

Magpie

Foam Trainer



Magpie Specifications

Length: 34in.

Wingspan (SF): 46in. **Wing Area (SF):** 414in²

Wingspan (SP): 40in. **Wing Area (SP):** 360in²

Weight (without battery): 12oz.

Thank you for purchasing the Magpie. The SF or Slow Fly model is an elevator/rudder setup, designed for the beginner pilot who wants a robust trainer. The SP or Sport model also has ailerons for the pilot who wants to step up to the next level of flying. The wings are interchangeable. Built properly, the Magpie should survive the majority of crashes you are likely to experience learning to fly.

Sincerely,
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Before You Begin

Before you begin building your Magpie, make sure you read and understand all of the instructions thoroughly.

Additionally, you will need to have the following items.

What You Will Need

- Smooth and flat work surface
- Wax paper to protect the plans
- Thin Cyanoacrylate (CA) glue
- Foam Safe Glue – 5 minute epoxy, white glue, or foam safe medium CA. We recommend a tube of 5 minute epoxy.
- Hobby knife with #11 blades
- Needle nose pliers
- Wire cutters
- Sanding block with 200 grit sandpaper
- 2" packing tape or wing tape for covering the wings and fuselage
- 3M77 spray adhesive
- 3 channel radio/4 channel for SP wing.
- GWS EPS350C-C motor
- 2 micro servos (3 for the SP)(we recommend either the Hitec HS55s, GWS Pico, Naro)
- Electronic Speed Control (ESC) capable of handling at least 10 amps
- KAN650 battery pack or 1000mAH or higher 2S LiPoly battery

Parts List

Quantity	Description of Part
Wood	
1	1/32" Laser cut plywood sheet
4	1/16" Laser cut plywood sheet
Foam	
2	Wing sections
2	Fuselage sections
5	Depron tail surfaces
Additional Parts	
1	1/8" round x 7 3/16" hardwood dowel
2	1/8" round x 2.5" hardwood dowel
2	6" heat shrink tubing
1	6" Velcro strip for mounting the battery
1	150" Plastic strapping
2	1/32" x 18" thin music wire for the pushrods
1	3/32" x 18" landing gear wire
2	Wheels
2	Wheel retainers
1	#2 x 3/8" motor retaining screw

Quantity	Description of Part
Additional Parts for the SP wing	
1	1/32" x 18" music wire
1	6" heat shrink tubing
1	88" Plastic strapping
1	1/16" plywood control horns sheet
1	1/32" plywood control horn reinforcement sheet
2	Depron ailerons

General Building Tips

- Use only foam safe glue to attach the foam sections. Regular CA will dissolve the foam.
- Don't remove any pieces from the balsa sheets until they're ready to be used. That way, parts won't get mixed up or disappear.
- After you remove pieces from the balsa sheets, carefully remove any of the extra material from where the piece was attached.
- Don't over force your pieces together. If they aren't going together properly, make sure you have the right pieces and that they are oriented correctly.
- If you want to remove the charred edges caused by the laser cutting process, dampen a cloth with bleach and gently rub the affected areas. Removing the char will not increase the strength but will make it look better.

Assembly Instructions

Step 1: Assemble the Wing

The first thing you are going to assemble is the wing of your airplane. This involves assembling the wing halves, attaching the spar strips, and then applying the packing tape.

Both the SF and SP wing build the same. The SP wing has less dihedral than the SF wing and has ailerons. The ailerons will be covered later.

WARNING

Do not let non-foam safe CA touch the foam. Regular CA will dissolve the foam.

1. Glue the wing halves together with 5 minute epoxy. You can hold them together with tape while the glue sets. Be sure that the two halves line up correctly. Do not worry about the dihedral angle. The wings are cut with the proper angle at the factory.



