

PHAZER

INSTRUCTION MANUAL



SPECIFICATIONS

Wingspan:	23 in [585mm]	Weight:	32 oz [910 g]	Radio:	4-channel, elevon mixing, 2 micro servos
Wing Area:	224 in ² [14.4 dm ²]	Length:	30 in [760mm]	Motor, ESC:	24-45-3790kV Ammo™, 35A ESC, HyperFlow™ 56mm fan
		Wing Loading:	20.6 oz/ft ² [63 g/dm ²]		

WARRANTY

Great Planes® Model Manufacturing Co. guarantees this kit to be free from defects in both material and workmanship at the date of purchase. This warranty does not cover any component parts damaged by use or modification. **In no case shall Great Planes' liability exceed the original cost of the purchased kit.** Further, Great Planes reserves the right to change or modify this warranty without notice.

In that Great Planes has no control over the final assembly or material used for final assembly, no liability shall be assumed nor accepted for any damage resulting from the use by the user of the final user-assembled product. By the act of using the user-assembled product, the user accepts all resulting liability.

If the buyer is not prepared to accept the liability associated with the use of this product, the buyer is advised to return

this kit immediately in new and unused condition to the place of purchase.

To make a warranty claim send the defective part or item to Hobby Services at the address below:

Hobby Services
3002 N. Apollo Dr. Suite 1
Champaign IL 61822 USA

Include a letter stating your name, return shipping address, as much contact information as possible (daytime telephone number, fax number, e-mail address), a detailed description of the problem and a photocopy of the purchase receipt. Upon receipt of the package the problem will be evaluated as quickly as possible.

READ THROUGH THIS MANUAL BEFORE STARTING CONSTRUCTION. IT CONTAINS IMPORTANT INSTRUCTIONS AND WARNINGS CONCERNING THE ASSEMBLY AND USE OF THIS MODEL.



Champaign, Illinois
(217) 398-8970, Ext 5
airsupport@greatplanes.com

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INTRODUCTION

Thank you for purchasing the Great Planes Phazer EDF ARF. On the workbench, the Phazer's main appeal is its simplicity—with only two servos, “radio installation” and setup are unusually simple and fast. And mounting the motor and fan unit goes quickly too, so you'll be off the workbench and out at the flying field in no time.

Out at the flying field the Phazer's appearance and fun flying characteristics should easily win you over. It's not “scary” fast, but still fast considering its size, and capable of at least 90 mph straight-and-level. If you can do without the attention and glory you get with bigger, more expensive jets (or if they're out of your budget!), you'll have a ball flying your Phazer.

For the latest technical updates or manual corrections to the Phazer visit the Great Planes web site at www.greatplanes.com. Open the “Airplanes” link, then select Phazer ARF. If there is new technical information or changes to this model a “tech notice” box will appear in the upper left corner of the page.

Academy of Model Aeronautics

If you are not already a member of the AMA, please join! The AMA is the governing body of model aviation and membership provides liability insurance coverage, protects modelers' rights and interests and is required to fly at most R/C sites.

Academy of Model Aeronautics

5151 East Memorial Drive
Muncie, IN 47302-9252

Tele. (800) 435-9262
Fax (765) 741-0057



Or via the Internet at: <http://www.modelaircraft.org>

IMPORTANT!!! Two of the most important things you can do to preserve the radio controlled aircraft hobby are to avoid flying near full-scale aircraft and avoid flying near or over groups of people.

SAFETY PRECAUTIONS

Protect Your Model, Yourself & Others... Follow These Important Safety Precautions

1. Your Phazer should not be considered a toy, but rather a sophisticated, working model that functions very much like a full-size airplane. Because of its performance capabilities, the Phazer, if not assembled and operated correctly, could possibly cause injury to yourself or spectators and damage to property.
2. You must assemble the model **according to the instructions**. Do not alter or modify the model, as doing so may result in an unsafe or unflyable model. In a few cases the instructions may differ slightly from the photos. In those instances the written instructions should be considered as correct.
3. You must take time to **build straight, true and strong**.
4. You must use an R/C radio system that is in good condition, a correctly sized engine, and other components as specified in this instruction manual. All components must be correctly installed so that the model operates correctly on the ground and in the air. You must check the operation of the model and all components before **every** flight.
5. If you are not an experienced pilot or have not flown this type of model before, we recommend that you get the assistance of an experienced pilot in your R/C club for your first flights. If you're not a member of a club, your local hobby shop has information about clubs in your area whose membership includes experienced pilots.

6. While this kit has been flight tested to exceed normal use, if the plane will be used for extremely high stress flying, such as racing, or if an engine larger than one in the recommended range is used, the modeler is responsible for taking steps to reinforce the high stress points and/or substituting hardware more suitable for the increased stress.

7. **WARNING:** The fuselage and tail cone adapter included in this kit are made of fiberglass, the fibers of which may cause eye, skin and respiratory tract irritation. Never blow into a part to remove fiberglass dust, as the dust will blow back into your eyes. Always wear safety goggles, a particle mask and rubber gloves when grinding, drilling and sanding fiberglass parts. Vacuum the parts and the work area thoroughly after working with fiberglass parts.

We, as the kit manufacturer, provide you with a top quality, thoroughly tested kit and instructions, but ultimately the quality and flyability of your finished model depends on how you build it; therefore, we cannot in any way guarantee the performance of your completed model, and no representations are expressed or implied as to the performance or safety of your completed model.

REMEMBER: Take your time and follow the instructions to end up with a well-built model that is straight and true.

DECISIONS YOU MUST MAKE

Radio Equipment

Transmitter:

- Transmitter with *elevator* or *aillevator* mixing or any other available programmable mix that can mix the aileron and elevator channels.

Two micro servos in the 20 oz-in torque range:

- (2) Futaba® S3157 digital, micro, high-speed/torque servos (FUTM0657)

Two 3" – 4" [75mm – 100mm] servo extension wires for connecting the servos:

- (2) Futaba J-series 75mm extension slim leads (FUTM3909)

Ducted Fan, Motor, Battery and ESC



- The Phazer has been designed to work with and includes the Great Planes *ElectriFly*® HyperFlow™ 56mm ducted fan system (GPMG3910) and the *ElectriFly* 24-45-3790kV *Ammo*™ inrunner brushless motor (GPMG5185).

- The Phazer has also been designed to fly with a 4S (14.8V) LiPo battery in the 2200mAh, 30C range. Weighing 9.2 oz. [260g] the Flight Power® 4S 2200mAh 30C EON-X™ LiPo (FPWP6199) has a good combination of compact size, reasonable weight and suitable power for flying the Phazer. It can also be charged at up to 5C for quick turnaround times to get you back into the air quickly!

Note: On a 4S 2200mAh 30C battery the Ammo motor/HyperFlow fan unit draws approximately 32A on the ground (static), about 30A in the air and consumes about 460mAh/minute at full-throttle.

- The Great Planes *ElectriFly* SS (Silver Series) 35A brushless ESC is also recommended. (GPMM1830)

Battery Charger

- A LiPo-capable battery charger is required. The Great Planes *ElectriFly* Triton™ EQ AC/DC Charger (GPMM3155) is recommended for a few reasons—it has built-in cell balancing and an LCD screen that indicates individual cell Voltage as well as final charge capacity (which is valuable for calculating flight times and other important data). The Triton EQ can be powered either by a 110V AC power source (wall plug-in) or external DC power source. For field-charging, the Great Planes 12V, 12A DC power supply (GPMP0901) is suitable.

- For batteries that have a Deans connector, a Charge Lead with banana plugs/Deans® Ultra® Male charge lead (GPMM3148) is also required with the Triton EQ.

ADDITIONAL ITEMS REQUIRED

Adhesives and Building Supplies

Nothing extraordinary is required to assemble your Phazer. Other than common hobby tools, here are the items required:

- 1/2 oz. Medium CA (GPMR6007)
- 1/2 oz. Thin CA (GPMR6001)
- CA applicator tips (HCAR3780)
- CA accelerator (GPMR6035)
- Threadlocker (GPMR6060)
- Great Planes Self Adhesive Lead Weights (GPMQ4485)
- Great Planes Pro™ 30-minute epoxy (GPMR6043) and Top Flite® Microballoons (TOPR1090) for gluing on the wings and installing the fan unit.

OR

- Zap Goo (PAAR3200) for gluing on the wings and installing the fan unit.

NOTE: Major wing repair or replacement will be easier if they are not permanently attached. Zap Goo or RTV silicone may be used for attaching the wings, yet can be removed later if required.

Following are the colors of MonoKote® used on the Phazer:

- Jet White (TOPQ0204)
- Missile Red (TOPQ0201)
- Metallic Platinum (TOPQ0408)

KIT INSPECTION

Before starting to build, take an inventory of this kit to make sure it is complete, and inspect the parts to make sure they are of acceptable quality. If any parts are missing or are not of acceptable quality, or if you need assistance with assembly, contact **Product Support**. When reporting defective or missing parts, use the part names exactly as they are written in the Kit Contents list.

Great Planes Product Support

3002 N Apollo Drive, Suite 1 Ph: (217) 398-8970, ext. 5
Champaign, IL 61822 Fax: (217) 398-7721

E-mail: airsupport@greatplanes.com

ORDERING REPLACEMENT PARTS

Replacement parts for the Great Planes Phazer ARF are available using the order numbers in the **Replacement Parts List** that follows. The fastest, most economical service can be provided by your hobby dealer or mail-order company.

To locate a hobby dealer, visit the Great Planes web site at www.greatplanes.com. Select "Where to Buy" in the menu across the top of the page and follow the instructions provided to locate a U.S., Canadian or International dealer.

Parts may also be ordered directly from Hobby Services by calling (217) 398-0007, or via facsimile at (217) 398-7721, but full retail prices and shipping and handling charges will apply.

Illinois and Nevada residents will also be charged sales tax. If ordering via fax, include a Visa® or MasterCard® number and expiration date for payment.

Mail parts orders **Hobby Services**
and payments by 3002 N Apollo Drive, Suite 1
personal check to: Champaign IL 61822

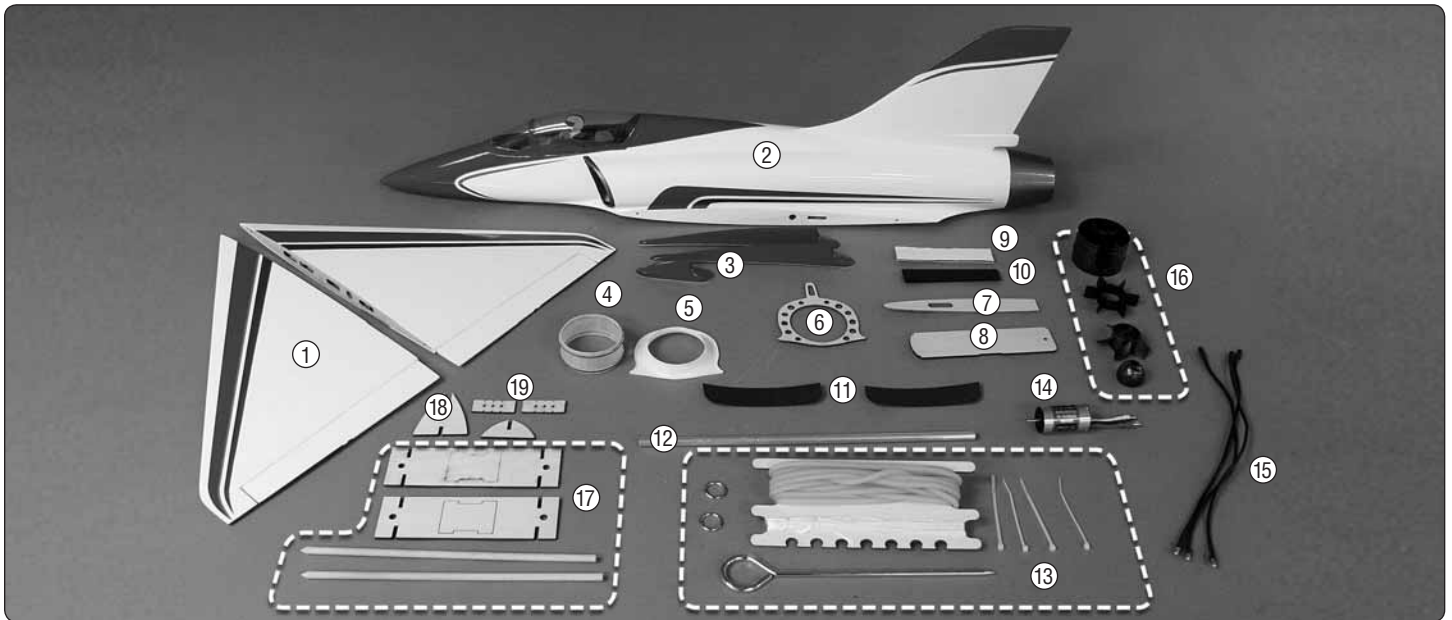
Be certain to specify the order number exactly as listed in the **Replacement Parts List**. Payment by credit card or personal check only; no C.O.D.

If additional assistance is required for any reason contact Product Support by e-mail at productsupport@greatplanes.com, or by telephone at (217) 398-8970.

REPLACEMENT PARTS LIST

Order No.	Description
GPMA4240	Fuselage
GPMA4241	Wing
GPMA4242	Canopy
GPMA4243	Skid set
GPMA4244	Flange/adaptor set
GPMA4245	Decal sheet
GPMA4246	Wing joiner tube
GPMA2885	Bungee launch set
GPMA2999	Bungee hook/nut/washer
GPMG3910	HyperFlow fan unit
GPMG5185	24-45-3790 Ammo brushless motor

KIT CONTENTS



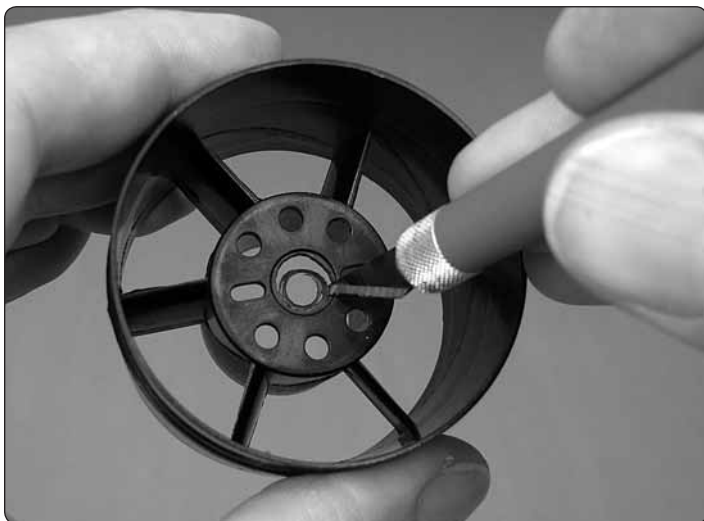
Kit Contents

- | | | | |
|-------------------------|-------------------------|---------------------------|---------------------------|
| 1. Wing | 6. Housing Mount | 11. Finger Grips | 15. Motor Extension Wires |
| 2. Fuselage w/ Canopy | 7. Fin Hole Cover | 12. Wing Joiner Tube | 16. HyperFlow Fan Unit |
| 3. Skid Set | 8. Battery Mount Plate | 13. Bungee Launch Kit | 17. Balance Stand |
| 4. Cone Adapter | 9. Velcro Battery Mount | 14. 24-45-3790 Ammo Motor | 18. Balance Gauge |
| 5. Front Housing Flange | 10. Velcro Strap | | 19. C. G. Supports |

ASSEMBLY INSTRUCTIONS

Ducted Fan Assembly

Reference the separate HyperFlow instruction sheet as necessary, but follow the instructions below for assembly/installation into the Phazer.

