



The ME109 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 ME109 was produced in greater numbers than any other plane (approx. 30,000) and has remained in use by some countries until 1967. The E (Emil) version was the first large scale production of the 109. Germany began production of the ME109E in early 1939 beginning with the E-1 version which was produced in the Augsburg factory and shifted to the Regensburg factory later that year. Many of these aircraft were assigned to Spain with the Condor Legion and proved their vast superiority in almost every category.

Armament included a pair of cowl-mounted 7.9mm machine guns along with a pair mounted in the wings. The E-3 variant incorporated an MG ff cannon between the engine cylinders that exited through the spinner. Problems with jamming and overheating forced the redesign of the gun in the designation change to E-4. This gun was removed in the later E-5 and E-6 versions. Early 109s used a Daimler-Benz DB601 engine that produced 1175 hp. The later versions used a DB601Aa engine that produced 1200 hp and had a max speed of 290 mph. The maximum range on the E-4 version was 410 miles.

The 109E3 and E4 saw heavy action during the Blitzkrieg against France and also over southern England during the Battle of Britain. Because the 109s had a small fuel supply they were eventually pulled from front line duty over Britain even though they proved superior to the RAF's Hurricanes and even early Spitfires.

By 1941 the 109E began to appear in the Mediterranean theatre. They served with the JG27 in North Africa. Due to the experience of the pilots, they were able to continue their success against the RAF's Kittyhawks and Hurricanes.



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Thank you for purchasing the ME109E 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.

Lightening Holes

Lightening holes are laser cut into all ribs and formers where possible. This allow us to keep the weight on each plane to a minimum without sacrificing strength. Extra care should be taken when handling parts since they are very fragile until glued in place.

Plastics and Fiberglass

The cowl is accurately reproduced in fiberglass. The radiators, exhaust stacks, flap fairings, cannon bulges and oil cooler fairing are also made from fiberglass. 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 .91 4-strokes. We mounted our engines inverted - this allows adequate cooling for the cylinder head. Since the tail surfaces on the 109E are scale, using anything over the recommended engine size may lead to stability issues. Scale exhausts can be fabricated.

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 ME109E. 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.

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

Due to limitations in the machining process, the spinner does not exactly match the E-4 variant around the nose of the spinner, though the overall shape is accurate.

The cockpit is as close as possible to the E-4 but we could not verify true accuracy because the museum examples of the 109E in many cases are not correct themselves.

The wing/flap junction has been simplified for ease of building, though the flap separation point is scale.

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.

General Building Information

The ME109E 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. The decals provided are fuel-proof but still should be clear-coated to insure that fuel doesn't soak underneath them.

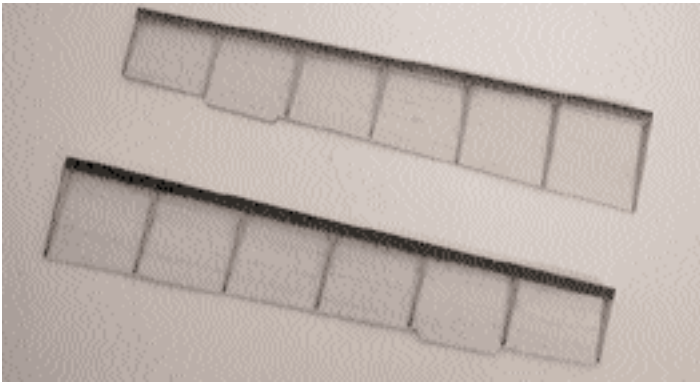
This aircraft is not a toy. It must be flown in a responsible manner according to the rules set forth by the Academy of Model Aeronautics. The builder assumes the responsibility for the proper assembly and operation of this product. Skyshark R/C shall have no liability whatsoever, implied or expressed, 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 A7 ribs into their slots in A1.
3. Glue A8 into the outer slot in A1.

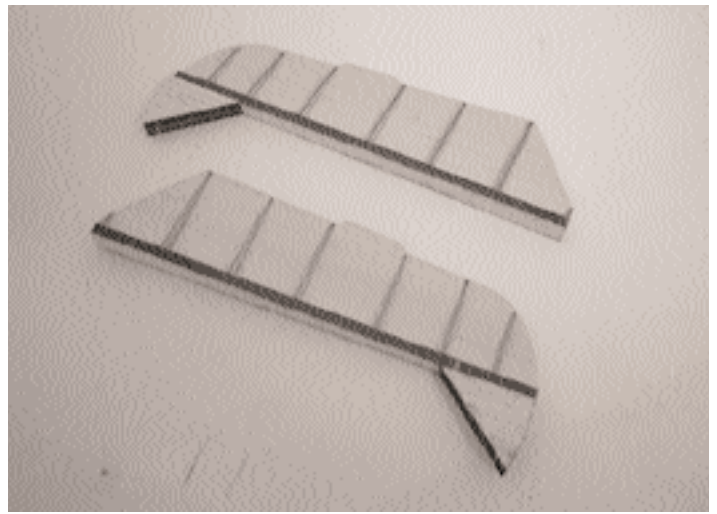


4. Align the aileron assembly onto A9 and glue in place.
5. Glue ribs A3 thru A7 to A1 and A9.
6. Repeat for the opposite aileron. Set these assemblies aside for now.

Elevators



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

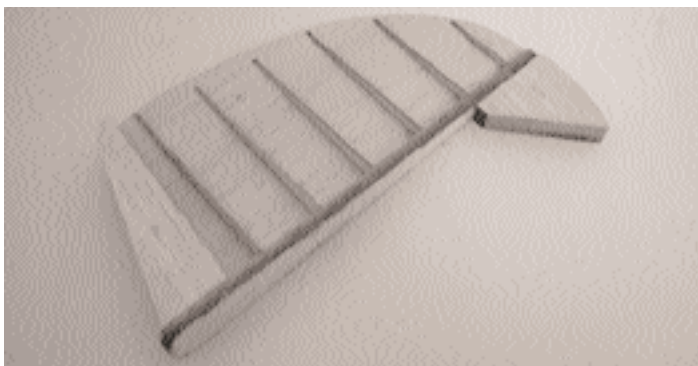


3. Align the elevator assembly onto E9 and glue in place.
4. Glue two E10s together. Align and glue the E10 counter balance to the front of E9.
5. Repeat for the opposite elevator. Set these assemblies aside for now. The elevators will be final shaped with the stab.

Rudder

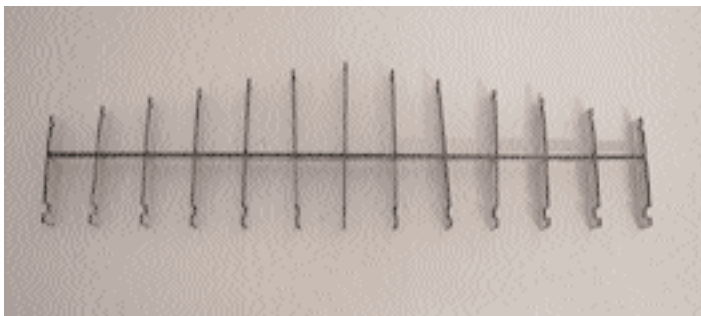


1. Slide R2 thru R7 into the slots in R1.
2. Align this assembly onto R8 with the top of R1 even with the top edge of R8, and glue.
3. Glue the ribs to R1.

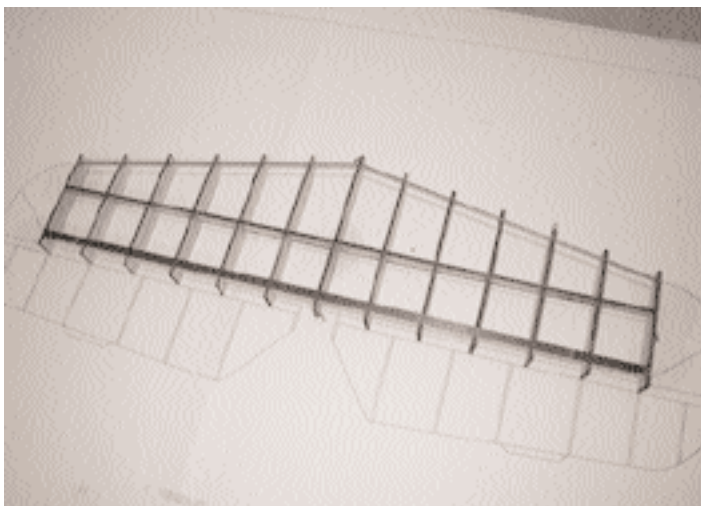


- 4. Glue 4 R9s together. Glue the R9s to the bottom of the rudder assembly.
- 5. Glue two R10s together. Glue the R10 counter balance to the front of R8.
- 6. Set this assembly aside for now. The rudder will be final shaped with the fin.

Horizontal Stabilizer



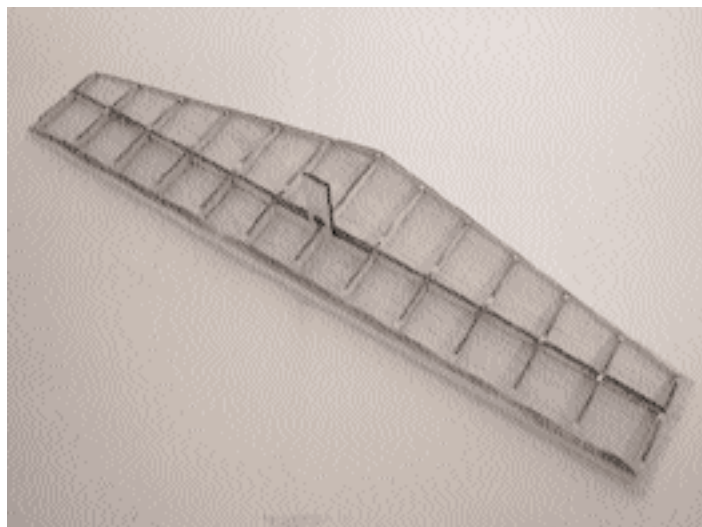
- 1. Slide S1 thru S6 into the slots in S8Ply Spar.



- 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.

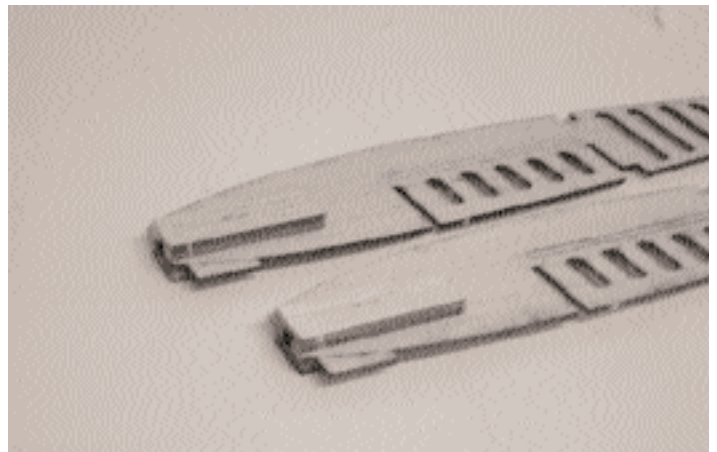


- 12. Sheet the bottom of the stabilizer.
- 13. Trim and sand the sheeting at the leading edge, trailing edge, and the rib ends.
- 14. Cut a leading edge for each side of the stab from 3/8 x 1/4 balsa. Glue these in place. Sand the ends flush with the ribs.
- 15. Glue two S11s together. Glue this assembly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

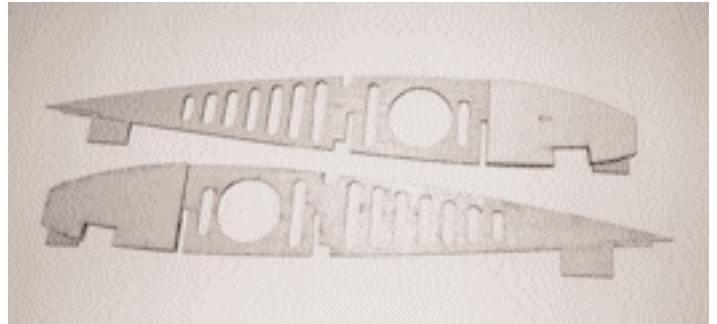
Wing Construction - Fixed Gear

Wing construction notes:

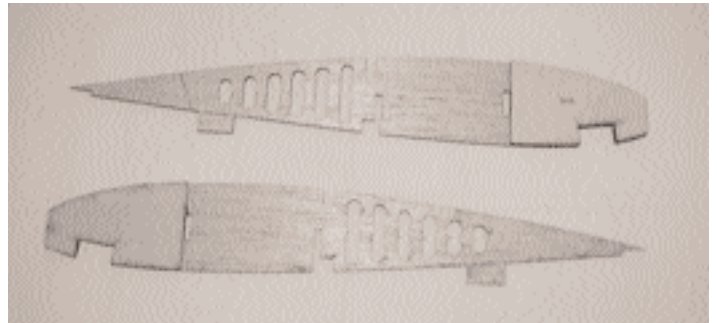
1. There are four possible wing construction combinations - fixed gear without flaps, fixed gear with flaps, retract gear without flaps, and retract gear with flaps. We have separated construction steps into the two most popular combinations, fixed gear without flaps, and retracts with flaps. If you 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 W9 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.



