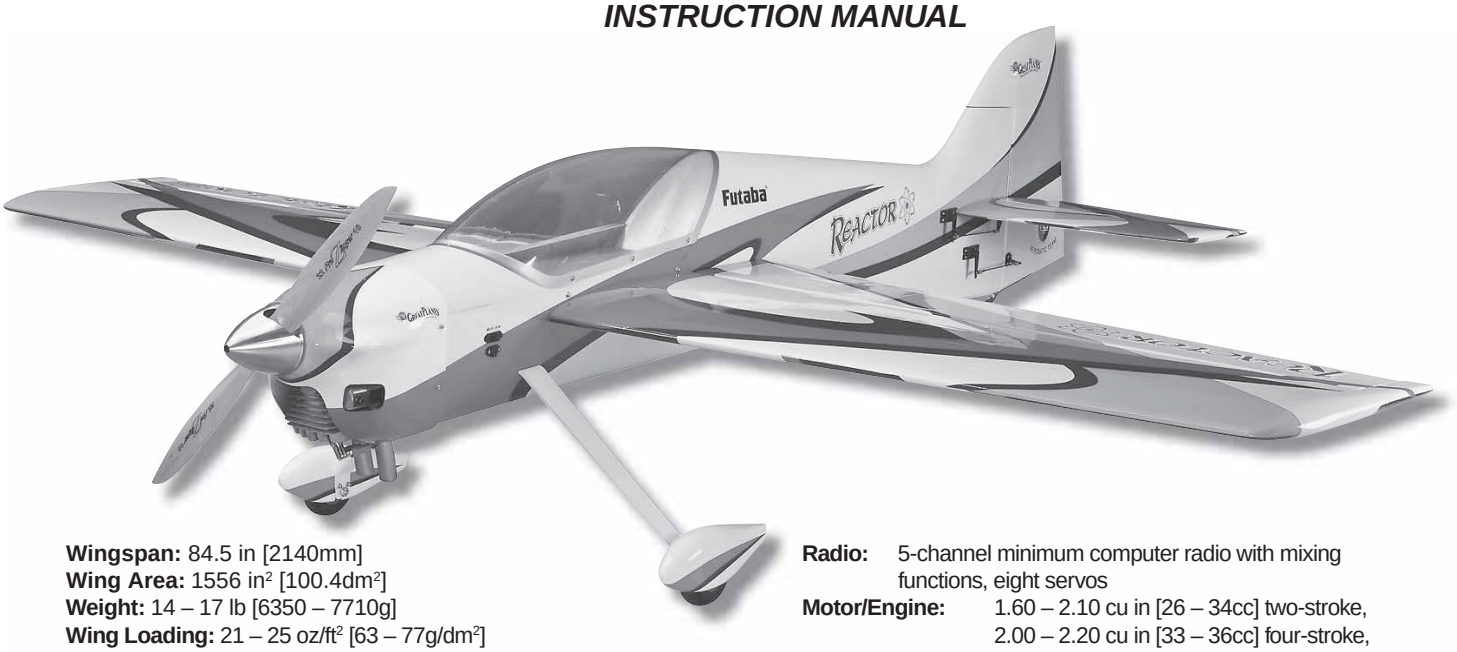
REACTOR PERFORMANCE SERIES™

ALMOST READY-TO-FLY 1.60 GLOW / 43 cc GAS SPORT AEROBAT

INSTRUCTION MANUAL



Wingspan: 84.5 in [2140mm]
Wing Area: 1556 in^2 [100.4dm^2]
Weight: 14 – 17 lb [6350 – 7710g]
Wing Loading: 21 – 25 oz/ft^2 [63 – 77g/dm^2]
Length: 85 in [2160mm]

Radio: 5-channel minimum computer radio with mixing functions, eight servos
Motor/Engine: 1.60 – 2.10 cu in [26 – 34cc] two-stroke,
2.00 – 2.20 cu in [33 – 36cc] four-stroke,
2.5 – 3.0 cu in [43 –50cc] gas
RimFire™ 80-75-230 out-runner brushless motor

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

For the latest technical updates or manual corrections to the 1.60 – 50cc Reactor 3D visit the Great Planes web site at **www.greatplanes.com**. Open the "Airplanes" link, then select the 1.60 – 50cc Reactor 3D 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

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

Academy of Model Aeronautics
5151 East Memorial Drive
Muncie, IN 47302-9252
Tele. (800) 435-9262
Fax (765) 741-0057
Or via the Internet at:
http://www.modelaircraft.org

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

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

1. Your 1.60 – 50cc Reactor 3D 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, this airplane, if not assembled and operated correctly, could possibly cause injury to yourself or spectators and damage to property.

2. You must assemble the model **according to the instructions**. Do not alter or modify the model, as doing so may result in an unsafe or unflyable model. In a few cases the instructions may differ slightly from the photos. In those instances the written instructions should be considered as correct.

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

4. You must use an R/C radio system that is in good condition, a correctly sized engine, and other components as specified in this instruction manual. All components must be correctly installed so that the model operates correctly on the ground and in the air. You must check the operation of the model and all components before every flight.

5. If you are not an experienced pilot or have not flown this type of model before, we recommend that you get the assistance of an experienced pilot in your R/C club for your first flights. If you're not a member of a club, your local hobby shop has information about clubs in your area whose membership includes experienced pilots.

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

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

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

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

DECISIONS YOU MUST MAKE

This is a partial list of items required to finish the 1.60 – 50cc Reactor 3D that may require planning or decision making before starting to build. Order numbers are provided in parentheses.

Gas Engine Option & Required Parts

The gas engine option offers great 3D power, less clean-up, and the economy of gas. With a DA-50 engine installed, flying weight is 16 lbs [7260g]. We expect most users will choose this option. If you are using a gas engine, you will need:

- ❏ DA-50 engine must be ordered with 3" standoffs
- ❏ Fuel tank conv kit (SULQ2684)
- ❏ (2) Dubro 1/8" I.D. Fuel Line Barb (DUBQ0670)
- ❏ (1) 1/8" Tygon fuel line 3' (DUBQ0493)
- ❏ (1) Neoprene gas fuel line (in-tank) (DUBQ0455)
- ❏ 1500mAh 4.8V battery (for ignition) (FUTM1285)
- ❏ (1) Pro HD switch harness Futaba® J (HCAM2761)
- ❏ (1) Ernst charge jack FUT J (ERNM3001)
- ❏ (4) 1/4-20 x 1-1/2" [38mm] SHCS (for DA-50)
- ❏ (4) 1/4" [6.4mm] Washers
- ❏ (4) 1/4" [6.4mm] Lock washers
- ❏ (4) 1/4-20 Blind nuts

Glow Engine Option & Required Parts

The glow engine option offers the easiest setup for good sport flying and the lightest flying weight. Flying weight with an O.S.® 1.60 FX two-stroke is 14 lbs [6350g]. If you are using a glow engine, you will need:

- ❏ A suitable engine mount for engines greater than 1.80 cu in [29 cc]
- ❏ A suitable Pitts muffler (O.S. 1.60 FX uses SLIG6018 or BISG4116)
- ❏ A suitable propeller per engine manufacturer's recommendation
- ❏ Medium fuel line (GPMQ4131)

Electric Motor Option & Required Parts

The electric option weighs 17 lbs [7711g]. With the prop listed below, this setup delivers 4750 watts of power. This is more than enough power to accomplish most 3D maneuvers. For a sport setup, please use a smaller prop. DO NOT use a larger prop or more than 12S. If you choose the electric option, you will need:

- ❏ Great Planes RimFire™ 80-75-230 out-runner brushless motor (GPMG4800)
- ❏ Great Planes 80mm motor standoff style motor mount (GPMG1275)
- ❏ Kontronik™ 63V 120a ESC (KONM3140)
- ❏ (1) 12" [300mm] Servo extension (HCAM2711)
- ❏ (2) FlightPower 5000mAh 6S LiPo (FPWP0364) (wired in series for 12S)

–OR–

- ❏ (3) Great Planes 5000mAh 4S LiPo (GPMP0636) (wired in series for 12S)
- ❏ A suitable series connector (GPMM3143)
- ❏ A suitable battery safety jumper
- ❏ Zinger Pro propeller 22" x 8 (ZINQ1602)
- ❏ FlightPower V-Balance cell balancer & charge harness set (FPWM0120)
- ❏ TME Xtrema LiPo charger (TMEP3000)
- ❏ RC Electronics Watt's Up Watt Meter (RELP0101)

Radio System Recommendations

Because the split elevators require one servo each, you will need to have a radio system that performs mixing functions. We recommend using at least a 6-channel computer radio. We set up our Futaba radio so that channel 5 is assigned to the second elevator and channel 6 is assigned to the second aileron.

We provide several places to mount your radio equipment based on the engine type. The servo extension lead lengths we recommend will allow you to mount your radio in all of the positions suggested in this manual. If you know that your radio equipment is to be mounted in the aft equipment tray, you may choose shorter servo leads for the tail and eliminate the 6" [152mm] leads we recommend for the inboard aileron servos.

- ❏ 6-channel computer radio system (5ch w/ mixing min)
- ❏ (7) Futaba S9155 servos for flight controls (FUTM0215) **–OR–** min 150 oz-in [11 kg-cm] torque metal gear standard servos
- ❏ (1) Futaba S3004 standard servo for throttle (FUTM0004)
- ❏ (2) 6" HD extensions (ails inboard) (HCAM2000)
- ❏ (2) 24" HD extensions (ailerons) (HCAM2200)
- ❏ (3) 36" HD extensions (tail servos) (HCAM2726)
- ❏ (2) Y-harness HD digital (FUTM4135)
- ❏ 4200mAh 4.8V battery (HCAM6335) **–OR–** 4200mAh 6V battery (HCAM6355)
- ❏ Pro HD switch harness Futaba J (HCAM2761)
- ❏ Ernst charge jack Futaba J (ERNM3001)

ADDITIONAL ITEMS REQUIRED

In order to finish your Reactor, you will need:

- ❏ (7) Great Planes large scale 1.5" single-side servo arm (GPMM1105)
- ❏ Dubro #4 plastic washers (for cowl) (DUBQ3240)
- ❏ R/C foam rubber 1/4" [6mm] (HCAQ1000)

Adhesives & Building Supplies

- ❏ 21st Century® sealing iron (COVR2700)
- ❏ 21st Century iron cover (COVR2702)
- ❏ Drill bits: 1/16" [1.6mm], 5/64" [2mm], 3/32" [2.4mm], 5/32" [4mm], 3/16" [4.8mm], 1/4" [6.4mm], 9/32" [7.1mm]
- ❏ 1 oz. [30g] Medium Pro™ CA+ (GPMR6008)
- ❏ 1 oz. [30g] Thin Pro CA (GPMR6002)
- ❏ CA applicator tips (HCAR3780)
- ❏ CA debonder (GPMR6039)
- ❏ Pro 30-minute epoxy (GPMR6047)
- ❏ Epoxy brushes (6, GPMR8060)
- ❏ Mixing sticks (50, GPMR8055)
- ❏ Mixing cups (GPMR8056)
- ❏ Builder's triangle set (HCAR0480) **–OR–** metal template set (30/60/90 and 45° triangles, HCAR0500)
- ❏ Threadlocker™ threadlocking compound (GPMR6060)
- ❏ Hobby Heat™ micro torch (HCAR0755)
- ❏ Silver solder w/flux (STAR2000)
- ❏ Panel Line Pen (TOPQ2510)
- ❏ 18" [457mm] Flexible steel ruler (HCAR0460)
- ❏ Hobbico retractable fabric tape measure (HCAR0478)
- ❏ Rotary tool such as Dremel®
- ❏ Rotary tool reinforced cut-off wheel (GPMR8200)
- ❏ 8-32 Tap and drill set (GPMR8103)
- ❏ Tap handle (GPMR8120)
- ❏ Pliers with wire cutter (HCAR0625)
- ❏ Hobbico heavy-duty diagonal cutter 7" (HCAR0627)
- ❏ Electric drill
- ❏ Hobbico ball-end hex wrench set – metric (HCAR0521)
- ❏ Hobbico ball-end hex wrench set – SAE (HCAR0520)
- ❏ Ratchet with #1 Phillips bit & 1/4" [6mm] socket
- ❏ Center punch **–OR–** scratch awl
- ❏ (2) 1" [25mm] C-clamps
- ❏ Masking tape (TOPR8018)
- ❏ Medium T-pins (100, HCAR5150)
- ❏ Great Planes Easy-Touch™ hand sander 5-1/2" [140mm] (GPMR6169)
- ❏ Sandpaper assortment
- ❏ 3M® green Scotch-Brite™ abrasive pad
- ❏ Electrical tape
- ❏ Toothpicks, round
- ❏ Petroleum jelly
- ❏ Denatured alcohol (for epoxy clean up)

Optional Supplies & Tools

- ❏ Robart Super Stand II (ROBP1402)
- ❏ C.G. Machine™ (GPMR2400)
- ❏ 36" [914mm] Metal ruler (HCAR0475)
- ❏ Hobbico Builder's Protractor (HCAR0490)
- ❏ Great Planes 4-in-1 Tool (GPMR8035)
- ❏ Precision Magnetic Prop Balancer (TOPQ5700)
- ❏ 1" [25mm] Double-sided foam mounting tape (GPMQ4442)
- ❏ Hobby saw & handle (ZONR2060)
- ❏ Stick-on segmented lead weights (GPMQ4485)
- ❏ 38% Extra 330S Pilot Figure (GPMA3207)
- ❏ R/C-56 Glue 4oz (JOZR5007)

ORDERING REPLACEMENT PARTS

Replacement parts for the Great Planes 1.60 – 50cc Reactor 3D ARF are available using the order numbers in the **Replacement Parts List** that follows. The fastest, most economical service can be provided by your hobby dealer or mail-order company.

To locate a hobby dealer, visit the 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

Description	**How to Purchase**
Missing pieces	Contact Product Support
Instruction manual	Contact Product Support
Full-size plans	Not available

Contact your hobby supplier for the following parts:

GPMA3090	Fuselage
GPMA3091	Wing Set
GPMA3092	Cowl
GPMA3093	Wheel Pants
GPMA3094	Tail Surface Set
GPMA3095	Landing Gear
GPMA3096	Canopy
GPMA3097	Wing Tube
GPMA3098	Decal
GPMA3099	Spinner

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 (or 45-minute) epoxy **or** 6-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. 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. However, some technically-minded modelers may wish to check these measurements anyway. To view this information visit the web site at **www.greatplanes.com** and click on "Technical Data." Due to manufacturing tolerances which will have little or no effect on the way your model will fly, please expect slight deviations between your model and the published values.

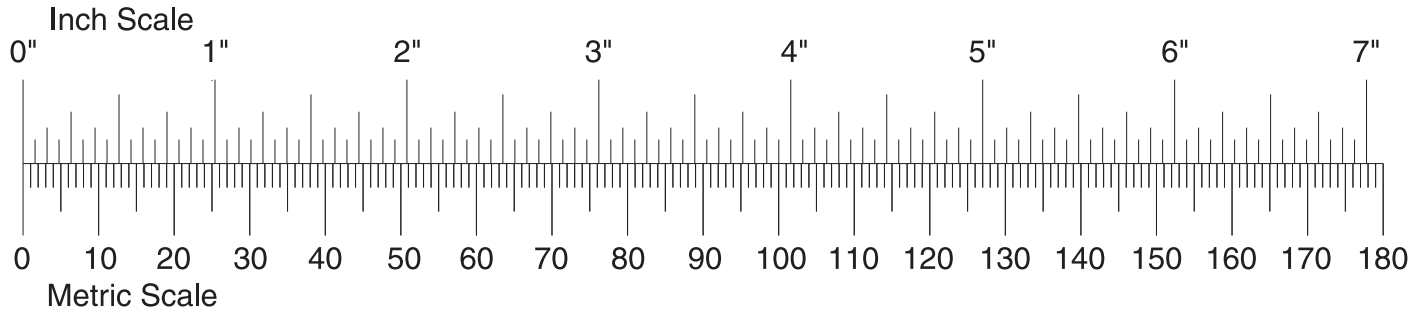
COMMON ABBREVIATIONS

Stab = Horizontal Stabilizer
Fin = Vertical Fin
LE = Leading Edge
TE = Trailing Edge
LG = Landing Gear
Ply = Plywood
" = Inches
mm = Millimeters
SHCS = Socket Head Cap Screw
ESC = Electronic Speed Control

METRIC CONVERSIONS

1" = 25.4mm (conversion factor)

1/64" = .4mm	3/4" = 19.0mm
1/32" = .8mm	1" = 25.4mm
1/16" = 1.6mm	2" = 50.8mm
3/32" = 2.4mm	3" = 76.2mm
1/8" = 3.2mm	6" = 152.4mm
5/32" = 4.0mm	12" = 304.8mm
3/16" = 4.8mm	18" = 457.2mm
1/4" = 6.4mm	21" = 533.4mm
3/8" = 9.5mm	24" = 609.6mm
1/2" = 12.7mm	30" = 762.0mm
5/8" = 15.9mm	36" = 914.4mm

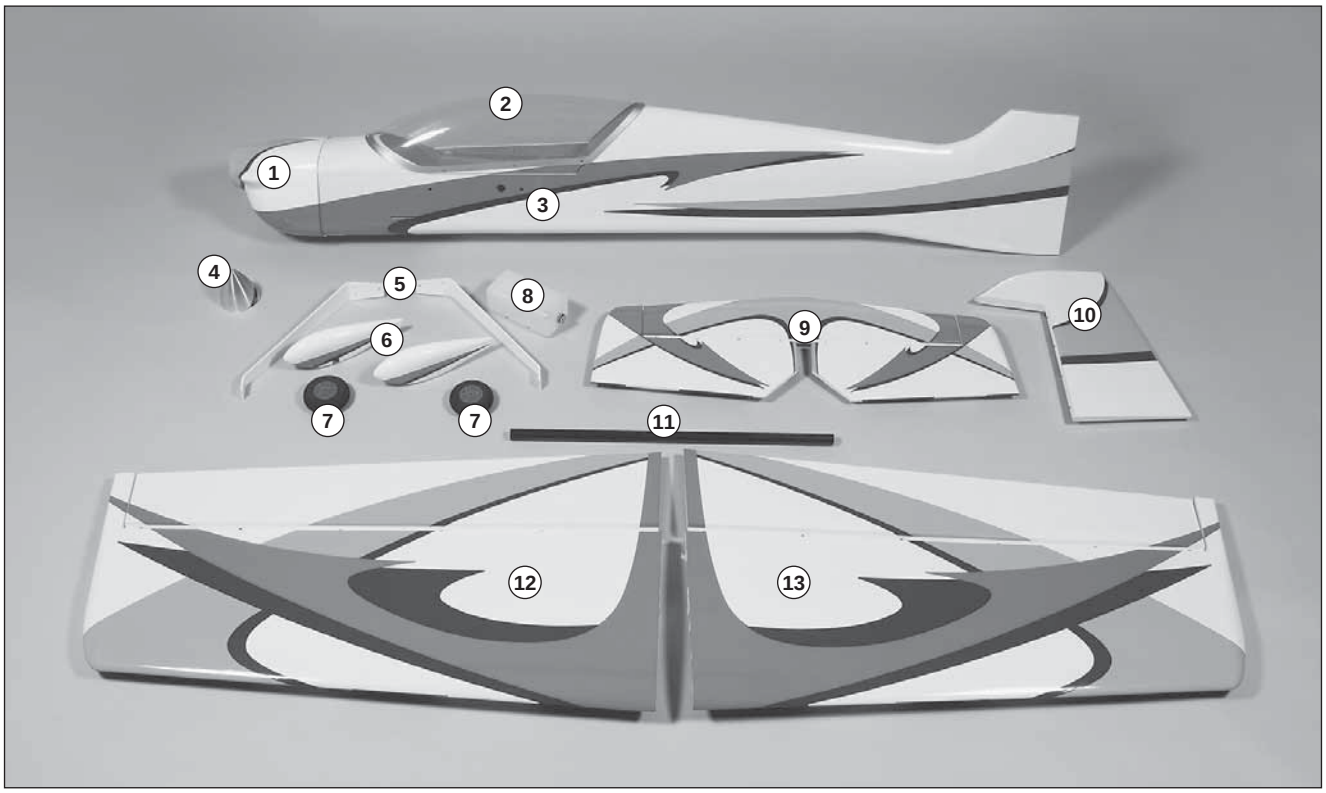


KIT INSPECTION

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
Champaign, IL 61822
Telephone: (217) 398-8970, ext. 5
Fax: (217) 398-7721
E-mail: airsupport@greatplanes.com

KIT CONTENTS



Kit Contents

1	Cowl	9	Horizontal Stabilizer & Elevators
2	Canopy	10	Rudder
3	Fuselage	11	Wing Tube
4	Spinner	12	Right Wing Panel w/Aileron
5	Main Landing Gear (L&R)	13	Left Wing Panel w/Aileron
6	Wheel Pants (L&R)		
7	Main Wheels (2)		
8	Fuel Tank		

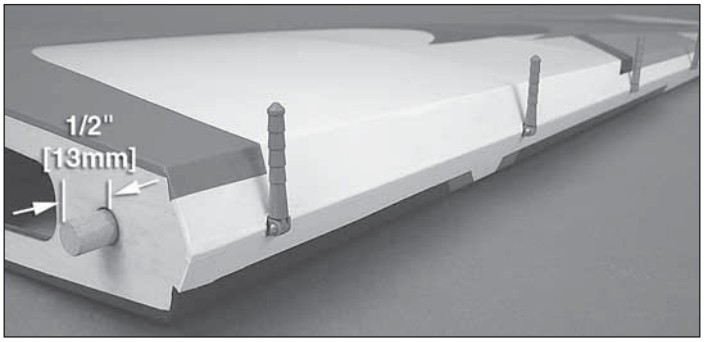
PREPARE FOR ASSEMBLY

❏ Lay out all of your covered parts like the fuselage, wings, and control surfaces. Inspect the covering for wrinkles and peeled edges. Use a covering iron set for low to medium/high heat and tack down the covering. Medium heat may be necessary to stretch out any wrinkles, but be careful not to apply too much heat to areas where covering is applied over covering.

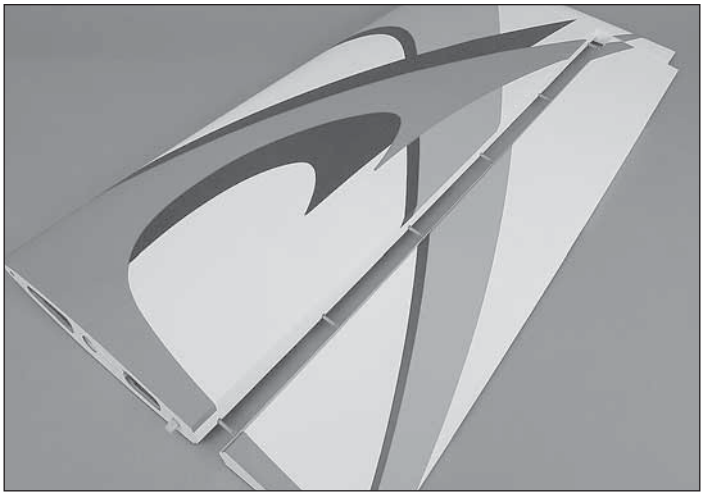
BUILD THE WINGS

Hinge the Ailerons

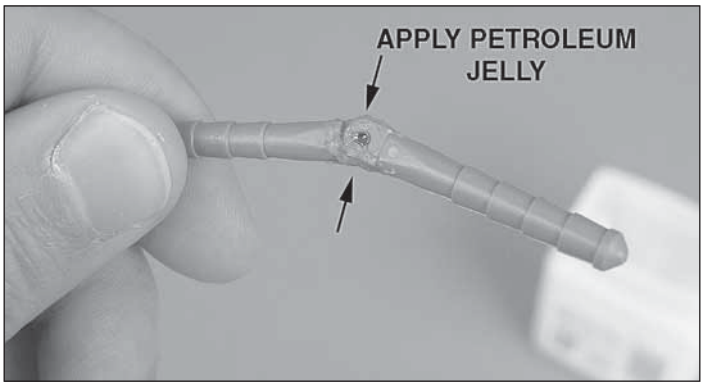
❏ 1. You will need the following supplies: Denatured alcohol, 30-minute epoxy, epoxy mixing cups, mixing sticks, round toothpicks, petroleum jelly, masking tape, and some paper towels.