2. Install the spar. Measure and cut two lengths of 1/2" plastic strapping so that they are the length of the wing. **Sand the strapping to help the glue adhere. This is very important.** Lay a strip down on a sheet of wax paper and apply epoxy to the strapping, ensuring that there is an even layer of epoxy with no dry areas. Lay the strapping in the notch on the wing and apply a length of wing tape or packing tape over the strapping to hold it in place. Install the second spar in the same manner. Give the epoxy a chance to set up before moving on to the next step.



3. If you prefer, you may shape the wingtips. I like to cut a radius into the front of the wingtip to give the wing a more sweeping look. This is also a good idea if you expect to be crashing as it makes the wingtip stronger. Cut the radius with an xacto then sand the cut even and rounded.



Installing the servo plate (SP wing only)

Mount the aileron servo reinforcement plates so that they are centered on the wing joint and the front plate is directly behind the strapping plastic. Separate the plates enough so that your servo will fit between them with about 1/16" extra gap. Glue the plates with epoxy. You may want to hold the plates in place while the glue sets.



Covering the Wing

Next, you are going to cover the Magpie wing using either colored wing tape, or clear packing tape. You can use additional colored tapes to give your wing detail.


Choosing a Pattern

Make sure you choose a high contrast pattern using at least two colors, with the darker color on the bottom and the lighter color on top. This will help you differentiate up from down and left from right. Try drawing your pattern out on paper before attempting it on your wing.

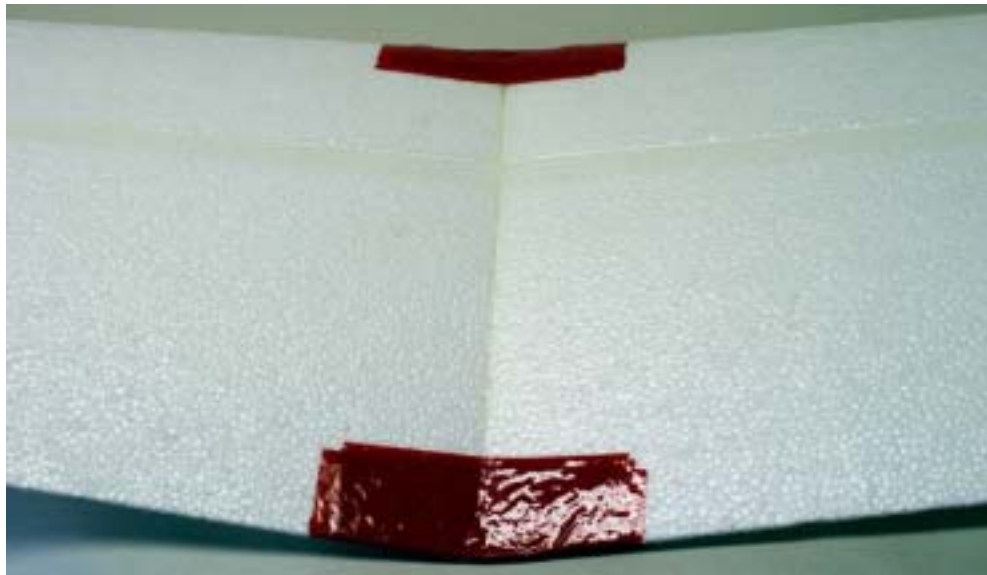
Applying the Covering Tape

For the Magpie, we recommend using wing tape (a colored tape) which can be purchased from Mountain Models or clear packing tape which can be purchased at many office supply stores.

1. Lightly sand the entire wing. Remove all the dust or the tape will not adhere.

 WARNING
The adhesive spray is known to contain acetone which will eat foam. In order to minimize the problems, you must have a clean nozzle emitting a fine mist, which is kept a good distance away from the wing and moved quickly. Apply a very light coating on the surfaces, allow some dry time, and then apply another light coating, letting it evaporate a bit before bonding. The slight eating of the foam ends up being part of the bond.

2. Spray the wing with 3M 77 and let it set for about 5 - 15 minutes, until it is tacky.
3. Reinforce the center of the wing where it will be held on with rubber bands. Do this by laying down 4 strips of tape, 4" long on the top of the trailing edge of the wing, overlapping the bottom of the wing by 1/2". Do the same for the leading edge.



