TWINSTAR EP ARF

ARF
ALMOST READY-TO-FLY

INSTRUCTION MANUAL

SPECIFICATIONS

Wingspan:	47.5 in [1205 mm]	**Weight:**	4-4.25 lb [1810-1930 g]	**Radio:**	4-channel minimum with 4 servos and standard size receiver
Length:	42.5 in [1080 mm]				
Wing Area:	392 in^2 [25.3 dm^2]	**Wing Loading:**	24-25 oz/ft^2 [73-76 g/dm^2]	**Motor:**	RimFire .10 (35-30-1250) x 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.

GREAT PLANES® MODEL MANUFACTURING COMPANY

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

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INTRODUCTION

Congratulations on your purchase of the Twinstar EP! Now you can experience dual motor flight in a smaller package. It's perfect for practicing up for scale twin engine models or just to have some fun throwing it around in the air. The Twinstar EP is plenty thrusty and capable of aerobatics and is also extremely easy to fly. This would be a good 2nd or 3rd plane after a trainer has been mastered and you have some low wing experience. Best of all, this model can be tossed in the backseat of a car fully assembled to get a quick flight over lunch.

For the latest technical updates or manual corrections to the Great Planes Twinstar EP visit the Great Planes web site at www.greatplanes.com.

Open the “Airplanes” link, then select the Twinstar EP. 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.

AMA

We urge you to join the AMA (Academy of Model Aeronautics) and a local R/C club. The AMA is the governing body of model aviation and membership is required to fly at AMA clubs. Though joining the AMA provides many benefits, one of the primary reasons to join is liability protection. Coverage is not limited to flying at contests or on the club field. It even applies to flying at public demonstrations and air shows. Failure to comply with the Safety Code (excerpts printed in the back of the manual) may endanger insurance coverage. Additionally, training programs and instructors are available at AMA club sites to help you get started the right way. There are over 2,500 AMA chartered clubs across the country. Contact the AMA at the address or toll-free phone number below.

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. Always disconnect the power on the model before switching off the transmitter. Without a signal to the receiver, the ESC may command the motor to rotate which could cause injury to yourself or surrounding property. Always turn the transmitter on before plugging the flight battery into the ESC.

2. Your Twinstar EP 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 Twinstar EP, if not assembled and operated correctly, could possibly cause injury to yourself or spectators and damage to property.

3. 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.

4. You must take time to **build straight, true** and **strong**.

5. You must use an R/C radio system that is in first-class condition, and a correctly sized motor and components (battery, servos, etc.) throughout the building process.

6. You must correctly install all R/C and other components so that the model operates correctly on the ground and in the air.

7. You must check the operation of the model before **every** flight to ensure that all equipment is operating and that the model has remained structurally sound. Be sure to check clevises or other connectors often and replace them if they show any signs of wear or fatigue.

8. 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.

9. While this kit has been flight tested to exceed normal use, if the plane will be used for extremely high stress flying, or if a motor 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.

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

This is a partial list of items required to finish the Twinstar EP that may require planning or decision making before starting to build. Order numbers are provided in parentheses.

Radio Equipment

The Twinstar EP requires a minimum 4-channel radio system with four 39 oz.-in. [2.8 kg-cm] minimum torque micro sized servos.

Because the motors are mounted on the wings, rudder authority is important. We recommend the Futaba S3150 mini servo as an optional higher torque servo for the rudder and it is shown in the building section of this manual.

In addition, two 12" [305mm] servo extensions are required for the aileron servos. Two Y-harnesses will also be required for the ailerons and the ESCs.

Recommended part numbers for the radio components are provided below:

- ❍ Futaba S3115 Micro Precision Servo (FUTM0415)
- ❍ Futaba S3150 Slim Digital Servo (FUTM0303)
- ❍ Hobbico 12" Extension Futaba J (HCAM2100)
- ❍ Futaba Dual Servo Extension 6" J (FUTM4130)

Brushless Motor Recommendations

We recommend two RimFire .10 brushless motors and two 25A ESCs. Other motors may work fine. However, the motor mount holes are spaced for the RimFire .10 and this motor has been extensively flight tested and performs well in the Twinstar EP. Two 8x8E electric propellers are recommended with the RimFire .10. Many batteries will work as a flight battery. We suggest the 11.1V 3800mAh FP30 FlightPower pack. Part numbers are provided below:

- ❍ Great Planes RimFire .10 35-30-1250 Outrunner Brushless (GPMG4595)
- ❍ Great Planes Silver Series 25A Brushless ESC 5V/2A BEC (GPMM1820)
- ❍ APC 8x8 Thin Electric Propeller (APCQ4116)
- ❍ FlightPower LiPo FP30 3S 11.1V 3800mAh 30C (FPWP3383)

If you need a charger for your flight battery, we suggest either the Triton EQ or Triton 2 EQ. Both are very versatile chargers that can charge virtually any hobby battery currently available.

- ❍ Great Planes ElectriFly Triton EQ AC/DC Charger (GPMM3155)
- ❍ Great Planes ElectriFly Triton2 EQ AC/DC Charger (GPMM3156)

ADDITIONAL ITEMS REQUIRED

Adhesives and Building Supplies

This is the list of Adhesives and Building Supplies that are required to finish the Twinstar EP:

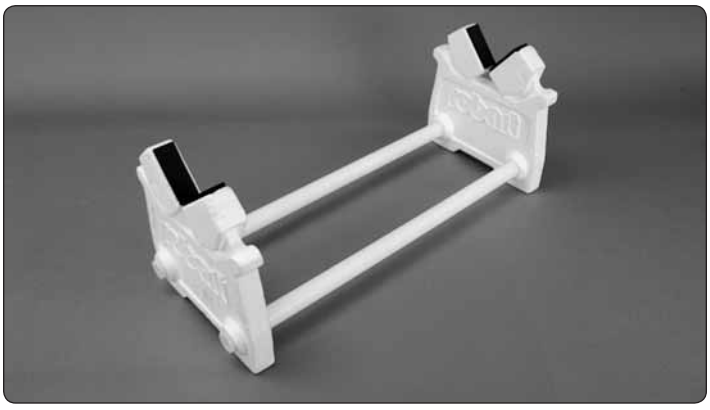
- ❍ 1/2 oz. [15g] Thin Pro CA (GPMR6001)
- ❍ Pro 6-minute or 30-minute epoxy (GPMR6045 or GPMR6047)
- ❍ Threadlocker thread locking cement (GPMR6060)
- ❍ Denatured alcohol (for epoxy clean up)
- ❍ Drill bits: 1/16" [1.6mm], 5/64" [2mm]
- ❍ Rotary tool with cutting bit
- ❍ Revell Premium Soft Handle Knife w/Blades (5) (RMXR6900)
- ❍ Top Flite MonoKote sealing iron (TOPR2100)
- ❍ Top Flite Hot Sock iron cover (TOPR2175)
- ❍ Panel Line Pen (TOPQ2510)
- ❍ Small clamps
- ❍ Masking tape
- ❍ Household oil

Optional Supplies and Tools

Here is a list of optional tools that will help you build the Twinstar EP:

- ❍ 1/2 oz. [15g] Thick Pro CA- (GPMR6013)
- ❍ 1/2 oz. [15g] Medium Pro CA+ (GPMR6007)
- ❍ 2 oz. [57g] spray CA activator (GPMR6035)
- ❍ 4 oz. [113g] aerosol CA activator (GPMR6034)
- ❍ CA applicator tips (HCAR3780)
- ❍ CA debonder (GPMR6039)
- ❍ Epoxy brushes 6, (GPMR8060)
- ❍ Mixing sticks (GPMR8055)
- ❍ Mixing cups (GPMR8056)
- ❍ Pliers with wire cutter (HCAR0630)
- ❍ T.A. Emerald Performance Duster Compressed Air (TAEC1060)
- ❍ Servo horn drill (HCAR0698)
- ❍ Hobby Heat micro torch II (HCAR0755)
- ❍ Dead Center™ Engine Mount Hole Locator (GPMR8130)
- ❍ DuraTrax Ultimate Body Reamer (DTXR1157)
- ❍ Precision Magnetic Prop Balancer (TOPQ5700)
- ❍ AccuThrow Deflection Gauge (GPMR2405)
- ❍ CG Machine™ (GPMR2400)
- ❍ Hobbico Flexible 18" Ruler Stainless Steel (HCAR0460)
- ❍ Top Flite MonoKote trim seal iron (TOPR2200)
- ❍ Top Flite MonoKote heat gun (TOPR2000)
- ❍ Hobbico Pin Vise 1/16 Collet w/6 Bits (HCAR0696)
- ❍ Hobbico 8-Piece Ball Tip Hex L Wrench SAE (HCAR0520)
- ❍ Hobbico 7-Piece Ball Tip Hex L Wrench Metric (HCAR0521)
- ❍ Great Planes Clevis Installation Tool (GPMR8030)
- ❍ Great Planes Precision Prop Reamer Standard (GPMQ5006)

Building Stand



A building stand or cradle comes in handy during the build. We use the Robart Super Stand II (ROBP1402) for all our projects in R&D, and it can be seen in pictures in this manual.

IMPORTANT BUILDING NOTES

- When you see the term ***test fit*** in the instructions, it means that you should first position the part on the assembly **without using any glue**, then slightly modify or *custom fit* the part as necessary for the best fit.
- Whenever the term ***glue*** is written you should rely upon your experience to decide what type of glue to use. When a specific type of adhesive works best for that step, the instructions will make a recommendation.
- Whenever just ***epoxy*** is specified you may use ***either*** 30-minute epoxy ***or*** 6-minute epoxy. When 30-minute epoxy is specified it is **highly** recommended that you use only 30-minute epoxy, because you will need the working time and/or the additional strength.
- **Photos** and **sketches** are placed **before** the step they refer to. Frequently you can study photos in following steps to get another view of the same parts.
- The stabilizer and wing incidences and motor thrust angles have been factory-built into this model.
- The Twinstar EP is factory-covered with Top Flite MonoKote film. Should repairs ever be required, MonoKote can be patched with additional MonoKote purchased separately.

Following are the colors used on this model and order numbers for six foot rolls.

Royal Blue	TOPQ0221	Black	TOPQ0208
Jet White	TOPQ0204	Missile Red	TOPQ0201

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.

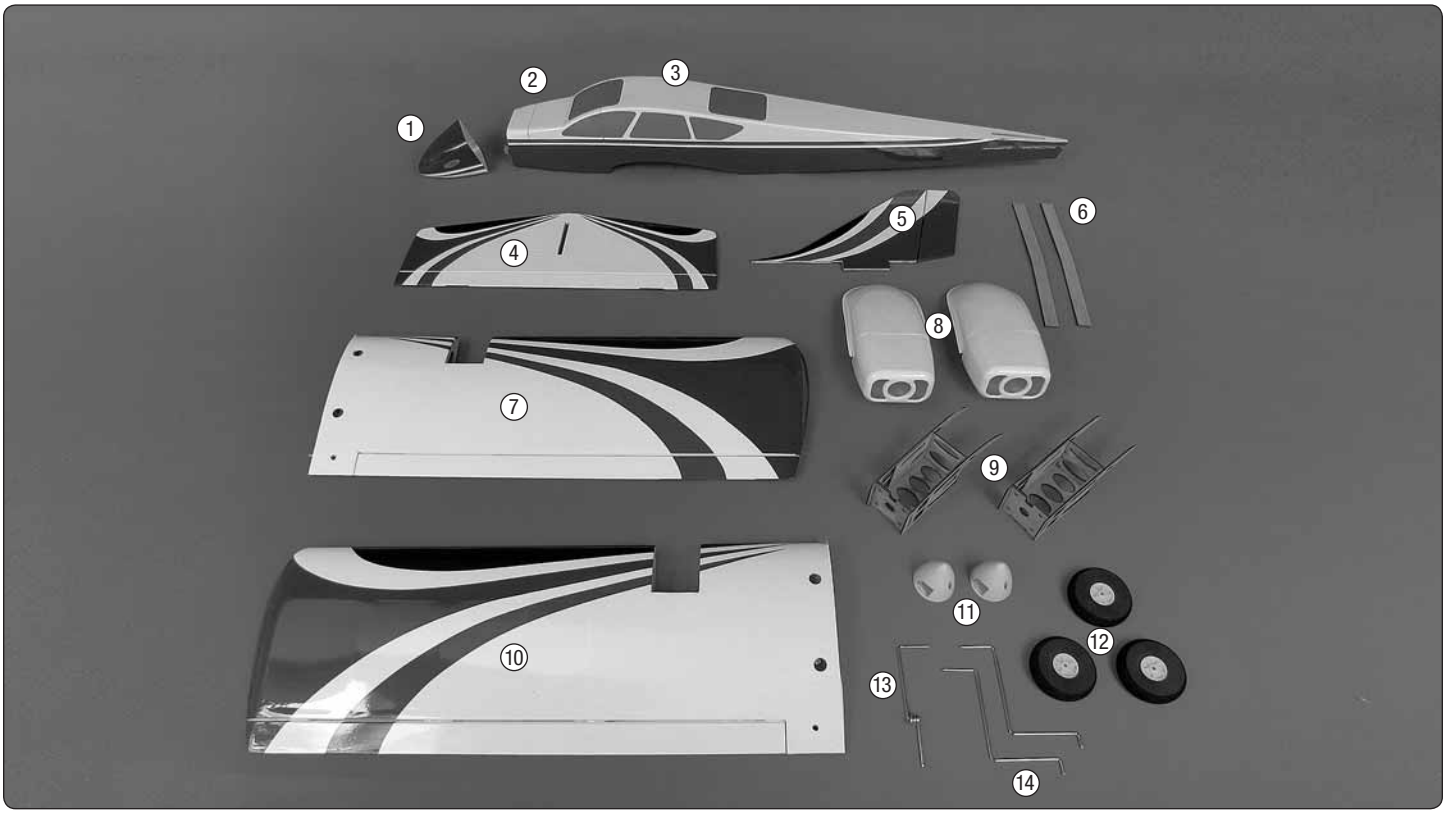
Great Planes Product Support
3002 N Apollo Drive, Suite 1 Ph: (217) 398-8970, ext. 5
Champaign, IL 61822 Fax: (217) 398-7721

E-mail: **airsupport@greatplanes.com**

ORDERING REPLACEMENT PARTS

Replacement parts for the Great Planes Twinstar EP 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.

