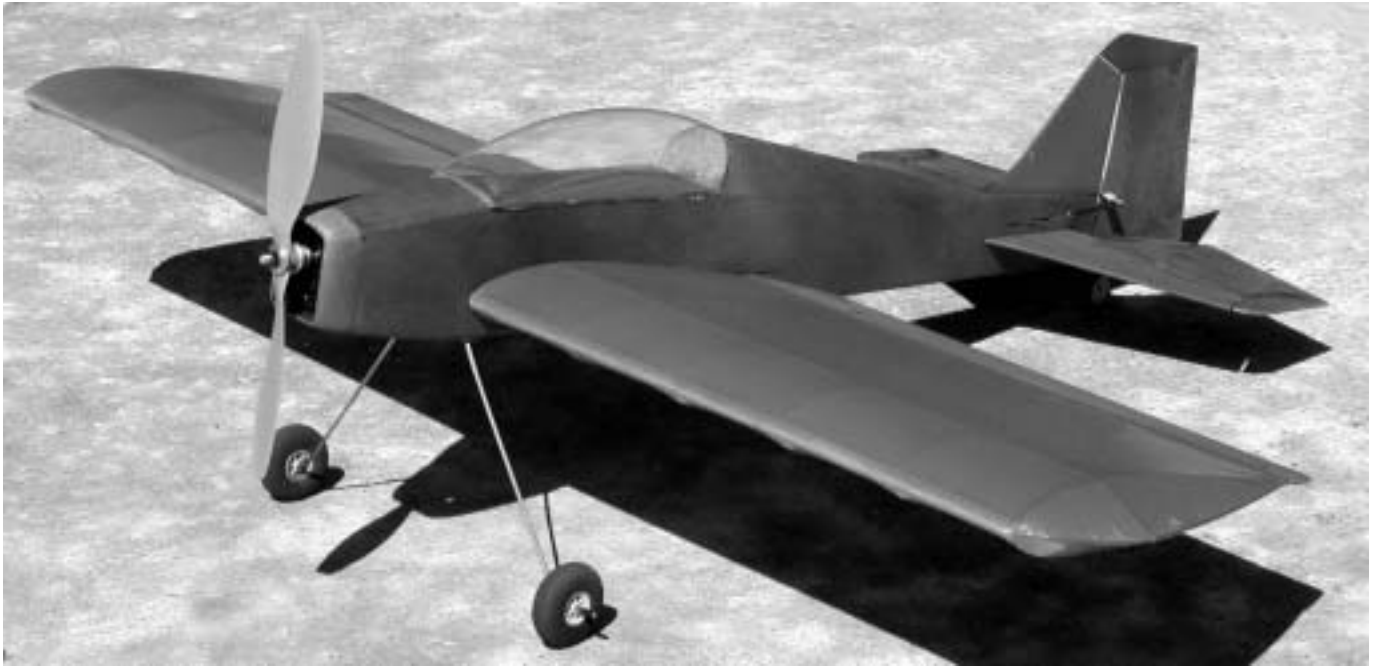


MiniFlash Builder's Manual



Thank you for purchasing the MiniFlash. The MiniFlash has been designed for the intermediate to advanced pilot who wants a plane with outstanding performance that will fly in a very limited space

Specifications

Wingspan: 32"

Wing Area: 305 sq. in.

Weight: 10-11 ounces without battery

Wing Loading: 8 oz/sq. ft. depending on battery

September 26, 2002

Last revised January 5, 2003

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Required Building Supplies

- ❑ X-acto™ with #11 blades
- ❑ Thick and thin CA – Cyanoacrylate glue (Super Glue)
- ❑ Sanding block with 200 grit sandpaper
- ❑ Smooth, flat work table
- ❑ Wax paper to protect plans
- ❑ Needle nose pliers
- ❑ Wire cutters
- ❑ Hobby Iron for applying covering – also called a sealing iron

Required Equipment

- ❑ Four channel radio minimum, 5 channel preferred for aileron/ flap mixing
- ❑ Four micro servos: Hitec HS55s recommended
- ❑ GWS EPS300C-D motor with 12x6 propeller
- ❑ Electronic Speed Control (ESC) capable of handling at least 10 amps
- ❑ Battery pack: 8 cell 600mAH Nicads or 720mAH NiMH configured 4 over 4

