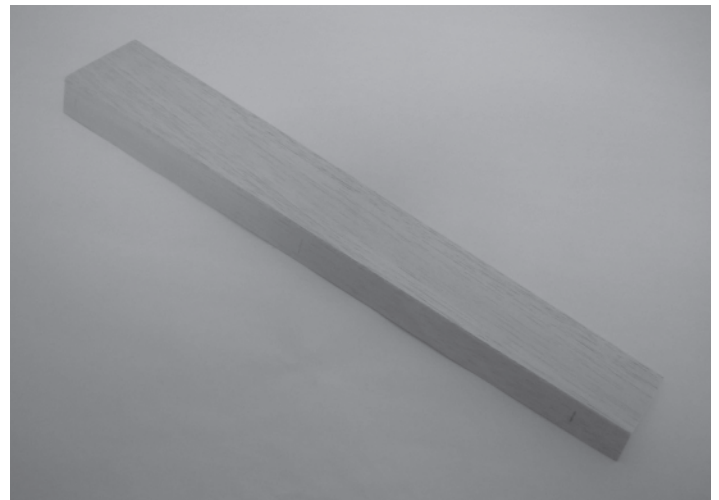
- ☐ 91. Glue the Wf2 thru Wf8 Flap ribs into the slots in Wf1 (there is a left and right side Wf1).
92. Glue Wf9 Flap Leading Edge to the ribs, aligning Wf9 so there will be excess material on both sides of the ribs.

93. Sand the sides of Wf9 flush with the ribs. Sand the bottom of Wf9 flush with Wf1. Bevel sand the trailing edge of Wf1 to match the rib camber.

94. Test fit the flap and align mark the flap control horn location. Glue Wf10 into the open bay corresponding to this mark.

95. If you wish to hide the flap control horns as shown on the plans, mount the 1/2A Control horn now. Relieve the flap leading edge as necessary for the control horn and clevis.

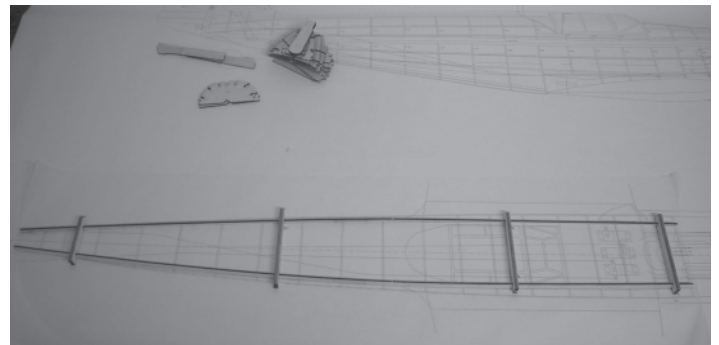
96. Sand the top of Wf9 flush with the rib tops.



- ☐ 97. Sheet the top of the flap with 1/16 x 4 balsa sheet. Sand the sheeting at the trailing edge, leading edge, and sides.

