

## AILERONS AND FINAL FUSELAGE

- You will need the following tools:
  - 36" straight edge
  - Thin and medium CA glue
  - Epoxy
  - alcohol
  - Hobby knife with fresh blades
  - Sanding block with 80 grit paper
  - Dremel with large cutoff disc and sanding drum
  - Needle nose pliers
  - Magic marker
  - Tape – masking or electrical
  - Heat source to heat shrink
  
- Parts list:
  - Rib template from section I and II
  - .047" piano wire (4)
  - Servos (8) Not supplied
  - 18" servo extensions (3) Not supplied
  - 16-20 Ounce fuel tank Not supplied
  - Fuel line Not supplied
  - Fuel dots or other fueling system Not supplied
  - Engine Not supplied
  - Engine mount Not supplied
  - Throttle linkage Not supplied
  - Foam padding Not supplied
  - Tie wraps for radio and fuel tank Not supplied
  - Shrink wrap for servo connections Not supplied
  - Channel splitter for less than 8 ch radio Not supplied
  - Covering Not supplied
  - Paint Not supplied
  - Ail and Fus misc wood pack:
    - 1/16" X 3" X 36" sheets (8) balsa
    - 3/8" X 3/8" X 36" leading edges (4) balsa
  
  - Bag 8 contents:
    - Aileron ribs (24) 1/8" balsa





- True one edge of a sheet of 1/16" X 3" X 36" balsa.

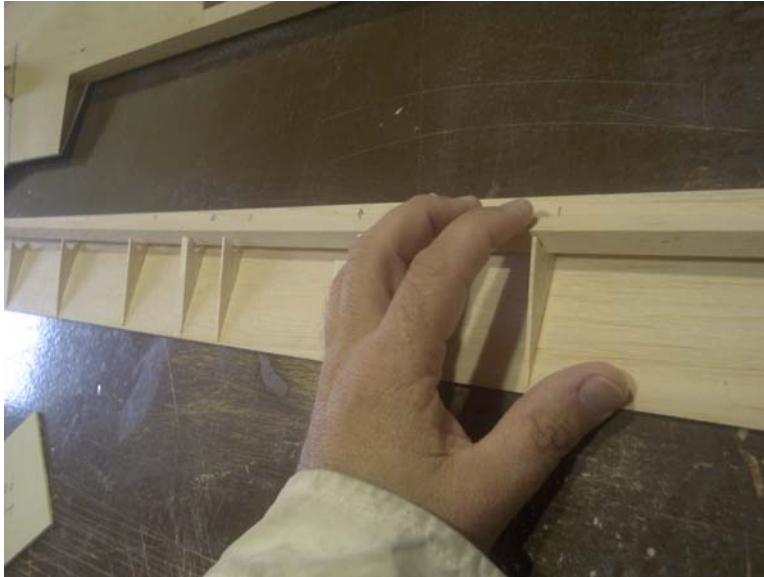


- Set the edge you just trued into the opening for one of your ailerons. Square the inboard end and trim the outside edge using a straight edge and hobby knife. Also mark and cut the excess wood from the trailing edge so the sheet fits perfectly into the aileron opening.



- Mark the locations of each wing rib.

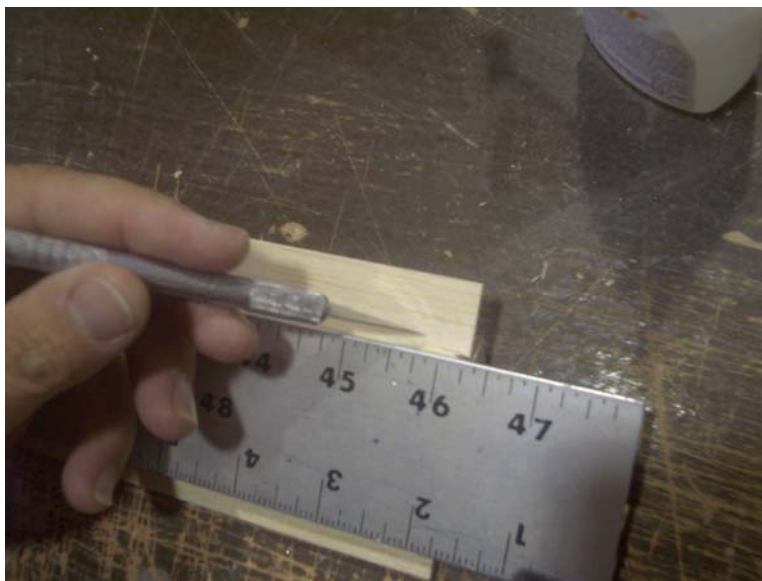
- If you are using the outboard mounted servos, also mark the location where you will need to mount the servo horn.
- Measure ¼” from the leading edge of your sheet and make a line along the full length of the aileron.