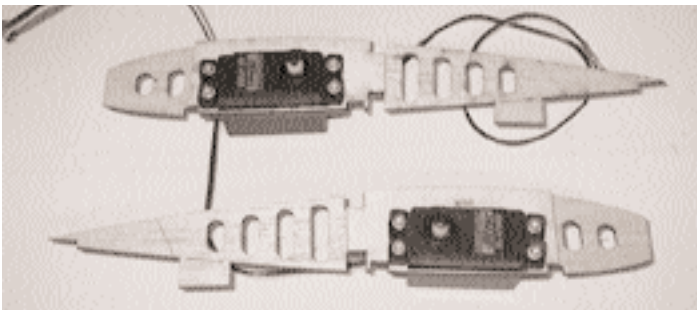
- 1. Glue W1A to W1, aligning the slots.
- 2. Glue W1B on top of W1A.
- 3. Turn W1 over and repeat with W1A and W1B. This will create a pocket for the wing dowels. Repeat for the remaining W1.



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



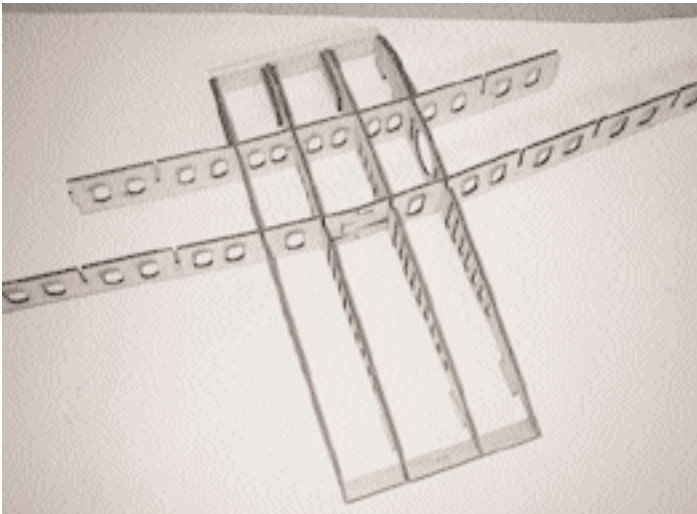
- 5. Epoxy W4A to W4. Repeat for the remaining W4. Make a left and right side.



6. Epoxy W9A to W9. Repeat for the remaining W9. 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.



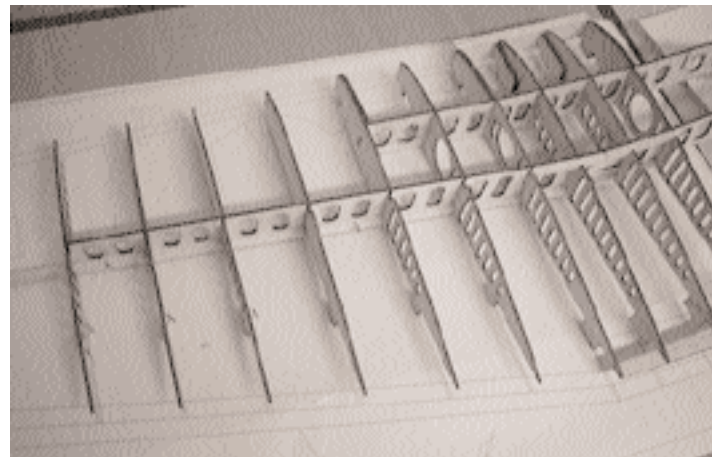
9. The wing center section will be assembled prior to pinning to the board. Do this by sliding both W1s into the center slots in W15. Then fit W16 and W17 together and slide into the slots in W1s. Slide W2s into the next slots, making sure that W2As face out-board. W16 and W17 are not left or right pieces,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

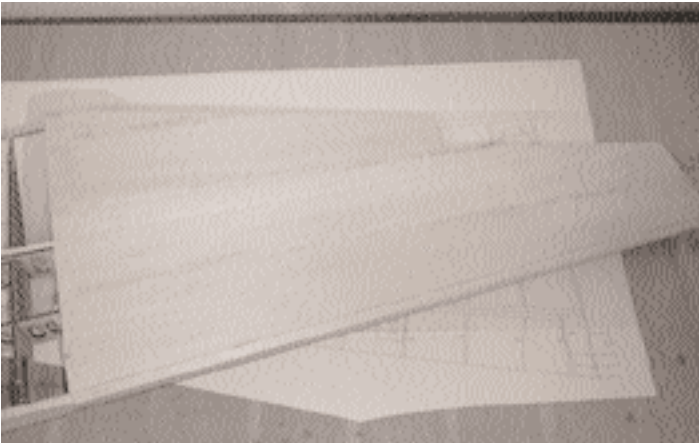
18. Glue W9 in place.

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

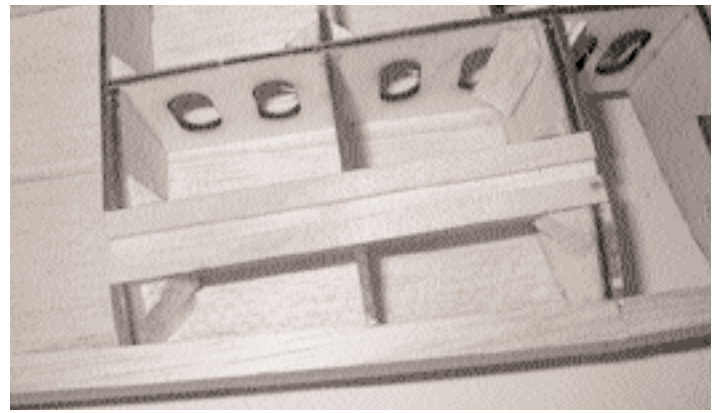
20. Run the servo leads through the holes in the ribs and spars.



- 21. Align and glue ribs W10 thru W14 in place.
- 22. Glue a 1/4 x 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 3/8 x 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 1/16 x 4 x 36 and one 1/16 x 3 x 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.



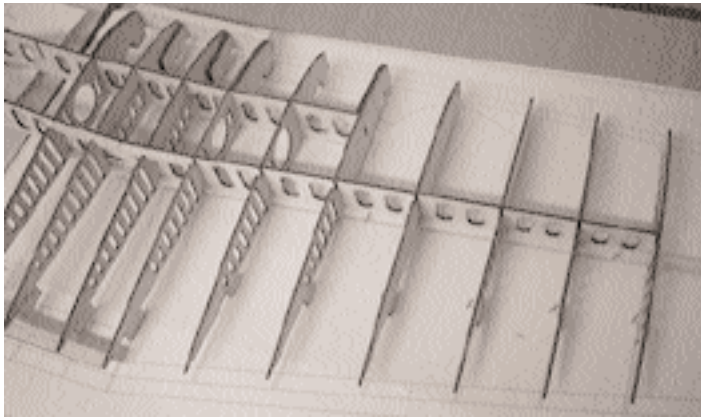
- 32. Sand the "feet" off of the ply spar on the left wing panel.
 - 33. Trim the gear block to fit from W2 to W4.
 - 34. Trim the gear block anchor to fit under the gear block at W4. Epoxy the gear block and gear block anchor in place.
- Hint: Tri-stock may be added as shown to strengthen to gear block, and tri-stock may be added to the inner rib/spar joints for added strength.*
- 35. Carefully drill a 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 1/16 balsa sheeting to make shear webs. Add shear webs to spars between W9 thru W14.
 - 37. Glue 1/8 x 1/4 balsa pieces into the slots in W9 and W10 as servo hatch supports.



- 38. Cut three 1/16 x 4 x 36 and one 1/16 x 3 x 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 $\frac{1}{4}$ x $\frac{1}{4}$ 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.



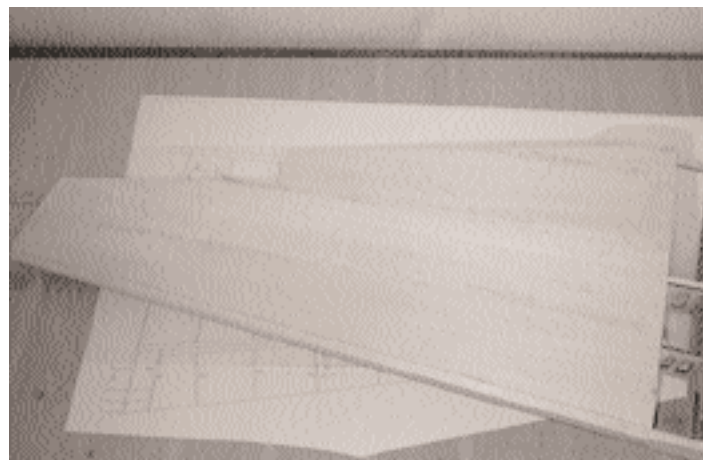
52. Align and glue ribs W10 thru W14 in place.

53. Glue a $\frac{1}{4}$ x $\frac{1}{4}$ 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 $\frac{3}{8}$ x 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 $\frac{1}{16}$ x 4 x 36 and one $\frac{1}{16}$ x 3 x 36 balsa sheets to 29". Edge glue these sheets.

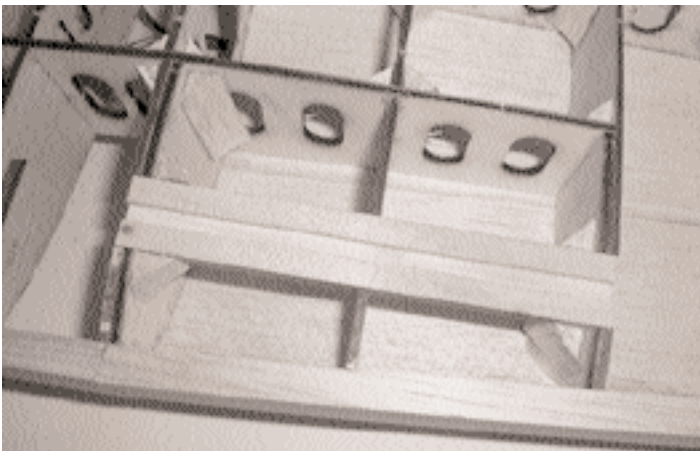
58. Trim the sheeting to match the leading edge sweep angle.

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.

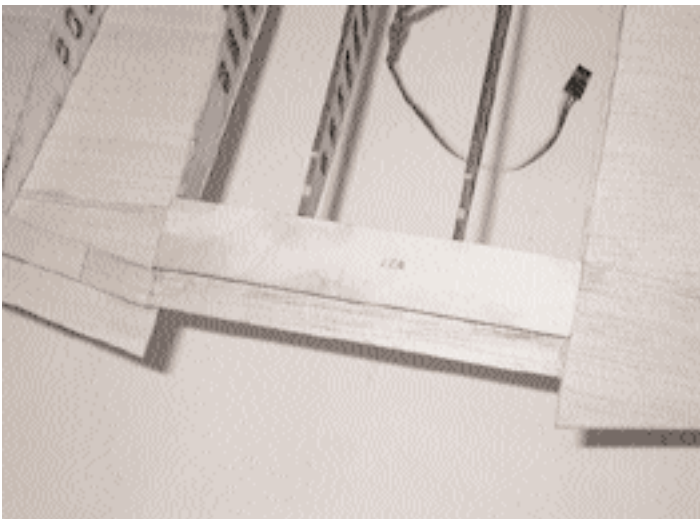
65. Trim the gear block anchor to fit under the gear block at W4. Epoxy the gear block and gear block anchor in place.

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.