98. Repeat these steps for the remaining flap.

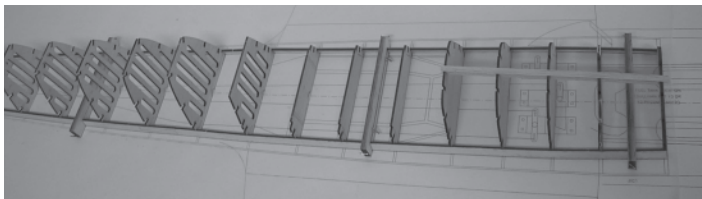
## Fuselage Assembly



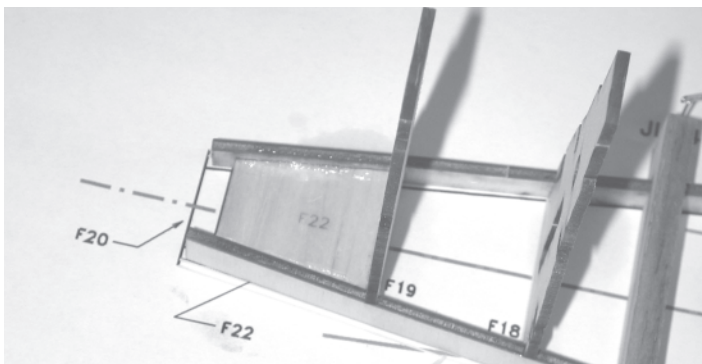
- ☐ 1. Assemble and glue F21A and F21B together. Assure that the assembly is straight. Make two pieces - these will act as the fuselage "crutch".
2. Align the F21 assemblies on the plans with the front edges even with the F1 bulkhead location and slide Jig 1 thru Jig 4 over the crutch as indicated on the plans. Pin the jigs in place outside the crutch.



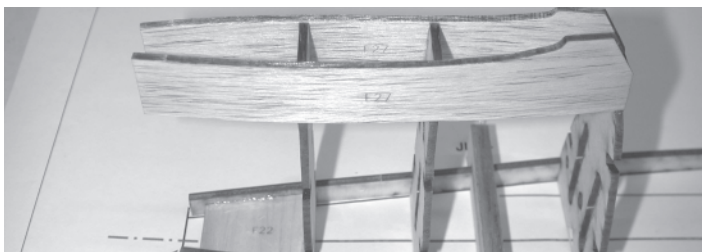
**Note:** The jigs are designed to place a “twist” in the crutch to follow the bulkhead contour. The jigs should stay in place during construction until about halfway through stringer attachment. The jigs are designed to be “twisted” off, breaking away to top portion while leaving the inner portion to be removed after sheeting.



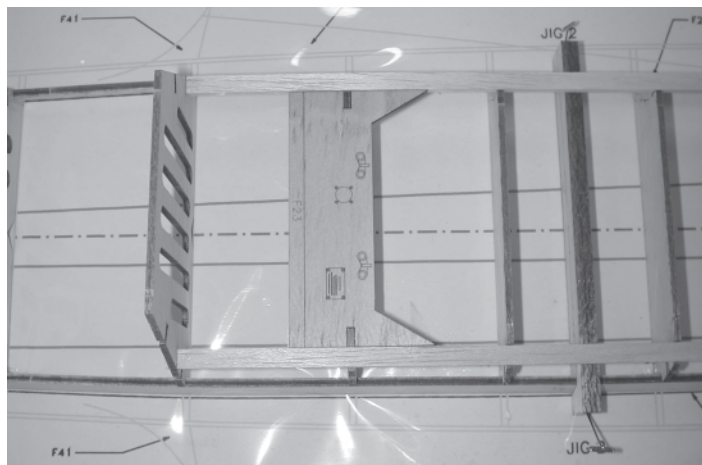
- ☐ 3. Glue F1A to the crutch. There will be a slight amount of pressure on these joints while the remaining bulkheads are placed, so ensure a good glue joint.
4. Glue F2A, F3A, F4A and F5A to the crutch in sequence.
5. Glue F6A thru F8A in place. Leave the centers of these bulkheads intact. (the centers of these bulkheads will be removed, but not until cockpit assembly). Make sure the engraved side of F8A faces forward.
6. Glue F9A thru F14A to the crutch in sequence.
7. Glue F15A thru F19 to the crutch. Note that these bulkheads have pushrod holes in them. The pushrod holes are duplicated so that the bulkhead may be reversed without consequence.