KIT CONTENTS



Kit Contents

1 Nose Cone
2 Battery Hatch
3 Fuselage
4 Horizontal Stabilizer and Elevator
5 Vertical Fin and Rudder
6 Wing Joiner
7 Right Wing Panel with Aileron
8 Nacelle Covers
9 Nacelle Frames
10 Left Wing Panel with Aileron
11 Nylon Spinner
12 Wheels
13 Nose Gear
14 Main Gear

To locate a hobby dealer, visit the Hobbico web site at www.hobbico.com. Choose "Where to Buy" at the bottom of the menu on the left side of the page. Follow the instructions provided on the page 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 and payments by personal check to:
Hobby Services
3002 N Apollo Drive, Suite 1
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.

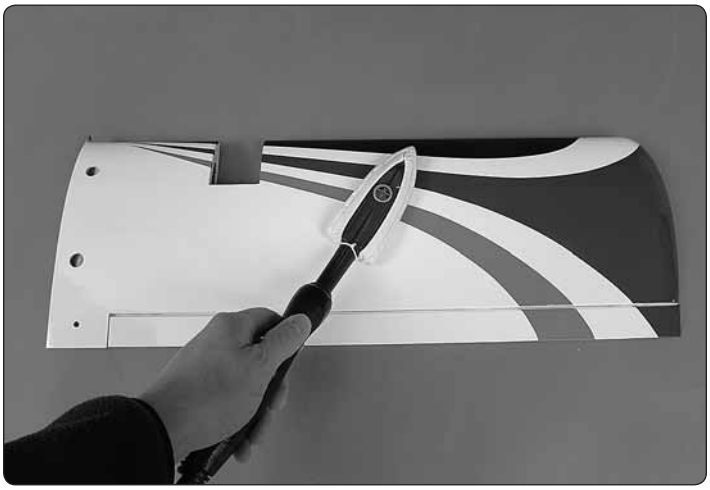
If additional assistance is required for any reason contact Product Support by e-mail at productsupport@greatplanes.com, or by telephone at (217) 398-8970.

REPLACEMENT PARTS LIST

Order No.	Description
GPMA4390	WING SET TWINSTAR EP ARF
GPMA4391	FUSELAGE TWINSTAR EP ARF
GPMA4392	TAIL SET TWINSTAR EP ARF
GPMA4393	SPINNER TWINSTAR EP ARF
GPMA4394	NACELLE FRAME L/R TWINSTAR EP
GPMA4395	NACELLE COVER (2) TWINSTAR EP
GPMA4396	LANDING GEAR TWINSTAR EP ARF
GPMA4397	NOSE CONE TWINSTAR EP ARF
GPMA4398	DECAL SET TWINSTAR ARF
GPMA4399	BATTERY HATCH TWINSTAR EP ARF
GPMA4400	ESC Y-HARNESS TWINSTAR EP ARF

PREPARATIONS

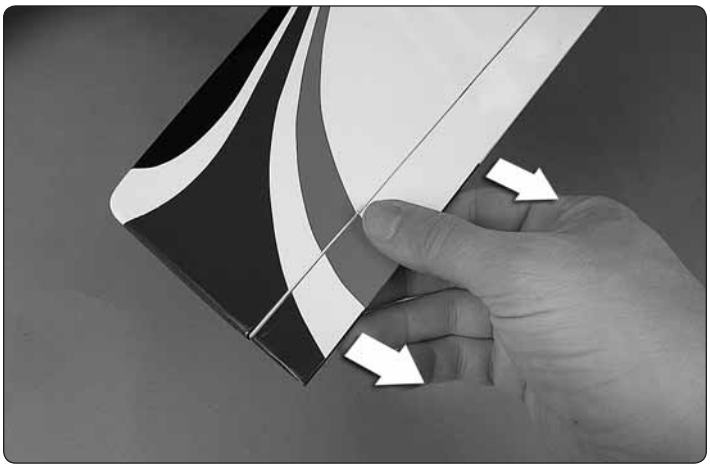
❏ 1. If you have not done so already, remove the major parts of the kit from the box and inspect for damage. If any parts are damaged or missing, contact Product Support at the address or telephone number listed in the “Kit Inspection” section on page 4.



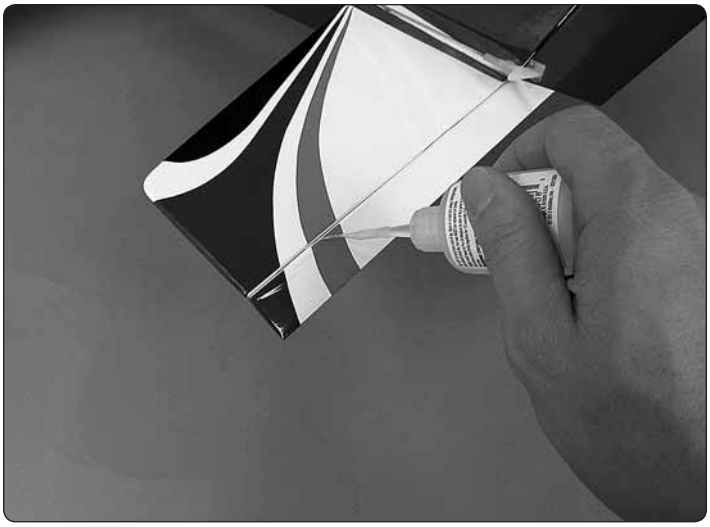
❏ 2. Use a covering iron with a covering sock on high heat to tighten the covering if necessary. Apply pressure over sheeted areas to **thoroughly** bond the covering to the wood. Take care when applying heat onto trim covering applied over the base color. Move the iron at a rate slow enough to get the covering hot but not so slow that the top color shrinks on top of the base color causing the edges to pull away.

Check the Pre-Installed Hinges

This model has all of the control surfaces pre-hinged at the factory. No additional glue is typically necessary; however, all of the hinged surfaces must be carefully checked to confirm they are securely attached. This procedure should be part of your pre-flight check each and every time you fly.



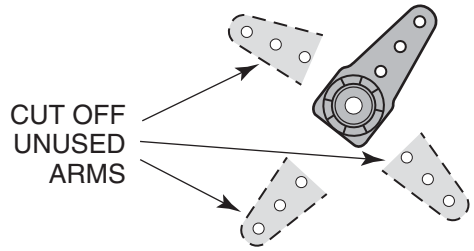
❏ 1. Grasp each control surface at one end, taking care not to dent or puncture the covering or the wood structure beneath. Pull the control surface away from the hinge line. Move your hand along the surface and repeat the check for the entire length of the surface.

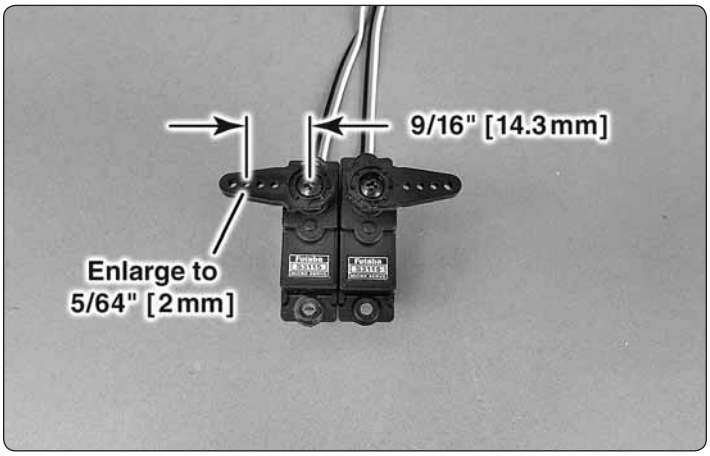


❏ 2. If you find a control surface with loose hinges, you will need to add thin CA glue to the hinges. Push the control surface back into place. Deflect the control surface all the way in one direction in order to expose the center of the hinge. Apply 6 to 7 drops of thin CA glue to each hinge. Do NOT use accelerator! The CA glue must be allowed to slowly wick into the hinge and surrounding wood. When the glue has dried, flip the model over and add 6 or 7 drops to the other side of each hinge. It is recommended that you reinforce every hinge on the model with CA glue if you found even one loose hinge. Confirm the control surfaces move freely and are well secured.

ASSEMBLY

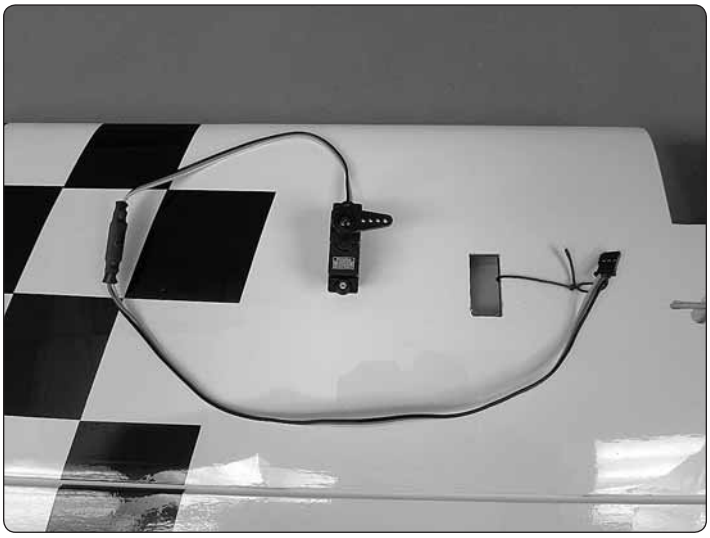
Build the Wing





❏ 1. Center your aileron servos with your radio system. Test fit four-armed servo arms onto the servos to determine

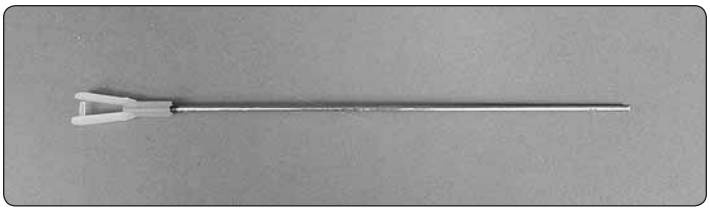
their best orientation so that the arms are closest to being perpendicular with the servo case. Cut three arms from each servo arm leaving one arm on each servo that matches the photo. Enlarge the hole closest to 9/16" [14.3 mm] to the center of the servo arm of each remaining arm with a 5/64" [2 mm] drill bit. Attach a 12" [305 mm] servo extension to each servo. Secure the connection using the pieces of included heat shrink tubing. Install the rubber grommets and eyelets onto the servo mounting tabs.



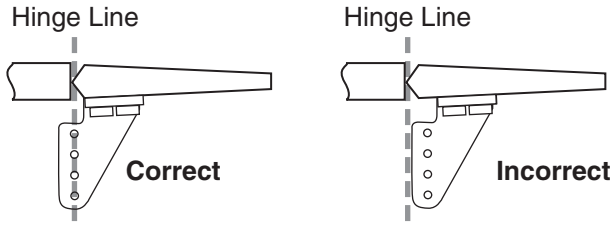
❏ 2. Tie the string ends that are taped inside the wings at the aileron servo bays to the servo extension connectors.

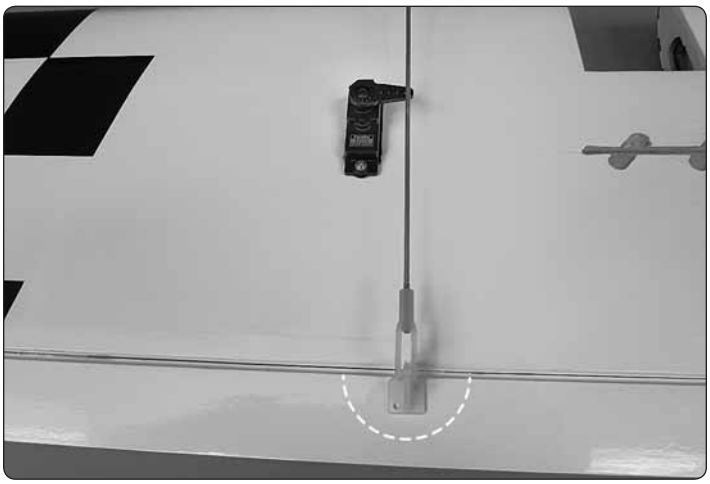
❏ 3. Pull the strings through the root ribs. Be careful not to damage the wing ribs as you pull the servo leads through them.

