

# ULTIMATE FUN FLY



## Building and Flying Instructions

### Designing the ULTIMATE fun fly by Mike Pratt

After designing the Fazer, I started thinking about a new sport fun fly design. The problem was there were already a number of monoplane designs being produced. I wanted to design something totally different from the other fun fly models, something that was readily recognizable by all modelers. After thinking about it for awhile I came to the conclusion that no one has a fun fly biplane. A biplane would be a natural for a fun fly model - quick, responsive and aerobatic.

Ultimate Aircraft (Division of Ultimate Aerobatics Ltd.) in Ontario, Canada produced three different versions of the Ultimate biplane. The 10 DASH 100, the 10 DASH 200 and the 10 DASH 300S.



Ultimate Aircraft provided plans, kits and fully assembled aircraft in the three different versions. One of the new breeds of high performance aerobatic aircraft, the 10 DASH 300S was designed for the ultimate in aerobatic competition - the unlimited class.

The Ultimate 10 DASH 300S was chosen because it's an ideal platform for designing a fun fly model around. Since its introduction in 1985, the full scale Ultimate has captured the imagination of modelers around the world and has quickly become one of the most popular models at many flying fields.

## Engines, Propellers, And Mufflers

The recommended engine range for the ULTIMATE is .32 to .46 displacement two-stroke engines or .40 to .53 displacement four-stroke engines. There are a tremendous variety of engines available in either type. Each type has advantages and disadvantages. Two-stroke engines are light and powerful but are usually louder and need to turn a smaller diameter propeller. Four-stroke engines are somewhat heavier than the two-stroke engines, but they are almost always quieter. Four-stroke engines turn a much larger diameter propeller but the propeller size must be carefully selected or it is possible to over rev the four-stroke engines during maneuvers. Selecting the proper size of propeller for your particular engine is a very important part of the set up. The ULTIMATE, like most fun fly models, was designed to use low-pitch props to control the speed of the model. What we want is acceleration, climb and vertical performance, not straight line speed. Select a propeller from the chart below for the maximum fun with your Ultimate model.

Engine Size	Prop Diameter	Prop Pitch
.32 to .46 cu. in. two-stroke	10" to 12" dia.	3" to 4" pitch
.40 to .53 cu. in. four-stroke	12" to 13" dia.	4" to 5.5" pitch
DO NOT USE PROPS PITCHED HIGHER THAN 5.5"		

Use an effective muffler! A loud muffler may cost you (and possibly your club) the use of your flying field if it annoys a non-flying neighbor. Use the muffler that came with your engine or one of the after-market mufflers that are available. Because you tend to fly this type of model much closer than normal the other flyers at the field will really appreciate your quiet engine!

## Radio Equipment Requirements

Your ULTIMATE will require at least a four-channel radio system with five standard size servos to operate the ailerons, elevator, rudder, and throttle. To take full advantage of the flight performance of the ULTIMATE a radio system with mixing capabilities is preferred. By mixing a number of channels together you can greatly enhance the maneuverability of your ULTIMATE. A good example would be coupling the elevators to the flaps. When coupled, the elevators go up and the flaps go down, (and vice versa) giving the model the ability to make really tight turns or loops. Another example is hooking up the flaps to a three-position switch on your transmitter.

- With the switch in NO.1 position the flaps are kicked up about 10°. This acts like spoilers on a sailplane giving the model a faster descent for landing.
- With the switch in the NO.2 position the flaps are in the neutral position.
- With the switch in the NO.3 position the flaps are lowered to about 30° for a nice slow approach to a landing.

Be certain that your radio system's frequency is approved for use in R/C model aircraft. Using a frequency assigned to R/C model cars and boats not only exposes your model to interference from model car and boat drivers (who may not even be in sight), it is also against the law.

## You'll Need A Good Sanding Block

An assortment of different size sanding blocks are indispensable tools for model construction. A good general purpose block can be made by wrapping a 9"x11" sheet of sandpaper around a piece of hardwood or plywood. Use three screws along one edge to hold the overlapped ends of the sandpaper. Use 80-grit paper for rough shaping. As you progress through the building process switch to progressively finer grades of sandpaper. For final sanding switch to 220 or 360 grit paper.

In addition to the large block there are places where a smaller sanding block is quite handy. Also, a sandpaper "file" can be made by gluing sandpaper to a flat spruce stick or around a hardwood dowel for working in tight places.

## Notes Before Beginning Construction

Any references to right or left refers to your right or left as if you were seated in the cockpit.

To build good flying models, you need a good straight building board. Crooked models don't fly well! The building board can be a table, a workbench, a reject "door core" from the lumber yard, or whatever - as long as it is perfectly flat. Cover the top surface of the building board with a piece of Celotex™ type wall board or foam board, into which pins can be easily pushed. Don't hesitate to use plenty of pins during assembly to hold drying parts in their correct position.

When pinning and gluing parts directly over the full-size plans, cover the plan with wax paper to prevent gluing the parts to the plans. Don't use a ball point or felt tip pen for making marks on the model during construction. If not sanded off, these ink marks may show through the model's final finish. Use a soft pencil for all identification and location marks. Leave all laser-cut parts in the sheets until needed in construction. Remove the pieces from the sheets by cutting the skips holding the parts in the sheets.

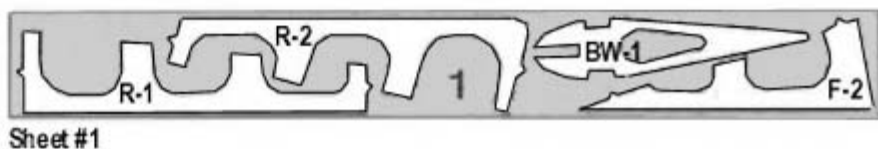
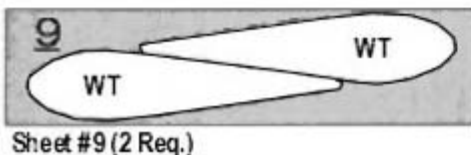
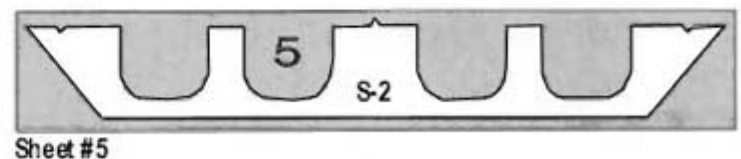
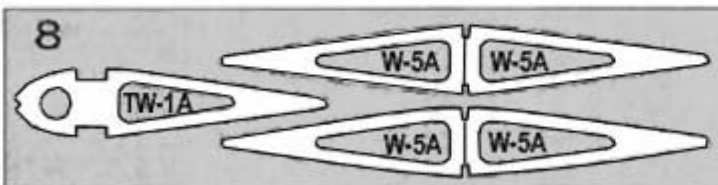
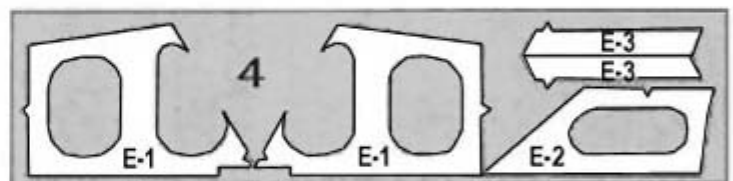
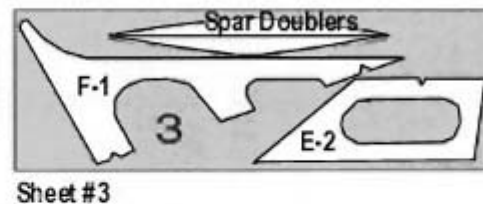
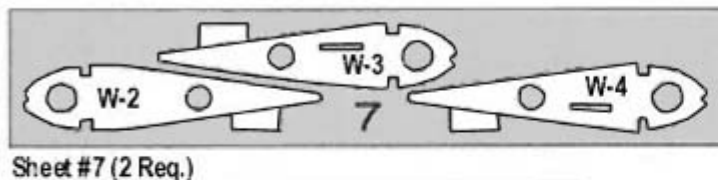
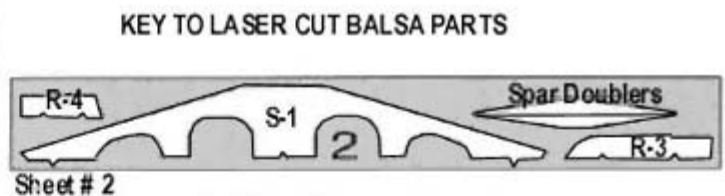
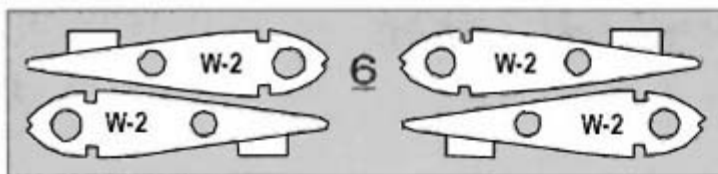
The laser-cut balsa and plywood parts can be identified using the plans and the diagrams below. Mark the identification numbers on the corresponding parts with a pencil before removing them from the laser-cut sheets. All of the other parts can be identified by the "COMPLETE KIT PARTS LIST". Sort the different sizes of sticks and sheets into separate piles to avoid confusion during building.

## About The Building Sequence

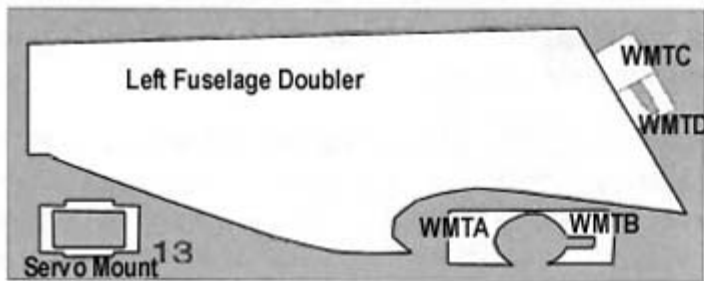
The quickest and most efficient way to complete a model is to work on several pieces at the same time. EXAMPLE: While the glue is drying on the wing, you can start or proceed with the fuselage (or other components). The building sequence used in these instructions is the best way to build each of the major components of the model.

<b>ULTIMATE COMPLETE KIT PARTS LIST</b>							
<b>Laser-Cut Balsa</b>							
1	1/4"x3"x 24" Sheet No.1 R-1 & R-2 Rud., F-2 Fin & BW-1 A Rib	1	1/4"x 3"x 24" Sheet No.2 S-1 Stab., R-3 & R-4 Rud. & Spar Doub.	1	1/4"x 4"x 12" Sheet No.3 F-1 Fin, E-2 Elevator & Spar Doublers	1	1/4"x4"x 18" Sheet No.4 E-1, E-1, E-2, E-3, E-3 Elevators
1	1/4"x 3"x 18" Sheet No.5 S-2 Stabilizer	4	1/16"x4"x18" Sheet No.6 W-2 Wing Ribs	2	1/16"x 3"x 18" Sheet No.7 W-2, W-3, W-4 Wing Ribs	2	1/16"x4"x18" Sheet No.8 TW-1 A & W-5A Wing Ribs
2	3/32"x 3"x 12" Sheet No.9 WT WingTips	2	3/32"x 4"x 15" Sheet No. 10 Shear Webs				
<b>Balsa Sheet</b>							
8	1/16"x2"x24" Leading Edge Sheets	2	1/16"x3"x24" Center Section Sheets	8	1/16"x1-1/4"x24" Trailing Edge Sheets		
<b>Balsa Sticks</b>							
8	1/4"sq.x24" Wing Spars	6	1/16"x1/4" 36" Wing Rib Cap Strips				
<b>Special Cut Balsa</b>							
4	1/4"x1-1/2"x19-1/4" Ailerons	4	5/16"x1/2"x24" Leading and trailing edges	1	1/2"x3"x12" Canopy	1	1/2"x6"x36" Fuselage
<b>Laser-Cut Birch Plywood</b>							
1	1/16"x6"x 8" Sheet No. 11 CSST Center Sheet, BW-1A Rib & WBR, WPR Reinforcements	1	1/8"x6"x15" Sheet No. 12 TW-1 & W-5 Wing Ribs	1	1/8"x6"x15" Sheet No. 13 Left Fuse Doubler, Servo Mount, WMTA, WMTB, WMTD, WMTC	1	1/8"x6"x15" Sheet No. 14 Right Fuse Doubler, Servo Mount, WMTA, WMTB, WMTC, WMTD
<b>Laser-Cut Lite-Ply</b>							
1	1/8"x4"x18" Sheet No. 15 Wing Struts						
<b>Wire Parts</b>							
2	1/16" dia.x24" Elevator and Rudder Pushrods	5	2-56 x10" Threaded Rods				
<b>Miscellaneous Parts</b>							
1	1/8 o.d. x24" Nylon Antenna Tube	1	.090 Left Aluminum Landing Gear	1	.090 Right Aluminum Landing Gear	1	set .070 ABS Molded Wheel Pants
1	set .040 ABS Molded Servo Hatch Covers	3	Decals sheets	2	38"x50" Plans	1	40 page Photo Illustrated Instruction Book
<b>Hardware Package #1</b>							
2	3/8"x1/2"x5" Maple Engine Mounts	1	1/4" Dia. x2" Wing Dowel	1	1/4' Dia. x4" Elevator Joiner Dowel	2	1/4" sq. x1" Basswood Throttle Mounts
1	3/16" birch plywood Laser-cut Cabane Strut	1	1/16" Dia. Pre-Formed Tailwheel Wire	1	1/8" Molded Engine Mount		

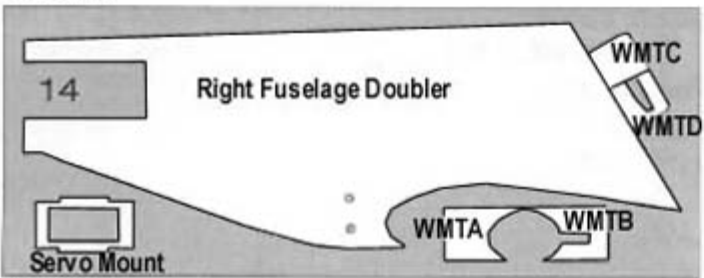
<b>Hardware Package #2</b>						
1 pkg. 19 pieces Sig Easy Hinges	1	1/16"x1/2"x6" Servo Tape	1	5/16" balsa Laser-cut Cabane Fill-in	1	1/2 sq. x3" balsa Fuselage Fill-in
4 1/4"x1-1/2"x2" balsa Aileron Fill-in	1	1/8" Lite-Ply Laser Cut Triple Tool				
<b>Hardware Package #3</b>						
2 Medium Right Nylon Control Horns	1	Small Left Nylon Control Horn	1	Small Right Nylon Control Horn	4	1/8" dia. Nylon L.G. Clips for Push rod Guides
8 Small Nylon L.G. Straps for Push rod Guides	4	Nylon Interconnect Horns	10	# 4 Nylon Flat Washers	10	4-40 x3/8" Nylon Socket Head Bolts
1 2-56 Nylon Ball Link	7	2-56 Nylon RC Links	1	10-32 x1" Nylon Bolt		
<b>Hardware Package #4</b>						
8 #2 x1/4" Sheet Metal Screws	16	#2 x3/8" Sheet Metal Screws	4	2-56 x1" Round Head Bolts	4	4-40 x1-1/4" Socket Head Bolts
4 4-40 x3/8" Socket Head Bolts	4	4-40 J-Bolts	4	6-32 x1-1/2" Round Head Bolts	4	2-56 Hex Nuts
2 6-32 Hex Nuts	6	6-32 Aircraft Locking Nuts	18	4-40 Blind Nuts	4	No.6 Flat Washers
2 1/16" Ld.x2-56 Threaded Brass Couplers	1	5/64" Ld. x2-56 Threaded Brass Coupler	1	Ball Rivet & Washer	1	10-32 Brass Insert
6 2-56 Solder Links						
<b>Additional Items Required To Complete The Aircraft</b>						
1 2-1/4" Spinner	2	2-1/4" Main Wheels	1	3/4" Tailwheel	2	Rolls of Covering - SCC-415
1 4 or 6 oz. Fuel Tank - SS-4 or SS-6	1	4 oz. Supercoat Clear Butyrate Dope - LC-001	1	4 oz. Supercoat Medium Blue Dope - SD-033	1	16 oz. Supercoat Medium Blue Dope Spray - SD-276



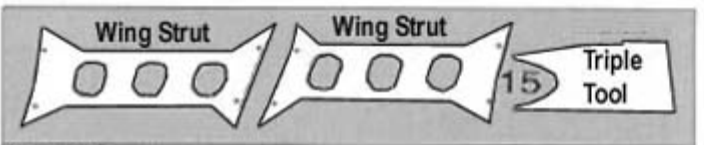




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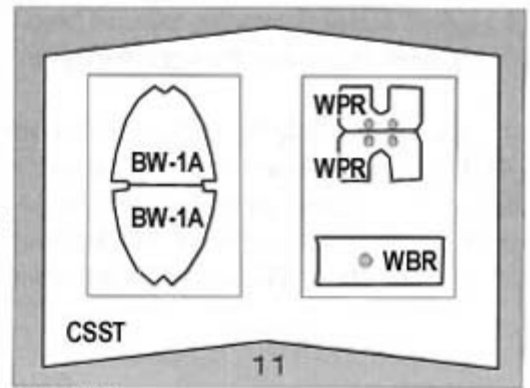


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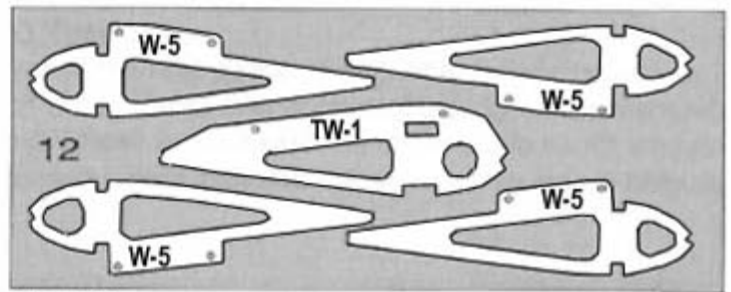


Sheet #15

KEY TO  
LASER CUT  
PLYWOOD PARTS



Sheet #11



Sheet #12

## Glue

There are so many different glues available today for model construction that it can be confusing for even the experienced modeler. To simplify matters, most glues can be classified as one of four basic types:

- Fast cyanoacrylate adhesives (abbreviated in this book as "CA") such as SIG CA.
- Easy-to-use water-based glues such as SIG-BOND (yellow) and SIG SUPER-WELD (white).
- Super strong (but heavier) two-part epoxy glues such as SIG KWIK-SET (5-minute cure) and SIG EPOXY (3-hour cure).
- Traditional solvent-based model cements such as SIG-MENT.