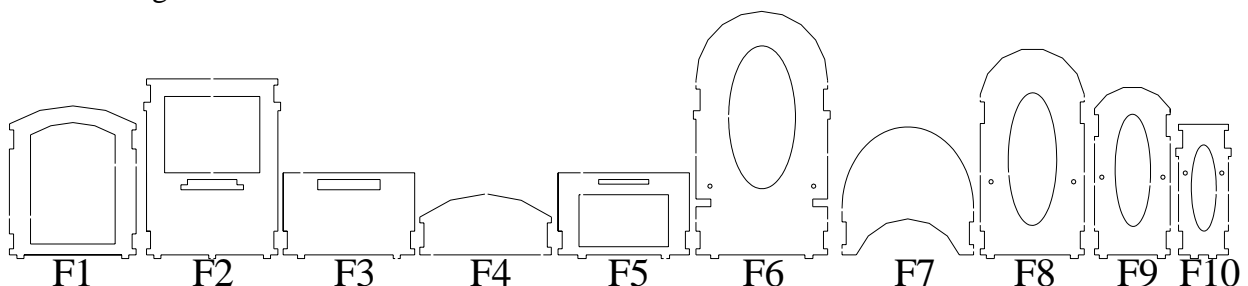
Parts List

Loose Parts

- 1 ea – 1/16” laser cut plywood sheet
- 3 ea – 1/32” laser cut balsa sheets
- 5 ea – 1/16” laser cut balsa sheets
- 2 ea – 3/32” laser cut balsa sheets
- 1 ea – 1/8” laser cut balsa sheets
- 1 ea – 1/64” plywood wing servo mounts
- 2 ea – cowl balsa
- 2 ea – 1/4" square x 18” balsa leading edge
- 3 ea – 1/32” x 18” thin music wire for tailwheel and pushrods
- 1 ea – Plastic Canopy
- 1 ea - Covering

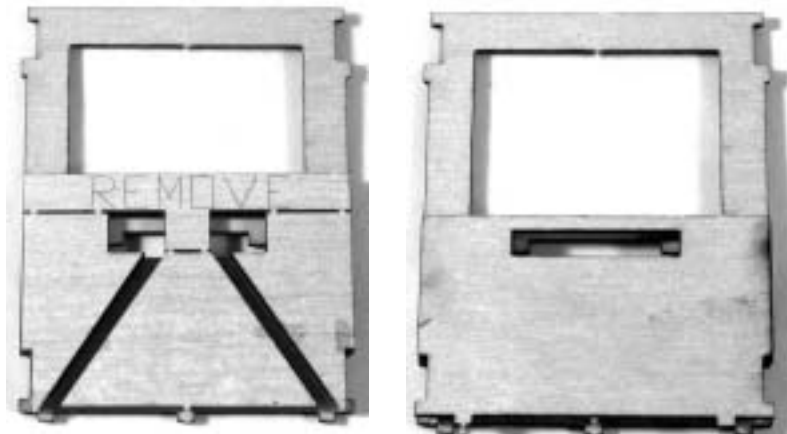
Bagged Parts

- 1 ea – Motor Mount 1/16” ply sheet
- 2 ea – 3/32” x 7.5” landing gear wire
- 1 ea – 1/8"round x 2.75” hard wood dowel
- 1 ea – 6” x 3/32” heat shrink tubing for pushrods
- 1 ea – 1/2" x 1/8” heat shrink tubing for wheel retainers
- 1 ea – 6” Velcro strip for mounting the battery and receiver
- 2 ea – Wheels
- 1 ea – 4” tailwheel tire rubber
- 1 ea - Neodymium canopy hold down magnet with tack
- 1 ea – Tyvek strip for canopy hinge and tailwheel reinforcement
- 1 ea – 4-40 wing bolt



Fuselage Assembly

- ❑ The fuselage is made up from 1/16" laser cut plywood & 1/16" and 1/32" laser cut balsa. Lay the plans out on a flat worktable and tape them down, and then lay a sheet of wax paper over the plans. This will protect the plans from the glue. Each joint can be glued by holding the pieces in place and applying a drop of thin CA to the joint. In the past, you may have used pins to hold parts down, but I find this process to be faster and you don't have to worry about the pin damaging the balsa. However, you do have to worry about keeping your fingers far enough away from the joints or your fingers will become part of the model. You can also prevent your fingers from becoming part of the model by wrapping your fingertips with squares of masking tape (sticky side towards your fingers). Build one part at a time, removing only that part from the balsa sheet so that you don't mix the parts up. I strongly recommend using disposable needle type tips for the CA.
- ❑ Assemble the landing gear leg support before gluing the bulkheads to the fuselage base. The landing gear support is constructed by sandwiching 3/32" balsa framing between 1/16" plywood bulkheads F2 and F3. Glue the 3/32" balsa framing to bulkhead F2 as shown in the photo below. Be sure to leave a 3/32" gap between the balsa framing. You can use the main landing gear wire as a spacer. Break away the tab with the word "REMOVE" on it then carefully align bulkhead F3 with the landing gear support assembly as shown and glue into place with thin CA. You can also align F3 by positioning the F2/balsa assembly into the fuselage base then installing F3 into the base. This will assure that F2 and F3 are oriented properly.



- ❑ Glue the 1/16 plywood bulkhead support to F6 as shown. The plywood will be oriented towards the back of the fuselage when you install the bulkhead to the fuselage bottom.



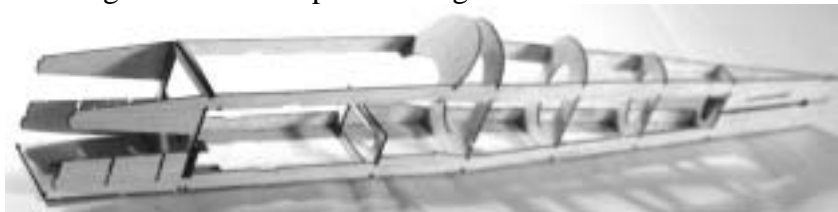
- ❑ Lay the 1/16" bottom fuselage sheet on the worktable and glue bulkheads F2/F3, F5, F6, F8, F9, and F10 in place perpendicular to the base. Don't glue F1 in place yet. Make sure the bulkheads are seated firmly against the bottom sheet.