❏ 4. Fit the servos into the servo openings and drill 1/16" [1.6mm] holes through the mounting tabs on the servo cases into the rails. Thread a servo mounting screw (included with the servo) into each hole and remove it. Apply a drop of thin CA to each hole to harden the surrounding wood. When the CA has hardened, install the servos into the openings as shown using the screws supplied with the servos.



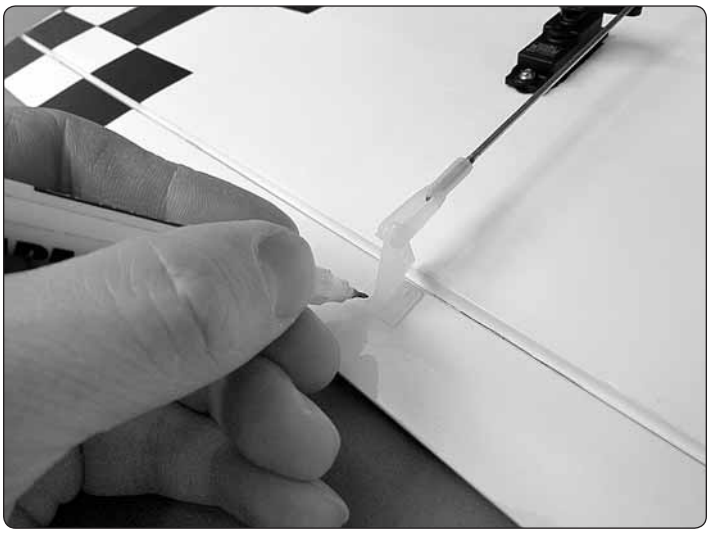
❏ 5. Thread a nylon clevis onto two 6" [150mm] aileron pushrods 20 complete turns.

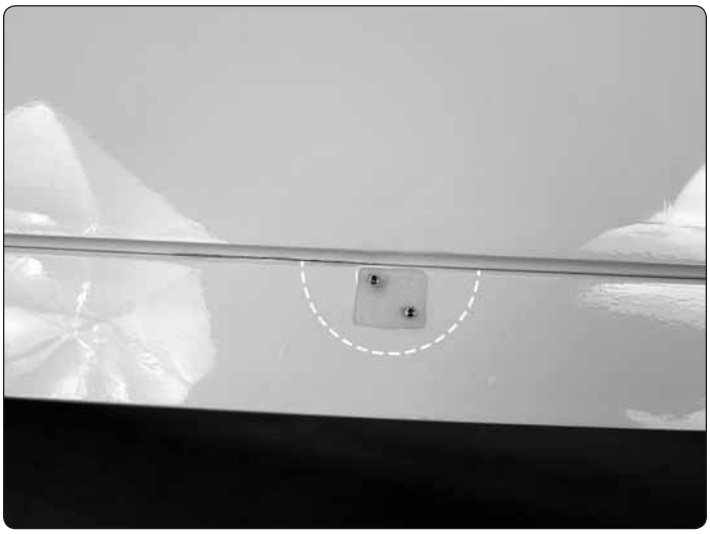




❏ 6. Separate the back plates from two control horns using a knife or sprue cutters. Connect the clevises on the aileron

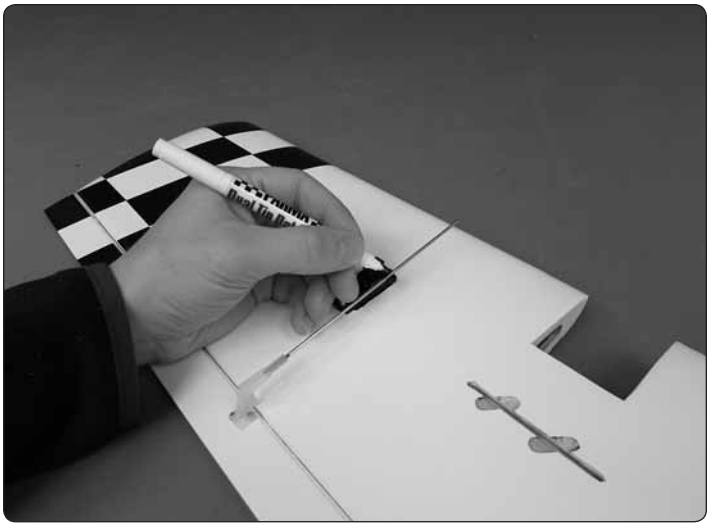
pushrods to the outer holes of the control horns. Position the control horns over the hardwood plates in the ailerons (if you cannot see them, hold the aileron at a shallow angle in good lighting or use a small pin to puncture the covering) being sure the pushrods are lined up with the enlarged holes in the aileron servo arms.



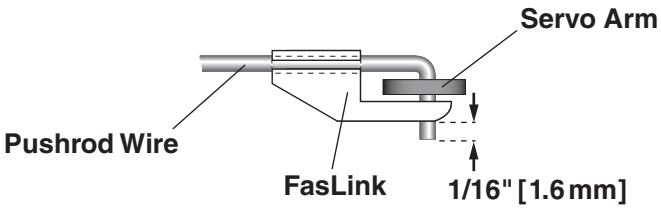


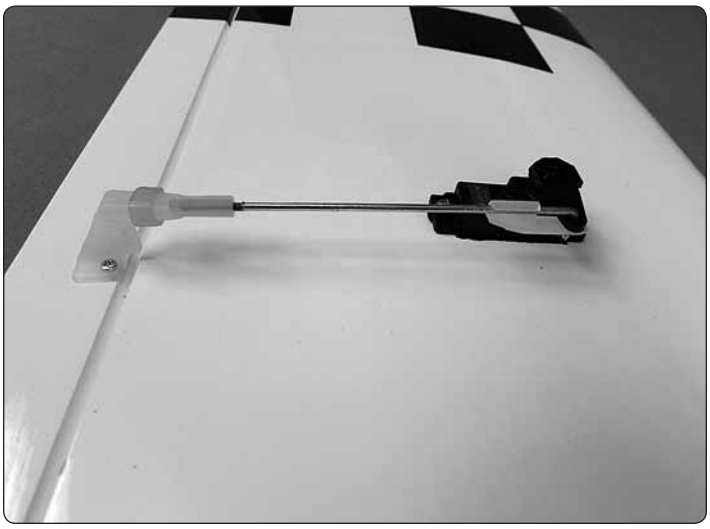
❏ 7. Use a felt-tip pen to mark the location of the control horn mounting holes onto both ailerons.

Drill 5/64" [2mm] holes at the marks you made. Thread 2-56 x 1/2" [13mm] machine screws into each hole and secure the control horns into place with the control horn back plates.

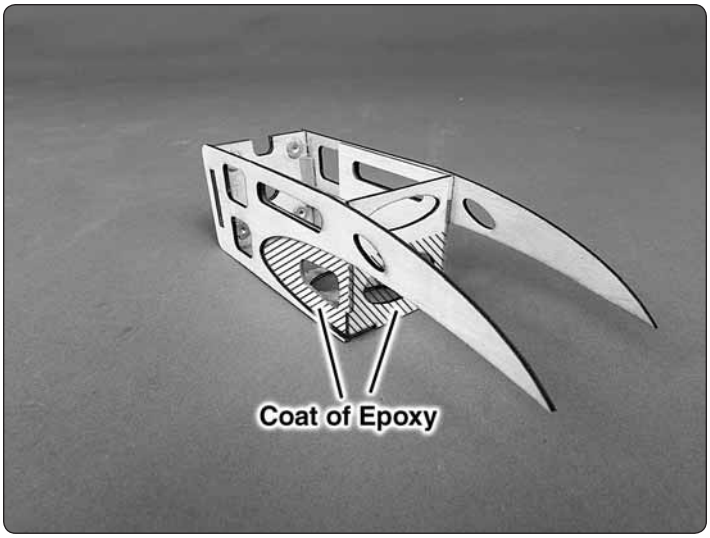


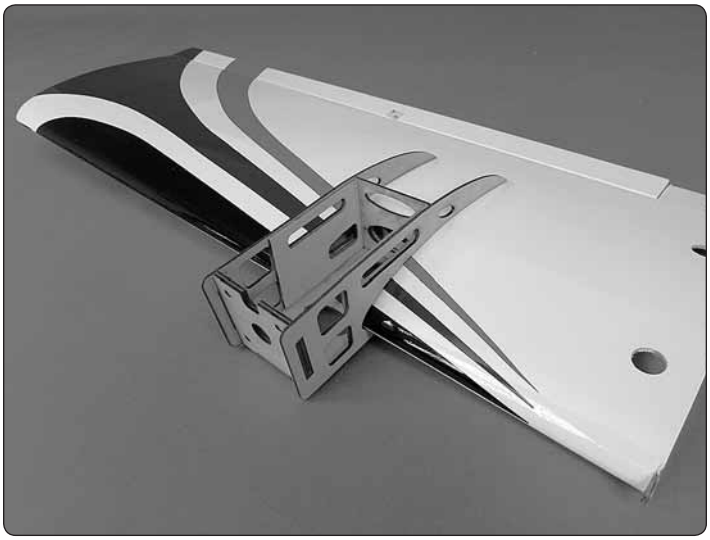
❏ 8. With the ailerons in the neutral position (use tape or small clamps to hold them in place), mark the pushrod wires where they cross the enlarged holes in the servo arms.

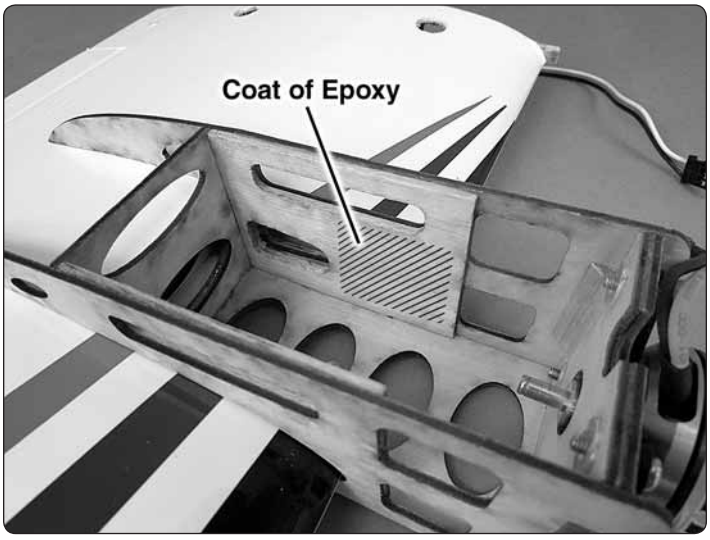




❏ 9. Make a 90 degree bend at the mark on each pushrod and cut off the excess pushrod 1/4" [6mm] beyond the bends. Attach the pushrods to the servo arms using nylon FasLinks. Thread the clevises in or out on the pushrods as necessary to center the ailerons with the servo arms still perpendicular to the servo cases. (Never center the servo with the power on.) When satisfied, slide silicone clevis retainers onto the ends of the clevises to secure them.



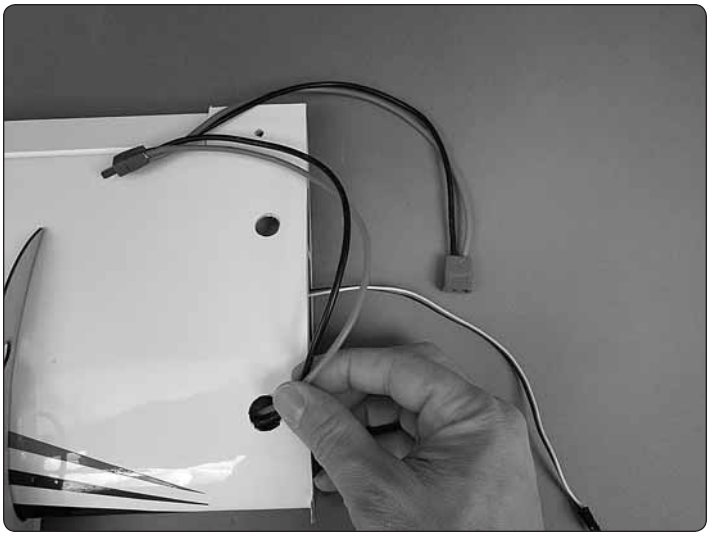


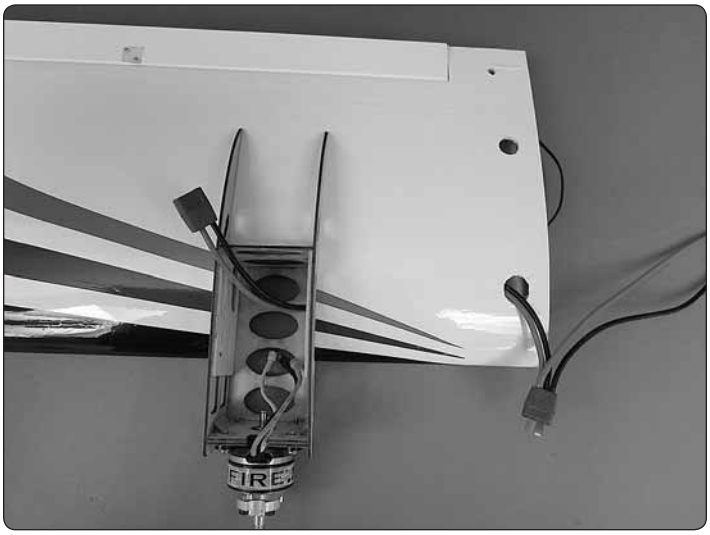


❏ 10. Locate the plywood nacelle frames. Coat the wing pockets and aft ends with epoxy and fit the frames into the cutouts in the wings. Wipe away any excess epoxy with a paper towel wetted with denatured alcohol. Use tape to hold them in place. With epoxy still wet, put a thin coating on the inside wall in the location shown on each frame. This will provide a smooth surface to mount the ESC.