Each of these types has different characteristics and advantages. Often times, the choice of which type to use is strictly a matter of personal preference based on experience with previous models. CA is recommended because of its ability to penetrate an already assembled joint. In other words, parts can be assembled dry (without glue), the alignment checked and adjusted, and then the glue can be applied to the joints. You should also have some epoxy on hand ( 5-minute).

SIG CA, like most brands of cyanoacrylates, comes in three viscosities - thin, medium, and thick. Odorless CA is generally more expensive, but is ideal for people who can't tolerate the fumes of normal CA. An accelerator spray and debonder are also available and are described below.

**SIG CA THIN** - Thin CA should only be used when the two parts to be joined are in perfect contact with zero gap. Capillary action pulls this glue deep in the wood resulting in a very strong bond and it cures in just a few seconds. Thin CA can be used to tack assemblies together, but these joints should be glued again later with medium or thick CA. Thin CA is also necessary for installing EASY HINGES.

**SIG CA PLUS** - Our medium thickness CA is excellent for almost any step during construction . The extra thickness allows the glue to fill small gaps, but it cures a little slower than a thin CA.

**SIG CA SLOW** - This thickest formula is good for filling large gaps and building up strong fillets in joints requiring extra strength. It also cures slow enough to allow you to apply it to one part and position it on another before it cures. This feature is useful when laminating large sheeted areas like a fuselage side and a fuselage doubler.

**SIG KWIK-SHOT ACCELERATOR** - Spraying accelerator on CA (any thickness) will cure it almost instantly. Although CA is fast, it's sometimes nice to speed it up even more.

**DEBONDER** - This can be used to separate parts, but you'll probably use it for unsticking your fingers more than anything else!

**CAUTION:** Some people have experienced allergic reactions when exposed to epoxy or cyanoacrylate glues. Allergic reactions are relatively rare, however, it is always important that glues, paints, thinners, and solvents always be used with adequate ventilation.

## Warning! This Is Not A Toy

Flying machines of any form, either model-size or full-size, are not toys! Because of the speeds that airplanes must achieve in order to fly, they are capable of causing serious bodily harm and property damage if they crash. IT IS YOUR RESPONSIBILITY AND YOURS ALONE to assemble this model airplane correctly according to the plans and instructions, to ground test the finished model before each flight to make sure it is completely airworthy, and to always fly your model in a safe location and in a safe manner.

The governing body for radio-control model airplanes in the United States is the ACADEMY OF MODEL AERONAUTICS, sometimes referred to as the AMA. The AMA SAFETY CODE provides guidelines for the safe operation of R/C model airplanes. While AMA membership is not mandatory, it is a good idea and we encourage all new R/C fliers to join the AMA. Membership in the AMA provides you with important liability insurance protection in case your R/C model should ever cause serious property damage or personal injury to someone else.

For more information, contact:

ACADEMY OF MODEL AERONAUTICS  
5151 East Memorial Drive  
Muncie, IN 47302  
Phone: 317-287-1256

## Limit Of Liability

The craftsmanship, attention to detail, and actions of the builder/flyer of this model airplane kit will ultimately determine the flight performance and safety of the finished model. SIG MFG. CO.'s only obligation shall be to replace those parts of the kit proven to be defective or missing. The user shall determine the suitability of the product for his or her intended use and shall assume all risk and liability in connection therewith.

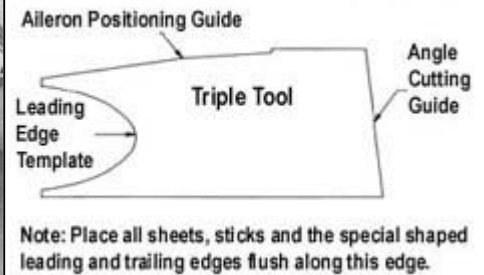
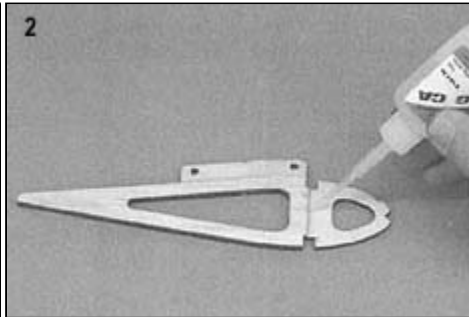
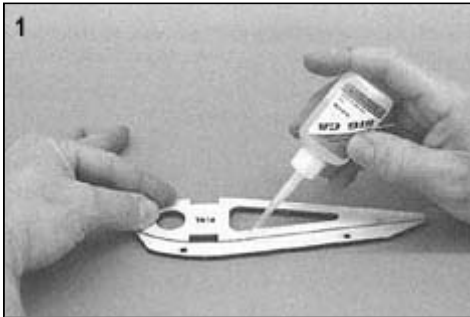


# WING CONSTRUCTION

## Sub Assemblies

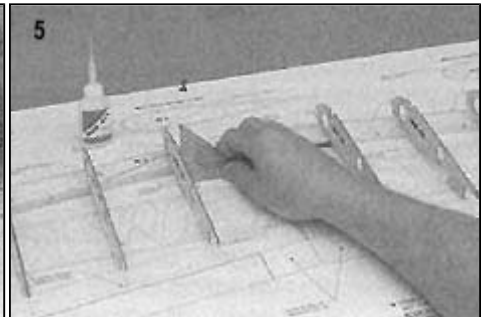
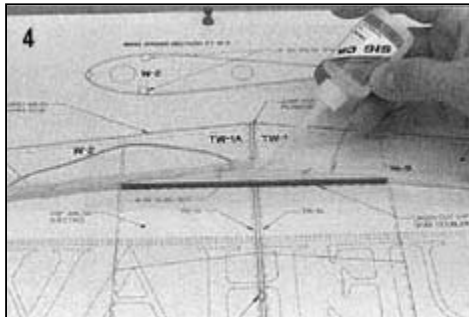
A number of sub assemblies must be constructed before actual wing construction can begin.

1. The trailing edge end of the TW-1 and TW-1A ribs have a small angle that slants forward. Make sure the angle of the TW-1A ribs matches the TW-1 rib. Glue one of the TW-1A balsa ribs to each side of the TW-1 plywood rib using CA.
2. Make sure the angle on the trailing edge of the W-5A balsa ribs matches the angle of the W-5 plywood rib. Glue one of the W-5A 1/16" balsa half ribs onto each side of the W-5 1/8" plywood rib. Repeat for the three remaining W-5 plywood ribs.
3. For your convenience a laser-cut triple tool has been provided. This tool has three different functions:
  - a. Angle cutting guide: for trimming all balsa spars and the leading edge, trailing edge, and center section sheeting.
  - b. Leading edge template: for the final shaping of the leading edge.
  - c. Aileron positioning guide: to properly locate the aileron fill-ins when building the top and bottom wings and to set the ailerons in their neutral position during radio set up.

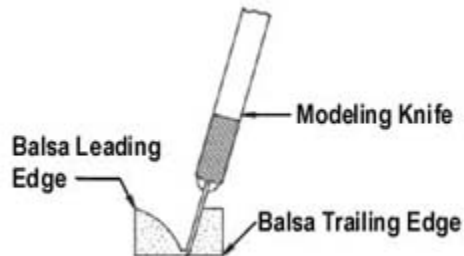


## Top Wing Assembly

4. Trim one end of two 1/4" sq.x24" balsa spars. Use the angle guide to achieve the proper angle. Pin these spars in place over the plans as shown in the photo. Pin the laser-cut 1/4" balsa spar doubler in place and glue the doubler to the spars using thin CA.



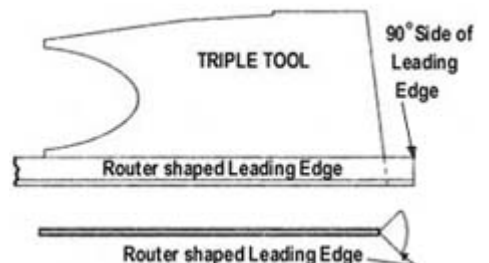
5. Pin in place (10) of the W-2 balsa ribs. Check the spars are fully seated in the spar notches in each wing rib and each rib is pinned to the building board. Using a small 90° square, make sure all the ribs are square to the plan and all the ribs are parallel to each other. Tack glue the ribs to the wing spar with thin CA.



**BUILDERS TIP:** When pinning the ribs to the building board always run two pins through each alignment tab, one on each side at a 45 angle. Pin the front of the rib by passing a pin through the rib and into the 1/4" balsa spar.

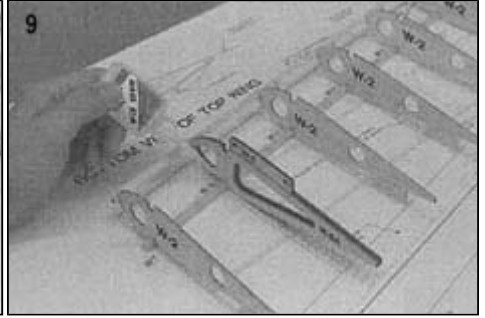
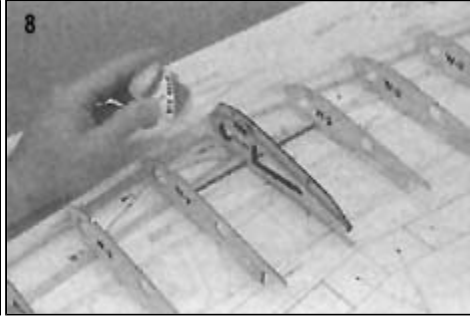
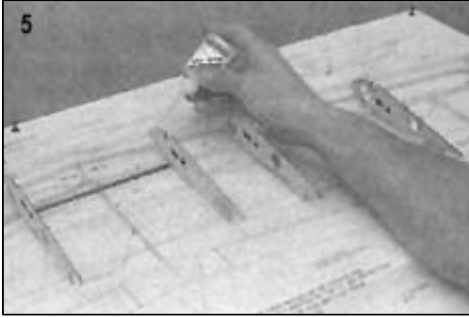
6. The leading and trailing edges have been pre-shaped from a single piece of balsa. Separate the two by cutting them apart as shown in the drawing.

7. Trim the ends of two of the special shaped balsa leading edges using the angle guide and a razor saw. The 90° corner of the leading edge must be flush with the bottom of the angle guide. Pin the leading edges to the front of the balsa ribs making sure the leading edges are fully seated in the notches in the ribs. Also, the intersection of the two leading edges must be in the center of the TW-1 plywood rib.

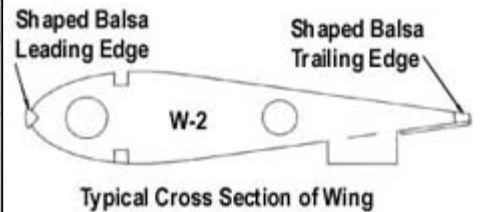
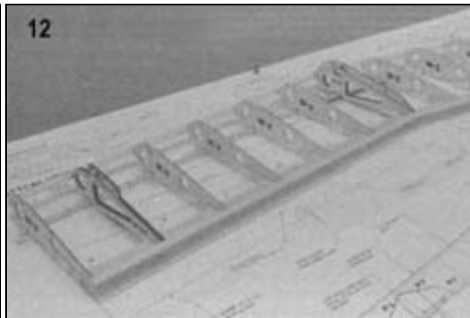
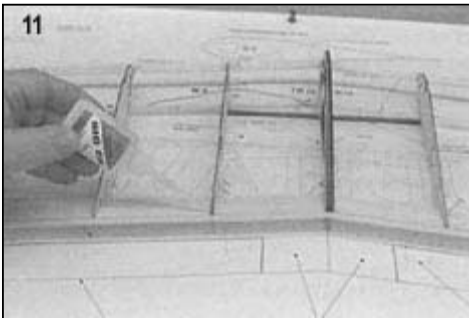


Glue the leading edge to the ribs. But do not glue the center of the leading edge together.

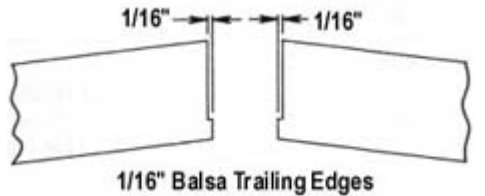
- Place the laminated TW-1 rib in its proper location as shown in the photo and tack glue in place using thin CA.
- Install the two laminated W-5 ribs in their proper locations and tack glue them in place with thin CA.
- Place a straight edge on the rear of the ribs from TW-1A to the tip rib W-2. Sighting from the end of the wing, each rib should be touching the straight edge. Correct any warps at this time before proceeding. When satisfied with the alignment of the wing ribs, securely glue all the ribs, spars and leading edges with medium CA.



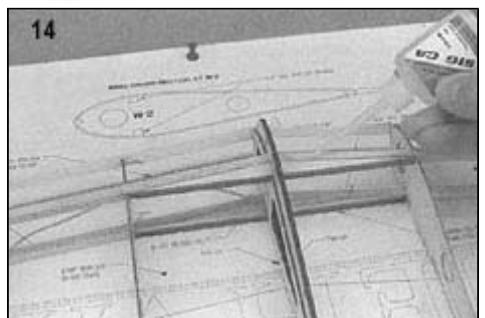
- Trim one end of two 1/16"x1-1/4"x24" balsa sheets using the angle guide and a razor saw. As illustrated in the photo, draw a pencil line parallel to the trailing edge 1/4" from the side of the sheet along its entire length. Pin the sheet to the bottom of the ribs making sure the intersection of the two pieces of sheeting is in the center of the TW-1 plywood rib and the ends of the ribs line up with the pencil line. Sight down the trailing edge and correct any warps before gluing the trailing edge sheeting in place with thin CA. Repeat this step for the opposite wing panel.
- Place the angle guide against the narrow end of the special shaped trailing edge. Use a razor saw to trim off the end of the special shaped trailing edge. Refer to the drawing and glue the special shaped trailing edge to the bottom trailing edge sheeting with medium CA. Make sure the special cut trailing edge is up against the rear of the ribs. Repeat this step for the opposite wing panel.



- Trim one end of two 1/16"x1-1/4"x24" balsa sheets using the angle guide and a razor saw. Cut a 1/16" relief in the angled end of both balsa sheets to fit around the end of the TW-1 plywood rib. Place a bead of slow CA glue along the top of the special shaped trailing edge and on the tops of the each rib. Pin in place the trailing edge sheets making sure the intersection of the two sheets is centered in the TW-1 plywood 1/16" rib and allow the glue to cure.