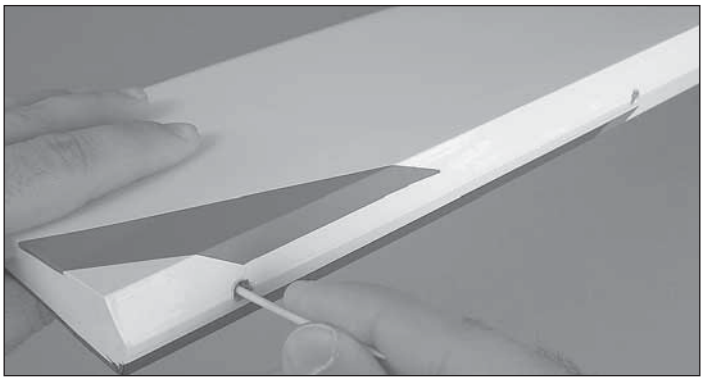
❏ ❏ 2. Start with the right wing and aileron. Install one 1-3/8" [35mm] anti-rotation dowel in the location shown using epoxy. The tip should be 1/2" [13mm] from the rib. Test fit six-point type hinges into the wing so that the hinge pin is aligned with the hinge line. Deflecting each hinge 90° will help you determine when the hinge pin is parallel with the hinge line. If the hinge is too tight, you may use your hobby knife or a 5/32" [4mm] drill bit to carefully enlarge the hole.



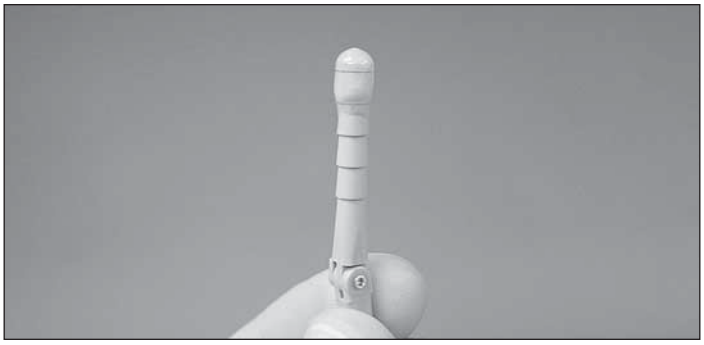
❏ ❏ 3. Fit the aileron tightly up against the wing and deflect it up and down a few times checking for binding.



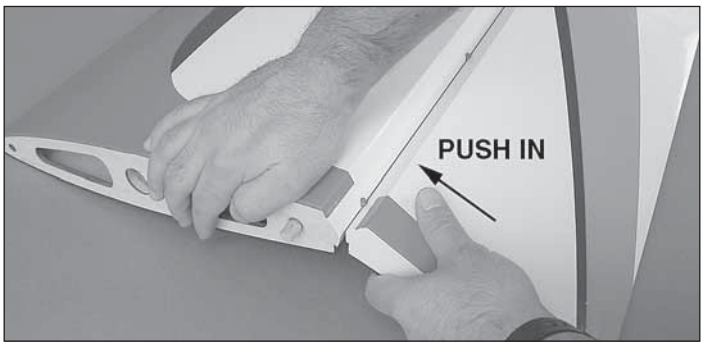
❏ ❏ 4. Remove the aileron and the hinges. Prepare each hinge first by cleaning off any mold release compound left on the parts during manufacture. Use denatured alcohol for this. Prepare each hinge for gluing by thoroughly coating the center section with petroleum jelly.



❏ ❏ 5. Mix up a batch of 30-minute epoxy and use a toothpick to generously coat the inside of each hole or “pocket.” Apply epoxy to both the wing pockets and the aileron pockets. **Warning:** This glue joint is critical and you must take the time to ensure it is done properly.

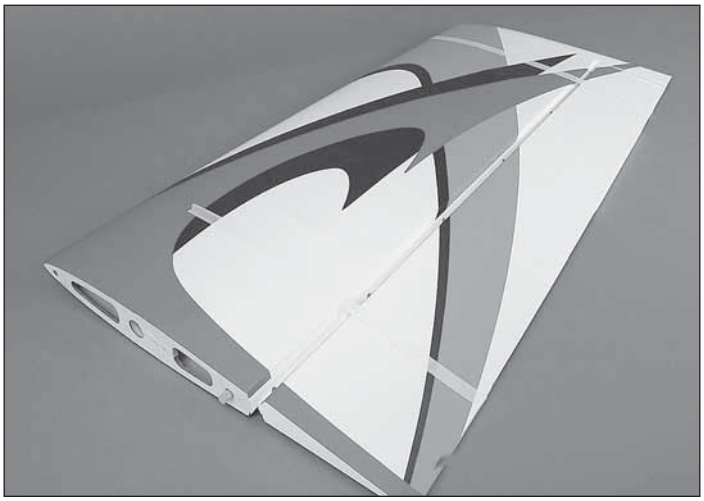


❏ ❏ 6. Dip both ends of each hinge (about two barbs deep) into your epoxy cup.



❏ ❏ 7. Fit the hinges into the wing, making sure that you align each one. Fit the aileron tightly and deflect it a few times in both directions. This will straighten any hinges that are slightly out of alignment.

❏ ❏ 8. Clean up any excess epoxy that has squeezed out of the pocket using a paper towel. Check both sides of the hinge line.

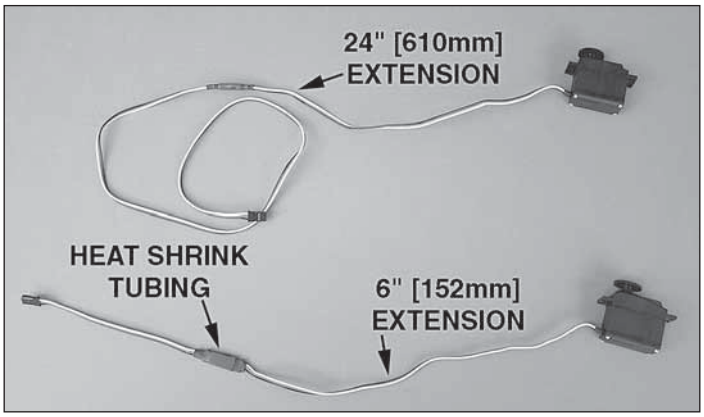


❏ ❏ 9. Use masking tape to hold the aileron snug up against the hinge line. Set the wing aside and allow the epoxy to fully cure before you remove the tape or move the ailerons.

❏ 10. Repeat steps 2 through 9 for the left wing.

Install the Aileron Servos

To get the best performance from your Reactor, we recommend that you use four Futaba 9155 digital servos. These precision servos have the right amount of torque (153 oz-in [11 kg-cm]) and will give you the best control. As a budget alternative you can use a metal geared servo with a minimum 100 oz-in [7.2 kg-cm] torque rating but you should expect a slower response and some control blow-back at higher speeds. **DO NOT** use only one aileron servo per wing, no matter what the torque rating.

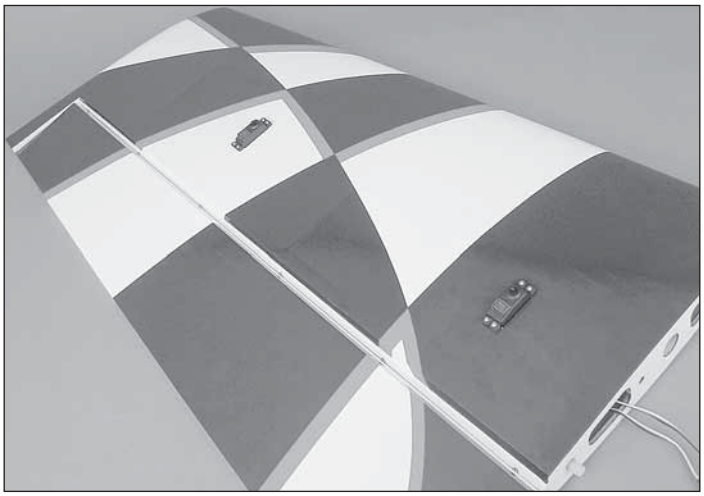


❏ ❏ 1. Prepare your outboard aileron servo with a 24" [610mm] extension. Prepare the inboard servo with a 6" [152mm] extension. Use heat shrink tubing to secure the connectors so they do not come loose. **Note:** If you anticipate mounting your radio equipment in the aft-most equipment bay, you do not need the 6" [152mm] extensions installed.

❏ ❏ 2. Locate the aileron servo bays on the underside of the wing and trim away the covering. If you have not done so already, use a covering iron to tack down the covering before you trim.

❏ ❏ 3. Starting with the outboard servo bay, tie the guide string to the 24" [610mm] servo lead extension. Pull the extension through the wing.

❏ ❏ 4. Place the aileron servos in position and use a 1/16" [1.6mm] bit to drill the mounting holes for your servos into the wing. Temporarily remove each servo and wick a few drops of thin CA into the holes you drilled.

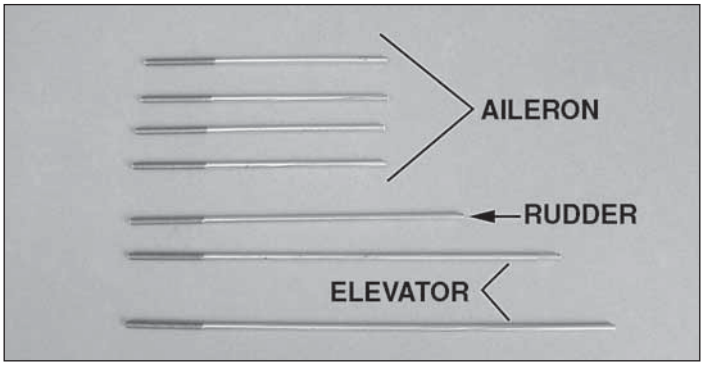


❏ ❏ 5. Install the aileron servos using the screws provided with your servos.

❏ 6. Repeat steps 1 through 5 for the left wing.

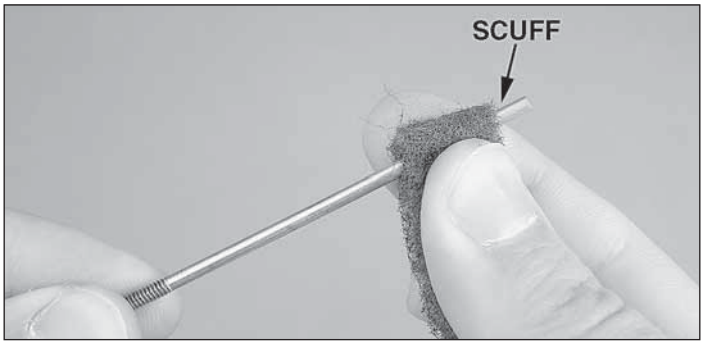
Assemble the Pushrods

In this section you will build the aileron pushrods as well as the elevator and rudder pushrods. We'll start with the four identical aileron pushrods and finish with the others which you can set aside to be used later. For this section you'll need to have some silver solder and liquid silver-solder flux. We recommend using the Stay-Brite silver soldering kit (STAR2000).

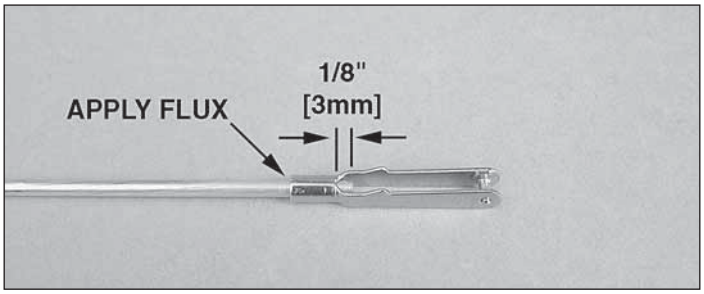


❏ ❏ 1. Locate the seven 4-40 x 12" [305mm] threaded one end pushrods. You'll need to cut the rods down to the following lengths:

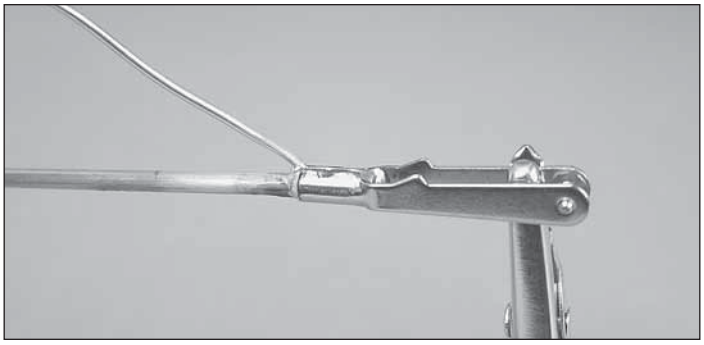
A) Four (4) 3-1/2" [89mm] aileron pushrods
B) One (1) 4-1/2" [114mm] rudder pushrod
C) One (1) 5-1/4" [133mm] left elevator pushrod
D) One (1) 7-1/4" [184mm] right elevator pushrod



❏ ❏ 2. Starting with the aileron pushrods, gather the four 4-40 x 3-1/2" [89mm] threaded one end rods and four solid metal (unthreaded) clevises. Roughen the unthreaded end of each with some coarse 150-grit sandpaper or a coarse Scotch Brite® pad.



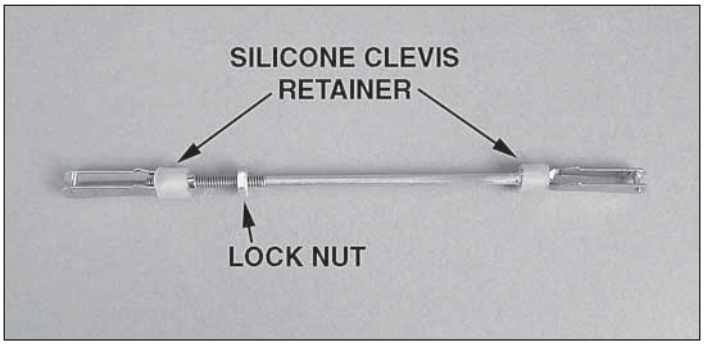
❏ ❏ 3. Apply a few drops of soldering flux to the unthreaded end of the pushrod. Position the clevis so that 1/8" [3mm] of the pushrod protrudes past the barrel of the clevis.



❑ ❑ 4. Use a hobby torch to heat both the clevis and the pushrod. Apply silver solder to the joint. The heat of the clevis and the pushrod should melt the solder, not the direct flame of the torch.

❑ ❑ 5. While the joint is still hot but after the solder solidifies use a clean, damp cloth to wipe the flux from the joint before it hardens. Flux is corrosive and must be thoroughly cleaned from the joint.

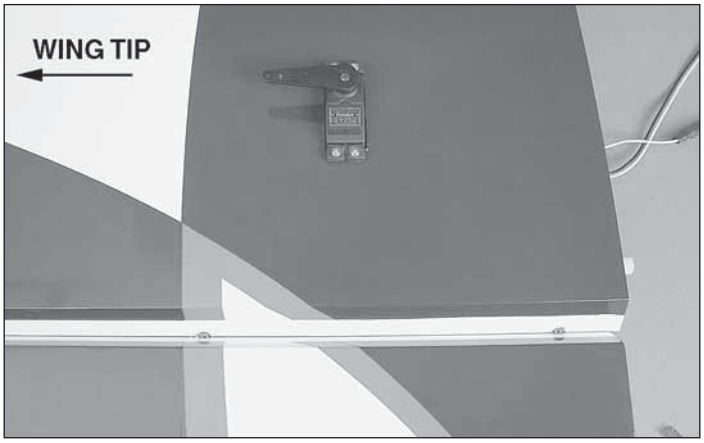
❑ ❑ 6. Coat the joint with a thin film of oil to prevent corrosion.



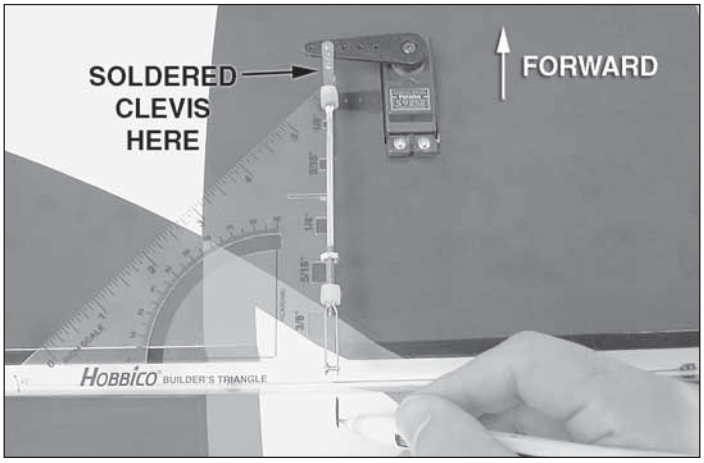
❑ ❑ 7. Fit a silicone retainer onto the rod, a 4-40 hex nut, another silicone retainer, and a 4-40 threaded clevis onto the rod in that order. The threaded end of your pushrod should look like the picture above.

❑ 8. Repeat steps 2 through 7 for the remaining pushrods.

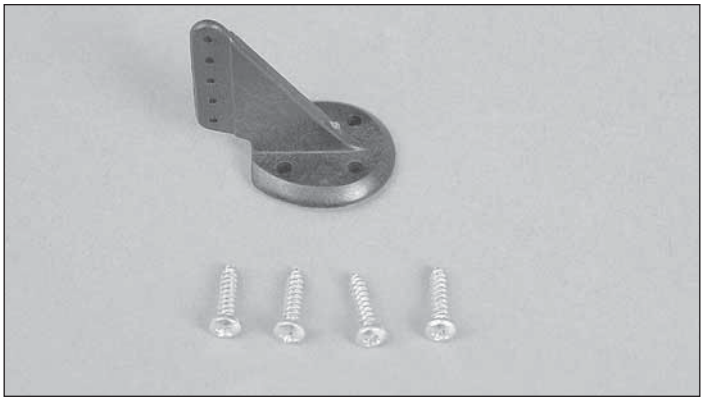
Install the Control Horns

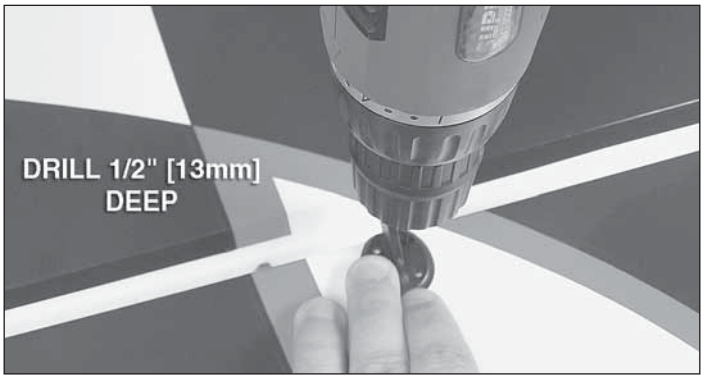


❑ 1. Use your radio to center your aileron servos. Attach a 1-1/2" [38mm] single-sided servo arm (GPMM1105) to each servo so that the arm is parallel with the hinge line when the servo is centered. Install the arms so that they point outward toward the wing tip.



❑ ❑ 2. Attach the soldered clevis end of each pushrod to the servo arm in the hole that is 1-1/4" [32mm] out from the center of the arm. Extend the pushrod straight back so that it is 90° to the hinge line and draw a centerline on the aileron. Use a builder's triangle to ensure that the rod is 90° to the hinge line.

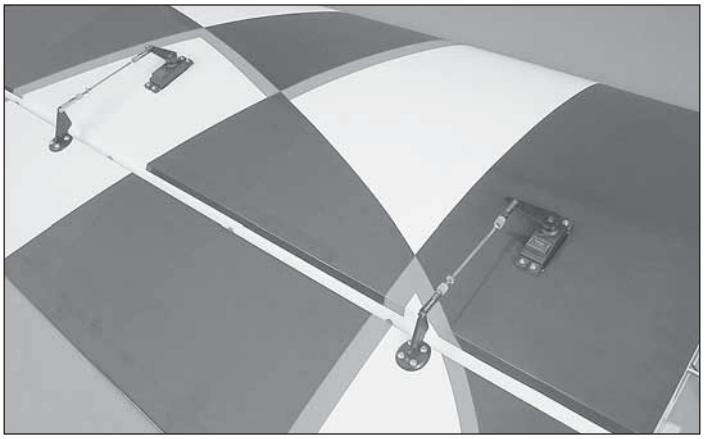




❏ ❏ 3. Center a control horn over the line that you made, making sure that the clevis holes are also centered over the hinge line. Hold the horn in position and use a 1/16" [1.6mm] drill bit to drill four 1/2" [13mm] deep holes in the aileron. You can wrap a piece of tape around the drill shank to help keep you from drilling the holes too deep.

❏ ❏ 4. Use four #4 x 1/2" [13mm] sheet metal screws to mount the control horns. Remove the screws and use thin CA to harden the threads you created in the wood. Reinstall the control horn.

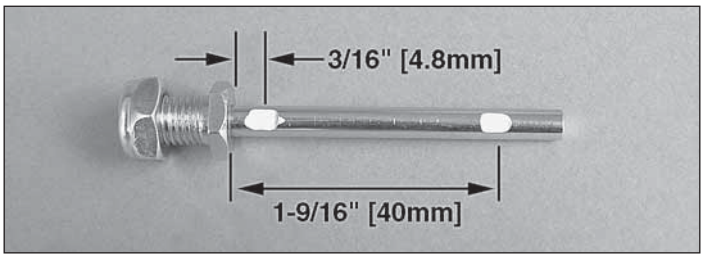
Repeat steps 2 through 4 for the remaining aileron control horns.



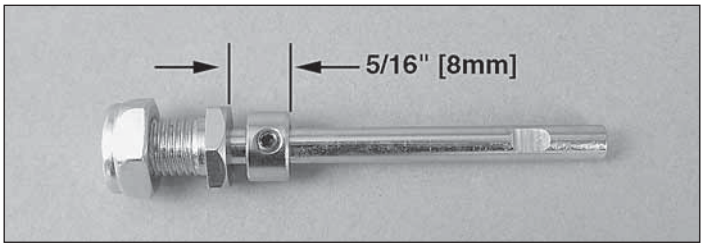
❏ 5. When you're done installing all of the control horns, adjust the length of your pushrods using the threaded clevis and attach them to the control horns. Tighten the lock nuts and position the silicone retainers after you have centered the flight controls.

BUILD THE FUSELAGE

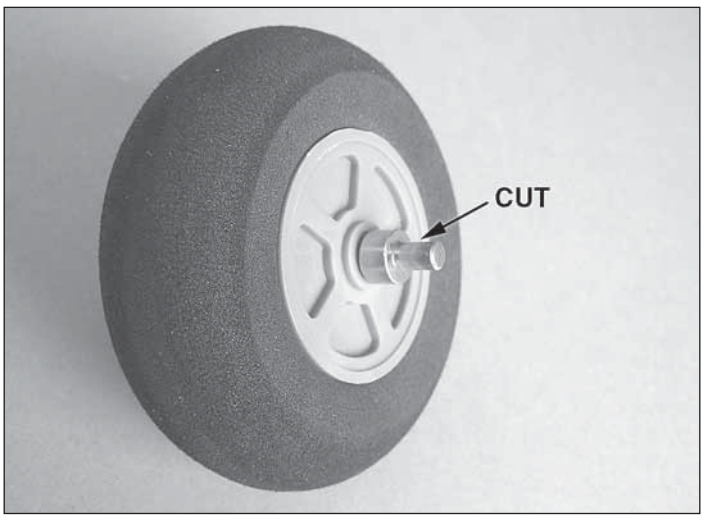
Main Landing Gear Installation



❏ 1. Locate the 3/16" x 2" [4.8 x 51mm] axles, four 3/16" [4.8mm] wheel collars, four set screws, two axle nuts, and the two main wheels. File flat spots in the axle in the locations shown above.