- Using your template to get the correct angle, glue the ribs in place with **thin CA**. Sand each rib slightly if necessary to get a good joint with the sheeting. The “V” notch in each rib must align perfectly with the ¼” line you drew on the sheeting. Do not worry about the trailing edges of the ribs yet.
  - Place a balsa rib at each rib location mark you made.
  - If you are using the outboard servos, trim and glue a thick rib where the aileron horn will be mounted.
  - At the inboard end of the aileron, place a balsa rib flush with the end, backed by a lite ply rib.
- Cut and glue one of your **3/8” X 3/8” X 36” balsa** aileron leading edges to your aileron.
  - Sand the bottom corner just enough for the leading edge to fit into the “V” notches in the ribs.
  - When it fits, glue in place with **thin CA**.
- Reinforce your joints with **medium CA** sparingly to fill any gaps.
- Trim the excess sheeting from the leading edge of the aileron to match the angle of the 3/8” stock.

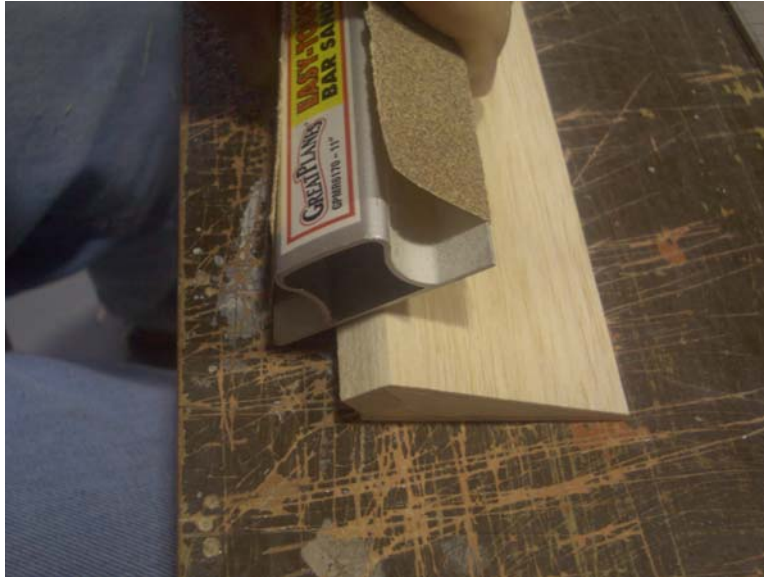


- Move the trailing edge of the aileron to the edge of the building table. Carefully sand the top surface with a sanding block and 80 grit paper.
  - Keep the block lengthways to the aileron and use gentle pressure.
  - Sand only enough that the top sheet will be able to make contact with all ribs, the leading edge, and about 1/8" along the trailing edge.