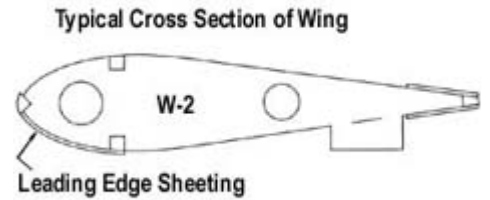


- Trim one end of two 1/4" sq. balsa spars using the angle guide to achieve the proper angle. Install the one 1/4" balsa spar into the slots in the top of the ribs making sure that the end of the balsa spars is in the center of the TW-1 plywood rib and pin in place. Install the lasercut 1/4" balsa spar doubler in its proper location and pin in place. Install the second 1/4" balsa spar into the slots in the top of the ribs and against the first spar. Glue the spars and the spar doubler to the ribs with thin CA.

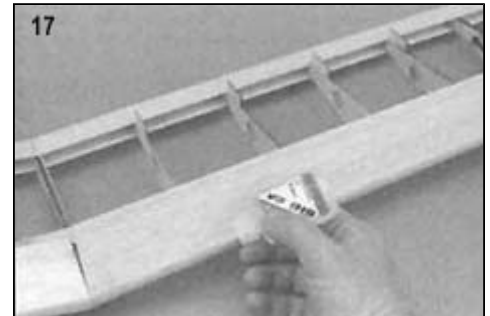




15. Remove all pins and carefully remove the wing from the building board and reglue all joints with medium CA glue. **DO NOT REMOVE THE ALIGNMENT TABS FROM THE RIBS.** The alignment tabs will be needed when the wing is repinned to the building board in a later step. If an alignment tab is inadvertently broken off while sheeting the leading edges on this side of the wing, it must be glued back onto the rib in their proper location.

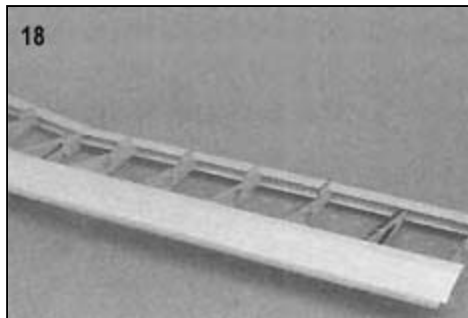


16. Trim the ends of two 1/16"x2"x24" balsa sheets using the angle guide. Use a long sanding block and sand the front edge of the sheet until it fits flush all along the leading edge. The 2" dimension of the balsa sheet is slightly oversized allowing the modeler to trim the balsa sheet for a perfect fit. Trial fit the leading edge sheet onto the wing and check to see if any of the sheet on the spar side needs to be trimmed. If necessary, trim the sheet flush with the rear of the wing spar.



17. Place the 1/16" balsa sheet onto the special shaped leading edge with the angled end of sheet in the center of the TW-1 plywood rib. Glue the sheet to the leading edge along its entire length with thin CA .

18. Place a bead of slow CA glue on the top of the 1/4" spar from the TW-1 rib to the W-2 tip rib. Carefully roll the sheet around the ribs onto the spar and pin in place. Make sure that the sheet is making contact with the top of each rib and allow the glue to cure.



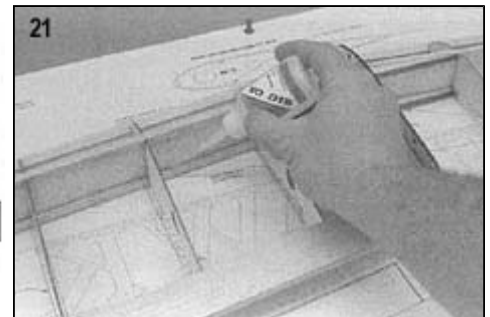
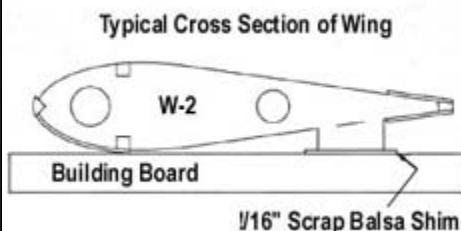
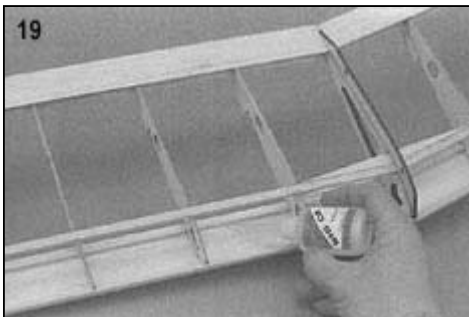
**BUILDERS TIP:**

If the balsa sheet is too stiff it will not bend around the ribs without splitting. Coat the outside of the sheet with isopropyl alcohol. This will help soften the balsa sheet and make it easier to form around the ribs.

19. Turn the wing over and glue each rib to the leading edge sheet with medium CA.

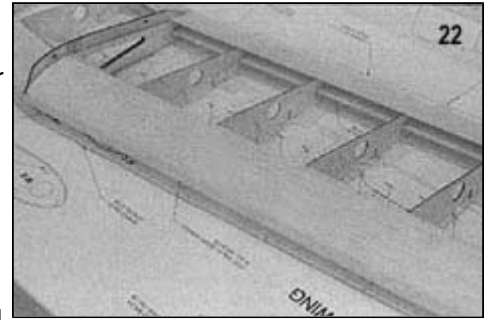
20. Repeat steps No. 16 through No. 19 to sheet the other half of this wing panel. Position the wing back on the building board and place a 1/16" balsa shim under each of the alignment tabs. Pin the wing securely to the building board by passing pins through the alignment tabs, 1/16" balsa shims and into the building board. Also pin the spar and leading sheet to the building board by passing pins through the sides of the wing spars in each of the rib bays. With the wing repinned to the building board, it is held perfectly straight while the shear webbing is installed during the next step.

21. The laser-cut 3/32" balsa shear webs are cut to exact size, but the retaining tabs must be removed to get an exact fit. One or two passes with a sanding block is all that is needed to remove the retaining tabs. Install a shear web into each of the rib bays and make sure that you glue the shear webbing to the top and bottom spar and to each of the wing ribs.

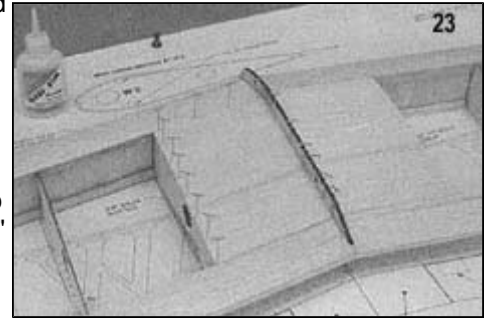


22. Sheet the leading edges of this side of the wing by trimming the ends of two 1/16"x2"x24" balsa sheets using the angle guide. Use a long sanding block and sand the front edge of the sheets until they fit flush all along the leading edges. The 2" dimension of each balsa sheet is slightly oversized allowing the modeler to trim the balsa sheets for a perfect fit. Trial fit the leading edge sheet onto the wing and check to see if any of the sheet on the spar side needs to be trimmed. If necessary, trim the sheet flush with the rear of the wing spar.

Place the 1/16" balsa sheet onto the special shaped leading edge with the angled end of sheet up against the TW-1 plywood rib. Glue the sheet to the leading edge along its entire length with thin CA. Place a bead of slow CA on the top of the spar from the TW-1 rib to the W-2 tip rib and along the top of each wing rib. Carefully roll the sheet around the ribs and onto the spar and pin in place. Make sure that the sheet is making contact with the top of each rib and allow the glue to cure.



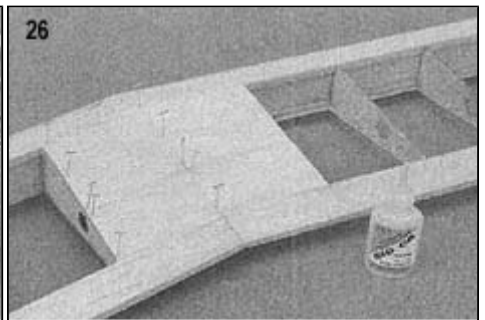
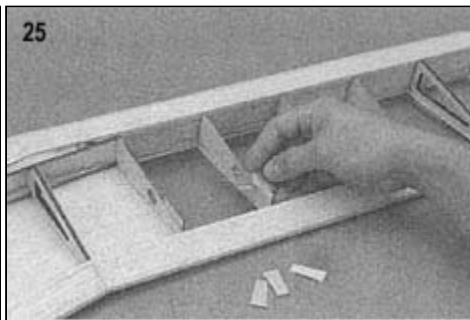
23. Using the angle guide, trim one end of a 1/16"x3"x24" balsa sheet. Measure over 3-9/16" and using the angle guide cut off the sheet. Make four of these angled sheets to sheet the bottom center section of the top wing. Glue and pin in place one of the four angled sheets so that it is flush against the leading edge sheet and the side of the TW-1 plywood rib. Next, trim off the bottom of another of the angled sheets so that it fits flush against the trailing edge sheet and the TW-1 plywood rib. It must also be flush against the previously installed angled sheet. Pin and glue in place with thin CA. Repeat this step for the opposite wing panel.



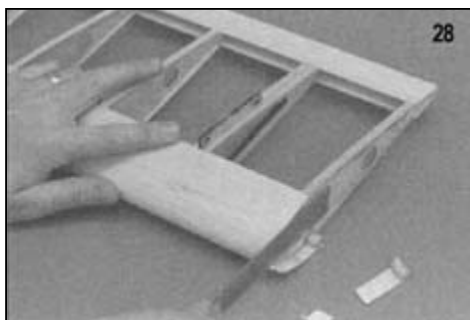
24. Cut to length and glue in place the 1/16"x1/4" balsa cap strips. Make sure the cap strips are glued to the ribs and are not allowed to pull away from the ribs. Two cap strips are required for each of the W-5 plywood ribs, one on each side. Cut a 1/16" recess in each of the cap strips to clear the tab on the W-5 rib as shown on the wing plan.

The bottom of the top wing is now nearly completed. Remove all pins and carefully remove the wing from the building board.

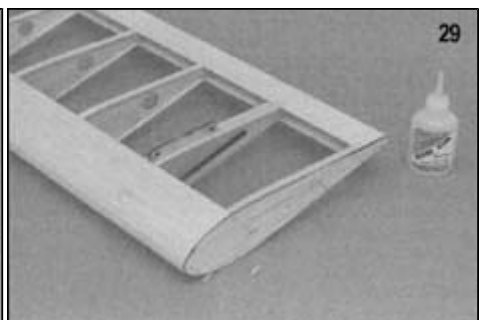
25. Carefully cut away the alignment tabs on each rib with a modeling knife. Smooth up any rough edges with a sanding block making sure that you do not distort the shape of the airfoil.
26. Using the angle guide, trim one end of a 1/16"x3"x24" balsa sheet. Measure over 3-5/8" and using the angle guide cut off the sheet. Make four of these angled sheets to sheet the center section of the top wing. Glue and pin in place one of the angled sheets so that it is flush with the leading edge and centered on the TW-1 rib. Next, trim off the bottom of one of the angled sheets so that it is flush with the trailing edge sheet and it is also centered on the TW-1 rib. Repeat this step for the opposite wing panel.
27. Cut to length and glue in place the 1/16"x1/4" balsa cap strips. On this side of the wing the W-5 plywood ribs need only a single 1/16"x1/4" balsa cap strip.



28. On each wing tip cut off the excess leading and trailing edge sheet, spars, and leading edge with a razor saw so they are flush with the W2 tip rib. Sand the wing tip to a flat surface with a sanding block and 220 grit sandpaper.

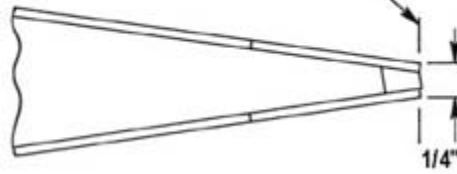


29. Glue and pin in place the wing tips (WT) on the outside of the W-2 tip ribs with medium CA and allow to cure. Sand off any glue that may have been squeezed out.

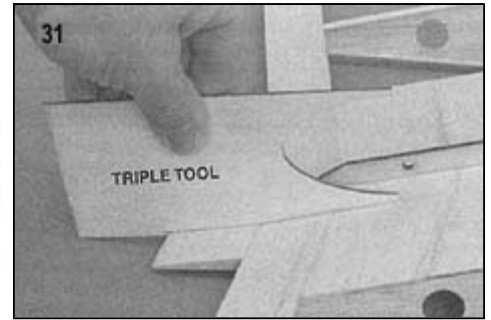


30. Refer to the drawing, and carefully sand the back of the trailing edge to achieve a thickness of 1/4".

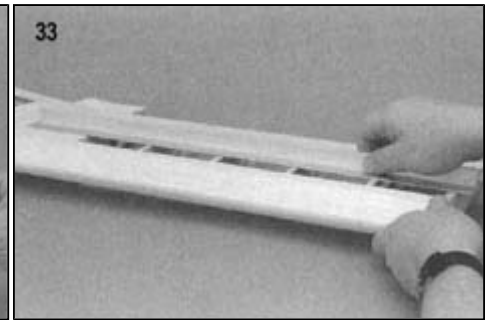
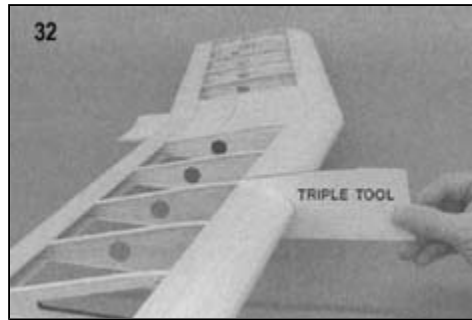
Sand Flush and Flat to this line



31. Pin in place the two pre-cut 1/4" balsa aileron fill-in sheets in the locations shown on the wing plan. Use the aileron positioning guide on the triple tool to properly align the aileron fill-ins and glue in place with thin CA.



32. The pre-shaped leading edge was left slightly oversize so the modeler can match the leading edge to the leading edge sheet. Finish shaping the leading edge with a long sanding block. Periodically check the shape of the leading edge with the leading edge template on the triple tool. Use the template along the entire leading edge to achieve a consistent form.

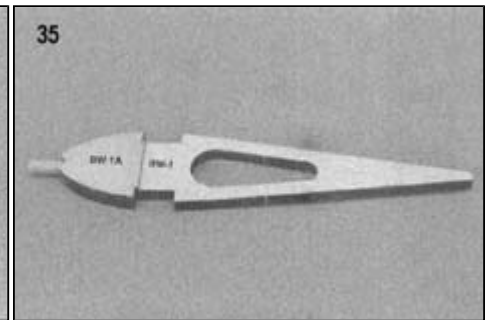
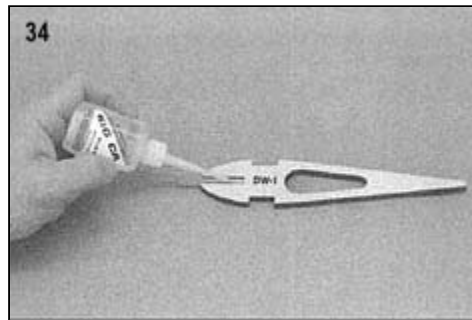


33. Give the wing a final sanding over its entire surface with a long sanding block. Start out with 220 sandpaper to remove any prominent high spots and then switch to 360 sandpaper for the final sanding. Be careful!!! Excessive sanding may distort the airfoil shape and/or severely weaken the wing.

## Bottom Wing Assembly

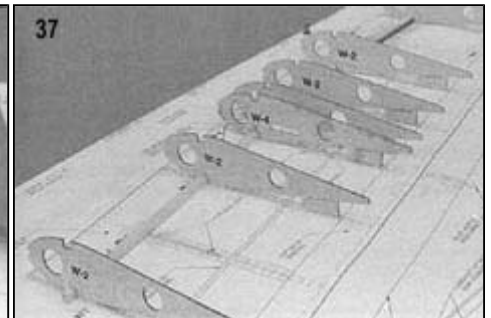
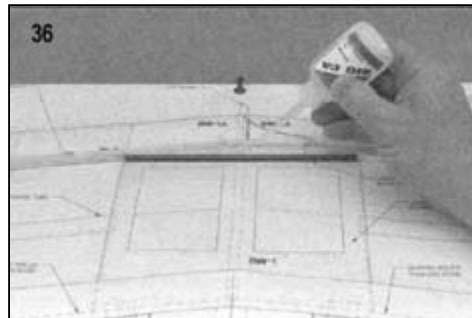
Many of the construction steps for both the top and bottom wing are identical.

