TWINSTAR™ ARF

INSTRUCTION MANUAL

Wingspan: 56 in [1420mm]
Wing Area: 560 sq in [36.1dm²]
Weight: 5-5.5 lb [2270 – 2490g]
Wing Loading: 21 – 23 oz/sq ft [64 – 70g/dm²]
Length: 40 in [1015mm]
Radio: 4-Channel with five servos
Engine: .15-.25 cu in [2.5-4cc] two-stroke, .26-.40 cu in [4.5-6.5cc] four-stroke

WARRANTY

Hobbico® 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 Hobbico's liability exceed the original cost of the purchased kit.** Further, Hobbico reserves the right to change or modify this warranty without notice.

In that Hobbico 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.

HOBBICO®

Champaign, IL
(217) 398-8970
E-mail: *airsupport@hobbico.com*

TABLE OF CONTENTS

INTRODUCTION

The Hobbico TwinStar™ ARF is a fun, exciting sport twin aircraft. It makes a terrific first twin or "twin trainer" to help you get ready to fly more true-to-scale and also more challenging-to-fly twins such as a DC-3, or it simply can be a really fun twin aircraft for the average sport pilot. ENJOY!

For the latest technical updates or manual corrections to the TwinStar visit the Hobbico web site at *www.hobbico.com*. Open the "Airplanes" link, then select the TwinStar 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.

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
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.

PROTECT YOUR MODEL, YOURSELF & OTHERS...FOLLOW THESE IMPORTANT SAFETY PRECAUTIONS

1. Your TwinStar should not be considered a toy, but rather a sophisticated, working model that functions very much like a full-size airplane. If the TwinStar is not assembled and operated correctly, it could possibly cause injury to you 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 correct.

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

4. You must use an R/C radio system that is in first-class condition, and a correctly sized engine and components (fuel tank, wheels, etc.).

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

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

7. 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 can help you find a club and experienced pilots.

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.

ADDITIONAL ITEMS REQUIRED

Hardware & Accessories

This is the list of hardware and accessories required to finish the Twinstar ARF. Order numbers are provided in parenthesis.

- ❑ Y-harness (HCAM2751 for Futaba®)
- ❑ R/C foam rubber 1/2" [13mm] (HCAQ1050)
- ❑ 3' [900mm] Standard silicone fuel tubing (GPMQ4131)

Adhesives & Building Supplies

- ❑ 1/2 oz. [15g] Thin Pro CA (GPMR6001)
- ❑ 1/2 oz. [15g] Medium Pro CA+ (GPMR6007)
- ❑ Pro 30-minute epoxy (GPMR6047)
- ❑ Pro 6-minute epoxy (GPMR6045)
- ❑ Drill bits: 1/16" [1.6mm] and 5/32" [4mm]
- ❑ 4-40 Tap and drill set (GPMR8101)
- ❑ Tap handle (GPMR8120)
- ❑ Stick-on, segmented lead weights (GPMQ4485)

Covering Tools

- ❑ Top Flite® MonoKote® sealing iron (TOPR2100)
- ❑ Top Flite Hot Sock™ iron cover (TOPR2175)

Optional Supplies & Tools

- ❑ 2 oz. [57g] Spray CA activator (GPMR6035)
- ❑ CA applicator tips (HCAR3780)
- ❑ CA debonder (GPMR6039)
- ❑ Epoxy brushes (6, GPMR8060)
- ❑ Mixing sticks (50, GPMR8055)
- ❑ Mixing cups (GPMR8056)
- ❑ Builder's Triangle Set (HCAR0480)
- ❑ Curved-tip canopy scissors for trimming plastic parts (HCAR0667)
- ❑ Pliers with wire cutter (HCAR0630)
- ❑ Robart® Super Stand II (ROBP1402)
- ❑ Masking tape (TOPR8018)
- ❑ Denatured alcohol (for epoxy clean up)
- ❑ Dead Center™ Engine Mount Hole Locator (GPMR8130)
- ❑ AccuThrow™ Deflection Gauge (GPMR2405)
- ❑ CG Machine™ (GPMR2400)

IMPORTANT BUILDING NOTES

Descriptions of **machine screws** include the number of **threads per inch** and a length. Example: 4-40 x 3/4" [19mm].

That describes a number four screw that is 3/4" long with forty threads per inch.

- 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.** If necessary, modify the part to ensure 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 6-minute, 30-minute **or** 45-minute epoxy. When 30-minute epoxy is specified it is **highly** recommended that you use only 30-minute (or 45-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. In many cases, you can get a different look at the same parts by looking at photos in following steps.

ORDERING REPLACEMENT PARTS

E-Replacement parts for the Hobbico TwinStar 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 e-mail order company.

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. If a hobby shop is not available, replacement parts may also be ordered from Tower Hobbies at *www.towerhobbies.com*, or by calling toll free (800) 637-6050.

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.

If ordering via mail, send parts orders and payments by personal check to:

Hobby Services
3002 N Apollo Drive, Suite 1
Champaign IL 61822

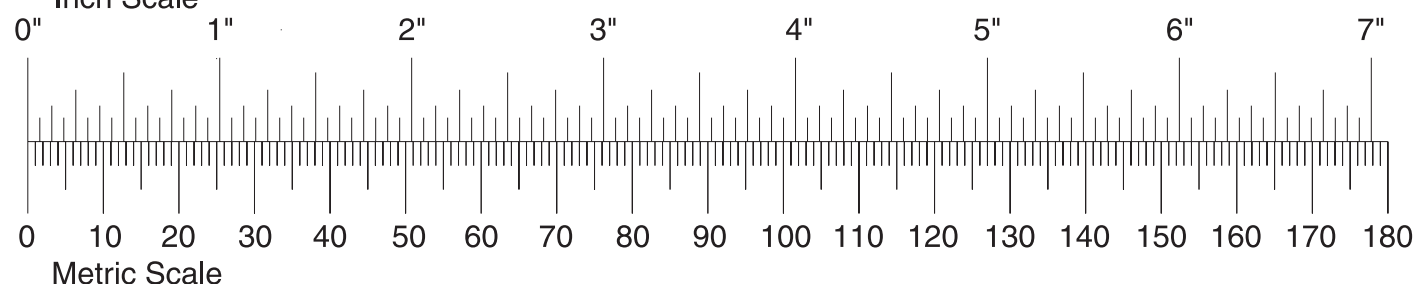
Be certain to specify the order number exactly as listed in the **Replacement Parts List**. Payment by credit card or personal check only; no C.O.D.

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

Replacement Parts List

Order Number	Description	How to Purchase
	Missing pieces	Contact Product Support
	Instruction manual	Contact Product Support
HCAA3750	Wing Set	Contact Your Hobby Supplier to Purchase These Items
HCAA3751	Fuselage	
HCAA3752	Tail Set	
HCAA3753	Spinner (2 pcs.)	
HCAA3754	Landing Gear	
HCAA3755	Nacelle Set (Left & Right)	
HCAA3756	Nacelle Cover (2 pcs.)	
HCAA3757	Nose Cone	
HCAA3758	Fuel Tank	
HCAA3759	Decal Set	

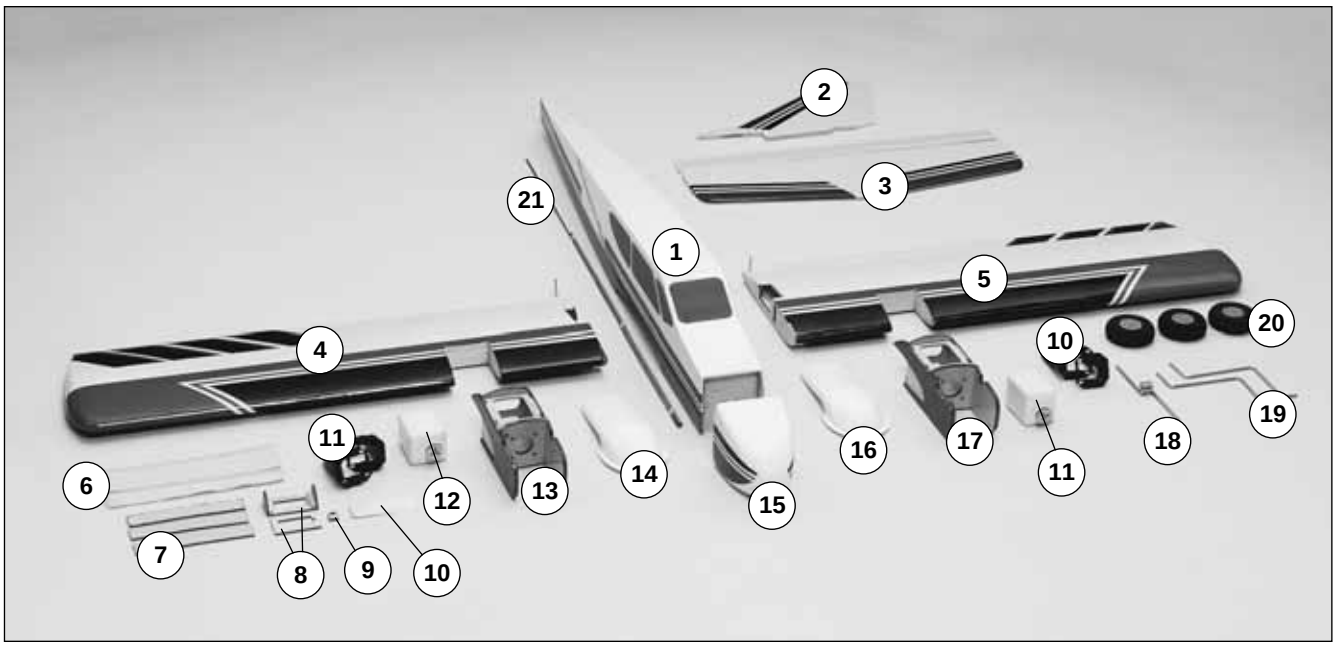
To convert inches to millimeters, multiply inches by 25.4



KIT CONTENTS

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.

Hobbico Product Support
3002 N Apollo Drive, Suite 1
Champaign, IL 61822
Telephone: (217) 398-8970, ext. 5
Fax: (217) 398-7721
E-mail: *airsupport@hobbico.com*



Kit Contents

1. Fuselage
2. Fin & Rudder
3. Stabilizer & Elevator
4. Left Wing & Aileron
5. Right Wing & Aileron
6. Hook & Loop Material
7. Wing Joiner (3)
8. Servo Mounts
9. Nose Gear Pushrod Support
10. Wing Bolt Plate
11. Engine Mounts
12. Fuel Tank (2)
13. Right Engine Nacelle
14. Right Nacelle Cover
15. Nose Cone
16. Left Nacelle Cover
17. Left Engine Nacelle
18. Nose Gear
19. Main Landing Gear (2)
20. 2-3/4" [70mm] Wheels (3)
21. Pushrods

Kit Contents (not photographed)

(2) Large Control Horn
(6) Nylon Clevis
(2) Aileron Torque Rod Horn
(4) 2-56 x 1/2" [13mm] Machine Screw
(6) Nylon FasLink
(1) Screw-Lock Pushrod Connector
(1) Nylon Retainer
(1) 4-40 x 1/4" [6mm] Socket Head Screw
(6) Silicone Retainer
(7) 5/32" [4mm] Wheel Collar
(6) 6-32 Set Screw
(1) 6-32 x 1/4" [6mm] Socket Head Cap Screw
(1) Nylon Steering Arm
(1) Nylon Nose Gear Mount
(4) 4-40 x 1/2" [13mm] Bolt
(28) #4 Washer
(16) 4-40 x 3/4" [19mm] Socket Head Cap Screw
(16) #4 Lock Washer
(2) 1/4-20 x 2" [50mm] Nylon Bolt
(1) Landing Gear Strap
(8) #4 x 1/2" [13mm] Screw
(12) #2 x 3/8" [9.5mm] Screw
(12) #2 Washer

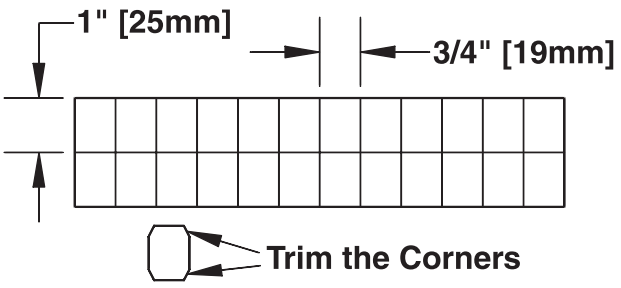
PREPARATIONS

❏ 1. If you have not yet done so already, remove the major parts of the kit from the box (wings, fuse, tail parts, etc.) and inspect them for damage. If any parts are damaged or missing, contact ***Product Support*** as listed on page 5.