4. Starting from the trailing edge, run a strip of tape across the length of one wing, overlapping the center by one inch. The first strip should wrap around the trailing edge by 1/2". Continue laying down strips of tape to cover the bottom of your wings, overlapping

each piece by 1/4" or more. The tape should also extend past the wingtip where you will wrap the tape around the tip before trimming.



TIP

Keeping your scissors or hobby knife clean is very important to the covering process. After every five to ten cuts, wipe your blade with a Windex dampened paper towel. The residue from the tape can make clean cuts almost impossible since the tape will stick to the blades and just rip instead of cut.

5. Repeat Step 3 for the rest of your wing.

HINT

You can use permanent markers to decorate your covering if you don't want to add weight or covering complexity.

Smoothing out the Covering Tape (Optional)

Using a heat gun or hair dryer, you can carefully shrink the tape until you get a glassy finish. This is not a required step, but will make the surface look more polished. Be very careful as the tape can shrink enough to pull away from the adjoining tape. It is also very easy to melt the foam. Start with the gun on a low setting and increase the heat till the tape just starts to shrink. Too much heat is a bad thing.

1. Start shrinking the bottom of the wings first, beginning at the leading edge and moving towards the trailing edge. Do the middle areas last.

2. Follow the heat gun's path using a covered hand (you can use a thick, clean sock or a towel), pressing down firmly, smoothing the surface and allowing the tape to adhere to the adhesive.
3. Once the bottom is done, shrink the top in the same fashion.

Step 2: Assemble the Fuselage

You will assemble the fuselage by first gluing the two fuselage halves together, adding strapping plastic for reinforcement, sanding to shape, adding servo mounting plates, then taping the fuselage. Follow along carefully as there are a few critical steps along the way.

1. Glue the two fuselage halves together. You can use epoxy, white glue, or foam safe CA. Hold the fuselage halves together with tape till the glue sets. Take great care to keep the fuselage straight.



2. The rear of the fuselage is tapered, making it difficult to apply the strapping plastic in the next step as the fuselage will bend when you press down on the strapping plastic. If you shim the back with the wedges that were cut from the rear fuselage, it will be much easier to keep the fuselage straight.
3. Glue the two fuselage reinforcement straps into place. Measure and cut the 1/2" plastic strapping so that it fits from the motor cutout to the tail. The strapping will be positioned 1.5" up from the bottom of the fuselage at the front of the fuselage, and 1.25" up from the bottom of the fuselage at the rear of the fuselage. Glue as you did the wing spar and hold the strapping down with wing tape or packing tape. **Don't forget to sand the strapping plastic before you glue it.** The tape can be removed when the epoxy is set.

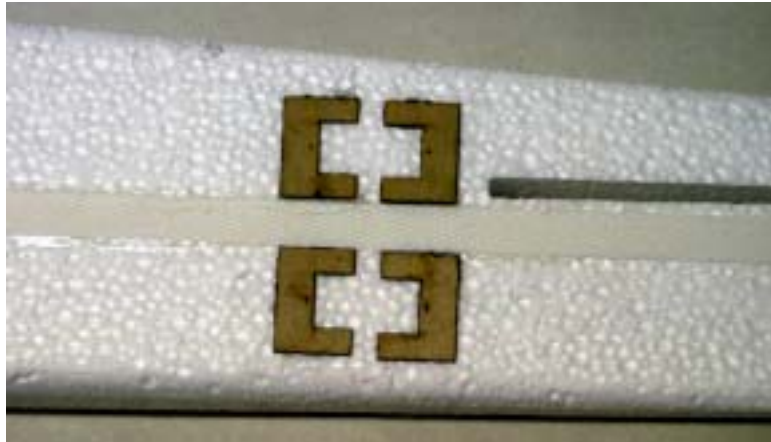


NOTE: This is your last chance to make sure your fuselage is straight. Sight along the top of the fuselage from front to back and check for any curving. The strapping can correct a curved fuselage but, if you are not careful, can make the fuselage curve.