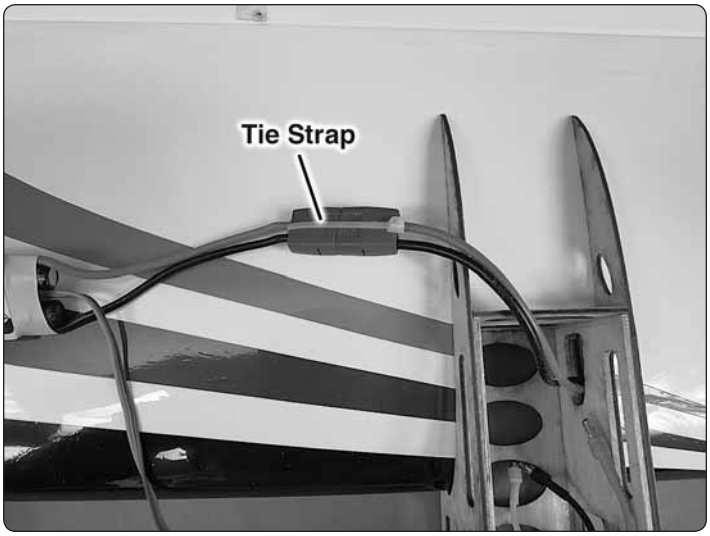
❏ 11. Install the aluminum X-mount onto the motors using the screws included with the motors and thread locking compound. Install the prop adapters using the screws included with the motors and thread locking compound.

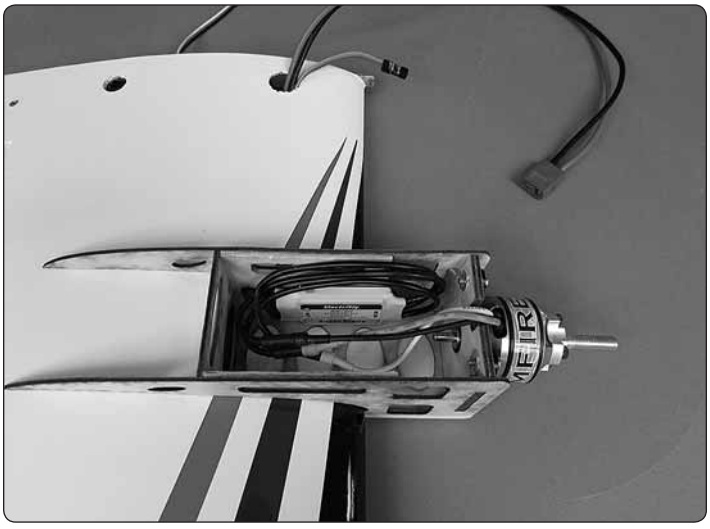
❏ 12. Mount the motors to the nacelle firewalls using 3 x 12 mm machine screws, 3mm flat washers, and thread locking compound. Be sure that the motor leads are towards the top of the wing.



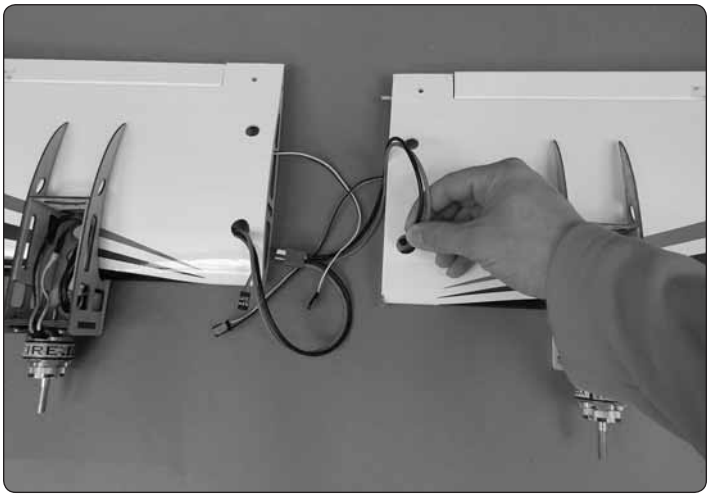


❏ 13. Feed one of the female ends of the battery Y-harness through the forward wing sheeting hole in one wing panel. Manuever it through the wing ribs and into the nacelle frame.



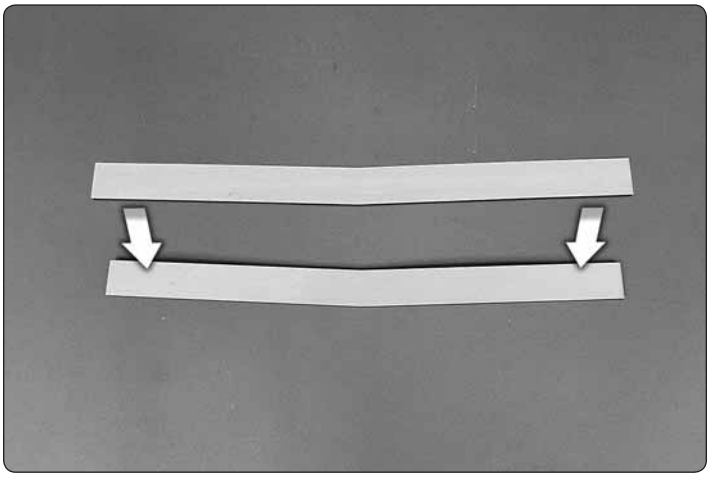


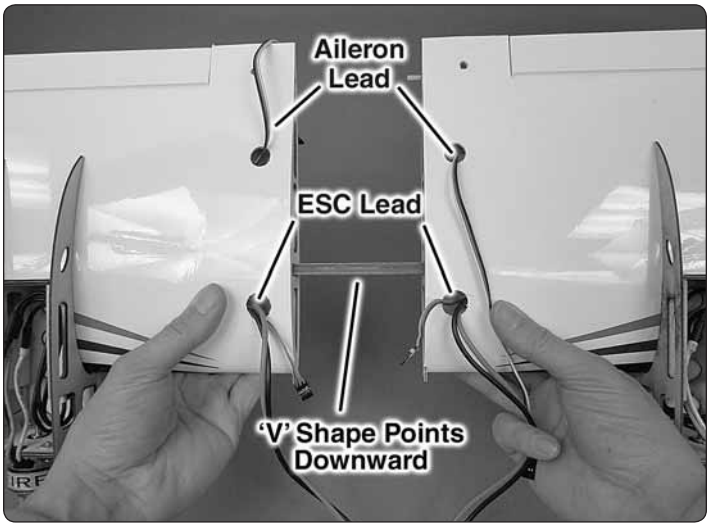
❏ 14. Connect an ESC to the battery Y-harness end you inserted through the wing. Use one of the included tie straps to secure the connectors together as shown. Use a piece of the included double-sided foam tape to stick the ESC to the inside of the nacelle frame where you applied the epoxy coating.



❏ 15. Feed the other female end of the battery Y-harness through the wing sheeting hole in the other wing panel and into the nacelle frame. Connect the ESC to the battery

Y-harness and secure it with a tie strap. Look ahead to the photo in step 16 and feed the ESC receiver leads through the same holes as the battery harness and the aileron servo leads through the aft wing sheeting holes.

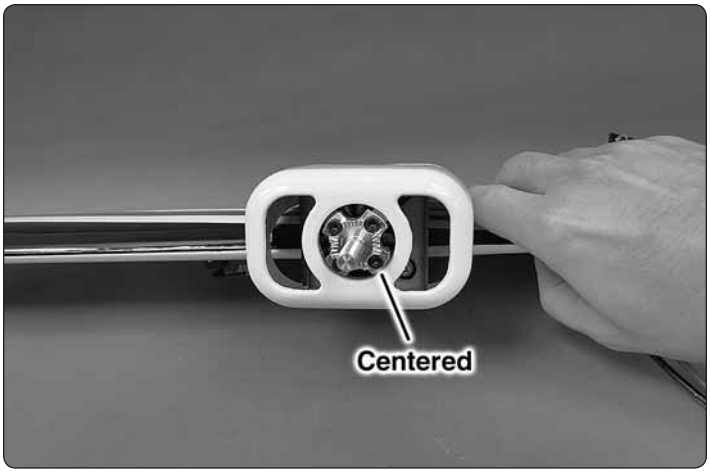


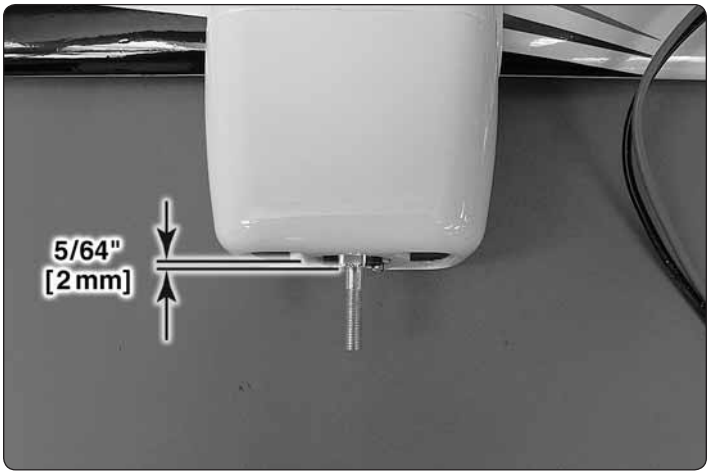


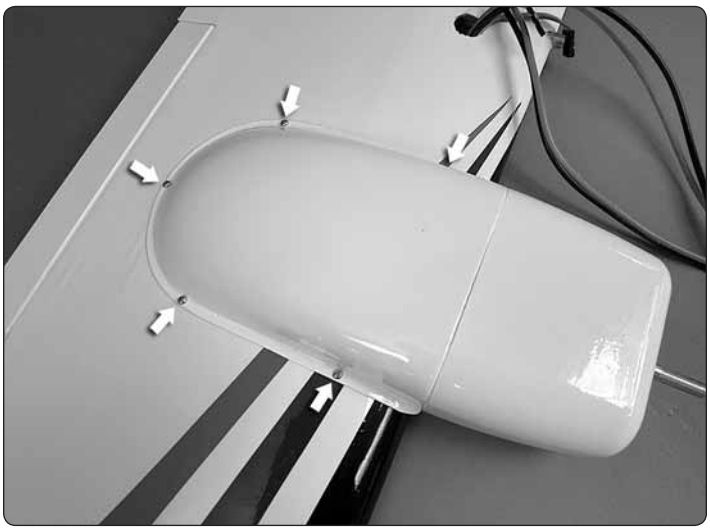
❑ 16. Use epoxy to laminate the two wing joiner pieces together. Use a paper towel dampened with denatured alcohol to clean up any excess epoxy from around the joiner. Use sping clamps or weight the joiner with something heavy while the epoxy cures. When the epoxy is cured test fit the joiner into each wing panel, making sure it can slide in all the way without difficulty. Sand the joiner if necessary. Mix up a batch of 30-minute epoxy and coat both wing roots, joiner pockets and the joiner. Slide the wing panels together and use tape to hold the panels tightly together while the epoxy cures. Clean up excess epoxy with denatured alcohol.

CHECK THE MOTOR ROTATION

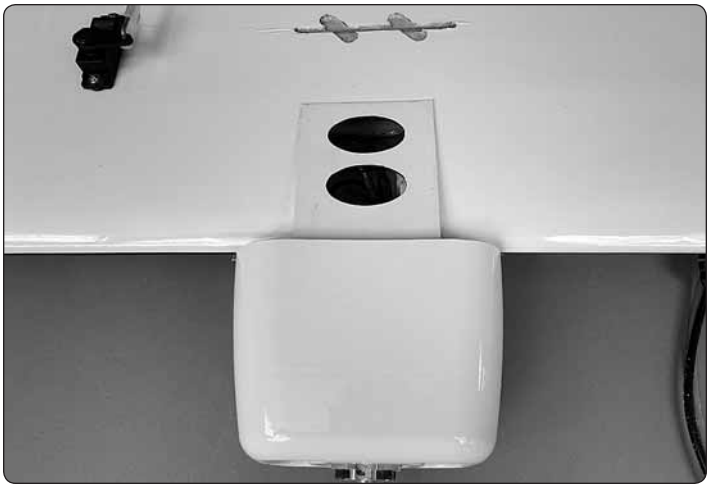
Before installing the nacelle covers in the next step, we recommend temporarily connecting the ESCs to your receiver and power up the system. Use the transmitter to operate the motors. Check to ensure that both motors are rotating counter-clockwise when looking at them head on. If not, disconnect any two of the three motor leads for the motor running the incorrect direction and swap their positions. Run the motors again to confirm the correct rotation.