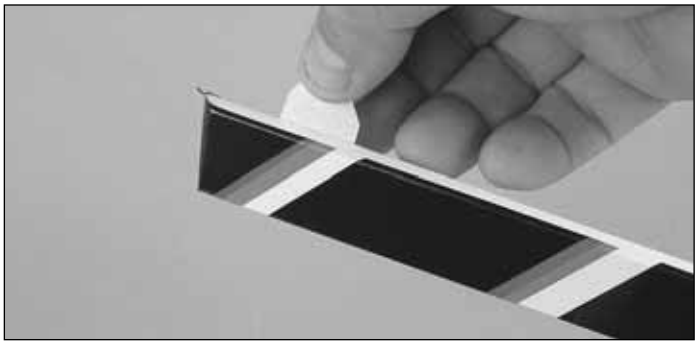
❏ 2. Remove the masking tape and separate the ailerons from the wing, the rudder from the fin and the elevator from the stab. Where necessary, use a covering iron set for low temperature covering materials, with a covering sock, to tighten any covering that may have loosened during storage or from removing the masking tape. Apply pressure over sheeted areas to **thoroughly** bond the covering to the wood.

BUILDING INSTRUCTIONS

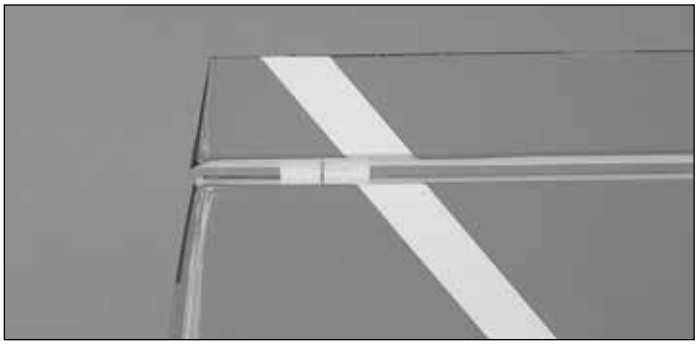
Hinge the Control Surfaces



❏ 1. Cut nineteen 3/4" x 1" [19 x 25mm] hinges from the 2" x 9" [50 x 230mm] CA hinge strip. Snip the corners off so they go in easier.

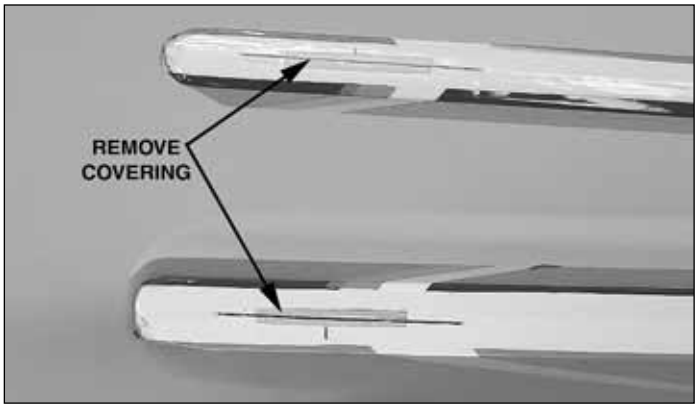


❏ 2. Test fit four hinges into the hinge slots of both ailerons and both wings. If you have difficulty inserting the hinges, insert a #11 blade into the slot and carefully move it back and forth to slightly widen the slot.



❏ 3. Test fit the ailerons to the wing with the hinges.

❏ 4. Separate the ailerons from the wing and take out all the hinges.

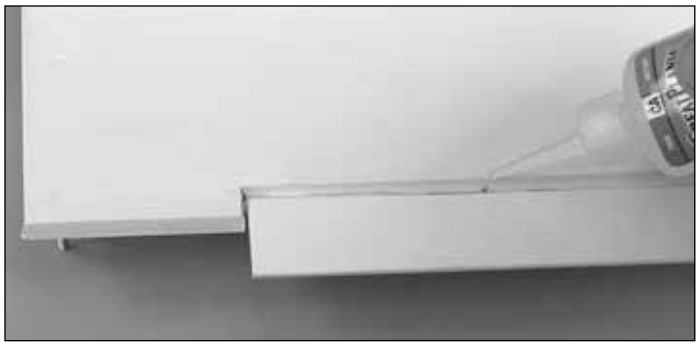


❏ 5. Cut a small strip of covering from both sides of each hinge slot. If this is not done, the covering may interfere with the penetration of the CA into the slot and the movement of the aileron.

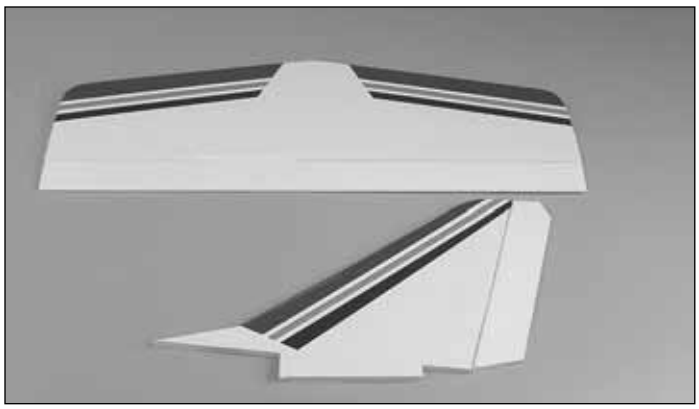
❏ 6. Fit the hinges to the ailerons. Be sure that slightly less than half the hinge is within the aileron, and the hinge is straight.

❑ 7. Mix a small amount of epoxy. Coat the inside of the aileron torque rod holes with epoxy. DO NOT put epoxy in the hinge slots.

❑ 8. Fit the ailerons to the wings with the hinges and the torque rods. Adjust the aileron so there is a small gap–just enough to see light through or to slip a piece of paper through–between the aileron and the wing. Remove any excess epoxy with a paper towel dampened with denatured rubbing alcohol.

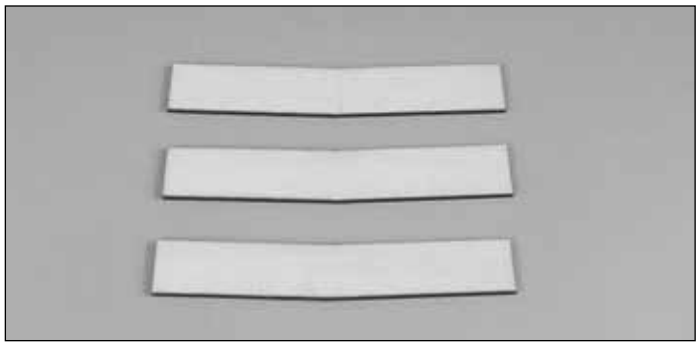


❑ 9. Apply six drops of thin CA to the top and bottom of each hinge. Do not use CA accelerator. After the CA has fully hardened, test the hinges by pulling on the ailerons.

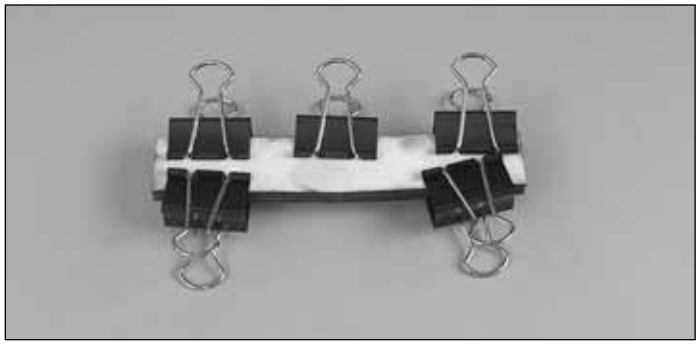


❑ 10. Install the right aileron, elevator and the rudder using the same technique as the ailerons.

Join the Wing Halves



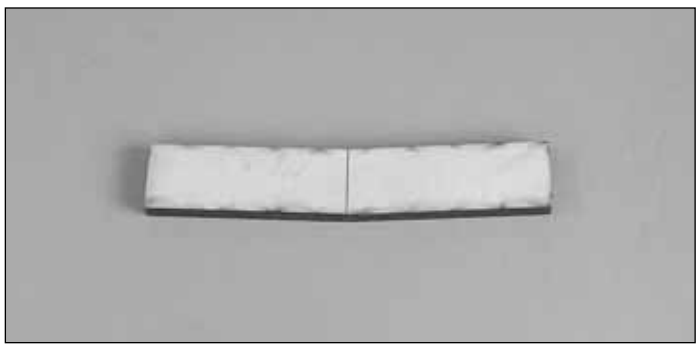
❑ 1. Locate the three 1/8" [3mm] die-cut plywood wing joiners. Arrange the joiners in the same orientation as they will be glued together.



❑ 2. Mix approximately 1/4 oz. [7.5ml] of 30-minute epoxy. Using a mixing stick or epoxy brush, apply an even coat of epoxy on both sides of one of the wing joiners. Sandwich this coated joiner between the remaining two joiners. Quickly proceed through the following steps (3 and 4) before the epoxy hardens.

❑ 3. Excess epoxy will squeeze out of the seams between the joiners and must be removed before the epoxy is allowed to cure. Use a paper towel dampened with rubbing alcohol to remove any excess epoxy.

❑ 4. Use clamps to firmly hold the wing joiners together. If any more epoxy squeezes out, remove it using a paper towel. Make sure that the joiners are evenly lined up with each other.



❑ 5. After the epoxy has hardened, remove the clamps. Draw a centerline on both sides of the plywood wing joiner.

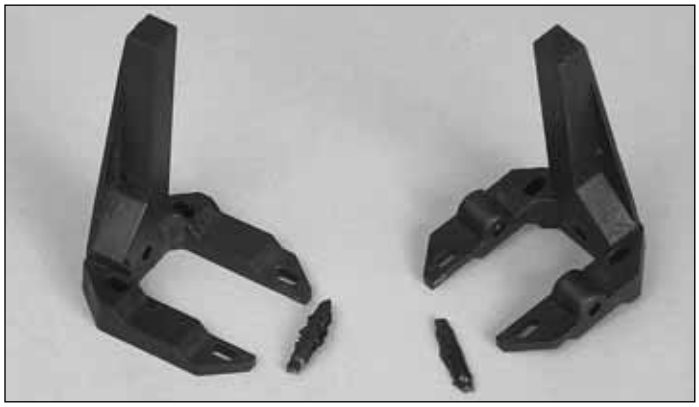
❏ 6. Test fit the wing joiner into both wing panels. The joiner should slide in with little resistance up to the centerline. Test fit the wing panels together, making sure that they are flush without any gaps.