- ❑ Position the two bottom side fuselage stringers and glue with thin CA. Only glue from F2/3 back



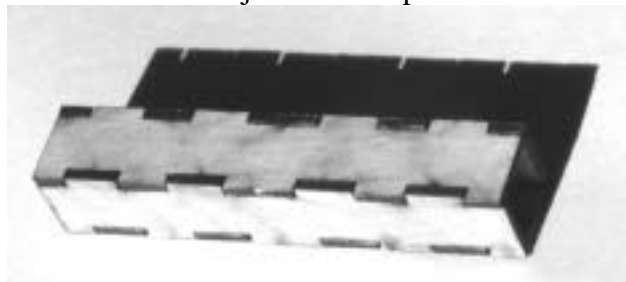
- ❑ Position **one** top side fuselage stringer and glue in place. After gluing one side of the stringers to the fuselage bulkheads, glue the canopy braces F4 and F7 into place. After F4 and F7 are installed, position and glue the other top side stringer.



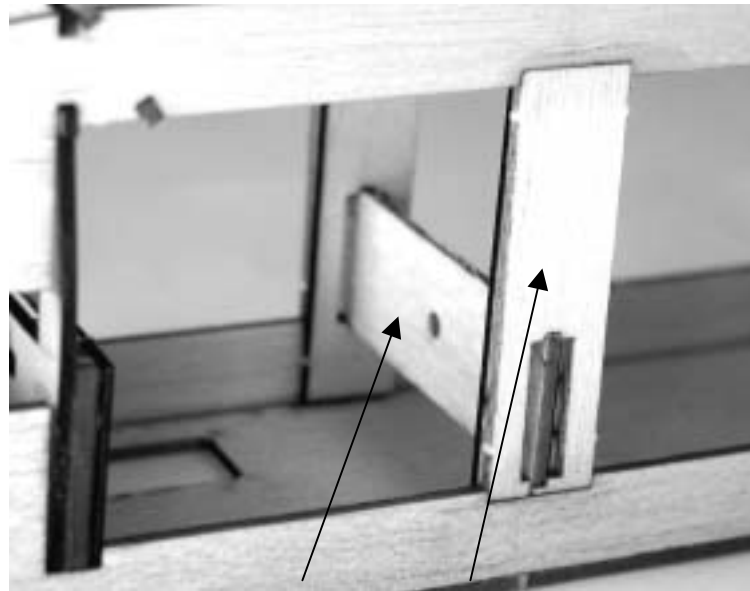
- ❑ Glue F1 into place.
- ❑ Glue the 1/16" plywood motor mounts into place with thick CA.



- ❑ Gently bend the front of the bottom sheet up to the stringers and F1 and glue with thin CA.
- ❑ Glue the motor mount parts together ensuring they are square and tight. Position the motor mount stick in the two motor mounts so that it just extends past the rear mount. Glue with thick CA.



- ❑ Position the 1/16" balsa spar supports in the notches in the fuselage stringers and glue with thin CA. The opening is on the bottom. Position the 1/16" plywood spar supports against the balsa spar supports but don't glue. Slide the 2"x.7"x1/16" balsa spar separator through the plywood spar supports, which will align them to the balsa spar supports. Check that the spar separator is flush with the outside of the balsa spar supports. When everything is aligned and straight, glue with thin CA.



Spar separator Spar supports

- ❑ Carefully align the fuselage side with the three tabs in the bulkheads. Glue the fuselage sides to the fuselage frame assembly. I use thin CA and flow it into the joints. **Do not glue the left fuselage side to the top stringer between F4 and F7. You will add two Tyvek canopy hinges when you attach the canopy. The Tyvek hinges will slide between the stringer and the fuselage side.**



- ❑ Place the servo tray between bulkheads F5 and F6 and allow it to rest on top of the lower stringers. Push it back to the stop on the stringer. Ensure the servo screw pilot holes are towards the front and rear of the fuselage, as in the photo below. Glue the servo tray in place with thick CA when satisfied with the positioning.



- ❑ Create a Z bend on one end of the 18" x 1/32" pushrod wire then feed the other end through the holes in the rear bulkheads for the rudder and elevator. You may need to use a hobby knife to

guide the pushrods out from the back of the fuselage. Tape the pushrods to the servo tray to temporarily hold them in position.

- ❑ The 1/32" balsa turtledeck will be bent over the formers F7-F10. In order to get the balsa to bend that much, wet it down with water. Wet down both sides of the balsa then wipe off the excess water. Position the turtledeck so that the back end is flush with the back edge of F10. Glue one side in to place with thin CA as shown.



- ❑ Carefully shape the turtle deck over the fuselage formers. Start gluing from the center between F8 and F9 and work your way out to the ends. The balsa will have swelled from the soaking so will not fit flush with F7. You can pull it in with a rubber band or wait for it to dry.



- ❑ Glue the 1/16" balsa rear fuselage top into place. This piece contains two cut notches for the vertical stabilizer.