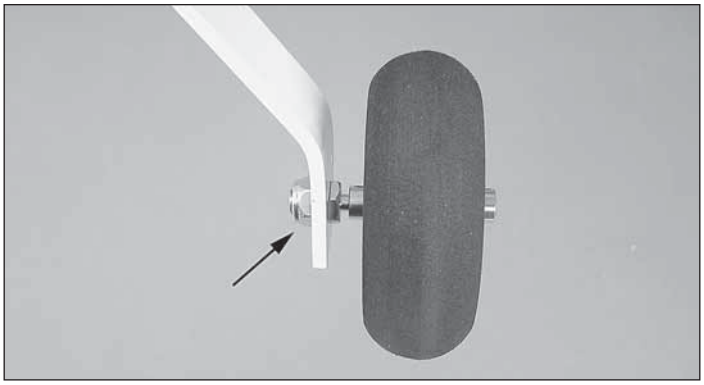


❏ 2. Install the inner wheel collar so that the outer face of the wheel collar is 5/16" [8mm] from the base of the axle. Apply threadlocking compound to the set screw and tighten the wheel collar in position. Install the wheel and the other wheel collar.

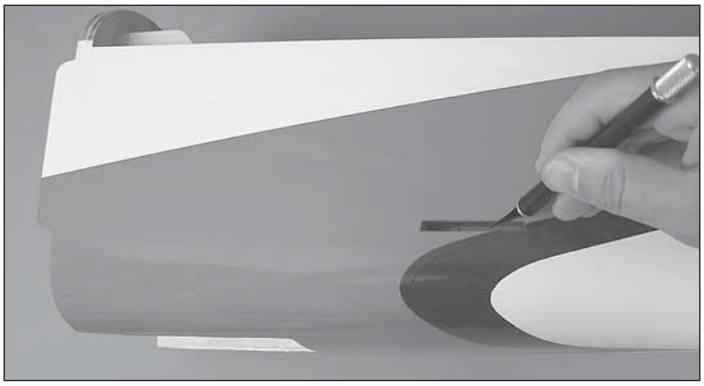


❏ 3. Use a rotary tool with a cutoff wheel attachment to cut off the excess portion of the axle.

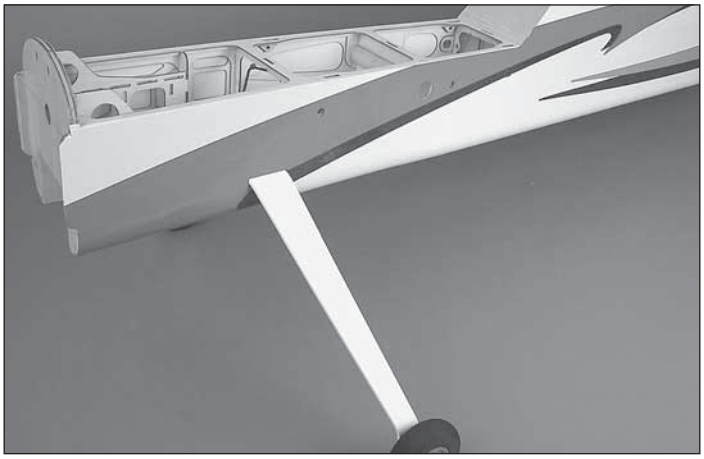
❏ 4. Prepare the other axle the same way.



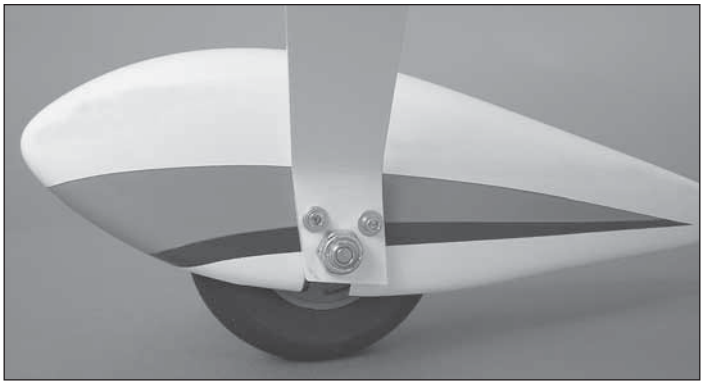
❏ 5. Attach the axles to the main landing gear legs using the self-locking axle nut.



❏ 6. Trim the covering from the main landing gear slots in the fuselage.

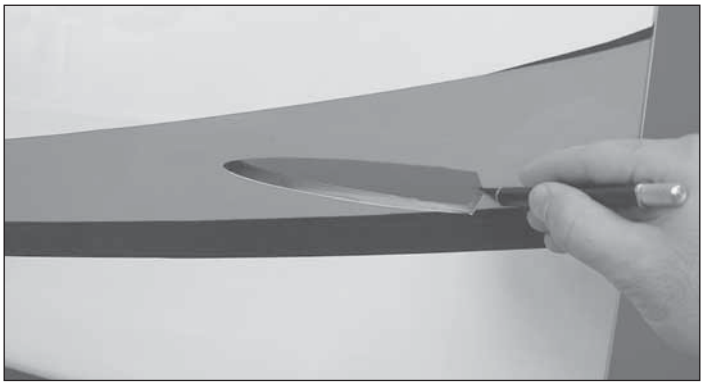


❏ 7. Use six 6-32 x 5/8" [16mm] SHCS, six #6 split ring lock washers, and six #6 washers to attach the landing gear to the fuselage. Use threadlocking compound on the screws. **Note:** The landing gear is swept back.

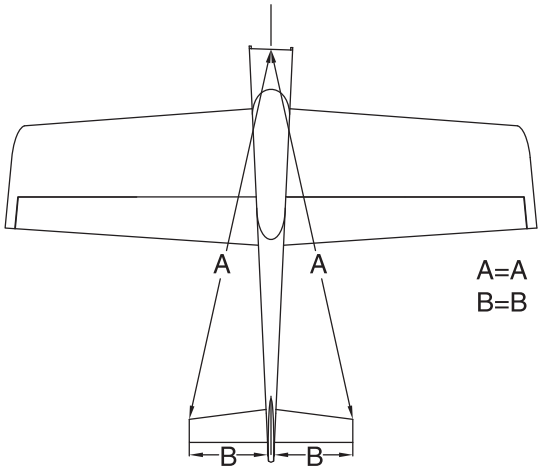


❏ 8. Attach the wheel pants to the landing gear legs using four 4-40 x 1/2" [13mm] SHCS, four split ring lock washers, and four #4 washers. Use threadlocking compound on the screw threads.

Install the Horizontal Stabilizer



❏ 1. Start by trimming the covering from the horizontal stabilizer slot in the fuselage. Cut the covering from both sides of the fuselage. Use your covering iron to securely tack the edges of the covering to the fuselage sides after you're done trimming.



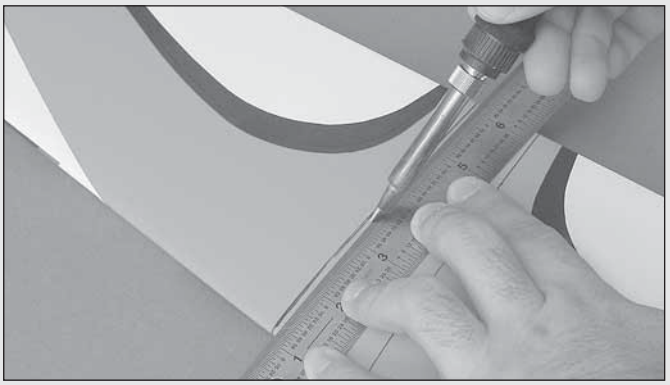
❏ 2. Slide the stab into the fuselage. Center it from left to right and fore and aft, making sure that the distances are equal.

❏ 3. Holding the stab in position, use a fine-point, felt-tip marker to trace lines onto the stab. Don't forget to trace lines on the bottom side of the stab, too.

❏ 4. Trim the covering along a line that is 3/32" [2.4mm] inside of the lines you drew on the stab. Refer to the ***"Expert Tip"*** below on how to cut away covering. When you're done trimming, wipe away the lines using alcohol.

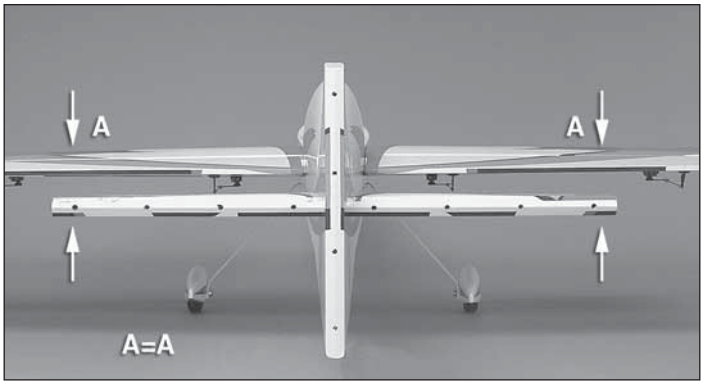
EXPERT TIP

HOW TO CUT COVERING FROM BALSA

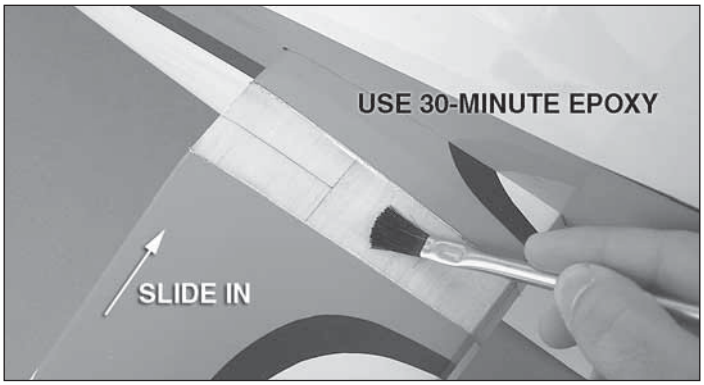


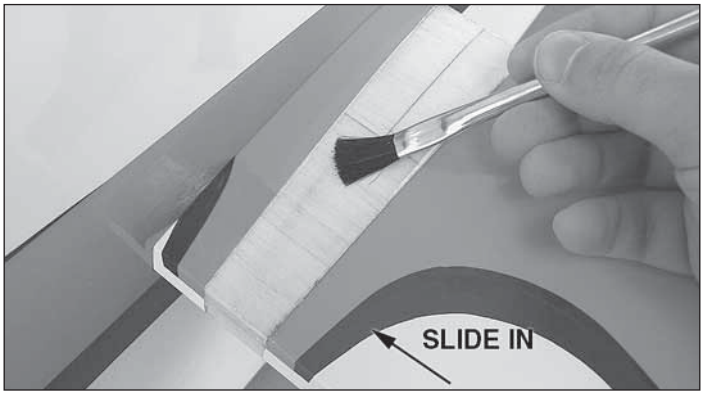
Use a thin metal straightedge and a regular (15W) soldering iron instead of a hobby knife to trim away your covering. While a hobby knife may work, it damages the underlying wood fibers and can cause the stabilizer to fail. Allow the iron to heat up to operating temperature. Gently run the tip of the iron across the covering using the straightedge as a guide. Move the iron at a rate that melts the covering but does not burn the wood fibers. A few gentle passes are preferable to slower passes that can damage the wood.

❏ 5. Trim the covering for the wing tube and wing dowels on the fuselage.



❏ 6. Temporarily install the wings onto the fuselage using the wing tube and the plastic 1/4-20 x 1" [25mm] wing bolts. Fit the stab once again and check the alignment of the stab with the wings by leveling the wings with your work surface and then measuring the distance between that and the tips of the stab. The distances from each stab tip should be equal and the stab should be parallel with the wings. If there is a slight misalignment, you may apply weight to the high side or lightly sand the fuselage sides until the stab aligns.



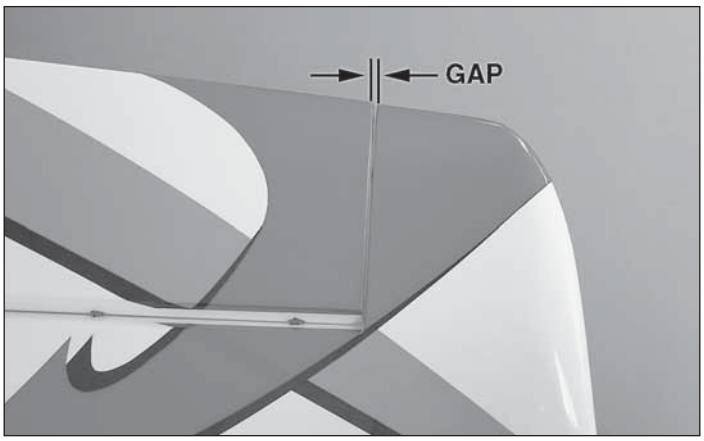


❏ 7. Apply 30-minute epoxy to the top and bottom of the stab center section and slide it into the fuselage. Pull the stab through the fuselage past center and re-coat the center section on the opposite fuselage side. Slide the stab back into the fuselage, and then center it and level it like you did earlier.

❏ 8. Use paper towels and denatured alcohol to wipe away any excess epoxy from the stab to fuselage joint. Check to see that the stab stays in position and allow the epoxy to cure.

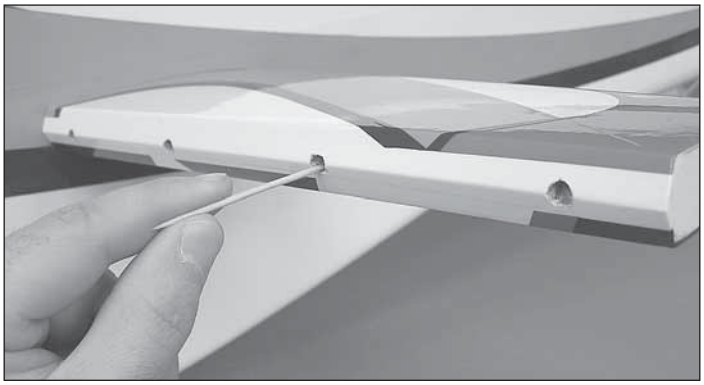
Hinge the Horizontal Stabilizer

This section details the process for hinging the elevators. We performed the operation using 30-minute epoxy. This is generally enough time to do both elevators with one batch if you are completely prepared. If you are worried about accomplishing both sides, or you are working in a warm climate, do one elevator at a time.

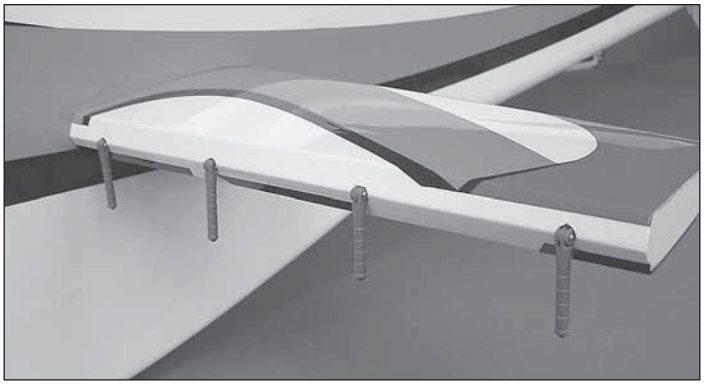


❏ 1. Test fit eight hinges in the stab and then fit the elevators. Check for free movement of the elevators and that there is a visible gap between the tip of the stab and the elevator counterbalances. If the counterbalance interfers with the stab, you should remove the covering from the tip of the stab and sand off enough material until you get a good fit You'll have to re-cover the area of wood you exposed. **DO NOT attempt to re-drill the hinge holes!**

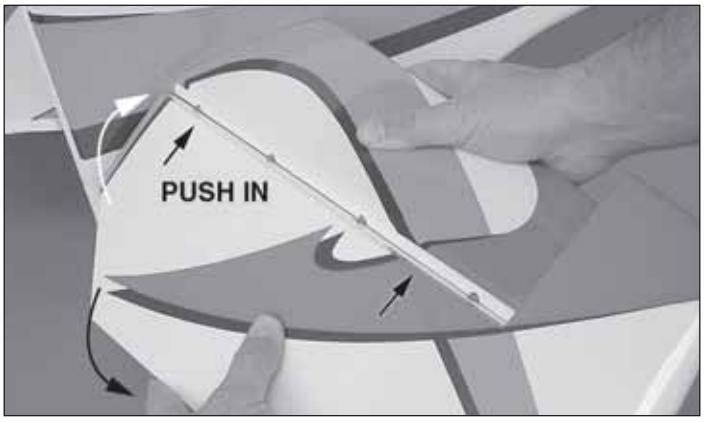
❏ 2. Remove the hinges and the elevators. Prepare the hinges as you did earlier using petroleum jelly.



❏ 3. Thoroughly coat the hinge pockets and the tips of each hinge with 30-minute epoxy.



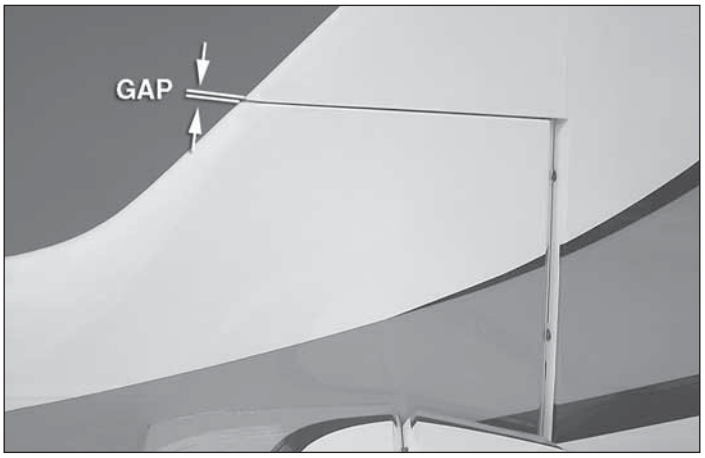
❏ 4. Fit the hinges into the stab, making sure to orient them so that the hinge pin is parallel to the hingeline.



❏ 5. Install both elevators. Push each one up against the hinge line. Deflect them up and down so that the hinges align properly. Use tape to hold the elevators level and up against the hinge line like you did with the ailerons.

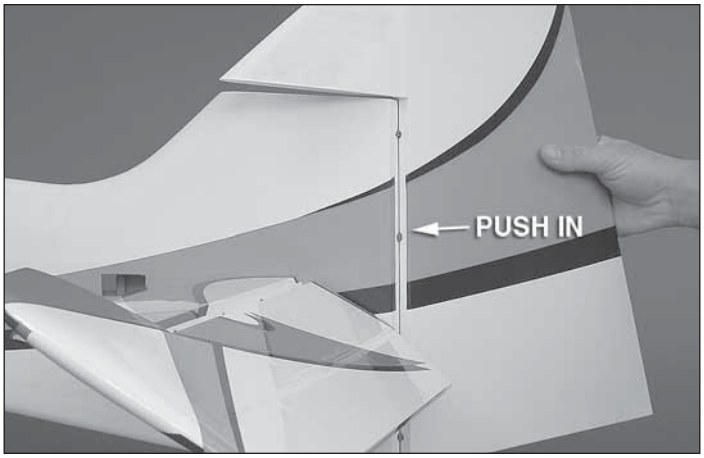
❏ 6. Allow the epoxy to cure before you remove the tape or try to move the elevators.

Hinge the Rudder



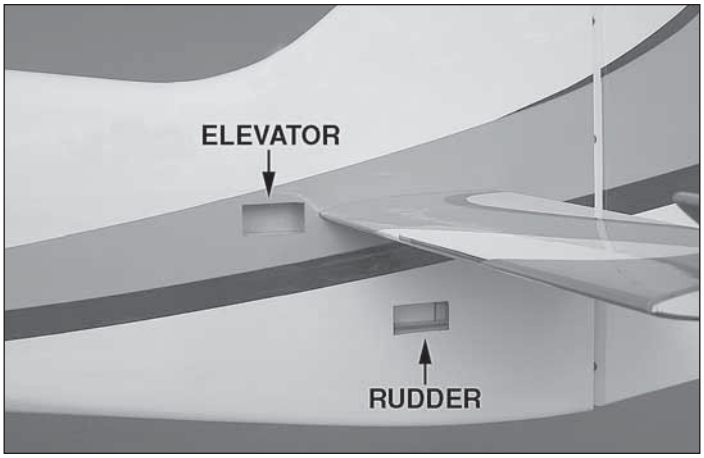
❏ 1. Test fit the rudder using the four remaining hinges. Check for free rudder movement and a visible gap between the tip of the fin and the rudder counterbalance.

❏ 2. Prepare the hinges as you did with the aileron and elevator hinges.



❏ 3. Use 30-minute epoxy to glue your hinges in place. Remember to align them and to deflect the rudder both ways when you install it.

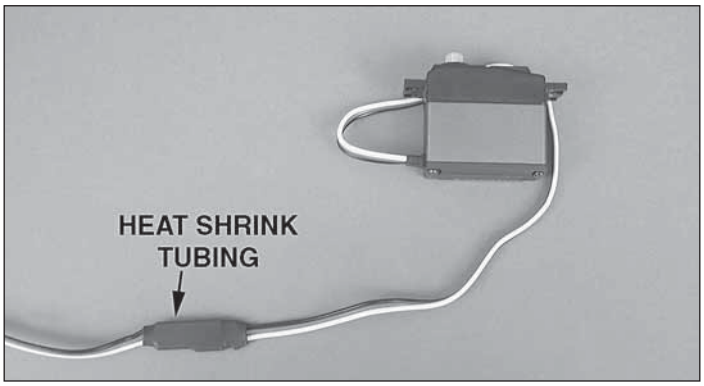
❏ 4. Use tape to hold your rudder in place while the epoxy cures.



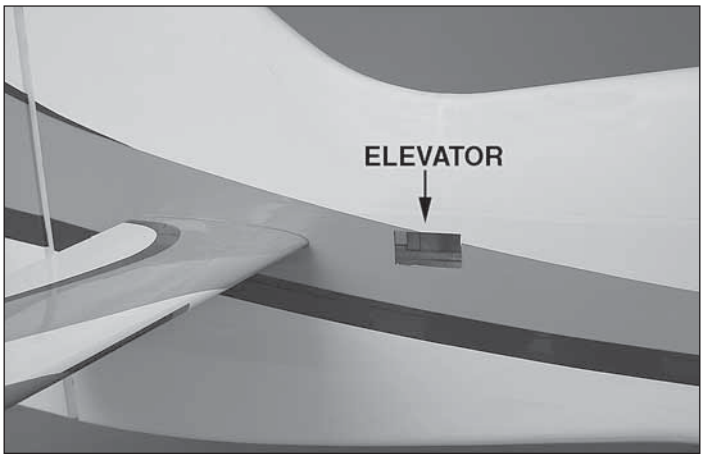
❏ 2. Trim the covering from the elevator and rudder servo bays on the left side of the fuselage.