❏ 7. Confirm the dihedral is between 2-1/4" and 2-3/4" [55 and 70mm] measured from the center of one wing tip to the work bench with the other wing panel flat on the bench. If your wing's dihedral is outside this range, please contact **Product Support**.

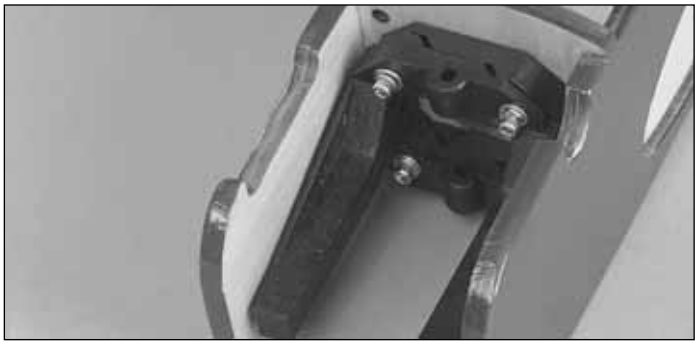
❏ 8. Mix 3/4oz [25ml] of 30-minute epoxy to glue the wing together. Liberally coat the inside of the left wing joiner pocket and left root rib. Fit the joiner into the joiner pocket. Be sure the joiner is in the correct orientation to the wing to provide the proper dihedral angle.

❏ 9. Fit the right wing half over the joiner. Clean the excess epoxy from the outside of the wing using a paper towel dampened with denatured rubbing alcohol. Use clamps and several strips of masking tape to hold the panels securely together.

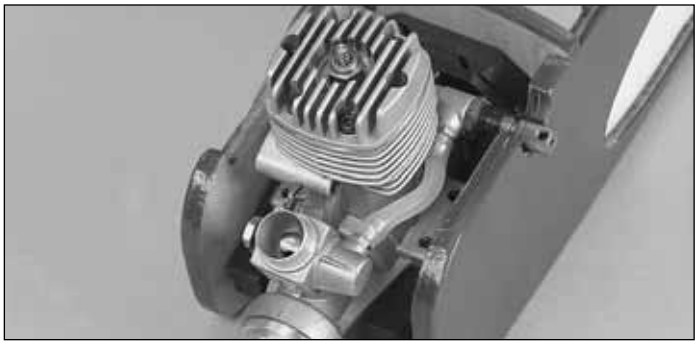
Mount the Engines



❏ ❏ 1. Trim the spreader bars from both halves of one engine mount.

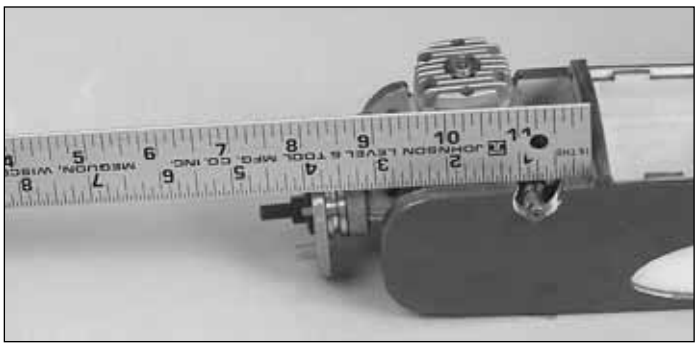


❏ ❏ 2. Mount the engine mount to the left firewall with four 4-40 x 3/4" [19mm] socket head cap screws, #4 flat washers and #4 lock washers. Do not fully tighten the bolts.

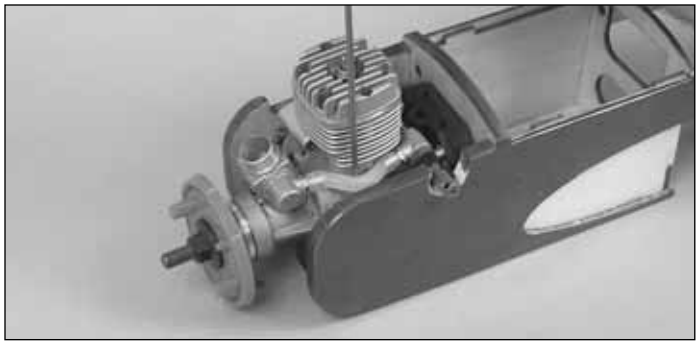


❏ ❏ 3. Adjust the width of the mount to fit the engine. Tighten the mounting bolts.

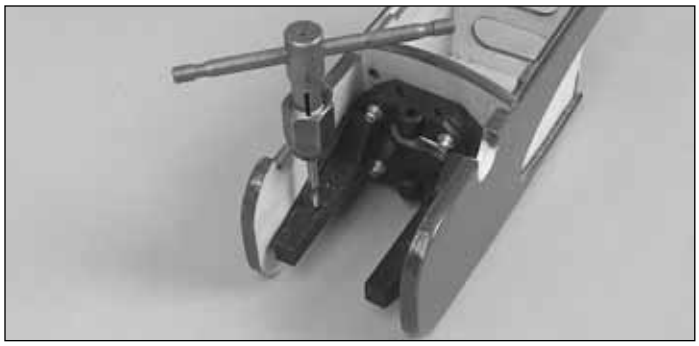
❏ ❏ 4. Place the backplate of the spinner on the engine. **Note:** Depending on your engine choice, it may be necessary to enlarge the hole in the backplate.



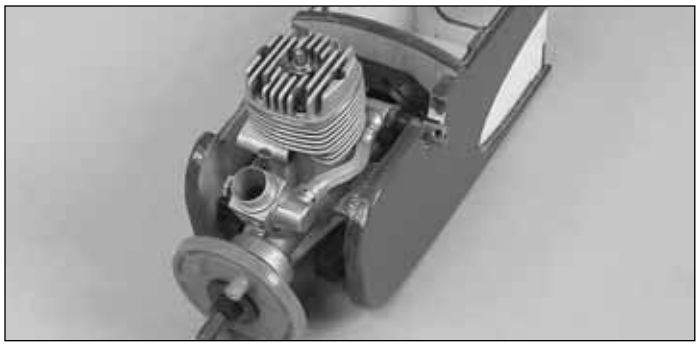
❏ ❏ 5. Use a few drops of medium CA to tack glue the engine to the mount with the backplate of the spinner 3-3/4" [95mm] from the firewall.



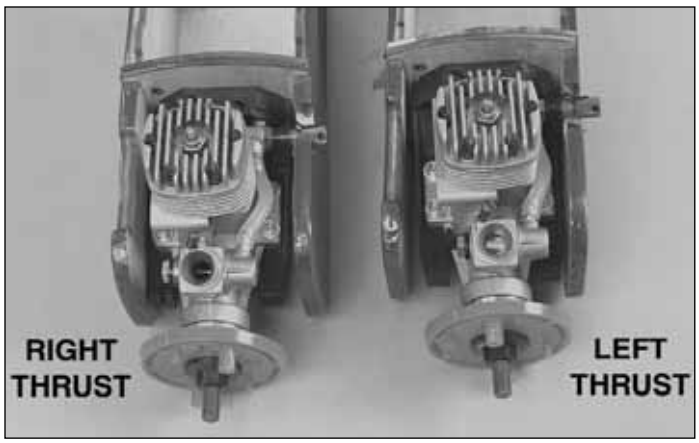
❏ ❏ 6. Use the Great Planes® Dead Center™ Engine Mount Hole Locator (GPMR8130) or your preferred method to mark the engine mount holes onto the engine mount.



❏ ❏ 7. Remove the engine from the mount. Drill #43 holes through the mount at the marks you made. Tap 4-40 threads into the mount.

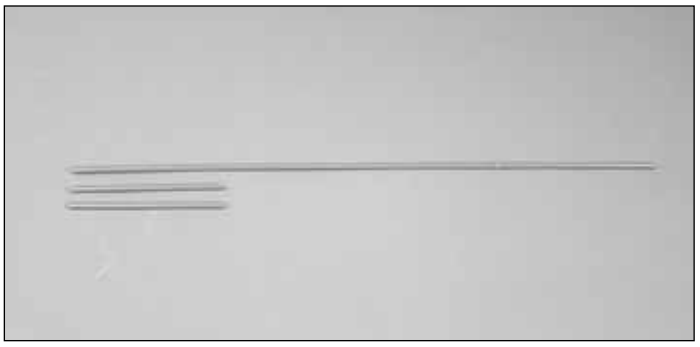


❏ ❏ 8. Mount the engine to the mount with four 4-40 x 3/4" [19mm] socket head cap screws, #4 flat washers and #4 lock washers.

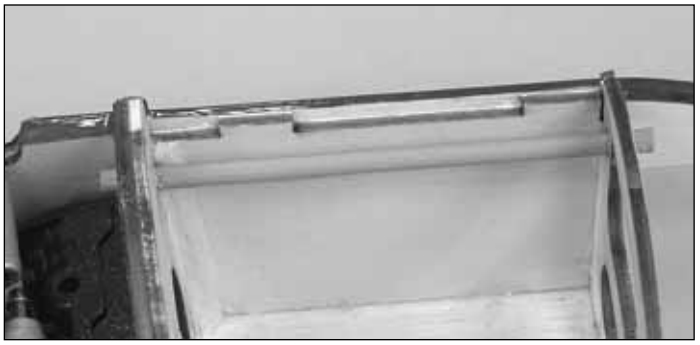


❏ 9. Repeat steps 1-8 for the right engine.

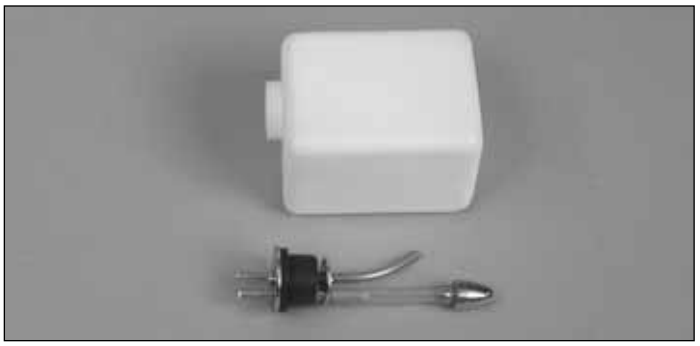
Assemble & Install the Fuel Tanks



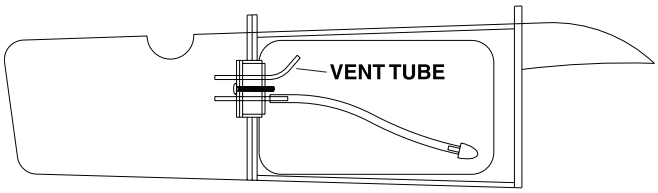
❏ 1. Cut two 4" [100mm] pieces from the 24" [600mm] long gray plastic tube. The remaining 16" [400mm] piece will be used for the nose gear.



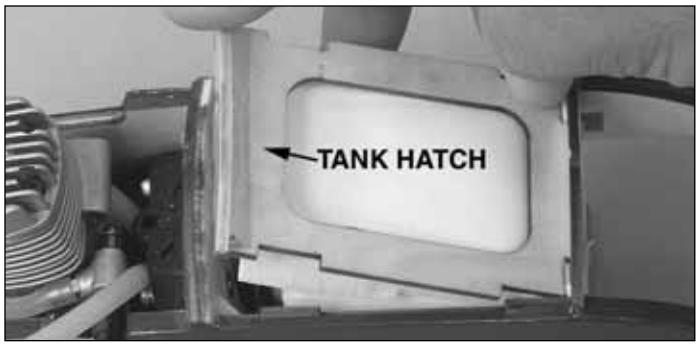
❏ 2. Glue one 4" tube to the formers in the left nacelle as shown.