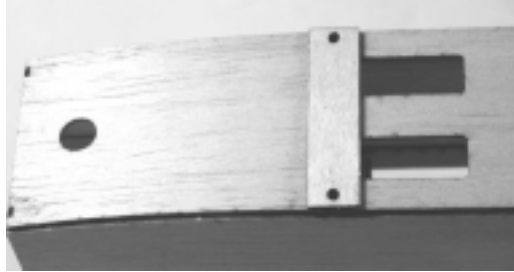
- ❑ Position the 1/32" front fuselage top and glue. It is easiest to glue one side, then the other, then the front and back.



- ❑ Glue the two 5/16" balsa cowls to F1 then sand to shape.



- ❑ Align the holes in the 2" x 1/2" x 1/16" plywood landing gear support to landing gear holes in the bottom of the fuselage as shown and glue in to place. The holes will be wider than those in the fuselage.



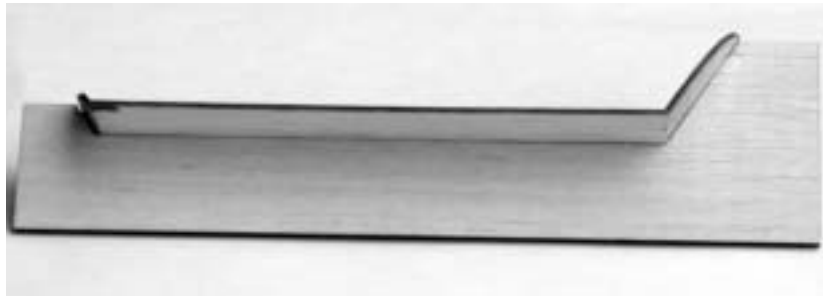
- ❑ Sand the front of the turtle deck flush with the front turtle deck former F7.
- ❑ Sand the corners of the fuselage to give it more of a rounded look.
- ❑ Now is a good time to paint or cover the fuselage. Try to keep it light.
- ❑ Bend the 3/32" landing gear legs as shown on the plans. **Sand the part of the gear legs that slides in the fuselage to ensure a good glue joint.** Slide the gear legs into the fuselage so that the gear legs can be seen but don't extend into the battery hold down opening. Carefully align the gear legs and flow a lot of thin CA into the holes. You could also glue the legs in with epoxy if you prefer. Slide the wheels onto the legs. Sand the end of the gear legs for a good glue joint. Cut a 1/8" piece off the 1/2" heatshrink tubing. Slide the tubing over the end of the gear leg and glue with thick CA taking care to not glue the wheels.

Canopy Assembly

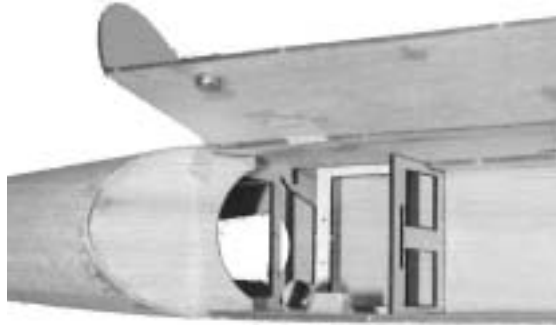
- ❑ Align the 3/32" balsa canopy base with the cockpit cavity. Sand the ends to the correct angle to match bulkheads F4 and F7 and to get a good fit.
- ❑ Position the front and rear canopy formers on the canopy base and sand the bottom of the canopy formers to the correct angle so that they rest flush with the canopy base. When satisfied with the fit, remove the canopy parts from the fuselage, place a piece of wax paper over F4 and F7 to protect them from glue, reposition the canopy parts then glue the canopy parts together using the fuselage to align them.



- ❑ Paint the canopy base and add your Snoopy head if you wish.
- ❑ Lightly glue the canopy alignment jig to the bottom of the canopy base. You will break it off later so don't glue it well. The jig keeps the angle correct as you position the canopy base into the canopy.



- ❑ Position the clear plastic canopy in place over the canopy base. Mark a line with a felt-tip pen around the base of the canopy below the wood canopy floor and the formers. Make the mark 1/8" to 1/4" oversized. Remove the plastic canopy from the canopy base, then trim the canopy to the mark. Epoxy or CA the plastic canopy to the base. Let it dry then trim the canopy flush with the base. Break away the alignment jig. **Note: When gluing the canopy to the base, ensure that the base doesn't get twisted.**
- ❑ Cut two 1" long strips of Tyvek to be used as canopy hinges (the white paper-like material in the bagged parts). Glue one canopy hinge 1/4" from the front of the canopy and the other 1/4" from the back. The hinges are glued to the left side of the canopy lengthwise with half of the hinge extending past the side of the canopy. Glue them with thin CA.
- ❑ Slide the hinges between the fuselage side and the fuselage stringer. Glue with thin CA. Also, finish gluing the stringer to the fuselage side
- ❑ In the parts bag, you'll find a 1/4" x 1/4" x 3/4" balsa stick with a metal tack pressed into it, and a small Neodymium magnet. Remove the tack from the balsa stick and align the stick with the base of the top stringer inside the fuselage cavity. Place this near the back of the fuselage cavity on the opposite side of the Tyvek canopy hinges. When satisfied with the positioning, glue into place with CA. Align the Neodymium magnet with the balsa stick and glue to the bottom side of the canopy assembly.
- ❑ Press the tack partially into the 1/4" stick so that the magnet will be aligned with the tack. Apply a drop of thin CA where the tack meets the stick. Be certain to not get CA between the tack and the magnet. Close the canopy and press it down until it is flush with the fuselage. The tack will now have been pushed into the stick the correct height.