34. Place a piece of wax paper on the building board and pin the laser-cut BW-1 1/4" balsa center rib down flat over the wax paper. Glue in place the 1/4"x2" hardwood dowel as shown in the photo with CA. When the glue has cured, sand any excess glue off the sides of the BW-1.



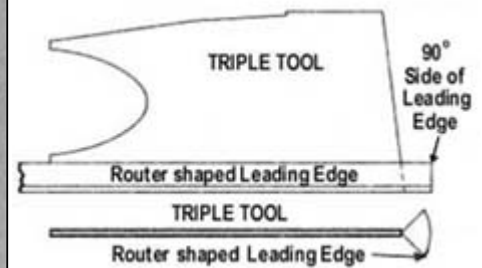
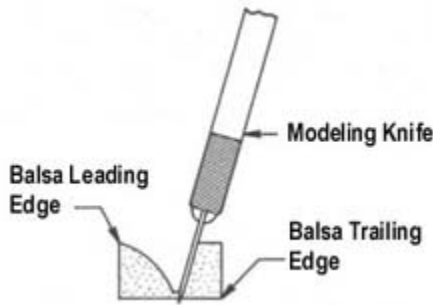
35. Glue one of the laser-cut 1/16" plywood doublers BW-1A onto each side of the BW-1 center rib with medium CA and allow to cure.

36. Trim one end of two 1/4" sq. x24" balsa spars. Use the angle guide to achieve the proper angle. Pin these spars in place over the plans as shown in the photo. Pin the laser-cut 1/4" balsa spar doubler in place and glue the doubler to the spars using thin CA.

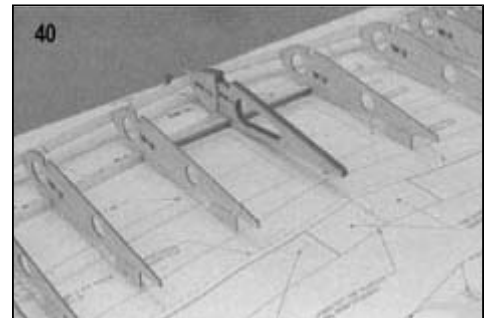


37. Pin in place the eight W-2's, the two W-3's and the two W-4 balsa ribs. Make sure the spars are fully seated in the spar notches in each of the wing ribs. Using a small 90° square, make sure all the ribs are square to the plan and all the ribs are parallel to each other. Tack glue the ribs to the wing spar with thin CA.

38. The leading and trailing edges have been pre-shaped from a single piece of balsa. Separate the two by cutting them apart as shown, with a modeling knife.
39. Trim off one end of the two special shaped leading edges as illustrated in step No.7. Next, wrap a piece 220 grit sandpaper around a 1/4" dowel and sand a half round recess in one end of two of the pre-shaped balsa leading edges. This recess allows the leading edge to fit around the wing dowel in the BW-1 rib.

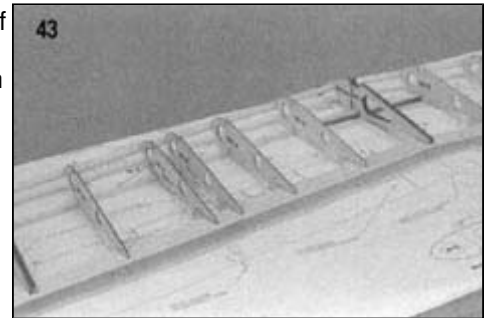


40. Pin the BW-1 balsa rib in it's proper location making sure that the angle in the trailing edge end of the rib is swept forward. Refer to the BW-1 cross-section on the wing plan. Next, pin the special shaped leading edges to the front of the ribs with the half round recess in the leading edges around the 1/4" dia. wing dowel in the BW-1 rib.



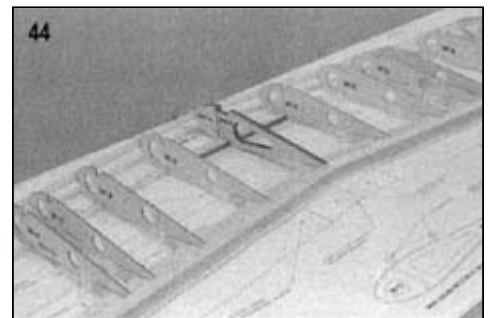
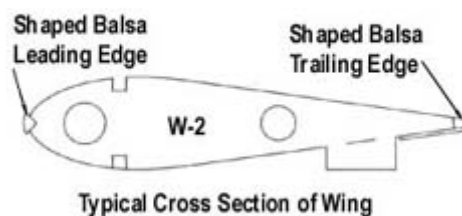
41. Place the laminated W-5 ribs in their proper locations and pin in place. The pin should pass through the balsa lamination, not the plywood.

42. Place a straight edge on the rear of the ribs from TW-1 A to the tip rib W-2. Sighting from the end of the wing, each rib should be touching the straight edge. If not, correct any warps at this time before proceeding. When satisfied with the alignment of the wing ribs, securely glue all the ribs, spars and leading edges with medium CA.

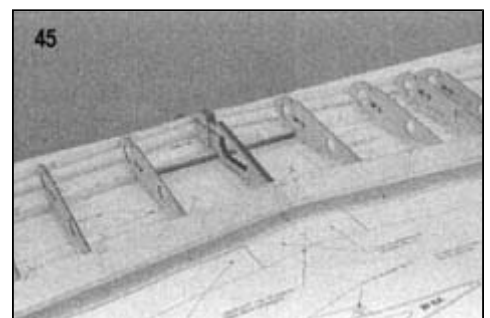


43. Trim one end of two 1/16"x1-1/4"x24" balsa sheets using the angle guide and a razor saw. As illustrated in the photo, draw a pencil line parallel to the trailing edge 1/4" from the side of the sheet along it's entire length. Pin the sheet to the bottom of the ribs making sure the intersection of the two pieces of sheet is in the center of the BW-1 balsa rib and the ends of the ribs line up with the pencil line. Sight down the trailing edge and correct any warps before gluing the trailing edge sheet place with thin CA. Repeat this step for the opposite wing panel.

44. Place the angle guide against the narrow end of the special shaped trailing edge. Use a razor saw to trim off the end of the special shaped trailing edge. Refer to the drawing and glue the special shaped trailing edge to the bottom trailing edge sheet with medium CA. Make sure the special cut trailing edge is up against the rear of the ribs. Repeat this step for the opposite wing panel.

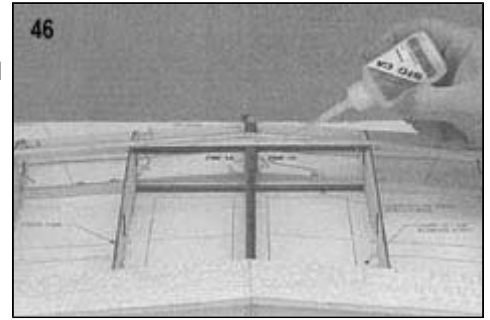


45. Trim one end of two 1/16"x1-1/4"x24" balsa sheets using the angle guide and a razor saw. Place a bead of slow CA glue along the top of the special shaped trailing edge and on the tops of the each rib. Pin in place the trailing edge sheets making sure the intersection of the two sheets is centered in the BW-1 balsa rib and allow the glue to cure.



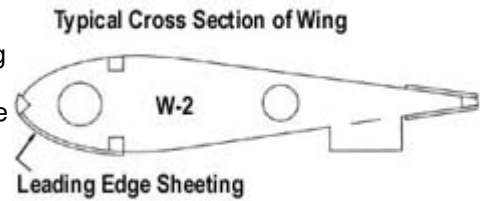


46. Trim one end of two 1/4" sq. balsa spars using the angle guide to achieve the proper angle. Install the two 1/4" sq. balsa spars into the slots in the top of the ribs making sure that the intersection of the two spars is in the center of the BW-1 rib and pin in place. Install the lasercut 1/4" balsa spar doubler in its proper location and pin in place. Glue the spars and spar doubler to the ribs with thin CA.



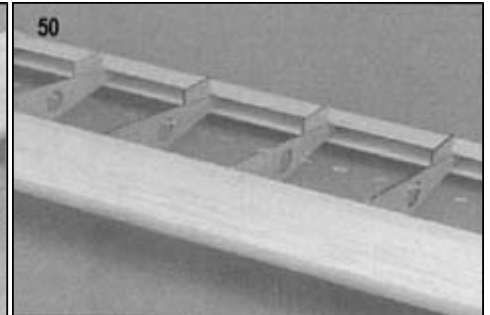
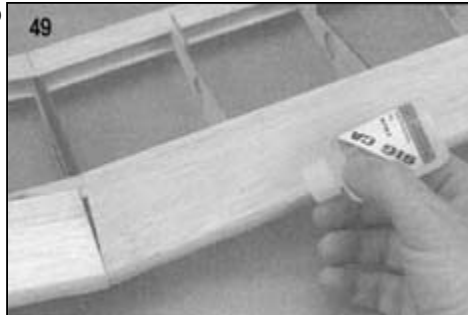
47. Remove all pins and carefully remove the wing from the building board and reglue all joints with medium CA glue. DO NOT REMOVE THE ALIGNMENT TABS FROM THE RIBS. The alignment tabs will be needed when the wing is repinned to the building board in a later step. If an alignment tab is inadvertently broken off while sheet this side of the wing, it must be glued back onto the rib in its proper location.

48. Trim the ends of two 1/16"x2"x24" balsa sheets using the angle guide. Use a long sanding block and sand the front edge of the sheet until it fits flush all along the leading edge. The 2" dimension of the balsa sheet is slightly oversize allowing the modeler to trim the balsa sheet for a perfect fit. Trial fit the leading edge sheet onto the wing and check to see if any of the sheet on the spar side needs to be trimmed. The sheet must be flush with the rear of the wing spar as illustrated in the above drawing.



49. Place the 1/16" balsa sheet onto the special shaped leading edge with the angled end of sheet in the center of the TW-1 plywood rib. Glue the sheet to the leading edge along its entire length with thin CA.

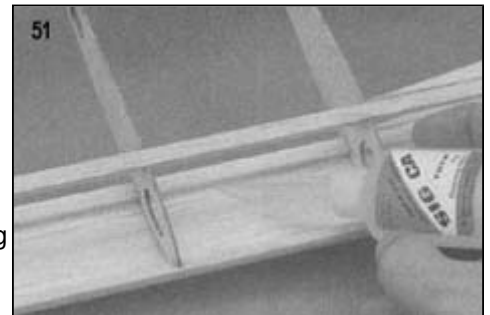
50. Place a bead of slow CA glue on the top of the 1/4" spar from the TW-1 rib to the W-2 tip rib. Carefully roll the sheet around the ribs onto the spar and pin in place. Make sure that the sheet is making contact with the top of each rib and allow the glue to cure.



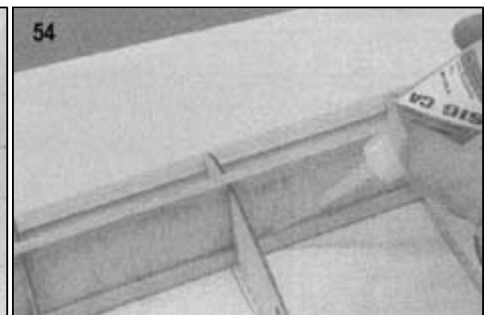
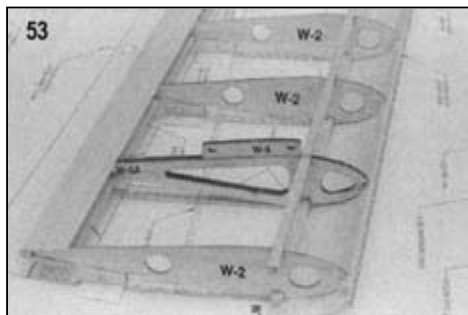
51. Turn the wing over and glue each rib to the leading edge sheet with medium CA.

52. Repeat steps No. 48 through No. 50 to sheet the other half of this wing panel.

53. Position the wing back on the building board and place a 1/16" balsa shim under each of the alignment tabs. Pin the wing securely to the building board by passing pins through the alignment tabs, 1/16" balsa shims and into the building board. Also pin the spar and leading edge sheet to the building board by passing pins through the sides of the wing spars in each of the rib bays. With the wing repinned to the building board, it is held perfectly straight while the shear webbing is installed during the next step.

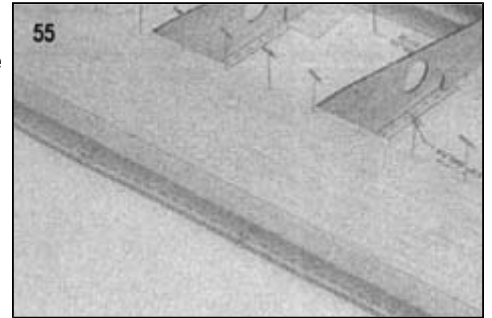


54. The laser-cut 3/32" balsa shear webs are cut to exact size, but the retaining tabs must be removed to get an exact fit. One or two passes with a sanding block is all that is needed to remove the retaining tabs. Install a shear web into each of the rib bays and make sure that you glue the shear webbing to the top and bottom spar and to each of the wing ribs.



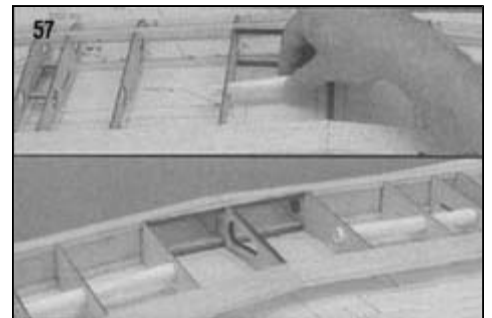
55. Sheet the leading edges of this side of the wing by trimming the ends of two 1/16" x 2" x 24" balsa sheets using the angle guide. Use a long sanding block and sand the front edge of the sheets until they fit flush all along the leading edges. The 2" dimension of each balsa sheet is slightly oversize allowing the modeler to trim the balsa sheets for a perfect fit. Trial fit the leading edge sheet onto the wing and check to see if any of the sheet on the spar side needs to be trimmed. If necessary, trim the sheet flush with the rear of the wing spar.

Place the 1/16" balsa sheet onto the special shaped leading edge with the angled end of sheet in the center of the BW-1 rib. Glue the sheet to the leading edge along its entire length with thin CA. Place a bead of slow CA glue on the top of the spar from the BW-1 rib to the W-2 tip rib and along the top of each wing rib. Carefully roll the sheet around the ribs and onto the spar and pin in place. Make sure that the sheet is making contact with the top of each rib and allow the glue to cure.



56. Install the laser-cut 1/8" plywood aileron servo mount between the wing ribs W-3 and W-4 by twisting the servo mount until the tangs of the servo mount snap into the wing rib slots. Glue the servo mount in place using medium CA.

57. Make a paper tube by cutting a 3"x6-1/4" rectangle from any light paper. Roll the paper rectangle around a pencil to produce a 6-1/4" long tube. Slip the pencil and paper into the holes in the rear of the wing ribs as shown in the photo. When properly positioned, release the paper. Use a couple of pieces of scotch tape to close the outside edge of the paper tube and glue the tube to wing ribs using CA glue. Repeat this step for the opposite wing panel.

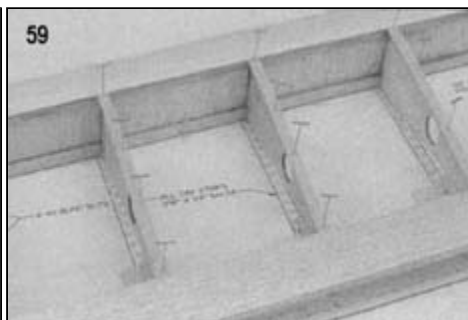


58. Glue the laser-cut 1/16" plywood center section sheet (CSST) in place with slow CA making sure it is centered on rib BW-1. Also, make sure the plywood sheet is contacting the tops of the ribs and is not allowed to pull away. Use pieces of masking tape to hold the sheet in place until the glue cures.

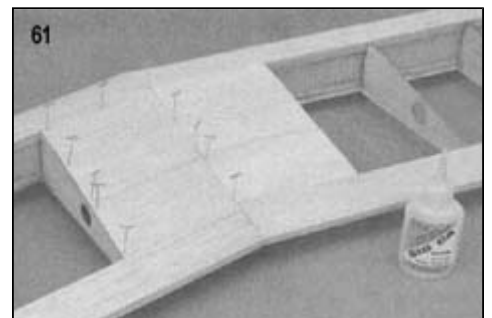
59. Cut to length and glue in place the 1/16"x1/4" balsa cap strips. Make sure the cap strips are glued to the ribs and are not allowed to pull away from the ribs. Two cap strips are required for each of the W-5 plywood ribs, one on each side. Cut a 1/16" recess in each of the cap strips to clear the tab on the W-5 rib as shown on the wing plan.