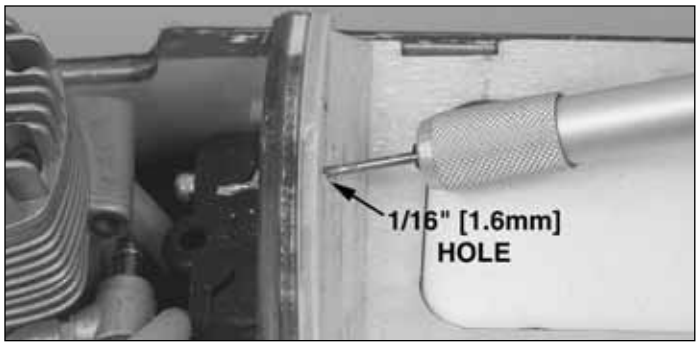
❏ 3. Arrange the fuel tank stopper and tubes as shown in the photo, then insert them into the tank. Tighten the screw to expand the stopper, thus sealing the tank. Be certain the fuel line weight (clunk) at the end of the fuel line inside the tank does not contact the rear of the tank. Otherwise, the line may become stuck above the fuel level and discontinue fuel flow. Attach a 12" [300mm] piece of fuel line to both tank lines.



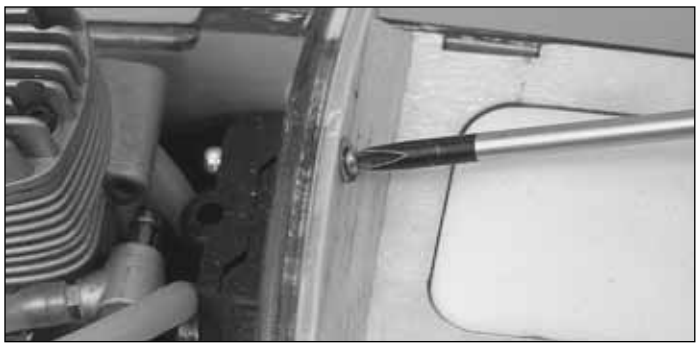
❏ 4. Place a 1/2" [13mm] thick piece of foam in the bottom of the tank compartment. Be certain the vent tube inside the tank is pointing upward.



❏ 5. Place a 1/2" [13mm] thick piece of foam on top of the tank. Fit the tank hatch into the rear former in the nacelle.

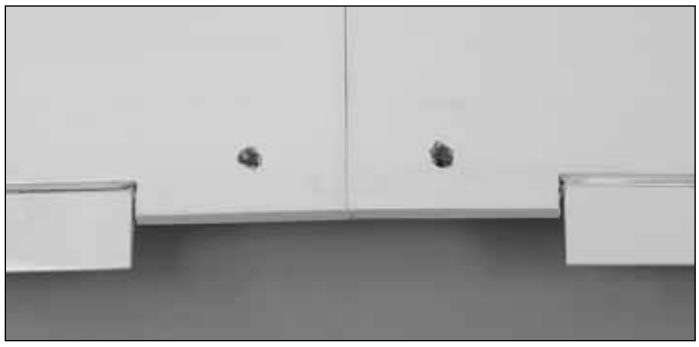


❏ 6. Rotate the tank hatch down to capture the tank. Drill a 1/16" [1.6mm] hole through the front of the tank hatch and the forward former.

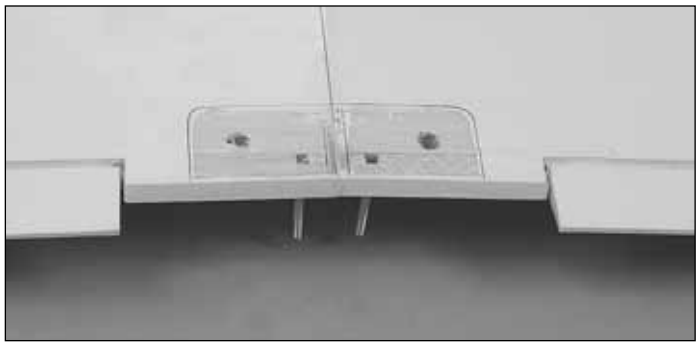


❏ 7. Secure the hatch with a #2 x 3/8" [9.5mm] wood screw and #2 washer.

Mount the Tail



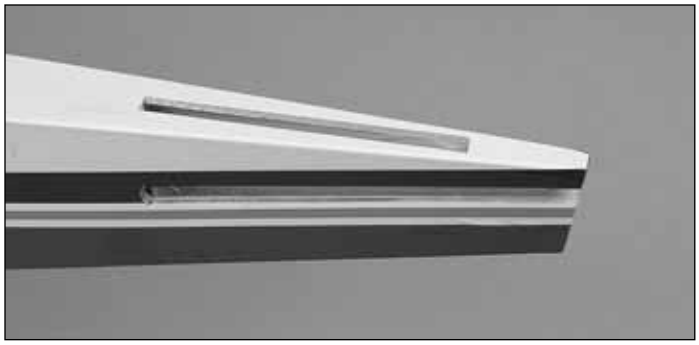
❏ 1. Cut the covering from the wing bolt holes. Center the wing bolt plate on the bottom of the wing and trace around it with a ballpoint pen.



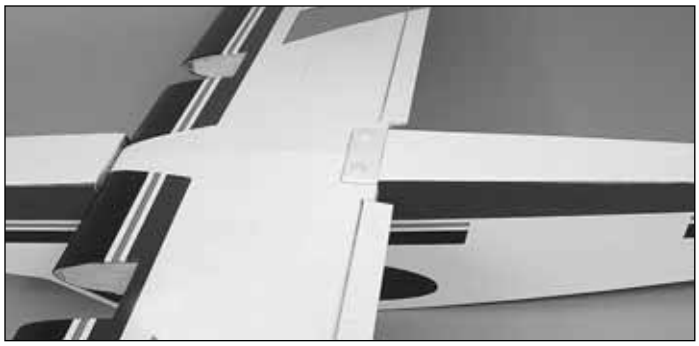
❏ 2. Trim and remove the covering 1/16" [1.6mm] inside the pen line.

❏ 3. Glue the wing bolt plate to the wing with medium CA. **Note:** There are two holes through the wing where the aileron torque rods are located. **DO NOT** get glue in these holes.

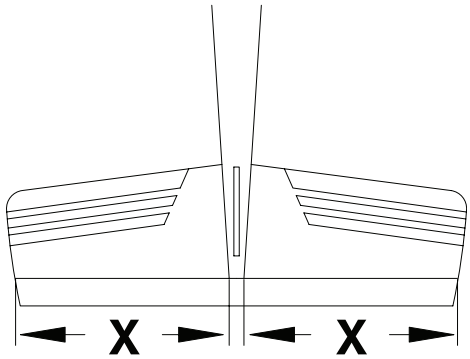
❏ 4. Using the holes in the wing as a guide, drill 5/16" [8mm] holes through the wing bolt plate.



❏ 5. Use a sharp hobby knife to remove the covering from the stab and fin slots.

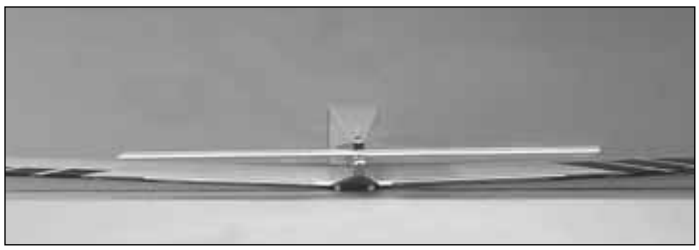


❏ 6. Attach the wing to the fuse using two 1/4-20 x 2" [50mm] nylon wing bolts.

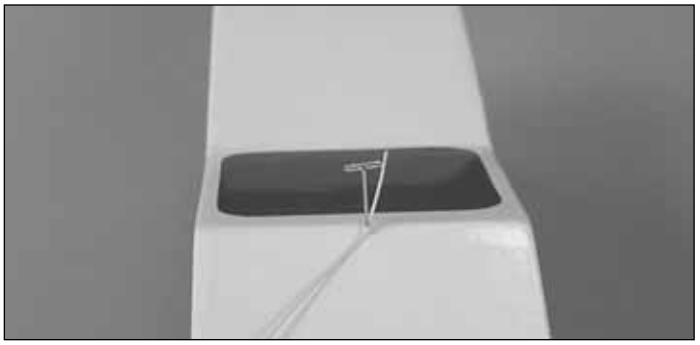


X=X

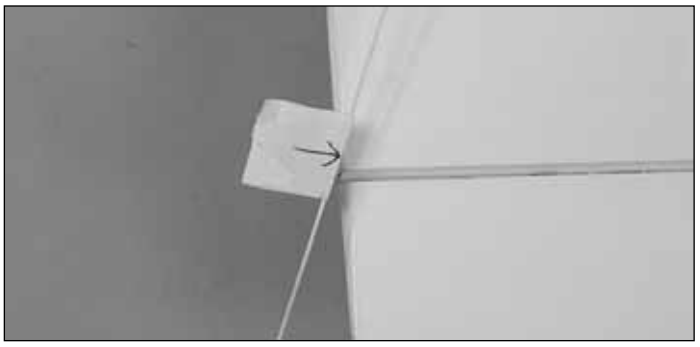
❏ 7. Slide the stab into the fuse. Center the trailing edge by taking accurate measurements as shown in the "X" = "X" sketch.

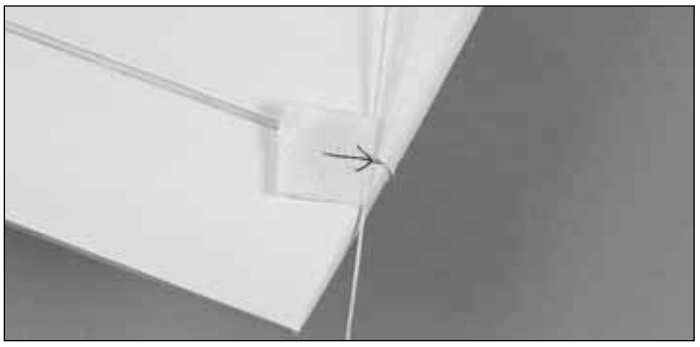


❏ 8. With the wing mounted to the fuse, stand five to ten feet behind the model and view the stab and wing. If the stab is parallel to the wing, proceed to the next step. If the stab and wing do not align, remove the stab and sand the high side of the slot in the fuse where the stab fits until the stab aligns with the wing.

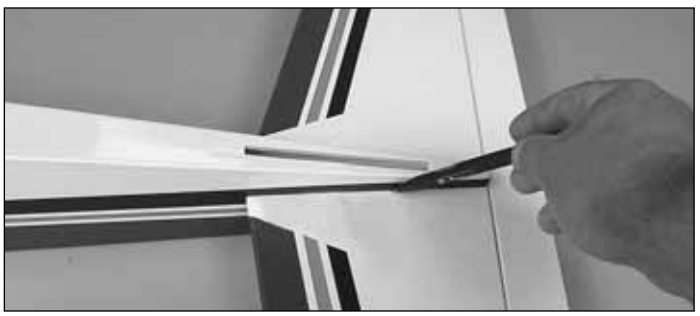


❏ 9. Stick a pin into the top of the fuse centered at the front of the turtle deck. Tie a small loop in one end of a 42" [1000mm] piece of non-elastic string. Slip the loop in the string over the T-pin.