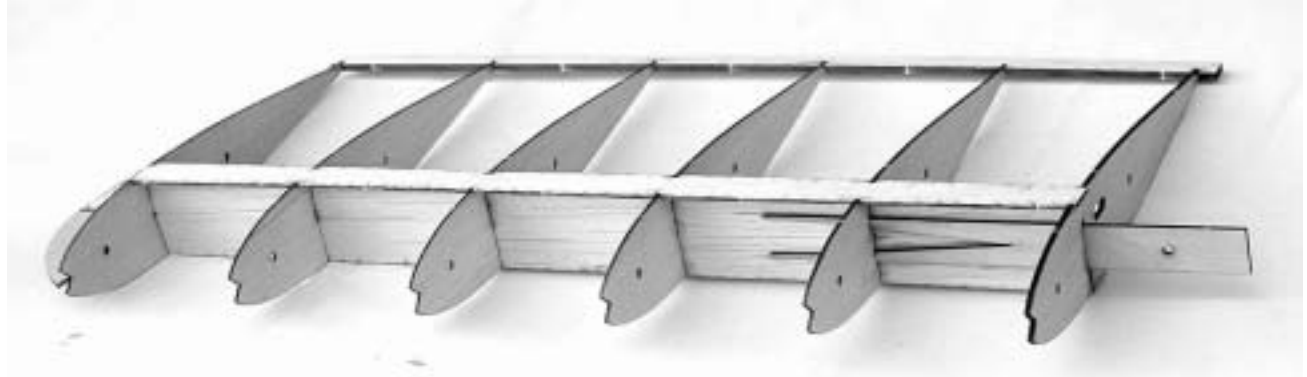


Wing Assembly

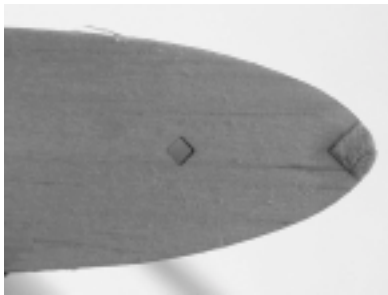
The wings are assembled by sliding the ribs into the vertical spar, capping the spar, adding the trailing edge, then gluing everything in place. You have to make sure that you make a left and right side by orienting one vertical spar to the left, and one to the right. Also note that there are two ribs that have cutouts for the center spar. These ribs must be placed at the inside end of the vertical spar.

- ❑ Set one vertical spar on the building table so that slots are facing up.
- ❑ Starting with the last rib (the one closest to the pointed end of the vertical spar) slide the ribs over the vertical spar. **Note that the 3/32" inner rib has the additional opening for the center spar and the 1/16" rib that is next to the inner rib has notches to accept the center spar and also has a "2" engraved in it.** Do not glue yet.

- Place the cap spar over the vertical spar and press it into place.
- Install the trailing edge, noting the orientation. The angled end is the outer end and will be on the same side as the pointed end of the vertical spar.
- Slide the wing tip into the vertical spar.
- Once everything is straight and true, flow some thin CA into all the joints.
- Position the 1/16" plywood center spar through the innermost rib and butted against the second rib. Ensure it is parallel with the wing and glue in place. Note that one center spar goes in front of the vertical spar and one goes behind the vertical spar. It doesn't matter which is which.



- Measure and cut the 1/4" square balsa leading edge stick and glue it to the ribs. Sand it to a blunt rounded shape as shown in the photo.



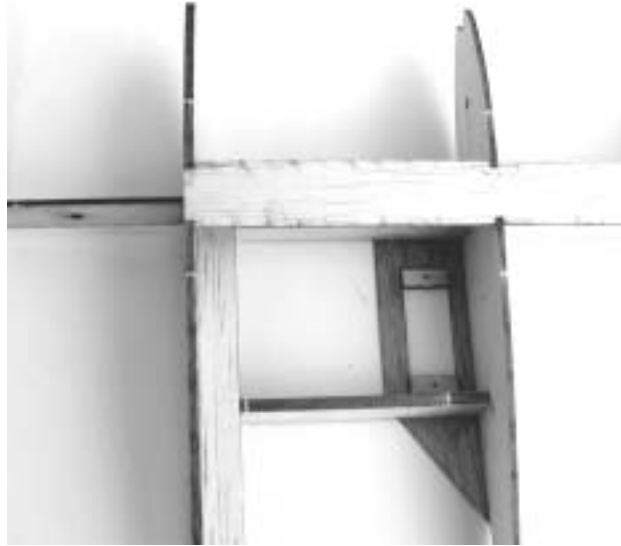
- Position the 3/32" balsa inner rib reinforcement into place and glue. This reinforcement is to prevent the rib from bowing in when you shrink the covering.



- Glue the two 1/16" ply servo backing plates to each wing servo mount. Make sure that you make a left and right side.