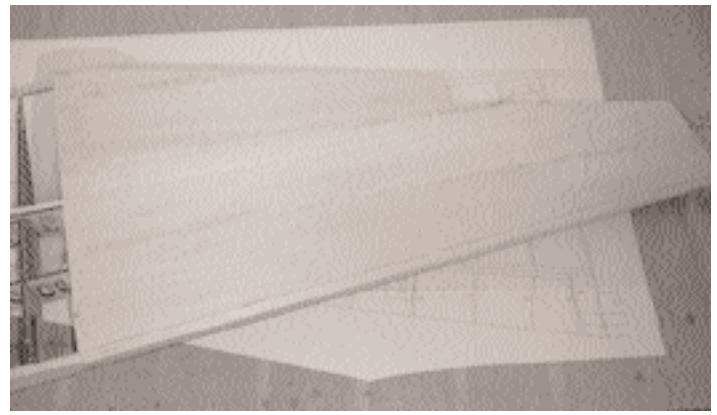
66. Carefully drill a 3/16" hole in the gear block to match the slot in the gear block anchor at W4. Try not to drill through the wing sheeting!

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.

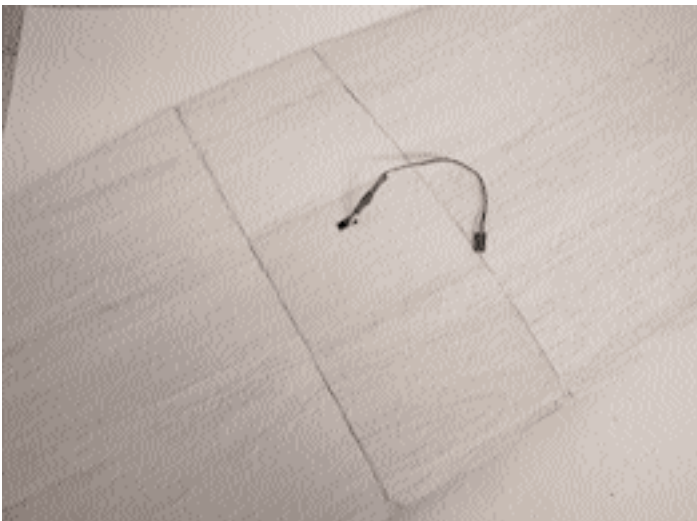
74. Cut the sheeting from the gear wire slot.

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.

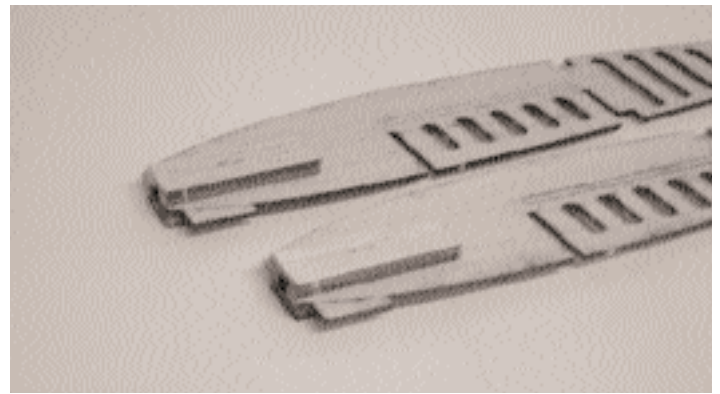
83. Glue the wingtips in place and sand to shape.

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 W9 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.

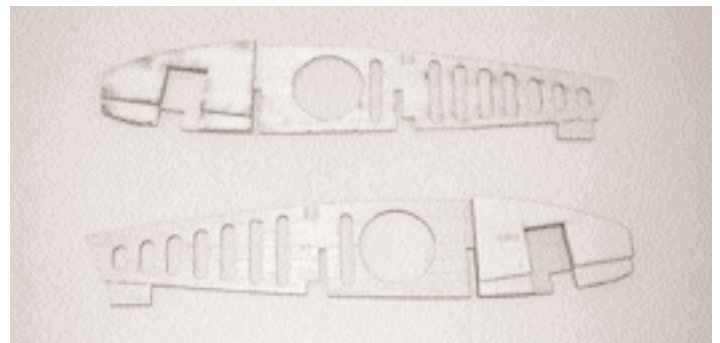


- 1. Glue W1A to W1, aligning the slots.
- 2. Glue W1B on top of W1A.
- 3. Turn W1 over and repeat with W1A and W1B. This will create a pocket for the wing dowels. Repeat for the remaining W1.

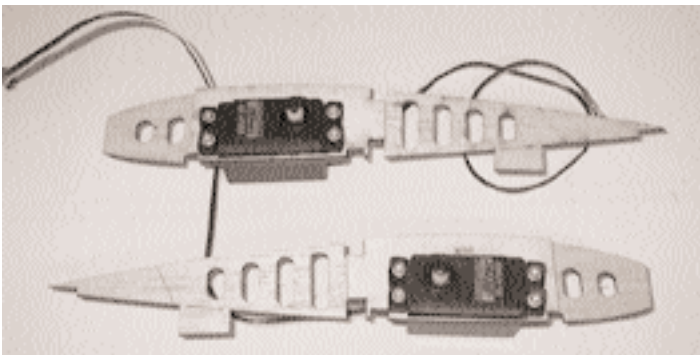


- 4. Epoxy W2R1 to W2. Repeat for the remaining W2. Make a left and right side.
- 5. Epoxy W2R2 to W2R1, aligning the upper edge to properly position the part. Repeat for the remaining W2.

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.



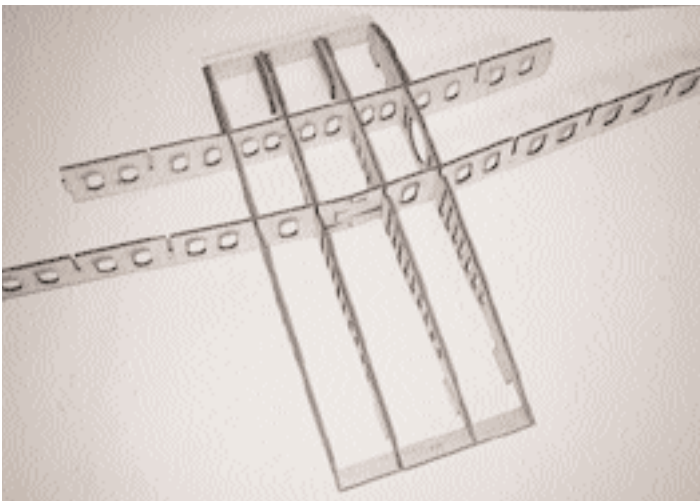
8. Epoxy W9A to W9. Repeat for the remaining W9. Make a left and right side.

9. Mount the aileron servo onto W9 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.



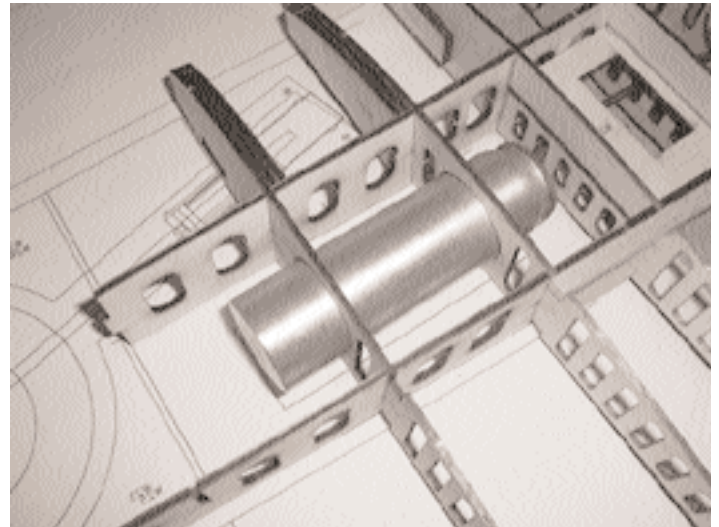
13. The wing center section will be assembled prior to pinning to the board. Do this by sliding both W1s into the center slots in W15. Then fit W16 and W17 together and slide into the slots in W1s. Slide the W24 Servo Tray into the slots in W1s. Slide W2s into the next slots, making sure that W2R!/W2R2s 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 W9 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.

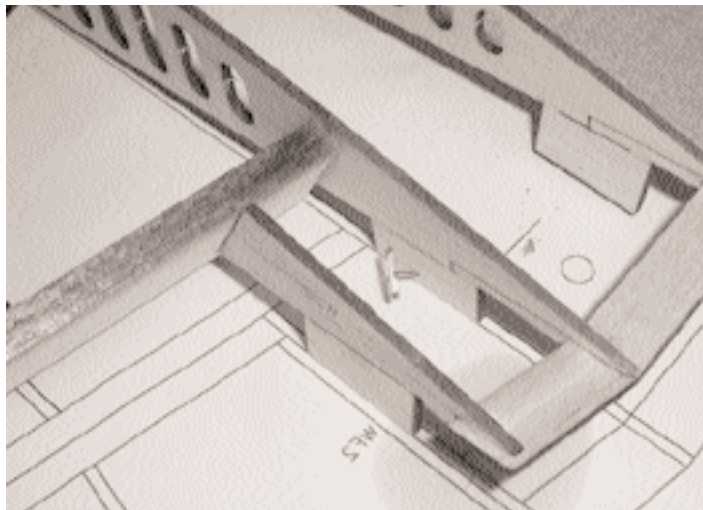
21. Slide W3 into the slots in the Ply Spars and glue. Make sure that the retract supports face inboard.

22. If you are using Springair retracts, prepare the air tank by adding a 3" piece of air line to the tank.

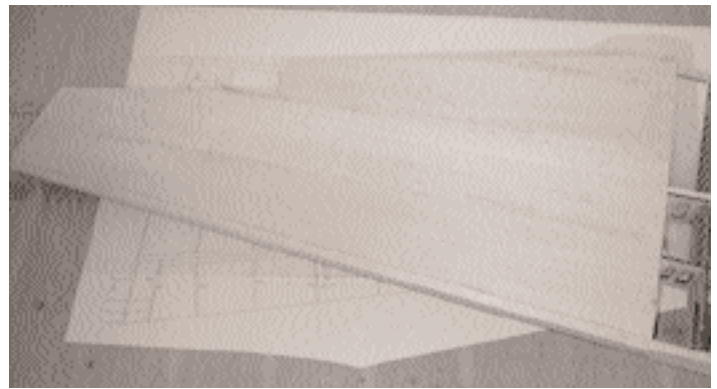
Note: Since Springairs only use air to bring the gear up, they have a smaller air requirement, thus smaller air tanks. Most other retract air tanks will not fit inside the wing structure and will have to be mounted in the fuselage.



- 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.
- 26. Glue the left side W9(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 W10 thru W14 to the balsa spar.
- 28. Glue the upper 1/4 x 1/4 balsa spar into the slots in the ribs.
- 29. Sand the end of a 3/8 x 1 balsa leading edge to match the angle of the center section leading edge. Glue the leading edge to the ribs.



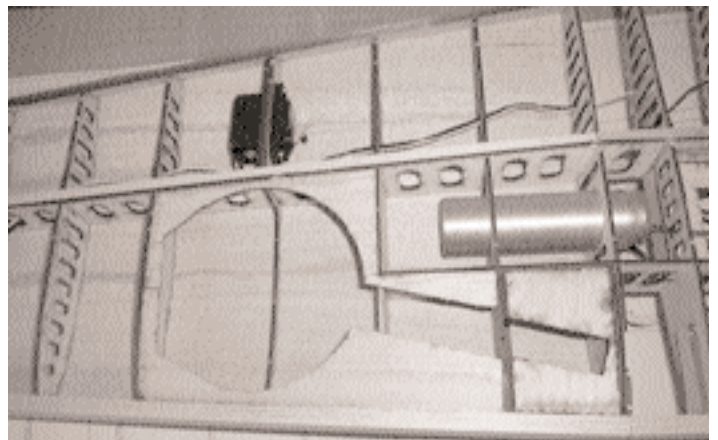
- 30. Align W21 Flap Spar so that the bottom edge of the spar is even with the bottom edge of the ribs, and butts against W2. Glue the spar in place. Sand W21 flush with the outer side of W9.
- 31. Align W20 Aileron Spar with ribs W9 thru W14 and glue in place.
- 32. Align W22 on the plans and glue to W21 Flap Spar.
- 33. Cut W19 at the engraved line and glue to W22 and W2.



- 34. Cut three 1/16 x 4 x 36 balsa sheets to 29". Edge glue these sheets. Edge glue one of the leftover 7" 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 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 ¼ x 1/8 balsa sticks to the cutouts in W9 and W10 as servo hatch supports.
46. Add ¼ 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.
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. 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.