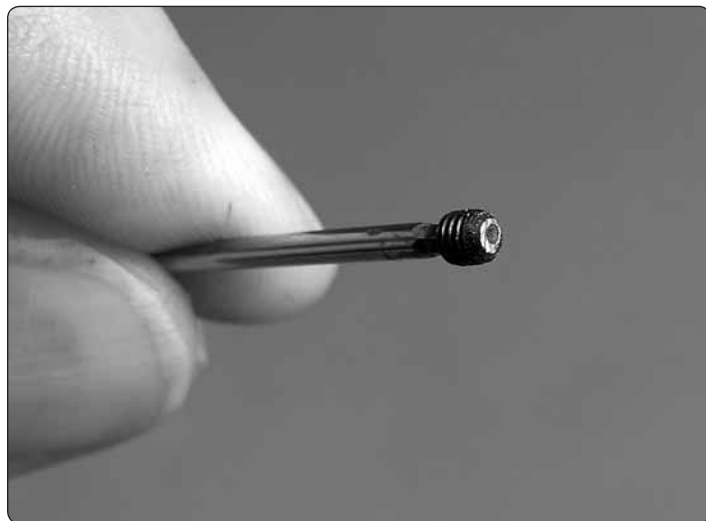
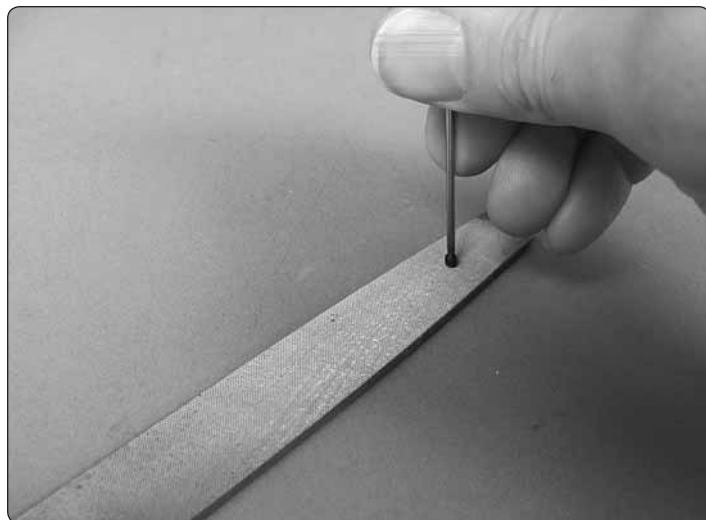


❑ 1. Enlarge the hole in the fan housing to allow installation and removal of the motor without having to remove the brass fan adapter.

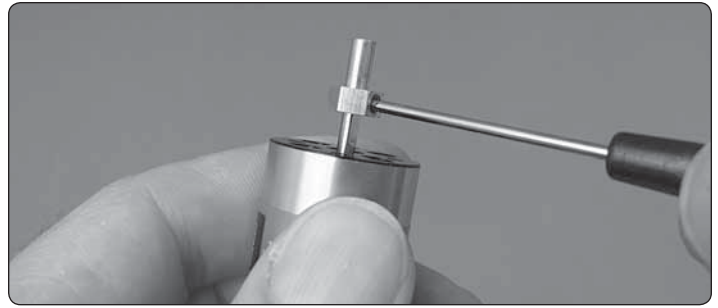
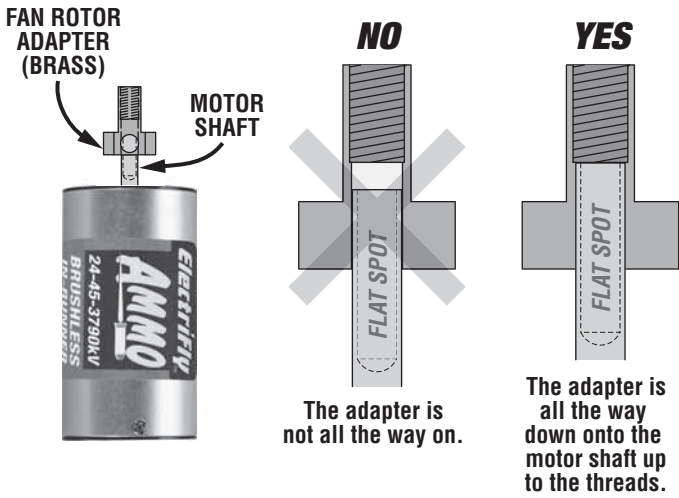
❑ 2. As shown in the HyperFlow manual, trim the three **alignment guides** from inside the housing to accommodate the motor.



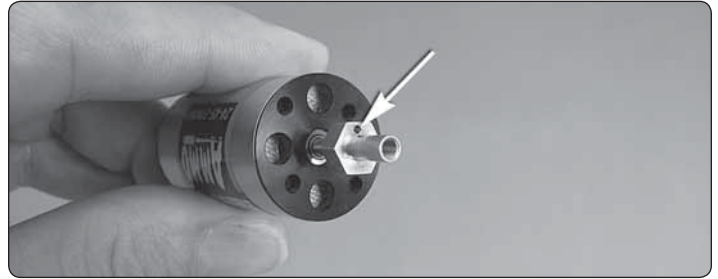
❑ 3. Trim any flashing from around the fan housing so the fiberglass **cone adapter** will fit correctly.



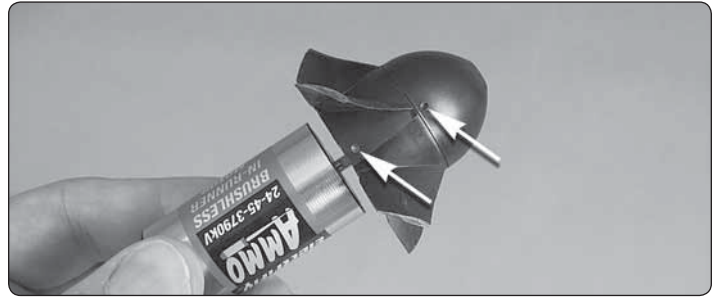
❑ 4. Key one of the 3mm set screws (for fastening the brass fan rotor adapter to the motor shaft) onto a 1.5mm Allen wrench—a basic “L” wrench is included if you don’t have one of your own. Use a metal file to lightly file down the end of the screw—it won’t take much—just a few passes to remove the slightest fraction of an inch.



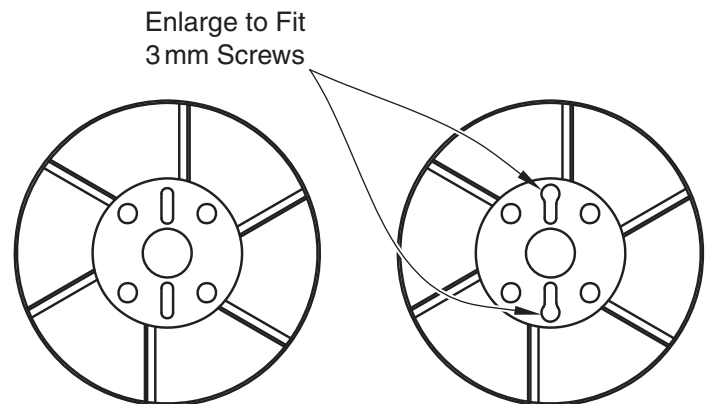
7. Take out the set screws and **lightly** wet the threads with threadlocker. Then tighten them back into the adapter locking it onto the shaft.



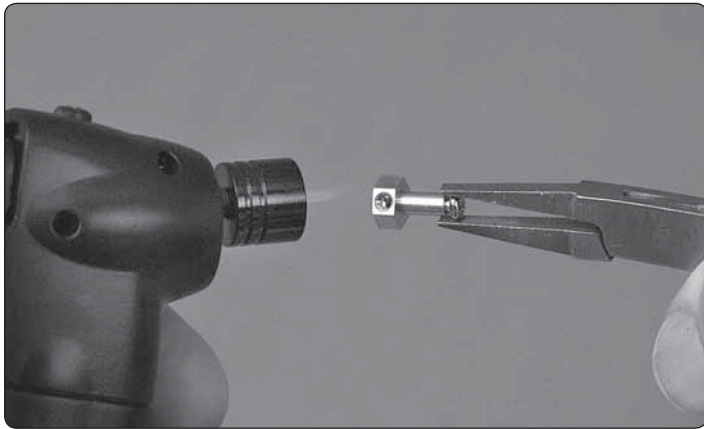
8. Use a felt-tip pen and/or drill a small dimple on top surface of the base of the adapter where shown. If necessary, this will be used as an alignment cue for balancing the fan later.



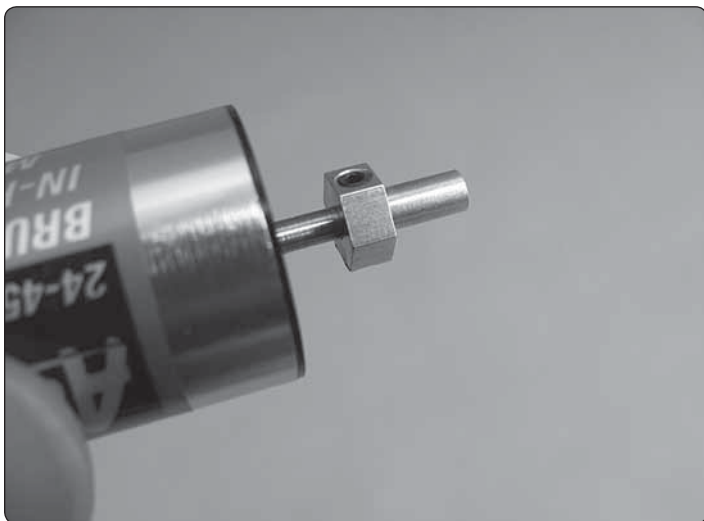
9. Temporarily fit the fan onto the adapter and the cone onto the fan. Use a 1/16" [1.6mm] twist drill, in a pin vise or held in your fingers, to **lightly** dimple the side of the fan and cone that align with the side of the adapter that also has the dimple. Make sure all three dimples are in alignment. These will all serve as temporary reference marks.



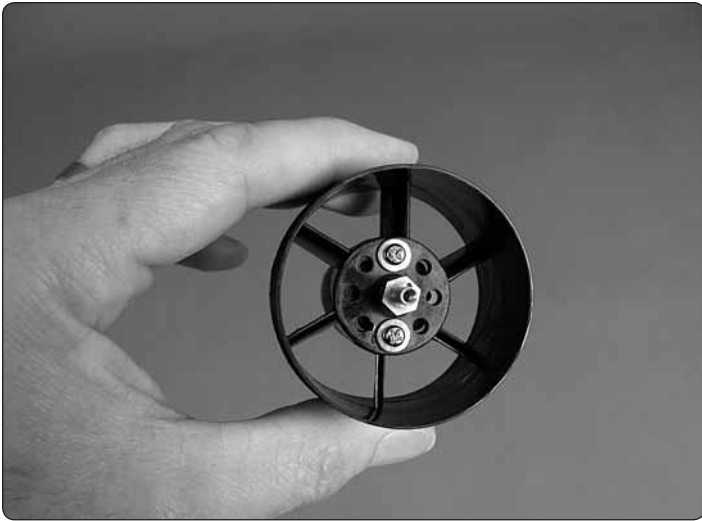
10. Remove the cone and fan from the motor. Use a hobby knife to slightly enlarge the slots in the fan housing as shown to accommodate the motor screws.



5. Retrieve the brass **fan rotor adapter** that was packaged with the HyperFlow fan unit. Fit the adapter onto the motor shaft with one of the set-screw holes in the adapter aligned with the flat spot on the shaft and make sure the adapter goes all the way on up to the threads. If you can't get the adapter to go on all the way just by pressing it on, use a hobby torch to heat the adapter first.



6. Test-fit both set screws into the brass adapter on the shaft—the screw you filed down goes into the hole that is not over the flat spot. Make sure the end of that screw is flush (or slightly below) the surface of the adapter. If necessary, file down the screw a little more.



❑ 11. Mount the motor to the fan housing with two of the 3 x 5mm screws packaged with the Ammo motor; one or two washers for each screw; and a drop of threadlocker on the threads. The washers will make sure the screws don't bottom out on the fiberglass insulator ring inside the motor.

❑ 12. As shown in step 6 in the HyperFlow manual, test-fit the **stator extension** to the fan housing—make sure the little notch in each stator blade allows the blade to fit all the way to the blades in the housing. If necessary, slightly enlarge any notches that interfere for a proper fit.

❑ 13. Once satisfied with the fit of the stator extension, carefully glue it to the fan housing with CA—use CA **sparingly** so as not to let excess run down inside the housing.



❑ 14. Lightly sand the edge of each blade on the stator extension to remove any flashing and to make sure they are even with the housing.



❑ 15. Use medium-grit sandpaper to smooth the rough edges around the motor wire hole in the fiberglass **cone adapter** so it won't damage the motor wires.

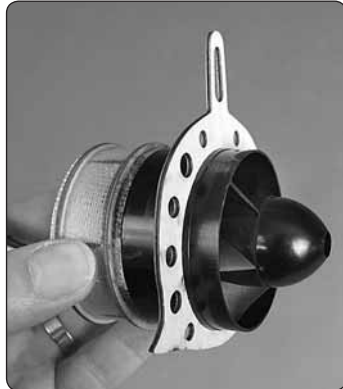
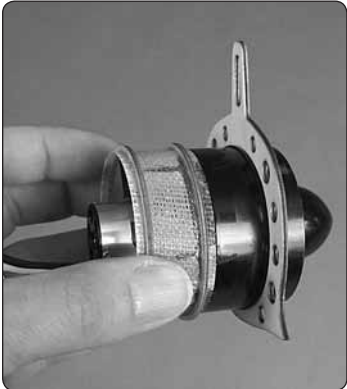


❑ 16. Test-fit, **but do not glue** the cone adapter to the rear of the fan housing. Note that the hole in the housing should be 180 degrees from the side of the motor where the wires exit—this will be the **top** of the unit. Once you have the housing and adapter mated correctly, permanently glue the two together by adding a few drops of thin CA to the seam around the outside. Also apply a few drops of medium CA to each stator blade where it contacts the inside of the adapter—again, use CA sparingly so as not to cause excess to run down inside the fan.

❑ 17. Fit the cone to the fan and the fan onto the adapter with all the dimples aligned. Secure the cone and fan to the adapter with a 3mm screw and washer, but don't use any threadlocker yet.