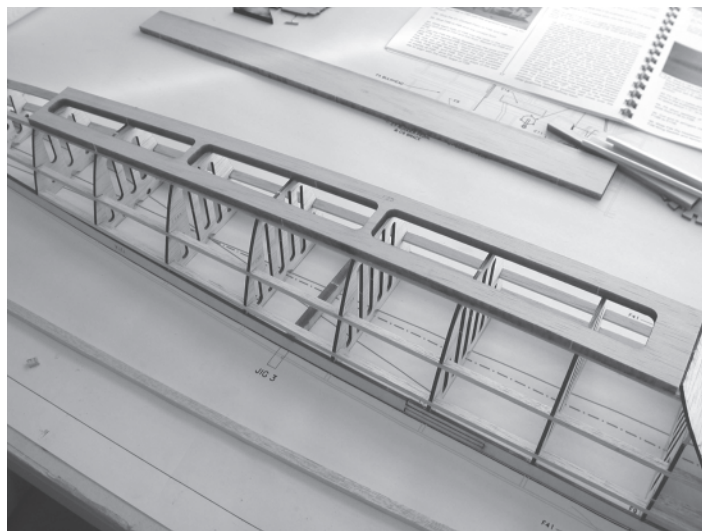
- ☐ 8. Slide F22 inside the crutch, flat on the board, and butt against the rear of the F19 bulkhead. Glue in place (a portion of the crutch will be sanded away to contour the fuselage after sheeting, so F22 will support this area).



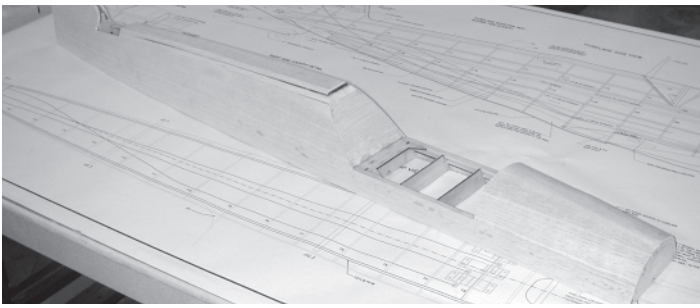
- ☐ 9. Soak the F27 Stab Saddles in water or a water/ammonia mix. Form the F27s to fit into the notches in F17A, F18, and F19. Align the front of the saddles with F17A and glue in place.



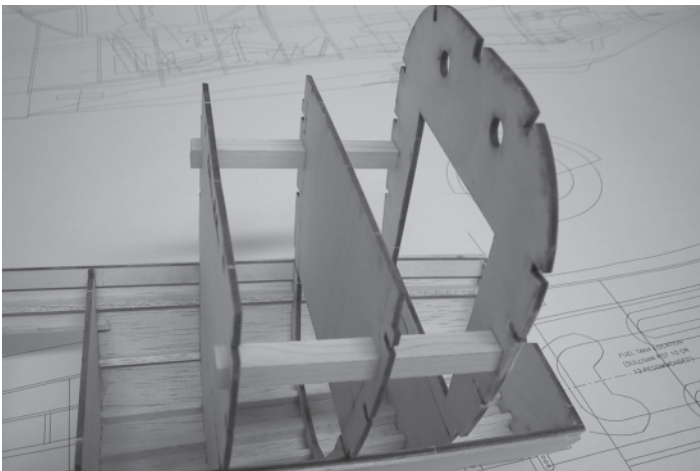
- ☐ 10. Test fit F20 to the rear of the fuselage. The rounded bottom of F20 will butt against F22, but the crutch will not fully contact F20. This is normal. Trim F20 as necessary if the crutch is too long.
11. Align F20 vertically with the board. Do not align the notches in F20 with the ends of the stab saddles - the saddles are slightly longer to allow for trimming. Glue F20 to F22 and the F27s.
12. Cut two pieces of 1/8 x 1/4 balsa stringer to fit between the horizontal slots in F5A and F9A. Glue these to F5A thru F9A.
13. Cut a piece of 1/4 x 1/4 balsa to fit in the upper slots in F1A thru F5A. Glue in place.
14. Fit F23 into the slots in F8A level with the stringers with the engraved line facing aft and glue.
15. Bevel the bottom edge of F24 to fit flush against F23 with F24 laying back touching F9A. Align F24 with the stringers and the engraved line on F23. Glue to F23 and F9A. Remove top of jigs 1-4 now.