- ❑ Glue a servo mount under the wing and between the first and second rib, attached to the second rib and the vertical spar. Glue a 2.75"x.5"x1/8" balsa servo mount reinforcement under the servo mount and behind the rear servo backing plate.



- ❑ Build the second wing. **Make sure that you are building a mirror image so that you don't end up with two of the same side.**

Covering the wings

The MiniFlash kit comes with a clear, paintable covering called Doculam which is actually a laminating film. The frosted side has a heat activated adhesive. Unlike most coverings, Doculam does not have a backing sheet. Compared to SoLite (Solarfilm Lite – another excellent choice for the MiniFlash), Doculam is stronger, heavier, and needs a higher temperature to adhere and to shrink.

- ❑ Lay the wing on the table and cut a piece of covering so that it overlaps the wing by ~2".
- ❑ Tack one corner of the trailing edge then the other corner of the trailing edge with a covering iron, ensuring that the covering is tight.
- ❑ Pull the covering tight and straight then tack the two corners of the leading edge.
- ❑ Tack down the entire leading and trailing edge. Wrap the covering around the back of the trailing edge and tack it down across the back of the trailing edge.
- ❑ Pull the covering tight across the high point of the wingtip and tack.
- ❑ Here's the fun part: work the covering around the curve of the wingtip so that the wrinkles are evenly distributed. This will make shrinking the wrinkles out easier.
- ❑ Tack down the covering to the inner rib.
- ❑ Trim the covering so that there is a 1/8"-1/4" overlap around the inner rib. Tack down the overlap to prevent the covering from pulling away when you shrink it.
- ❑ Cover the other side.
- ❑ Once both sides of the wing are covered, shrink the covering with a covering iron or heat gun. If you are using the supplied clear covering, you will need a fair amount of heat to shrink the covering but too much heat will result in a hole.
- ❑ Tack the covering down around the servo holes then cut the holes out with a sharp Xacto.
- ❑ You can paint the supplied covering with Testors car body paint, which has been specifically designed for lexan car bodies.

Finishing the wings

- ❑ Glue the end caps onto the 1/8" balsa ailerons. Align the ailerons with the trailing edges of the wings. The notch cut for the control horn is on the side closest to the fuselage. Note that each aileron is tapered to fit with the trailing edge. Sand a 45 degree bevel into the front edge of the ailerons. Note that the way you angle the bevel determines if it is a right or left aileron. The bevel should be such that the aileron touches the wing at the top, not bottom.
- ❑ Paint or cover the ailerons.
- ❑ Use 3/4" packaging tape for the hinges. Once the tape is applied, you can strengthen the tape bond with some thin CA by flowing it into the tape joint. The CA will wick into the balsa. Be certain not to glue the aileron to the trailing edge.
- ❑ Feed the wings through the holes cut in the sides of the fuselage and join the left and right spars. Ensure the wing is straight and then glue the inner spar seam with CA, or, if you want removable wings, bolt the two spars together with the supplied 4-40 bolt.
- ❑ Insert the control horns into the notches in the aileron so the horn is angled towards the leading edge of the wing. Glue into place with CA.

Tail Assembly

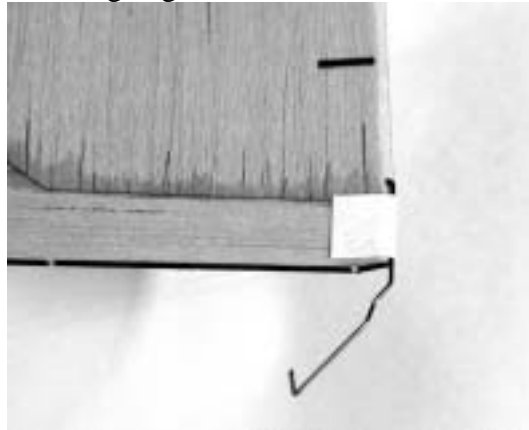
- ❑ The tail assemblies are made up from the 3/32" laser cut sheet. Lay the plans out on a flat worktable and tape them down, and then lay a sheet of wax paper over the plans. This will protect the plans from the glue. The pieces of balsa are positioned over the plans and glued together. . Build one part at a time, removing only that part from the balsa sheet so that you don't mix the parts up. Assemble each half of the elevator and then join them with the 1/8" x 2.75" hardwood dowel.



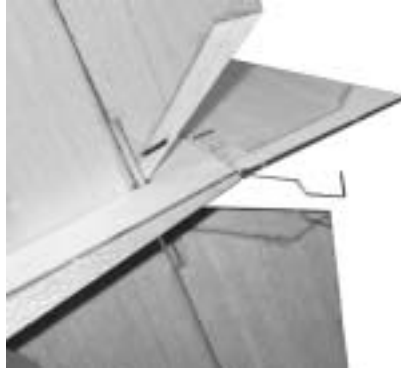
- ❑ Sand a 45 degree bevel in the **leading edge** of the rudder. Also sand a 45 degree bevel in the **trailing edges** of the horizontal stabilizer.
- ❑ Paint the tail assemblies if desired.
- ❑ The vertical stabilizer rests on the rear fuselage top. Insert the tabs of the stabilizer into the notches in the back of the fuselage. Ensure the stabilizer sits at a 90 degree angle to the fuselage and glue into place.
- ❑ Face the elevator so that the trailing edge faces the front of the plane and insert it into the slot cut in the fuselage. Once it is centered, rotate it around to face the correct direction and push it back towards the rear. Insert the horizontal stabilizer into the fuselage slot. **Be certain you have both assemblies in place before gluing the horizontal stabilizer to the fuselage.**
- ❑ The edges of the stabilizer must be equidistant from the fuselage. Once satisfied with the alignment, glue into place with some thin CA. **Ensure no glue touches the elevator.**
- ❑ Use 3/4" packaging tape for the hinges. Align the elevator with the horizontal stabilizer and tape into place. You can reinforce the tape joint like you did with the ailerons.
- ❑ Insert the plywood control horn into the elevator and glue into place with thin CA. The horn is attached to the top of the elevator.
- ❑ Shape the tail wheel wire as shown in the picture. The first bend will create the axle. The second bend will go over the edge of the wheel, with the third bend running parallel with the wire between the first and second bends.