Install the Elevator & Rudder Servos

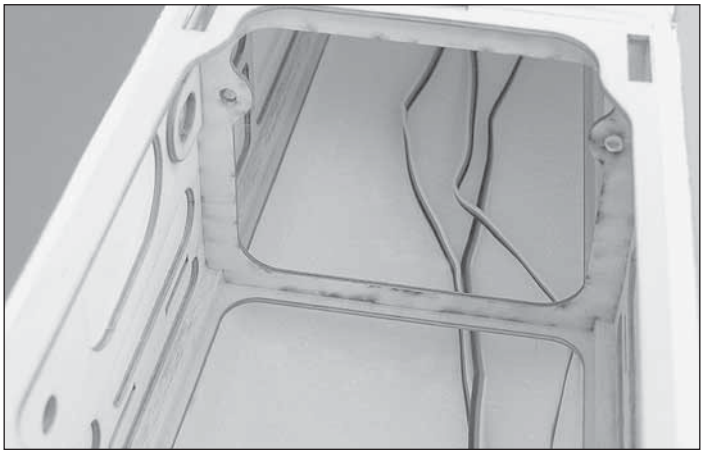
For the elevator and rudder servos, we recommend that you use Futaba 9155 digital servos. For the elevators only, you can use a metal geared servo with a minimum 100 oz-in [7.2 kg-cm] torque rating but you should expect a slower response and control blow-back at higher speeds. **Note:** You **must** use a servo with a minimum 150 oz-in [11 kg-cm] torque rating **for the rudder**.



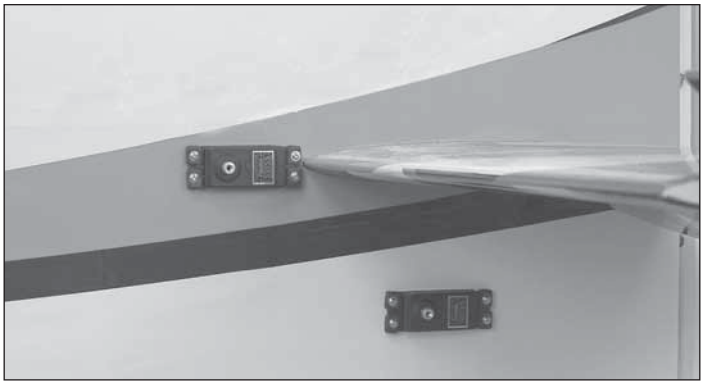
❏ 3. Attach a 36" [914mm] servo lead extension to the three tail servos. If you anticipate mounting your receiver in the aft-most equipment tray, you may use shorter servo lead extensions.



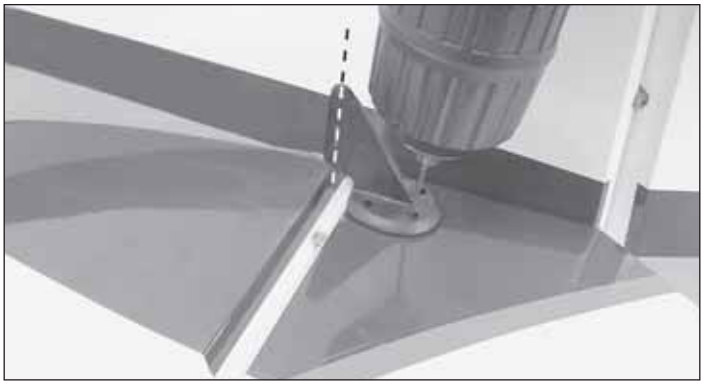
❏ 1. Trim the covering from the elevator servo bay on the right side of the fuselage as shown.



❏ 4. Fit your rudder and elevator servos in place. Route the wires under the formers as shown.



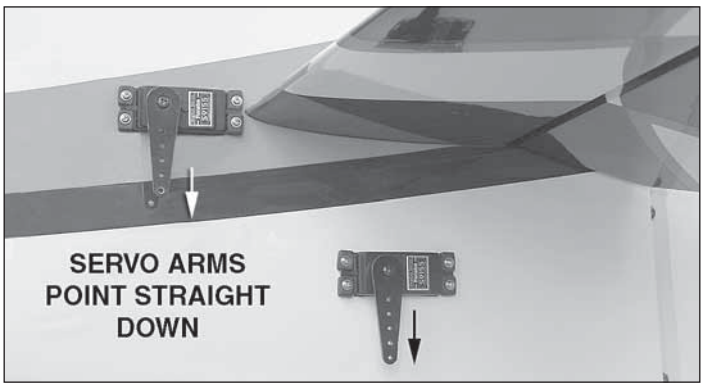
❏ 5. Install the elevator and rudder servos. Use a 1/16" [1.6mm] drill bit to drill the holes and use thin CA to harden the wood.



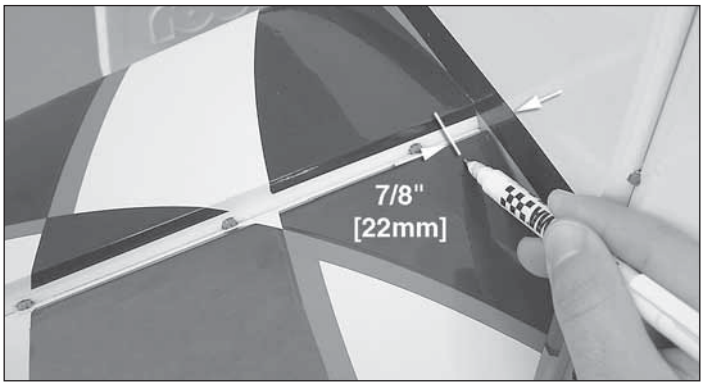
❏ 3. Center a control horn over the line that you made making sure that the clevis holes are also centered over the hinge line. Hold the horn in position and use a 1/16" [1.6mm] drill bit to drill four holes in the elevator. Remember to only drill 1/2" [13mm] deep.

❏ 4. Use four #4 x 1/2" [13mm] sheet metal screws to mount the elevator control horns. Remove the screws and use thin CA to harden the threads you created in the wood. Reinstall the control horn.

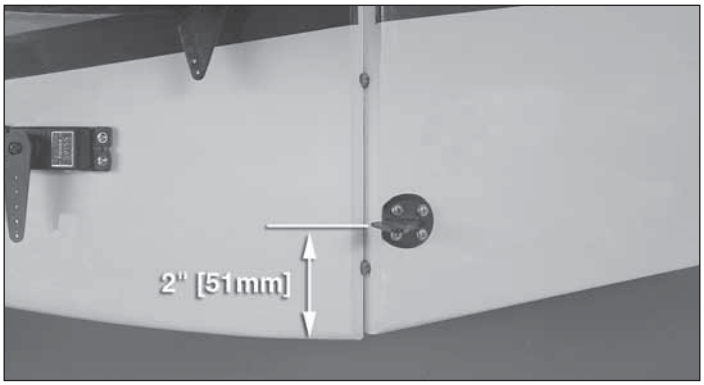
Install the Control Horns



❏ 1. Center your servos. Attach a 1-1/2" [38mm] single-sided servo arm to each servo so that the arm is 90° to the servo case when the servo is centered. Install the arms so that they point down.

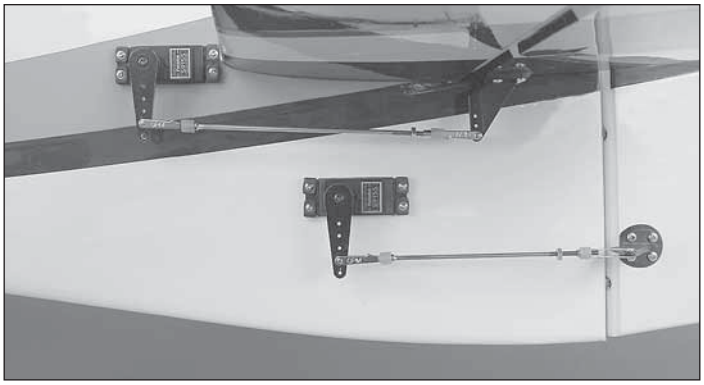


❏ 2. Turn the fuselage over (a foam building stand is helpful here). Use a felt-tip pen to make a mark on each elevator that is 7/8" [22mm] from the side of the fuselage.



❏ 5. Make a line 2" [51mm] from the bottom edge of the rudder. Drill the holes for the rudder horn and install it with four #4 x 1/2" [13mm] sheet metal screws.

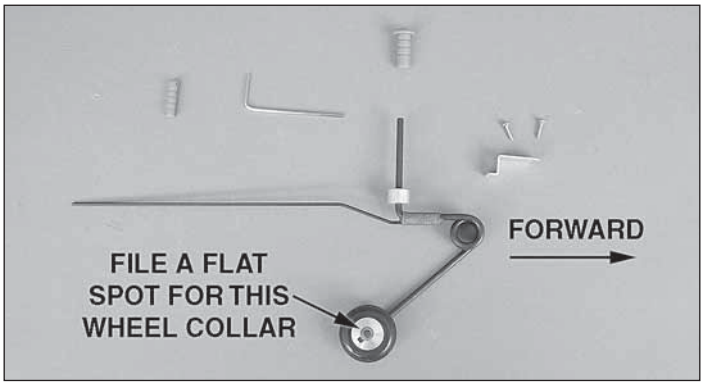
❏ 6. Install a 4-1/2" [114mm] pushrod to the rudder servo and rudder. The pushrod should be installed on the servo arm so that it is 1-1/4" [32mm] out from the center of the servo arm and in the outermost hole of the control horn. Turn on your radio and center the rudder by adjusting the clevis.



❏ 7. Install the 5-1/4" [133mm] pushrod to the left elevator servo and elevator.

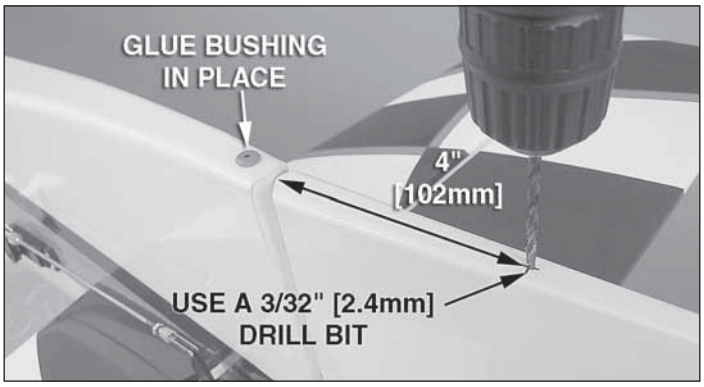
❏ 8. Install the 7-1/4" [184mm] pushrod onto the right elevator servo and elevator.

Tail Gear Installation

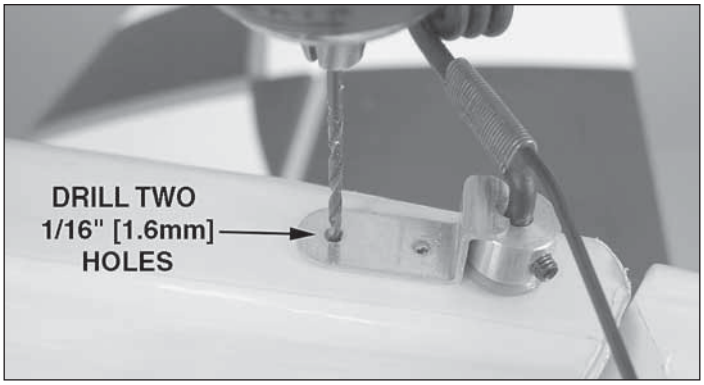


❏ 1. Locate the tail gear assembly. Remove the wheel collar and file a flat spot on the axle where the set screw contacts the axle. Apply threadlocking compound to the wheel collar set screw and reinstall it.

❏ 2. Turn the fuselage over. Trim the covering from the tailwheel mounting hole. Use epoxy to glue the nylon bushing in place. Don't get epoxy into the bushing.

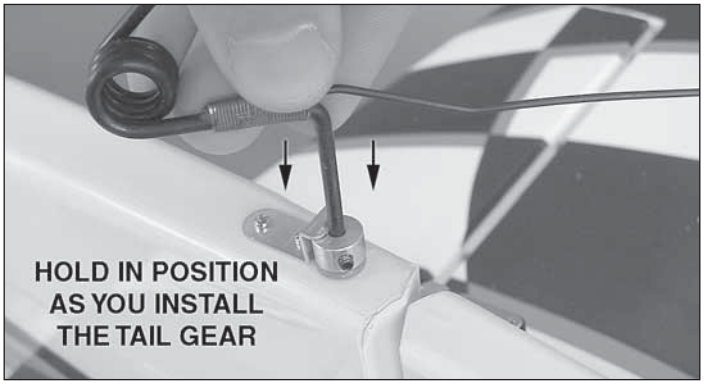


❏ 3. Make a mark 4" [102mm] back from the hinge line on the bottom of the rudder. Make sure that the mark is centered and drill a 1/2" [13mm] deep hole here for the plastic tailwheel guide wire post. Use a 3/32" [2.4mm] pilot drill bit and then step up to a 5/32" [4mm] bit for the final hole.

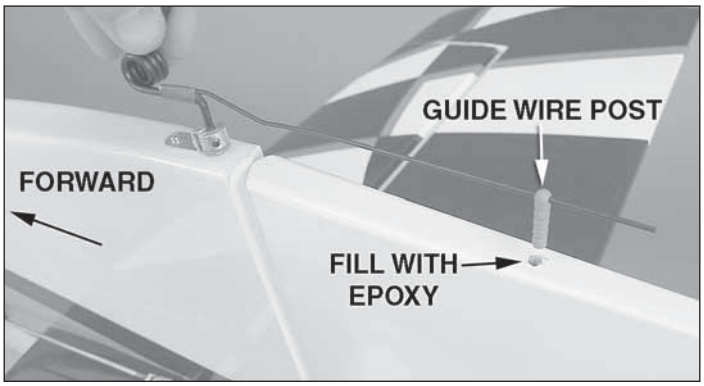


❏ 4. Fit the tail gear assembly into the bushing and fit the tail gear retainer to the fuselage bottom as shown. Drill two 1/16" [1.6mm] holes into the fuselage using the retainer as a guide. Remove the tail gear assembly.

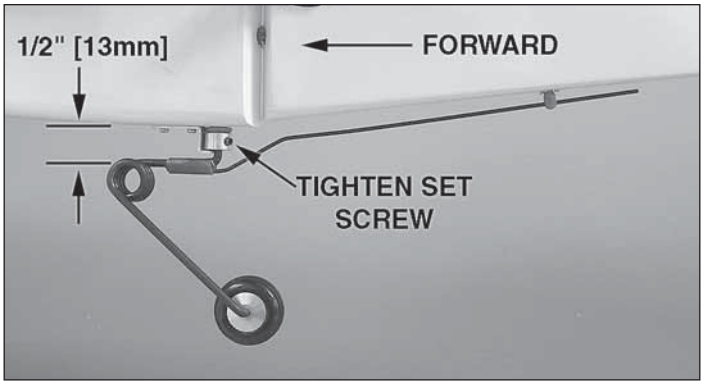
❏ 5. Use the two 8mm sheet metal screws to attach the retainer to the fuselage.



❏ 6. Loosen the tail gear collar set screw and remove the collar. Position the collar under the tail gear retainer as you insert the tail gear into the bushing. Do not tighten the collar yet.



❏ 7. Apply epoxy to the plastic tailwheel guide wire post and slide it onto the tailwheel guide wire. Glue the post into the hole you drilled in the bottom of the rudder.



❏ 8. Adjust the tail gear's position in the main bushing so that the tail gear wire is 1/2" [13mm] from the bottom of the fuselage. Use threadlocking compound on the set screw and tighten the collar.

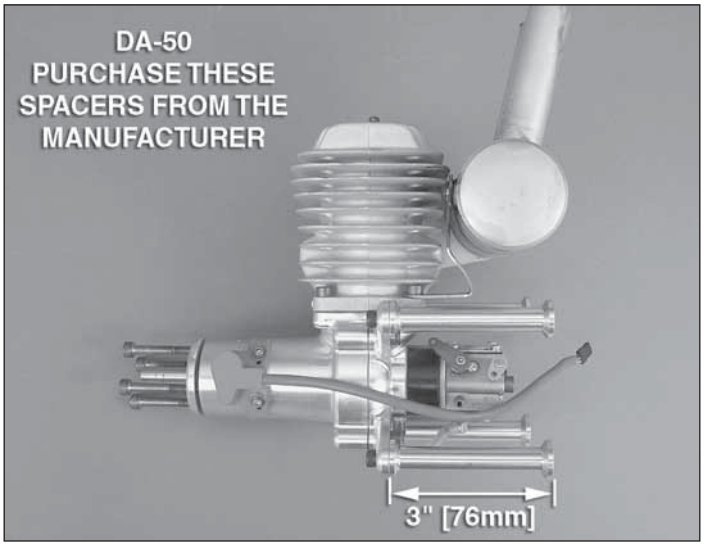
ENGINE/MOTOR INSTALLATION

In this section we cover the installation of the Desert Aircraft DA-50 gasoline engine, the O.S. 1.60 FX two-stroke glow engine, and the Great Planes ElectriFly 80mm brushless out-runner motor. Please jump to the section that applies to your engine/motor installation.

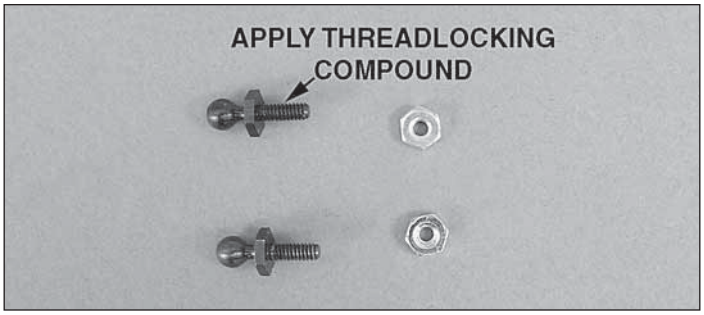
Gas Engine Installation

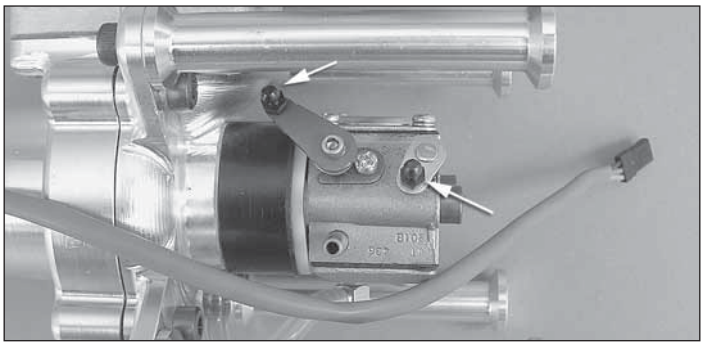
This section will cover the installation of the Desert Aircraft DA-50 engine. When you order your engine from Desert Aircraft, make sure that you specify that you need the 3" [76mm] standoff mounts and standard muffler.

A template is provided for the DA-50 gas engine as well as for the Fuji-Imvac™ BT-43 EI-2 engine. We recommend the DA-50 for the best 3D performance. The Fuji-Imvac BT-43 EI-2 is a suitable sport flying alternative and installs in a relatively similar manner. **Note:** Please use the included 12 x 20mm aluminum spacers if you are installing the Fuji-Imvac BT-43 EI-2.

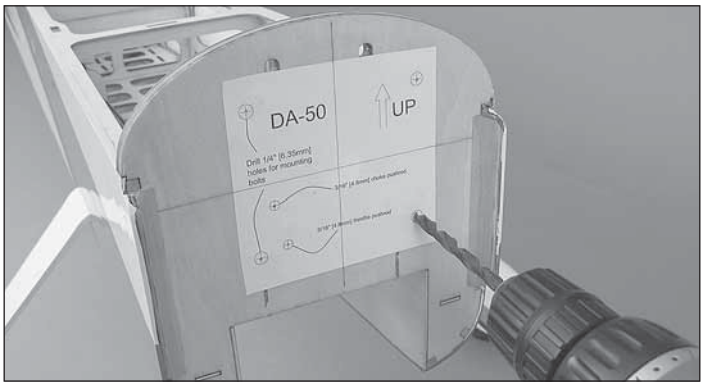


❏ 1. Install the 3" [76mm] aluminum standoffs using the hardware supplied by the engine manufacturer.



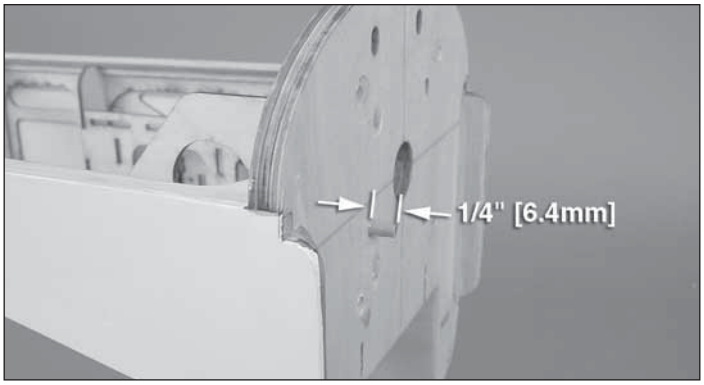


❏ 2. Locate two 2-56 threaded ball links and two 2-56 hex nuts. Install one on the throttle arm and one on the choke arm using threadlocking compound. Secure the ball links using the 2-56 hex nuts.

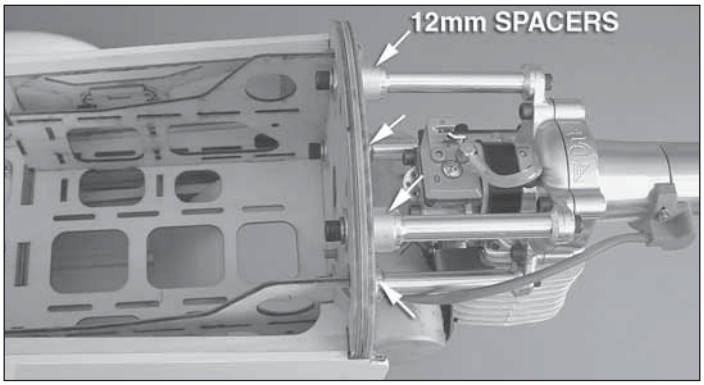


❏ 3. Turn to the back of this manual and cut out the drilling template for the engine you're using. Center the template by matching the template crosshairs with the firewall crosshairs. Tape it in place and use a 1/8" [3.2mm] drill bit to drill four engine mount pilot holes in the firewall. A center punch or scratch awl can be used to make a centering mark before you drill. Follow up with a 1/4" [6.4mm] drill bit and enlarge the holes.

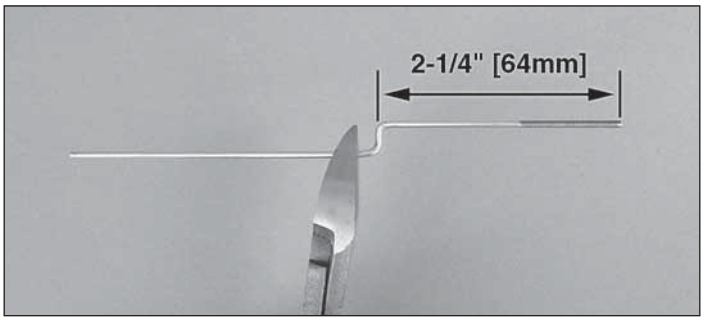
❏ 4. Drill out the throttle and choke pushrod holes using a 3/16" [4.8mm] drill bit. **Note:** Some variants of the DA-50 have the throttle and choke arms located on the other side, so please check your engine before you drill the holes.