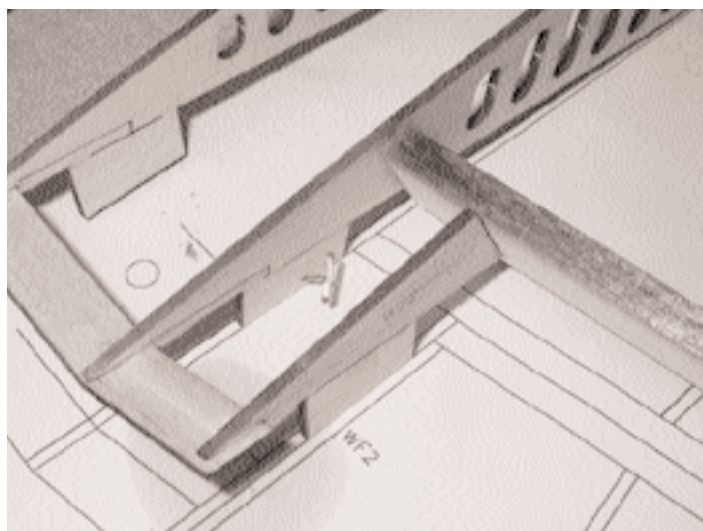
50. Trim and sand the sheeting at the wingtip, aileron and flap bays, and at the W2 rib.

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 ¼ x ¼ 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.
58. Glue the left side W9(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 W10 thru W14 to the balsa spar.
60. Glue the upper ¼ x ¼ balsa spar into the slots in the ribs.
61. Sand the end of a 3/8 x 1 balsa leading edge to match the angle of the center section leading edge. Glue the leading edge to the ribs.



62. Align W21 Flap Spar so that the bottom edge of the spar is even with the bottom edge of the ribs, and butts against W2. Glue the spar in place. Sand W21 flush with the outer side of W9.
63. Align W20 Aileron Spar with ribs W9 thru W14 and glue 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.



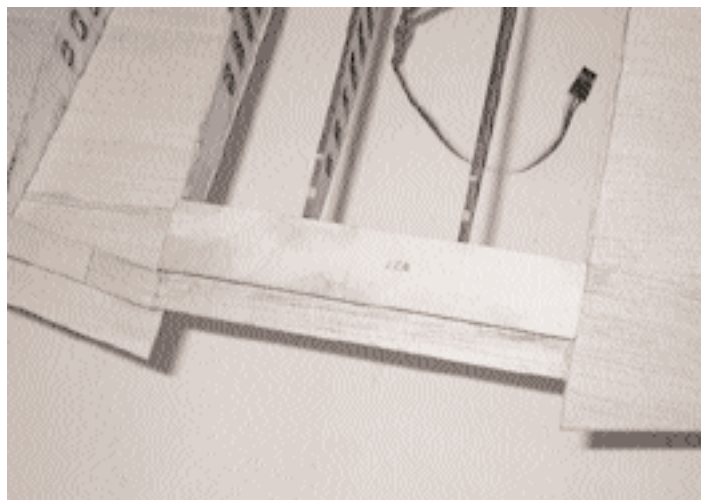
66. Using one of the previously made wing sheets, align the sheet on the wing structure so that the end slightly overlaps the W2 rib. Mark the point at the tip for the leading edge of rib W14 and trim the sheet to match the leading edge taper.

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

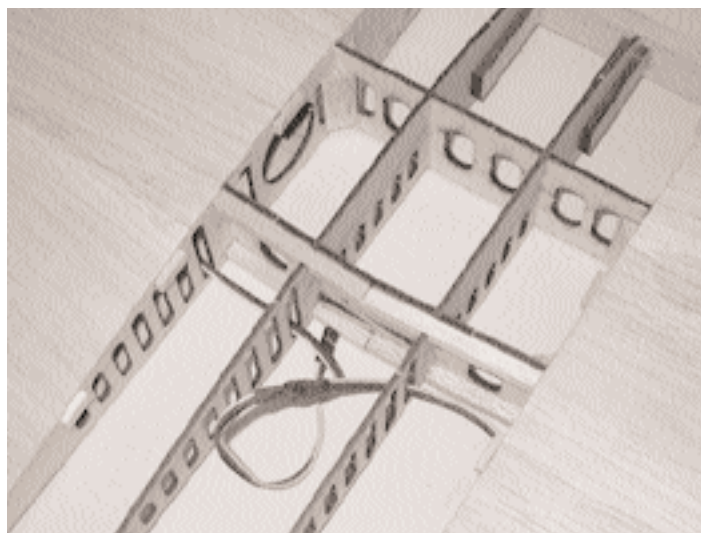
67. Sheet the upper right wing panel.
68. Remove the wing from the board. Measure .5 inches aft of W19 and cut the trailing edge sheeting at this line. Bevel the edge of the sheeting to match the lower rib camber.
69. Trim the sheeting at the tip, the aileron bay and the flap bay.



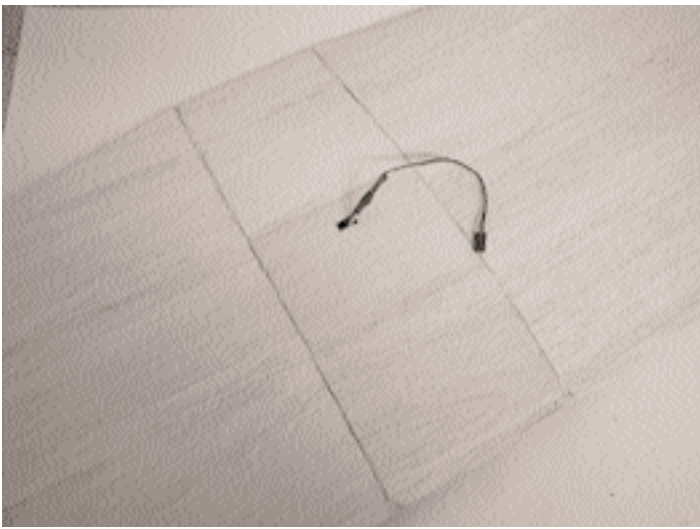
70. Remove the left side rib jig tabs. Make sure the tabs on the right side stay secure.
71. Sand the "feet" off the ply spars.
72. Add 1/16" balsa shear webs to the spars outboard of W8 to the tip. Align the grain of the wood vertically.
73. Epoxy W23 retract plate into the cavity between W2 and W3.
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 Wf9 Flap ribs into the slots in Wf1 (there is a left and right side Wf1).

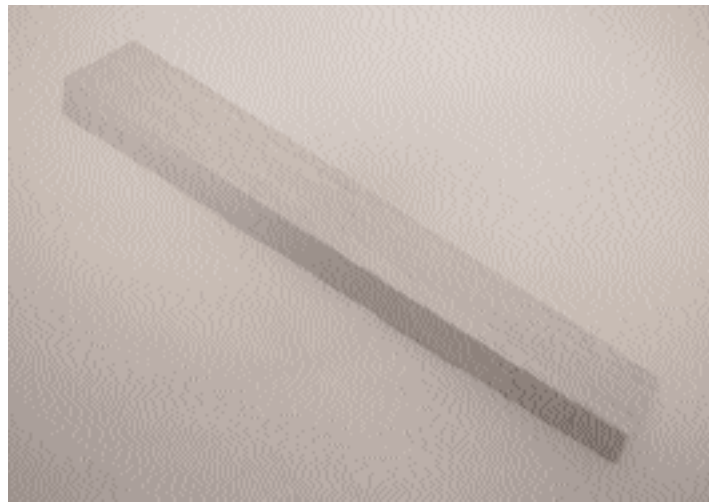
92. Glue Wf10 Flap Leading Edge to the ribs, aligning Wf10 so there will be excess material on both sides of the ribs.

93. Sand the sides of Wf10 flush with the ribs. Sand the bottom of Wf10 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 Wf11 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.

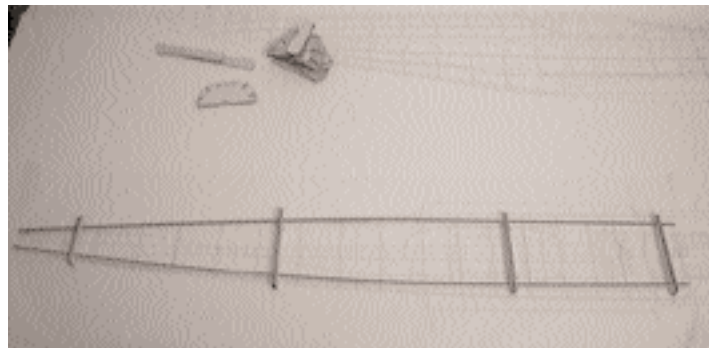
96. Sand the top of Wf10 flush with the rib tops.



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.

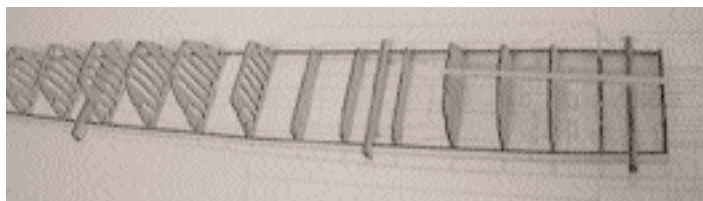
Fuselage Assembly



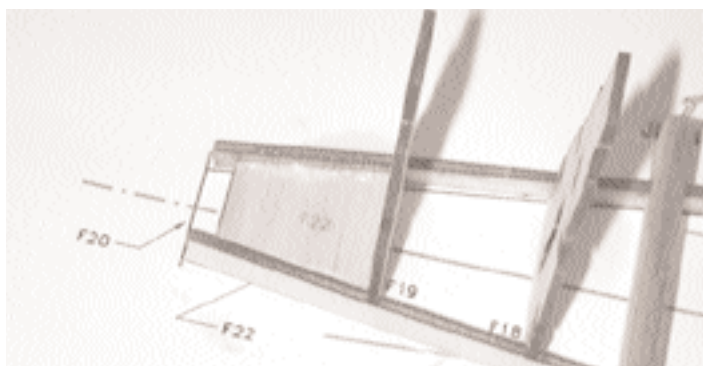
1. Assemble and glue F21A and F21B together. Assure that the assembly is straight. Make two pieces - these will act as the fuselage "crutch".

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.



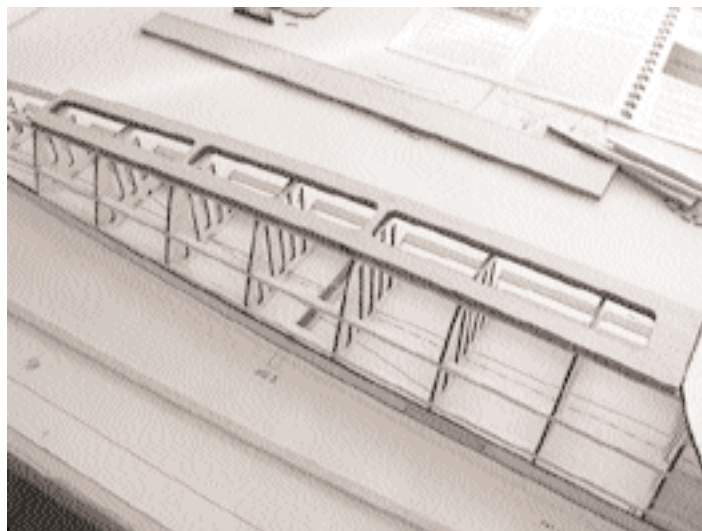
- 8. Slide F22 inside the crutch, flat on the board, and butt against the rear of the F19 bulkhead. Glue in place (a portion of the crutch will be sanded away to contour the fuselage after sheeting, so F22 will support this area).

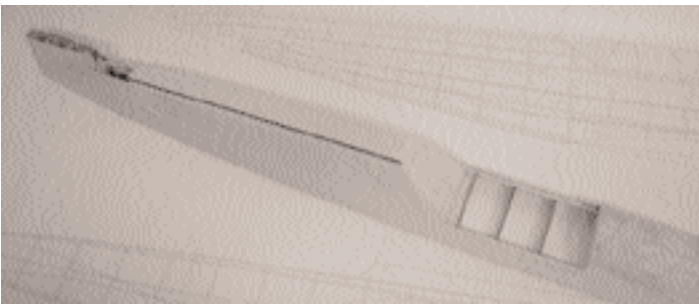


- 9. Soak the F27 Stab Saddles in water or a water/ammonia mix. Form the F27s to fit into the notches in F17A, F18, and F19. Align the front of the saddles with F17A and glue in place.



- 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. Glue F23 behind F8A level with the stringers with the engraved line facing aft.
- 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 1-3 now.