NOTE: The top of the bottom wing is now nearly completed. Remove all pins and carefully remove the wing from the building board.

60. Carefully cut away the alignment tabs on each rib with a modeling knife, or a single edge razor blade. Smooth up any rough edges with a sanding block making sure that you do not distort the shape of the airfoil.

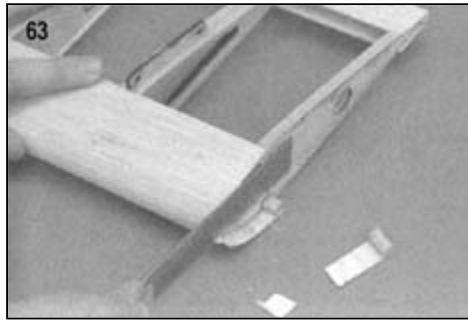


61. Using the angle guide, trim one end of a 1/16"x3"x24" balsa sheet. Measure over 3-5/8" and using the angle guide cut off the sheet. Make four of these angled sheets to sheet the bottom center section of the bottom wing. Glue and pin in place one of the angled sheets so that it is flush with the leading edge and centered on the BW-1 rib. Next, trim off the bottom of one of the angled sheets so that it is flush with the trailing edge sheet and it is also centered on the BW-1 rib. Repeat this step for the opposite wing panel.

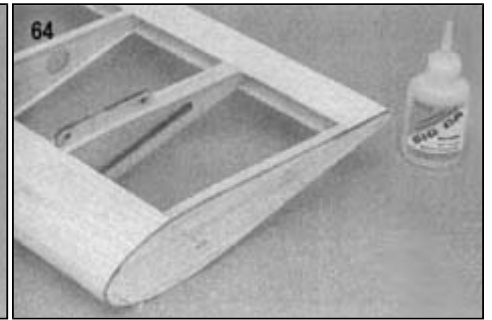


62. Cut to length and glue in place the 1/16" X 1/4" balsa cap strips. On this side of the wing the W-5 plywood ribs need only a single 1/16"x1/4" cap strip.

63. On each wing tip cut off excess leading and trailing edge sheet, spars, and leading edge with a razor saw so they are flush with the W-2 tip rib. Sand the wing tip to a flat surface with a sanding block and 220 grit sandpaper.

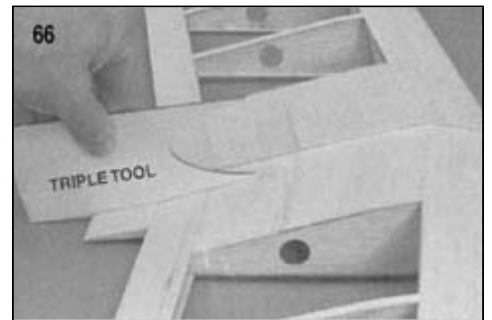
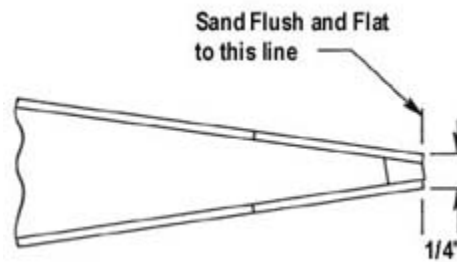


64. Glue and pin in place the wing tips (WT) on the outside of the W-2 tip ribs with medium CA glue and allow to cure. Sand off any excess glue that may have been squeezed out.

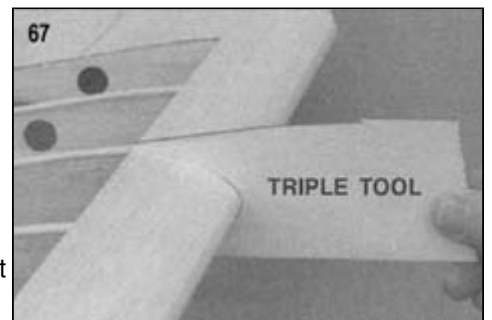


65. Referring to the drawing, carefully sand the back of the trailing edge to achieve a thickness of 1/4".

66. Pin in place the two pre-cut 1/4" balsa aileron fill-in sheets in the location that is shown on the wing plan. Use the aileron positioning guide on the triple tool to properly align the aileron fill-ins and glue in place with thin CA.



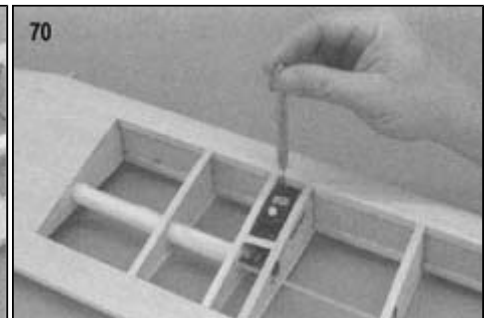
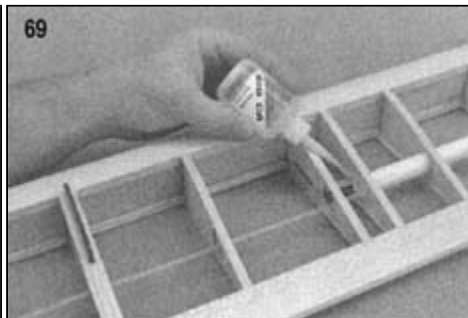
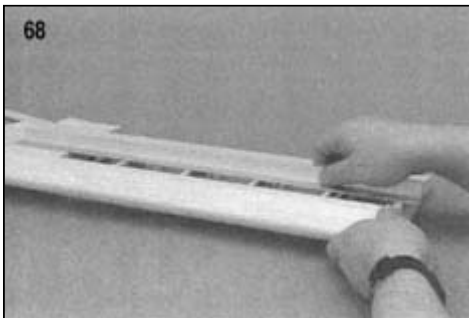
67. The pre-shaped leading edge was left slightly oversize so the modeler can match the leading edge to the leading edge sheet. Finish shaping the leading edge with a long sanding block. Periodically check the shape of the leading edge with the leading edge template on the triple tool. Use the template along the entire leading edge to achieve the proper form.



68. Give the wing a final sanding over its entire surface with a long sanding block. Start out with 220 sandpaper to remove any prominent high spots and then switch to 360 sandpaper for the final sanding. Be careful!!! Excessive sanding may distort the airfoil shape and/or severely weaken the wing.

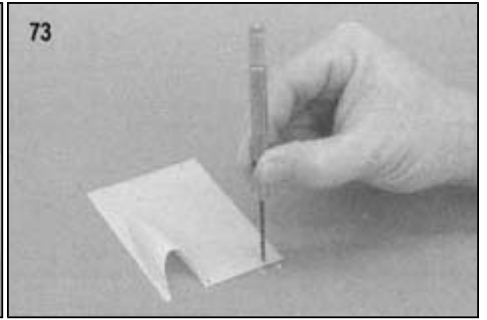
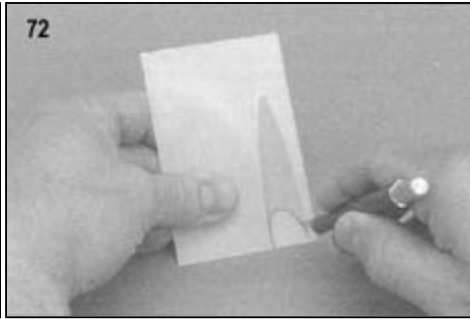
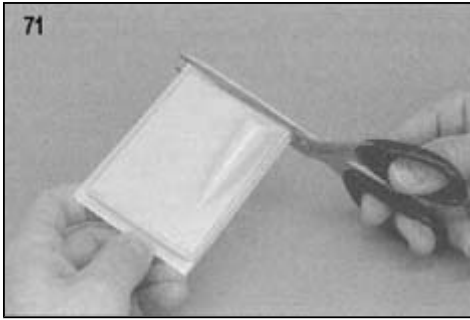
69. Drill a 1/8" dia. hole in the wing tip (WT) at the rear of the lighting hole in the W-2 tip rib. Install the 1/8" O.D. nylon antenna tube as illustrated on the wing plan and glue in place with medium CA. Cut off any excess nylon tube flush with the outside of the wing tip (WT). Do not throw away the excess antenna tube. The remainder of the nylon tube will be used for the pushrod guides.

70. Temporarily install the aileron servos. Use a 1/16" drill bit and a pin vise to drill holes in the laser-cut plywood servo mount for the servo mounting screws.



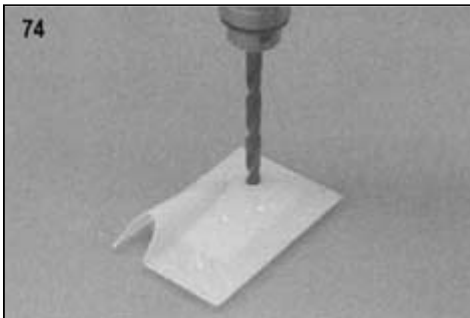
71. Two vacuum formed ASS servo hatch covers have been provided, one left and one right. Cut-out the hatches along the molded line using a pair of scissors. Sand the four outside edges of each hatch with a sanding block and 220 sandpaper to get a straight, square hatch.

72. Use a sharp (new) No. 11 blade and a modeling knife, cutout the back of the hatch fairing as shown in the photo. Do not try to cut all the way through the ASS plastic on the first pass. Make three or four passes cutting a little deeper on each pass. Remove any rough edges with 220 sandpaper wrapped around a 1/4" hardwood dowel.



73. Drill four holes in each of the ASS hatch covers using a 3/32" drill bit and a pin vise. The locations of these hole are marked by small dimples in the plastic, two along the front edge and two along the rear edge.

74. The right ASS servo hatch also has a dimple 3/4" from the front edge of the hatch next to the fairing. Using progressively larger bits, drill a 3/8" hole through the hatch cover at this dimple.



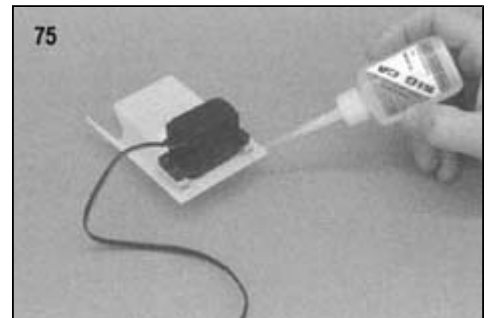
#### A NOTE ABOUT SERVOS:

There are many manufacturers of servos in the market place today and it seems like they all make their servos just a little bit different from one another.

Depending on the make and type of servo that you use, you may have to adjust the height of the servo by placing thin plywood shims under the servos.

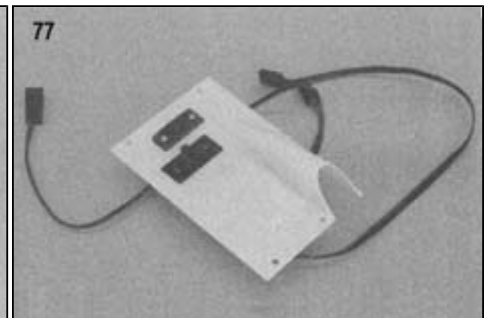
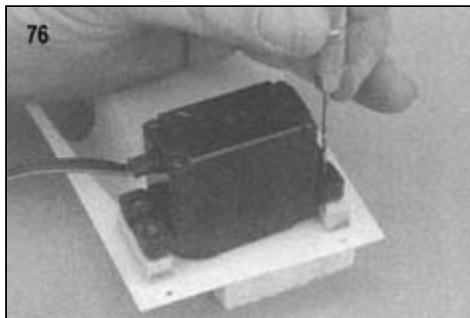
The servo output arm must clear the ASS hatch covers by at least 1/16" to keep it from binding.

75. To mount the throttle servo, install the rubber grommets (servo and mounting hardware are not provided) on the servo mounting lugs with the flange of the eyelets on the top of the mounting lug. Place the servo onto the right hatch with the servo output arm extending through the center of the 3/8" hole. Hold the servo parallel to the front edge of the hatch and place the two 1/4" sq. basswood mounting blocks under the servo mounting lugs. With thin CA, glue the basswood blocks to the ASS hatch.



76. Using a 1/16" drill bit and a pin vise, drill the four holes in basswood servo mounts for the servo mounting screws. DO NOT DRILL THROUGH THE ASS HATCH!!!

77. Mark the location of the required holes for the switch and charge jack on the left ASS hatch cover. Leave room for the elevator servo that will be mounted during final assembly. Start the holes with a drill and carefully enlarge them until the charge jack and switch harness fit their openings.

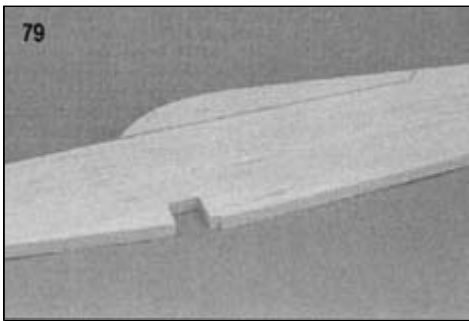
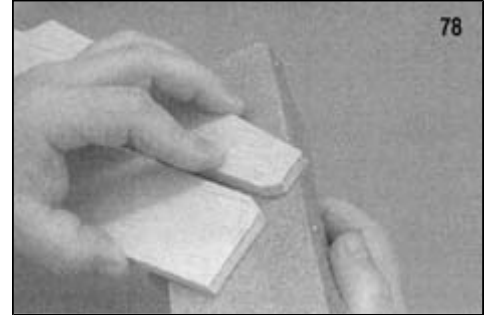


NOTE: The throttle, elevator and rudder servos, switch harness and charging jack will be permanently mounted to the hatches during final assembly.



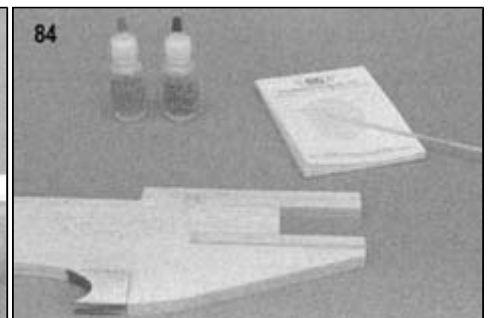
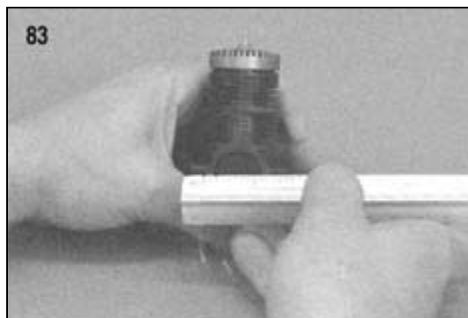
## FUSELAGE CONSTRUCTION

78. Draw a vertical line on each side of the fuselage 2-5/8" from the rear. Draw two vertical lines on the back of the fuselage 1/8" in from each side. Taper each side of the fuselage from the 2-5/8" side line to the rear 1/8" line to achieve a 1/4" thickness (same thickness as the rudder). Start out using a small razor plane and then switch to a sanding block to finish tapering the rear of the fuselage.
79. Place a small piece of wax paper under the canopy cutout and pin the fuselage down flat. Apply a liberal bead of slow CA glue to the bottom of the canopy and pin it in place on the fuselage. Wipe off any excess glue and allow the glue to cure.
80. a. The front wing mount assembly is made up by laminating four laser-cut plywood pieces together, two WMTA's and two WMTB's. Glue the two WMTB's together with SIG Kwik Set Epoxy (5 minute) and allow to dry. Next, glue one of the WMTA's to each side of the laminated WMTB's.
- b. The rear wing mount assembly is also made up by laminating four laser-cut plywood pieces together, two WMTC's and two WMTD's. Glue the two WMTD's together with SIG Kwik Set Epoxy (5 minute) and allow to dry. Next, glue one of the WMTC's to each side of the laminated WMTD's.