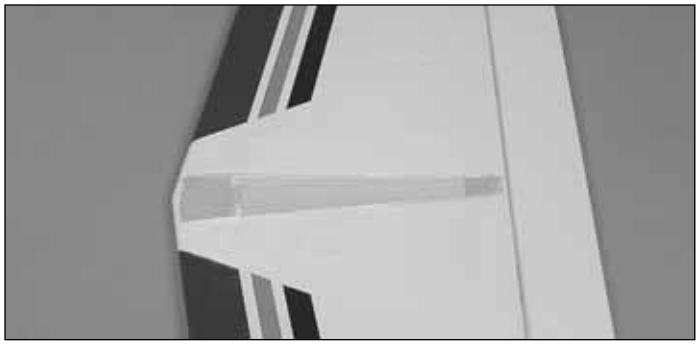




❏ 10. Fold a piece of masking tape over the other end of the string and draw an arrow on it. Slide the tape along the string and align the arrow with one end of the stab as shown in the photo. Swing the string over to the same position on the other end of the stab. While keeping the stab centered from side-to-side, adjust the stab and slide the tape along the string until the arrow aligns with both sides. Be certain the stab remains centered from side-to-side during this process.



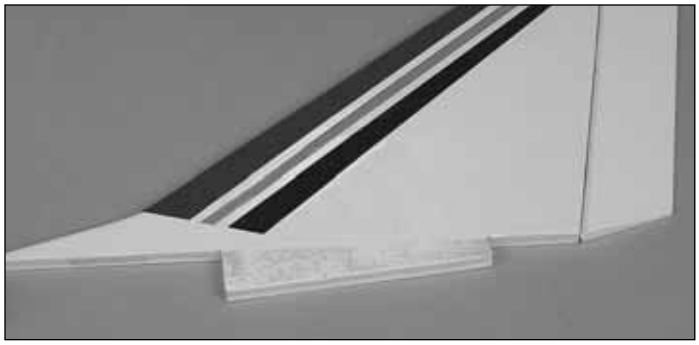
❏ 11. Use a fine-point felt-tip pen such as a Top Flite® Panel Line Pen™ (TOPQ2510) to mark the outline of the fuse onto the top and bottom of both sides of the stab.



❏ 12. Remove the stab from the fuse. Use a sharp #11 hobby knife to cut the covering from the stab 1/16" [1.6mm] inside the lines you marked. Use care to cut **only into the covering** and **not** into the wood. Wipe away the marks on the stab you made in the previous step.

❏ 13. Use 30-minute epoxy to glue the stab into the fuse. For the most strength, apply epoxy to both sides of the stab and to the slot in the fuselage. Slide the stab into position. Wipe away excess epoxy with a tissue dampened with alcohol. Confirm the stab is centered, level with the wing and the string still aligns side to side.

❏ 14. Fit the fin in place and mark the covering on the fin where it contacts the fuse.

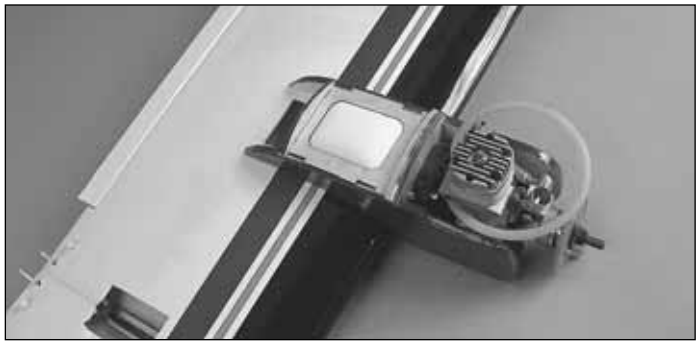


❏ 15. Trim the covering 1/16" [1.6mm] below the lines you made on the fin. Cut away only the covering. Be very careful not to cut into the fin itself. Wipe away the marks on the fin you made in the previous step. The epoxy used in the next step will make removing those lines difficult.

❏ 16. Apply epoxy to all joining surfaces of the fin. Fit the fin in place, aligning the TE of the fin with the TE of the fuse. Confirm that the fin is perpendicular to the stab.

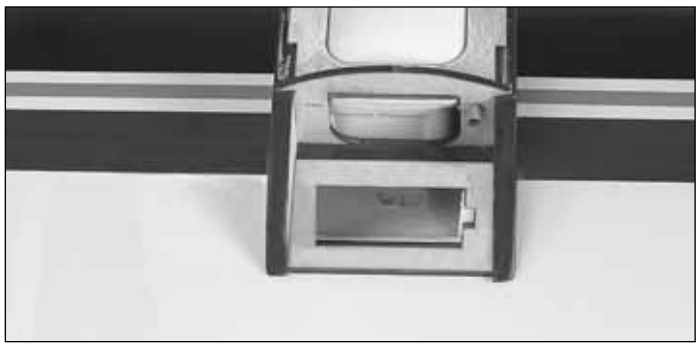
Finish the Wing

❏ 1. Use a sharp hobby knife to remove the covering from the throttle servo openings.

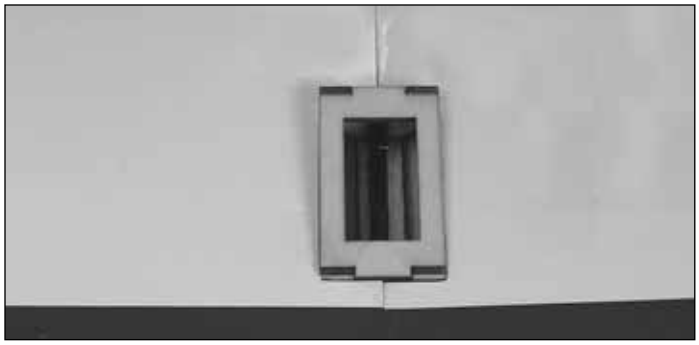


❏ 2. Test fit the **left nacelle** in the **left wing**. Remove the nacelle. Coat the rib openings on the left wing and the rib openings on the left nacelle with 30-minute epoxy. Push the nacelle onto the wing. Wipe away any excess epoxy with a paper towel dampened with alcohol. **Note:** The left engine points slightly to the left and the right engine points slightly to the right.

❏ 3. Test fit the **right nacelle** onto the **right wing**. Remove the nacelle. Coat the rib openings on the right wing and the rib openings on the right nacelle with 30-minute epoxy. Push the nacelle onto the wing. Wipe away any excess epoxy with a paper towel dampened with alcohol.



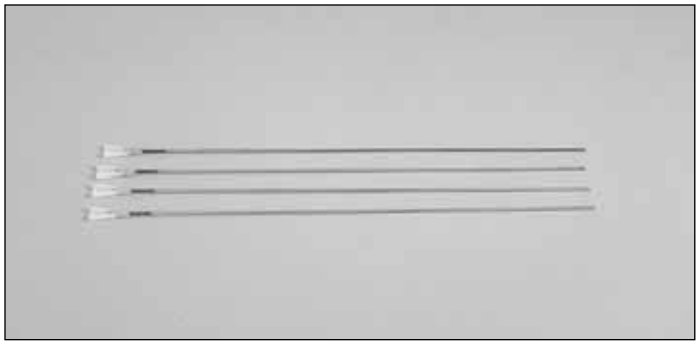
❏ 4. Glue the servo trays to the sides of the nacelles with thin CA. **Note:** The notches in both of the servo trays go towards the right.



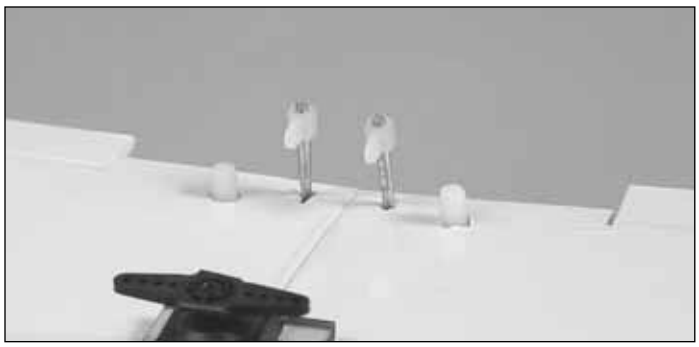
❏ 5. Glue the aileron servo tray in place with medium CA.

❏ 6. Install the throttle servos with the hardware provided with the servos.

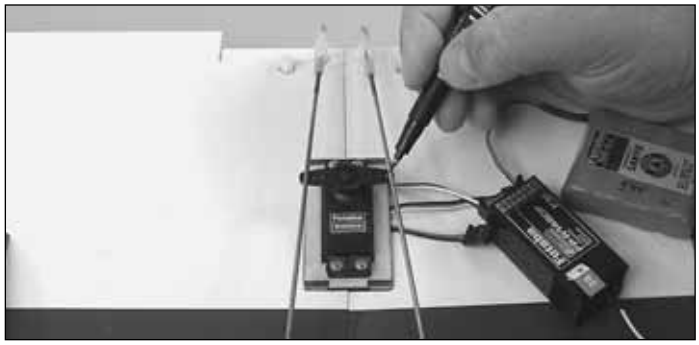
❏ 7. Install the aileron servo.



❏ 8. Turn a nylon clevis 15 full turns onto each of the four 12" [300mm] pushrods.

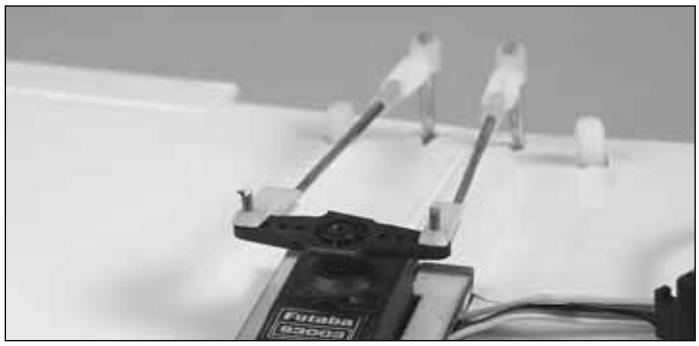


❏ 9. Thread the nylon aileron torque rod horns onto the aileron torque rods so that 1/16" [1.6mm] of threads are showing above the horns.



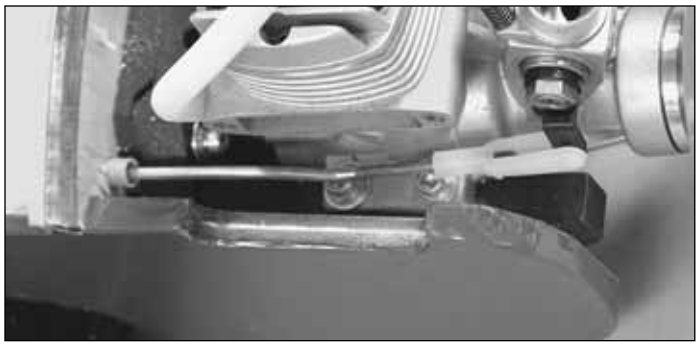
❏ 10. Center the aileron trim and turn the transmitter on. Plug the aileron servo and battery into the receiver. Attach the pushrods to the aileron torque rod horns. Center the ailerons and mark the location the pushrod crosses the servo arm.

❏ 11. Bend the pushrods 90 degrees at the marks you made. Cut the pushrod 3/8" [9.5mm] from the bend. Fit the pushrod through the holes in the servo arm. **Note:** The cutoff piece of pushrod makes a great drill bit if the hole in the arm is too tight.



❏ 12. Using FasLinks, attach the pushrods to the servo arm.

❏ ❏ 13. Slide the throttle pushrod through the tube. It is very important that the throttle pushrod move freely. To ensure that it does, bend the pushrod as shown.