4. Sand the fuselage to round the edges as shown in the photo below. Start with 220 grit sandpaper and round the top and bottom. You will find it easier if you only sand in one direction. I like to completely round the top and bottom but just a little is fine. You'll want to sand outside as the foam dust will make quite a mess. Remove as much of the foam dust as possible before continuing. **DO NOT SAND THE WING SADDLE (The area where the wing meets the fuselage).**



5. Mount the rear servo reinforcement plates so that the elevator servo plates are 1/4" in front of the horizontal stabilizer and the bottom of the plates are just above the plastic strap. The rudder servo plates are just below the plastic strap. Separate the plates enough so that your servos will fit between them with about 1/16" extra gap. Glue the plates with an even layer of epoxy.



6. Glue the two 1/16" plywood wing mounts to the fuselage. The wing mounts fit on either side of the wing saddle and are raised up about 1/8". They have an engraved line on them to help align them to the fuselage. Ensure that the wing mounts are aligned with each other or the wing will be crooked. You can use a straight edge to check for level. Glue with epoxy.



7. Lightly spray the entire fuselage with 3M77 and completely tape the fuselage with wing tape. I find it easiest to start with the bottom. To wrap the tape around compound curves, you can make small slits in the tape along the curve and perpendicular to the curve. Make sure to wrap completely around the rear of the fuselage. When you are done taping, you will need to go back and cut the tape away from the horizontal stabilizer slot, the motor mount slot, and the left side of the receiver hole (the opening under the wing saddle).



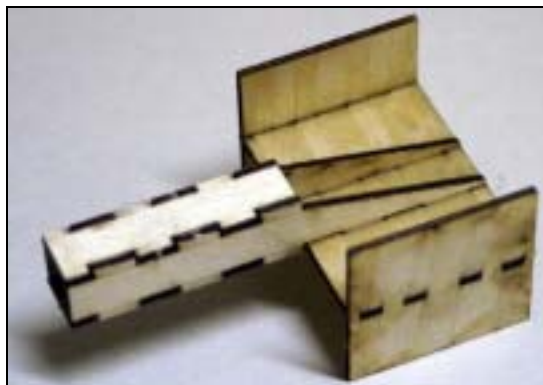
8. Put a fresh blade in your xacto and cut out holes in your fuselage for your servos. You will use the servo plates as a guide and cut the width of the slots 1/16" narrower than the width of your servos. This will give the servos a nice tight fit. I like to not cut completely through the fuselage and just work the foam out with a screwdriver. This is just for looks.



▶ Building and attaching the motor mount

There are two types of motor mounts provided: a GWS stick type mount and a firewall type mount. If you use the GWS EPS motor, you will use the stick mount. We will only describe the stick type mount as the firewall mount is quite similar.

1. Glue the motor mount together with thin CA. Be sure that the glue is completely dry before sliding the mount into the fuselage as the uncured CA will dissolve the foam.

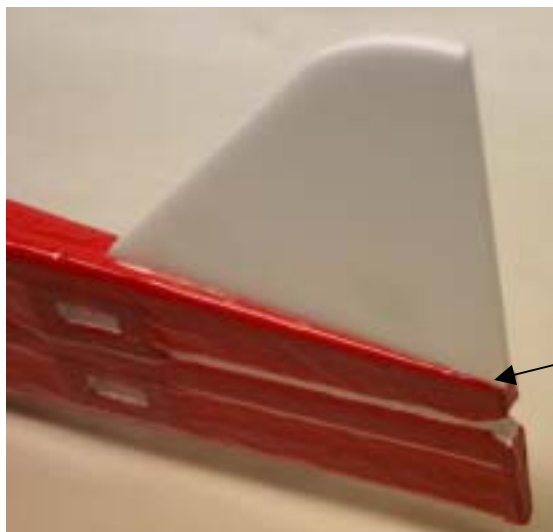


2. Ensure that a GWS type motor/gearbox will slide over the mount stick. You may need to sand the motor stick a bit to get the motor on.
3. Slide the motor mount into the fuselage and tape it into place. One piece of wing tape per side will hold the mount in nicely. In the photo, the mount is not taped yet. You can angle the mount to the right before taping to give the motor some right thrust. About 3 degrees should be right.