Mount the Fan in the Fuselage

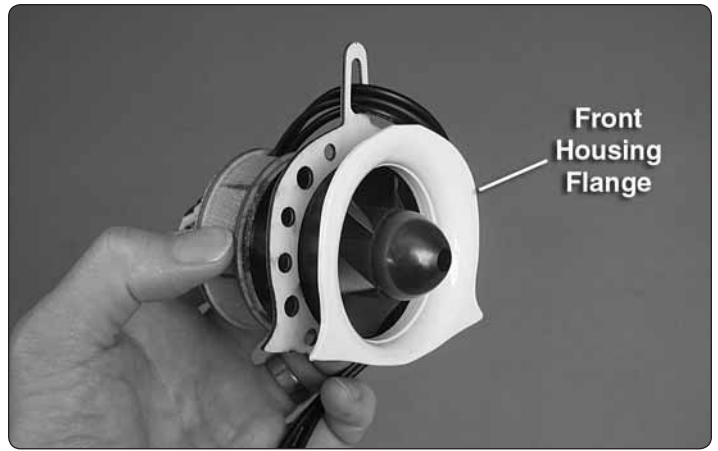
Installation of the fan unit may take a little “fine tuning” to get the parts into position. Once glued in it is permanent, but the motor and fan may still be removed if ever required later.



❑ 1. Test fit the plywood **fan housing mount** over the fan housing to make sure it fits—it should fit slightly snug, but not too tight because you’ll be installing the housing through the mount while both parts are in the fuselage. If the mount fits too tightly over the housing sand the inside of the mount so it fits.



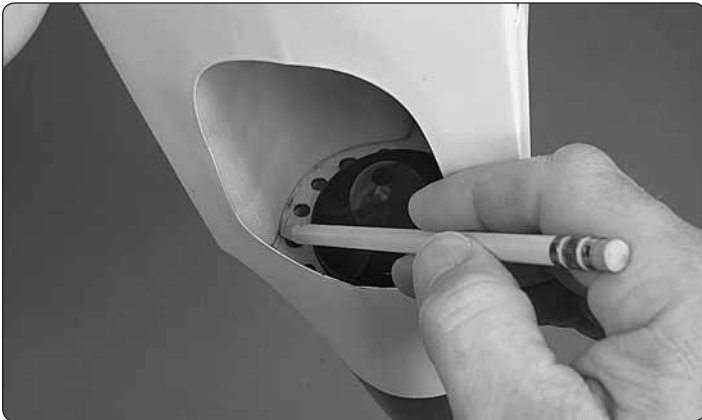
❑ 2. Carefully bend the motor wires upward toward the hole in the fiberglass cone adapter, then connect the motor extension wires through the hole. While you’re at it, position the plywood housing mount and guide the motor wires through it.



❑ 3. Test fit the **front housing flange** into the fan housing just to make sure it fits—if necessary, trim or sand a slight bevel inside the edge of the housing to easily accommodate the flange.



❑ 4. Remove the flange and housing mount from the fan unit, but don’t take the wires out of the housing mount. With the housing mount off the fan unit but the motor wires running through the mount, fit the mount and fan unit through the cheater hole in the bottom of the fuselage. Key the fiberglass adapter ring on the back of the fan unit around the inside of the fiberglass tail cone in the fuselage, then fit the plywood housing mount over the fan housing. If you cannot get the housing mount all the way into position do not force it. Proceed to the next step.



❑ 5. If necessary, use a pencil to mark the edges of the plywood housing mount where it requires any trimming to fit. **Hint:** You should be able to prop the fuselage vertically on your workbench, making it easy to see. Mark any areas of the housing mount that require trimming.

❑ 6. Take out the fan and housing mount, then trim the mount where you marked it for trimming. Continue to fit and trim the housing mount as necessary until you can get a good fit.



❑ 7. Once you can get a good fit, remove the housing mount and fan unit. Apply a fillet of thick, slow-drying glue such as 30-minute epoxy mixed with microballoons or Zap Goo around the end of the cone adapter ring. Install the fan unit and plywood housing mount into position, making certain the adapter ring is keyed all the way around the inside of the tail cone. Wipe off any excess glue, then use thick or medium CA to glue the fan housing mount to the fuselage and the fan unit to the fan mount.

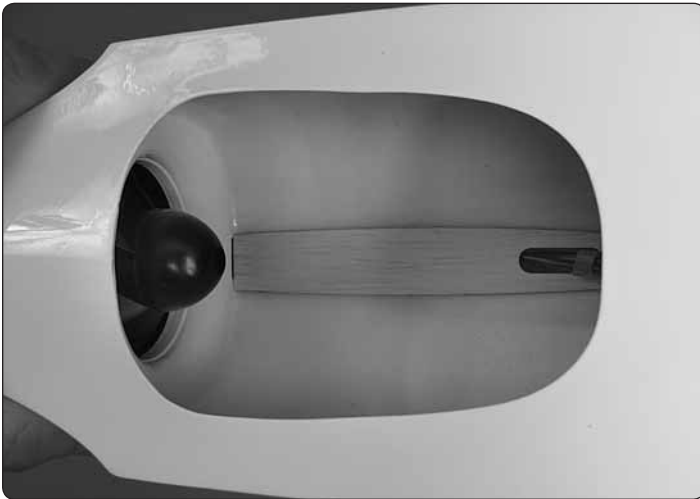
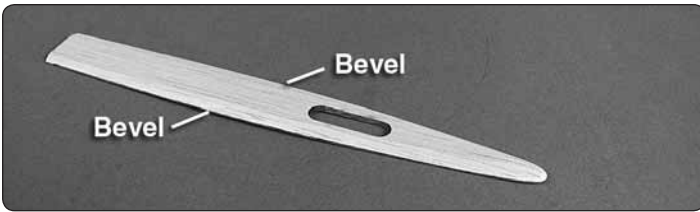


❑ 8. Test-fit the front housing flange, making sure it is keyed around the inside of the fan housing. Make any adjustments for a good fit.

❑ 9. Once satisfied with the fit of the front housing flange take it out of the fuselage. Apply a bead of thick CA around the lip where it fits into the housing, then reposition it into the fuselage and housing. Immediately wipe away any excess CA.



❑ 10. After the CA has hardened, use 30-minute epoxy mixed with microballoons, Zap Goo or RTV silicone to make a fillet around the flange to the fuselage. Permanently glue the flange into position.

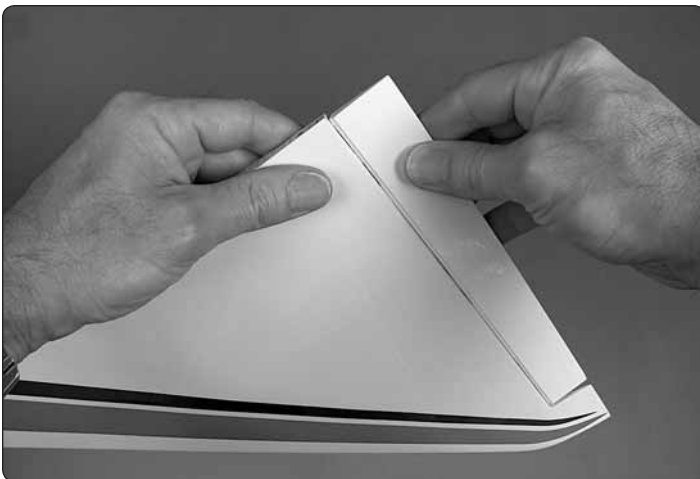


❑ 11. Bevel the edges around the balsa **fin hole cover**, then fit and glue into position.

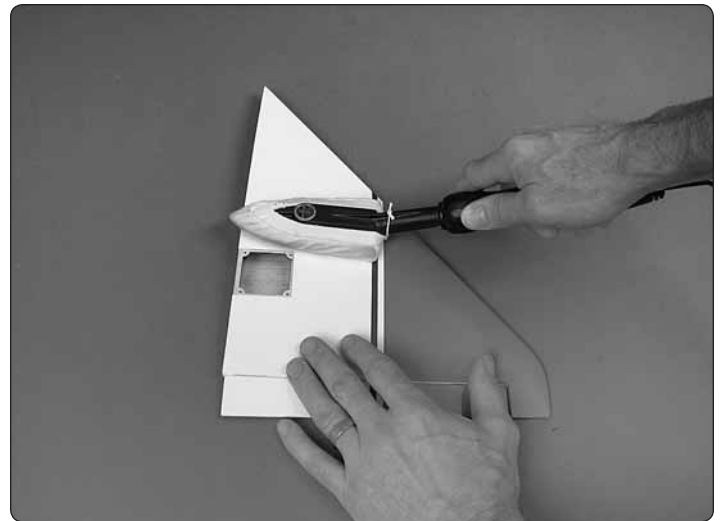


❑ 12. Mount the bungee hook to the bottom of the fuselage with a 3mm nut, washer and threadlocker on the threads.

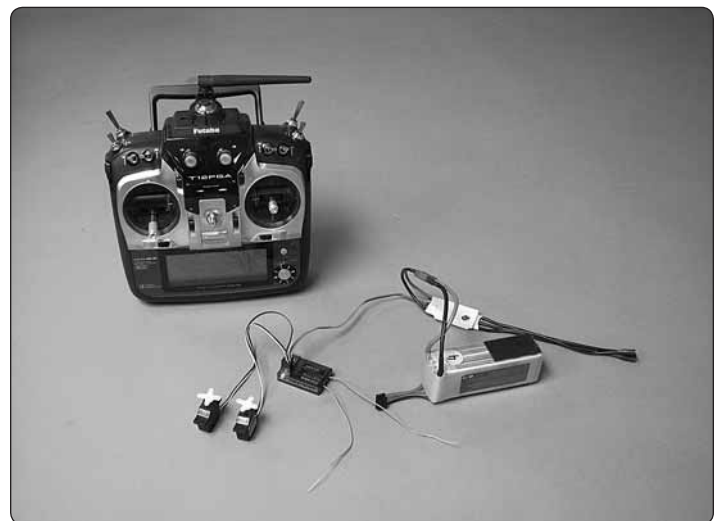
ASSEMBLE THE WING



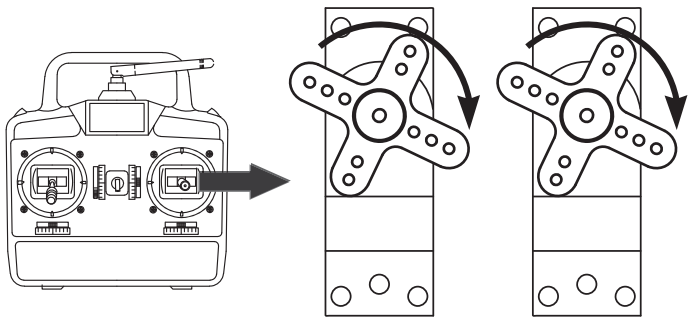
❑ 1. Pull hard on both elevons to make sure the hinges and the elevons are secure. If any hinges come out or seem loose, add a few drops of thin CA to the hinge in the gap, allow to harden, and then test again.



❑ 2. Use a covering iron with a cover sock to go over the wings and servo hatches and remove any wrinkles. When you do find wrinkles, first glide the iron over the area to shrink the wrinkle. Allow to cool for a second or two, then go back over the spot, pressing down to bond the covering to the wood. If the wrinkles won't go away and just bubble up, reduce the heat of your iron.

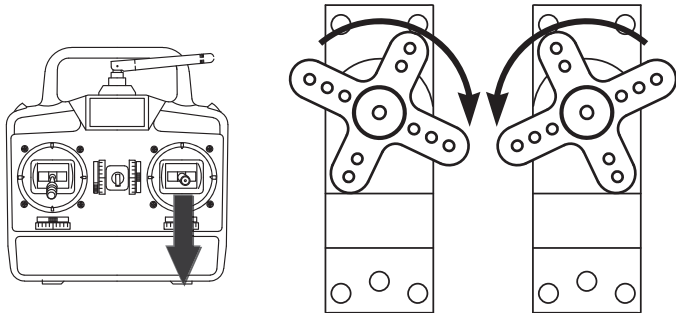


❑ 3. Temporarily connect your servos, receiver, ESC and battery and power them up with your transmitter.



Right Wing Servo Left Wing Servo

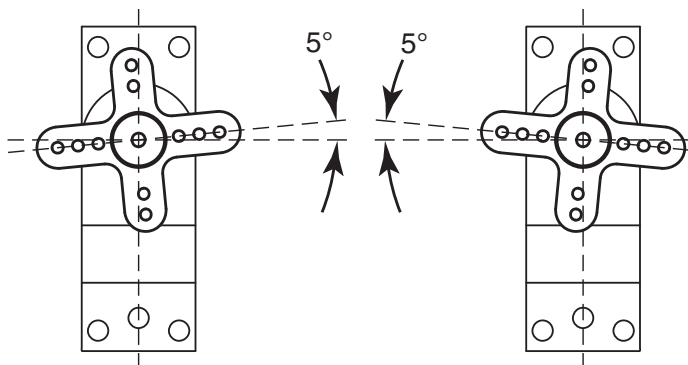
Right Aileron Control Input



Right Wing Servo Left Wing Servo

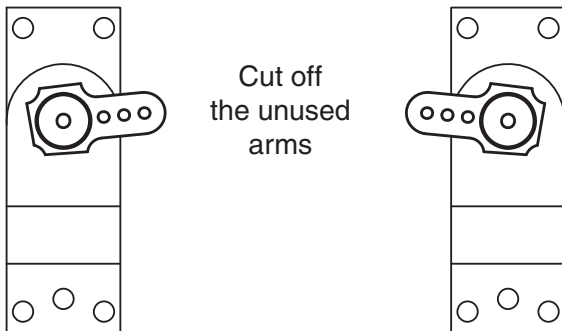
"Up" Elevator Control Input

□ 4. Make sure all the trims and sub trims are "zeroed" in your transmitter. Program the mixing in your transmitter so the servos respond in the correct direction as illustrated.