- ❑ Measure 3/4" from the bottom edge of the rudder and drill a 1/32" hole in the center of the leading edge. Gently push the tail wheel wire into the hole. Glue a piece of Tyvek material around the tail wheel wire where it enters the leading edge of the rudder.



- ❑ You will now make a small wire loop that will be attached to the fuselage and contain the tail wheel wire so that it forms something of a hinge. Cut a 1" piece of the 1/32" pushrod wire and fold it in half to form a U-shape. Make sure there is a gap large enough for the tail wheel wire will fit in the loop. Drill a 1/32" hole in the base of the back edge of the fuselage. Insert the loop into the hole so that it sticks out 1/16" and the hole in the loop is aligned vertically. Glue with CA. Feed the wire on the rudder through the loop as shown.



- ❑ Hinge the rudder to the vertical stabilizer with packing tape.
- ❑ Glue the two 1/16" laser cut plywood tail wheel halves together
- ❑ Wrap the strip of foam rubber around the tail wheel and cut the foam rubber 1/16" shorter than the circumference of the tail wheel. Glue the two ends of the foam rubber together with CA. Mount the foam rubber ring around the tail wheel and glue in place with CA.



- ❑ Slide the wheel onto the tail wheel wire.
- ❑ Slide the 1/16" laser cut plywood hub onto the tail wheel wire and glue in place with CA. Use caution to not glue the tail wheel to the wire.

Elevator and Rudder Servo

- Install the rudder and elevator servos into the servo tray.
- Attach the rudder pushrod through the outer hole of a single-horn servo control horn, then install the control horn to the rudder servo. Do the same with the elevator servo.

We will now attach the pushrods to the rudder and elevator. We will use a piece of 1/32" music wire bent to an "L". The short end of the L will go into the control horn hole and the long end will be attached to the pushrod with heat shrink tubing.

- Cut two pieces of heat shrink tubing 3/4" long.
- Slide a piece of heat shrink over the back of the rudder pushrod.
- Cut two pieces of 1/32" music wire 2" long. Measure in 1/4" and make a 90 degree bend.
- Take one of the music wires and insert the short end in the rudder control horn.
- Slide the other end of the wire into the heat shrink and heat the heat shrink. You will adjust the length so that the rudder points straight back. Use a drop of thin CA to prevent the pushrods from slipping in the heat shrink.
- Do the same for the elevator control horn.

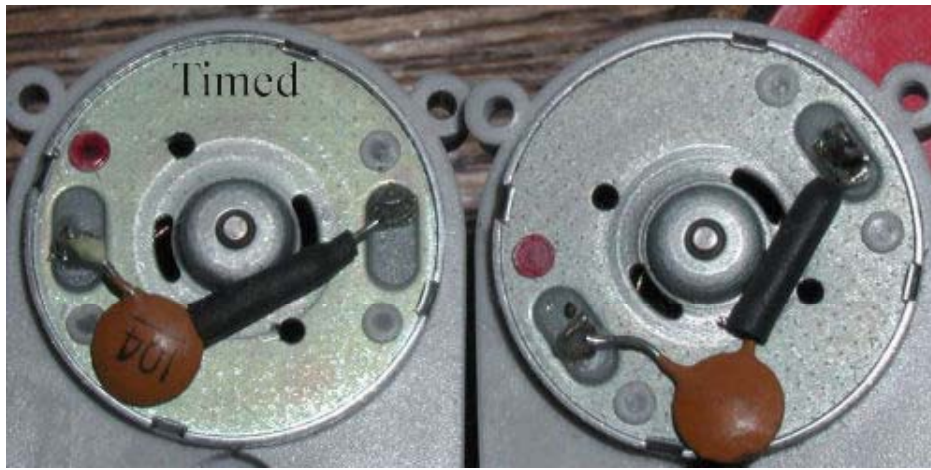


Aileron Servo

- Install the aileron servos. Feed the wire lead through the oval hole in the side of the wing and into the fuselage.
- If you have a computer radio where you can trim the individual aileron servos, you can make the aileron pushrods out of a single piece of 1/32" music wire. If you don't have a computer radio, make the pushrods out of two pieces of wire so that they overlap in the middle and are re-joined with some heat shrink tubing. This way you can adjust the length to trim the ailerons so that they are level with the wings. Once adjusted, apply a drop of thin CA to the heat shrink to prevent the wires from slipping.