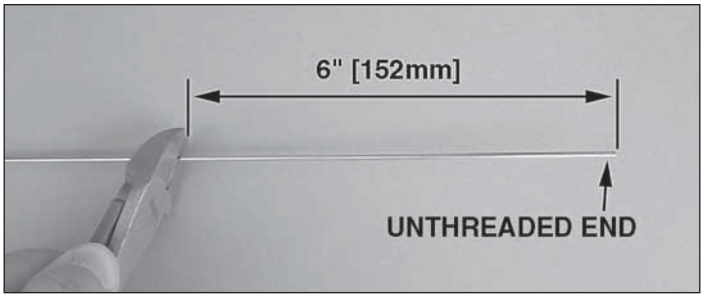
❏ 5. Cut a 1" [25mm] piece of outer pushrod tubing from the 36" [914mm] length supplied. Install it in the firewall as shown so that 1/4" [6.4mm] of the tube protrudes forward from the firewall. Roughen the surface with sandpaper and use epoxy to glue it in place.



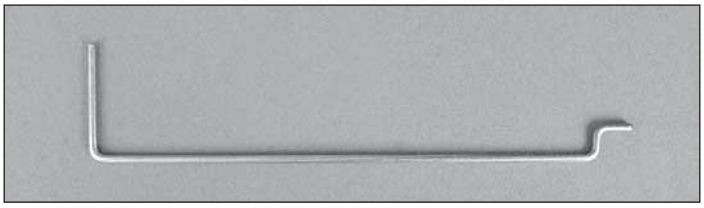
❏ 6. Obtain four 1/4-20 x 1-1/2" [38mm] SHCS, four 1/4" [6.4mm] lock washers, and four 1/4" [6.4mm] washers (not included). Locate the four included 12 x 20mm aluminum spacers. Install the engine to the firewall using threadlocking compound on the threads of the bolts as an added safety measure.



❏ 7. Locate the 2-56 x 6" [152mm] threaded one end rod. Measure 2-1/2" [64mm] from the threaded end and make a mark. Start your Z-bend at the mark so that the leg of the bend is 2-1/2" [64mm] from the threaded tip. Clip off the excess rod. This will be referred to as **"pushrod A."**

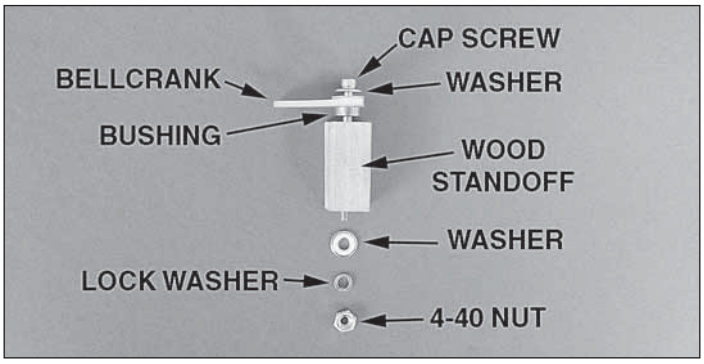


❏ 8. Locate the 2-56 x 36" [914mm] threaded one end rod. Measure 6" [152mm] from the unthreaded end and make a mark. Cut the wire at the mark and retain this portion. This will be referred to as **"pushrod B."** The remaining portion of the rod will be used for the throttle later.

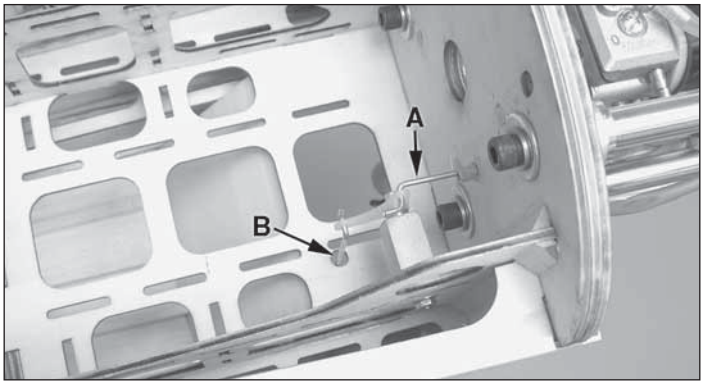


❏ 9. Make a Z-bend at one end of pushrod B and a 90° bend at the other end as shown. The last 3/4" [19mm] of rod should be left for the 90° bend.

❏ 10. Locate the nylon bellcrank and drill out the outermost holes in the arms using a 5/64" [2mm] drill bit.

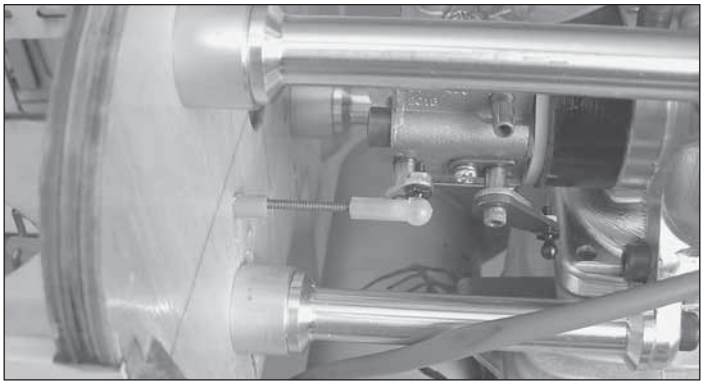


❏ 11. Locate one 4-40 x 1-1/2" [38mm] cap screw, one #4 lock washer, two #4 washers, one brass bellcrank bushing, one 4-40 nut, and one 1/2" x 1/2" x 1" [13 x 13 x 25.4mm] pre-drilled wooden standoff block. Fit the bellcrank parts in the order shown.

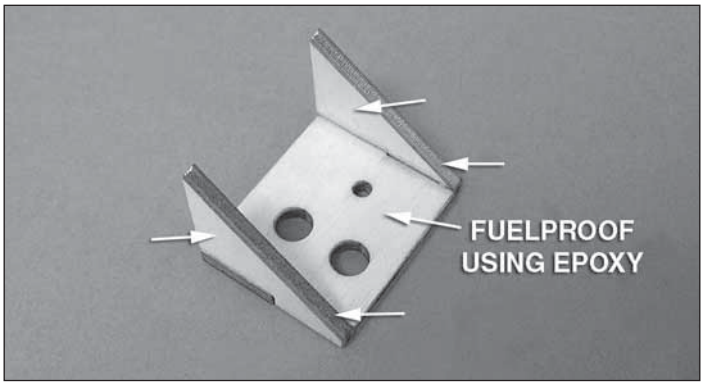


❏ 12. Loosely position the bellcrank assembly as shown and connect threaded pushrod A and pushrod B as shown. Apply

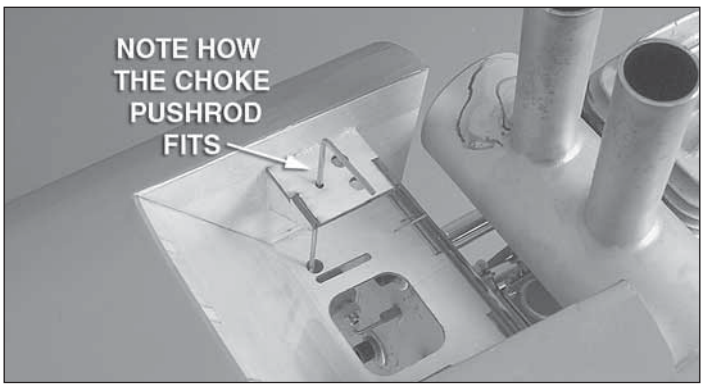
threadlocking compound to the screw threads and install the 4-40 nut using a #4 washer and lock washer.



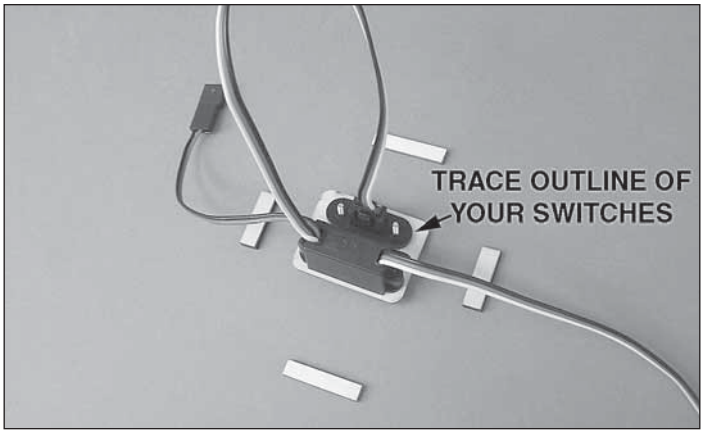
❏ 13. Thread a 2-56 nylon ball link socket onto **pushrod A** as shown and attach it to the choke arm.



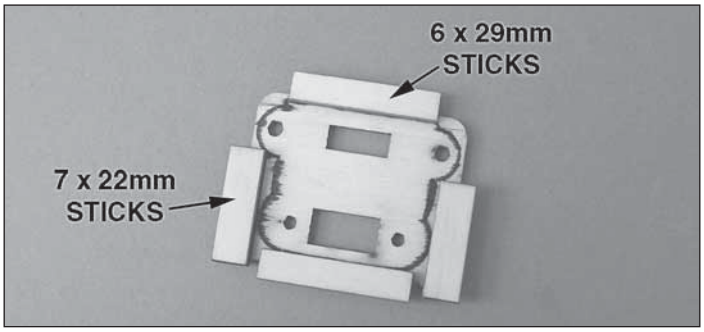
❏ 14. Locate the wood parts and build the fuel filler mount as shown. Fuelproof the filler mount with a thin layer of epoxy.



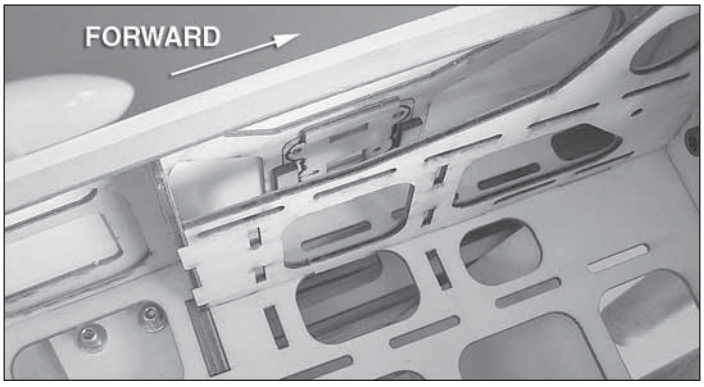
❏ 15. Turn the model over. Use epoxy to glue the fuel filler mount to the exhaust tunnel. Use sandpaper to roughen the surface to which the fuel filler mount will adhere.



❏ 16. Locate the switch plate that fits your brand of radio switch. Four plates are supplied: two Futaba switch & Ernst charge jacks and two Hobbico heavy-duty & Ernst charge jacks. Fit your switch and charge jack to the plate and use a pen or pencil to draw an outline of the switch and jack onto the back side of the plate. Remove the switch and charge jack.

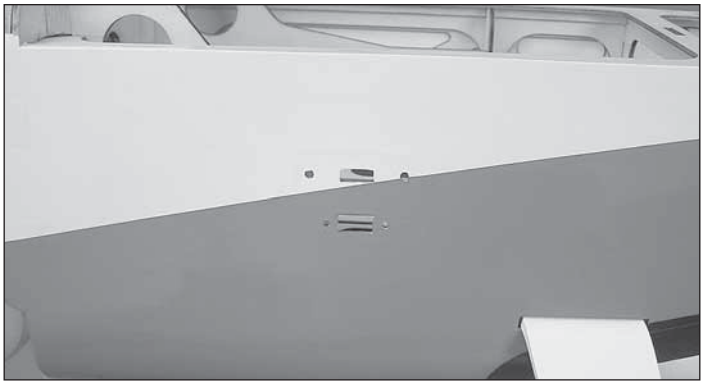


❏ 17. Use two 7 x 22mm and two 6 x 29mm sticks to make a flange for the charge plate.

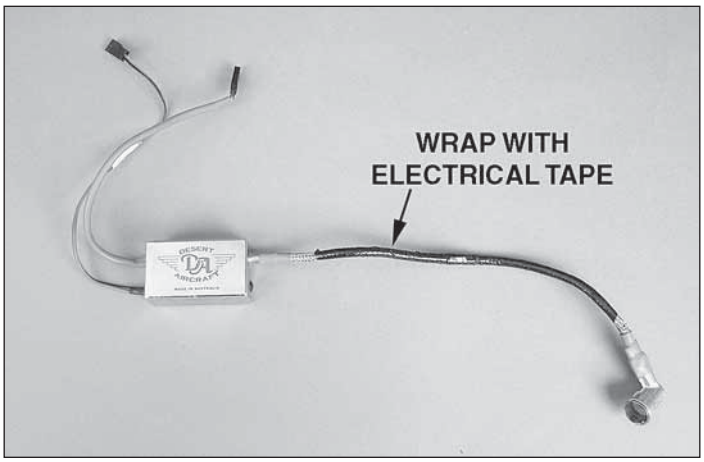


❏ 18. Install the switch plate on the model using epoxy to attach it. There are two forward locations reserved for the gas engine's ignition module. We chose the one on the left side.

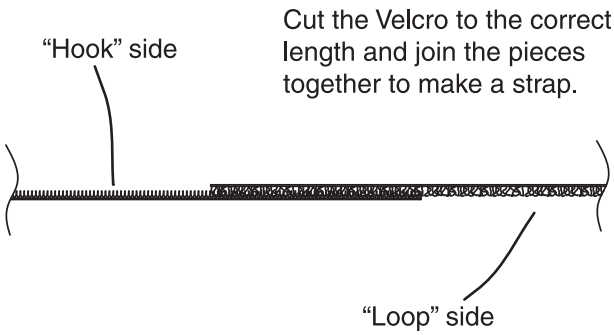
❏ 19. Tack down the covering over the switch plate using a covering iron set to a low temperature.



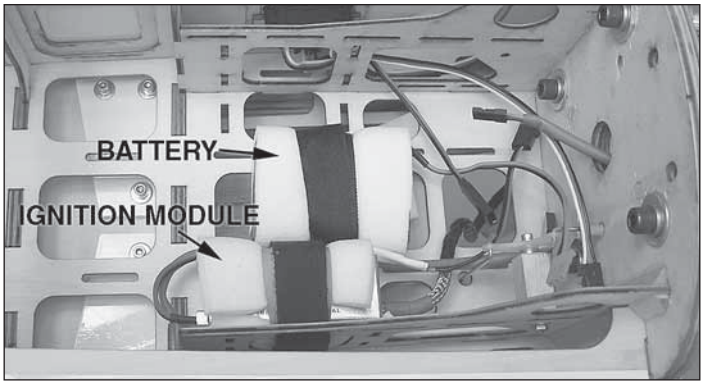
❏ 20. Trim the covering from over the switch plate holes and install the ignition switch and charge jack.



❏ 21. Wrap the shielded spark plug lead of the igniter unit with electrical tape. This will help prevent damage of the braided shield. Make sure that the battery leads you have match the leads for your ignition module. We had to splice in some new Futaba "J" leads to work with our battery.



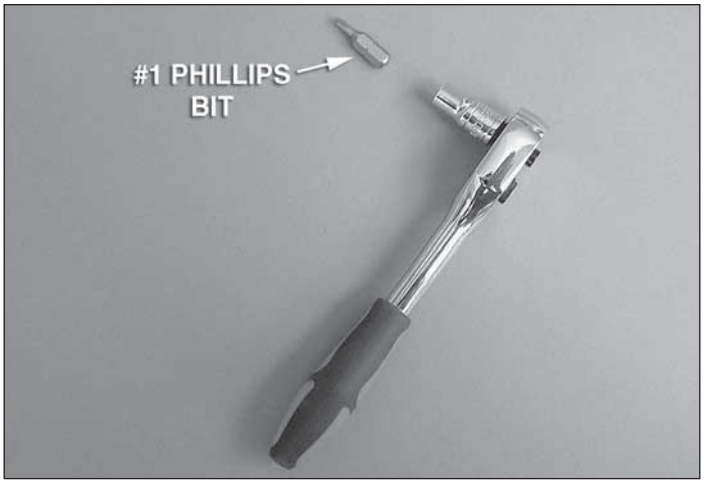
❏ 22. Cut two 5" [127mm] strips of non-adhesive backed hook and loop material. Make two sets of straps for your ignition unit and ignition battery by joining a piece of "hook" material to a piece of "loop" material.

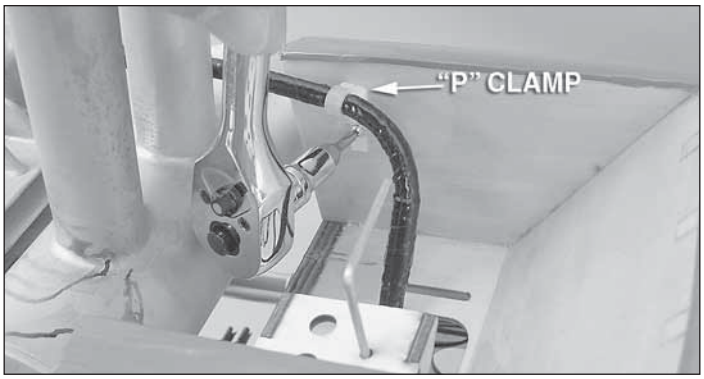


❏ 23. Wrap your ignition module in 1/4" [6.4mm] thick R/C latex foam rubber. Mount the ignition module to one of the uprights or to the forward compartment floor using one of the straps that you made.

❏ 24. Wrap the ignition battery in latex foam rubber. Mount the battery using the other strap that you made.

❏ 25. Connect the ignition module to the ignition switch. Connect the crank pickup to the ignition module. Connect the ignition battery to the ignition switch. Use heat shrink tubing to secure the connectors and a tie wrap to secure them to the upright.

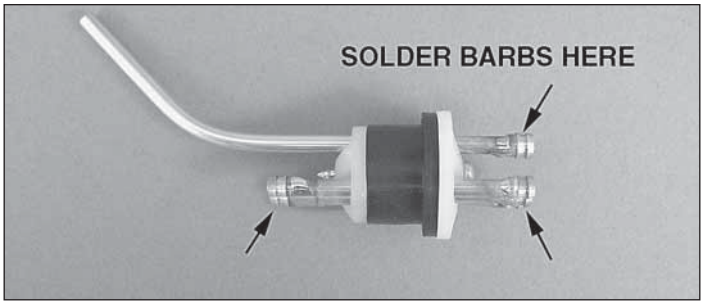




❏ 26. Turn the model over. Wrap a tie wrap around the spark plug lead to make a "P" clamp. Route the spark plug lead in a fashion that keeps it away from the muffler. Use a spare servo screw to attach this to the side wall of the exhaust box. Since a screwdriver won't fit, we suggest using a 1/4" [6.4mm] socket with a #1 Phillips bit.

❏ 27. The fuel tank hardware that is supplied with this kit is **suitable for glow fuel only and cannot be used with gasoline**. For this reason we recommend the Sullivan gasoline conversion kit (SULQ2684), five fuel line barbs (2x DUBQ0670), 36" [914mm] of Dubro 1/8" [3mm] Tygon fuel tubing (DUBQ0493), and 24" [610mm] of Dubro neoprene gas fuel line (in-tank) (DUBQ0455). Please retain the plastic tank and the fuel clunks. These are approved for gas.

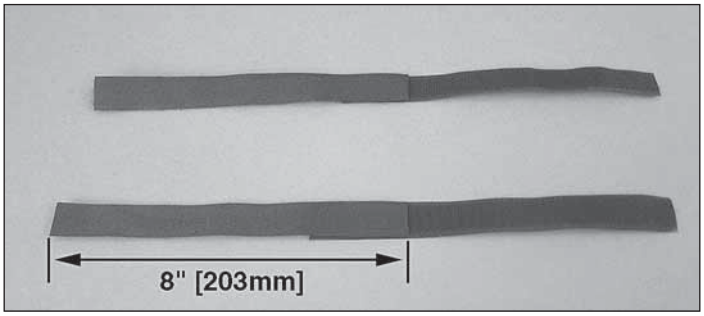
❏ 28. Cut one of the brass tubes in half. The other tube will be used as your fuel vent.



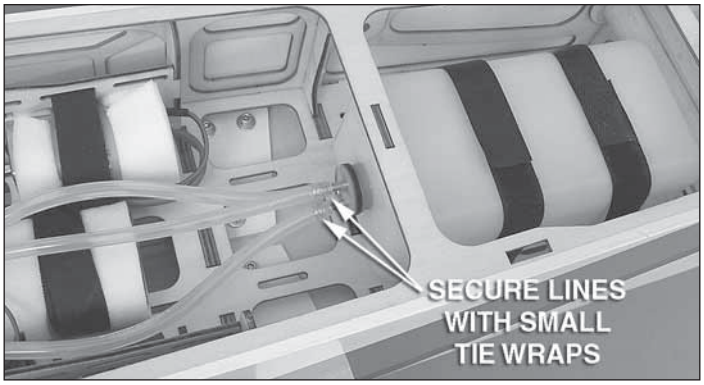
❏ 29. Build up the fuel tank stopper as shown and fit the fuel tubes. Solder the fuel line barbs in place.

❏ 30. Cut two pieces of fuel line so that each one is 5" [127mm] long. Build up the fuel tank with the vent line pointing to the top of the tank. Secure the lines within the tank with small tie wraps.

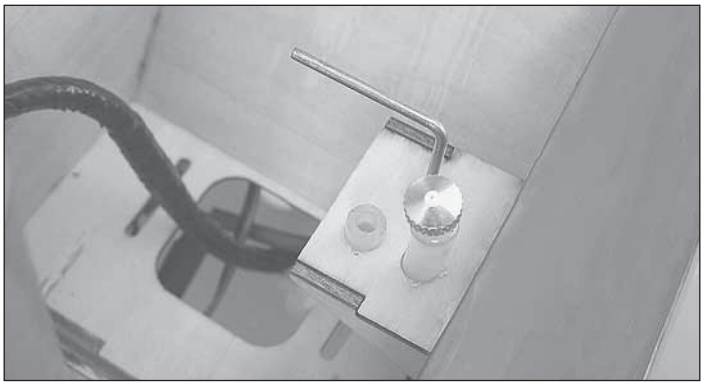
❏ 31. Finish assembling your tank and tighten the stopper screw. Be careful not to overtighten the stopper. This can split the tank along the seam. You may want to use a felt-tip pen to mark which direction the vent line is pointed so that you know where the top of the tank is.



❏ 32. Cut two 8" [203mm] strips of hook and loop material. Join each "hook" side to each "loop" side with a 2" [51mm] overlap.



❏ 33. Fit fuel lines to the tank and install it using the two straps you made. Route the fuel feed line to the carburetor. Use small tie wraps to secure the fuel lines to the lines on the tank.

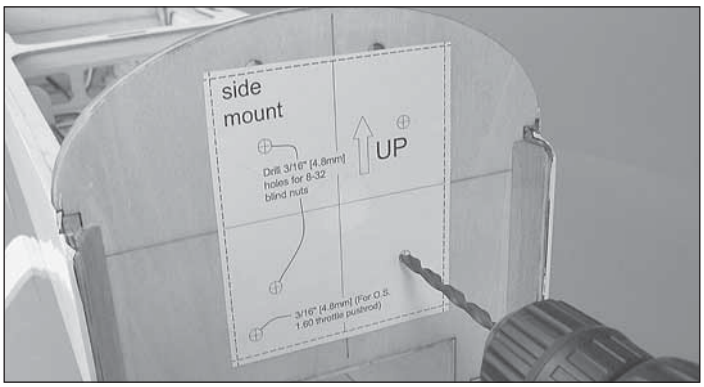


❏ 34. Route the vent and fill lines through the fuel filler mount and install a fuel filler plug.

Skip to the "Radio System Installation – Gas Engine" section.