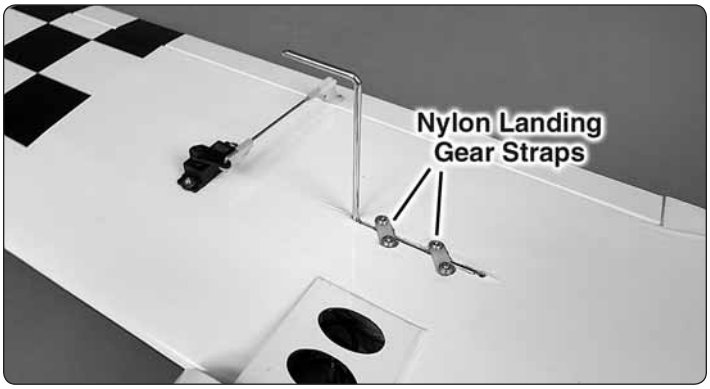




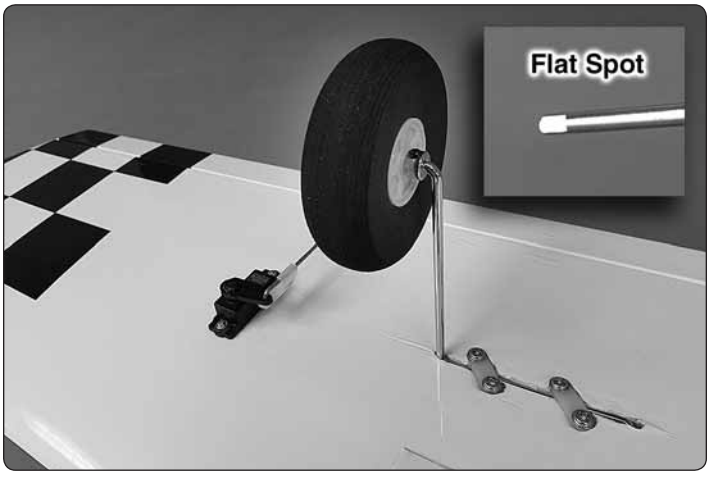
❑ 17. Position the ABS nacelle covers over the frames. Align them so the prop adapter is centered within the nacelle covers and the prop adapter faces are about 5/64" [2mm] in front of the covers. Use tape to temporarily hold the covers in place. Drill five 1/16" [1.6mm] holes evenly spaced around the perimeter of each cover in the locations shown. Remove the covers from the wing panels and thread a #2 x 3/8" [9.5mm] self-tapping screw into each hole and then remove it. Apply a few drops of thin CA glue to every hole and let it harden without the use of accelerator. Install the covers onto the wing panels using ten #2x 3/8" [9.5mm] screws.



❏ 18. Use a sharp hobby knife to trim the covering from two of the elliptical cutouts in the bottom of the nacelle frames. This will allow cool air to pass over the motors and ESCs and then exit the nacelle frames.



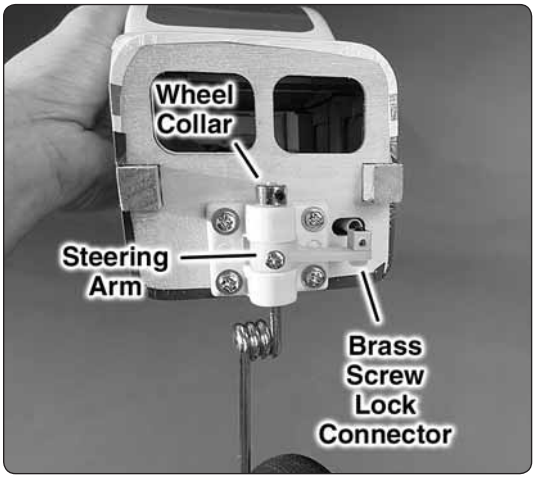
❏ 19. Fit the main landing gear wires into the slots in the wing. Place nylon landing gear straps into the cutouts in order to mark the locations for the screw holes. Drill 5/64" [2 mm] holes at the marks you made. Thread a #4 x 3/8" [9.5 mm] washer head screw into each hole and then remove it. Apply a drop or two of thin CA to each hole to harden the surrounding wood. Let the glue harden without accelerator. Install the straps in place using four washer head screws. Repeat for the other side.

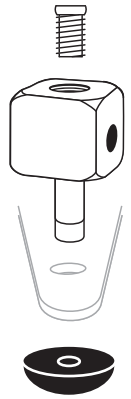


❏ 20. Slide a 3.5mm wheel collar followed by the wheel, then another 3.5mm wheel collar. Use a felt tip pen to mark the position of each collar onto the axle. Grind a flat spot onto the axle for each wheel collar set screw (look at the flat spots on the nose gear for an example). Install the wheel collars and wheels back onto the axles and secure the collars with 3mm set screws and thread locking compound. Check that the wheel rotates smoothly. Add a drop or two of oil if necessary.

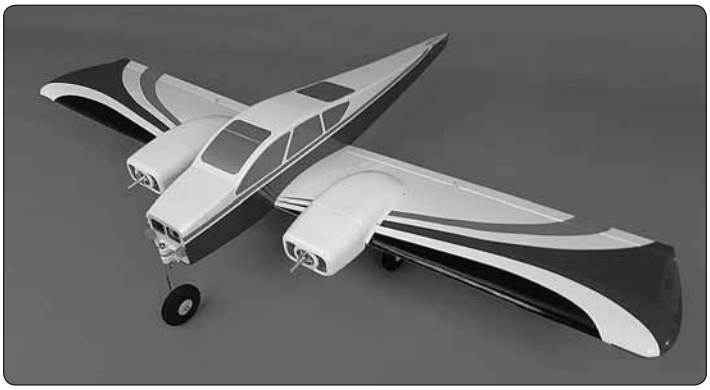
Assemble the Fuselage

❏ 1. Mount the steering nose block onto the front of the fuselage using four 3x12mm machine screws, four 3mm flat washers and thread locking compound.

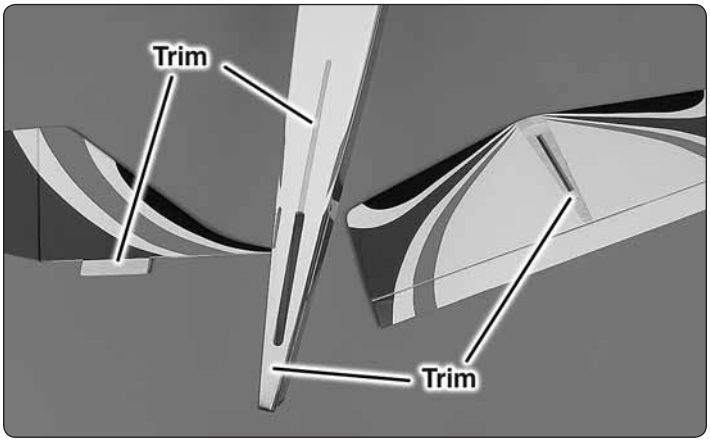




❏ 2. Install a brass screw lock connector into the outer hole of the nylon steering arm with a nylon retainer. Loosely thread a 3mm set screw into the screw lock connector. Loosely thread a 3x6mm machine screw into the steering arm. Assemble the nose gear into the steering block as shown. Tighten a wheel collar with a 3mm set screw at the top to secure the nose gear in place. Install the nose wheel onto the axle as you did the main wheels.



❏ 3. Temporarily mount the wing to the fuselage using the two 10-24 x 2" [51mm] nylon wing bolts.

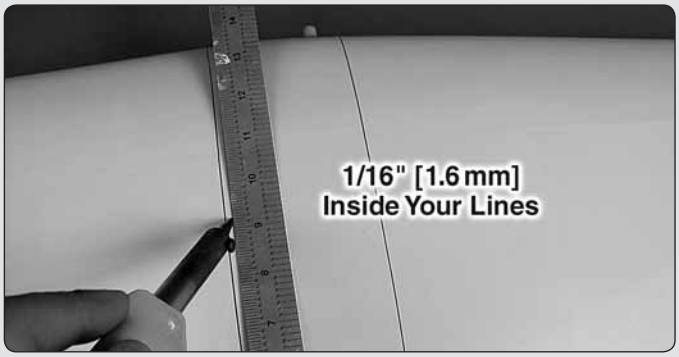


❏ 4. Fit the vertical fin and horizontal stabilizer into place. Use a felt tip marker to trace around the fuselage onto the tail parts top and bottom and left and right side. Trace around the fin onto the fuse. Remove the tail parts and trim the covering away 1/16" [1.6mm] inside your lines as shown.

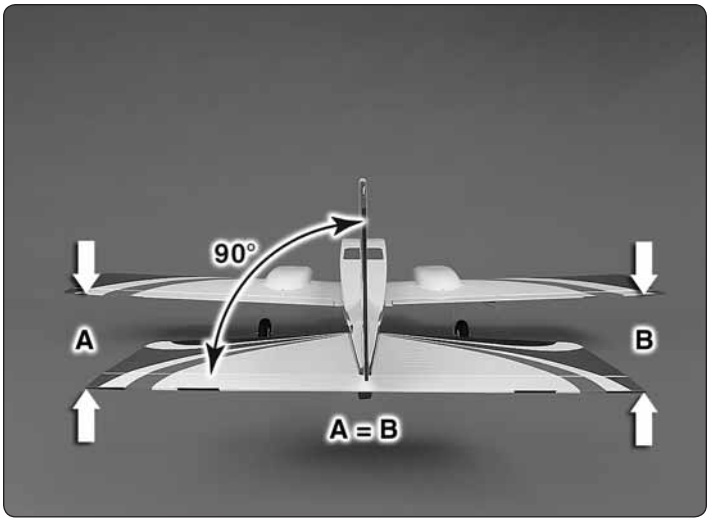
EXPERT TIP

HOW TO CUT COVERING FROM BALSA

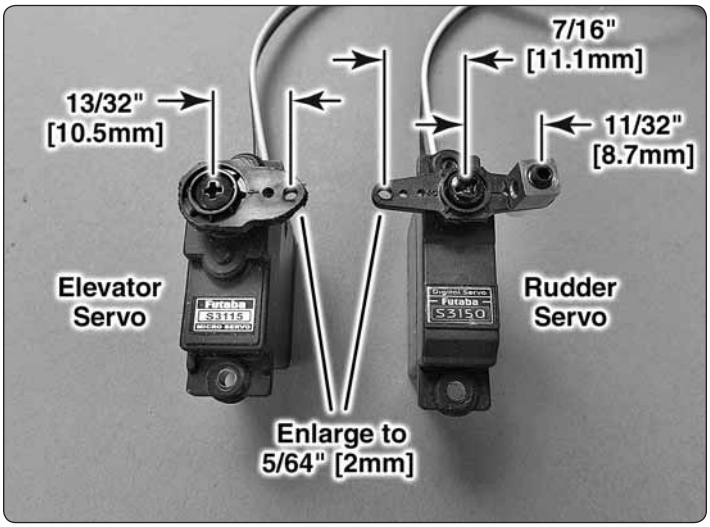
Use a soldering iron to cut the covering from the stab. The tip of the soldering iron doesn't have to be sharp, but a fine tip does work best. Allow the iron to heat fully.



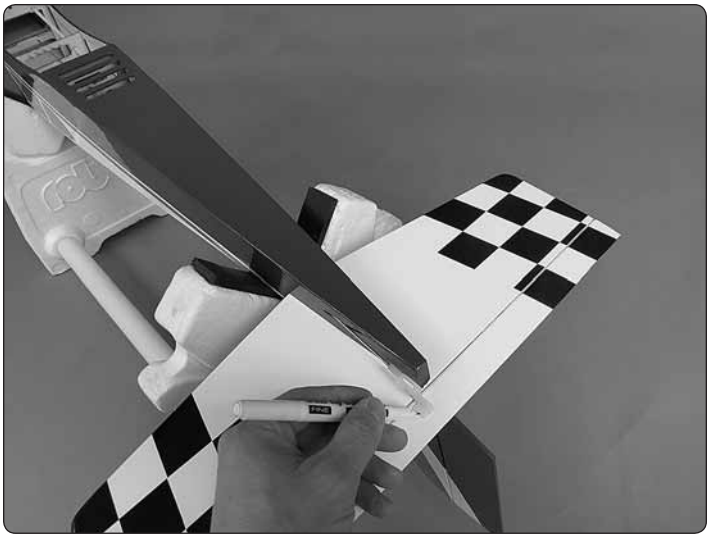
Use a straightedge to guide the soldering iron at a rate that will just melt the covering and not burn into the wood. The hotter the soldering iron, the faster it must travel to melt a fine cut. Peel off the covering.