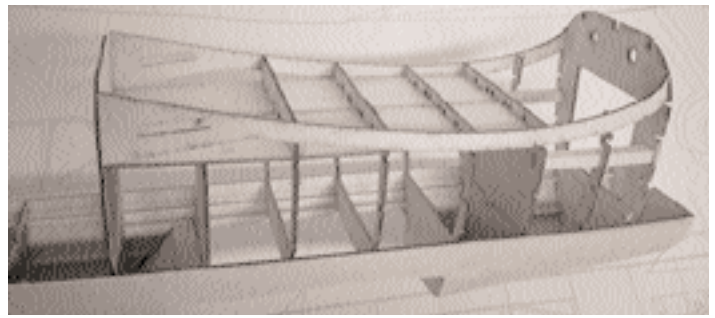




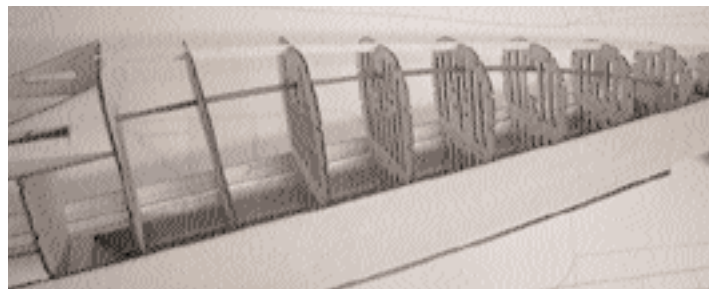
- 16. Fit a 1/8 x 1/4 balsa stringer into the lowest slots in the bulkheads from F16A to F1A. Glue in place. Repeat for the other side.
- 17. Lay the second row of stringers in place, butting against F20 to butt against F24, and from F5A to F1A. Glue in place. Repeat for the other side.
- 18. Lay the 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.



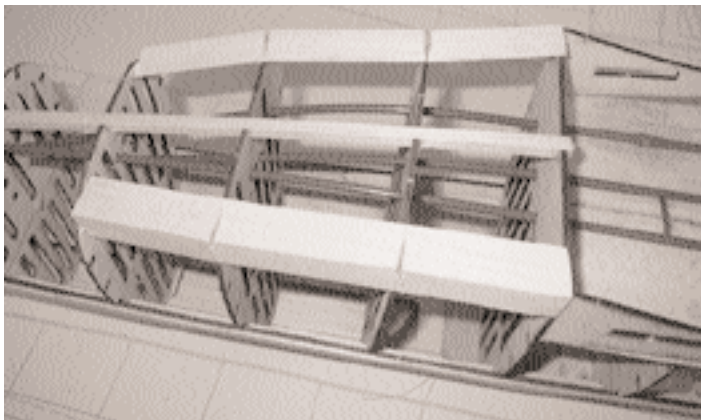
- 34. Align and glue bulkheads F10B thru F17B to their respective matching upper halves.

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.

38. OK, let's install pushrods. First, look at all those holes! Now say a few curse words. Done yet? Good - now let's install those pushrods. It's really not too hard. Remember that the holes are duplicated side to side so that if you accidentally got a bulkhead in backwards you wouldn't be cursing over that! First determine where the best location for your throttle servo should sit (different engines and mounting directions will determine which side is a better location). The elevator servo will sit in the middle. Slide the pushrod into the holes marked with an "E" (imagine that!) On the same side your throttle servo will sit. Continue sliding the pushrod through the holes in the bulkheads - the elevator pushrod will locate to the fuse center about halfway back. Slide the pushrod until it just clears the hole in F19. Next, for the rudder pushrod, select the hole marked "R" on the opposite side of the fuse from the elevator pushrod. Slide the rudder pushrod through the "R" holes on the same side of the fuselage (the rudder pushrod will not cross over the elevator pushrod). Cut a slot in the fuse sheeting aft of F19 and slide the pushrod through. Last, slide the tailwheel pushrod through the "T" hole next to the rudder pushrod. The tailwheel pushrod will cross over the other pushrods about halfway back.



39. Cut and sand a piece of $\frac{3}{4}$ tri-stock to fit on the bulkhead cutouts from F9 to F10. Sand the tri-stock flush with F9.

40. Repeat this procedure for tri-stock to fit from F10 to F11.

41. Fit a piece of tri-stock from F11 which will fit against but not overlap F12. The corner of the tri-stock should extend about $\frac{3}{8}$ " above the curve of F12.



42. Glue a $\frac{1}{8}$ x $\frac{1}{4}$ balsa stringer into the flat groove of the lower bulkheads from F1B to F17B. You will have to splice about $1\frac{1}{2}$ " to make the stringer long enough. This piece will fit against the crutch and is a sheeting anchor.

43. Fit $\frac{1}{8}$ x $\frac{1}{4}$ balsa stringers into the second and third slots in the bulkheads from F1B to F17B. You will have to splice about $1\frac{1}{2}$ " to make the stringer long enough.

44. Fit short sections of stringer into the remaining slots from F1B to F2B.

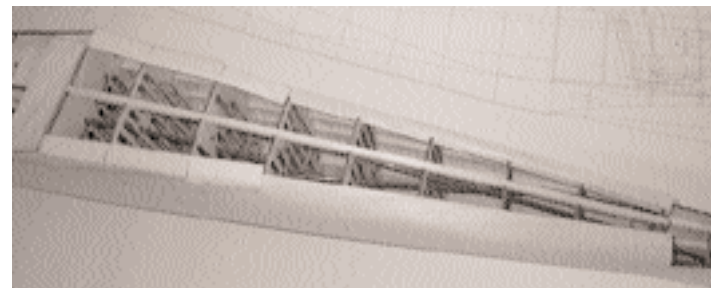
45. Cut and fit stringers into the remaining slots from F12B to F17B.

46. Slide F35 Ply Holddown Plate into the slots in the F28 Wing Saddle and epoxy in place.



47. Cut a $\frac{1}{16}$ x 4 x 48 balsa sheet to 39". Trim this sheet to fit against the upper fuselage sheeting between F1 and F17. The sheeting will lay flat against the side of the fuse from F1 to F12 and the tri-stock. At F12, cut the sheet so it can wrap around the curve of the bulkhead. You will have to wet the sheeting aft of F12 for it to wrap around the bulkheads. Sheet the aft portion of the fuselage only to the last row of stringers. Cut the sheeting flush with the stringer from F12 to F17.

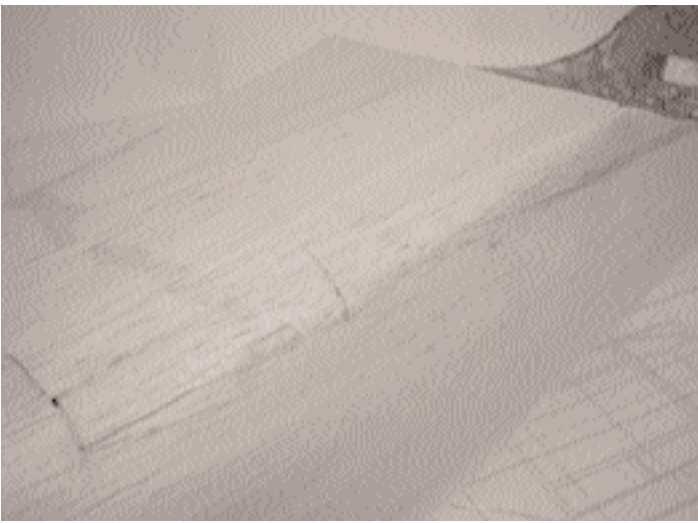
48. Repeat the sheeting procedure for the opposite side of the fuselage.



49. Glue an F37 Fuse Sheet to the lower fuselage from F9 to F12 and the $\frac{1}{4}$ x $\frac{1}{4}$ keel. Press the sheet to the bulkheads at the tri-stock area so the sheet "forms" into this juncture. Repeat for the F37 sheet on the opposite side.



50. Test fit the F38 Fuse Sheet to the center aft fuselage. Trim as necessary and sheet the remaining portion of the aft fuse.

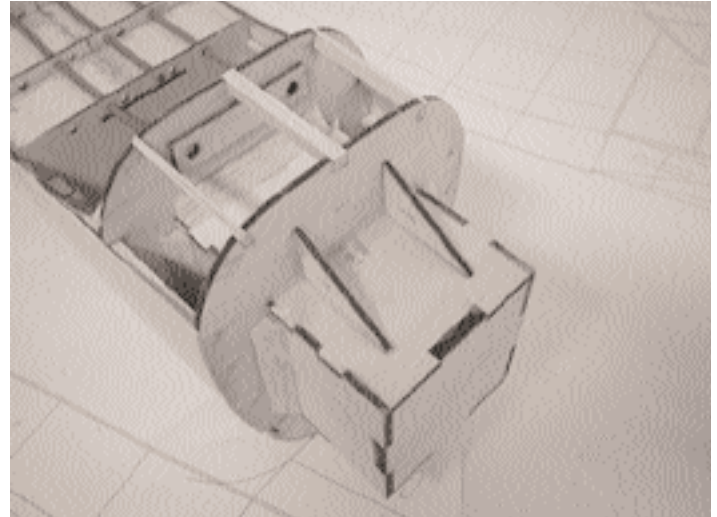


- 51. Sand the tri-stock and sheeting from F9 to F12 to blend the curve to F9. The sheeting at F9 will remain squared off. Try not to go overboard here and sand through the sheeting - most of the material removal will be from the tri-stock. Trim and sand the sheeting at F17.

Congratulations! You have successfully finished the most difficult part of building the model!



- 52. Trim and sand the fuselage sheeting at the wing saddle.
- 53. Test fit the wing to the saddle and trim as necessary to fit (the wing trailing edge may be 1/16 to 1/8" too long - we design for this. It's better than being too short!).
- 54. Align the wing to the fuse, both laterally and by squaring to the fuse. Mark the wing location and temporarily secure the wing to the fuselage (tape it, weight it down, or my personal favorite, just hold it in place and wonder later why the wing is crooked!).
- 55. Slide F34 Dowel Alignment Plate against F2B and epoxy in place.



- 56. Remove the wing for now.

The firewall assembly is designed to slide back and forth to adjust for your specific engine/mount combination. The firewall box also has 1degree down and 1 degree right thrust built in. Build it in the following manner:

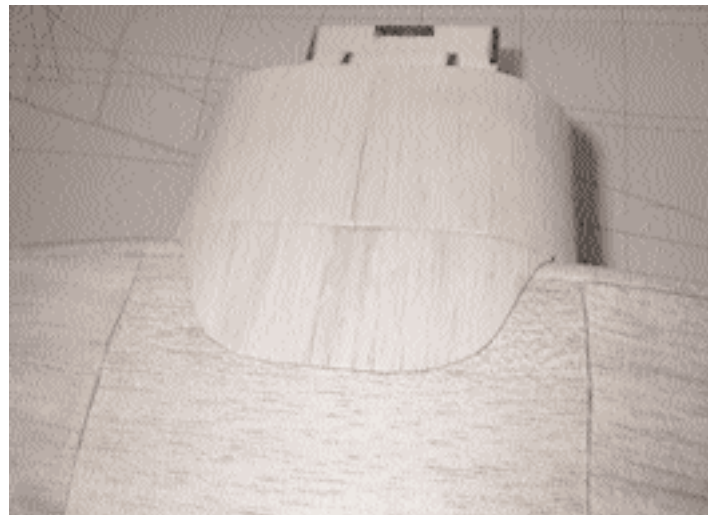
- 57. A few preparations will make building this assembly much easier. Test fit the side pieces and firewall to determine how everything goes together. The side pieces are notched differently and marked as to location so there is only one possible way to assemble them. The firewall will fit in any direction. Cut four pieces of 3/8 tri-stock to fit in the inside corners of the box, have several pieces of tape ready, and definitely use 15 or 30 minute epoxy to glue everything together (5 minute epoxy was tried, ended in a gooey mess!).
- 58. Do not glue the pieces separately, assemble all the pieces before the glue sets. Start by epoxying F29 Top and F30 Right Side to each other, and epoxying the firewall into the slots in F29 and F30. Add the tri-stock to F29 and F30. Next epoxy F31 Bottom to the assembly and add the tri-stock. Tape everything together as you go. Finally epoxy F32 Left Side in place, add the tri-stock and tape everything securely. Wipe away the excess epoxy.
- 59. Now to make sure everything is square. Slide the firewall assembly (just the very end, not the whole thing!) into the hole in F1 and leave it there to let the epoxy set.