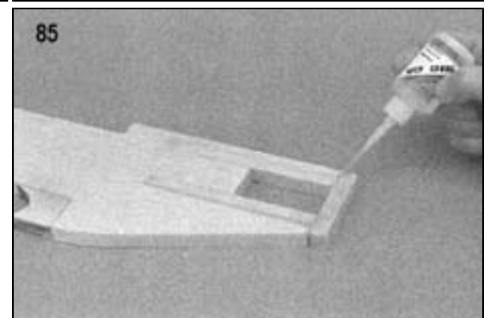


81. Install the threaded brass insert into the rear wing mount assembly by threading a 10-32 nut onto a 10-32 bolt. Apply some wax or light oil to the end of the bolt. Thread the brass insert onto the bolt and tighten the nut against the brass insert to lock the brass insert onto the bolt. Next, thread the brass insert into the rear plywood wing mount assembly until the insert is flush with the wing mount. Carefully glue the insert in place using medium CA. After the glue cures remove the bolt from the brass insert.
82. Place small pieces of wax paper under the fuselage at the wing mount locations and pin the fuselage to the building board. Glue the front and rear wing mount assemblies to the balsa fuselage with SIG Kwik Set Epoxy (5 minute) and allow to cure.

83. The spacing of the maple engine mounts must be adjusted to fit your particular engine. Measure the width of the crankcase to determine the correct spacing of the maple mounts. Install the maple mounts into the balsa fuselage and adjust the mount spacing by varying the thickness of the scrap balsa spacer under the bottom mount as shown on the fuselage plan.



84. Because the fuselage is routed to shape (not band sawed) the engine mount slots have a slight radius at the rear. Slightly round the ends of the maple engine mounts for a flush fit. Glue the maple engine mounts in place along with the proper balsa spacer with SIG Kwik Set Epoxy (5 minute) wipe off any excess epoxy glue with isopropyl alcohol and allow the glue to cure.



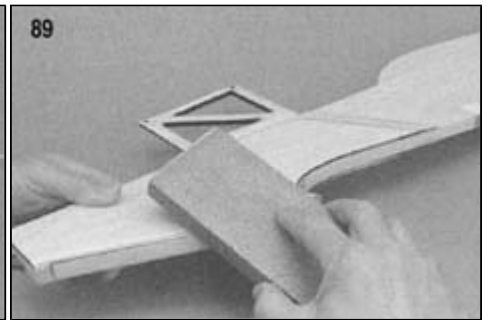
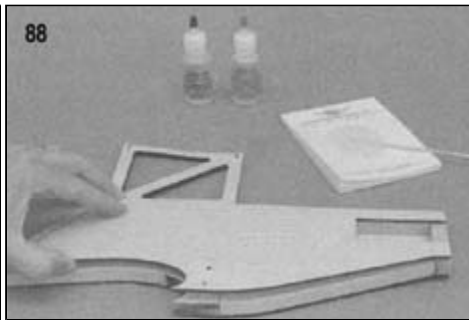
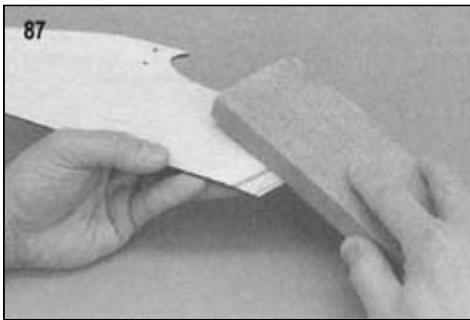
85. Glue the 1/2" sq. x3" balsa fuselage fill-in to the front of the fuselage and the maple engine mounts with medium CA.

86. Place a small piece of wax paper on your building board and pin the fuselage to the building board with the cabane cutout over the wax paper. Make sure the **LEFT SIDE OF THE FUSELAGE IS DOWN!!!** Glue in place the laser-cut 3/16" plywood cabane strut along with the laser-cut 5/16" balsa cabane fill-in with SIG Kwik Set Epoxy (5 minute). Wipe off any excess glue and weight the assembly down with a stack of old books or metal weights until the glue cures.



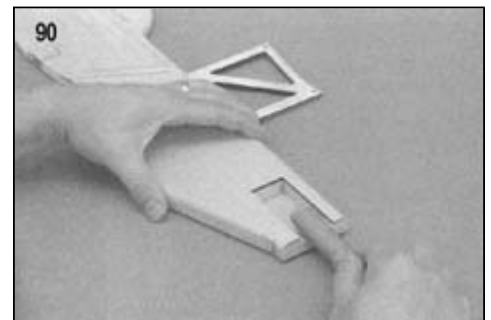
87. Taper the ends of the left and right fuselage doublers with a razor plane or sanding block. Make sure you taper the outside ends of the doublers - **NOT THE INSIDE ENDS.**

- 88.
- Glue the left laser-cut 1/8" plywood doubler to the left side of the fuselage using a liberal amount of SIG Kwik Set Epoxy (5 minute) applied to the inside of the doubler. Hold the doubler in place until the epoxy glue has cured with either metal weights or a stack of old books.
  - Apply a liberal amount of SIG Kwik Set Epoxy (5 minute) to the inside of the right laser-cut 1/8" plywood doubler (the one with the engine cutout) and glue the to the right side of the fuselage. Hold the doubler in place until the epoxy glue has cured, with either metal weights or a stack of old books.

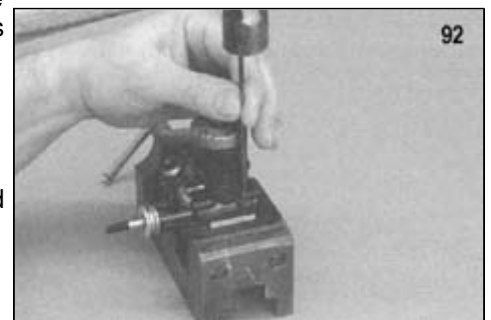


89. Use a razor plane to roughly round the edges of the plywood doubler and the balsa fuselage. Finish shaping the fuselage and doublers with a sanding block equipped with 80 grit sandpaper. Blend all the corners and smooth the flat areas with 220 grit sandpaper.

90. Wrap a piece of 80 grit sandpaper around a 3/4" dowel and sand a half round shape in the 1/2" sq. balsa fuselage fill-in (between the maple engine mounts) to provide clearance for the crankcase of your engine.



91. The injection molded engine mount was designed to accommodate a wide range of engine sizes (.25 to .45). Depending upon which size engine you use, it may be necessary to trim the insides of the mount to fit your particular engine. Scribe lines have been provided on the face of the mount as a guide for cutting. Carefully measure your engine and trim an equal amount from each side of the mount until your engine fits into the mount without spreading the mount.



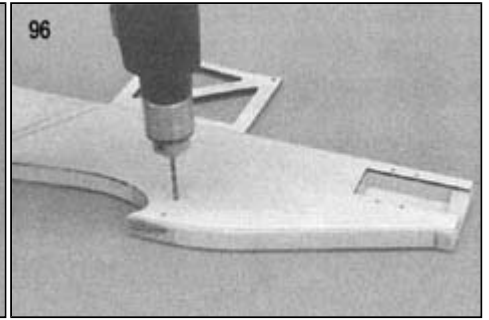
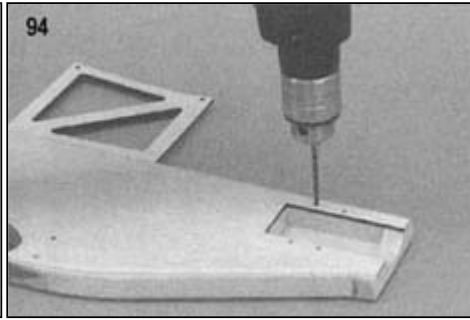
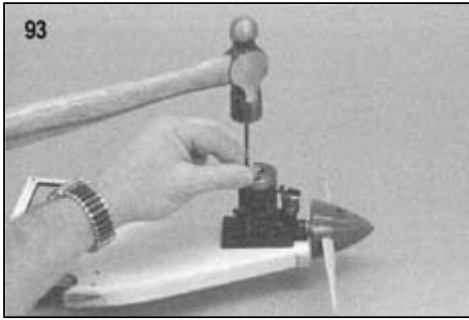
92. Place the engine and the injection molded engine on parallels or on a vise opened so that the motor mount sits only on the top face of the jaws. Mark the mounting hole locations with a center punch or a sharpened piece of music wire. Drill four holes through the molded mount at these locations with a 1/8" diameter drill bit.

93. Install the proper size propeller and spinner on the engine and place it and the molded mount on the fuselage as shown in the photo. Make sure you have a 1/8" gap between the spinner and front of the fuselage. Mark the mounting hole locations with a center punch or a sharpened piece of music wire.

94. Drill out the four engine mounting bolt holes in the previously marked locations with a 1/8" diameter drill bit.

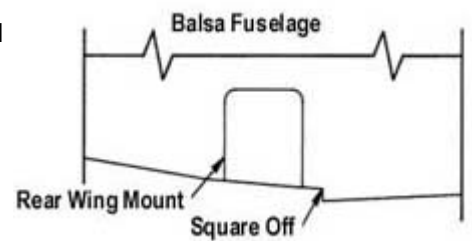
95. Drill the back side of each of the four engine mounting holes 3/16" deep with a 5/32" diameter drill bit for blind nut clearance. Note: The 4-40 blind nuts will be permanently installed after the fuselage has been covered.

96. The landing gear bolt hole locations have already been laser-cut into the right plywood doubler. Drill through the fuselage with a 5/32" diameter drill bit using the two holes as a guide.

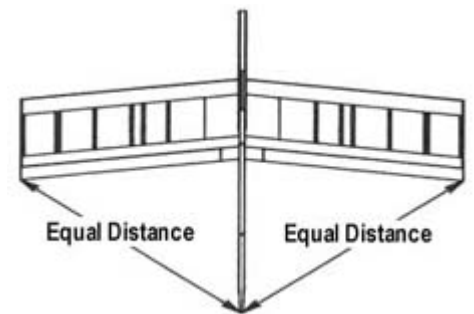


97. Because the fuselage is routed (not band sawed) you will have to square off the wing cut out just behind the rear wing mount. Refer to the drawing (near right) and notch the rear of the wing opening as shown.

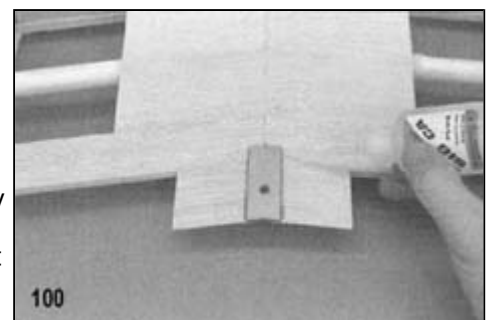
98. Place the fuselage on the bottom wing and carefully measure from the rear of each wing tip to the rear of the fuselage as shown in the drawing (far right). The rear of the fuselage should be an equal distance from each wing tip. When satisfied with the measurements, place alignment marks on the bottom of the fuse and wing using a soft lead pencil. Remove the wing from the fuselage.



99. Place a sharpened piece of 1/8" dowel or music wire about 7/8" long into the threaded brass insert. Reinstall the wing onto the fuselage and line up the previously made alignment marks. Lightly press down on the rear of the wing - the sharpened dowel will leave a small indentation in the balsa aileron fill-in. Drill a 3/16" diameter hole through the balsa aileron fill-in at the indentation.



100. Sand a bevel in the front edge of the laser-cut 1/16" plywood wing reinforcement (WBR) so that it will lay flat on the bottom of the aileron fill-ins. Glue the reinforcement in place as shown the photo. The hole in the reinforcement should line up with the previously drilled hole in balsa aileron fill-in.



101. Bolt the wing onto the fuselage and lightly tighten the 10-32 nylon bolt and check for any gaps between the fuselage wing saddle and the bottom wing. Sand off any high points on the fuselage wing saddle and/or the top of the bottom wing. There must be good fit between the fuselage wing saddle and the wing. If the wing is not perpendicular to the fuselage now is the time to adjust the wing saddle to achieve this.

### THE PERFECT WING SADDLE (Optional)

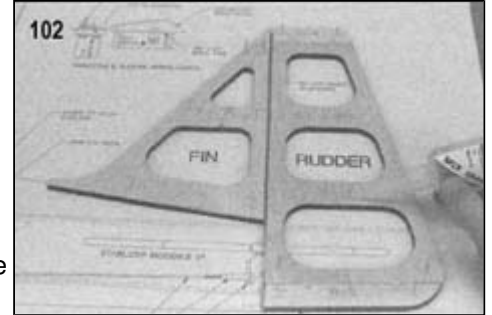
To produce the perfect wing saddle the following method has proved to be effective. Sand away just enough of the balsa fuselage and plywood doublers so there is a slight gap between the wing saddle and the wing. Do not sand the laminated plywood wing mounts or you will change the wing incidence. Tape a piece of Saran Wrap (or an equivalent plastic wrap) to the top of the bottom wing and wrap it around the leading and trailing edges. Use pieces of masking tape to hold the plastic wrap perfectly flat and smooth on the wing. Give the wing dowel and the 10-32 nylon bolt a coat of paste wax.

Thoroughly mix two equal parts of SIG Epoxolite putty (EP-001) together and spread this mixture on the fuselage wing saddle, keeping it away from the wing dowel hole and threaded brass insert. Next, bolt the wing onto the fuselage and tighten the 10-32 nylon bolt. The Epoxolite putty should ooze out from under the wing saddle. Make sure the wing and fuselage are perpendicular to each other and allow the putty to cure for 3-1/2 to 4 hours and then carefully remove the wing and the plastic wrap from the fuselage.

The putty at this time will not be totally cured, but it will be firm enough to allow you to trim the excess putty. Use a sharp modeling knife or a single edge razor blade and trim the putty flush with the balsa fuselage and the plywood doublers. After 24 hours lightly sand the sides of the fuselage and the Epoxolite with a 220 grit sandpaper to remove any imperfections.

## Fin And Rudder

102. Pin in place over the plan the laser-cut 1/4" balsa fin parts F-1 and F-2 and the rudder parts R-1, R-2, R-3 and R-4. Glue these parts together by flowing thin CA down into the joints (you didn't forget the waxed paper did you?). Apply a second coat of glue to the joints with medium CA and allow the glue to soak into the joint for a few seconds, and then wipe off any excess glue with a rag.



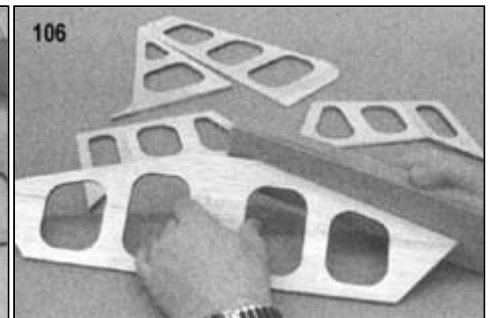
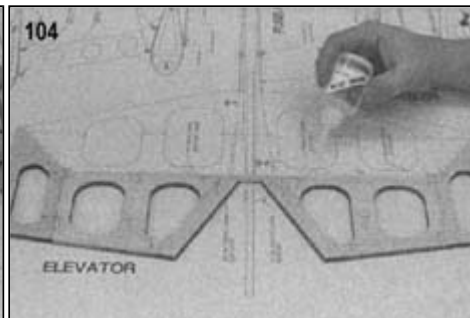
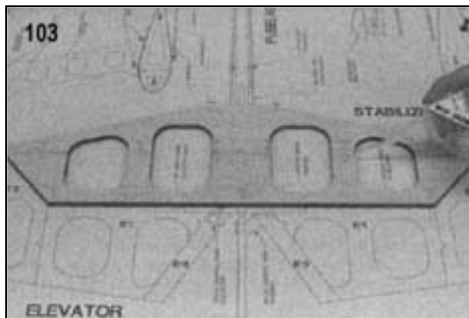
## Stabilizer And Elevator

103. Pin in place over the plan the laser-cut 1/4" balsa stabilizer parts S-1 and S-2. Use the same procedure as the previous step to glue the parts together.

104. Pin in place over the plan the laser-cut 1/4" balsa elevator parts E-1, E-2 and E-3 for both of the elevators using the same gluing procedure that is illustrated in step No.102. Glue the 1/4"x4" dowel elevator joiner to both of the elevator halves using SIG Kwik Set Epoxy (5 minute).

105. Using a long sanding block and 220 grit sandpaper, sand both sides of the fin, rudder, stabilizer and elevators.  
NOTE: Any imperfections that are not removed will show through the covering.

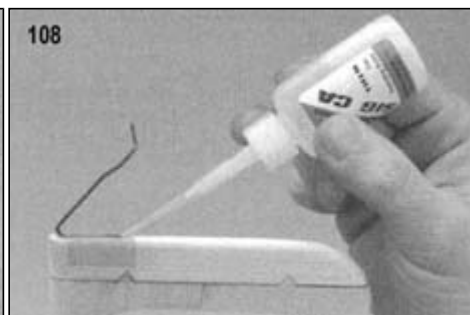
106. Using a sanding block and 220 grit sandpaper, carefully round (1/4" diameter) the leading edges of the stabilizer, elevators, fin and rudder. Next, round the trailing edges of the elevators and rudder including the bottom of the rudder.