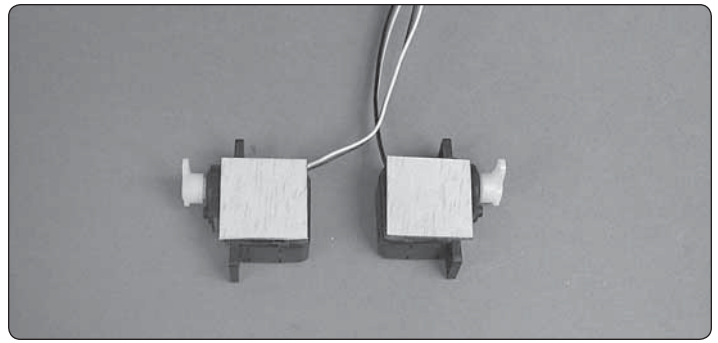
Right Wing Servo

Left Wing Servo



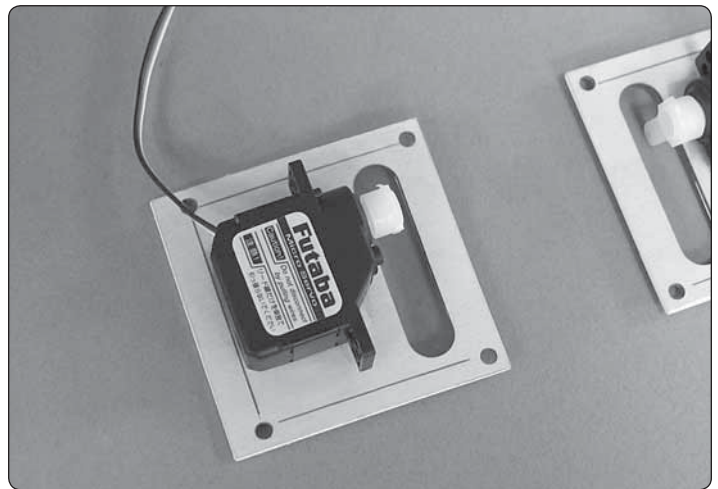
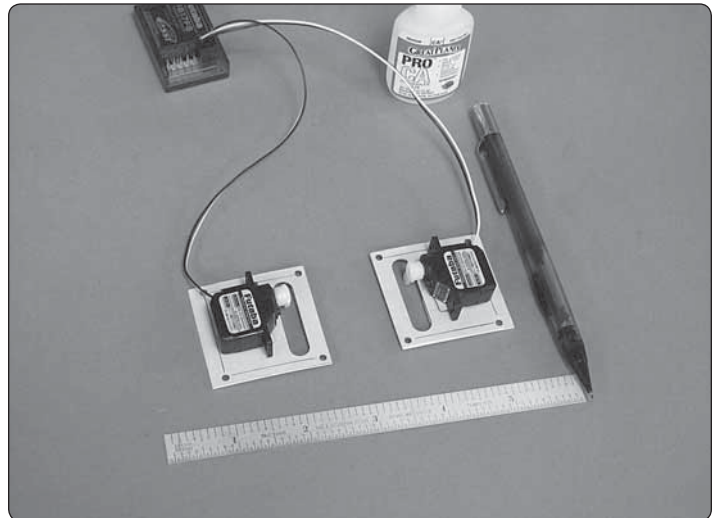
Cut off the unused arms

□ 5. Mount the servo arms to your servos so the inward-facing arms will have an approximately 5-degree angle as shown. Cut off the unused arms.

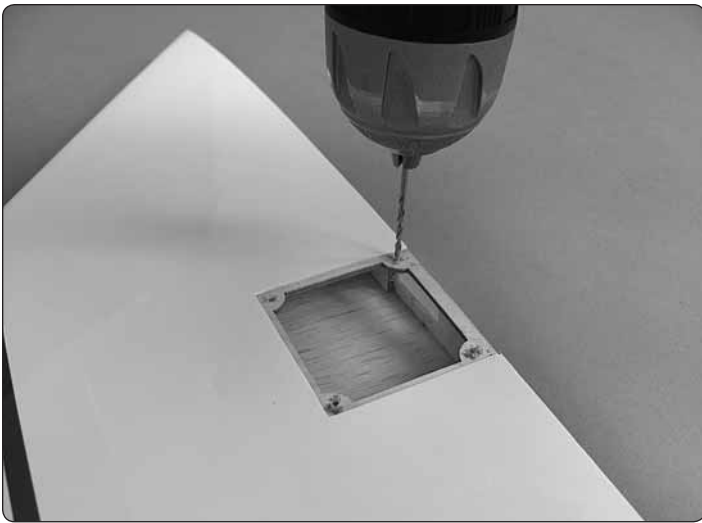


□ 6. Cut the 1/32" x 3/4" x 1-9/16" [1 x 20 x 40mm] balsa sheet in half. Use medium-grit sandpaper to roughen the side of each servo, then use medium CA to glue each balsa sheet to the side of each servo. **Caution:** Do not use thin CA for this step because it could wick into the servo through seams in the case.

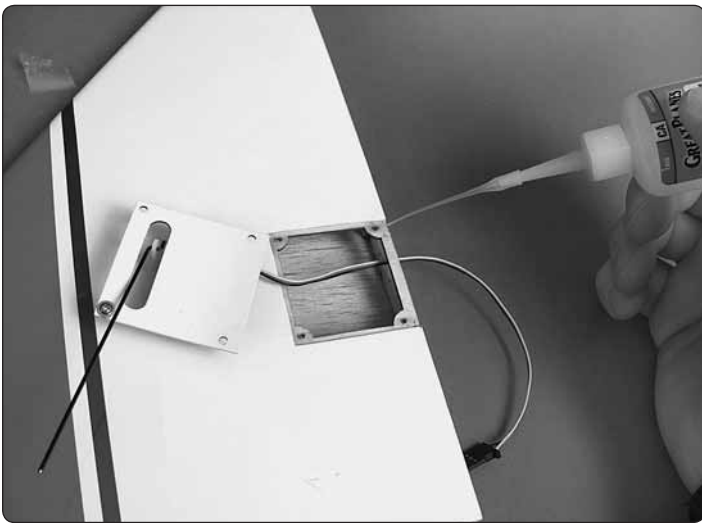
□ 7. Use a #53 (.046" [1.2mm]) drill to enlarge the holes in your servo arms and the holes in the included control horns to fit the 1.2mm Z-bend pushrods. If you don't have a drill you can use a hobby blade, but do so carefully and don't oversize the holes or there will be free play in the linkages.



□ 8. Use a straightedge and a pencil to mark lines across the inside of the hatch centered over the four screw holes. Glue the servos to the hatches with medium CA, making sure the servo doesn't extend over any of the lines.

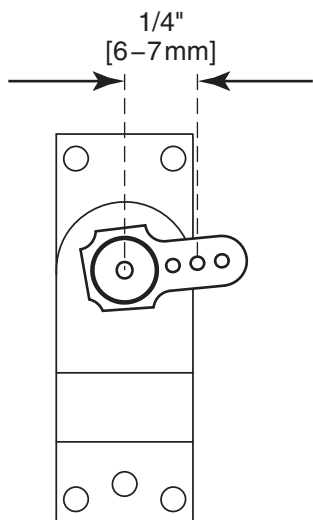


❑ 9. Enlarge the four hatch mounting holes in each wing with a 1/16" [1.6mm] drill.

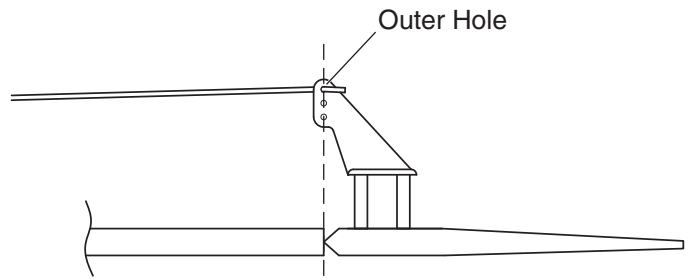


❑ 10. Temporarily mount the hatches in the wings with the washer-head Phillips screws. Take out the screws, add a drop or two of thin CA in each hole and allow to harden.

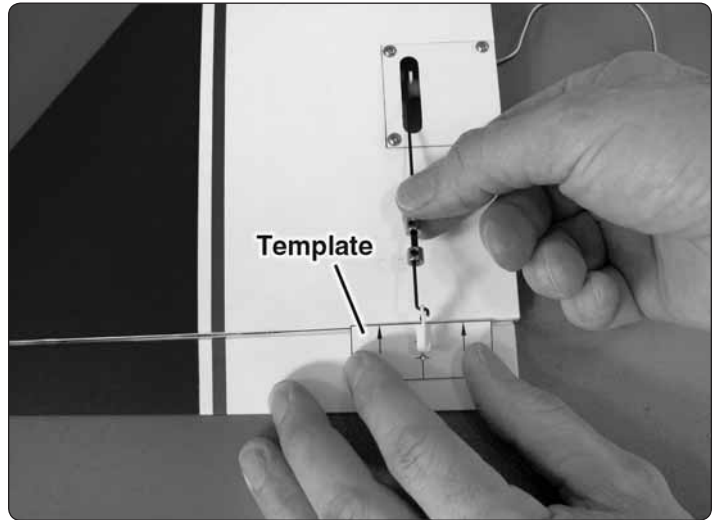
From here you can do one wing at a time, or work on them both simultaneously.



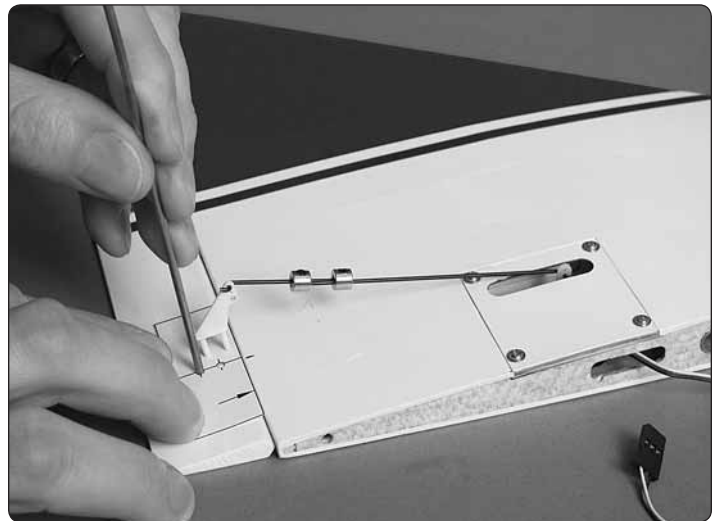
❑ 11. Insert one of the long Z-bend pushrods through the hole in the servo arm that is closest to 1/4" [6-7mm] out, then mount the arm to the servo with the servo arm screw and mount the hatch to the wing.



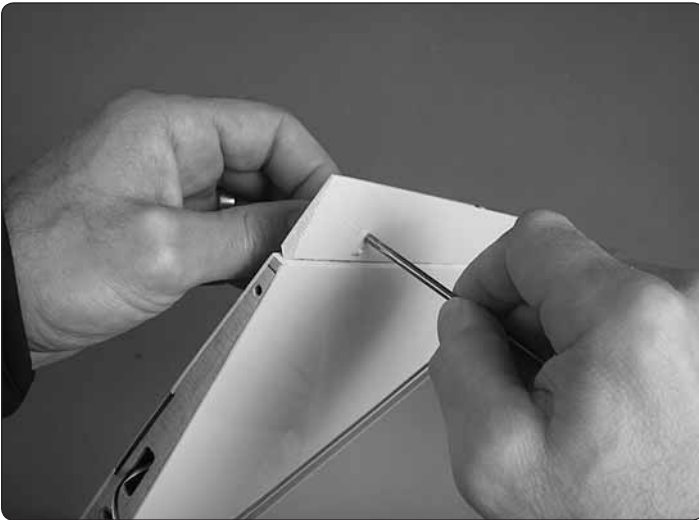
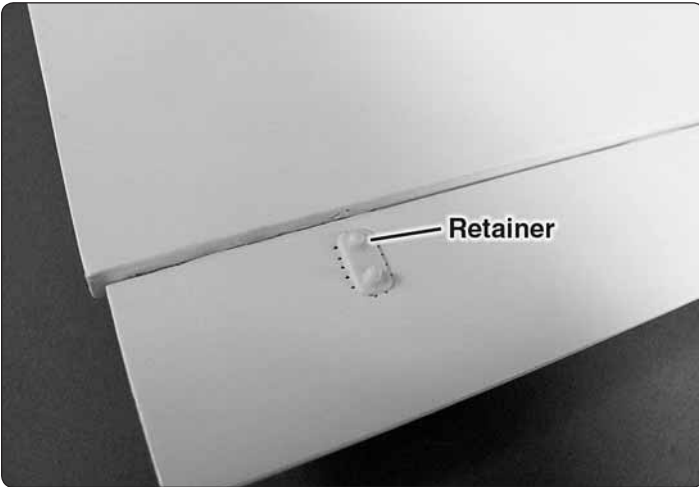
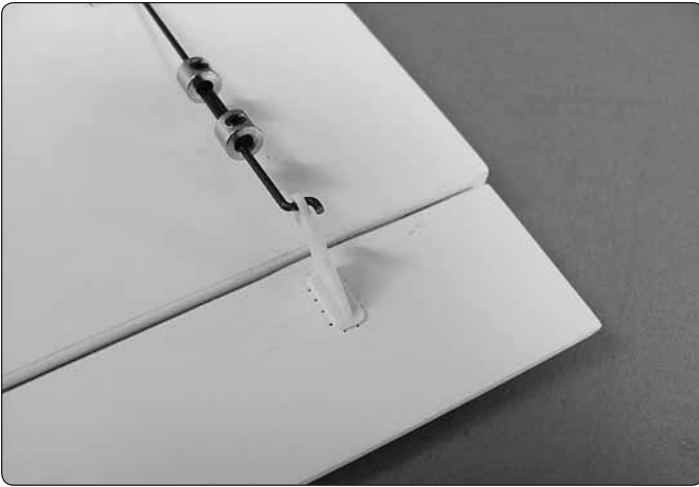
❑ 12. Temporarily mate one of the short Z-bend pushrods to the long pushrod on the servo with two collars and set screws, then fit one of the aileron horns onto the pushrod through the **outer** hole.



❑ 13. Cut an **Aileron Horn Template** from the back of the manual and align it with the trailing edge of the wing as shown. Position the template so the pushrod will be directly behind the servo arm and perpendicular to it.



❑ 14. Drill 3/32" [2.4mm] holes through the aileron where marked on the template (or use a 3/32" brass tube sharpened on the end to cut perfectly clean holes).



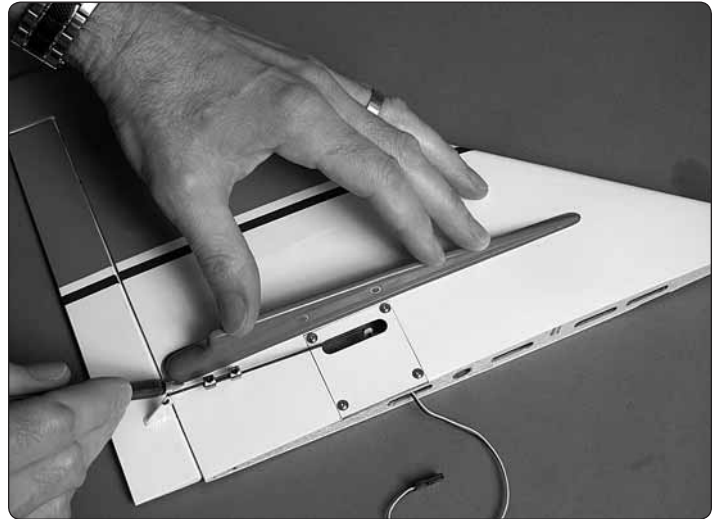
❑ 15. Loosen the collars to adjust the length of the pushrod assembly as necessary, then mount the horn to the aileron with the retainer on the top. (**Hint:** Use a 1/8" brass tube to tightly push the retainer over the posts on the top of the aileron.) Use a small pin to poke holes around the base of the retainer and the horn. Then apply thin CA to securely glue the horn into place.

❑ 16. If you haven't yet done so, hook up the other elevon the same way. Final elevon setup will be done later after the wings have been attached to the fuselage, so don't worry about adjusting the pushrods and tightening the collars at this time.