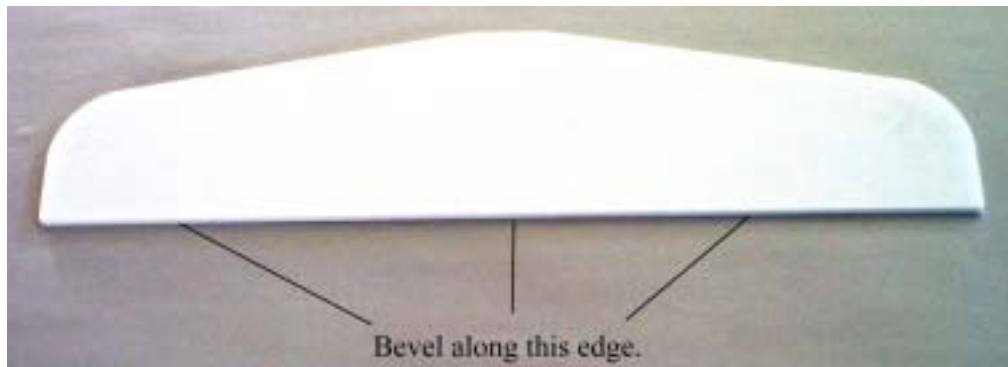
Step 3: Assemble and Install the Stabilizer, Rudder, and Elevator

1. Glue the vertical stabilizer to the top rear of the fuselage, flush with the rear of the fuselage. To make hinging the rudder easier, I prefer to offset the vertical stabilizer to the left so that the left side of the stabilizer is in line with the left edge of the rear of the fuselage. You will need to remove the tape from the fuselage where the vertical stabilizer will be glued.



Vertical Stabilizer in line with left edge.

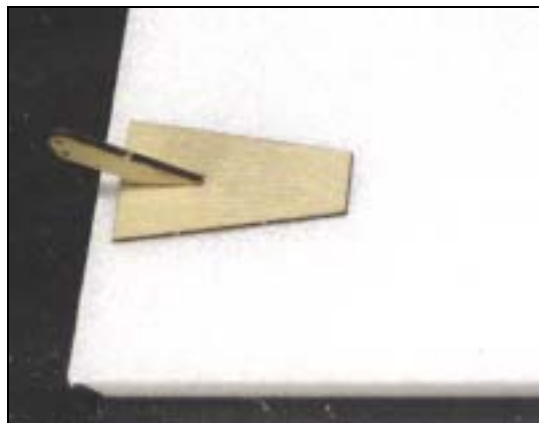
2. Cut a 45 degree bevel along the trailing edge of the horizontal stabilizer. This is so that the elevator can deflect down without interfering with the horizontal stabilizer. I like to use an xacto knife to cut the bevel. I lay a straight edge along the trailing edge and angle the knife inward.