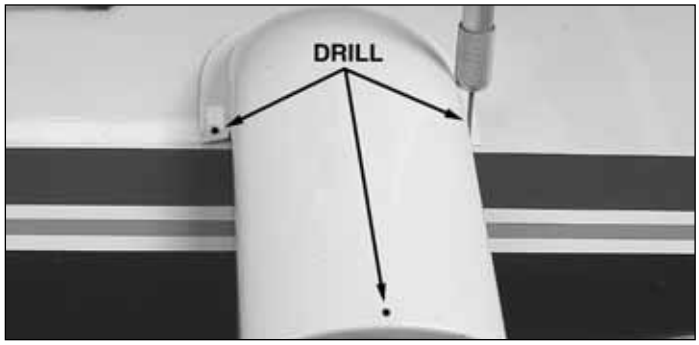
❏ ❏ 14. Center the throttle stick and its trim. Turn the transmitter on. Plug the throttle servo and battery into the receiver. Position the servo arm so that it is perpendicular to the pushrod. Attach the throttle pushrod to the carburetor arm. Position the pushrod so that the throttle barrel is halfway open.

❏ ❏ 15. Mark the pushrod where it crosses the hole of the servo arm.

❏ ❏ 16. Bend the pushrods 90 degrees at the mark you made. Cut the pushrod 3/8" [9.5mm] from the bend. Fit the pushrod through the holes in the servo arm.

❏ 17. Repeat steps 13-16 for the other engine.

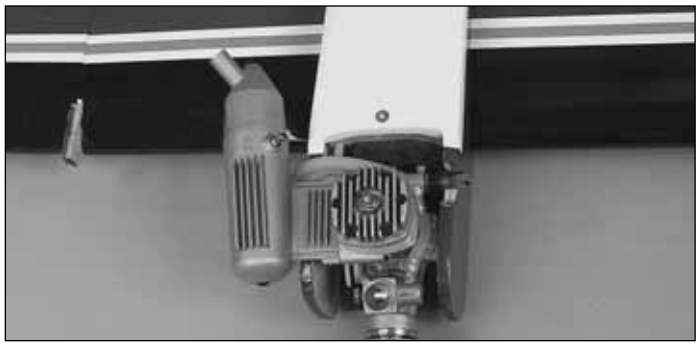
❏ 18. Connect both servos to the throttle channel with a Y-harness. Confirm that the full throttle, half throttle and idle are the same between the two engines. Make adjustments where necessary.



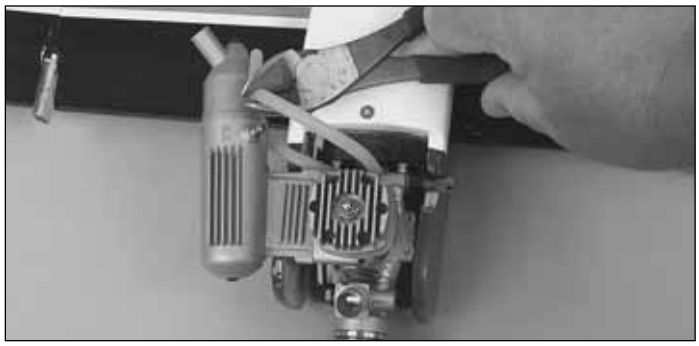
❏ 19. Trim the plastic nacelle covers along the trim lines. While holding the cover in place, drill three 1/16" [1.6mm] holes as shown.

❏ 20. Harden the holes in the wing sheeting with a drop of thin CA. **Note:** Make sure the CA does not close the holes. If it does, blow on it so the CA goes inside the wing.

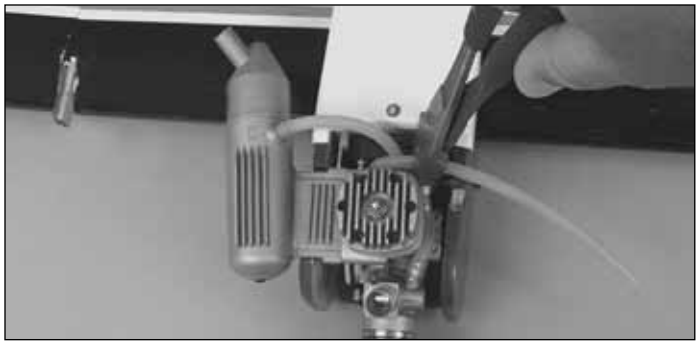
❏ 21. Mount the covers with #2 x 3/8" [9.5mm] screws and #2 washers.



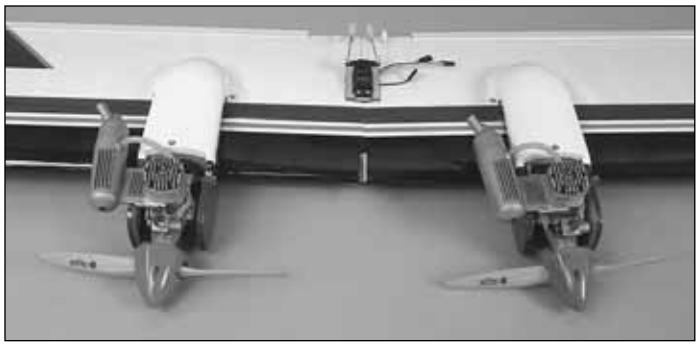
❏ 22. Attach the mufflers to the engines.



❏ 23. Cut the fuel line that comes from the vent tube so it is the correct length to reach the muffler.



❏ 24. Cut the fuel line that comes from the clunk so it is the correct length to reach the carburetor.

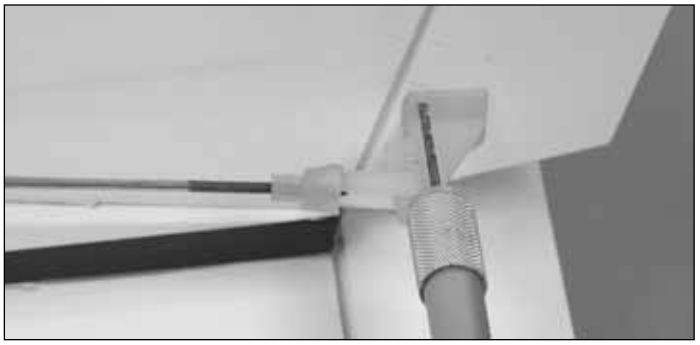


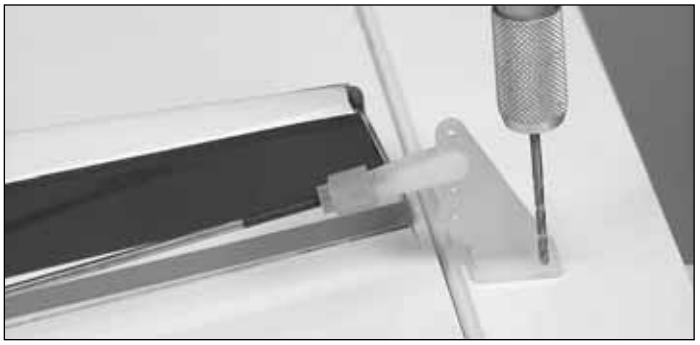
❏ 25. Install the propellers and spinners.

Install the Radio Gear

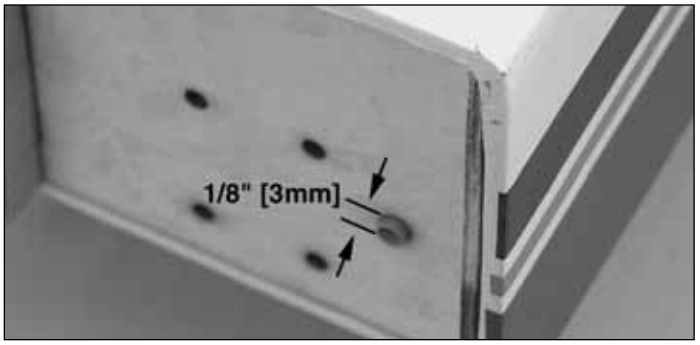
❏ 1. Cut and remove the covering from the pushrod tubes on the right side and top of the fuselage.

❏ 2. Screw the nylon clevises 20 turns onto the two 36" [900mm] pushrods. Place a silicone retainer over each of the clevises. Holding the clevis end, slide the two pushrods into the fuse through the openings you just trimmed.





❏ 3. Connect a large control horn to each clevis, using the second hole from the outside. Use the pushrods to set the location for the control horns. Hold each horn in position and mark the location of the mounting holes. Drill 3/32" [2.4mm] mounting holes through the marks. Attach the horns using #2 x 1/2" [13mm] screws and nylon nut plates. Do not overtighten the screws, as this may crush the underlying balsa. Slip the silicone retainer into place on the clevis.



❏ 4. Cut 3" [76.2mm] from the end of the 16" [400mm] gray pushrod outer tube. Roughen 1" [25mm] on each end of the 13" piece. Slide the tube through the forward former in the fuse so that 1/8" is protruding from the front. Glue the tube to the former with thin CA.

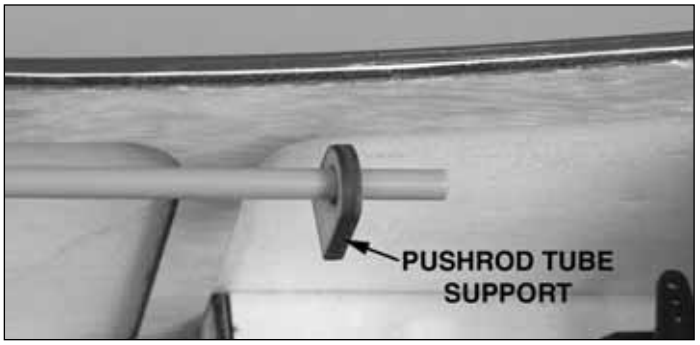
❏ 5. Make two servo arms as shown in the photo.

❑ 6. Mount the two servos, following the manufacturer's recommendations.

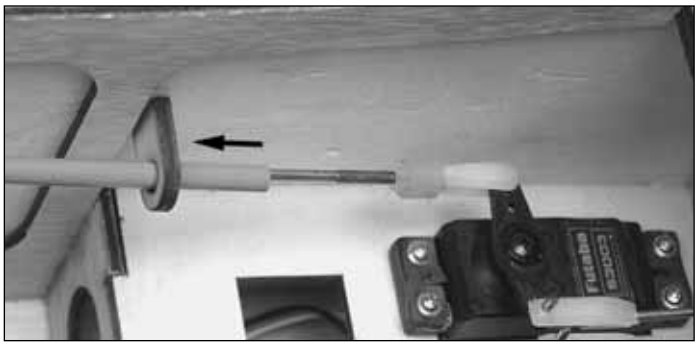
❑ 7. Turn on your transmitter and receiver and center the rudder and elevator trims. Center the elevator and mark the elevator pushrod where it crosses the servo arm. Enlarge the servo horn holes with a 5/64" [2mm] drill bit.

❑ 8. Make a 90° bend in the pushrod on your mark, then insert it through the enlarged hole in the servo arm. Cut off the excess wire 3/8" [9.5mm] above the bend. Secure the wire in place with a nylon FasLink.

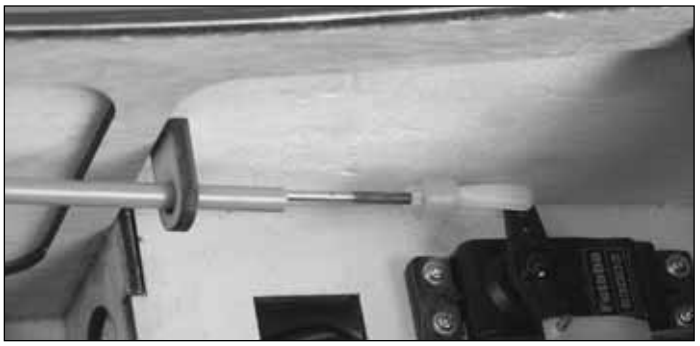
❑ 9. Follow the same steps for the rudder servo. Attach the rudder pushrod to the inside arm. You will attach the nose wheel to the outside arm later.