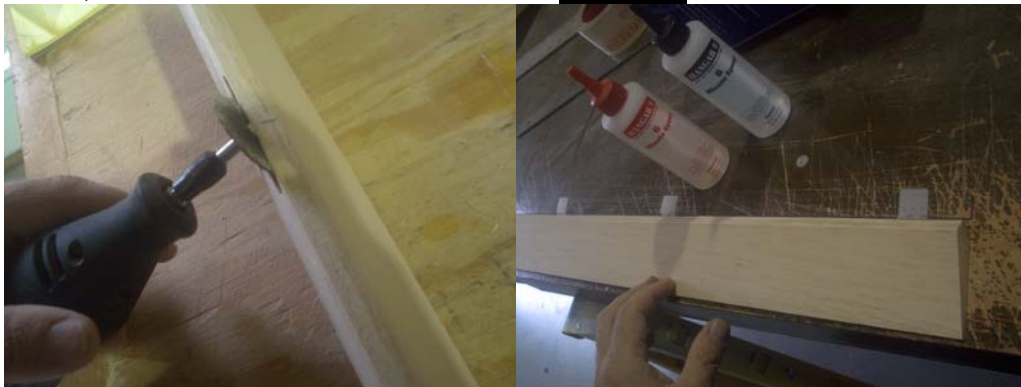


- True the trailing edge of another sheet of **1/16" X 3" X 36" balsa**.
  - Glue the sheet in place using **thick CA** on the ribs, leading edge, and trailing edge.

- Make absolutely certain your building surface is flat before gluing, as the top sheet will lock the shape of the aileron in place permanently.
- Weight in place for several minutes while the glue cures.



- Trim the top sheeting to match the bottom. Sand all joints smooth with the block and 80 grit paper. Sand the sharp leading edge until you get a straight, 1/16" flat along the entire length. If any joints are loose, secure with a small amount of **thin CA**.



- Install four hinges in the aileron using the techniques you used in section IV.
  - The inboard hinge must be 2" from the end of the aileron.
  - The outboard hinge should be 1/2" from the end of the aileron.
  - Space the remaining two hinges evenly. For strength, it is desirable to place them at rib locations.



- Cut and bend a hinge pin from .047” piano wire. Secure the pin to the wing using a #2 sheet metal screw and washer.
- For outboard servos, install your horn (not supplied) in the proper location. Remove the horn and stiffen the balsa where you drilled with **thin CA**.
- Repeat the above steps until you have all four ailerons.

## **FLYING WIRES**

- Slightly open one hole on each of the remaining steel straps.
  - Select 8 straps and place a 50 degree bend in the center of each. These will for the wing flying wires.
  - NOTE: we have eliminated the additional nylon straps shown in the pictures as they were redundant.
- Mount the wings on the fuselage. On each strut screw, place a #4 washer and one of the bent steel straps.
  - Bend two steel straps at their mid point at about a 30 degree angle. Open one of the holes in each strap to accept a 4-40 bolt. These will be used to hold the wing flying wires.

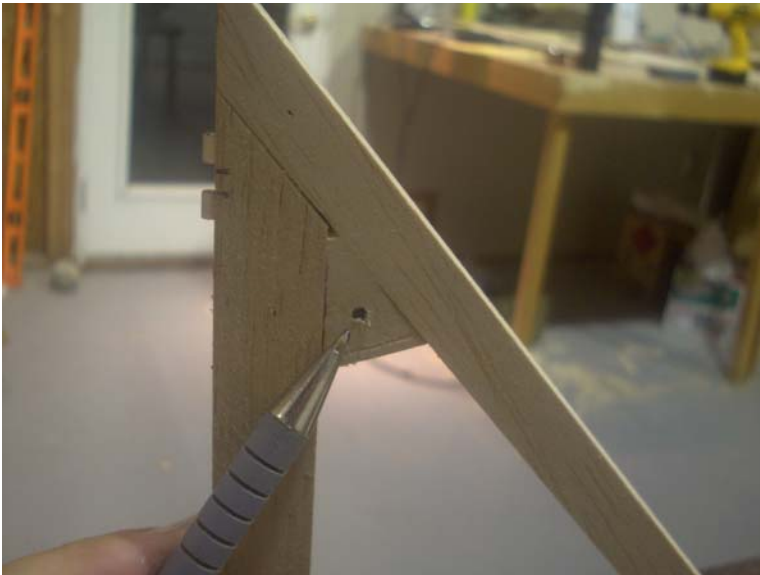
- Mount one steel strap on each side of the rear center strut when you install the wing.
- Assemble the eight flying wires. The next step describes how to fashion the wires. The following is the order in which to work:
  - Begin with the front wire that goes from the center strut to the lower wing. Then do the same wire on the opposite side. Snug these but **DO NOT TIGHTEN**.
  - Now do the other two wires on the front of the strut at the top wing mount. You may tighten these until they just start to make an audible note when plucked. If in doubt, leave them a little on the loose side
  - Finally, do the rear wires in the same order you did the front ones.