❏ 5. Re-insert the horizontal stabilizer and vertical fin into the fuse. With the wing in place, stand behind the model approximately 10 feet [3m] and confirm that the stab sits parallel with the wing. If not, weight can be added to the high side while gluing the stab in place, or the stab pocket can be lightly sanded until the stab and wing sit parallel. When satisfied, remove the stab and fin and coat the exposed wood with 30-minute epoxy (although messy, a more reliable glue joint can be attained if you also coat the inside edges of the stab pocket). Reinstall the stab and fin. Wipe away any excess epoxy with denatured alcohol and let the epoxy cure undisturbed. When cured, the wing can be removed from the fuselage and set aside as it will not be needed until the final set up of the plane.

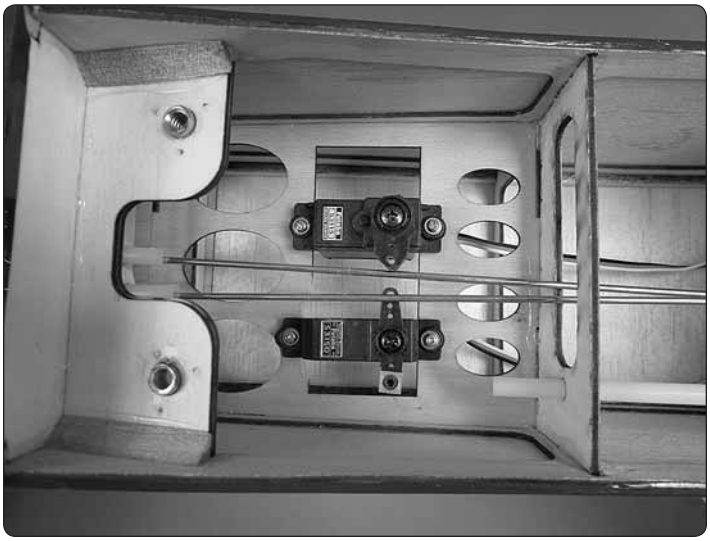


Install servo arms onto the elevator and rudder servos as shown. A brass screw lock connector is needed for the nose gear pushrod. Enlarge the holes for the rudder and elavator pushrods using a 5/64" [2 mm] drill bit. We chose a high torque servo for the rudder for more responsive yaw control in flight.

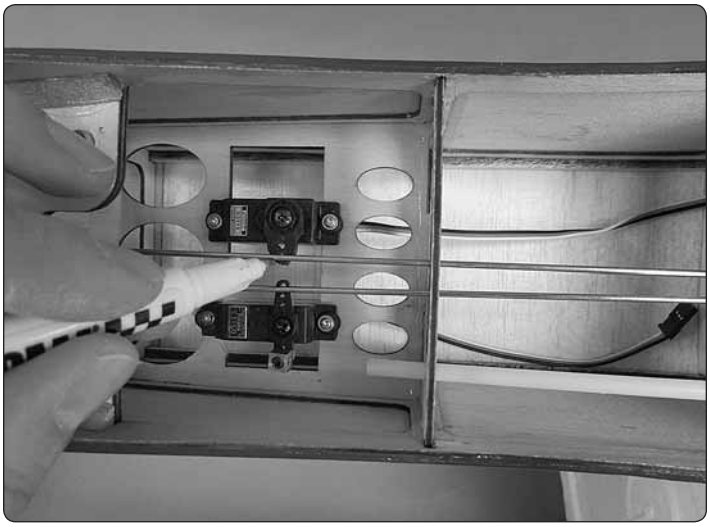


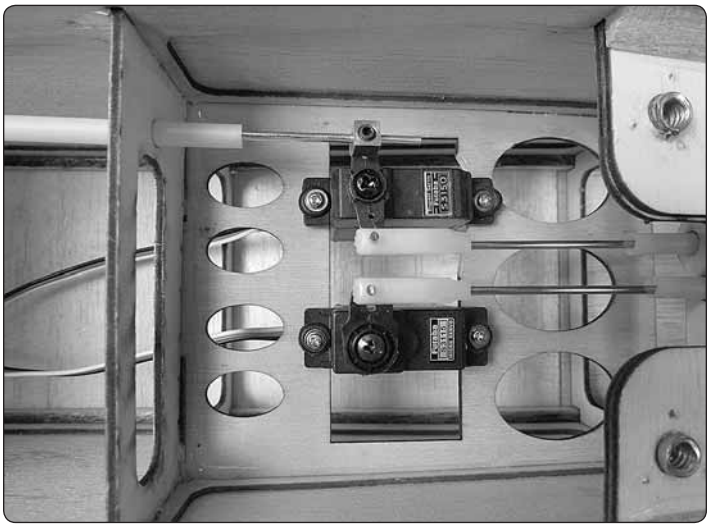
❏ 6. Thread a nylon clevis onto a 27" [685 mm] pushrod. Attach the clevis to a control horn and slide the pushrod into the outer pushrod tube on the right side of the fuse. As you did with the ailerons, align the control horn over the elevator hinge line and mark the location of the screw holes. Drill 5/64" [2mm] holes at your marks and install the horn using two 2-56 x 3/8" [9.8 mm] machine screws and the control horn backplate.

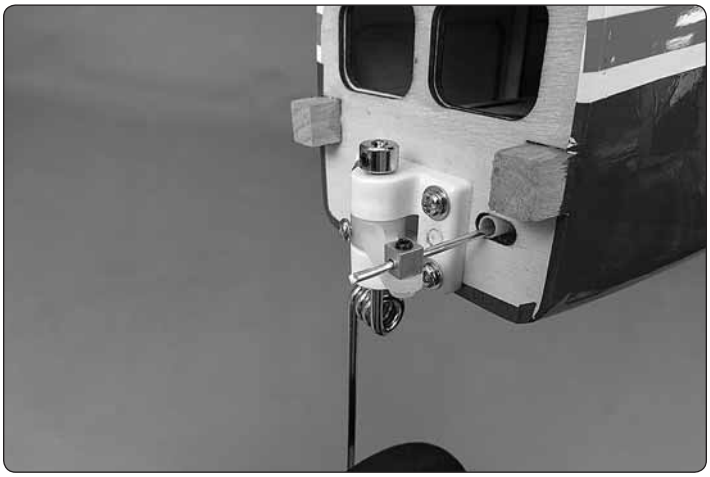
❏ 7. Install the rudder control horn in the same manner as you did the elevator control horn.



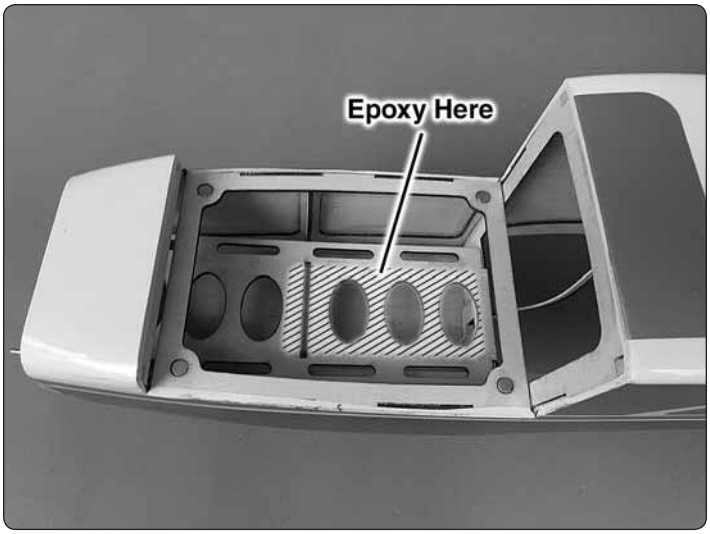
❏ 8. Install the rudder and elevator servos onto the tail servo tray using the hardware included with the servos. Use the position of the tail pushrods as they exit the pushrod tubes to determine the location of the servos on the tray. The servos should be aligned so that the pushrods overlap the enlarged holes in the servo arms. Be sure to harden the wood surrounding the mounting screw holes with thin CA. Center the servos with the radio.

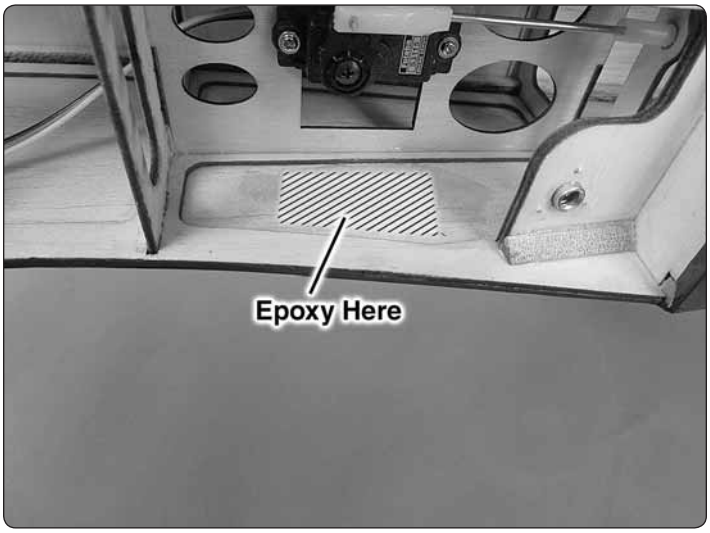






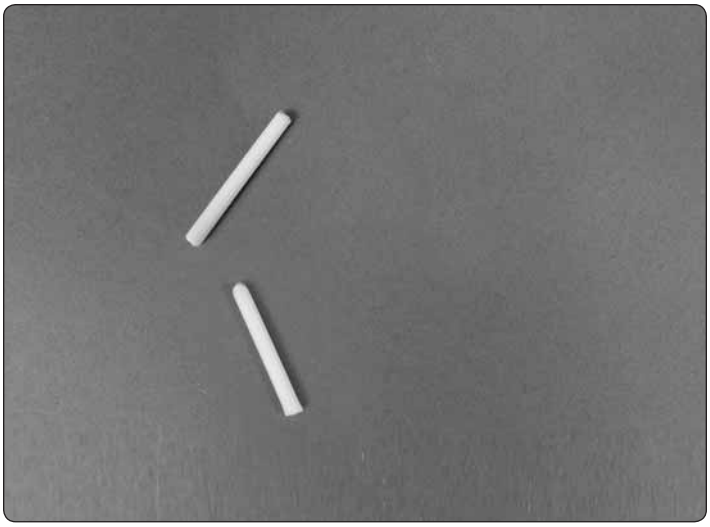
❏ 9. Use tape or clamps to temporarily hold the elevator and rudder in the neutral position. Mark the pushrods where they cross the enlarged holes in the servo arms. Make a 90° bend at the marks. As you did with the ailerons, cut the pushrods and connect them to the servos using two FasLinks. Cut off the threaded portion from the remaining 18" [457mm] pushrod. Slide it through the two screw lock connectors for the nose gear steering arm and rudder servo. Align the nose wheel so it's pointing straight, then tighten the set screws in the screw lock connectors. You may need to adjust the pushrod once you taxi the plane.

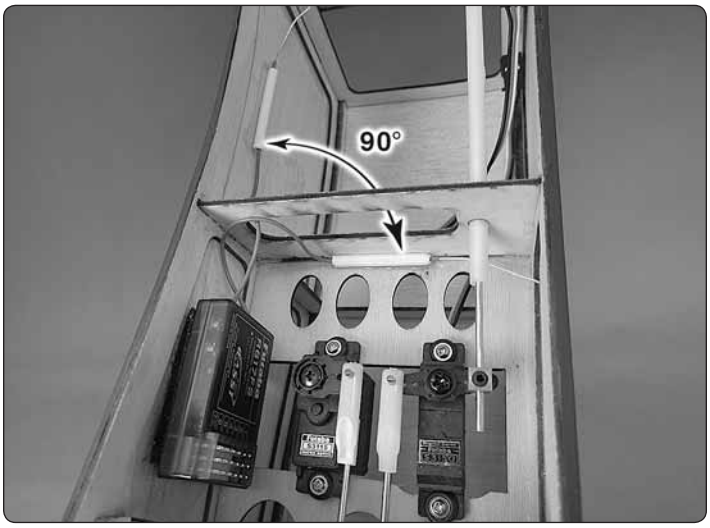




❏ 10. Mix up a small batch of epoxy and apply a thin coat to the battery tray and the side of the fuselage by the elevator servo for the purpose of attaching the receiver.

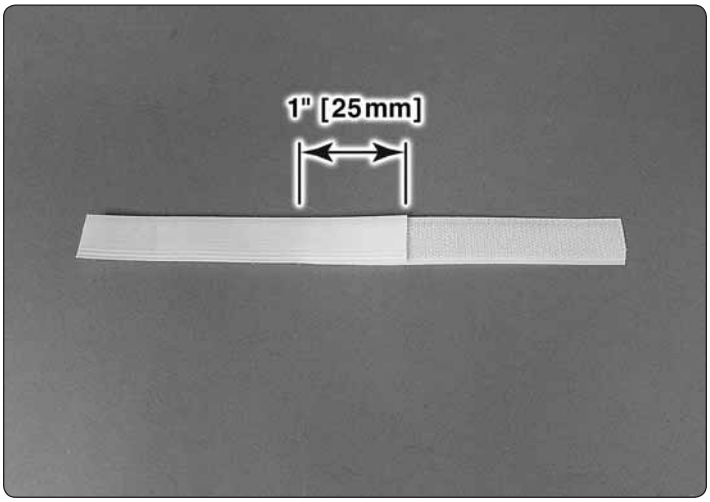
❏ 11. When the epoxy from the previous step has completely cured, use a piece of the included self-adhesive hook and loop material to attach the receiver as shown.