107. Drill a 1/16" diameter hole in the bottom of the rudder as shown on the plan. Use a modeling knife and cut a 1/16" deep slot in the bottom of the rudder and glue in place the pre-bent tailwheel wire with thin CA glue. Soak the balsa wood surrounding the wire with thin CA glue.

108. Reinforce the tailwheel wire with a piece of glass tape (not provided) and thin CA glue.

109. With all the control surfaces finished it's time to drill the holes for attaching the control horns and interplane horns to the ailerons, the control horns for the rudder and elevator, and the push rod guides in fuselage. Place the control surfaces and the fuselage over the plans and mark the hole locations. Using a 3/32" drill bit and a pin vise, drill a hole in each location.



### BUILDERS TIP:

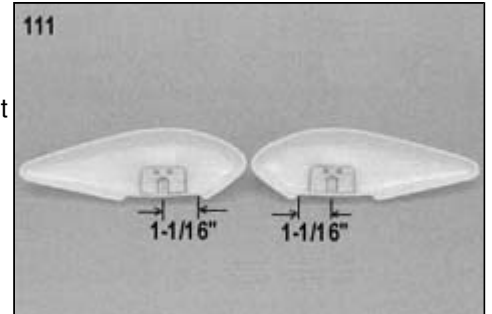
Apply a few drops of thin CA to each side of the holes and allow the glue to cure and then redrill each hole. This hardens the balsa around the holes and prevents the control horns from smashing into the wood when the screws are tightened.



## Wheel Pants

110. True up the edges of each of the wheel pant halves by gently sanding them against 220 grit sandpaper placed on a flat surface.

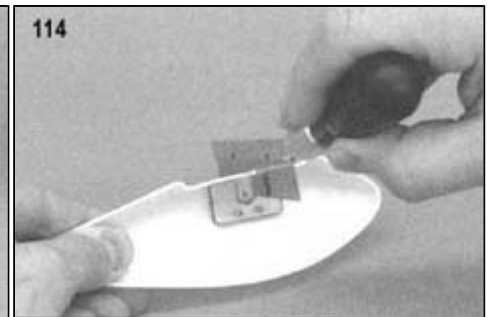
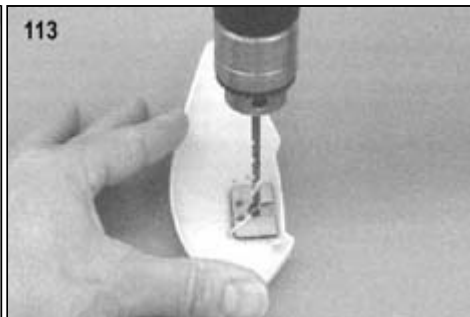
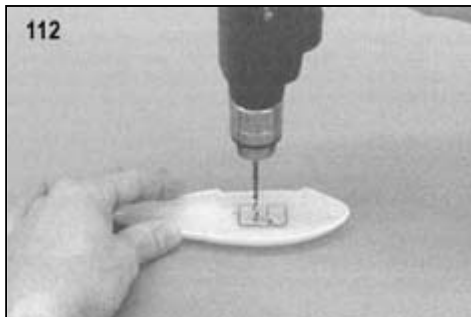
111. Using the measurements that are shown in the photo, glue in place the wheel pant reinforcements (WPR) with thin CA. Make sure that you glue one WPR to the inside of a left and right wheel pant half.



112. There are two 5/32" holes that have been laser-cut in the wheel pant reinforcement. Drill through the ASS plastic in each of these locations with a 5/32" drill bit.

113. Drill a 5/32" hole in the side of the ASS wheel pant at the top of the slot in the wheel pant reinforcement (WPR), This hole is to help cut out the ASS plastic from the slot.

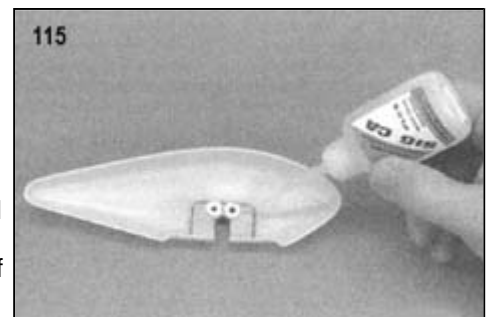
114. Using a razor saw, cut through the ASS wheel pant on both sides of the slot in the laser-cut plywood reinforcement (WPR) as shown in the photo, Remove the excess ASS plastic from the slot with a modeling knife,



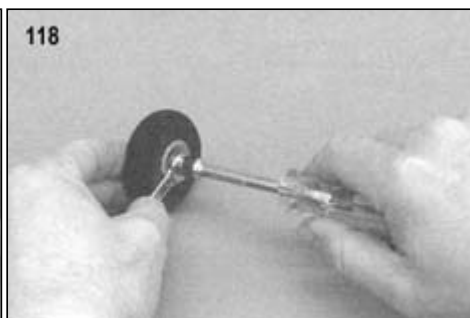
115. Gently tap in place the two 4-40 blind nuts to the inside of each of the wheel pant halves. Glue the 4-40 blind nuts in place with medium CA.

116. Use small pieces of masking tape to hold the pants together and to align the two halves. Apply thin CA to the seams of the wheel pants and allow the glue to cure.

117. Roughly cut out the wheel opening in the bottom of the wheel pants with a Dremel tool and a sanding drum, Remove only the flat sections from the bottom of the ASS pants, Use a modeling knife and sandpaper wrapped around various sizes of dowels to finish cutting out the wheel opening,



118. Place a #6 flat washer onto the 6-32 x 1-1/2" bolt (axle) and then slide the 2-1/4" wheel (not provided) over the axle. Add another #6 flat washer and thread on a 6-32 hex nut. Try for a clearance between the washer and the wheel that allows the wheel to turn freely, yet does not allow the wheel to wobble. Next, thread a 6-32 aircraft locking nut backwards onto the axle and tighten it up against the 6-32 hex nut.



119. Install the 6-32 axle and the wheel onto the aluminum landing gear and thread on a 6-32 aircraft locking nut. Use a small 5/16" open end wrench to hold the locking nut next to the wheel and securely tighten the outside 6-32 aircraft locking nut. One point on the 6-32 locking nut that is next to the wheel must be pointed up to match the slot in the ABS wheel pant.

120. Place the wheel pant over the wheel and slide it over the 6-32 locking nut. Securely fasten the wheel pant to the aluminum landing gear by threading the two 4-40 x3/8" socket head bolts through the aluminum landing gear and into the 4-40 blind nuts in the ABS wheel pants. This type of wheel pant attachment allows for quick and easy wheel pant removal and installation.

## COVERING AND FINISHING

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### Covering Notes

All of the Ultimate prototypes were covered Sig Supercoat iron-on plastic covering. Supercoat covering is ideal for sport models because it is light weight and easy to apply. The color scheme pictured on the label is quite easy to duplicate and only requires two rolls of Sig Supercoat covering covering (SCC415 Medium Blue). In addition to two rolls of covering you will need one four ounce jar of Supercoat clear butyrate dope (SIGLC001), and one four ounce jar of Supercoat medium blue butyrate dope (SIGSD033) to paint the cabane, the inside of the motor mount area, the wing interplane attachment points and the ABS hatch covers and wheel pants. This color matches the Supercoat iron-on plastic covering. The three decal sheets that are provided in the kit have the remaining markings to complete the color scheme.

NOTE: If you choose another brand of covering material, be sure to read the manufacturer's directions that come with the covering material. Follow their instructions when applying the material as different brand coverings have slightly different handling characteristics and application temperatures. However, the basic techniques for applying the iron-on plastic coverings of any brand are pretty much the same. We also recommend that you use a temperature gauge to set the temperature of your iron to the setting the covering manufacturer recommends (200 F. for Sig Supercoat covering).

#### BUILDERS TIP:

Before starting the actual application of the covering material, use a vacuum cleaner with the soft brush attachment and vacuum the entire model and work bench. This helps eliminate the dust particles that get under the covering.

### Covering The Fuselage

121. The structure that is to be covered must be clean, dry, and dust free. Wipe the entire model with a tack rag or a cloth dampened with alcohol to remove all excess balsa dust.
122. Cut or trace out a pattern of the fuselage profile from the plan. Use this pattern to cut out a piece of covering for each side of the fuselage (right and left). Allow approximately 1" of excess covering material around the outside edges of the fuselage. Place the covering material on the fuselage side and smooth out as many wrinkles as possible. Iron the covering in place overlapping the covering around all the outside edges of the fuselage. Repeat this step for the other side of the fuselage and overlap the seams of the covering material by at least 1/4".

### Covering The Wings

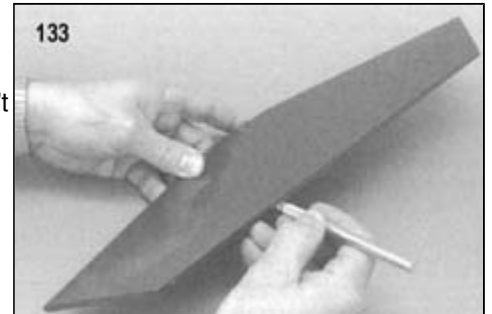
123. Start by covering the inside piece of the aileron fill-in with a 1/2" x 2" piece of covering. Overlap the covering onto the top of each aileron fill-in and iron the covering in place. Use a sharp modeling knife or a single edge razor blade and trim off the excess covering leaving only a 1/8" overlap on the top and bottom of the aileron fill-in.
124. Cover the end of each wing tip making sure you overlap the covering material around and onto the wing sheet and cap strips about 1/8".
125. Working with half of a wing at a time, cover the bottom of the wing and then the top. This leaves the front seam overlapped on the bottom where it is less visible. Cut the covering to size, allowing approximately 1" excess around the outside edges of the wing panel.  
Place the covering onto the wing panel and tack the covering in place all around the outside edges with a sealing iron (set at 200 for Sig Supercoat). Once it is smoothly tacked in place, work completely around the outside edges, sealing the covering entirely to the structure. Don't try to shrink the covering tight at this time.
126. Trim off the excess covering with a modeling knife or a single edge razor blade. Leave the covering wrapped around to the top edge of the trailing edge and on the centerline of the leading edge. Be sure to leave an overlap in the center of the wing panels.
127. Repeat the procedure in step NO.125 and cover the top of the wing. Overlap all seams at least 1/4".

128. To shrink the covering down tight in the inner areas, we recommend that you use a heat gun. You need a special heat gun that is made specifically for shrinking model coverings. If you do not have a heat gun, you can use your sealing iron to shrink the covering tight. Cover the iron with a sock and turn up the temperature a little more than it was for sealing the edges to compensate for the sock. The sock helps eliminate most of the scratches caused by a bare iron. Move the heat gun or iron slowly back and forth over the surface of the wing, allowing the heat to shrink all the covering material on that side at the same rate. Keep the heat gun moving at all times, holding the nozzle about 4" to 6" above the covering. If you stop moving for too long, or hold the gun too close, you will melt a hole in the covering.
129. Repeat steps No.123 through No.128 to cover the remaining wing panels.
130. Reseal the overlapping edges of the covering material with a sealing iron. Make sure that the covering is attached to each of the ribs, spars and the leading and trailing edges.
131. Cover the stabilizer, fin, rudder, elevators and interplane struts using the same techniques as used for covering the wing.

## Installing Sig Easy Hinges

SIG's famous EASY HINGES have been included in your kit to hinge all the control surfaces. Each ultra-thin hinge is actually a three-part laminate, a tough plastic inner core with an absorbent wicking material laminated to each side. They are specially designed to be installed with thin CA glue. The hinges have been chemically treated to slow down the set time of the glue to allow it to soak all the way to the ends of the hinge and into wood surrounding it for super strong bond. Once the glue has dried, the hinge cannot be pulled from the structure without tearing wood out with it! We recommend that all surfaces be completely covered before installing the EASY HINGES.

132. Use an #11 X-Acto blade (or similar) to cut slots in the stabilizer trailing edge and elevator leading edge to accept the EASY HINGES. Make the slots approximately 1/2" in depth and slightly wider than the hinge. Refer to the full-size plan for the exact hinge location.
133. After all the slots have been cut, insert EASY HINGES halfway into the stabilizer slots. **DO NOT GLUE THE HINGES YET!** Next, carefully slide the elevator onto the hinges. You'll find it easiest to slide the elevators onto the hinges at an angle, one at a time, instead of trying to push it straight onto all the hinges at once. Don't be concerned if the hinges aren't perfectly straight or centered in the slots - they don't have a center line.
134. To set the hinge gap, deflect the elevator to the maximum amount needed. For best control response, the gap should be as small as possible but big enough to allow full movement of the control surface.
135. Place three or four large drops of thin CA directly onto the hinges in the gap. The glue will wick into the slots as it penetrates both the wood and the hinge. Continue this process, gluing the same side of the EASY HINGES. Then turn the stabilizer over and repeat the gluing process on the other side of each hinge.
136. After the glued has cured (15 to 20 minutes) the joint should be flexed to full deflection in each direction a couple dozen times to reduce the stiffness. Don't worry about shortening the life of the hinges, as they are almost indestructible.
137. The ailerons and the rudder are hinged exactly like the stabilizer and elevators. When you assemble the rudder to the fin **DO NOT** glue the bottom hinges in the rudder and exposed wood parts.



## Painting The Wheel Pants And Hatch Covers

138. Prepare the wheel pants and servo hatch covers for painting by lightly sanding them with 360 or 400 grit sandpaper. Brush on three coats of Sig Litecoat clear dope onto the wheel pants and each of the servo hatches. Allow each coat to dry thoroughly and lightly sand them with 360 grit sandpaper before applying the next coat. Next, spray on two or three light coats of Sig Supercoat color (Medium Blue SD-276 in a 16 oz. spray can). Allow plenty of time for the dope to dry between each coat. Because butyrate dope dries very quickly, do not attempt to spray butyrate dope in cold weather or in high humidity. This will cause the dope to blush (turn cloudy). If you do see blushing, wait until a dryer and/or warmer day and spray another light coat of dope to remove the blush. **CAUTION:** Spray paint in well ventilated areas only.

139. Brush three coats of SIG Litecoat clear dope on the following areas: engine cutout, upper wing cabane, upper and lower wing interplane attachment points, interplane struts. Without scratching the covering, lightly sand all these areas. Now brush or spray two or three light coats of SIG Supercoat color (Medium Blue) on all of the above areas. A little bit of overlap (1/16") of dope onto the covering will assure a fuel proof seam.

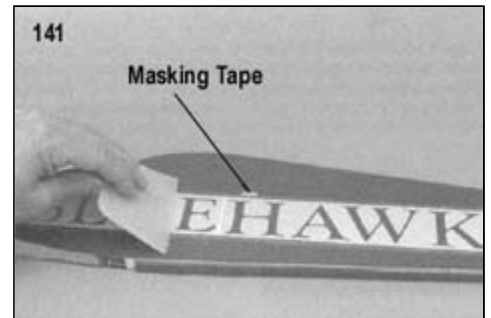
## Applying The Decals

The decals that are included in this kit closely represent the markings of the full scale ULTIMATE 10 DASH 300S Bluehawk. The letters "Bluehawk" in the large decal sheets were intentionally left clear so the lettering would match the many different brands and shades of coverings that are available. The wing and fuselage decals for the ULTIMATE are very long and are printed in two parts to make them easier to apply.

140. Cut out the decals using a modeling knife equipped with a sharp (new) No. 11 X-Acto blade and a straight edge. Leave about 1/32" to 1/16" of clear Mylar all around the outside edges of each decal.

141. Measure the location of the fuselage decal on the plan and place small pieces of masking tape along one edge on the side of the fuselage as positioning guides. The fuselage decal is applied from the tail forward using the stabilizer cutout and the trailing edge of the fuselage as a starting point. Once the rear half of the decal is correctly positioned overlap the front half of the decal about 1/16" over the rear half and work towards the front of the fuselage. Carefully squeegee the water from under the decal to lock it into position.

Repeat this procedure for the other side.



142. The top wing decal is applied in the same manner as the fuselage decal. Start at one wing tip and work across the wing.