- Note that in these pictures the screws are mounted backwards. Install your bolts as was described above and not as shown.
  - Take the end of your cable and thread it through a crimp ring, then through the appropriate steel strap on the fuselage.
  - Thread the cable end back through the crimp ring from the opposite direction and pull out any slack. Leave enough end to work with, but not more than a couple inches, or you will run out of cable.
  - Where the cable end is exiting the crimp ring, take it and bend it back towards the fuselage, reinsert it through the crimp ring in the same direction as you just went.
  - Grab the end once again, this time with pliers, and pull out as much slack as you can.
  - Finally, crimp the ring and cut off the extra cable.
- Form the adjustable ends as follows:
  - Thread a 4-40 nut on a rigging coupler.
  - Thread a quick link onto the coupler at least 4 turns, but no more than where the coupler is even with the end of the threaded portion of the link. Note: The flying wires will stretch during the first several flights. You must have as much room as possible on your threads to take up this slack.
  - Lock the quick link in position on the coupler with the 4-40 nut.
  - Connect the quick link onto the appropriate strut strap.

- Install the cable to the rigging couplers as follows:
  - Pull enough cable from the spool to reach the rigging coupler hole, plus about 3 inches. Cut at this point.
  - Thread a crimp ring on the cable, then thread through the rigging coupler and back through the crimp ring in the opposite direction.
  - Pull tight, and then slide the ring as close to the coupler as it will go. Bend the loose cable end sharply back towards the strut.
  - Rethread the cable through the crimp ring in the same direction you just went, and pull out all the slack using pliers.
  - Crimp the ring and cut the excess.
- Repeat for the other 7 wires.



- Move to your tail and drill the hard points for the flying wires on the vertical and horizontal stabilizers.
- Bend the remaining steel straps to the appropriate angles and install on the stabilizers using the 4-40 X ¾” bolts, washers, and locknuts. The fuselage straps will need to be mounted with your tailwheel mounting screws (double duty).
- Fashion and mount the flying wires in the same way you did for the wings.

- Form the upper cables first, then the lower.
- Adjust the linkages so the stabilizers appear parallel and perpendicular to the wings when you sight them from the front and rear.

## **ENGINE MOUNTING**

- The firewall is marked to locate the center of the engine mount, compensated for right and up thrust.
- Mount your engine on your mount so the **prop hub is 6 1/2" from the firewall mounting flange.**
- Install the engine mount on the firewall, centered on the offset marks.
  - Ensure your exhaust is pointed down, with the cylinder to the side and level.
  - Place 1/8" of washers between the mount and the firewall. This will allow room to adjust thrust angles during test flights if required.
- Install your muffler on the engine
- Drill holes in the firewall to run the fuel line to the engine.
- Plan and install your fueling system, including an in-line filter.
- Install your throttle servo in the provided mount behind the firewall.
- Fashion and install your throttle linkage from the servo to the engine
- Seal the engine intake and exhaust, as the following step will cause considerable dust.
- If your engine does not have a fuel pump, it is recommended that you provide for one to be mounted on the firewall. The rear tank location

makes a pump mandatory in most cases. If you do not plan to use a pump, you should modify the nose of the aircraft to move the tank forward, closer to the engine.

## COWL

- There are two methods for mounting your cowl.
  - The simplest is to simply overlap the cowl over the nose of the fuselage. The following instructions are for this method.
  - The alternative is to fashion a former so the cowl can be flush mounted to the surface of the fuselage. Details will not be provided for this method. In general:
    - You will trace the shape of the firewall onto a sheet of cardboard.
    - Cut a lite ply former from the cardboard, allowing 1/32" for the thickness of the cowl.
    - Mount the former onto the firewall, trimming as necessary to clear the motor mount, fuel lines, etc. Place mounting screws in locations that can be reached through the intakes and/or spinner fairing. Dowels may also be used for alignment.
    - Remount the former to the firewall, this time with wax paper over the firewall.
    - Trim and mount the cowl to the former.
    - Remove the cowl assembly, and reinforce the former to cowl joint with a paste made of epoxy and micro balloons.
  