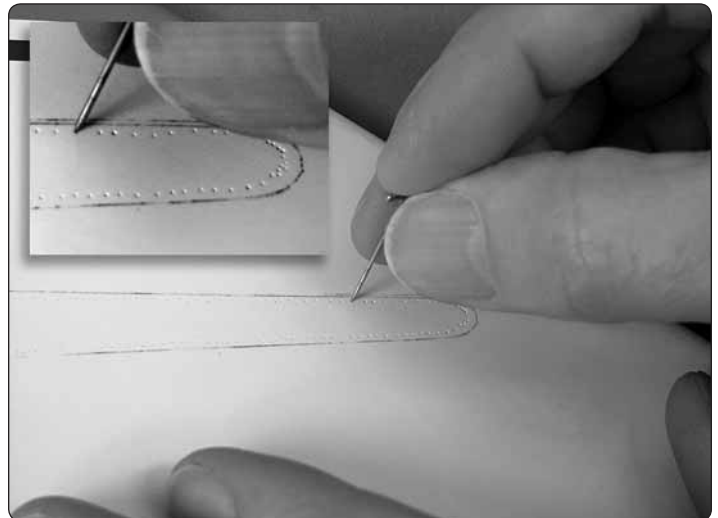
Mount the Wing Skids

- ❑ 1. The wing skids come pretty much ready to glue on, but if you want perfection you could true the factory-cut edges a little with a bar-sander and 80-grit sandpaper followed by 320-grit finishing with 400-grit to smooth the edges.
- ❑ 2. Determine which skid is the right and which is the left by test-fitting them onto the wing and seeing how they fit best.

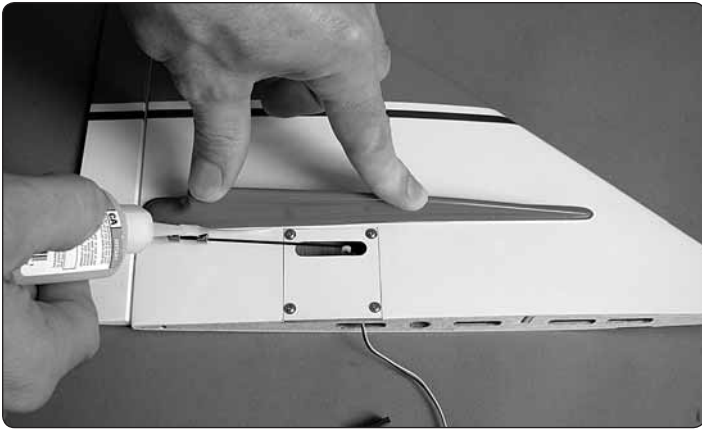
Let's do the right one first...



- ❑ 3. Position the **right** skid on the bottom of the **right** wing with the aft edge of the skid approximately 1/16" [1.5mm] ahead of the wing trailing edge and the inner edge of the skid approximately 1/16" [1.5mm] away from the edge of the hatch. Holding the skid in position, use a fine-point felt-tip pen to mark the outline of the skid onto the wing.



- ❑ 4. Use a small pin to poke pin holes through the covering all the way the inside edge of the line.



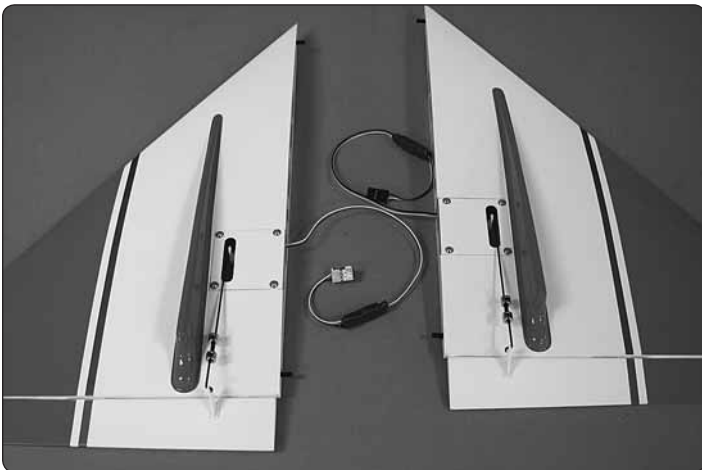
❑ 5. Use a piece of paper towel dampened with denatured alcohol to wipe off the ink lines. Position the skid aligned over the pin holes so none of them are visible. Then permanently glue the skid to the wing with thin CA.

❑ 6. Fit, then glue on the other wing skid the same way.

Finish the Wings

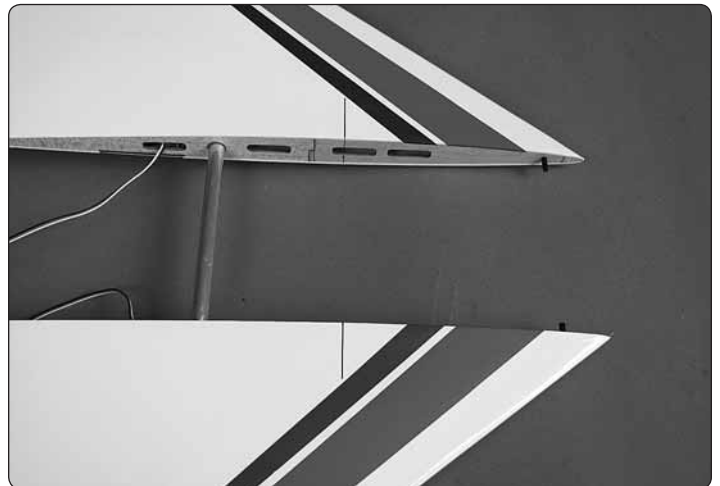
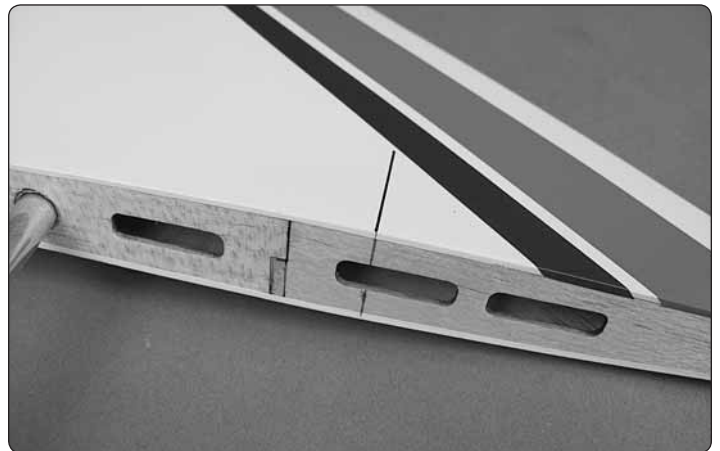
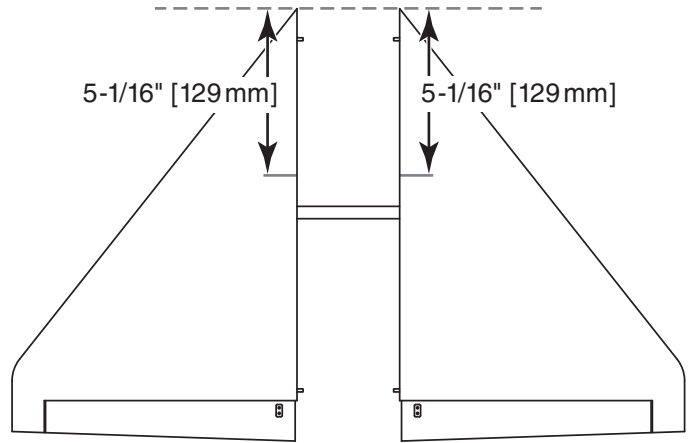


❑ 1. Fit, then use thin CA to glue the **alignment pegs** into the root of both wings near the leading and trailing edge.



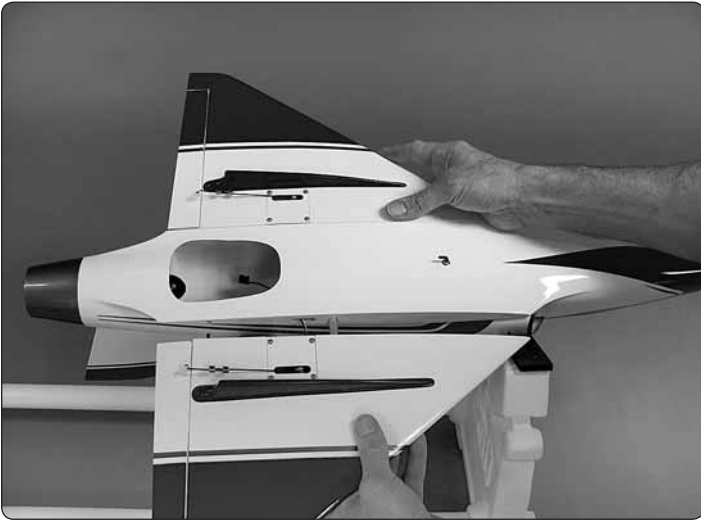
❑ 2. Connect a servo wire extension to each aileron servo wire coming out of the wing—just enough wire is needed so you can reach the plugs through the canopy hatch for plugging into your receiver—a total of 10" to 12" [255mm—300mm] of wire

is recommended with 10" [255mm] being the minimum, so use whatever length extensions you need. For each Futaba S3157 servo, a Futaba 75mm J-Series extension was used (FUTM3909). Use tape or heat-shrink tubing to secure the connection between the extension and the servo wire.



❑ 3. **Accurately** measure and mark the starting, recommended C.G. location on the root rib of both wings 5-1/16" [129mm] back from the leading edge of each panel. Temporarily fit the wings together with the aluminum joiner tube, then use a felt-tip pen and a straightedge to extend the lines partway across the top of the wing as shown. (Don't worry, the ink will be wiped away later.)

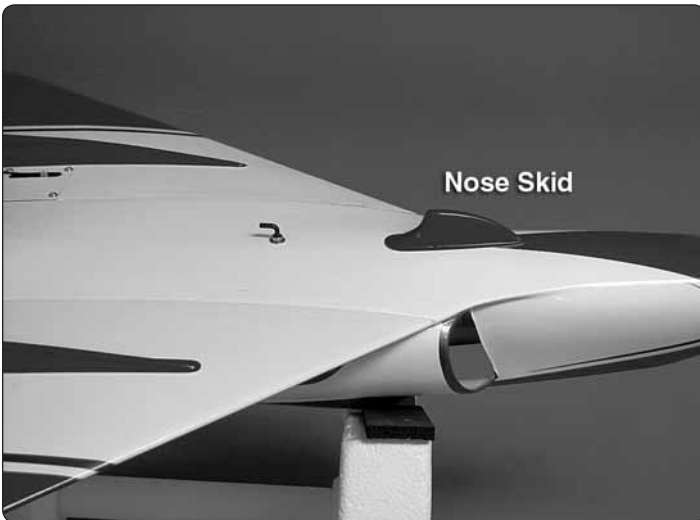
Mount the Wings to the Fuselage



- ❑ 1. Test-fit one, then the other wing to the fuselage with the aluminum wing joiner tube. Make any adjustments necessary for a good fit.

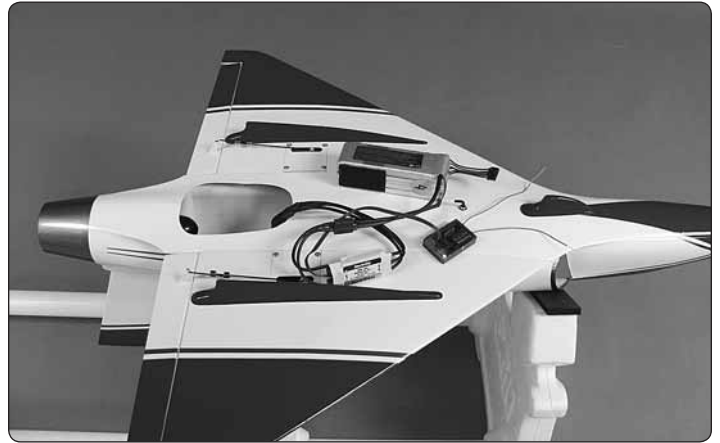
It is desirable **not** to have the wings permanently glued to the fuselage. If replacement or major repair is ever required, having the wings easily removable will be a relief if the time ever comes. RTV silicone is definitely suitable, but even though it can be relatively easily cut through, it is difficult to remove from the fiberglass fuselage. Zap Goo is another option because it bonds well, yet can be peeled off when required.

- ❑ 2. Attach the wings to the fuselage using whatever adhesive you prefer. Use masking tape to tightly hold the wings to the fuselage while the glue dries.

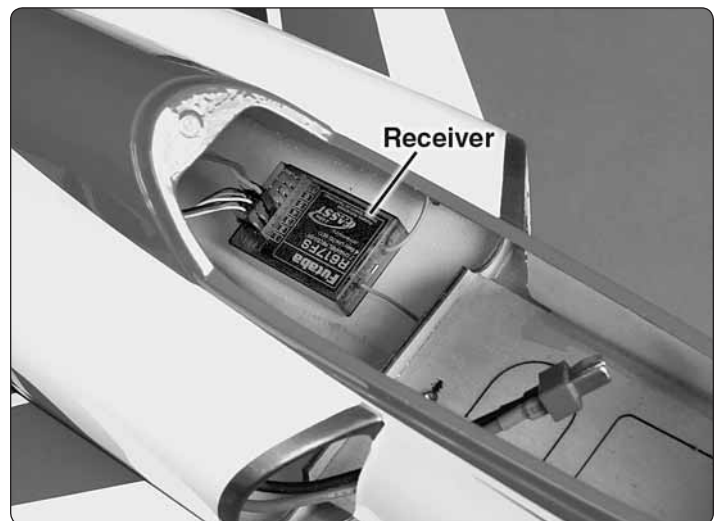
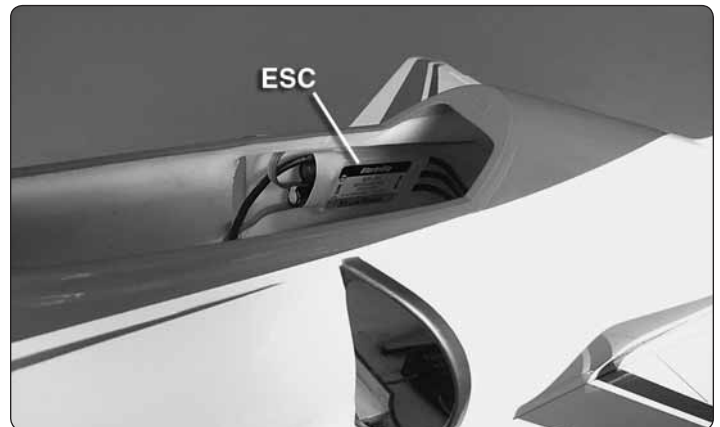


- ❑ 3. While the fuselage is upside-down, center the nose skid on the bottom of the fuselage and glue it into position with thin CA. The precise location isn't critical, but try to get the skid centered.