❑ 10. Slide the plywood **pushrod tube support** over the nose wheel pushrod tube.

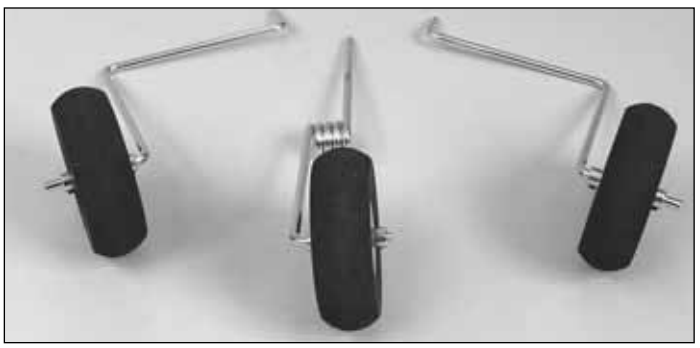


❑ 11. Screw the nylon clevises 20 turns onto the 17-1/2" [445mm] pushrods. Place a silicone retainer over the clevis. Slide the 17-1/2" [445mm] pushrod through the pushrod tube from the servo end. Attach the clevis to the servo.

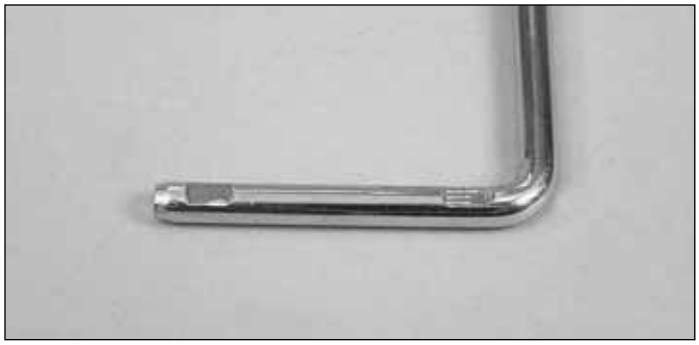


❑ 12. Glue the plywood pushrod tube support to the fuse side and the pushrod tube.

Install the Landing Gear

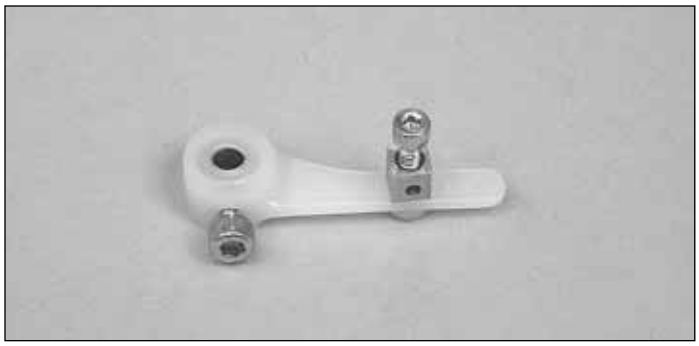


❑ 1. Temporarily slide the wheel collar, wheel and second wheel collar onto each of the three gear legs.



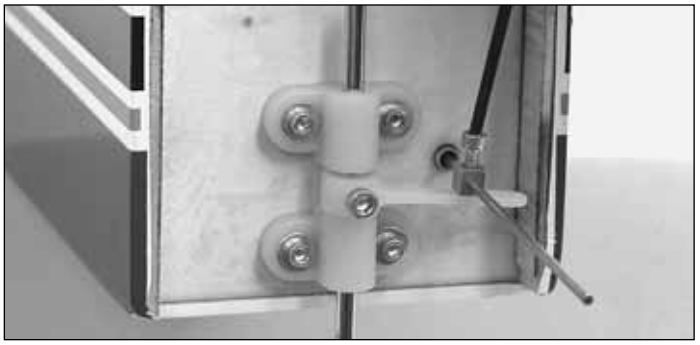
❏ 2. Determine where the set screw for each wheel collar will be positioned on the gear legs. Remove the wheel and wheel collars. File a flat spot on the bottom of the axle for the set screws.

❏ 3. Mount the nylon nose gear bearing to the fuse with four 4-40 x 1/2" [13mm] socket head cap screws.



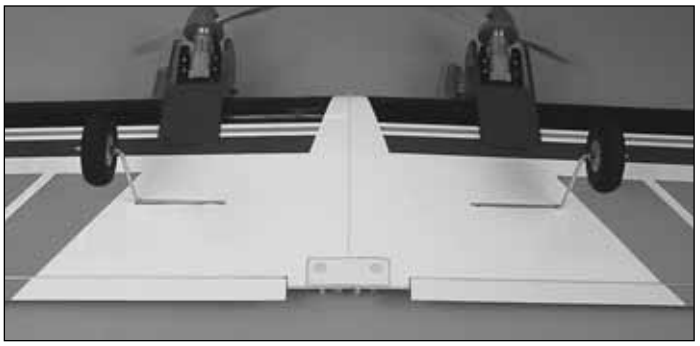
❏ 4. Assemble the steering arm pieces as shown.

❏ 5. Slide the brass screw-lock pushrod connector body down the pushrod. Slide the nose gear up through the steering arm and tighten the 6-32 socket head cap screw on the gear leg.

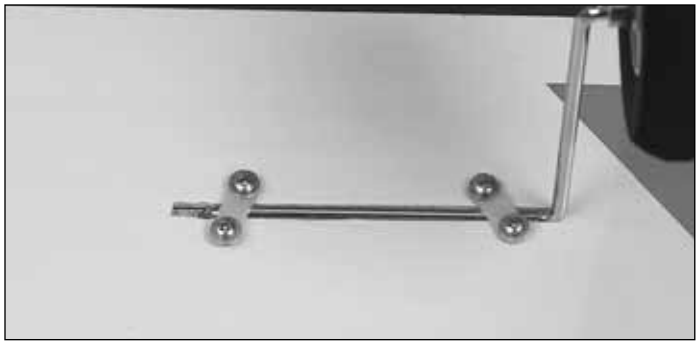


❏ 6. Center the rudder servo and tighten the 4-40 socket head cap screw.

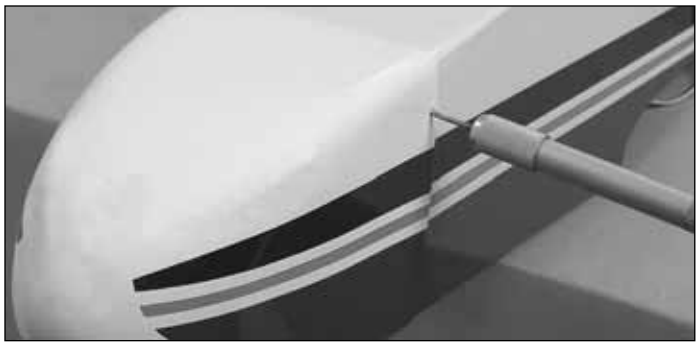
❏ 7. Trim the covering from the landing gear slots in the bottom of the wing.



❏ 8. Install the wire landing gear into the slots in the bottom of the wing.



❏ 9. Place two nylon **landing gear straps** over the landing gear wire as shown. Drill a 1/16" [1.6mm] pilot hole for each hole in the landing gear strap. Harden the holes with thin CA. Install each strap with two #4 x 1/2" [13mm] sheet metal screws.

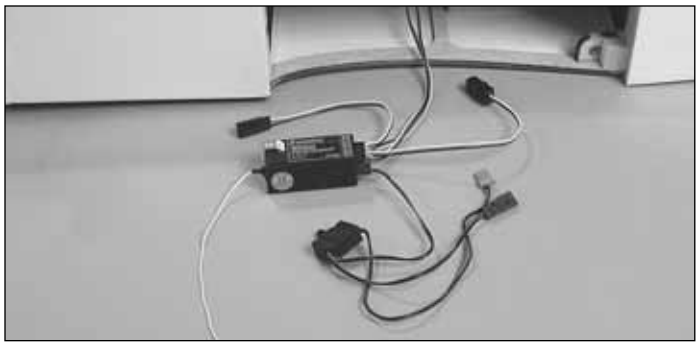


❏ 10. Slide the fiberglass nose cone onto the fuse. Drill a 1/16" [1.6mm] hole through the nose cone and fuse as shown.

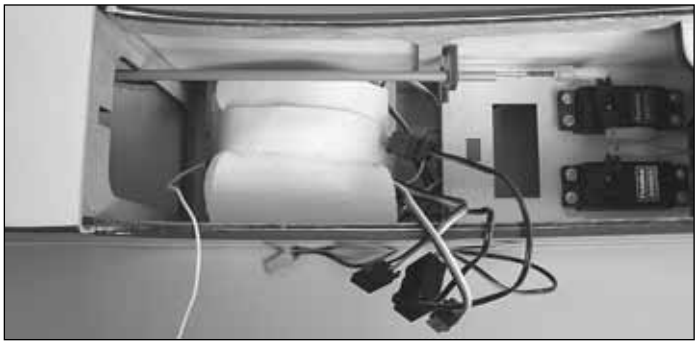
❏ 11. Mount the nose cone to the fuse with a #2 x 3/8" [9.5mm] screw and #2 washer.

❏ 12. With your assistant holding the cowl in position, mark, drill and mount the nose cone with the three remaining screws.

Mount the Receiver & Battery



❏ 1. Plug the following into the receiver:
- a. Switch
- b. Rudder Servo
- c. Elevator Servo
- d. Extension for the ailerons
- e. Y-harness for the throttles



❏ 2. Wrap receiver and battery in foam.

❏ 3. Secure the receiver and battery in the fuse with the hook-and-loop material.

❏ 4. Mount the switch and charge jack. On our prototype we used the Futaba charge jack (FUTM4243).

❏ 5. Put a strain relief on the antenna to keep stress off the solder joint inside the receiver. Drill a 1/16" [1.6mm] hole through the bottom of the fuse aft of the wing opening. Route the antenna through the hole and connect it to a pin pressed into the bottom of the fuse.

Apply the Decals

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

2. 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.

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

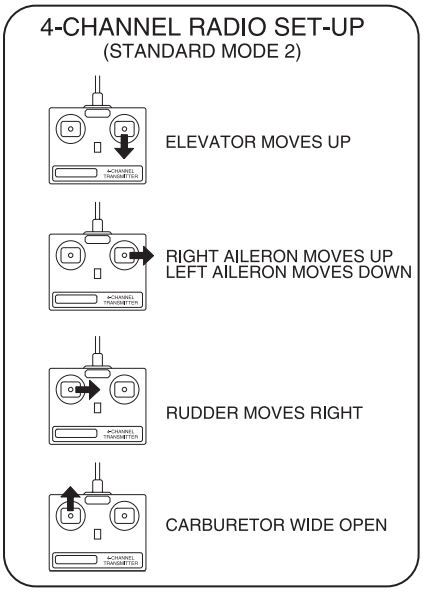
4. Use a piece of soft balsa or something similar to squeegee remaining water from under the decal. Apply the rest of the decals the same way.

GET THE MODEL READY TO FLY

Check the Control Directions

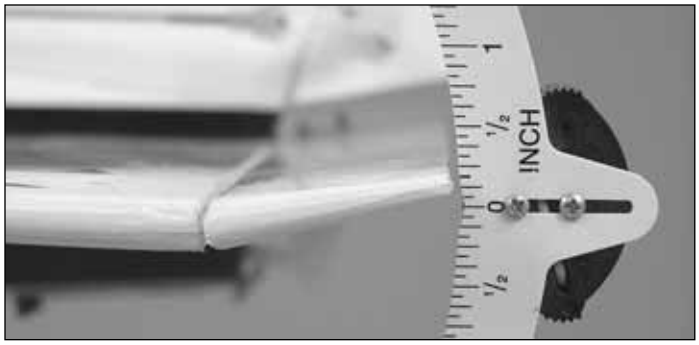
❏ 1. Turn on the transmitter and receiver and center the trims. If necessary, remove the servo arms from the servos and reposition them so they are centered. Reinstall the screws that hold on the servo arms.