60. When dry, remove the firewall and sand the edges and sides to remove any excess glue and to smooth the assembly.
61. Test fit the firewall and sand as necessary to allow the firewall to slide into place. You want a fit that is not sloppy, but does not require beating on the firewall to make it fit.
62. Assemble your engine and motor mount. Slide the firewall into the fuselage, set the engine/mount on the firewall and adjust the firewall until the distance from F1 to the prop flange is 7.5 to 7.55 inches (this allows for the depth of the cowl plus .100 to .125 inches for spinner to cowl clearance). Mark the firewall location and mark the firewall inside of F2 if any is protruding past F2. Remove the firewall and measure and mark all around the firewall sides corresponding to the mark you made. Cut and sand the firewall sides to match (shortening the firewall will make installing and accessing the fuel tank and servos easier).
63. Pre-cut six pieces of tri-stock to 3". Glue one of them to the forward inside edge of F2 (you can't access this area after sliding the firewall in) so that it will contact but not interfere with the firewall.
64. Again using 15 or 30 minute epoxy, add epoxy to the previously installed tri-stock, and slide the firewall in place. Re-measure and adjust the firewall as necessary. Now epoxy the firewall in place and add the tri-stock to the remaining corners around F2. Add epoxy to the firewall and the front of F1. Add the remaining tri-stock to the sides of the firewall. Epoxy two F33s to the top of the firewall/F1 and two F33s to the bottom.



65. Re-install the wing. Align the wing with the fuselage and mark its location.
66. Drill and tap the holes for the wing holddown bolts.

Note: Remember that the Holddown plate in the wing is about 1" forward of the trailing edge and is 1" wide. Measure this against the fuselage hold-down plate to determine where the bolts will locate.



67. Slide some wax paper between the wing leading edge and the fuselage.
68. Test fit W28 to the wing leading edge at F2. Trim as necessary to achieve a fit so that W28 is 1/16" below the fuse sheeting. Glue W28 to the wing.
69. Glue the W29 Fillets together. Fit and glue to W28 and the wing. Remove the wing from the fuselage.

Tail Assembly

The elevator pushrod will extend through the horizontal stabilizer at about a 40 degree angle. The following steps will create the space necessary for this.



1. Drill or bore a hole through the stabilizer as shown at about a 40 degree angle (no need to get precise here, just average it). The hole should pass completely through both the top and bottom sheet. To properly locate the hole, pass your drill bit or boring tool through the hole in the ply bracket first.



2. Test fit the stab to the fuselage.

3. Create an elevator pushrod and clevis. Trim the hole in the stab as necessary to allow the pushrod to pass through.
4. Your elevator joiner wire is provided with a steering arm installed which will act as the bellcrank. Align the arm so that it's centered on the wire and tighten the set screw so that with the wire "legs" at 0 deflection, the arm is tilted forward about 30 degrees.

Note: It's not necessary to actually mount the elevators and bellcranks now - fitting the bellcrank to the stab to create the clearances is what you're after here.

5. Attach the bellcrank to the elevator clevis and slide the pushrod into the tube. Mark the areas on the stab where material will have to be removed to allow the bellcrank to pivot freely. Remove the pushrod and clean out these areas. Test fit the pushrod until it moves freely without binding.



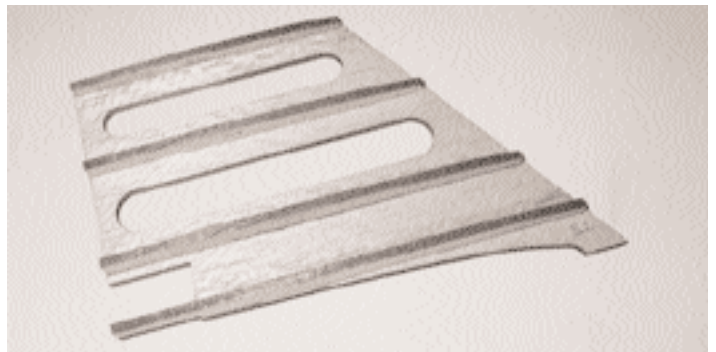
Add scrap balsa to the elevator halves at this time and drill a 3/32" hole in each elevator to match the joiner wire. Hinge the elevators at this time and check the overall fit. You can also insert brass tubes into the elevator to reinforce the hole.

You can also hinge the rudder at this time and cut a notch as necessary to clear the steering arm when the elevator is at full deflection. Do not glue the elevator or rudder until the plane is covered or painted.

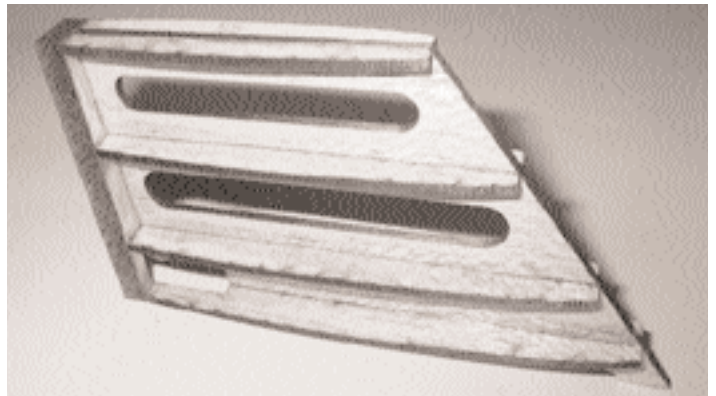


6. Re-fit the wing to the fuselage. Mount the stab to the fuselage and align it with the wing. Mark the stab location to the fuse. Check the stab for level with the wing and sand the stab saddle if necessary to level the stab. Epoxy the stab to the fuselage.

Hint: Although much engineering goes in to designing a fuselage that builds straight, it doesn't always come out that way (even for us!) So for this reason we advocate aligning the stab to the wing rather than to the fuse. Think of it this way - if your fuselage had, say, a half degree warp front to rear and a 1 degree twist, when you align the wing to the fuse, you're aligning it to a different geometric plane than you're aligning the stab to. This makes the flying surfaces fight each other. By aligning the stab to the wing, it tends to nullify warps and twists in the fuse, so that the flying surfaces will align better with each other.



7. Lay V1 on the board. Align V2 thru V5 with the engraved lines on V1 and glue in place.



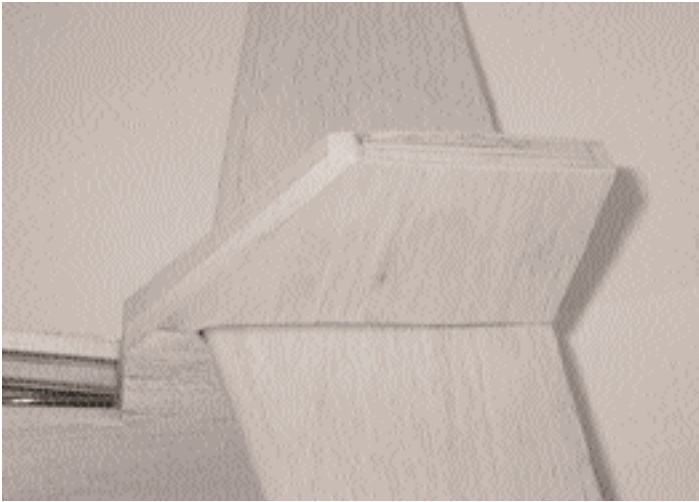
8. Turn the vertical stabilizer over and align the remaining V2 thru V5 ribs on the opposite side of V1 and glue the ribs in place.

9. Align V6 to the stab trailing edge and glue in place.

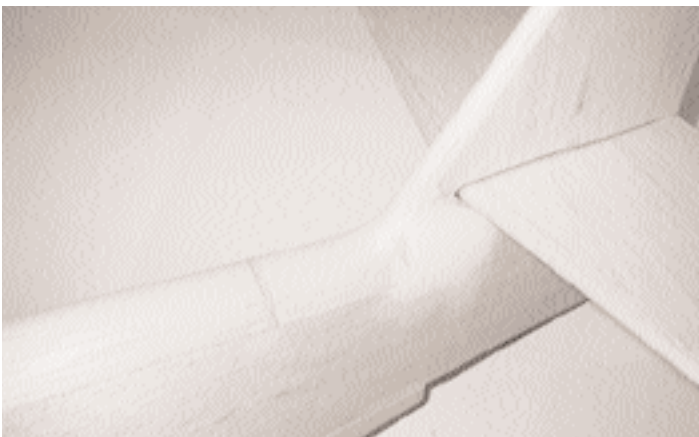
10. Align V7 to the stab leading edge and glue in place.

11. Lightly sand the stab surfaces to remove any high spots.

Note: We found it easier to sheet the stab prior to gluing the stab in place. However, you may glue the vertical stab to the horizontal prior to sheeting if you wish. The building steps reflect sheeting prior to installation.



- 12. Cut 3" pieces from 1/16 x 4 x 36 balsa. Edge glue two of these pieces to make a sheet for the vertical stab.
- 13. Sheet one side (doesn't matter which!) Of the stab. Trim the sheet at the leading edge, trailing edge, and at V5. Do not trim at the stab saddle yet.
- 14. Make another sheet and sheet the remaining side of the stab. Trim it in the same manner.
- 15. Trim the sheeting at the stab saddle to match the contour of V1. Test fit the stab to check your progress.
- 16. Align the vertical stab and epoxy in place.
- 17. Cut a piece of 3/8 x 1/4 balsa to length and glue to the leading edge of the vertical stab. Make sure it extends down along the fuselage protrusion. Trim and sand the leading edge at V5 and F17.



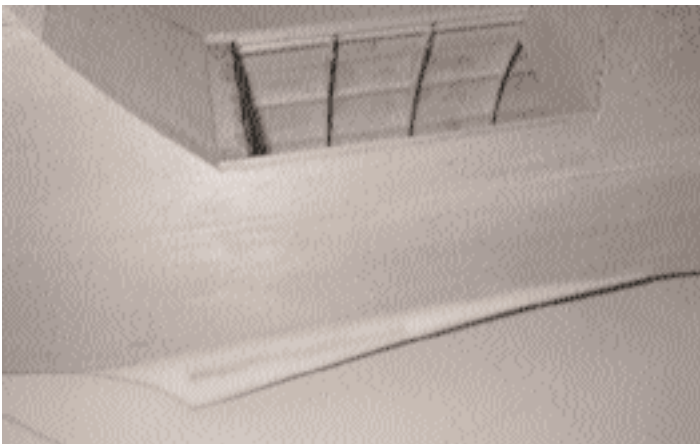
- 18. Test fit the two V8s by sandwiching the V9 fin post into the engraved slots. Trim as necessary (different wood densities makes it impossible to engrave the pieces to a specific depth all the time - some may be a bit shallow). Glue the two V8s together but do not glue V9 in yet.

- 19. Align the V8s to the fin top and glue in place. The V8s will align with the leading edge and there will be a "notch" at the trailing edge.
- 20. Fit the balsa fuse block to the notch in the fuse and glue in place. Trim and sand this block to match the fuse contour and sand the leading edge.
- 20. Sand the V8s to match the stab camber.
- 21. Glue V9 into the notch in the V8s.

Final Assembly

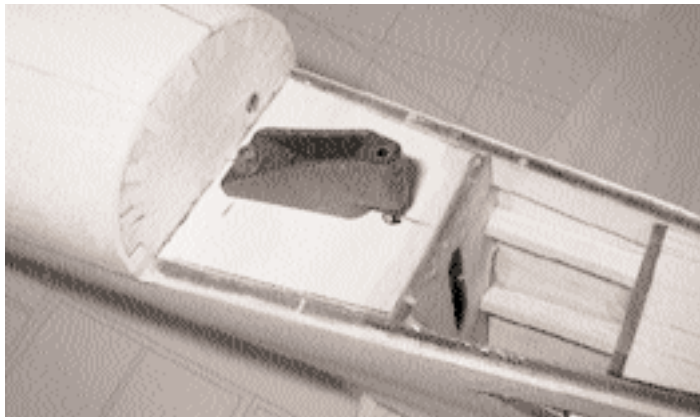


- 1. Tape a piece of wax paper to the wing so that it covers the wing/fuselage area. Mount the wing to the fuselage.
- 2. Create the wing fillet by first test fitting F39 to the fuse side. F39 has a straight side and a curved side. The curved side fits against the fuselage - trim this side to achieve a good fit. F39 should lay flat on the wing and the trailing edge should be even with the trailing edge of the wing. Glue F39 to the fuselage following the wing saddle contour.
- 3. Place F40 at a 45 degree angle to F39 even with the trailing edge and glue to the fuselage and F39.
- 4. Test fit F41 to the fuselage at the wing trailing edge trim as necessary for a good fit. Glue F41 to the fuselage and to F39.
- 5. Repeat Steps 1 thru 4 for the opposite side.