143. Locate the other decal positions and apply the remaining decals to the sides of the fin, rudder and fuselage.

### BUILDERS TIP:

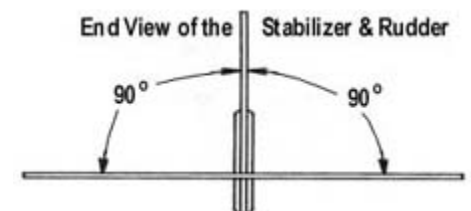
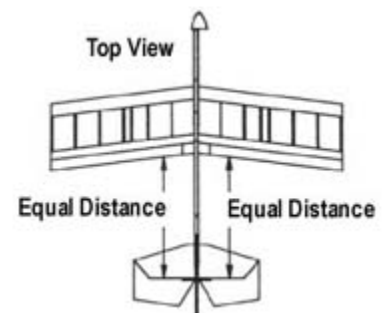
Find an empty window cleaner bottle and sprayer. Fill the bottle with water and add 6 to 10 drops of dishwashing detergent to the water and shake. Spray this solution onto the back of the decal and onto the surface on which they are to be placed. This procedure will allow you to position the decal in it's proper location without sticking to the covering. When satisfied with the location of the decal, squeegee out the soap and water solution from under the decal with an epoxy spreader or balsa paddle. Allow the decal to dry for at least 12 hours before flying.



## Final Assembly

144. Bolt the bottom wing to the fuselage. Place the stabilizer in the slot in the rear of the fuselage. Refer to the top view alignment drawing, and carefully align the stabilizer to the wing. When satisfied with the alignment, draw cut lines on the top and bottom of the stabilizer at the fuselage sides. Cut away the covering on the top and bottom of the stabilizer where it will be glued to the fuselage (there must be wood to wood contact in the joints). Use a sharp modeling knife or a single edge razor blade to cut the film. If possible do not cut any wood, just film.

145. Glue the stabilizer onto the fuselage using slow drying epoxy (SIGEG001) to allow you ample time to carefully re-align the stab with the fuselage. Check and double check the alignment of the stabilizer from the rear of the fuselage making sure that the stab is perpendicular to the fuselage and parallel to the wing. Pin the stabilizer in place and allow the glue to cure.





146. Cut a hinge slot in the rudder and in the rear of the fuselage for the bottom rudder hinge. Using Sig Kwik Set Epoxy (5 minute), glue the fin and rudder assembly into the pre-cut slot in the rear of the fuselage. DO NOT glue the bottom hinge! As you mate the fin to the fuselage, insert the bottom rudder hinge into the fuselage. Refer to the alignment drawing and make sure the fin and rudder are aligned perpendicular (90°) to the stabilizer. When satisfied with the alignment, pin in place and allow the glue to cure. After the epoxy has cured, glue the bottom hinge into the rudder and fuselage with thin CA, as was done for all the other hinges.
147. Install the aluminum landing gear onto the fuselage using the two 6-32 x 1-1/2" bolts and locking aircraft nuts. After tightening the nuts, cut the excess 6-32 bolt flush with the aircraft locking nut.
148. Install a 3/4" diameter tailwheel onto the tailwheel wire with a 1/16" wheel collar or with soldered small flat washers.
149. Install the 4-40 blind nuts in the cabane and interplane strut attachment tabs. Using a pair of pliers, press each blind nut into the laser-cut hole and glue.

## Installing The Tank And Engine

150. In preparation for mounting the engine, install the four 4-40 blind nuts in the previously drilled holes. Lightly tap the blind nuts in place with a small hammer and glue in place with thin CA. Paint the blind nuts to match the color of the fuselage.
151. Securely mount the engine and molded mount onto the fuselage using the four 4-40 x1-1/4" socket-head bolts that have been provided.

152. The fuel tank shown in the photo and on the fuselage plan is a Sullivan 4 oz. slant tank (SS4). You will notice the overflow vent/pressure vent is located in the upper left hand corner of the tank. This is to allow the fuel tank to be completely filled when the model is setting on its wheels. The pick up tube (clunk) must extend to the rear of the fuel tank and swing freely to all the corners inside the fuel tank.

Place the fuel tank on the fuselage and mark the locations of the four 4-40 J-bolts. Keep them close to the sides of the tank. Drill a 1/16" hole in each of these four locations and thread the J-bolts in place. Place a small drop of thin CA on the threads of each J-bolt to lock them in place. Insulate the fuel tank from vibration by placing a piece of foam rubber under the fuel tank and rubber band it in place with two No. 64 rubber bands.



### OPTIONAL FUEL TANK:

The 4 ounce fuel tank that is shown on the plan allows flight times of 5 to 7 minutes. This is more than adequate for most pilots. However, if additional flight time is desired, there is enough room on the side of the fuselage to install a Sullivan 6 ounce slant tank (SS6).

## Radio Installation

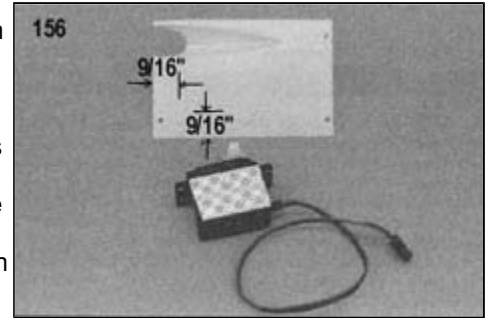
153. Mount the two small nylon control horns onto the ailerons, the two medium control horns onto the elevator and rudder, and the four interplane connect horns in the previously drilled mounting holes in each of the control surfaces. Mount each of the control horns with the No.2 x1/2" sheet metal screws that have been provided. Do not crush the balsa control surface by over tightening the sheet metal screws.

154. The servo output arms that are supplied with the servos (or the radio system) are equipped with four arms, trim off two of the short arms and one of the long arms. Make sure that all the servo output arms are the same length for the ailerons, rudder and elevator. This is a good time to assemble all of the components of your radio system together (servos, receiver, battery and switch harness) and bench test it. Set all the trim levers on the transmitter to their neutral positions and turn on the transmitter and the receiver. Install the servo output arms onto the elevator, rudder and the two aileron servos. Make sure that the servo output arms are perpendicular to the servo. Make sure all of the servos are working properly and turn off the radio system.



155. Reinstall the throttle servo in the right servo hatch as described in Step No. 76.

156. Using the measurements that are shown in the photo, trial fit each of the servos onto the ABS hatches making sure that the servo output arm is centered in the hatch fairing. Mark their proper locations on each hatch with a soft lead pencil. Wipe clean the sides of the servos and the ABS hatches with isopropyl alcohol to remove any oily residues. Apply two strips of the 1/16"x1/2" servo tape to the bottom sides of the elevator and rudder servos. Remove the paper backing from the tape and press each servo in place on the bottom of each hatch.



157. Reinstall the aileron servos with output arms into the wing. Make the aileron push rod by threading one of the nylon RC links onto the end of a 2-56 threaded rod until the end of the threads protrude into the clevis throat. Next, attach a 2-56 solder link to the servo output arm on the servo and connect the nylon RC link to the aileron control horn. With the aileron in the neutral position, cut off the excess rod with a pair of side cutters. Make sure that you leave enough wire for a solid solder joint in the solder link. Mark the location of the end of the solder link on the rod. Remove the solder link from the aileron horn, line up the end of the solder link with the mark and solder the link to the end of the rod. Snap the solder link on the aileron horn. Repeat this step to make the other push rod.

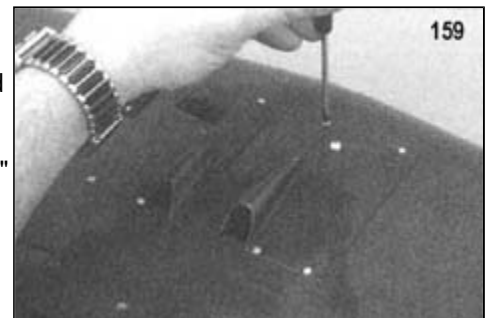
158. Wrap the receiver and the battery pack in 1/4" foam rubber. Install the receiver in the leading edge of the right wing and the battery pack in the leading edge of the left wing. Make sure that the receiver and the battery pack fit snugly into their openings. Pass the antenna wire through the antenna tube and out the wing tip of the left wing.



159. Install each ABS hatch assembly onto the wing with four No.2 x1/4" sheet metal screws.

160. Bolt the bottom wing to the fuselage.

161. Two 1/16" diameter x 24" music wire pushrods have been provided for the elevator and rudder. Make the elevator push rod by soldering one of the 2-56 threaded brass couplers (provided) to one end of the music wire pushrod. Thread a nylon RC link halfway (see step #157) onto the threaded brass coupler. Attach a 2-56 solder link to the servo output arm and connect the RC link to the nylon elevator control horn. Slip two pieces of 1/8" o.d. x1/2" nylon tubing over the 1/16" music wire push rod. These pieces of nylon tubing will be part of the pushrod guides in a later next step. Using a pair of side cutters, cut off the excess music wire leaving enough wire to allow a solid solder joint in the solder link. Mark the location of the end of the solder link on the rod. Remove the solder from the servo output arm, line up the end of the solder link with the mark and solder the link to the music wire push rod.



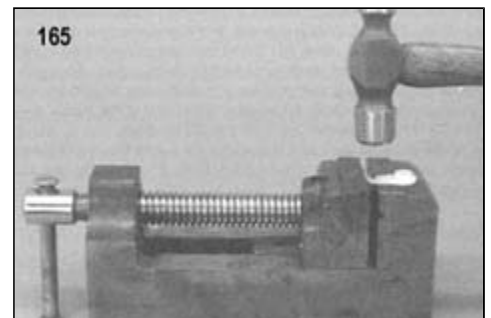
162. Attach the push rod to the elevator control horn with the nylon RC link and to the servo output arm with the solder link.

163. Repeat steps No. 161 through No. 162 to make the rudder pushrod.

164. Place one LG clip onto each of the nylon tubes (that were previously installed) and place a small drop of CA to hold them firmly to together. Refer to the plan and insert two 2-56 x 1" bolts into the LG clip and slip two LG straps onto the 2-56 bolts. Pass the bolts through the (previously drilled) holes in the fuselage and install two additional LG straps onto the 2-56 bolts. Next, install the LG clip and nylon tube from the opposite side of the fuselage onto the 2-56 bolts. Secure the push rod guides in place with two 2-56 hex nuts and place a small drop of CA onto the hex nut and bolt to lock them in place. Repeat this step for the other pushrod guide.

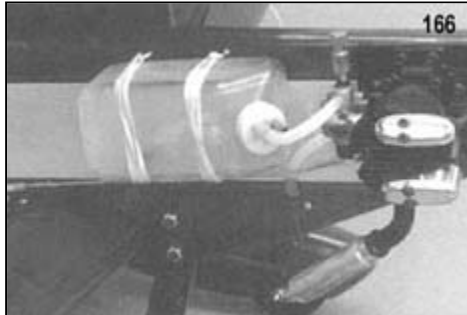


165. Insert a ball rivet into the throttle servo output arm and hold the head of the ball rivet in a vise or against a metal object. Peen the end of the rivet over with a small hammer as shown in the photo. Install the output arm onto the throttle servo.



166. Make the throttle push rod by threading a 2-56 nylon ball link onto a 2-56 x .078 I.D. threaded brass coupler. Snap the nylon ball link and brass coupler on to the rivet ball on the throttle servo arm. Thread a nylon RC link onto a 2-56 threaded rod and attach the RC link to the throttle lever on the engine. Set the throttle servo and the carburetor lever in the middle of their travel limits. Using a pair of side cutters, cut off the excess rod, leaving enough wire to allow a solid solder joint. Mark the end of the brass coupler on the rod. Remove the nylon ball link from the brass coupler and solder the threaded brass coupler to the end of the rod. Thread the nylon ball link onto the 2-56 brass coupler and snap the ball link into the rivet ball on the servo arm.

167. Bolt the top wing in place using the (10) 4-40 nylon socket head bolts and the (10) No.4 nylon flat washers that have been provided. The nylon bolts will shear off if the model is involved in a crash and this will help minimize the amount of damage the model will sustain. Make sure you do not overtighten the nylon bolts with the allen wrench.



168. Make the two interplane pushrods in the same manner as the aileron pushrods in step No. 157 of this instruction book.

## Radio Setup

169. Use the aileron positioning guide to check the neutral position of each aileron. Place the guide on the bottom of the wing. Adjust each of the ailerons to its neutral position by screwing the nylon RC link in or out until the aileron sits flush on the guide.

NOTE: Make sure the transmitter and receiver are turned on and the transmitter sticks and the trim levers are centered before adjusting any of the control surfaces.

170. The elevator and rudder must also be in the neutral position. Screw the nylon RC links in or out to adjust these control surfaces.

171. Place the model on a flat surface and measure the amount of elevator travel with a ruler as pictured in the photo. Adjust the elevator travel to the dimensions that are listed in the chart.

NOTE: If you are using a 4-channel radio without dual rates, use the low rate dimensions for the first few flights.



172. Check and adjust the aileron travel as per the dimensions in the control travel chart. Because there are so many different manufacturers of radio control equipment, it would be almost impossible to tell the modeler how to set up each type of radio for their ULTIMATE. Below is a chart that gives the modeler the suggested control travel for each of the control surfaces of the ULTIMATE. The second chart deals with radios that have mixing capabilities. Listed are the types of mixing that are desirable and the effects they have on the flight performance of the ULTIMATE.



Control Travel Chart		
Item	Low Rate Travel	High Rate Travel
ELEVATOR	3/4" up 3/4" down	1-1/4" up 1-1/4" down
AILERONS	3/8" up 3/8" down	9/16" up 9/16" down
RUDDER	1-1/2" lt. 1-1/2" rt.	2" lt. 2" rt.
THROTTLE	Full Range of throttle lever on Carb	

### NOTE:

The control throws that are listed are a good starting place. When the modeler feels more confident with the ULTIMATE, the control throws can be increased (a little at a time) to a maximum of 45° for the elevators and ailerons.



Control Mixing Chart Chart		
Mixing	Control Surfaces	Effect
FLAPERON	Elevators and Ailerons	Flaperon mixing is a desired feature because it allows the ailerons to continue to work while the flaps are deployed (or mixed). EXAMPLE: When the flaps are in the down position and you make a right turn, the right aileron raises up allowing the model to turn in that direction.
ELEVATOR FLAP	Elevators and Flaps	Elevator to flap mixing is also a desired feature. It allows the flaps and elevators to work together but in the opposite directions of each other (When mixed together, if the flaps travel downward, the elevators travel upward and vice versa). This gives the ULTIMATE the ability to make super sharp turns and loops.
3-POSITION SWITCH	Flaps and Elevators	Depending upon your brand and type of radio, the three position switch located on the transmitter may be used to set the flaps in three different positions.
		<b>Switch setting #1.</b> Kick the flaps up approximately 10°. The flaps now act like the spoilers of a sailplane killing part of the lift of the wing. This allows the ULTIMATE to make a faster descent for those quick take-offs and landings for which fun fly models are known.
		<b>Switch setting #2.</b> With the switch in this position, the flaps are held in the neutral position with the exception of the elevator to flap mixing for normal flying.
		<b>Switch setting #3.</b> Lower the flaps about 30°. This allows the ULTIMATE to make very slow landings or to fly forward at a speed that is almost a hover.

## Balancing Your Ultimate

For optimum flight performance balance the ULTIMATE precisely where indicated on the fuselage plan. Place a mark (a piece of masking tape) on the bottom of the cabane strut 1-3/16" from the back edge. Place the tip of your finger under the mark and lift up the model. If necessary, add small pieces of stick-on lead weights to the nose or tail to properly balance the model. Another method of adding or removing weight is to balance the model with different types of mufflers and spinners.

EXAMPLE: If the model is tail heavy, try using a heavier muffler and/or an aluminum spinner. If the model is nose heavy use a lighter weight muffler and/or spinner.

## Pre-Flight Checkout

Make sure the servos are securely mounted and that the servo arms have their retaining screws in place. It is also a good idea to re-check all the push rod connections, fuel tank mountings, fuel lines, wheels, engine mounting bolts and tighten the prop and spinner. Range check the radio as per the manufacturer's instructions and make sure it is fully charged. If there are any problems, send the radio in for repair before you attempt to fly.

DOUBLE CHECK EVERYTHING YOU CAN THINK OF! A model and radio that are not prepared and working properly on the ground before take-off will not improve in the air- IT WILL GET WORSE!!!! There is no point in attempting to fly the model until everything is 100% correct.

## Flying

The ULTIMATE can be dialed in to go from mild to wild. It is really a matter of preference how the modeler wants to set up and fly this model. With the control throws on the low rate setting, the Ultimate is quite easy to fly and can be handled by most intermediate RC pilots. However, once you turn on the high rate setting, it is a whole new ballgame. The Ultimate is very responsive and can perform just about any maneuver that you can think of in a heart beat. One of my favorite maneuvers with the Ultimate is to fly down the runway at about half throttle, pull the nose up slightly and execute a right snap roll recovering the model upright, and then executing a left snap roll and recover upright. Once you get the hang of it, you can do as many snap rolls in a row as you want. Like other fun fly models, the Ultimate was designed for close in flying. Always use good judgement and never place yourself or fellow modelers in harms way!!