❏ 2. With the transmitter and receiver still on, check all the control surfaces to see if they are centered. If necessary, adjust the clevises on the pushrods to center the control surfaces.



❏ 3. Make certain that the control surfaces and the carburetors 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 Throws



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.

These are the recommended control surface throws:

	High Rate	Low Rate
ELEVATOR:	3/8" [9.5mm] up 3/8" [9.5mm] down	1/4" [6mm] up 1/4" [6mm] down
RUDDER:	1" [25mm] right 1" [25mm] left	7/8" [22.5mm] right 7/8" [22.5mm] left
AILERONS:	3/8" [9.5mm] up 3/8" [9.5mm] down	1/4" [6mm] up 1/4" [6mm] down

IMPORTANT: 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 ARF 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.”

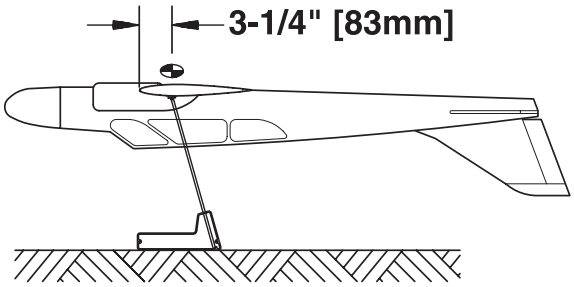
Balance the Model (C.G.)

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, landing gear, and the radio system.

❏ 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 3-1/4" [83mm] 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 3/16" [5mm] forward or 3/16" [5mm] 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, all parts of the model installed (ready to fly) and an empty fuel tank, place the model upside-down on a Great Planes CG Machine™, or lift it upside-down 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. 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, nose weight may be easily added by using a "spinner weight" (GPMQ4645 for the 1 oz. [28g] weight, or GPMQ4646 for the 2 oz. [57g] weight). If spinner weight is not practical or is not enough, use Great Planes (GPMQ4485) "stick-on" lead. A good place to add stick-on nose weight is to the fuselage under the nose cone (don't attach weight to the nose cone–it is not intended to support weight). Begin by placing incrementally increasing amounts of weight on the bottom of the fuse under the nose cone 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 fuse 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 center of the nose cone 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

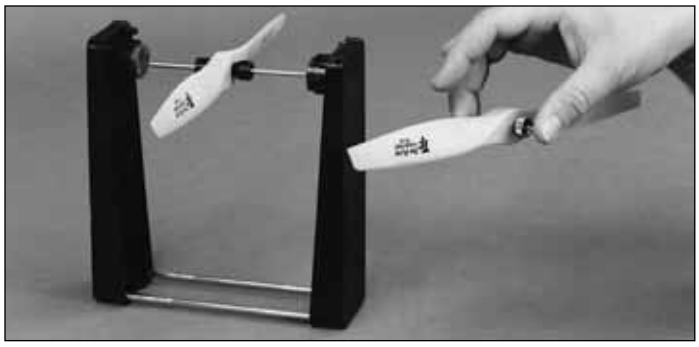
Whether you fly at an AMA sanctioned R/C club site or somewhere on your own, you should always have your name, address, telephone number and AMA number on or inside your model. This information is **required** at all AMA R/C club flying sites and AMA-sanctioned flying events. For your use, we've included an identification tag on the back cover.

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.

Balance the Propellers



Carefully balance your propellers 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 engine mounting screws and bolts loosen, possibly with disastrous effect, but vibration may also damage your radio receiver and battery. Vibration can also cause your fuel to foam, which will, in turn, cause your engine to run hot or quit.

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.

Ground Check

If the engine is new, follow the engine manufacturer's instructions to break in the engine. After break-in, confirm that the engine idles reliably, transitions smoothly and rapidly to full power and maintains full power–indefinitely. After you run the engine, inspect the model closely to make sure all screws remain tight and that the hinges, pushrods, connectors and prop are still secure.

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. Have an assistant stand by your model while you work the controls and tell you what the control surfaces are doing. Repeat this test **with the engine 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, poor solder joints or a defective cell in your battery pack, or a damaged receiver crystal.

ENGINE SAFETY PRECAUTIONS

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

Keep all engine fuel in a safe place, away from high heat, sparks or flames, as fuel is very flammable. Do not smoke near the engine or fuel; and remember that engine exhaust gives off a great deal of deadly carbon monoxide. Therefore, **do not run the engine in a closed room or garage**.

Get help from an experienced pilot when learning to operate engines.

Use safety glasses when starting or running engines.

Do not run the engine in an area of loose gravel or sand; the propeller 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 propeller as you start and run the engine.

Keep these items away from the prop: loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects such as pencils or screwdrivers that may fall out of shirt or jacket pockets into the prop.

Use a "chicken stick" or electric starter to start the engine. Do not use your fingers to flip the propeller. Make certain the glow plug clip or connector is secure so that it will not pop off or otherwise get into the running propeller.

Make all engine adjustments from behind the rotating propeller.

The engine gets hot! Do not touch it during or right after operation. Make sure fuel lines are in good condition so fuel will not leak onto a hot engine, causing a fire.

To stop a glow engine, cut off the fuel supply by closing off the fuel line or following the engine manufacturer's recommendations. Do not use hands, fingers or any other body part to try to stop the engine. To stop a gasoline powered engine an on/off switch should be connected to the engine coil. Do not throw anything into the propeller of a running engine.

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 copy of 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. 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.

- ❏ 1. Fuelproof all areas exposed to fuel or exhaust residue such as the nose cone mounting blocks, wing saddle area, etc.
- ❏ 2. Check the C.G. according to the measurements provided in the manual.
- ❏ 3. Be certain the battery and receiver are securely mounted in the fuse. Simply stuffing them into place with foam rubber is not sufficient.
- ❏ 4. Extend your receiver antenna and make sure it has a strain relief inside the fuselage to keep tension off the solder joint inside the receiver.
- ❏ 5. Balance your model *laterally* as explained on page 20 of the instructions.
- ❏ 6. Use thread-locking compound to secure critical fasteners such as the set screws that hold the wheel axles to the struts, screws that hold the carburetor arms, screw-lock pushrod connectors, etc.
- ❏ 7. Add a drop of oil to the axles so the wheels will turn freely.
- ❏ 8. Make sure all hinges are **securely** glued in place.
- ❏ 9. Reinforce holes for wood screws with thin CA where appropriate (servo mounting screws, nose cone mounting screws, etc.).
- ❏ 10. Confirm that all controls operate in the correct direction and the throws are set up according to the manual.
- ❏ 11. 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.
- ❏ 12. 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.
- ❏ 13. Make sure any servo extension cords used do not interfere with other systems (servo arms, pushrods, etc.).
- ❏ 14. Secure the pressure tap (if used) to the muffler with high temp RTV silicone, thread-locking compound or J.B. Weld.
- ❏ 15. Make sure the fuel lines are connected and are not kinked.
- ❏ 16. Balance your propellers (and spare propellers).
- ❏ 17. Tighten the propeller nuts and spinners.

❏ 18. Place your name, address, AMA number and telephone number on or inside your model.
❏ 19. Cycle your receiver battery pack (if necessary) and make sure it is fully charged.
❏ 20. If you wish to photograph your model, do so before your first flight.
❏ 21. Range check your radio when you get to the flying field.

FLYING

The TwinStar ARF is a great-flying model that flies smoothly and predictably. The TwinStar ARF 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 takeoff, see how the model handles on the ground by doing a few practice runs at **low speeds** on the runway. Hold "down" elevator to keep the model firmly on the nose wheel. If necessary, adjust the nose wheel so the model will roll straight down the runway. If you need to calm your nerves before the maiden flight, shut the engine down and bring the model back into the pits. Top off the fuel, then check all fasteners and control linkages for peace of mind.

Remember to takeoff into the wind. When you're ready, point the model straight down the runway, hold a bit of down elevator to keep the nose on the ground to maintain steering, then gradually advance the throttle. As the model gains speed slowly pull up elevator. Be smooth on the elevator stick, allowing the model to establish a **gentle** climb to a safe altitude before turning into the traffic pattern.

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 ARF for the first few flights, gradually getting acquainted with it as you gain confidence. Adjust the trims to maintain straight and level flight. After flying around for a while, and while still at a safe altitude with plenty of fuel, 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 she 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 fuel level, but use this first flight to become familiar with your model before landing.

Landing

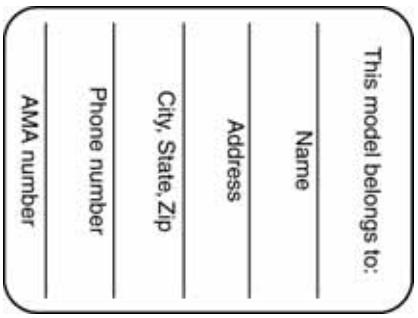
To initiate a landing approach, lower the throttle while on the downwind leg. Allow the nose of the model to pitch downward to gradually bleed off altitude. Continue to lose altitude, but maintain airspeed by keeping the nose down as you turn onto the crosswind leg. Make your final turn toward the runway (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, relax the elevator to give the nose wheel more control.

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.***

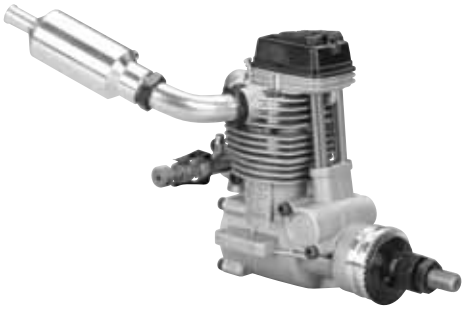
Have a ball! But always stay in control and fly in a safe manner.

GOOD LUCK AND GREAT FLYING!



Use this tag or photocopy it and use the copy. Please fill in the indicated information and place the tag in or on your model.

OTHER ITEMS AVAILABLE FROM HOBBICO



O.S.® FS-30S Surpass™
Boost the performance of your smaller model with the higher horsepower of the FS-30S Surpass 4-stroke! It produces more torque than the FS-26, and fits in the same mounting space – with no modifications needed. Comes with a muffler, along with standard Surpass features such a helix gear-driven camshaft and dependable updraft carburetor. It's an economical way to enjoy the benefits of a 4-stroke engine – including increased power, quieter, more realistic sound and better fuel economy. **OSMG0830**

Hobbico Ultra-Tote™ ARH
Convenience and carrying capacity – factory-painted Ultra-Totes offer both. They're 90% prebuilt and ARH (Almost-Ready-to-Haul), so they're easy to put to work almost immediately. Sturdy ply construction provides durability and strength. Design and dimensions of 19"L x 8"D x 17"H provide room for a ventilated 12V battery compartment, plus a universal power panel slot, caddy for a 1-gallon fuel can or bottle, spacious drawer and foam-padded cradles above an open top compartment. **HCAP5028**

Great Planes C.G. Precision Aircraft Balancer™
Accurate balancing makes trainers more stable, low-wings more agile, and pylon planes move at maximum speed. The innovative C.G. Machine helps you achieve optimum balance easily, without measuring or marking–and without the errors that fingertip balancing can cause. You'll quickly pinpoint your plane's exact center of gravity. Then you'll know at a glance whether weight should be added, removed or relocated. The C.G. Machine works with kits and ARF models of any size and wingspan. Its slanted wire balancing posts support models weighing up to 40 pounds. **GPMR2400**

HOBBICO®