FINAL ASSEMBLY

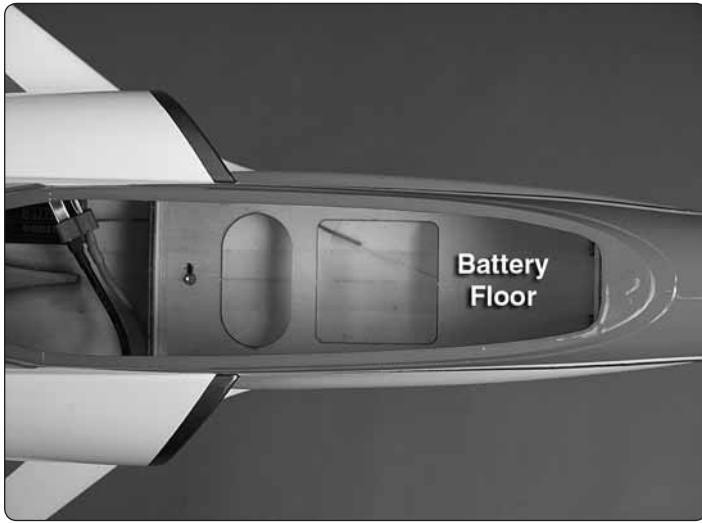


- ❑ 1. Connect the three motor wires to the ESC and temporarily power the system up just enough to see if the motor is turning in the correct direction. If the motor is not turning the correct direction switch any two of the motor wires with each other.

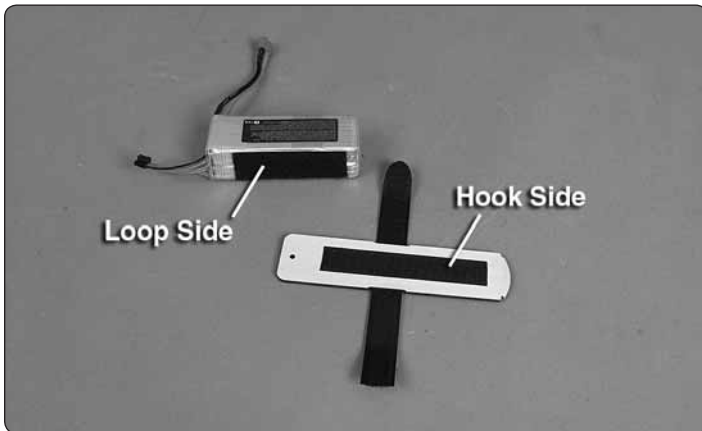


- ❑ 2. Disconnect the battery from the ESC. Determine where you will mount the ESC and receiver—the ESC can be mounted just aft of the opening in one of the intake ducts and the receiver can be attached to the bottom of the fuselage aft of the battery platform. Use a piece of paper towel dampened with denatured alcohol to clean the areas where you will mount the ESC and receiver, then mount each one with the included double-sided foam mounting tape.

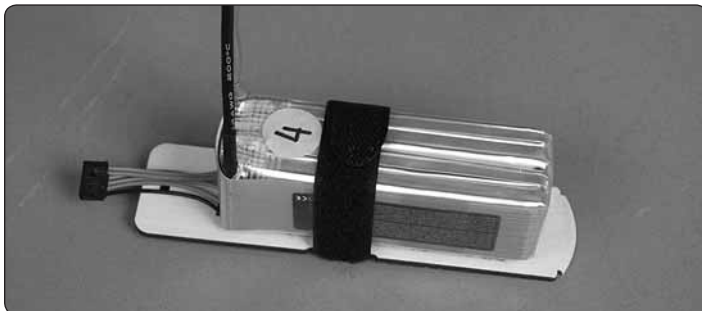
❑ 3. Use tape or the included plastic tube to position and mount the receiver antenna(s) inside the fuselage as recommended by the manufacturer. For the Futaba R617FS one of the antennas was guided forward under the battery floor and the other was taped to the inside of the fuselage running up the side and over the top.



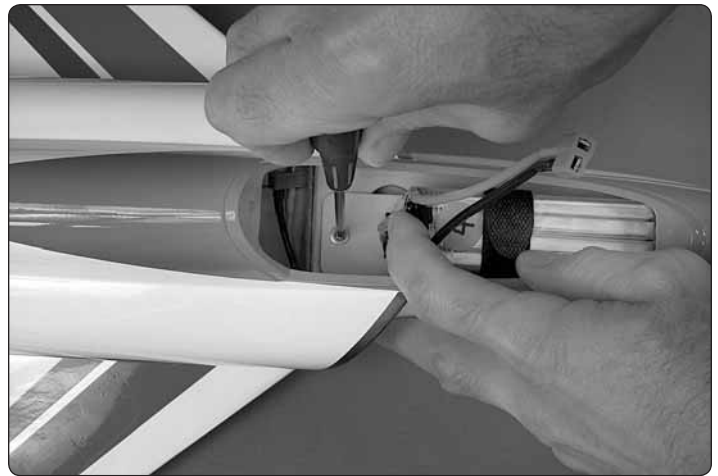
❑ 4. Cut the rest of the way through the holes in the battery floor and remove the plywood pieces.



❑ 5. Connect the Velcro battery straps to each other and glue them to the bottom of the plywood **battery mount plate**. Also apply the adhesive-back Velcro strips to the top of the battery mount plate and the bottom of your battery—the rougher, “hook” side goes on the mount plate and the softer, “loop” side goes on the battery.

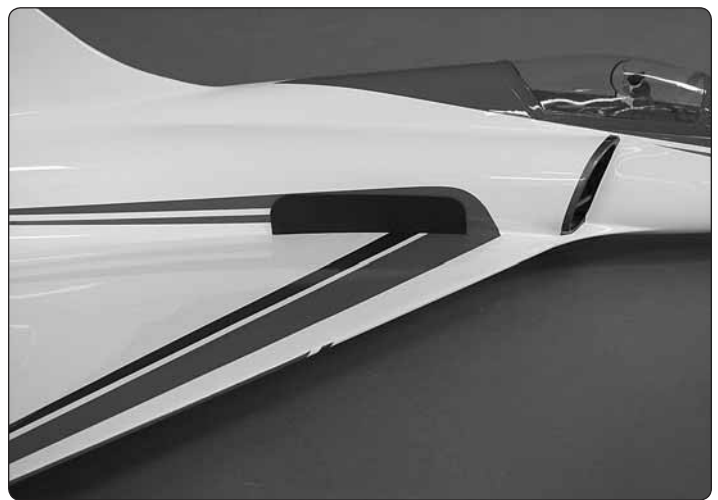


❑ 6. Mount the battery to the mount plate and strap it down with the strap.



❑ 7. Mount the battery and mount plate in the fuselage with the 3 x 10mm screw and washer. When mounting the battery “for real” later when you are ready to fly, you will be reminded to add a few drops of threadlocker to the threads of the screw.

Apply the Decals



❑ 1. Apply the optional **finger grips** to both sides of the fuselage if desired. They aren't necessary, but may help modelers who have problems with gripping the fuselage.

❑ 2. Use scissors or a sharp hobby knife to cut the decals from the sheet.

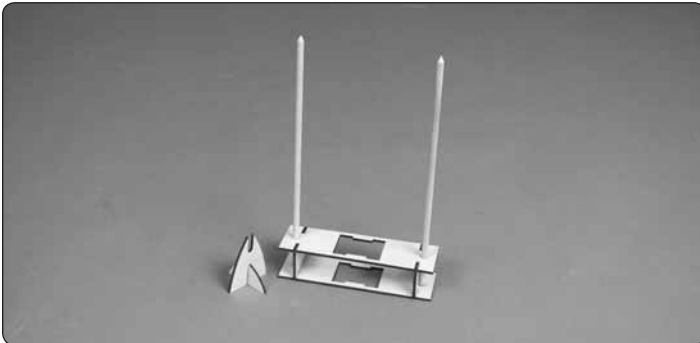
❑ 3. Be certain the model is clean and free from oily fingerprints and dust. Prepare a dishpan or small bucket with a mixture of liquid dish soap and warm water—about one teaspoon of soap per gallon of water. Submerge the decal in the soap and water and peel off the paper backing. **Note:** Even though the decals have a “sticky-back” and are not the water transfer type, submersing them in soap & water allows accurate positioning and reduces air bubbles underneath.

❑ 4. Position decals on the model where desired. Holding the decal down, use a paper towel to wipe most of the water away.

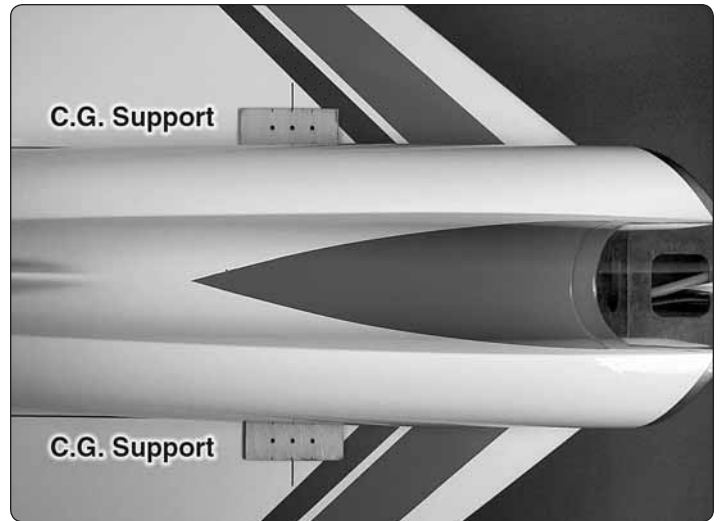
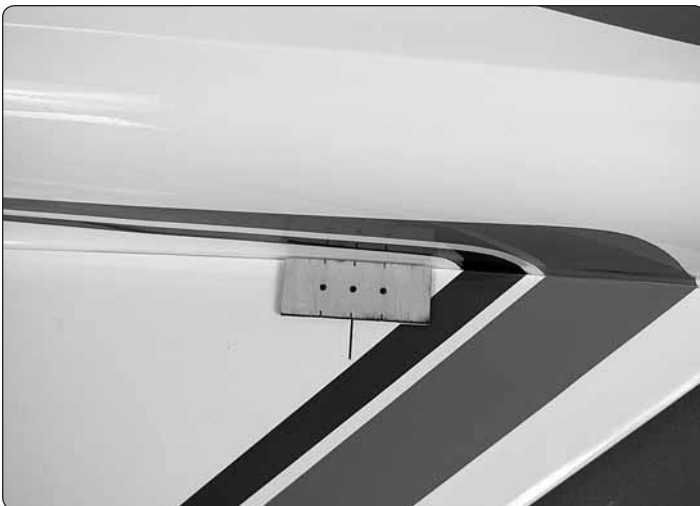
❑ 5. Use a piece of soft balsa or something similar to squeegee remaining water from under the decal. Apply the rest of the decals the same way.

GET THE MODEL READY TO FLY

IMPORTANT INFORMATION: The Phazer is slightly more sensitive to the C.G. location than other models, so be certain to check and set the C.G. according to the instructions in this manual. More than any other factor, the C.G. (center of gravity/balance point) can have the greatest effect on how a model flies and could determine whether or not your first flight will be successful. If you value your Phazer and wish to enjoy it for many flights, **DO NOT OVERLOOK THIS IMPORTANT PROCEDURE.** A model that is not properly balanced may be unstable and possibly unflyable.



❑ 1. Assemble and glue together the included balance stand and balance gauge.

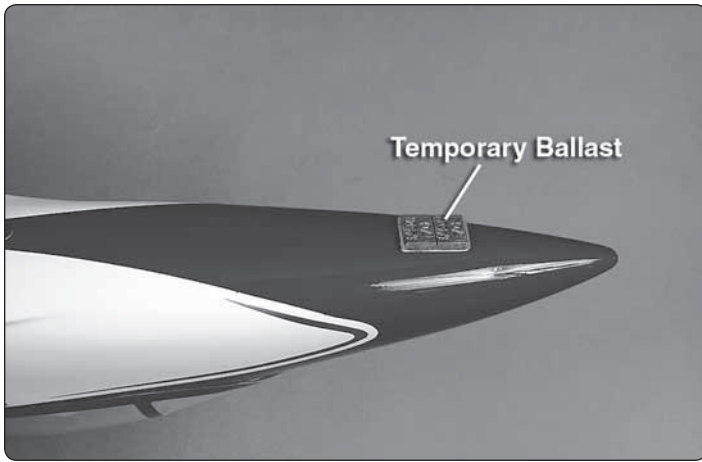


❑ 2. Use regular tape or double-sided tape to securely, but temporarily hold the plywood **C.G. supports** to the wing approximately 1/16" [1.5mm] from the fuselage.



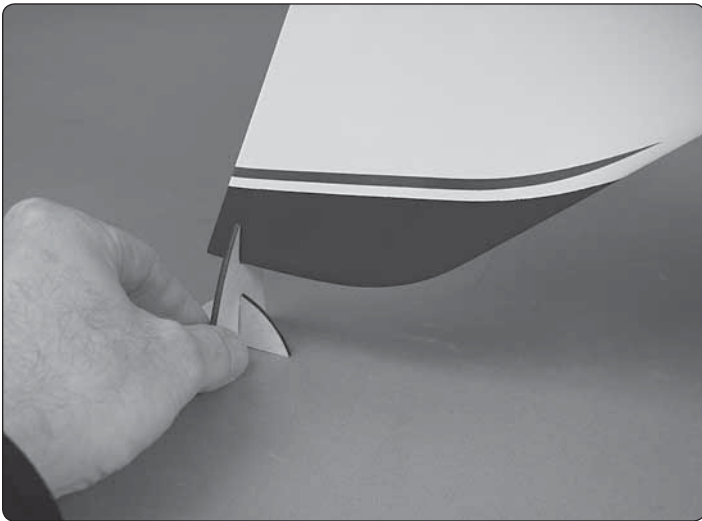
❑ 3. With the Phazer in ready-to-fly condition and the battery and all other components installed, key the pointed ends of the posts on the balance stand into the **middle holes** in the supports on the wing, then flip the assembly over placing the stand on its base to see where the model balances.

This is where the Phazer should balance for the first flights. Later, you may experiment by shifting the C.G. 5/16" [8mm] forward or 5/16" [8mm] back to change the flying characteristics. Moving the C.G. forward will improve stability, but will also decrease maneuverability. Moving the C.G. aft will allow the Phazer to fly slower, but it will then be less stable and bleed off even more speed in turns. In any case, **start at the recommended balance point** and do not at any time balance the model outside the specified range.



❑ 4. See where the Phazer balances supported at the middle holes in the support guides. Shift the battery forward or back as necessary and/or temporarily lay segments of lead ballast over the nose to get it to balance. Our prototypes required approximately .5 oz. in the nose to balance at the recommended location, or no ballast to balance slightly aft.

❑ 5. Once you find out how much (if any) ballast is required and/or where to position the battery on the mount plate, install the weight **inside** the fuselage.