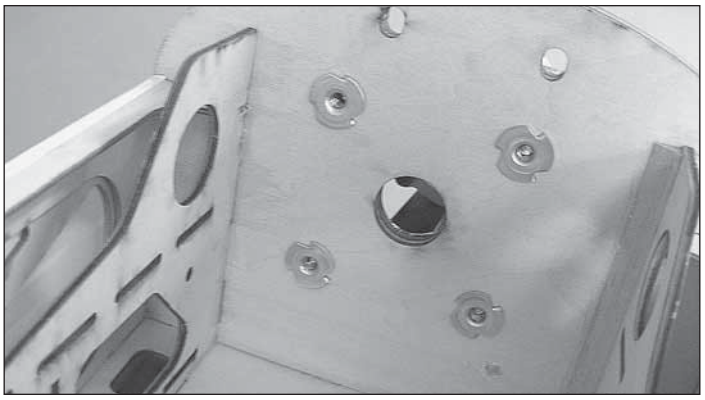
Glow Engine Installation

This section contains installation steps for the O.S. 1.60 FX two-stroke engine. The Great Planes engine mount supplied with this model is rated for 1.20 to 1.80-sized engines. If you are using an engine outside of this range, please use a suitable engine mount rated for it.

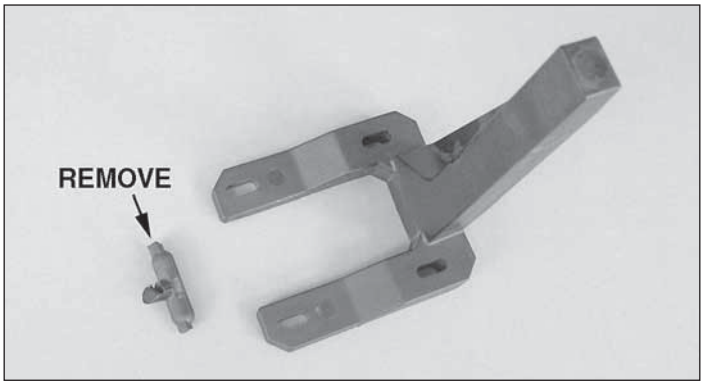


❏ 1. Turn to the back of this manual and cut out the drilling template for the engine you're using. Center the template by matching the template crosshairs with the firewall crosshairs. Tape it in place and use a 3/16" [4.8mm] drill bit to drill four engine mount holes on the firewall for the supplied engine mount. A center punch or scratch awl can be used to make a centering mark before you drill.

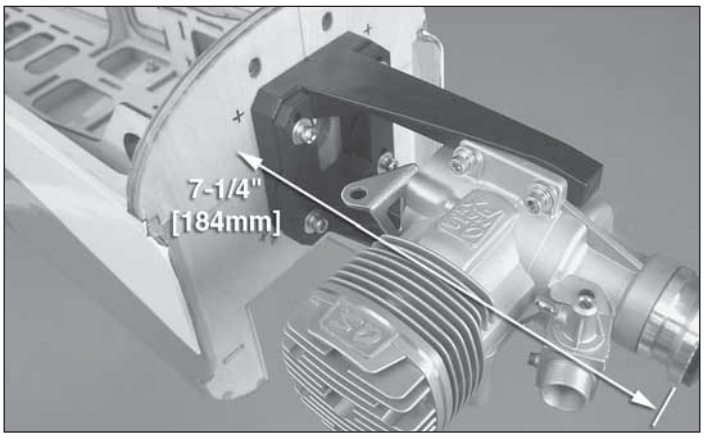
❏ 2. If you are using the O.S. 1.60 FX two-stroke engine, drill the hole for the throttle rod marked on the template. Use a 3/16" [4.8mm] drill bit for this.



❏ 3. Press four 8-32 blind nuts into the engine mount holes you drilled. Press them in from the back side of the firewall. You may need to use 8-32 bolts and washers to draw the nuts into the holes.



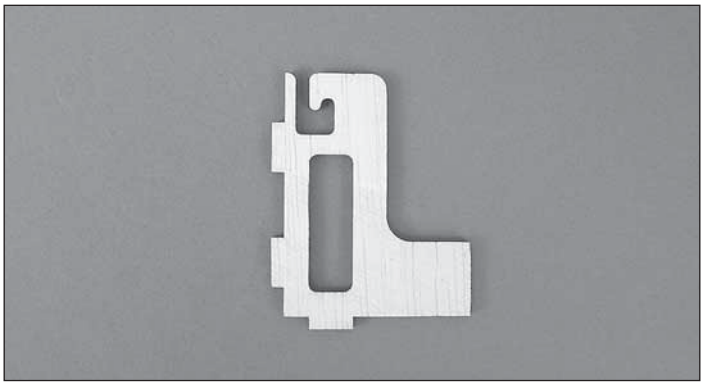
❏ 4. Break the tangs out of each molded engine mount half and grind off any remaining portion.

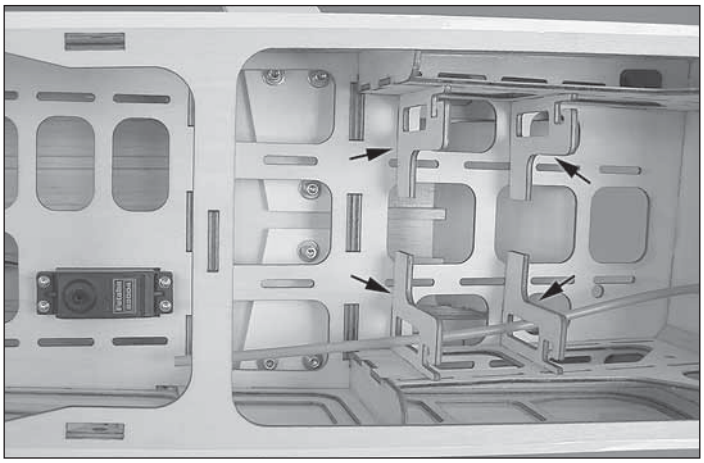


❏ 5. Fit the two engine mount sides together. Center the engine mount with the cross-hairs on the firewall and fit the mount to the firewall using four 8-32 x 1-1/4" [32mm] SHCS, four #8 lock washers, and four #8 washers. Leave the screws loose enough to adjust the width of the mounting

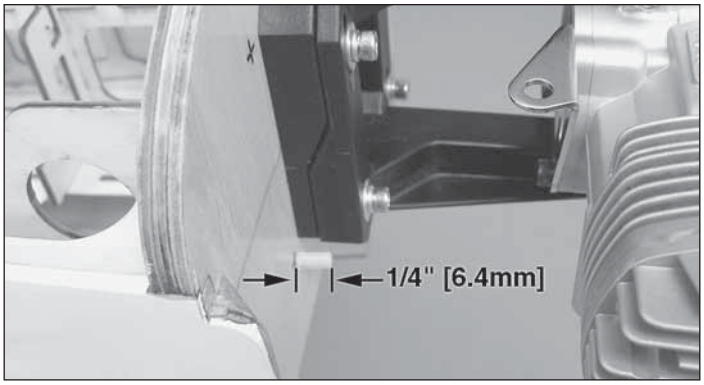
beams. Position the engine on the mount so that the drive washer is 7-1/4" [184mm] from the firewall. Clamp the engine in this position. Drill and tap your engine mount using an 8-32 tap set. Install the engine to the mount using four 8-32 x 1" [25mm] socket head cap screws (SHCS), four #8 lock washers, and four #8 washers.

❏ 6. Install the throttle servo in the center equipment tray as shown. Use a 1/16" [1.6mm] drill bit for the servo screw holes.

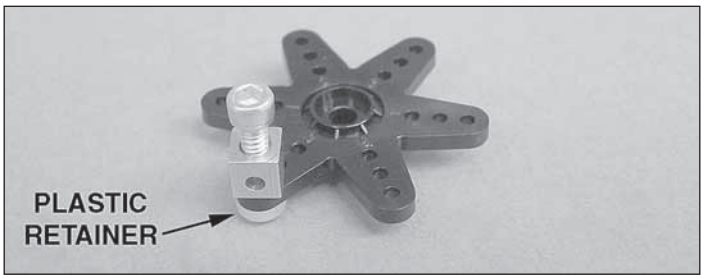




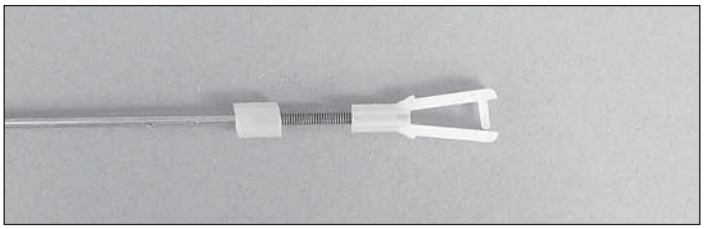
❏ 7. Dry-fit the fuel tank supports and route the plastic outer pushrod tube from the firewall to the servo.



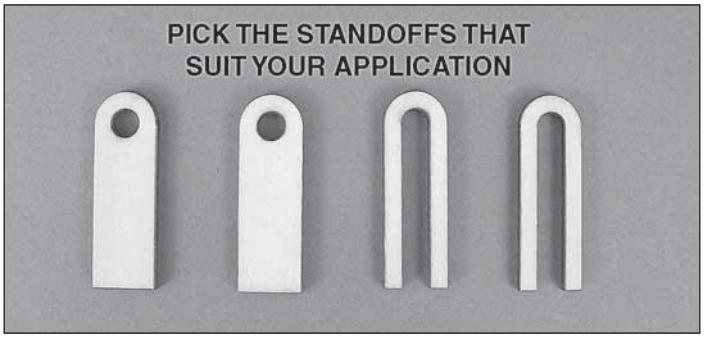
❏ 8. Trim the plastic pushrod tube so that there is at least 1/4" [6.4mm] of tube protruding forward of the firewall and that there is approximately 1-1/2" [38mm] of distance between the throttle servo output shaft and the tube. When you're satisfied with the fit of the pushrod tube, epoxy the fuel tank supports in place. Roughen the outer surface of the pushrod tube and epoxy it in place.



❏ 9. Install a screw-lock pushrod connector onto a short servo arm. Use a plastic retainer to hold this to the servo arm and a 4-40 x 1/4" [6.4mm] SHCS. Turn on your radio and position the servo arm. Install the arm to your throttle servo using the servo screw supplied with your servos.

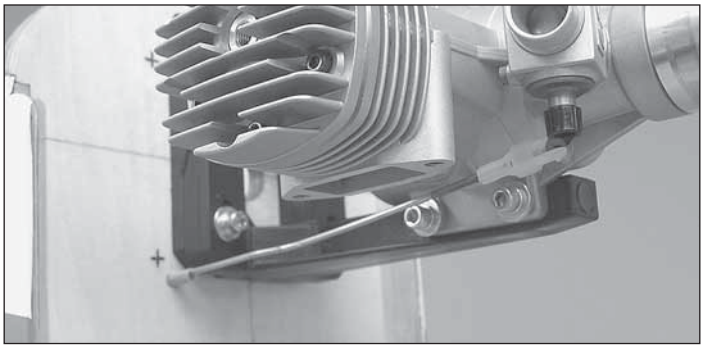


❏ 10. Locate the 2-56 x 36" [914mm] threaded one-end rod, one plastic clevis, and one silicone clevis retainer. Thread the plastic clevis onto the rod so that at least 3/8" [10mm] of thread is engaged. Slide a silicone retainer onto the rod and fit it into the pushrod tube.



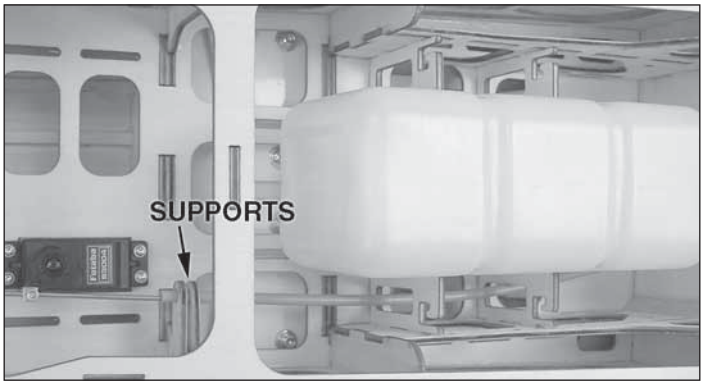
❏ 11. Locate two throttle rod standoffs. You will use these to support the pushrod tube at the servo arm, so slide these

onto the pushrod tube from inside the fuselage. **Note:** The base of each standoff can be trimmed down for a custom fit.

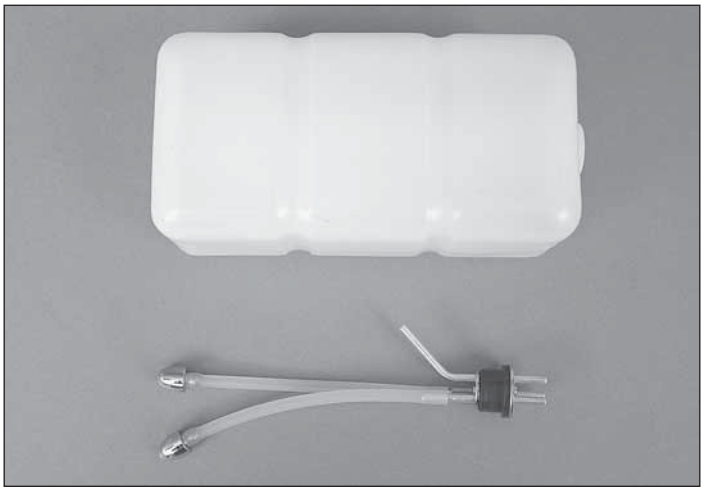


❏ 12. Slide the pushrod into the plastic tube and connect the clevis to your throttle arm. Slide the other end of the pushrod into the screw-lock pushrod connector. Bend the throttle pushrod as needed to clear your muffler or any obstructions.

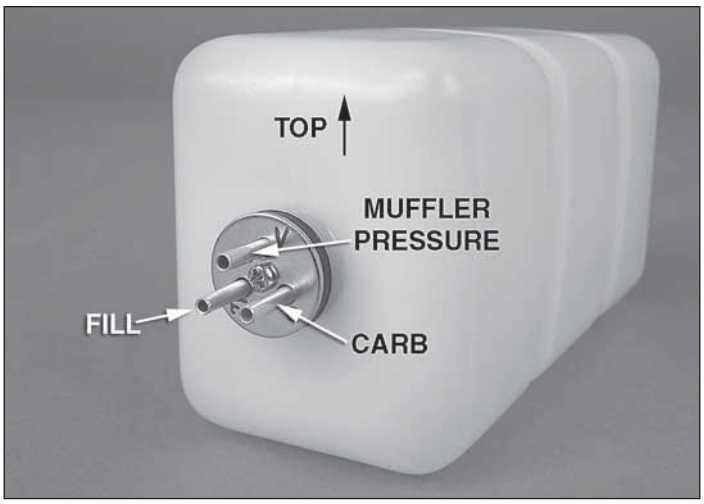
❏ 13. Turn on your radio and adjust your throttle linkage. Make sure that you can achieve full throttle, idle and throttle cut-off. Apply thread-locking compound to the 4-40 x 1/4" [6.4mm] SHCS and tighten it when you're satisfied that the throttle is rigged properly.



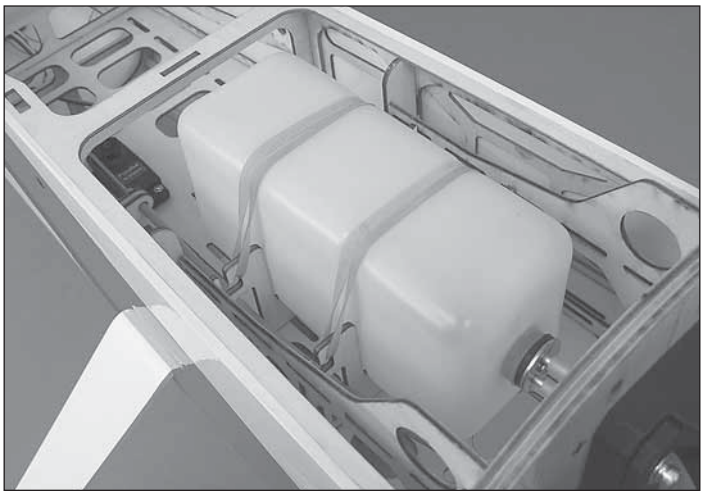
❏ 14. Fit and glue the pushrod supports to the fuselage former just ahead of the throttle servo. Glue them so that the pushrod aligns with the servo arm and won't bind up when the servo moves. Trim the excess pushrod wire, but leave enough in case you want to make adjustments later.



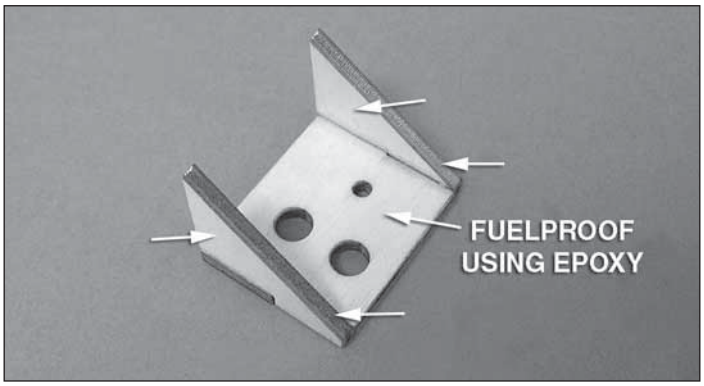
❏ 15. Cut two pieces of fuel line so that each one is 5" [127mm] long. Build up the fuel tank as shown with the vent line pointing to the top of the tank. You may want to use a felt-tip pen to mark which direction the vent line is pointed so that you know where the top of the tank is.



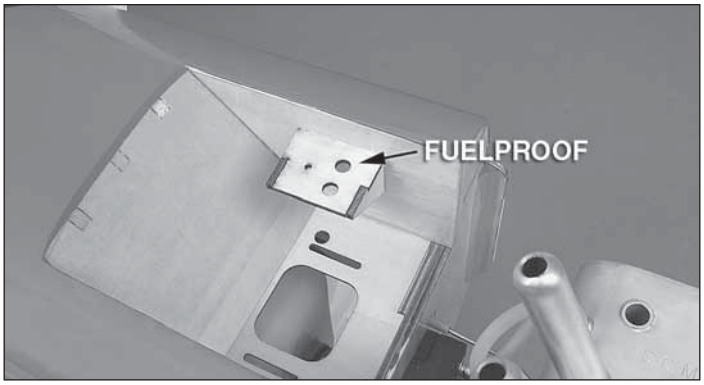
❏ 16. Finish assembling your tank and tighten the stopper screw. Be careful not to overtighten the stopper. This can split the tank along the seam.



❏ 17. Fit fuel lines to the tank and install it using two #64 rubber bands. You may test fit your muffler at this point and trim the vent line to length.



❏ 18. Locate the wood parts and build the fuel filler mount as shown.



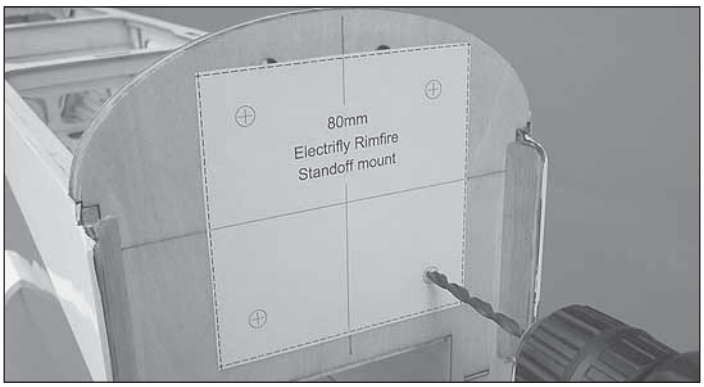
❏ 19. Turn the model over. Use epoxy to glue the fuel filler mount to the exhaust tunnel. Use sandpaper to roughen the surface of where the fuel filler mount will adhere to.

❏ 20. Test fit the covered balsa sheet as shown. The sheet is not "square." It matches the angle of the firewall. **Note:** One side has clear covering which must face outward.

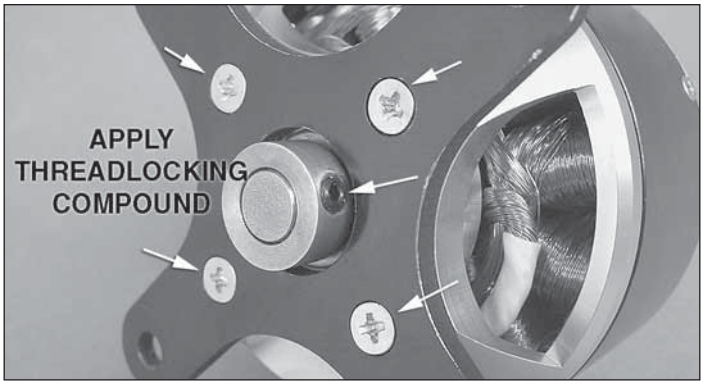
Skip to the "Radio System Installation – Glow Engine" section.

Electric Brushless Motor Installation

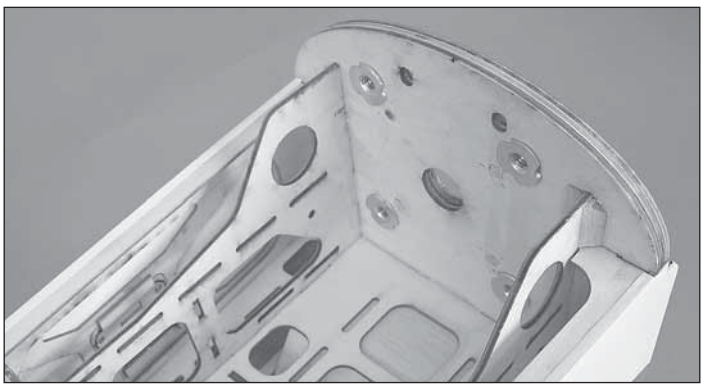
The electric power system shown in this section consists of a Great Planes Electrifly RimFire 80-75-230kV motor (GPMG4800), a Kontronik Power Jazz 63V Brushless 120A ESC (KONM3140), and two FlightPower 22.2V 5000mAh 6S LiPo batteries in series (FPWP0364).



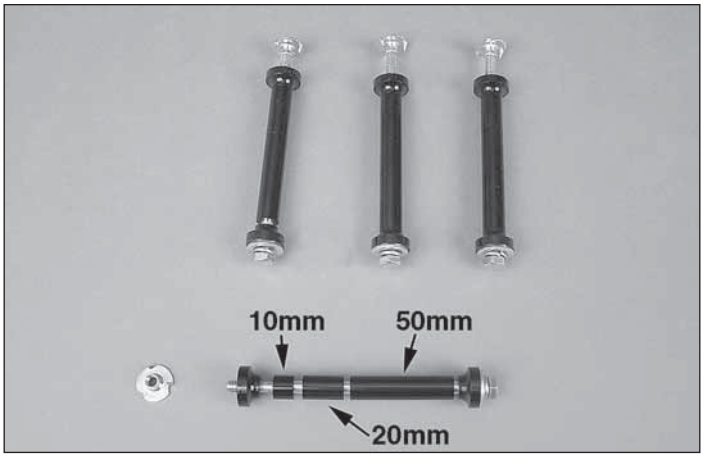
❏ 1. Turn to the back of this manual and cut out the drilling template for the RimFire electric motor. Center the template by matching the template crosshairs with the firewall crosshairs. Tape it in place and use a 9/32" [7.1mm] drill bit to drill four motor mount holes on the firewall for the Great Planes 80mm Standoff Mount. A center punch or scratch awl can be used to make a centering mark before you drill. **Note:** The Great Planes 80mm RimFire Standoff Mount set (GPMG1275) is available separately.