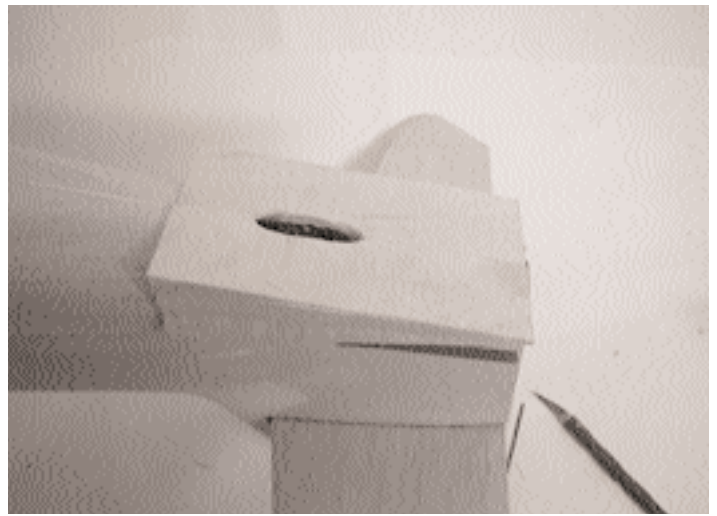


- 6. Remove the wing. Complete the wing saddles by filling the gaps with lightweight filler, then sanding the filler to a curved contour. As shown in the picture, F40 will not be completely covered with filler.

Hints and tips on fillers: Many materials may be used as fillers, such as hobby filler, lightweight spackle (this is what hobby filler is, just a different package), epoxy and micro-balloons, just to name a few. Hobby filler/spackle is usually water-based and will take forever to dry if applied too thick, plus it will shrink. If you use it, build up the fillet with 4 or 5 layers with light sanding in between. If you glass the fuse, be wary that the filler will absorb a lot of the resin. If you use resin/micro-balloons, here's a tip: Bondo is basically the same thing, just cheaper, but the consistency must be altered to make it lighter. Mix micro-balloons into the bondo before adding the hardener. Make it the consistency of a really thick paste, and you'll be surprised! It's very light and easy to sand.



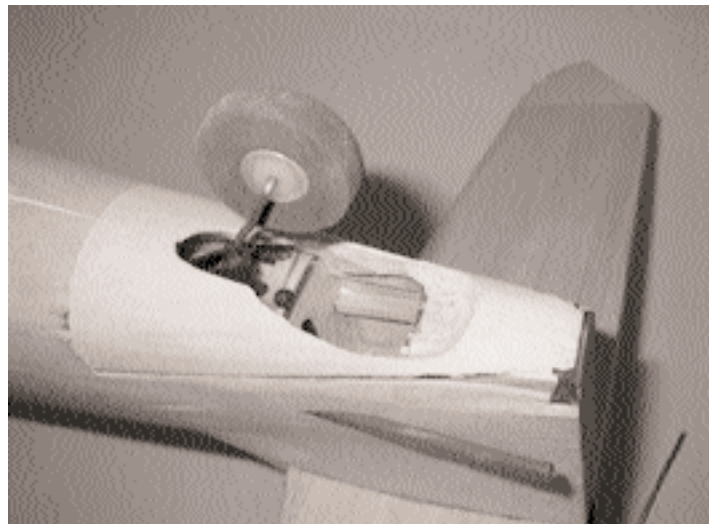
- 7. Test fit F36 into the bay in the aft fuse behind F17B and trim as necessary to make it fit.
- 8. Locate and mark the position of your tailwheel bracket - the tailwheel wire should be about 1.8" from the front of F36. Locate and drill the mounting holes and install the mount.
- 9. Epoxy F36 to the aft fuse. It should fit in the bay even with the crutch.
- 10. Create a tailwheel pushrod and clevis. Attach a steering arm and insert the pushrod into the housing. Mount the tailwheel and adjust the steering arm.



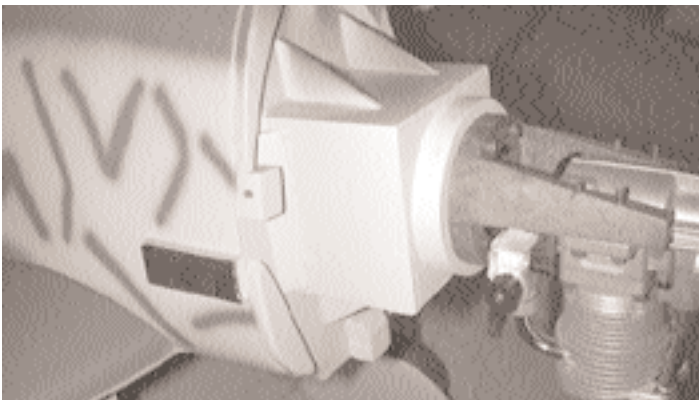
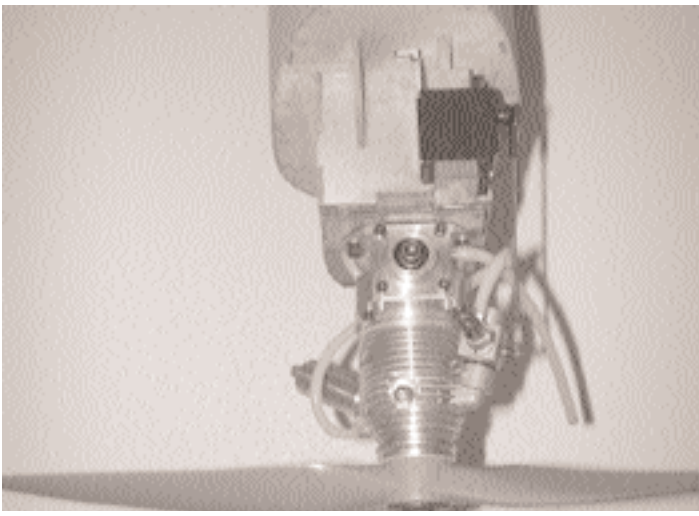
- 11. Two aft fuse blocks are provided - a left and right half. Test fit them to the fuse and hollow them out to clear the tailwheel and steering arm.

Hint: Only hollow the blocks out enough to clear the tailwheel mount before you glue them in place. The blocks will get very thin when you sand them, plus you'll be relieving the blocks to make the tailwheel cutout shape after shaping the outside of the blocks.

- 12. Remove the tailwheel (but not the mount). Glue the blocks to the aft fuse.



- 13. Trim and rough sand the blocks to the aft fuse shape. Follow the contour of the fin post and sand away part of the ply crutch to finish the shaping in this area. The fuse blocks will sand to a thin tip at the fin post.
- 14. Cut or grind out the area of the fuse blocks as shown to make the tailwheel cutout.
- 15. Use lightweight filler to fill any gaps and sand the area smooth.



1. Mount your engine. We used an RCV .60 on one of our test models with the throttle servo attached to the firewall box. If you decide to use an RCV rotary engine, you will need to cut adequate cooling ducts in the cowl - otherwise the engine will overheat.

2. Mount cowl using pieces of the included maple block. We used one block on the top of the firewall and 1 block on each side and bottom. Sand the blocks to match the contour of the firewall and add scrap balsa around the side of the fuselage so the cowl sits flush with the fuselage sides. You can tap the maple blocks so that nylon bolts can be treaded. We found that 6-32 nylon bolts have less tendency to vibrate loose than metal bolts.

3. Measure location for exhaust stacks. Glue stacks to cowl and fuse, cut to separate cowl.



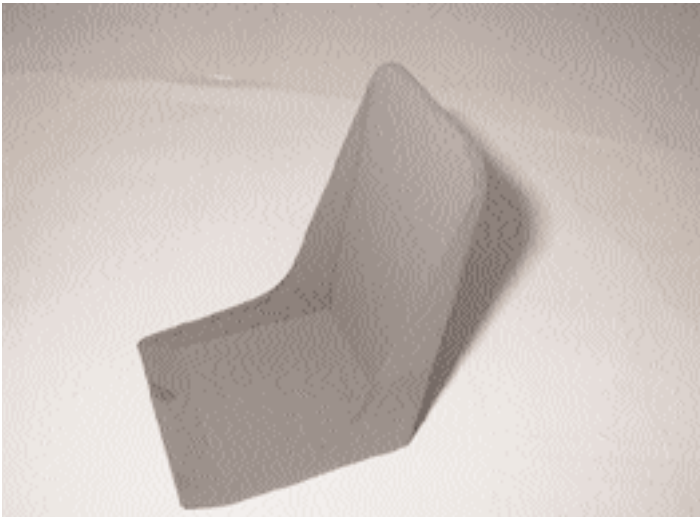
- 1. Glue C2 to cockpit floor.
- 2. Lightly score C3 at the centerline engraving line and bend slightly to "crown" the piece. Glue it to the cockpit floor.
- 3. Sand the edges of C8 to round the vertical sides only, and glue it to C3, angled forward.
- 4. Paint the cockpit interior light gray.
- 5. Detail the cockpit floor as desired (silver for chipped paint for the rivet detail, silver for the fuel tank cap and lines - the round thing in the center).



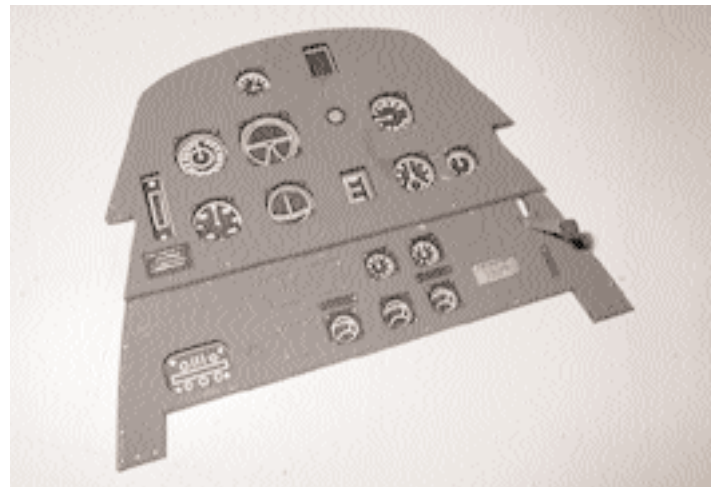
- 6. Glue the C6 brace to the back of the C7 Rudder Pedal. Repeat for the remaining pedal. Paint the pedals Dark Gray and glue to the front of the cockpit floor.
- 7. Paint C4 Dark Gray and glue to the right side of the cockpit floor outside of the engraved locating line for the seat brace.
- 8. Round the edges of C5. Paint Black and glue to the left side of the cockpit floor.



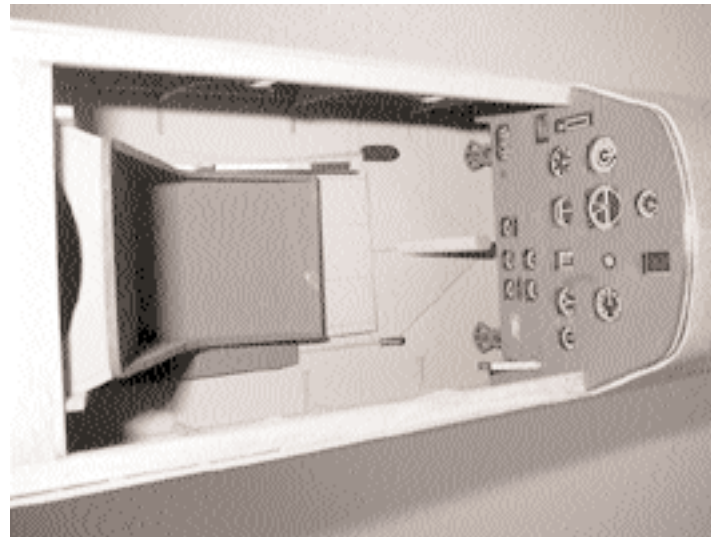
- 9. Paint C24 and C26 Light Gray. Paint C25 Light Gray with a Silver arm and Black handle.
- 10. Glue C24 to the cockpit right side and rear bulkhead on the engraved lines.
- 11. Glue C25 to the cockpit left side and rear bulkhead on the engraved lines.
- 12. Test fit C26 so that the angled side aligns with the sides of C24 and C25. Glue in place.



- 13. Align the bottom edge of C29 Seat Side with C28 Seat Back and glue. Glue C29 to the inside of C28.
- 14. Glue the C27 Seat Bottom to the bottom of C28 and C29.
- 15. Glue the remaining C29 Seat Side to the assembly.
- 16. Glue C30 to the seat assembly matching the angle of the forward edges of C29.
- 17. Paint the seat Dark Gray.