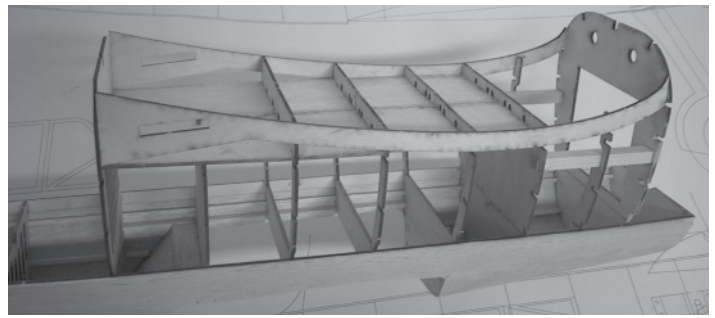




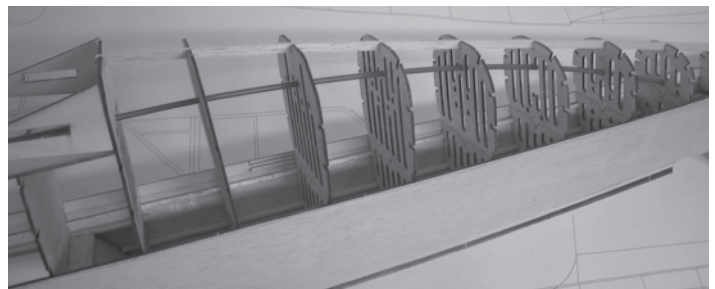
- ☐ 16. Fit a 1/8 x 1/4 balsa stringer into the lowest slots in the bulkheads from F16A to F1A. Glue in place. Repeat for the other side.
17. Lay the second row of stringers in place, butting against F20 to butt against F24, and from F5A to F1A. Glue in place. Repeat for the other side.
18. Lay the third row of stringers in place, butting against F20 to butt against F24, and from F5A to F1A. Glue in place. Repeat for the other side.
19. Select similar grain sheets of 1/16 x 4 x 48. Lay these sheets against the fuselage sides. Trim the bottom edge as necessary. Sheet the upper fuselage. Wetting the sheets will help when making the curve of the forward fuselage. The sheets may crack at the fuse juncture around F17A. This is normal and will be smoothed with filler later.
20. Trim and sand the sheeting even with the top stringer from F24 to F16A.
21. Glue F25 to the fuselage top, making sure the back edge is even with F16A.
22. Sand F25 to match the fuselage taper.
23. Align and glue F26 to F25.
24. Remove the fuselage from the board. Trim and sand the sheeting at F1A, F20, and the cockpit area.



- ☐ 25. Align and glue F2B, F3B and F4B to the fuselage bottom (if the center of F3B falls out, tape the pieces together until after assembly).
26. Cut two sections of 3/8 x 3/8 maple to fit in the slots in the bulkheads. Slide the maple rails in place but do not glue yet.



- ☐ 27. Glue F8B to F8A with the engraved side facing forward.
28. Glue the C1 Cockpit Floor to F4B and F8B.
29. Glue F9B to F9A and the cockpit floor.
30. Slide each side of F5B into the slots in the cockpit floor and glue to F5A and the floor. Repeat for F6B and F7B.
31. Lay the F28 Ply Wing Saddles into the slots in F6B and F7B, and against F9B (the assembly will be straight at F9B, but F2B may not be - that's why you didn't glue the rails yet...or did you?). Glue the F28 saddles to F6B, F7B and F9B. Work forward and glue the saddles to F5B, F4B, F3B, and F2B. The saddles will squeeze in slightly at F2B - glue the inner top edge of the saddle to align with the outer edge of F2B.
32. Glue the maple rails in place.
33. Remove the center of F3B.



- ☐ 34. Align and glue bulkheads F10B thru F17B to their respective matching upper halves.

**Note: Even though the pushrods must locate to specific sides, the pushrod holes are duplicated to prevent getting a bulkhead reversed.**

35. Glue a 1/4 x 1/4 balsa stick into the slots in the F9B thru F17B bulkheads.
36. Align and glue the F1B bulkhead to F1A.
37. Glue a 1/4 x 1/4 balsa stick into the slots in F1B and F2B.

*Hint: to align F1B and F1A easily, first glue F1B in place. Then glue the 1/4 x 1/4 keel to F2B only. Place a straight-edge along F1A and F1B and adjust F1B, then glue the keel in place.*