- Using a dremel with a sanding drum, cut out the air intakes and a generous portion of the spinner flange from the cowl.
  
- With the engine and related hardware in place, hold the cowl up to the fuselage. Attempt to place it in position so the prop hub is centered in the spinner fairing and protrudes 1/16" – 1/8" past the cowl.
  - Overlap the cowl around the nose of the fuselage.

- If the engine or muffler needs openings to clear the cowl, mark the area that is interfering with a magic marker on the outside of the cowl. The cowl is transparent enough to easily see where reliefs are required.
    - Remove the cowl and open the reliefs as marked using the dremel and sanding drum.
    - Try to do your grinding away from the engine, and blow dust before refitting the cowl
  - Cut an access hole for the glow driver.
  - Trim as necessary to clear the wing struts and landing gear.
- When the trimming is complete, tape the cowl in place so the prop hub is in the proper position.
    - Drill two 1/8" holes through the fuselage sides in a convenient location on each side (4 holes total).
      - Before drilling, check the inside of the fuselage to ensure you will clear any gussets. You will have to place a blind nut behind the hole, and need a flat spot to mount it.
    - Remove the cowl, and redrill the holes in the fuselage side to accept 4-40 blind nuts. Install the nuts on the inside of the fuselage, and lock in place with a small amount of epoxy.
      - It is an even better idea to epoxy a scrap of wood completely around the nuts, as they tend to get fuel soaked and fall out – not a happy situation at the airfield!
    - Reinforce the inside of the cowl where the holes were drilled with small squares of light weight glass cloth. Lay the cloth in place and wet with **thin CA**.
      - Redrill the holes in the cowl, and lightly sand the reinforcing cloth until smooth.
    - Mount the cowl using 4-40 X 1/2" bolts, a # 4 washer, and a 1/4" piece of fuel tubing . The fuel tubing acts as a cushion for the fiberglass.
  - Trial fit your 3" spinner and prop to ensure you have sufficient clearance with the cowl.

## **COVERING**

- If you wish to run any access tubes for the receiver antennae or servo wires, now is the time to do so. The servo wires normally run along the rear turtle deck. The antennae normally runs along the floor of the fuselage.
- Remove all hardware from the plane.
  - Mark the flying wires so they can be installed in the same locations.
  - Remove the wings, struts, rudder, ailerons, and elevators.
- Now is the time to final sand all surfaces to shape
  - Be sure to round the front and rear edges of the struts.
  - Clean up all lines that should be straight.
  - Radius all sharp edges.
- Final sand with 120 grit paper, just enough to remove any scratches or pen markings.
- Optional: coat all surfaces with a coat of nitrate dope.
- Mix an ounce or two of epoxy and add alcohol until you get a relatively thin consistency.
  - Work quickly if you use 5 minute epoxy!
  - Brush the mixture on the firewall, lower firewall access plate, hatch, and gear mounts.
  - Continue onto the fuselage sides and balsa sheeting for about an inch.
  - Be careful not to fill the holes for any of the blind mounting nuts. If you do, you will have to tap them later.
- When your fuel proofing is dry, lightly sand all coated surfaces with 220 grit paper.
- Blow any dust and wipe the plane with a damp cloth.
- Cover the plane as desired.
- Paint the cowl, wheel pants, canopy, and gear as desired to match your covering.