Motor and Gearbox Assembly

- The stock motor is neutrally timed. You can get more power out of it by timing it. I have a pair of bent nose pliers that have the tips ground to more of a point. On the endplate of the motor, there are two holes. I place the pliers in the holes and rotate the plate clockwise as shown in the photo. Note the position of the red dot in reference to the tab that holds the endplate on. (The dark dot in this black and white photo.) You may need to unsolder the capacitors on your motor to be able to rotate the plate far enough. Make sure you solder them back on!



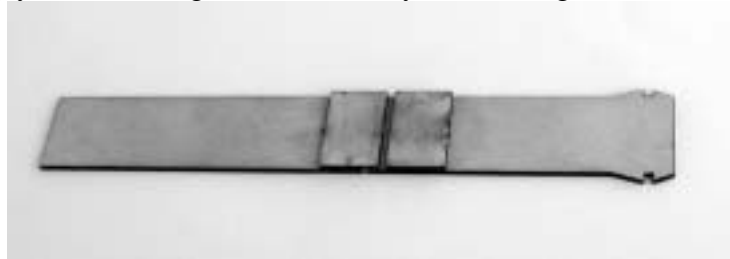
Timed Motor

Stock Motor

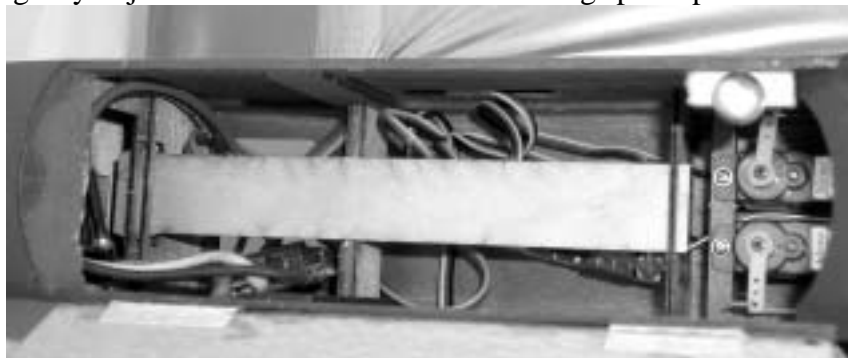
- ❑ It is a good idea to break your motor in. There are different schools of thought on how to do this but, essentially, you are trying to get the carbon brushes to seat. An easy way to do this is to run the motor for an hour on one cell with no propeller installed.
- ❑ Slide the motor over the motor mount stick. The motor comes with 4 tiny screws. I have no idea what they are for but you can use one to fasten the motor to the motor mount. Using the access hole in the bottom of the fuselage drill a small pilot hole through the plastic gearbox and into the motor mount. Screw the tiny screw in. It does not need to be tight.

Final Assembly

- ❑ Install the speed control so that it hangs from the bottom of the fuselage through the two front cooling holes. This is to keep the ESC cool.
- ❑ Mount the receiver with Velcro inside the fuselage cavity behind the wing spar.
- ❑ If you don't have a computer radio that allows aileron and flap mixing, you will need a Y cable to connect the two aileron servos to the receiver.
- ❑ On the bottom of the plywood battery mount, you will find two engraved lines. Glue the .5"x.75"x1/16" plywood rectangles to the battery mount, aligned to the lines.



- ❑ Slide the battery support into the slot cut in bulkhead F5, over the center wing seam and then through bulkheads F3 and F2. Pull up on the front of the battery support so it "clicks" into place. The two rectangles you just installed will click into the wing spar separator.



- ❑ Cut a 3 1/2" strip of Velcro and stick it to the battery mount.

Flying

Attach a battery to the Velcro strip on the wing inside the fuselage. Check that none of the control surfaces are binding and that everything, including the battery, is secure.

Before you fly the MiniFlash, check that the control surfaces move the correct directions. Always check the directions while you are behind the airplane. I highly recommend that you check the control surfaces before EVERY takeoff. For your first few flights, set the center of gravity (CG) 1/4" - 1/2" behind the vertical spar. With the battery installed, place a finger under each wing just behind the spar and close to the fuselage, and lift the MiniFlash. It should balance there. If not, adjust the battery forward or backwards till the CG is correct. Adjust your radio trim so that the elevator, rudder, and the ailerons are level. The throws should be as follows:

	Low Rates	High Rates
Ailerons	1/2"	1"
Elevator	3/4"	1 1/2"
Rudder	1"	1 1/2"

60% exp on Ailerons and elevator

Throws are measured center to one end.

For your first flight, be patient and wait for a calm day. Choose a large field where you have a smooth surface to use as a runway. Set the plane down pointing away from you. I would say to point it into the wind but it's a calm day, right? If everything goes well, applying full power will result in a short rollout and a rapid climb. Initiate turns slowly till you get used to the way the MiniFlash flies. Remember that this is a responsive airplane so feed control inputs carefully.

After you become comfortable with the plane, you may want to increase the control throws by moving the pushrods to the center holes of the control surfaces. This will make a big difference so be ready. If your transmitter has it, I recommend adding some expo to your aileron and elevator throws. You can also move the CG back for more radical maneuvers but move it back in small steps.