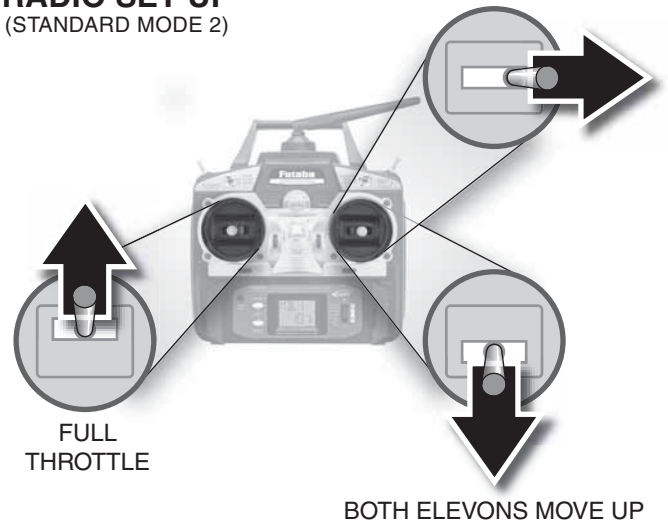
❑ 6. Double-check the C.G. with the gauge. Make any adjustments necessary by shifting the battery, then mark the final location of the battery onto the battery plate so you will always know where to position it.

Set the Control Throws

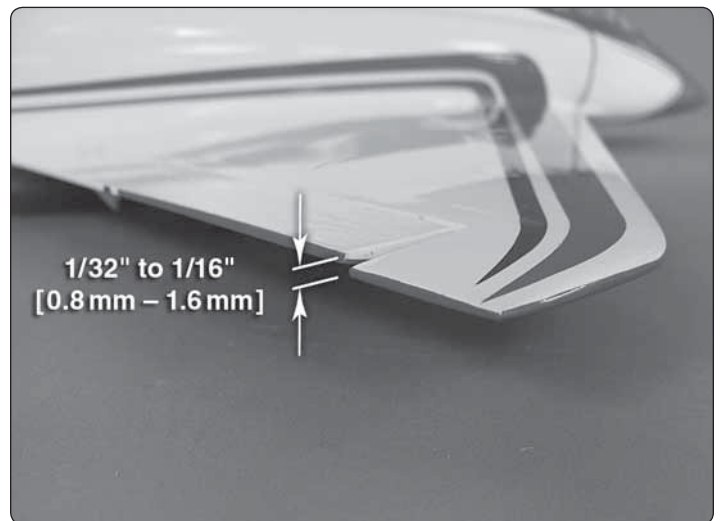
To ensure a successful first flight it is **important** that the Phazer is set up according to the control throws specified in this manual. The throws have been determined through actual flight testing and accurate record-keeping allowing the model to perform in the manner in which it was intended. If, after you have become accustomed to the way the Phazer flies, you would like to change the throws to suit your taste, that is fine. However, too much control throw could make the model too responsive and difficult to control, so remember, "more is not always better."

4-CHANNEL RADIO SET UP (STANDARD MODE 2)

RIGHT ELEVON MOVES UP
LEFT ELEVON MOVES DOWN

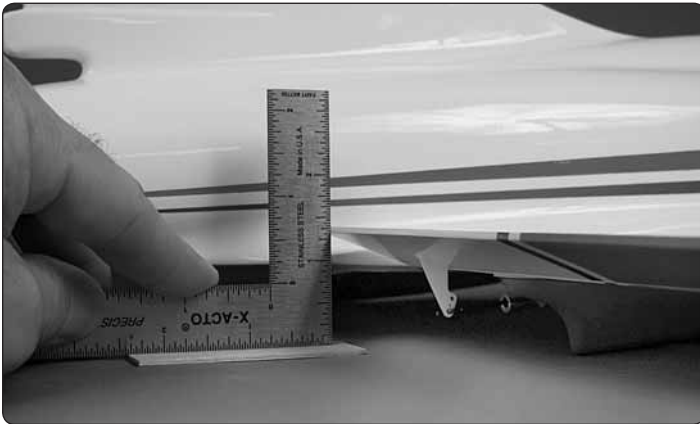
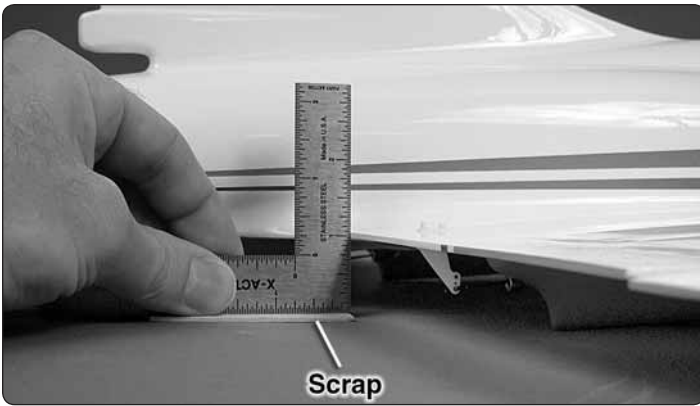


❑ 1. Turn on the transmitter and connect the motor battery. Double-check that the elevons respond in the correct direction according to your transmitter stick movements. Adjust the programming as necessary.



❑ 2. With the trims and sub trims in your transmitter centered, loosen the collars and adjust the pushrods so the elevons will have **1/32" to 1/16" [.8mm – 1.6mm] up trim** relative to the wing tip. This is the normally-trimmed condition which allows the Phazer to fly level.

❑ 3. One-at-a-time, remove the set screws in the collars, lightly wet the threads with threadlocker, then securely tighten the screws.



4. Now set the elevator and aileron throws according to the measurements below: (**Hint:** If necessary, use a scrap sheet of balsa or cardstock to shim up your ruler, making it easier to read the measurements.)

If your radio does not have dual rates, we recommend setting the throws at the high rate settings.

NOTE: The throws are measured at the **widest part** of the elevons (at the root end next to the fuselage).

These are the recommended control surface throws:				
	HIGH RATE		LOW RATE	
	Up	Down	Up	Down
ELEVATOR	3/8"	3/8"	3/16"	3/16"
	[10mm]	[10mm]	[5mm]	[5mm]
	17°	17°	9°	9°
AILERONS	3/16"	3/16"	1/8"	1/8"
	[5mm]	[5mm]	[3mm]	[3mm]
	9°	9°	6°	6°

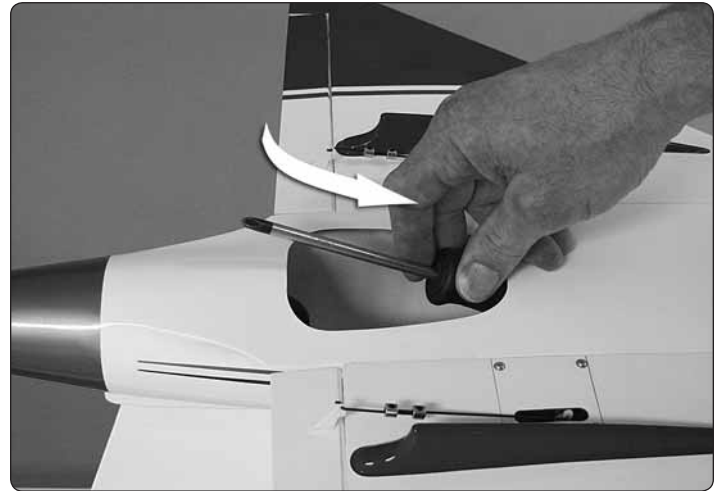
IMPORTANT!: When giving an elevator command from the control stick it is *imperative* that the deflection of both elevons is precisely identical to each other. Otherwise, the Phazer may yaw toward or away from the ground in banked turns, not to mention rolling out of loops. Spend time and use your critical eye to make sure both elevons deflect the same when an elevator input is given.

PREFLIGHT

Run-In the Fan

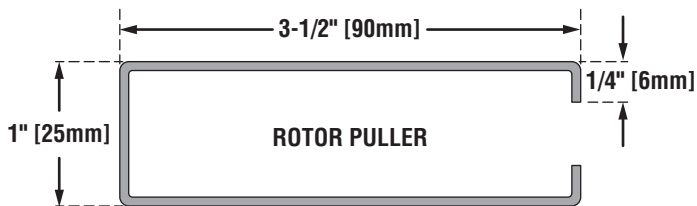
If possible perform this procedure outdoors. In any case, wear eye and hearing protection and request that any observers leave the room.

Follow the preparation and break-in procedures on the back page of the HyperFlow instruction manual for running-in your fan. Sometimes these HyperFlow fan units can emit a little resonance while transitioning through the rpm range, which is OK, but it must run smoothly at full-throttle. If the fan doesn't run smooth at full-throttle or if the resonance is more than you are willing to tolerate, follow the procedure to balance the fan:



1. Disconnect the battery from the ESC. Insert a #2 Phillips screwdriver into the cheater hole opening and into the fan cone. Hold the fan with one finger while turning the screwdriver to loosen the screw just enough to rotate the cone.

2. Using the dimple you made on the fan cone as an alignment cue, rotate the cone so the dimple aligns with the next fan blade over. Tighten the Phillips screw, connect the battery, then run up the fan again to see if it smooths out. Continue the procedure, rotating the cone one blade at a time until you can get it to run smoothly. If you cannot get the fan to run smoothly, proceed to the next step.



❑ 3. If you cannot get the fan unit to run smoothly by rotating the cone, perform the same procedure with the fan—use the dimple you marked on the brass rotor adapter to rotate and realign the fan “one hex at a time” until the unit runs smoothly. You should be able to pull the fan with your fingers, but if necessary you can make this “fan puller” from a piece of 1/16” [1.6mm] pushrod wire or music wire. You should be able to find an alignment combination of the fan and cone to get the unit to run smoothly.

❑ 4. When finished, be certain to securely tighten the Phillips screw with a drop of threadlocker.

Identify Your Model

No matter if you fly at an AMA sanctioned R/C club site or if you fly somewhere on your own, you should always have your name, address, telephone number and AMA number on or inside your model. It is **required** at all AMA R/C club flying sites and AMA sanctioned flying events. Fill out the identification tag on the decal sheet and place it on or inside your model.

Charge the Batteries

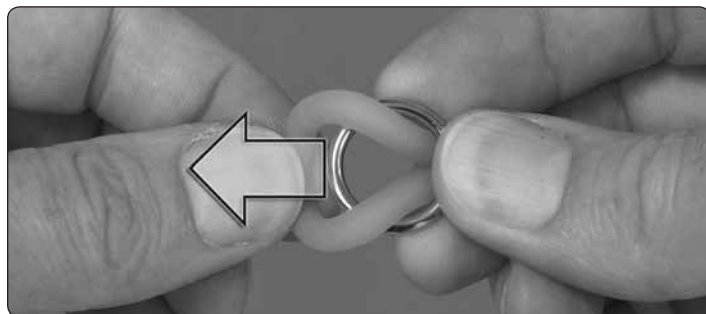
Follow the battery charging instructions that came with your radio control system to charge the batteries. You should always charge your transmitter and receiver batteries the night before you go flying, and at other times as recommended by the radio manufacturer.

CAUTION: Unless the instructions that came with your radio system state differently, the **initial** charge on **new** transmitter and receiver batteries should be done for 15 hours **using the slow-charger that came with the radio system**. This will “condition” the batteries so that the next charge may be done using the fast-charger of your choice. If the initial charge is done with a fast-charger the batteries may not reach their full capacity and you may be flying with batteries that are only partially charged.

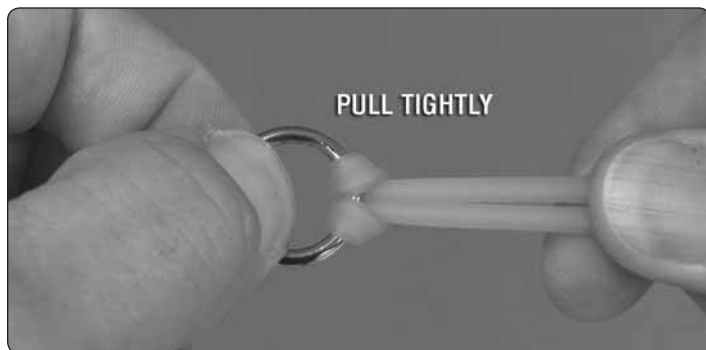
Assemble the Bungee Launch



❑ 1. Loop one end of the rubber tubing and insert it through one of the metal rings.

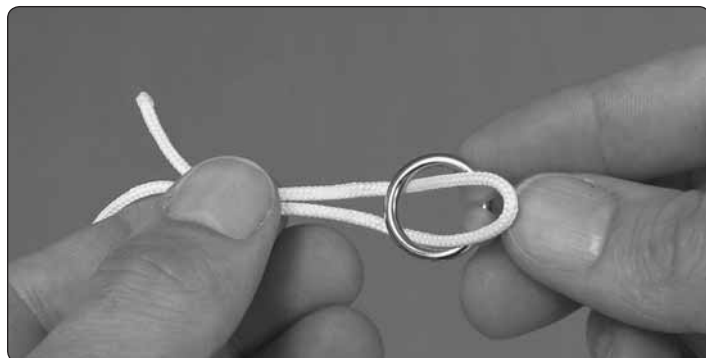


❑ 2. Bend the loop down around the ring. Then pull the ring the rest of the way through the loop.

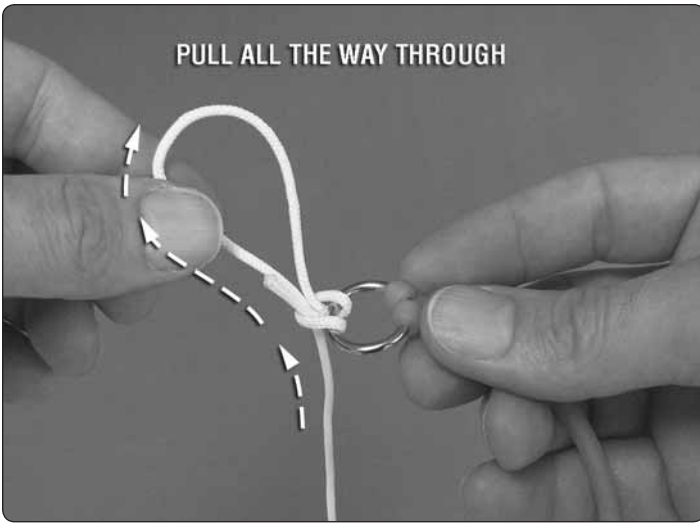


❑ 3. Pull the tubing to tighten the knot and make sure it is secure.

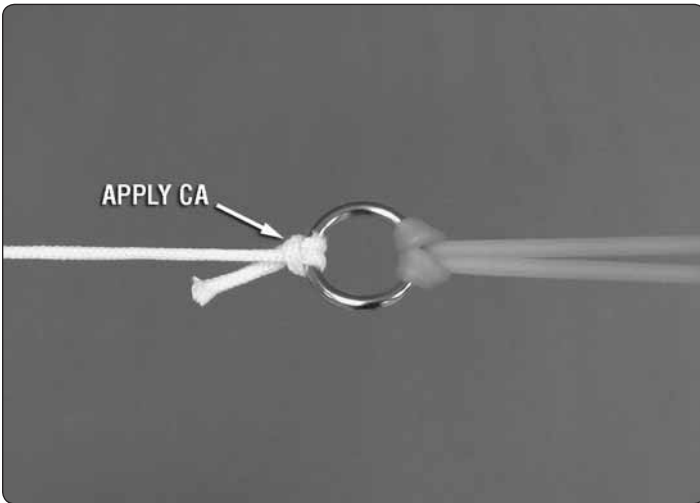
Now attach the cord...