## **FINAL ASSEMBLY**

- Reinstall all hardware in its proper locations.
- Mount the fuel tank:
  - For the best aerobatics with no change to CG as the tank drains, it is designed to be mounted on the CG. This will be approximately ½” forward of the rear center wing strut.
  - Try to center the tank at this location.
  - Glue some padding to the fuselage surface, and use tie straps to hold the tank in place.
- Mount the engine, cowl, prop and spinner.
- Install the fuel lines.
- Install the throttle servo and linkage.
- Mount the receiver in a convenient location behind the fuel tank. Connect the throttle servo to the appropriate channel. Run the antennae as desired. I prefer to run in along the floor of the fuselage.
- Install the rudder servo first, then the elevator servos.
  - Connect 18” servo extensions to the servo wires and secure with heat shrink. Run along the fuselage and plug into the appropriate channels of your receiver. Tie wrap if needed to support.
    - The elevators will be mixed into two separate channels.
    - If you do not have enough channels to mix the elevators, you will have to install a channel splitter “Y” for the elevator servos to operate in the proper direction
  - Carefully position the wires so they will not chaff when the surfaces move.
  - Do not drill the mounting holes until after the surfaces are in position
- Install the rudder and elevators.

- Turn on your transmitter and temporarily plug the battery pack directly into the receiver.
  - Ensure all trims and subtrims are neutral. Set your mixing for the split elevators. Check the servos for the proper travel direction and reverse now if necessary.
  - Plug each surface onto its servo post. Position on the spline that gets the surface as close to centered as possible.
  - Install the hinge pins and secure with the #2 screws and washers.
  - Use your subtrim to center the surfaces when the sticks are centered.
  - After setting the neutral with subtrim, set the end points for each surface with the travel volume feature. Set the high rates now, we will reduce with low rates later.
    - Set the rudder for max travel without hitting the elevators.
    - The elevators should stop at 45 degrees (or more if you beveled the stabilizer). Make sure they are exactly equal when viewed from behind at full travel.
  - If you have to use a channel splitter for the elevators, set the primary channel as above. Use the splitter adjuster to set the neutral on the second elevator half.
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- Disconnect your battery and turn off your transmitter.
  - Install your wing servos with appropriate linkages and extensions.
    - Feed the wires through wings as needed for your servo options.



- There should be a connection to disconnect the servos in the center strut area.
- Connect the servos to the appropriate channels.
  - If you are using an 8 channel radio, use 4 separate mixed channels.
  - If you have less than 8 channels, you will need to use a “Y” harness on two channels.
- Set the neutrals and end points for the ailerons.
  - Turn on your transmitter and temporarily plug your battery directly into the receiver.
  - Make sure your trims and subtrims are neutral.
  - For less than 8 channels and/or outboard servos:
    - Install the ailerons, horns, arms, and control linkages.
    - Center the neutrals using the linkages.
    - Adjust the end points to 35 degrees using the holes in the arms and horns.
  - For 8 channels or more:
    - Set up your mixes to get one aileron per channel.

- Plug each aileron onto the servo post as close to centered as possible. Install and secure the hinge pins.
    - For each aileron channel:
      - Center the aileron using the subtrim feature.
      - Set the end points using the travel volume feature for each channel.
      - Set the end point max throw to 35 degrees
  - Unplug your battery.
- Finalize your base radio settings as follows:
  - Set your low rates as follows:
    - Elevator and ailerons: 25% of high rate
    - Rudder: 35% of high rate
  - Set high rate expo to -60%
  - Set low rate expo to 0 to -20%
- Check your CG.
  - Mount the wings on the fuselage. Make sure all hardware, except the battery and switch, is in place. Set the canopy in place, but do not secure it yet.
  - Lift the plane from under the upper wing, 1/2" inch forward of the front edge of the rear center strut.
  - The upper stringer should sit perfectly level. A slight tilt aft, or a moderate tilt forward can be tolerated.
  - Find a location for your battery that will adjust the CG as needed.
    - Under the rear strut mount is the neutral location.
    - Adjust forward to the firewall or aft to the rear of the cockpit if needed.
    - Use foam padding and tie straps to secure the battery.
- Choose a location for your receiver switch based on your battery and receiver locations. Install the switch assembly. Connect the leads and use heat shrink to safety the connection.
- Install the canopy.
  - You will use five #2 sheet metal screws and washers.
    - Two on each side that will pass into the basswood stringer doublers.

- One in the front center that will pass into the 3/16" balsa stringer there.
- Cut 5 small patches of glass cloth and thin CA them into position on the backside of the canopy where the holes will be drilled.
  - Sand lightly till smooth.
- Position the canopy, drill the holes, and install the screws.