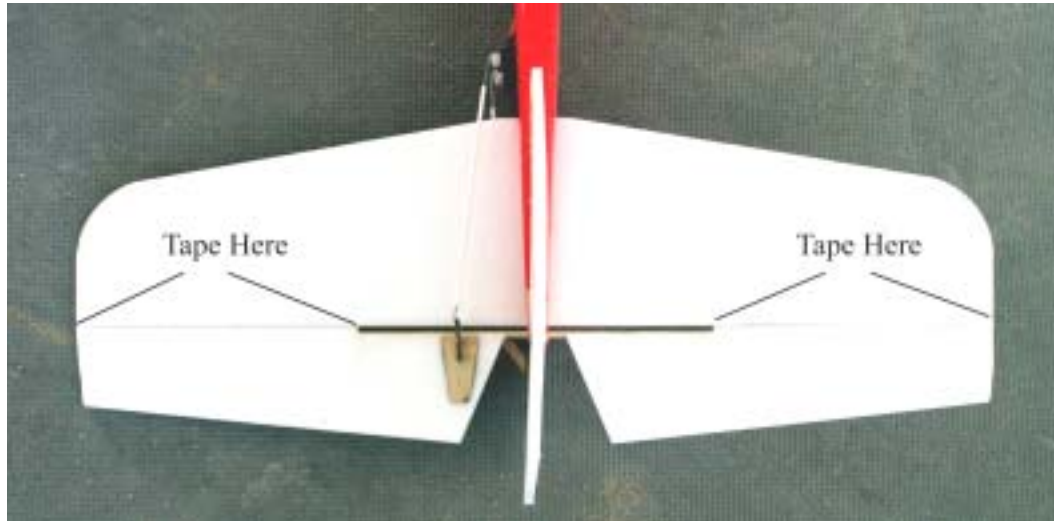
3. Join the two elevators together with the 7 3/16" dowel. Use the horizontal stabilizer as a guide to set the distance between the two elevators. The outer tips of the elevators should line up with the tips of the horizontal stabilizer. If you run the end of the dowel along the edge of the elevator where you will be gluing the dowel, you will create a groove for the dowel to set in. Glue with epoxy. Ensure both elevators remain flat while the glue dries. I find it helpful to hold the dowel on place with packing tape as the glue dries.



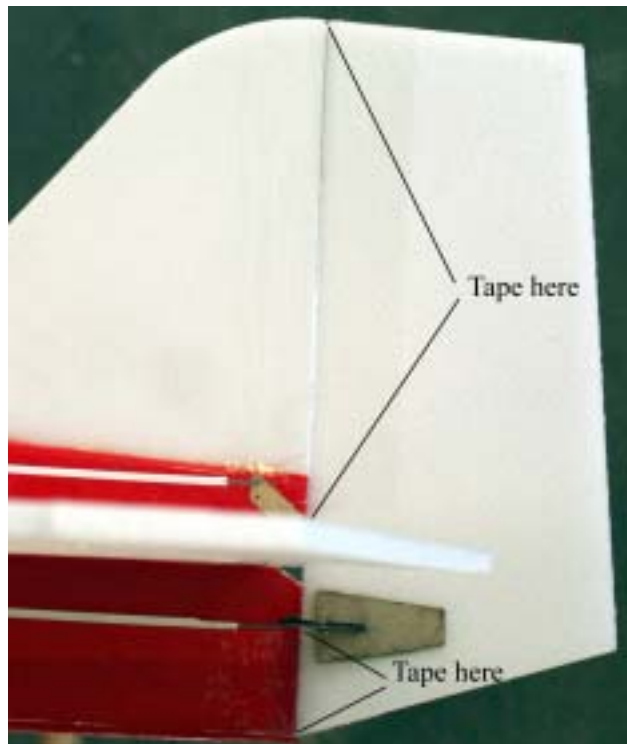
4. With a sharp xacto and a straight edge, cut a 45 degree bevel in the leading edge of the rudder. The bevel in the rudder will angle so that the furthest forward point (the part that will be hinged to the fuselage) is on the left.
5. There are two control horn reinforcement plates. Slide a control horn into the plate and epoxy the plate and horn to the top of the elevator into the provided slot. The horn will be in the left elevator as shown in the above photo.
6. Follow the same procedure for the rudder horn. The rudder horn will be on the left side of the rudder.



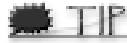
7. Tape the elevator to the horizontal stabilizer with packing tape so that, with the hinge on top, the control horn slot is on the left elevator. The elevator should just kiss the stab but should also be able to deflect 45 degrees or more in both directions. In the photo, the horizontal stabilizer is installed in the fuselage. We will do that later.