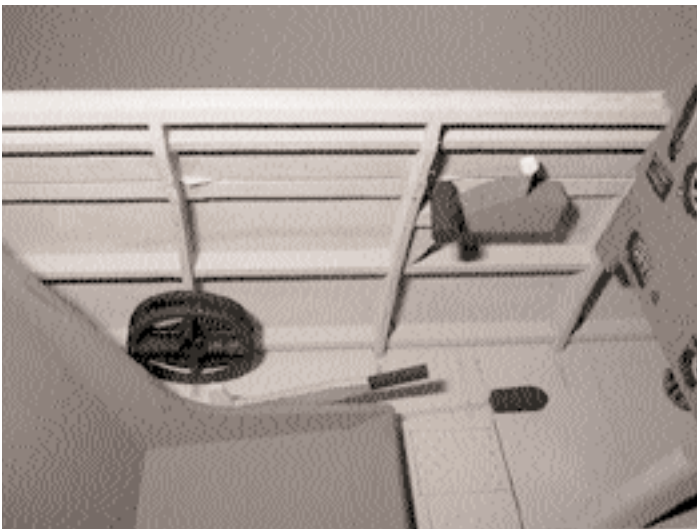


- 18. Paint the C12 and C31 Instrument Panels Dark Gray with Black Instrument edges and silver and red details.
- 19. Cut out the printed instrument panel -----
- 20. Align and glue C31 to C12.
- 21. Glue C32 Gear Handle into the slot in C12.



- 22. Slide the instrument panel into place against the F5 bulkhead and glue.

Glue the seat in place between C24 and C25, with the seat base resting on the cockpit floor, the back against C26, and the forward edge about 1/4" behind C2.

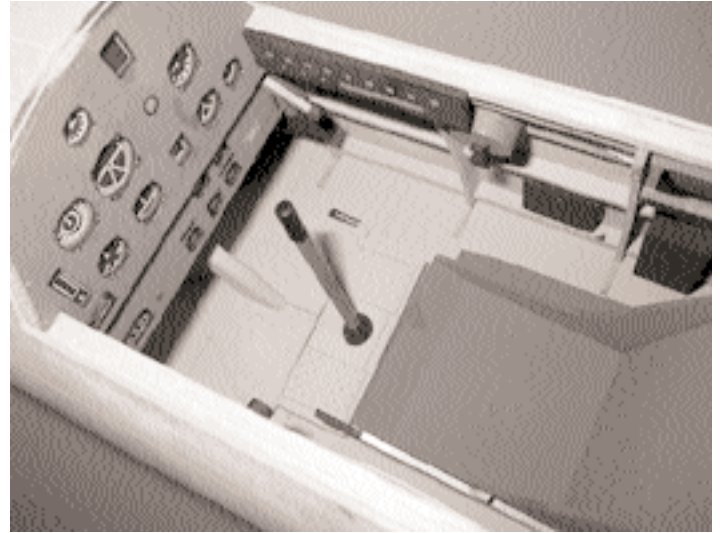


- 23. Align and glue C22 to C21.
- 24. Align and glue C23 to C22.
- 25. Cut a 3/8" piece of 1/4" dowel and glue this piece to the rear lever on C22. This is the throttle grip.
- 26. Paint the assembly Dark Gray with silver levers, the small knob (mixture control) white, and the throttle grip black.
- 27. Glue the throttle quadrant in place (as shown on the plans) to the front edge of F6 on the left side cockpit wall.
- 28. Paint C38 and the C20 Trim Wheels black. Sandwich C38 between the C20s, aligning the spokes of the wheels, and glue.
- 29. Glue the trim wheel to the F7 bulkhead on the left side cockpit wall as shown on the plans.



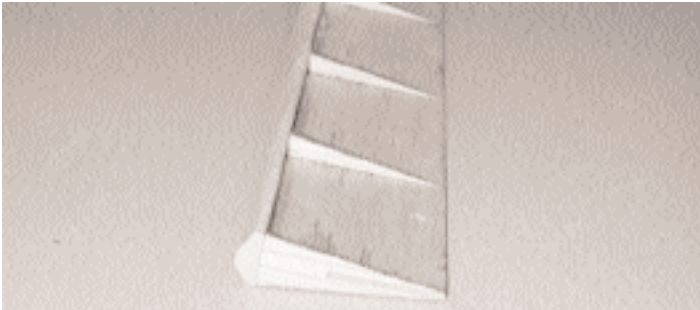
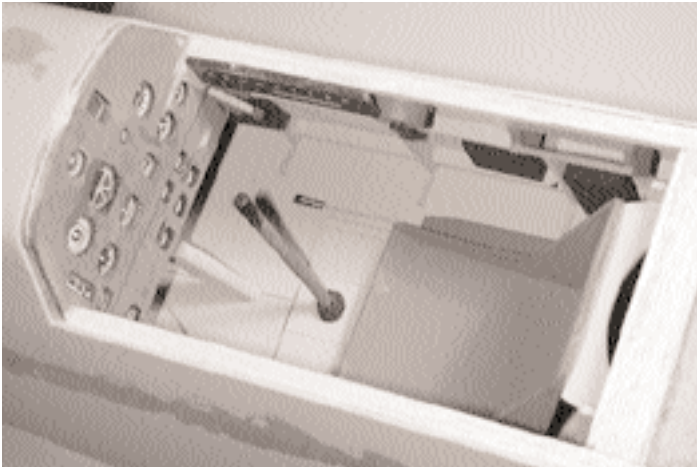
- 30. Paint C10 and C11 black and glue to the right side cockpit wall as shown on the plans.
- 31. Glue C17, C18 and C19 together to form a box, paint Dark Gray, and glue to the right side cockpit wall.

- 32. Glue C14 to C13. Paint Dark Blue. Paint C15 black and glue to C14. Glue this assembly to the right side cockpit wall.
- 33. Paint C16 black with silver details and glue to the right side cockpit wall against the instrument panel.



- 34. Cut a 3" piece of pushrod tubing for the control stick.
- 35. Sand C35 to a taper and glue to the end of the stick (C35 is the boot at the base of the stick).
- 36. Fill the opposite end of the stick (so the end is no longer hollow), and wrap a few rounds of 1/2" wide tape around the stick to form the grip. Paint the stick Dark Gray and the boot and grip Black. Glue the stick to the cockpit floor.
- 37. Glue the C34 Hatch to the aft cockpit bulkhead. Paint Light Gray
- 38. Glue C37 headrest to C35 Armor Bulkhead.
- 39. Glue C35 Armor Bulkhead to F8 at the angle shown on the plans.
- 40. Glue C36 to top of C35 as shown on plans. Paint Armor bulkhead light gray and headrest black
- 41. Insert pilot figure if desired.
- 42. Test fit canopy to fuse. Cut out slot in canopy if you wish to install the radio mast. Glue the radio mast to aft cockpit bulkhead.
- 43. Glue canopy to fuselage.

Some additional cockpit photos for reference:



1. Mount the elevators and rudder (do not glue yet). Sand elevators to match stab. Sand rudder to match the fuselage.

2. Hinge and test fit ailerons.

3. Bevel leading edge of all control surfaces so that you have enough deflection for proper flight.

4. Add scrap balsa to reinforce the control horn mounting areas on each control surface and sand flush with the ribs.

5. Sand bevel on flaps. Hinge and test fit flaps.

6. The control surfaces are now ready to be covered with the film or fabric of your choice. **DO NOT SHEET THE CONTROL SURFACES!!** (except the flaps)



7. Cut out radiators and flap fairings. Measure location for fairings and mount fairings to flaps.

8. Test fit radiators and trim for left side/right side fit. Glue radiators in place. You will need to cut the rear of the radiators if you are using flaps - this will allow the flaps to deploy without binding. (see photo)

9. Cut out cannon bulges and measure and fit to wing bottom.

10. Fit plastic rear oil cooler to fuse to match cowl and glue.

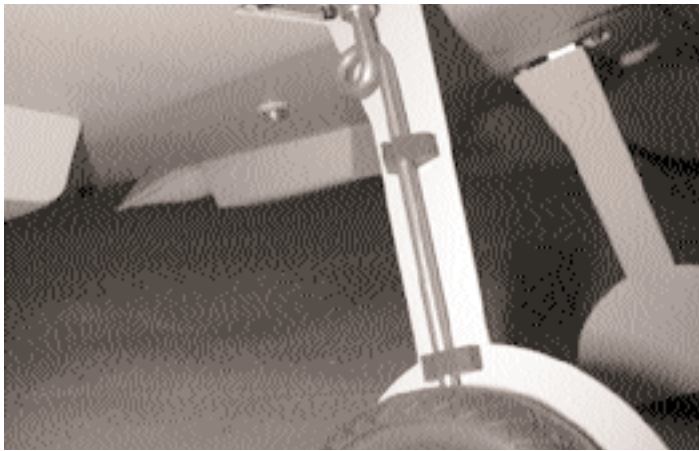


11. Glue the F42 stab braces to the stab and fuse. See plans for locations.

This completes the airframe assembly. The items remaining, such as covering, painting, engine installation, radio component installation, and hooking up the control surfaces are builder's choice, and there are so many options that it would be impossible to cover them. The specifics of the aircraft pictured are as follows:

Retract installation:

I opted to not cut the wheel well openings until after painting the aircraft to avoid overspray in the wheel wells. The openings may be cut at any time, however. Mount and hook up the retracts and install the gear leg with the wheel installed. Manually retract the gear and mark the wheel location, and cut the well openings carefully. Remove the excess support ribs now and finish paint the wheel well. The tail wheel steering should be hooked up at this time.



Gear doors:

Pre-cut gear doors are provided and are laser-cut. They can be attached to the gear legs using the enclosed rubber brackets. Center the gear door over the cut-out in the wing and attach the rubber bracket to the gear door using medium CA. Gear doors attached in this manner should be removed before flight.

Covering and painting:

This model was covered with .5 ounce per sq. Yard fiberglass cloth and fiberglass resin. I do recommend the fiberglass finish due to its increased strength - not structurally, but resistance to minor hangar rash. The finish paint was urethane primer, followed by the top coat. The Federal Standard colors are noted on the 3-views, but as a note, it is very difficult to match FS colors with commercially available R/C paints. I used Testors enamel paints, over the urethane primer, and after applying the decals, applied an overall urethane flat clear finish for fuel proofing.

You can also use .5 - .75 oz. fiberglass cloth with a water-base polyurethane as long as you prep the wood with a cellulose-base sanding sealer. Failure to properly seal the wood will result in warped sheeting. This method makes for a very lightweight finish with little sanding.

Radio installation:

Mount the servos and run the pushrods. Note that we recommend dual elevator servos, and provide mounting locations for them. Next, balance the airplane with everything but the receiver and battery installed. The balance point is biased slightly nose-heavy, so try not to go too much farther forward than the location shown. Determine the battery and receiver location based on the balance requirements, to lessen any extra weight, add any servo extensions needed, and mount the battery and receiver.

Flying:

None of the prototypes weighed over 8 pounds, though the weight range specified allows for more due to individual variations. I do recommend using dual rates on the ailerons and elevators. Both pitch and roll modes get more sensitive at higher speeds. Due to the narrow gear stance, ground handling will be a little more difficult than the average warbird. Some rudder will be needed on takeoff and the initial climbout. The ME109E will perform all the usual maneuvers, with no bad characteristics. Flap usage presents no unusual handling characteristics. The flaps do not cause any large pitch changes when deployed, just a slight nose down moment that is easily controlled with elevator, or can be programmed in flap/elevator mixing. Don't get too slow with the flaps out, because at extremely slow speeds the ailerons require large inputs to maintain control. This characteristic was not present at higher speeds. Landing are very gentle with no tip stalls. For a smooth landing just cut the power and let the plane settle in. 3-point landings are no problem.

Decals

The decals are produced from automotive grade vinyl and cut to size. The vinyl itself is fuel-proof, however, the ink on some of the smaller printed vinyl decals are printed using resin base ink and may not withstand repeated exposure to nitro or oil. We recommend that any printed vinyl be clearcoated with a polyurethane or other fuel proof paint either before or after application. The best way to do this is to lightly clean the decal with rubbing alcohol, then spray 2 or 3 light coats of clear. To apply decals: First insure the surface is smooth, clean and dust free. Remove the backing from the decal and gently rub them onto the surface, working from the center outward. For ease of application on larger decals, wet the surface with windex or mild soap-water, position the decal and use a credit card to squeegee the liquid out from under the decal. Blot any excess liquid with a clean cloth or paper towel. Let dry for 24 hrs after application