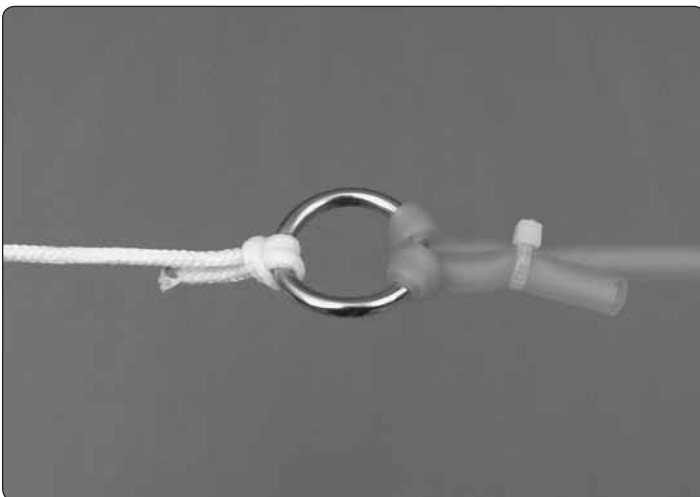
❑ 4. Loop one end of the cord through the ring.



- ❑ 5. Bring the loop in back over itself and the ring. You'll have to pull the rest of the cord up all the way through the loop before tightening it around the ring.



- ❑ 6. Pull tightly on the tubing and the cord to make sure it is secure. Add a drop of thin or medium CA to the knot in the cord over the ring.



- ❑ 7. Secure the end of the tubing to the ring with one of the included small nylon ties.

- ❑ 8. Attach the other end of the tubing to the stake and the other end of the cord to the other ring. Add another nylon tie to the end of the tubing at the stake as well.

- ❑ 9. Now the bungee is ready to use. Wind it back up onto the plywood holder.

AMA SAFETY CODE

Read and abide by the following excerpts from the Academy of Model Aeronautics Safety Code. For the complete Safety Code refer to *Model Aviation* magazine, the AMA web site or the Code that came with your AMA license.

General

- 1) I will not fly my model aircraft in sanctioned events, air shows, or model flying demonstrations until it has been proven to be airworthy by having been previously, successfully flight tested.
- 2) I will not fly my model aircraft higher than approximately 400 feet within 3 miles of an airport without notifying the airport operator. I will give right-of-way and avoid flying in the proximity of full-scale aircraft. Where necessary, an observer shall be utilized to supervise flying to avoid having models fly in the proximity of full-scale aircraft.
- 3) Where established, I will abide by the safety rules for the flying site I use, and I will not willfully and deliberately fly my models in a careless, reckless and/or dangerous manner.

- 5) I will not fly my model unless it is identified with my name and address or AMA number, on or in the model. Note: This does not apply to models while being flown indoors.

- 7) I will not operate models with pyrotechnics (any device that explodes, burns, or propels a projectile of any kind).

Radio Control

- 1) I will have completed a successful radio equipment ground check before the first flight of a new or repaired model.
- 2) I will not fly my model aircraft in the presence of spectators until I become a qualified flier, unless assisted by an experienced helper.
- 3) At all flying sites a straight or curved line(s) must be established in front of which all flying takes place with the other side for spectators. Only personnel involved with flying the aircraft are allowed at or in the front of the flight line. Intentional flying behind the flight line is prohibited.

- 4) I will operate my model using only radio control frequencies currently allowed by the Federal Communications Commission.

- 5) **I will not knowingly operate my model within three miles of any pre-existing flying site except in accordance with the frequency sharing agreement listed** [in the complete AMA Safety Code].

9) Under no circumstances may a pilot or other person touch a powered model in flight; **nor should any part of the model other than the landing gear, intentionally touch the ground, except while landing.**

CHECK LIST

During the last few moments of preparation your mind may be elsewhere anticipating the excitement of the first flight, causing you to overlook certain checks and procedures. Follow the check below to avoid this.

- 1. Confirm that all controls operate in the correct direction.
- 2. Make certain you've set the **C.G.** and the **control throws** according to the measurements provided in the manual.
- 3. Make sure the servo arms are secured with the screws that came with them and make sure the set screws in the collars on the pushrods are tightened with threadlocker.
- 4. Make sure the elevon horns are secure and glued.
- 5. Make sure the receiver antenna(s) are mounted per the manufacturer's instructions.
- 6. Tug on the elevons to make sure all the hinges are **securely** glued in place.
- 7. Place your name, address, AMA number and telephone number on or inside your model.
- 8. Range check your radio when you get to the flying field.

FLYING

The Phazer is a great-flying model that flies smoothly and predictably, but it possesses no self-correcting tendencies what-so-ever and therefore, must be flown only by reasonably-experienced pilots who are able to decisively provide the correct control inputs.

Ground Check and Range Check

Perform an operational ground check of your radio following the manufacturer's instructions that came with your radio.

Set a Flight Timer

Prevent over discharging your LiPos and/or dead-stick landings by using the timer in your transmitter (or a separate timer if your transmitter doesn't have one) to signal when it's time to land. If your transmitter has a timer built in, link the timer to the throttle stick so it starts and stops when the stick is raised to about 10% – that way you'll be counting actual motor run time, not total air time.

Until you have the data to make your own calculations, set your timer to a conservative 3-minutes so you won't go over.

Here's how to calculate your own flight times:

You need to know three things:

- A. The target capacity you want to use from your battery for a flight.
- B. How long you flew.
- C. How much capacity was used from the battery for that flight.

To prevent over discharging your battery you should use no more than 80% of your battery's capacity. If using the recommended 2200mAh battery that would be 1760mAh (2200mAh x .8).

Say for example, you flew for three minutes and it took 1275mAh to recharge your battery. Since your limit is 1760mAh you still had 485mAh to go, so lengthen your flight time accordingly. You could also calculate that the consumption rate for that flight was 425mAh per minute (1275mAh divided by 3 minutes). Dividing your target capacity of 1760mAh/minute by 425mAh/minute gives you a flight time of 4.1 minutes (4 min. 6 seconds—virtually 4 minutes.)

Do this for several trials (or for every flight!) to calculate accurate values for how long you can fly!

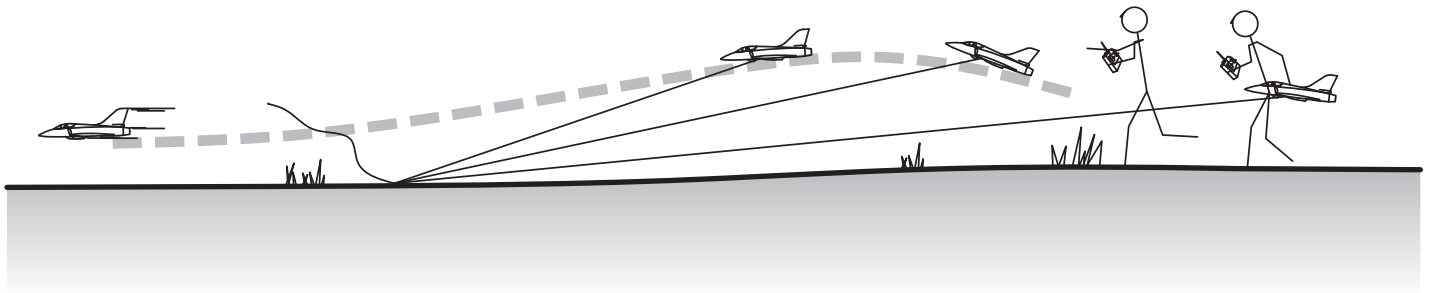
Launching

Don't forget to install the 3mm battery plate screw with threadlocker. This needs to be done only once every dozen or so flights as residual threadlocker sufficiently holds the screw in place.

The Phazer may be hand-launched or bungee-launched by an assistant or by the pilot. If you're at all hesitant, the easiest and surest way to get your Phazer airborne is to have an assistant bungee launch it for you—at least for the maiden flight. After that you can bungee-launch it yourself every time. Experienced pilots who don't feel like setting up the bungee can definitely hand-launch the Phazer themselves, or have an assistant hand-launch it for them. The bungee might be a bit of a hassle to unwind, lay out and put away, but it's a *no-brainer* and **guaranteed** to get your Phazer in the air.

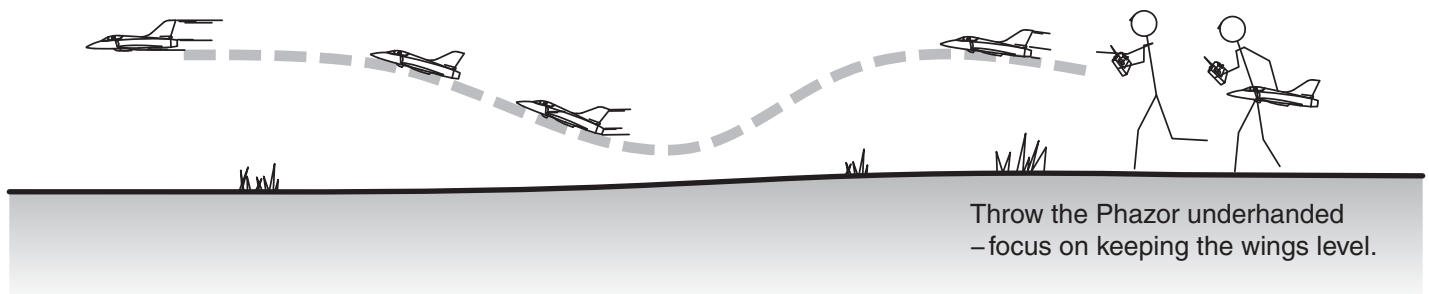
To bungee-launch the Phazer, be sure the ground will hold the stake securely, then push it all the way in at about a 45 degree angle away from the launch spot. Unwind the bungee, laying it out so the launch will be into the wind. As the bungee unwinds, always inspect the tubing and cord to make sure there are no cuts, cracks, tears or any other defects. Also make sure the line and cord are **securely** connected to the rings and stake.

After you have the bungee laid out, but before stretching it out, turn on your transmitter and connect the battery. As you should always do before every flight, **double-check that the controls are responding properly and in the correct direction**, then arm the motor and run it up for a second to make sure it is making full power.



Stretch out the bungee, walking fifteen to twenty steps away downward, from the stake. Then connect it to the hook on the bottom of the plane. If using an assistant, inform him of your intentions and make sure he acknowledges, then go to full throttle. Holding the Phazer at an approximately 30 degree angle, wings level, **give it a good push into the air** and let go. The Phazer should lunge forward. Then it may descend slightly before it gets up to flying speed—this will all happen in about a second, so you need to get your fingers back on the sticks right away! Fly the Phazer out of the launch and the bungee will automatically release.

After you get a few bungee launches under your belt the only hard part will be remembering to wind it back up and bring it back home with you!



Throw the Phazor underhanded
– focus on keeping the wings level.

With hand-launching, the main hurdle to overcome will be flying speed—the bungee gets the Phazer up to speed right away, but the Phazer has to fly away from a hand-launch and build speed on its own.

Whether the pilot or an assistant, hold the Phazer over the top of the fuselage so it can be thrown in an underhand fashion. Though it is important to throw the Phazer hard, concentrate more on throwing it with the wings level and the nose pointed up at about a 20 – 30-degree angle. When ready, go to full-throttle, then throw the Phazer into the air. Remember to focus on keeping the wings level. Initially, the Phazer will have little flying speed, so the pilot won't have much control (emphasizing the importance of a good launch). The Phazer will gradually build up enough speed and fly away, but as long as the wings are level the worst thing that will happen is it will simply land! If the launch was poor and the wings are not level you have to hope it can gain enough airspeed to fly out of it. Otherwise your Phazer may go in with the wings banked, possibly causing damage.

Factors that help the hand-launch are launching on high rates, having the C.G. anywhere between the recommended location and the aft location, and launching into a headwind. Same as with the bungee-launch, it's best to have an assistant hand-launch the Phazer the first time so you will know what to expect when you're ready to try it yourself.

Bungee launches are consistent because most of the human factor has been taken out. But human error can cause the hand-launch to go wrong, so make sure you (or your assistant) know what they're doing before trying a hand-launch.

With a good launch the Phazer will eventually gain speed and easily fly away. Then you'll wonder what all the fuss was about!

Flying

Simply stated, the Phazer is a “hoot” to fly! It sounds pretty cool, looks *quirky* and *cute* in the air and is actually quite docile even though it’s pretty fast. But delta-wing airframes do have a few peculiarities that you should anticipate. The Phazer is unusually stable and will not stall and spin from turning too sharply, but it does bleed off speed in tight turns—if you turn **too** tightly for **too** long it will bleed off enough airspeed to lose significant altitude or the nose may rotate downward, so just fly it “large” for the first minute until you get used to it. And same as any jet, more time and distance are required to get the Phazer back up to speed after throttling up, so you have to fly “ahead” of it some.

Those two concepts in mind, once airborne the primary objective will be to get the Phazer trimmed for straight-and-level flight. It’s not so fast that you won’t be able to fly it full throttle, but fly it around at whatever speed you are comfortable with while you are getting it trimmed. Also test how the Phazer responds on high and low rates (but you’ll probably end up flying it on high rates most of the time). Try some rolls, loops and inverted flight. If you find the nose of the Phazer yawing downward in turns, the C.G. may be too far forward. Try moving the C.G. aft.

Landing

While at altitude and still with plenty of battery power, simulate a few landing approaches by cutting the throttle and watching how the Phazer glides. Then throttle up, go around and try it again. You might notice that the Phazer bleeds off speed a little faster than you expected. Knowing this you can make

your approaches a little shorter, or simply “drag” it in with some throttle. If you end up coming in hot simply throttle up, fly by and go around again. When the Phazer does touch down it safely glides along the grass before coming to a quick stop.

After every landing inspect the intake, fan and exhaust tube and remove any grass or debris—and don’t forget to note how long you flew on that battery so you can start calculating your own flight times!

One final note about flying your Phazer. Have a goal or flight plan in mind for **every** flight. This can be learning a new maneuver(s), improving a maneuver(s) you already know, or learning how the model behaves in certain conditions (such as on high or low rates). This is not necessarily to improve your skills (*though it is never a bad idea!*), but more importantly so you do not surprise yourself by impulsively attempting a maneuver and suddenly finding that you’ve run out of time, altitude or airspeed. Every maneuver should be deliberate, not impulsive. For example, if you’re going to do a loop, check your altitude, mind the wind direction (anticipating rudder corrections that will be required to maintain heading), remember to throttle back at the top, and make certain you are on the desired rates (high/low rates). A flight plan greatly reduces the chances of crashing your model just because of poor planning and impulsive moves. **Remember to think.**

Have a ball! But always stay in control and fly in a safe manner.

GOOD LUCK AND GREAT FLYING!

This model belongs to:					
	Name				
	Address				
	City, State, Zip				
	Phone Number				
	AMA Number				

Aileron Horn Template