8. If there is any doubt as to the strength of the tape hinge, you can flip the elevator over onto the stab and hinge the other side of the joint.
9. Slide the horizontal stabilizer into the slot in the rear of the fuselage so the hinge is facing up and glue with foam safe CA, white glue, or epoxy. Ensure that the stabilizer is square to the fuselage.
10. Hinge the rudder to the rear of the fuselage the same way you hinged the elevator. You will need one piece of tape below the rudder control horn, and another above the elevator to the top of the rudder. The hinge will be on the left side of the fuselage.

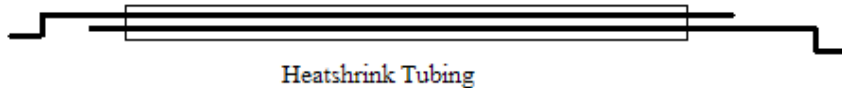


Step 4: Install the Elevator and Rudder Servos



You should center your servos before you hook them up to the pushrods. To do this: Connect your servo to your receiver, connect your ESC to your receiver, turn on your transmitter, and then connect your batteries to your ESC. Your servos will move to a neutral position, assuming all of your radio trims are set to zero (0).

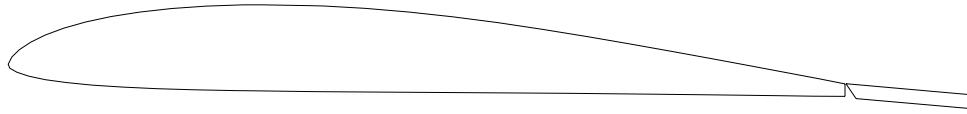
1. Press the servos into the slots you made in the fuselage build. You will need servo extension cables as your servo cables will not be long enough to reach the receiver. You can either tape the cables to the side of the fuselage or cut a slot into the fuselage as shallow as possible and press the wires into the slot. Close the slot up with tape.
2. The pushrods are made from two pieces of 1/32" x 5.5" music wire with a Z bend on one side. One Z bend goes in the servo horn and the other Z bend goes in the rudder or elevator control horn. The two wires are joined with a piece of heat shrink tubing. Be very careful shrinking the tubing as the foam melts easily. Once the pushrods are adjusted to the correct length, where the servo horn is centered and the tail surface is straight back, carefully place a drop of thin CA on the end of the heat shrink so that it will wick into the tubing. This creates a very strong joint.



3. If you have the SF wing, skip ahead to the next section.
4. cut a 45 degree bevel in the ailerons, ensuring that you make a right and a left aileron (the bevel is on the opposite side on one). Using packing tape as a hinge, attach the ailerons to the wings so that the outer edge of the ailerons are flush with the outer edge of the wings.
5. Glue the control horn reinforcement plates and control horns into the top of the ailerons.
6. Cut out a hole for the aileron servo as you did with the other two servos. The hole can go through the wing to get the servo wire out the bottom of the wing.
7. Make up two more pushrods as you did above but cut the wire to 4.5". Attach as shown.



- The ailerons should be aligned so that they are halfway between the top curve of the wing and the bottom.



Step 5: Install the Wing

- Slide the two 1/8" x 2.5" dowels through the holes in one wing mount, through the fuselage, and through the hole in the other wing mount. You will probably not need to glue the dowels in place.



- Set the wing on the mount and secure it with 6 rubber bands.


Step 6: Install the Motor

You will need:

- Motor/gearbox (*not provided with kit*)
- #2 x 3/8" motor retaining screw (*Bagged Parts*)

▶ Installing the Motor

- Slide the motor over the motor mount stick and slide the motor as far back as possible.
- Using a small drill bit or the tip of an xacto, start a hole in the side of the gearbox for the motor retaining screw. Screw in the motor retaining screw and then install the propeller.


If you are using a GWS propeller, make sure the print on the blades is facing forward.

Step 7: Install the Receiver and Speed Controller

We are not going to cover the receiver and speed controller (ESC) specific information, please refer to your manufacturer's instructions for more information, if necessary.