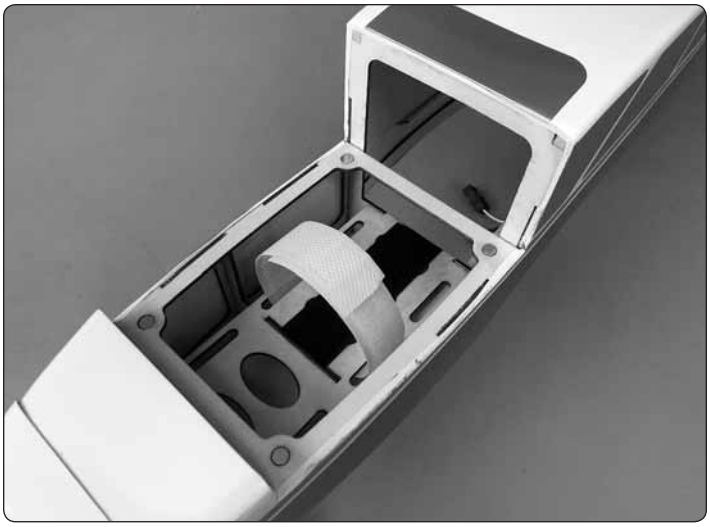




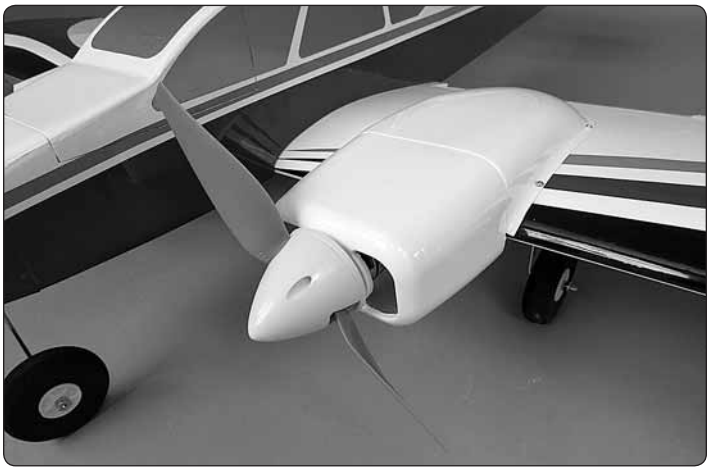
❏ 12. Cut the included 4" [100 mm] length of white tube into two equal pieces. Use CA to glue the pieces 90 degrees to each other near the receiver. Feed the antenna wires into the tubes. Note: some receivers may have only one antenna or no exposed antennas at all. Consult your radio manual for requirements for positioning the antenna(s).

❏ 13. Mark the location of the nose gear wire onto the nose cone when you hold it up in place. Use a rotary tool to cut a slot for the wire. The nose cone can be glued, screwed (screws not included) or taped on. We prefer using tape on this model because it allows easy access to the nose gear as well as looking better. If you decide to glue it on then we recommend RTV silicone.

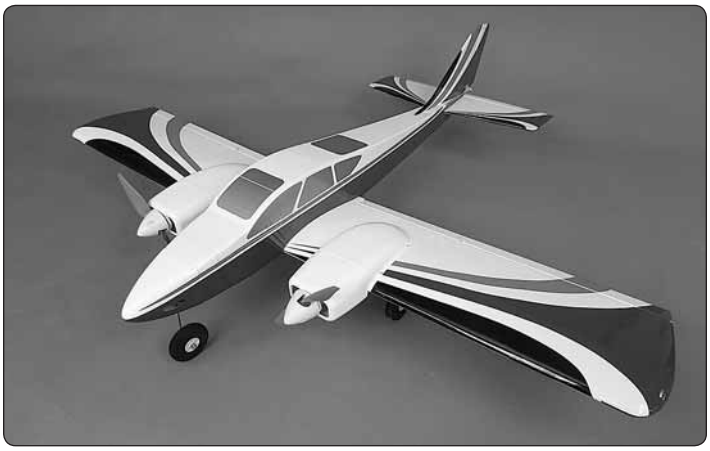




❏ 14. Cut a length of non-adhesive hook and loop material 5" [127mm]. Overlap the mating ends approximately 1" [25mm] to make a strap. Put a piece of hook material from the self-ahesive hook and loop material and stick it to the battery tray. Fish the strap you made through the middle slots in the battery tray.



❏ 15. If you have already used your radio to check the operation of the motors, install the propellers and spinners onto the motor shafts.



❏ 16. Congratulations on the completion of the Twinstar EP! Now it's time to put on the decals, balance the plane and confirm the control throws.

Apply the Decals

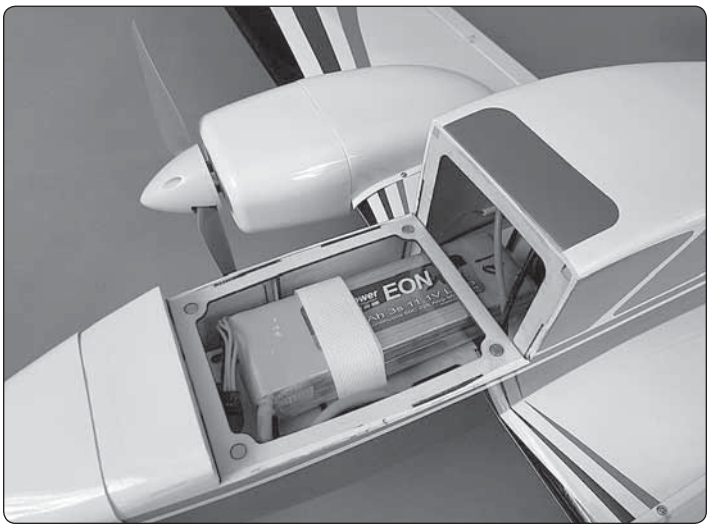
❏ 1. Be certain the model is clean and free from oily fingerprints and dust. Prepare a dishpan or small bucket with a mixture of liquid dish soap and warm water—about one teaspoon of soap per gallon of water. Submerse the decal in the soap and water and peel off the paper backing. **Note:** Even though 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.

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

❏ 3. 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

Check the Control Directions

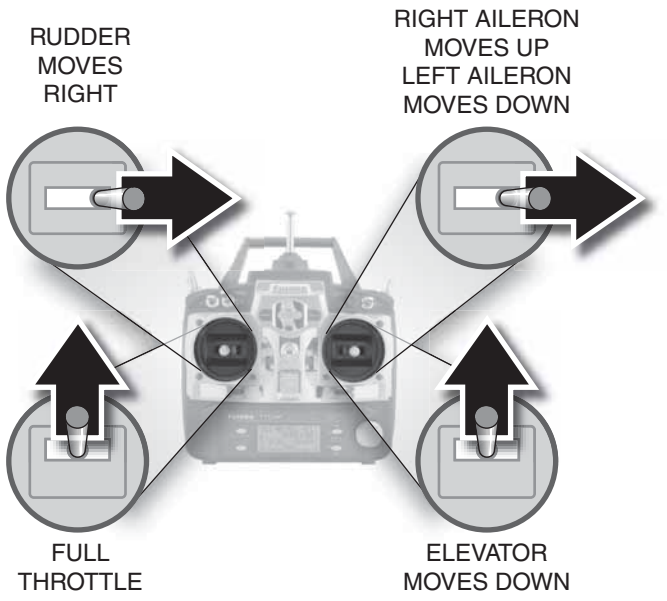


❏ 1. Apply the loop side of the self-adhesive hook and loop material to your flight battery. Install the pack in the battery compartment and strap it down.

❏ 2. Turn on the transmitter, plug in the battery and center the trims (remember the flight battery should never be plugged in if the transmitter is off!). If necessary, remove the servo arms from the servos and reposition them so they are centered. Reinstall the screws that hold on the servo arms.

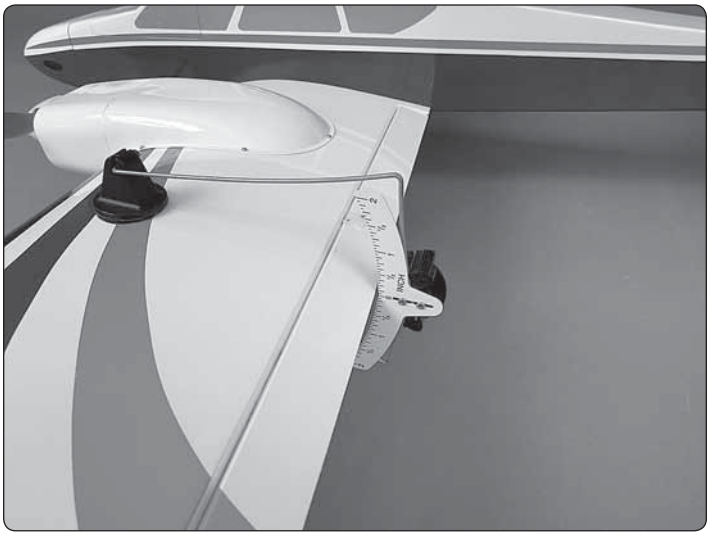
❏ 3. With the transmitter still on and the flight battery plugged in, check all the control surfaces to see if they are centered. If necessary, adjust the clevises on the pushrods to center the control surfaces.

4-CHANNEL RADIO SET UP (STANDARD MODE 2)



❏ 4. Make certain that the control surfaces and the throttle respond in the correct direction as shown in the diagram. If any of the controls respond in the wrong direction, use the servo reversing in the transmitter to reverse the servos connected to those controls. Be certain the control surfaces have remained centered. Adjust if necessary.

Set the Control Directions



Use a Great Planes AccuThrow (or a ruler) to accurately measure and set the control throw of each control surface as indicated in the chart that follows. If your radio does not have dual rates, we recommend setting the throws at the **low** rate setting.

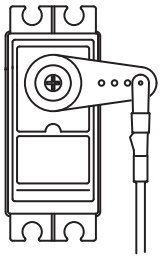
NOTE: The throws are measured at the **widest part** of the elevators, rudder and ailerons.

These are the recommended control surface throws:		
	LOW	**HIGH**
ELEVATOR Up & Down	1/4" [6.4mm] 14°	3/8" [9.5mm] 20°
RUDDER Right & Left	13/16" [21mm] 23°	1-1/16" [27mm] 30°
AILERONS Up & Down	1/4" [6mm] 11°	7/16" [11mm] 21°

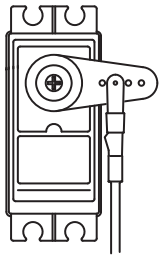
IMPORTANT: The Twinstar EP has been **extensively** flown and tested to arrive at the throws at which it flies best. Flying your model at these throws will provide you with the greatest chance for successful first flights. If, after you have become accustomed to the way the Twinstar flies, you would like to change the throws to suit your taste, that is fine. However, too much control throw could make the model difficult to control, so remember, "more is not always better."

At the Servos

The pushrod farther out means **More Throw**

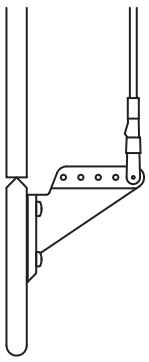


The pushrod closer in means **Less Throw**

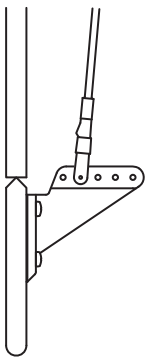


At the Control Surfaces

The pushrod farther out means **Less Throw**



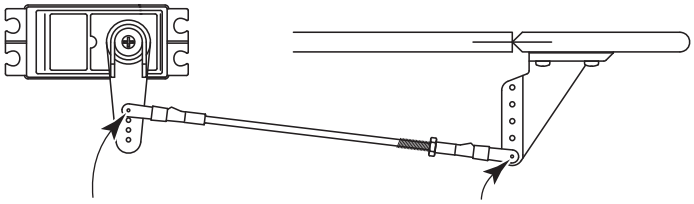
The pushrod closer in means **More Throw**



❏ 1. If necessary, adjust the location of the pushrod on the servo arms with your ATVs remaining set at 100%. Increase or decrease the throw according to the measurements in the control throws chart.

If you built your model using the servo arm hole measurements given to you then your control throws should match or be close to the recommended control throws. If not, the pushrod may be moved inward on the control horn to increase the throw, but it's better to go **farther out** on the servo arm because this will introduce less free play than the alternative. Only after moving the pushrod all the way out on the servo arm, if you still can't get the throw required, you'll have to resort to moving the pushrod closer in on the control horn. **Note:** If you have a computer radio, it is always desirable to set your ATVs to 100% (or as near 100% as possible to achieve the control throw required).