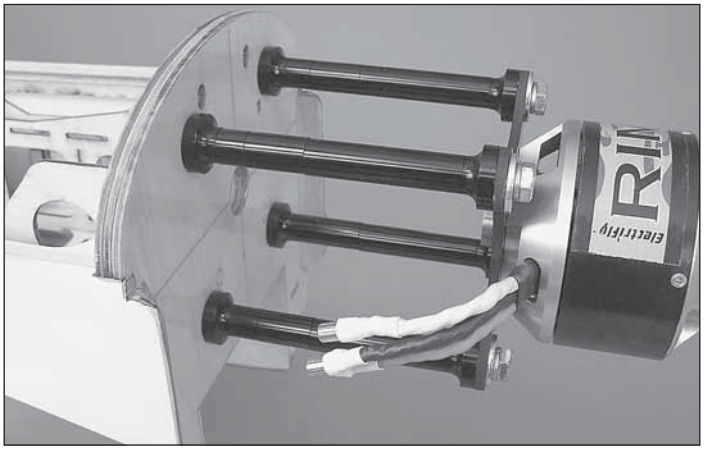


❏ 2. Prepare your motor by removing the motor mount screws, the two forward motor case set screws, and the rear locking collar set screw. Apply threadlocking compound to these and reinstall them.

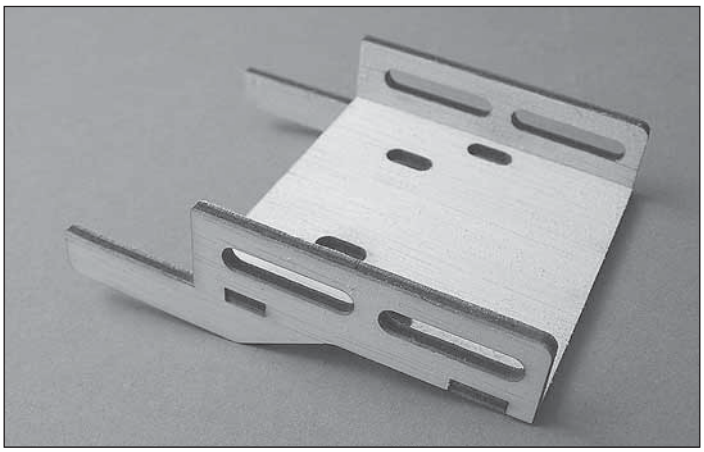


❏ 3. Install four 1/4-20 blind nuts in the firewall from the back side.

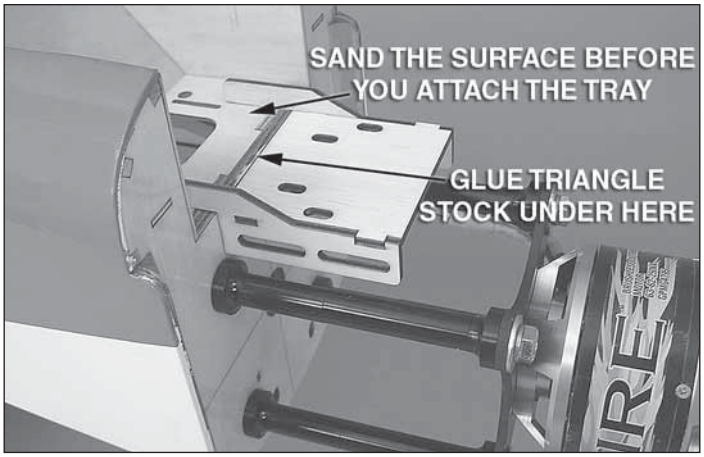




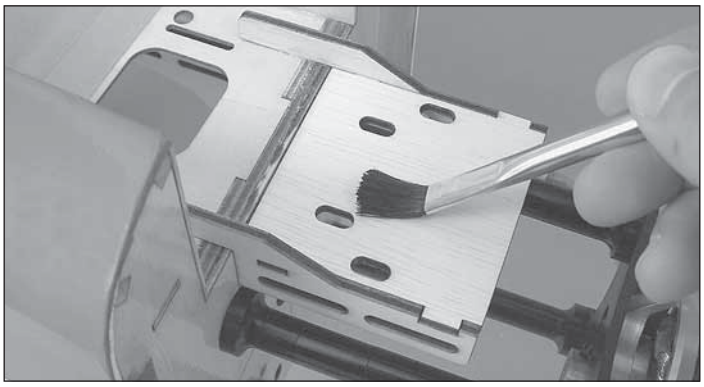
❏ 4. Locate four 50mm, 20mm, and 10mm standoff spacers as well as eight mounting feet, four 1/4-20 x 5" [127mm] bolts, four flat washers, and four lock washers. Install the motor using these parts as shown.



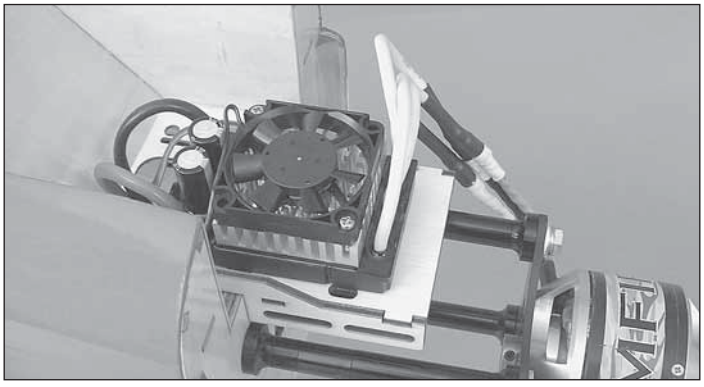
❏ 5. Build up the ESC tray as shown.



❏ 6. Use 80-grit sandpaper to roughen up the coated surface of the firewall and the equipment tray where the ESC tray will mount. Use epoxy to bond the ESC tray to the fuselage as shown. A piece of triangle stock is supplied to help secure the tray to the firewall.



❏ 7. If your ESC must be held on with double-sided tape, mix up some epoxy and thin it down with denatured alcohol. Coat the bottom surface of the ESC tray. Allow the epoxy to cure.

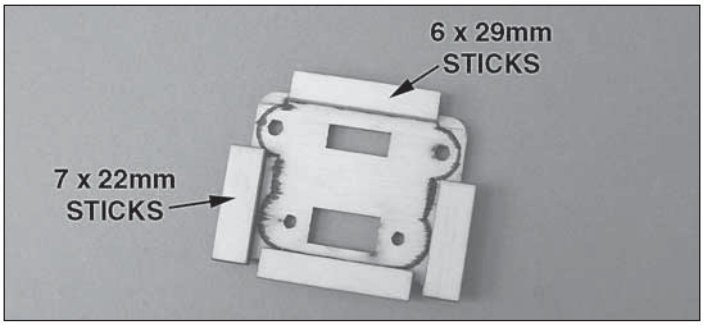


❏ 8. Mount your ESC using double-sided tape or the method specified by the manufacturer.

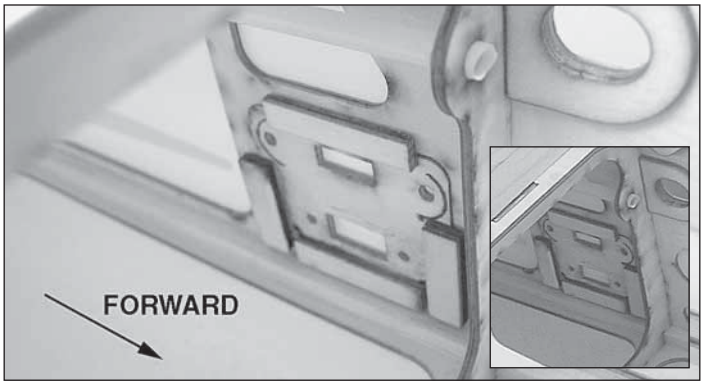
Skip to the "Radio System Installation – Electric Brushless" section.

RADIO INSTALLATION

Radio System Installation – Gas Engine

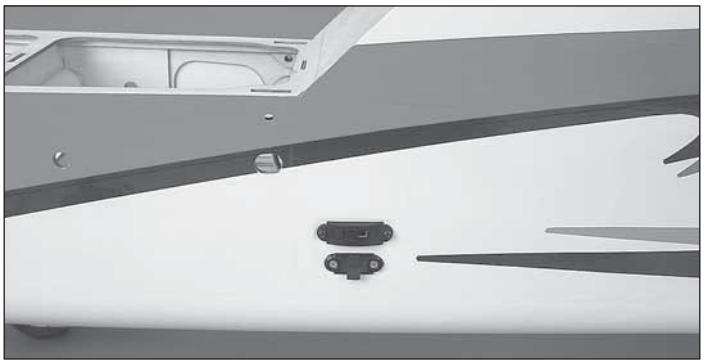


❏ 1. Prepare an ignition switch plate as you did earlier.

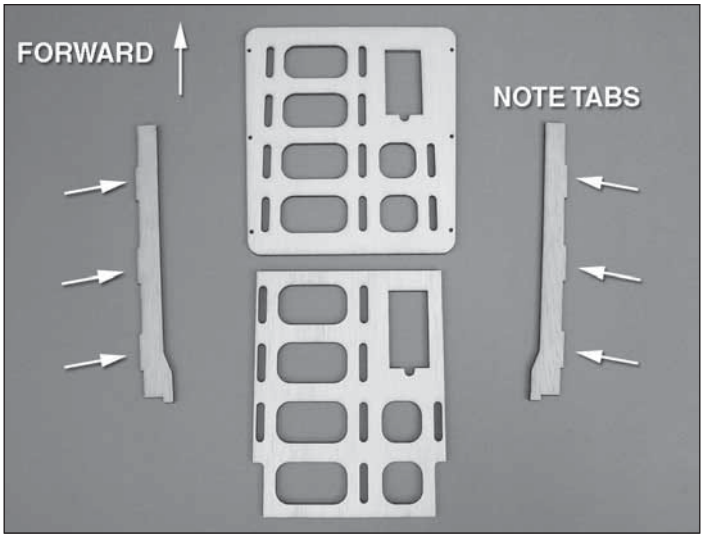


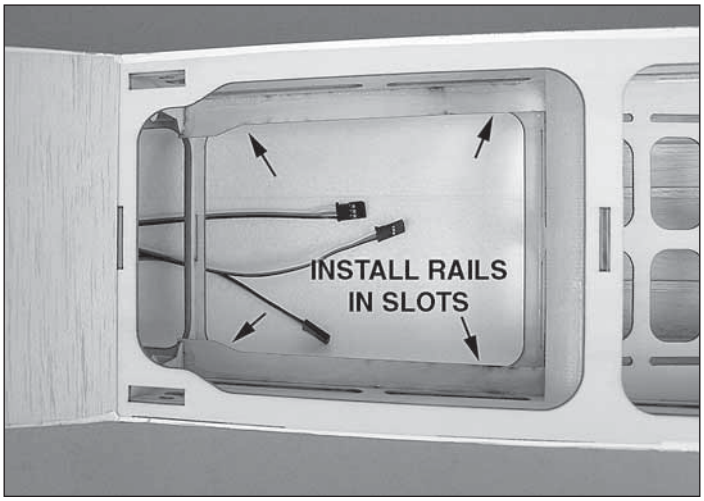
❏ 2. Install the ignition switch plate on the model using epoxy. A cutout for the switch plate is provided in the left and right rear fuselage. You may choose either location.

❏ 3. Tack down the covering over the switch plate using a covering iron set to a low temperature.

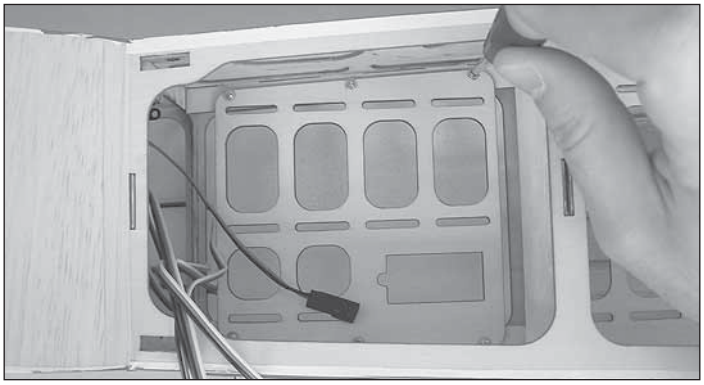


❏ 4. Trim the covering from over the switch plate holes and install the ignition switch and charge jack.

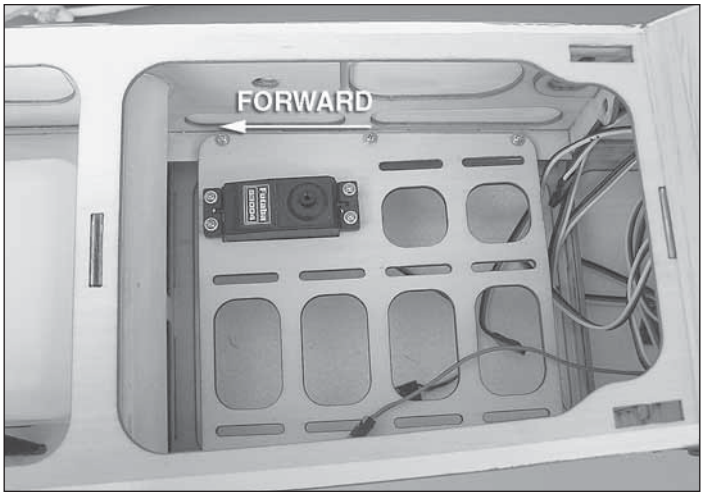




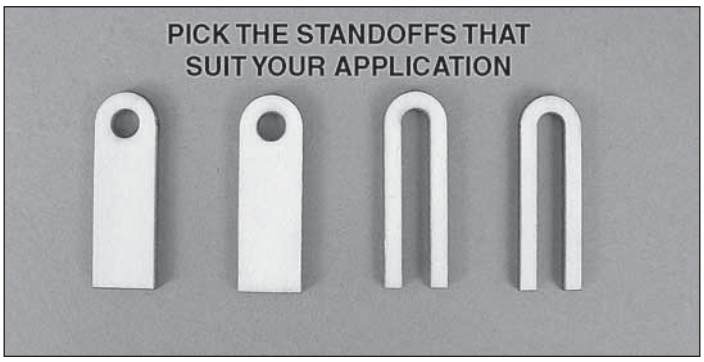
❏ 5. Locate the aft equipment tray, the tray doubler and the two side rails. Glue the tray doubler to the bottom of the tray. Align the tabs on each rail with the corresponding slots in the fuselage and glue each rail in place as shown.

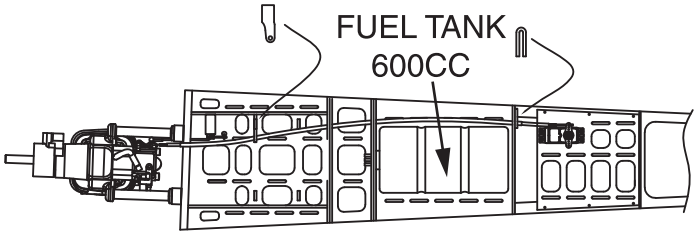


❏ 6. Position the aft equipment tray in the aft bay and use a 1/16" [1.6mm] drill bit to drill six pilot holes through the side rails. Harden the holes with thin CA. Use six #2 x 3/8" sheet metal screws with six #2 washers to attach the aft equipment tray.

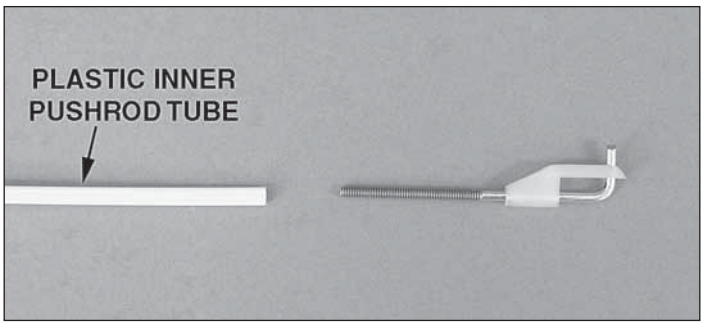


❏ 7. Install the throttle servo in the aft tray. Drill four 1/16" [1.6mm] holes and harden them with thin CA. Note the position of the servo output shaft.

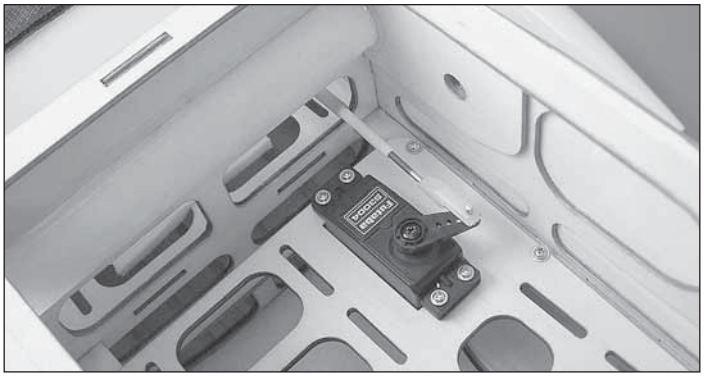




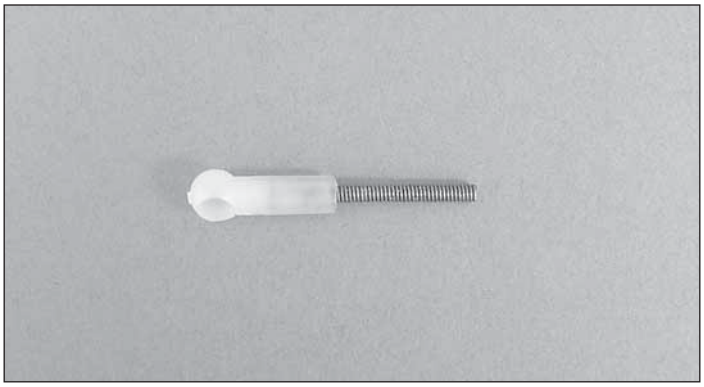
❏ 8. Locate the wood pushrod standoffs. Fit them to the gray outer pushrod tube and install the tube. Route it clear of the bellcrank and around the fuel tank. Trim the tube to fit and test fit the standoffs.



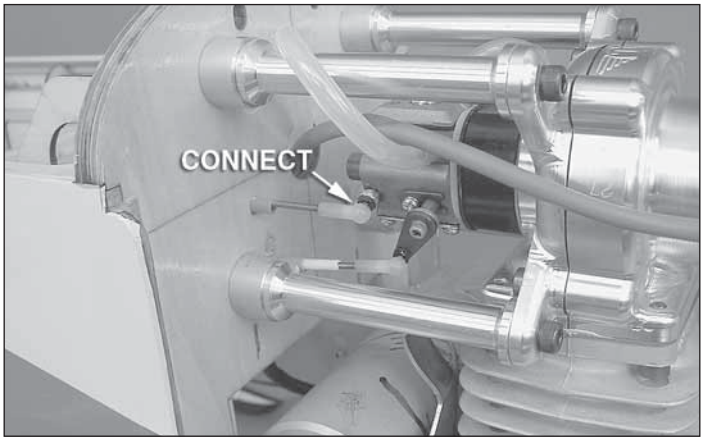
❏ 9. Locate the 24" [610mm] plastic inner pushrod tube, one 2-56 x 6" [152mm] threaded one-end rod, and one nylon FasLink™. Trim the rod 2" [51mm] from the threaded end and make an "L" bend. Thread the rod into one end of the inner pushrod tube. This side will attach to your throttle servo arm.



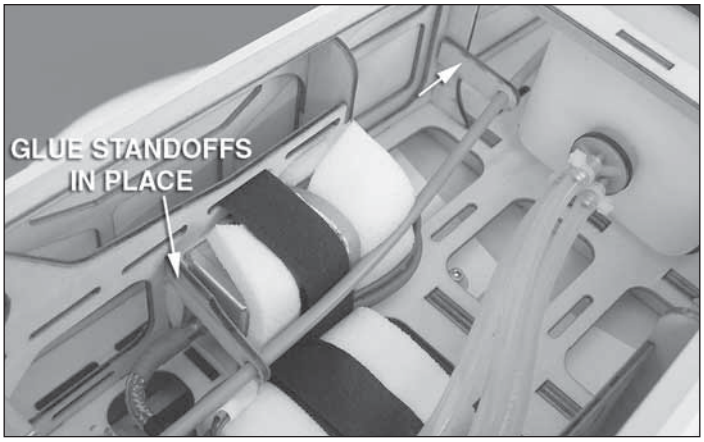
❏ 10. Install a servo arm. Set your throttle servo to the full-throttle position and connect the pushrod.



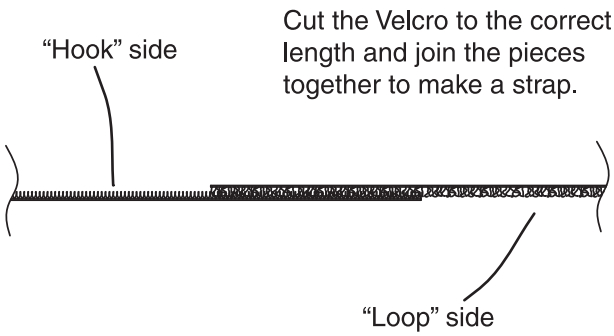
❏ 11. Locate one nylon ball link socket and one 2-56 x 1" [25mm] threaded rod. Thread the rod into the ball link socket.



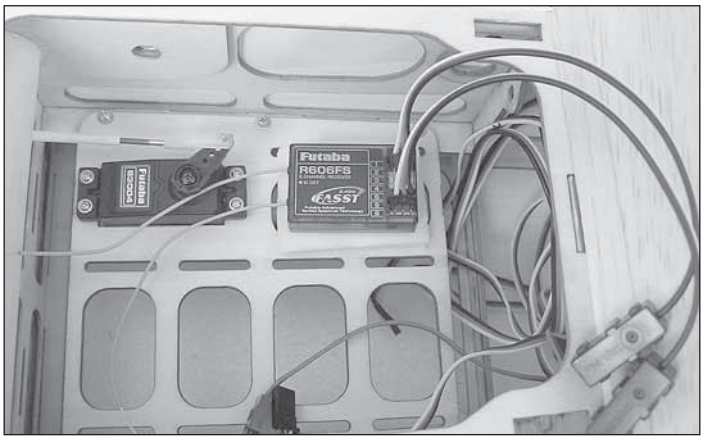
❏ 12. Trim the inner pushrod tube to length and install the ball link socket onto the throttle. Keep in mind that the throttle is sprung shut and that you will have to hold it fully open when you adjust the pushrod length.



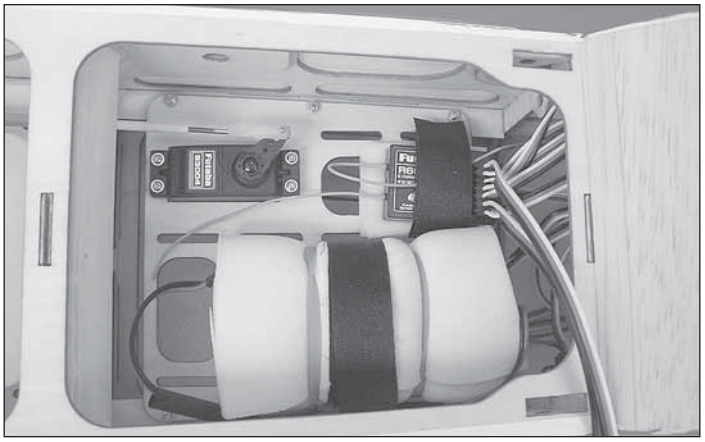
❏ 13. Position and glue the pushrod standoffs and the outer pushrod tube in place.



❏ 14. Locate the non-adhesive backed hook and loop material. Make two sets of straps for your receiver and battery by joining a piece of non-adhesive backed "hook" material to a piece of "loop" material.