Attaching the Receiver

- The receiver is positioned in the cutout in the fuselage below the wing. Connect the servos and ESC to the receiver, following the guides on the receiver itself. The channel that you plug the ESC and servos into are dependent on the transmitter. For example, a Hitec transmitter uses channel one for the rudder (or aileron if you have the SP wing), channel two is elevator, and channel three is the throttle. Other brand transmitters may assign channels differently.
- Once the receiver is installed, you can close the fuselage opening with some wing tape.

Attaching the ESC

- The speed controller (ESC) is attached to the side the fuselage with the supplied Velcro. Do not make a cutout in the fuselage for the ESC as the ESC must be exposed to the air for cooling. Connect the battery to and the motor to the ESC, following the guides on the controller itself.

Step 8: Finishing the Kit

Well, you're almost there...the end is in sight; just a few more steps and you can go flying, assuming the weather is cooperating.

Setting the Center of Gravity

The Center of Gravity (CG) will affect how the airplane recovers from a nose up or nose down condition (pitch stability). With the CG too far forward, the plane will be quite stable, but require a lot of up elevator to fly level. This will result in an increased low end speed. On the other hand, too far back and the plane will be hard to control, requiring constant input to keep the plane flying straight and level. Set the CG .25"-.5" behind the rear of the wing spar. You adjust the CG by moving the battery as follows.

Attaching the Battery (LiPolys)

1. Cut the rough side of the Velcro strip down to 3" in length, and then attach it to the side of the fuselage.
2. Attach the soft side of the Velcro strip to the side of your battery pack.

Attaching the Battery (NiMH)

1. First you need to find out where the battery needs to be to balance the plane. Set the battery on the plane and position it such that the plane balances properly. This must be done with the plane completely ready to fly with everything installed.
2. Once the battery position has been determined, you can cut a hole in the side of the fuselage to hold the battery. The hole should be slightly snug to keep the battery secure. Use a sharp xacto blade to cut the hole.



Setting the Control Throws

You need to adjust your radio trim so that the elevator, rudder, and ailerons are all level. The throws are as follows:

	Low Rates	High Rates
Elevator	+-.5 inch	+ -1 inch
Rudder	+-.75 inch	+ -1.25 inch
Ailerons (SP)	+-.5 inch	+ -1 inch

If you are new to flying, set up your controls so that the maximum deflections measured from the furthest point back on the control surface, are what is specified in the low rates column. The plane will be fairly gentle set up as such. If you are brand new to flying and will be teaching yourself, you might want to set the rudder throws to +- .5" and the elevator to about 3/8". These soft controls will help to keep you from over controlling.

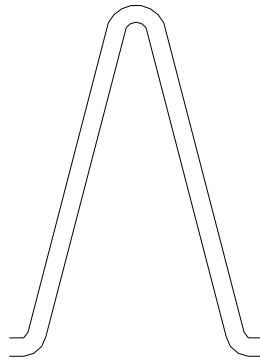
Setting the Lateral Balance

The lateral balance is along the length of the airplane. If you mount the battery on one side of the fuselage, the balance will be off. You can easily check the balance by resting the propeller shaft on a finger and gently lifting the rudder with your other hand such that the airplane is completely off the ground. If the plane rocks to one side, the balance is off. I found that, on my Magpie, a quarter and a nickel on the wingtip opposite the battery was required when I used 1200mAH Lipoly cells. I cut a slit in the wingtip and pressed the coins in the slit then taped the slit shut.

Addendum – Adding landing gear

While the Magpie does not need gear, the kit comes with hardware to add it if you desire.

Start by bending the 3/32" x 16" music wire as shown. The point in the image is the center of the wire.



Glue the two sides to the landing gear base with CA or epoxy. Attach the wire to the base with the wire ties.



Measure $\frac{3}{4}$ " from the ends and make the final bend for the wheels. The wheels can be retained by the internal star washers. The gear base is taped to the bottom of the fuselage with the point of the wire facing back. The wheels should be even with the front of the wing.