Preferred Pushrod Hookup



"Closest in" on servo arm

"Farthest out" on control horn

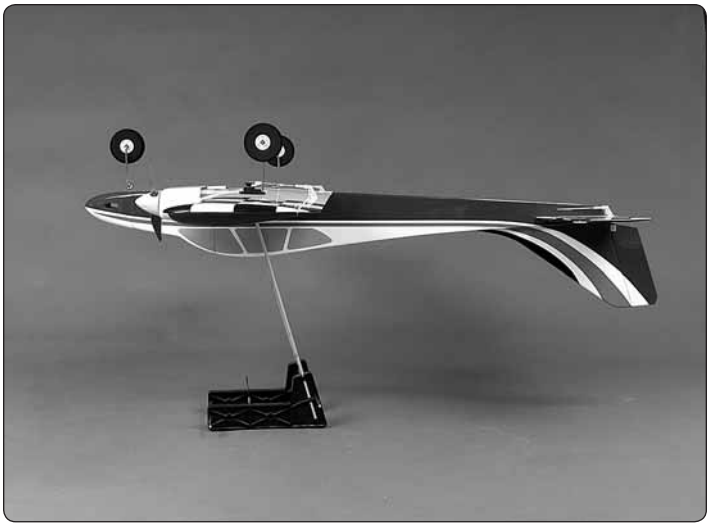
Balance the Model (C.G.)

More than any other factor, the **C.G.** (balance point) can have the **greatest** effect on how a model flies, and may determine whether or not your first flight will be successful. If you value this model and wish to enjoy it for many flights, **DO NOT OVERLOOK THIS IMPORTANT PROCEDURE.** A model that is not properly balanced will be unstable and possibly unflyable.

At this stage the model should be in ready-to-fly condition with all of the systems in place including the engine or brushless motor, landing gear, and the radio system (and battery pack if applicable).

❏ 1. Use a felt-tip pen or 1/8" [3mm]-wide tape to accurately mark the C.G. on the top of the wing on both sides of the fuselage. The C.G. is located 2-1/2" [64mm] back from the leading edge of the wing.

This is where your model should balance for the first flights. Later, you may wish to experiment by shifting the C.G. up to 5/16" [8mm] forward or 5/16" [8mm] back to change the flying characteristics. Moving the C.G. forward may improve the smoothness and stability, but the model may then require more speed for takeoff and make it more difficult to slow for landing. Moving the C.G. aft makes the model more maneuverable, but could also cause it to become too difficult to control. In any case, **start at the recommended balance point** and do not at any time balance the model outside the specified range.



❏ 2. With the wing attached to the fuselage and all parts of the model installed (ready to fly), place the model on a Great Planes CG Machine upside down, or lift it at the balance point you marked.

❏ 3. If the tail drops, the model is "tail heavy" and the battery pack and/or receiver must be shifted forward or weight must be added to the nose to balance. If the nose drops, the model is "nose heavy" and the battery pack and/or receiver must be shifted aft or weight must be added to the tail to balance. If possible, relocate the battery pack and receiver to minimize or eliminate any additional ballast required. If additional weight is required, use Great Planes (GPMQ4485) "stick-on" lead. A good place to add stick-on nose weight is to the front of the fuselage above the nose gear steering block (don't attach weight to the cowl—it is not intended to support weight). Begin by placing incrementally increasing amounts of weight on the bottom of the front of the fuse until the model balances. Once you have determined the amount of weight required, it can be permanently attached. If required, tail weight may be added by cutting open the bottom of the fuselage and gluing it permanently inside.

Note: Do not rely upon the adhesive on the back of the lead weight to permanently hold it in place. Over time, fuel and exhaust residue may soften the adhesive and cause the weight to fall off. Use #2 sheet metal screws, RTV silicone or epoxy to permanently hold the weight in place.

❏ 4. **IMPORTANT:** If you found it necessary to add any weight, recheck the C.G. after the weight has been installed.

Balance the Model Laterally

❏ 1. With the wing level, have an assistant help you lift the model by the underside front of the fuselage behind the nose gear and the bottom of the fuse under the TE of the fin. Do this several times.

❏ 2. If one wing always drops when you lift the model, it means that side is heavy. Balance the airplane by adding weight to the other wing tip. **An airplane that has been laterally balanced will track better in loops and other maneuvers.**

PREFLIGHT

Identify Your Model

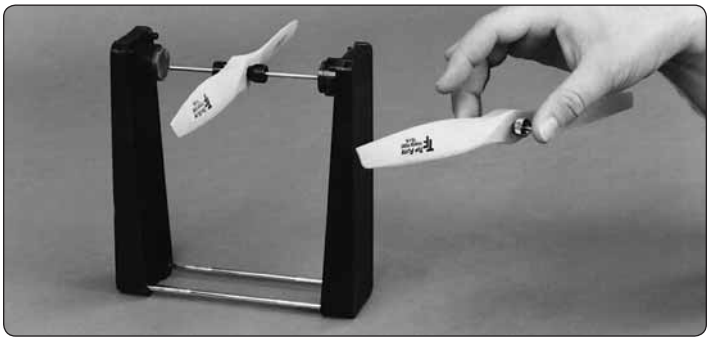
No matter if you fly at an AMA sanctioned R/C club site or if you fly somewhere on your own, you should always have your name, address, telephone number and AMA number on or inside your model. It is **required** at all AMA R/C club flying sites and AMA sanctioned flying events. Fill out the identification tag on page 23 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 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 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.

Balance Propellers



Carefully balance your propeller and spare propellers before you fly. An unbalanced prop can be the single most significant cause of vibration that can damage your model. Not only will motor mounting screws loosen, possibly with disastrous effect, but vibration may also damage your radio receiver and battery.

We use a Top Flite Precision Magnetic Prop Balancer (TOPQ5700) in the workshop and keep a Great Planes Fingertip Prop Balancer (GPMQ5000) in our flight box.

Range Check

Ground check the operational range of your radio before the first flight of the day. With the transmitter antenna collapsed and the receiver and transmitter on, you should be able to walk at least 100 feet away from the model and still have control (if using a 2.4GHz radio system, refer to the radio manual for the range checking procedure). Have an assistant stand by

your model and, while you work the controls, tell you what the control surfaces are doing. Repeat this test **with the motor running** at various speeds with an assistant holding the model, using hand signals to show you what is happening. If the control surfaces do not respond correctly, **do not fly!** Find and correct the problem first. Look for loose servo connections or broken wires, corroded wires on old servo connectors, or a damaged receiver crystal from a previous crash.

MOTOR SAFETY PRECAUTIONS

Failure to follow these safety precautions may result in severe injury to yourself and others.

- Always disconnect the power on the model before switching off the transmitter. Without a signal to the receiver, the ESC may command the motor to rotate which could cause injury to yourself or surrounding property. Always turn the transmitter on before plugging the flight battery into the ESC.
- Get help from an experienced pilot when learning to operate electric motors.
- Use safety glasses when running electric motors.
- Do not run the motors in an area of loose gravel or sand; the propellers may throw such material in your face or eyes.
- Keep your face and body as well as all spectators away from the plane of rotation of the propellers as you run the motors.
- Keep these items away from the props: loose clothing, shirt sleeves, ties, scarves and ascots, long hair or loose objects such as pencils or screwdrivers that may fall out of shirt or jacket pockets into the props.
- The motors gets hot! Do not touch them during or right after operation.

AMA SAFETY CODE *(excerpts)*

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 range 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. Because of this, you may be more likely to overlook certain checks and procedures that should be performed before the model is flown. To help avoid this, a check list is provided to make sure these important areas are not overlooked. Many are covered in the instruction manual, so where appropriate, refer to the manual for complete instructions. Be sure to check the items off as they are completed (that's why it's called a *check list!*).

❏ 1. Check the C.G. according to the measurements provided in the manual.

❏ 2. Be certain the battery and receiver are securely mounted in the fuse. Simply stuffing them into place with foam rubber is not sufficient.

❏ 3. Extend your receiver antenna (if applicable).

❏ 4. Balance your model *laterally* as explained in the instructions.

❏ 5. Use threadlocking compound to secure critical fasteners such as the set screws that hold the wheel collars to the axles, screw-lock pushrod connectors, etc.

❏ 6. Add a drop of oil to the axles so the wheels will turn freely.

❏ 7. Make sure all hinges are **securely** glued in place.

❏ 8. Reinforce holes for wood screws with thin CA where appropriate (servo mounting screws, cowl mounting screws, etc.).

❏ 9. Confirm that all controls operate in the correct direction and the throws are set up according to the manual.

❏ 10. Make sure there are silicone retainers on all the clevises and that all servo arms are secured to the servos with the screws included with your radio.

❏ 11. Secure connections between servo wires and Y-connectors or servo extensions, and the connection between your battery pack and the on/off switch with vinyl tape, heat shrink tubing or special clips suitable for that purpose.

❏ 12. Make sure any servo extension cords you may have used do not interfere with other systems (servo arms, pushrods, etc.).

❏ 13. Balance your propeller (and spare propellers).

❏ 14. Tighten the propeller nut and spinner.

❏ 15. Place your name, address, AMA number and telephone number on or inside your model.

❏ 16. Cycle your receiver battery pack (if necessary) and make sure it is fully charged.

❏ 17. If you wish to photograph your model, do so before your first flight.

❏ 18. Range check your radio when you get to the flying field.

FLYING

The Twinstar EP ARF is a great-flying model that flies smoothly and predictably. The Twinstar EP does not, however, possess the self-recovery characteristics of a primary R/C trainer and should be flown only by experienced R/C pilots.

CAUTION: (THIS APPLIES TO ALL R/C AIRPLANES): If, while flying, you notice an alarming or unusual sound such as a low-pitched "buzz," this may indicate control surface *flutter.* Flutter occurs when a control surface (such as an aileron or elevator) or a flying surface (such as a wing or stab) rapidly vibrates up and down (thus causing the noise). In extreme cases, if not detected immediately, flutter can actually cause the control surface to detach or the flying surface to fail, thus causing loss of control followed by an impending crash. The best thing to do when flutter is detected is to slow the model **immediately** by reducing power, then land as soon as safely possible. Identify which surface fluttered (so the problem may be resolved) by checking all the servo grommets for deterioration or signs of vibration. Make certain all pushrod linkages are secure and free of play. If it fluttered once, under similar circumstances it will probably flutter again unless the problem is fixed. Some things which can cause flutter are; Excessive hinge gap; Not mounting control horns solidly; Poor fit of clevis pin in horn; Side-play of wire pushrods caused by large bends; Excessive free play in servo gears; Insecure servo mounting; and one of the most prevalent causes of flutter; Flying an over-powered model at excessive speeds.

Takeoff

Before you get ready to take off, see how the model handles on the ground by doing a few practice runs at **low speeds** on the runway. If you have dual rates on your transmitter, set the switches to "high rate" for takeoff, especially when taking off in a crosswind. The Twinstar has more than adequate thrust with two motors so takeoffs will occur quickly and easily. When you first advance the throttle the plane will usually turn left slightly. Correct by applying sufficient right rudder to hold it straight down the runway. When the plane has sufficient flying speed, lift off by smoothly applying up elevator (don't "jerk" it off into a steep climb!), and climb out gradually.

Flight

For reassurance and to keep an eye on other traffic, it is a good idea to have an assistant on the flight line with you. Tell him to remind you to throttle back once the plane gets to a comfortable altitude. While full throttle is usually desirable for takeoff, most models fly more smoothly at reduced speeds.

Take it easy with the Twinstar for the first few flights, gradually getting acquainted with it as you gain confidence. Adjust the trims to maintain straight and level flight. You will find that the Twinstar is a very docile, honest plane that is capable of basic aerobatics. After flying around for a while and while still at a safe altitude with plenty of battery charge, practice slow flight and execute practice landing approaches by reducing the throttle to see how the model handles at slower speeds. Add power to see how the model climbs as well. Continue to fly around, executing various maneuvers and making mental notes (or having your assistant write them down) of what trim or C.G. changes may be required to fine tune the model so it flies the way you like. Mind your battery level, but use this first flight to become familiar with your model before landing.

Landing

To initiate a landing approach, lower the throttle while on the downwind leg. Allow the nose of the model to pitch downward to gradually bleed off altitude. Continue to lose altitude, but maintain airspeed by keeping the nose down as you turn onto the crosswind leg. Make your final turn toward the runway (into the wind) keeping the nose down to maintain airspeed and control. Level the attitude when the model reaches the runway threshold, modulating the throttle as necessary to maintain your glide path and airspeed. If you are going to overshoot, smoothly advance the throttle (always ready on the right rudder to counteract torque) and climb out to make another attempt. When you're ready to make your landing flare and the model is a foot or so off the deck, smoothly increase up elevator until it gently touches down. Once the model is on the runway and has lost flying speed, release the up elevator to place the nose on the ground, regaining nose wheel control. Remember to mind your battery charge. Do not wait until the battery is depleted to begin your landing approach. You will need some charge left if you need to abandon your approach and circle back around.

One final note about flying your model. 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!

IDENTIFICATION TAG

Fill out the tag and place it inside your model.

This model belongs to:

Name

Address

City, State, Zip

Phone Number

AMA Number