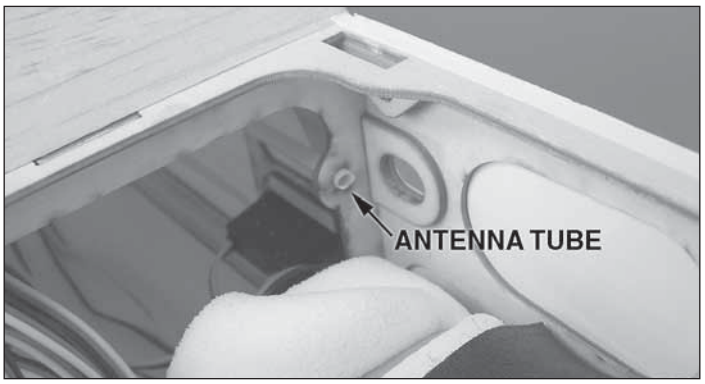


❏ 15. Connect a Y-connector to each aileron channel. Connect the other servo leads and the battery switch to your receiver.



❏ 16. Wrap your receiver and battery pack with 1/4" [6.4mm] thick latex foam. Use the straps you made to mount your battery and receiver to the aft equipment tray.

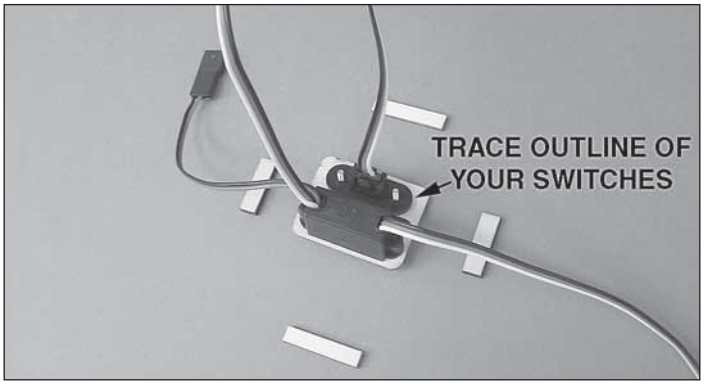
❏ 17. Connect the battery to the switch. Use heat shrink tubing to secure the connection between the battery and the switch.



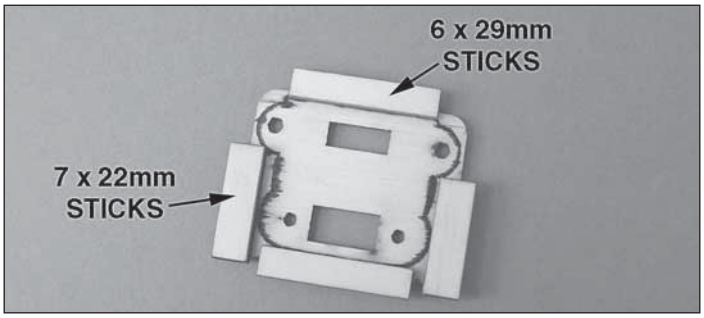
❏ 18. We used a 2.4GHz radio system for this build-up, but if you're using a 72MHz radio system an antenna routing tube is provided for you in the upper left side of the fuselage.

Skip to the "Final Assembly" section.

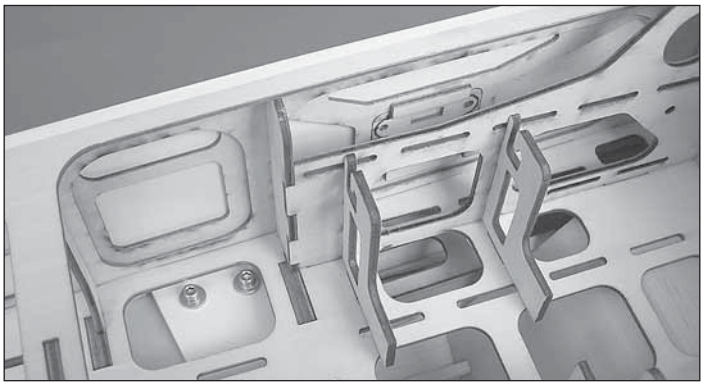
Radio System Installation – Glow Engine



❏ 1. Locate the switch plate that fits your brand of radio switch. Four plates are supplied: two Futaba switch & Ernst charge jacks and two Hobbico heavy-duty & Ernst charge jacks. Fit your switch and charge jack to the plate and use a pen or pencil to draw an outline of the switch and jack onto the back side of the plate. Remove the switch and charge jack.



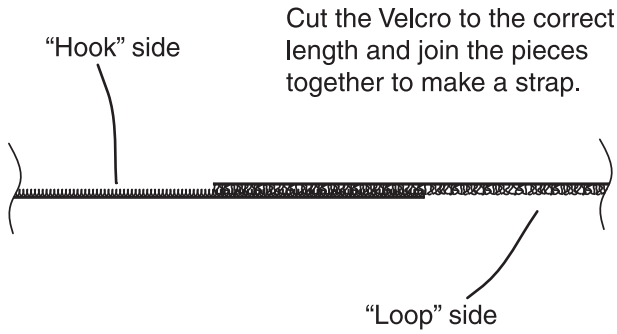
❏ 2. Use two 7 x 22mm and two 6 x 29mm sticks to make a flange for the charge plate.



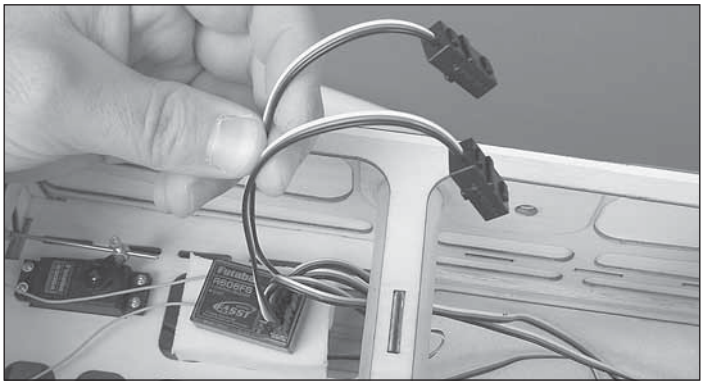
❏ 3. Install the switch plate on the model using epoxy to attach it. There are six places to mount the switch plate, so choose the one that suits you best.

❏ 4. Tack down the covering over the switch plate using a covering iron set to a low temperature.

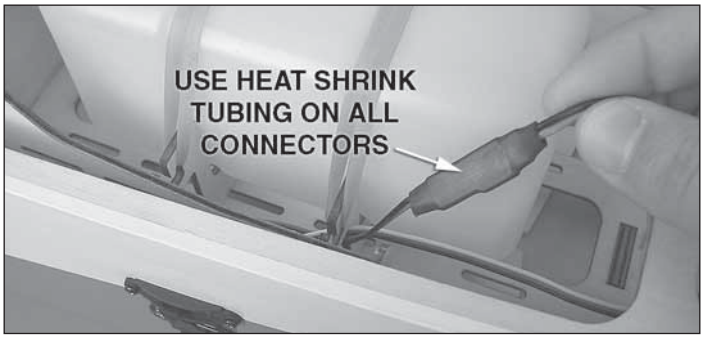
❏ 5. Trim the covering from over the switch plate holes and install the switch and charge jack.



❏ 6. Locate the non-adhesive backed hook and loop material. Make two sets of straps for your receiver and battery by joining a piece of "hook" material to a piece of "loop" material.

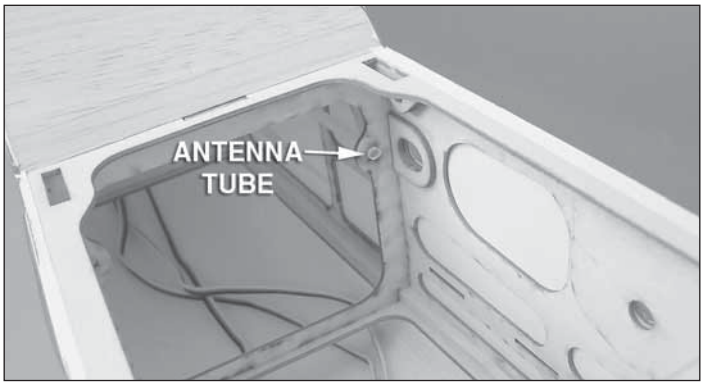


❏ 7. Connect a Y-connector to each aileron channel. Connect the other servo leads to your receiver



❏ 8. Connect the battery to the switch and the switch to the radio. Use heat shrink tubing to secure the connection between the battery and the switch.

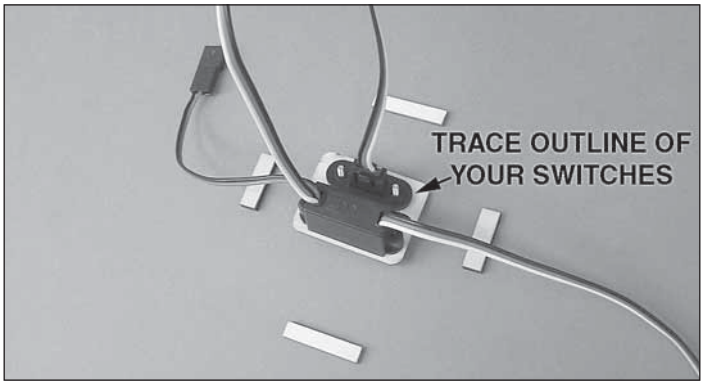
❏ 9. Wrap your receiver and battery pack with 1/4" [6.4mm] thick latex foam. Use the straps you made to mount your battery and receiver to the center equipment tray.



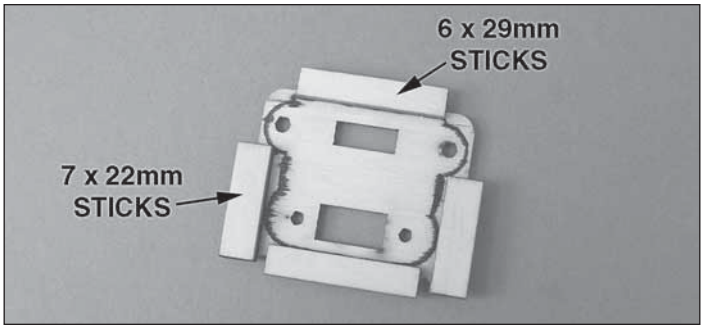
❏ 10. We used a 2.4GHz radio system for this build-up, but if you're using a 72MHz radio system, an antenna routing tube is provided for you in the upper left side of the fuselage.

Skip to the "Final Assembly" section.

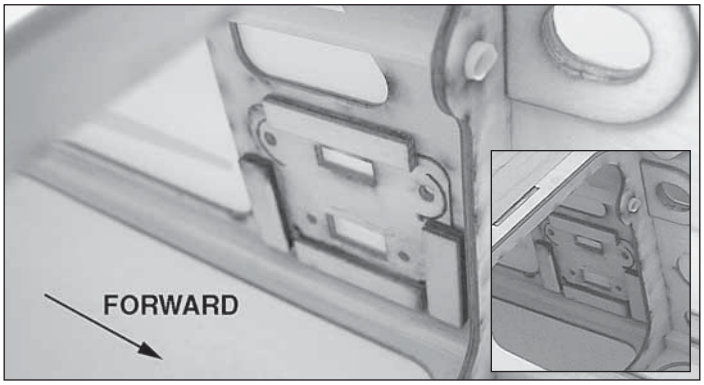
Radio System Installation – Electric Brushless



❏ 1. Locate the switch plate that fits your brand of radio switch. Four plates are supplied: two Futaba switch & Ernst charge jacks and two Hobbico heavy-duty & Ernst charge jacks. Fit your switch and charge jack to the plate and use a pen or pencil to draw an outline of the switch and jack onto the back side of the plate. Remove the switch and charge jack.

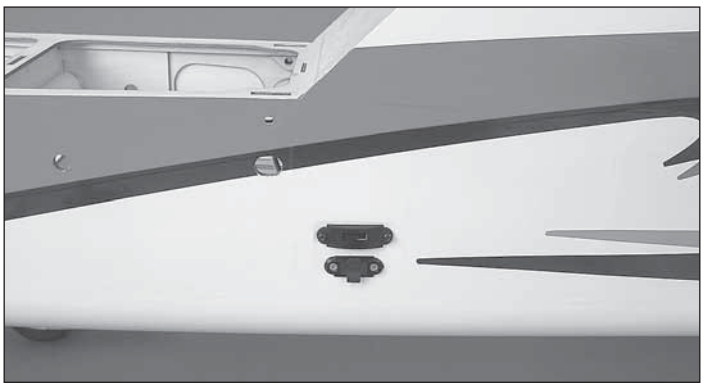


❏ 2. Use two 7 x 22mm and two 6 x 29mm sticks to make a flange for the charge plate.

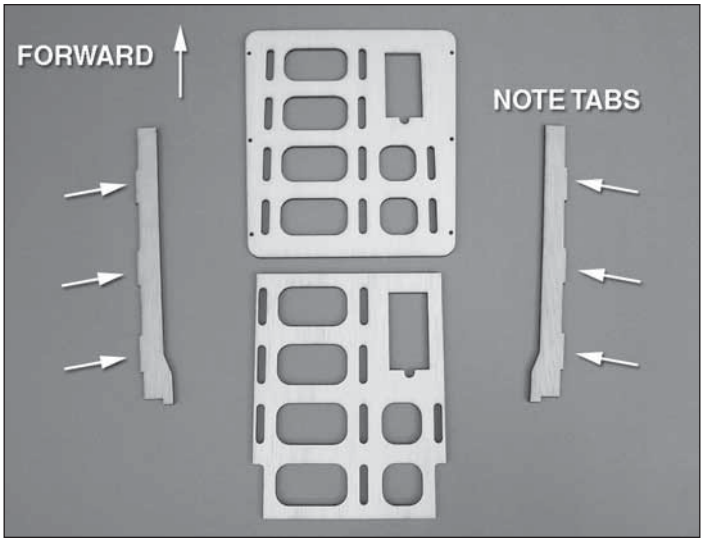


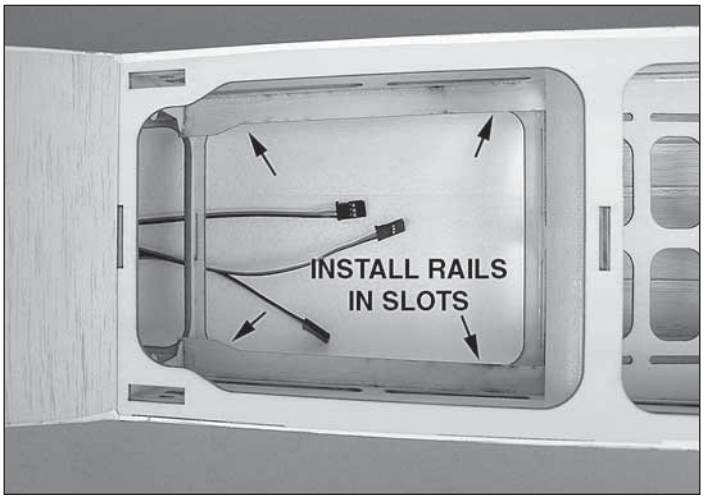
❏ 3. Install the switch plate on the model using epoxy. For C.G. reasons, the radio equipment is mounted in the aft equipment bay. A cutout for the switch plate is provided in the left and right rear fuselage. You may choose either location.

❏ 4. Tack down the covering over the switch plate using a covering iron set to a low temperature.

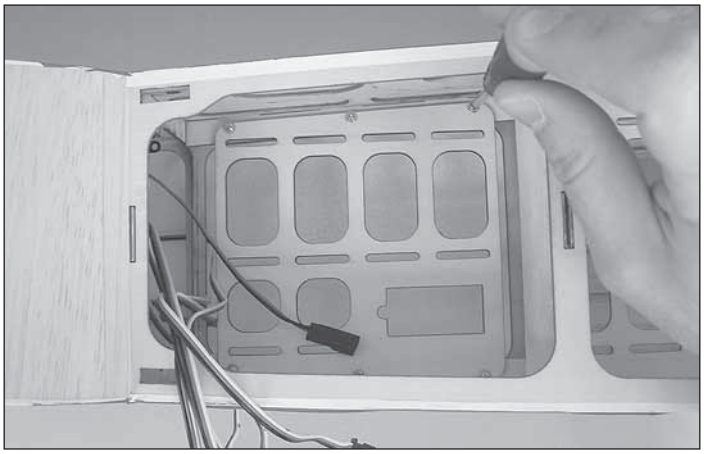


❏ 5. Trim the covering from over the switch plate holes and install the switch and charge jack. Iron the covering to the switch plate before you begin trimming.

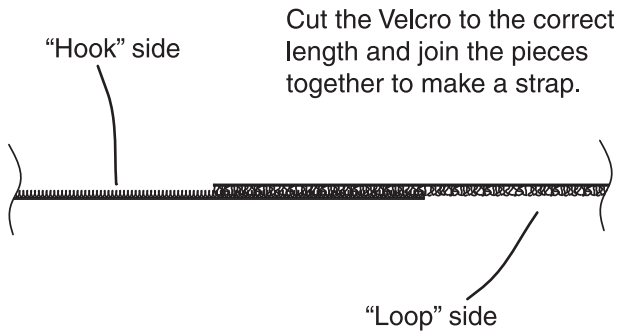




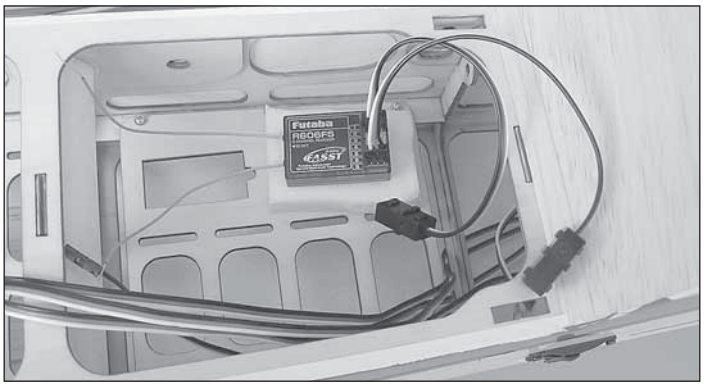
❏ 6. Locate the aft equipment tray and the two side rails. Align the tabs on each rail with the corresponding slots in the fuselage and glue each rail in place as shown.



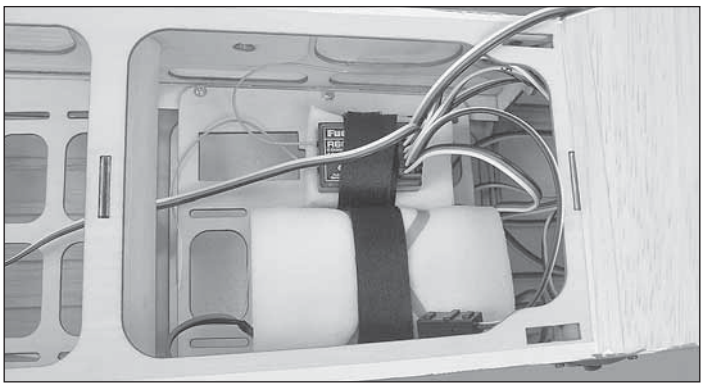
❏ 7. Position the aft equipment tray in the aft bay and use a 1/16" [1.6mm] drill bit to drill six pilot holes through the side rails. Use six #2 x 3/8" [10mm] sheet metal screws with six #2 washers to attach the aft equipment tray.



❏ 8. Locate the non-adhesive backed hook and loop material. Make two sets of straps for your receiver and battery by joining a piece of "hook" material to a piece of "loop" material.

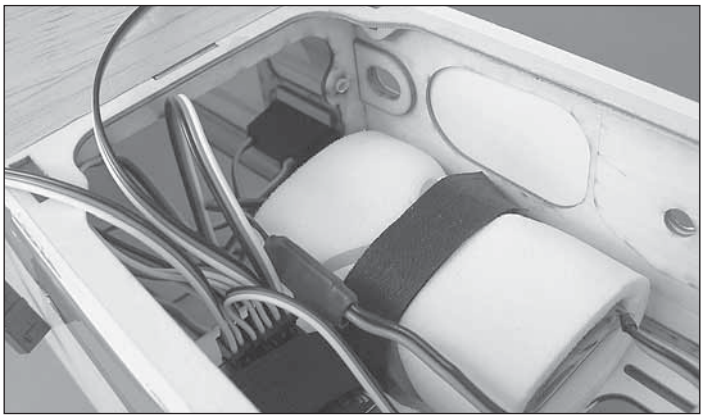


❏ 9. Connect a Y-connector to each aileron channel. Connect the other servo leads, the battery switch, and your ESC signal lead to your receiver.



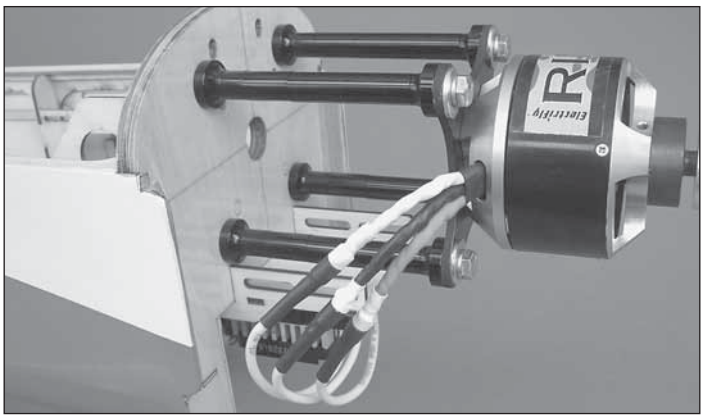
❏ 10. Wrap your receiver and battery pack with 1/4" [6.4mm] thick latex foam. Use the straps you made to mount your battery and receiver to the aft equipment tray.

❏ 11. Connect the battery to the switch. Use heat shrink tubing to secure the connection between the battery and the switch.



❏ 12. We used a 2.4GHz radio system for this build-up, but if you're using a 72MHz radio system, an antenna routing tube is provided for you in the upper left side of the fuselage.

❏ 13. Use the remaining hook and loop material to make battery straps for your LiPo battery packs.



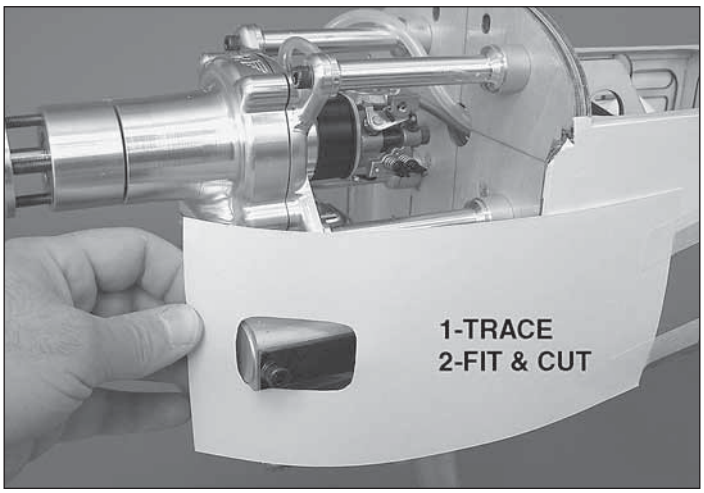
❏ 14. Read the ***"Motor & Battery Safety"*** section. Visually inspect your motor and ESC wiring and check for any shorts, bad solder joints, or open connections. Without a propeller attached, turn on your transmitter and receiver. Plug a LiPo battery into your ESC, arm the ESC, and slowly advance the throttle to check for proper direction of rotation from the motor. If the motor does not rotate clockwise (as viewed from the "pilot's" seat), swap any two motor leads. **Note:** The throttle channel may need to be reversed in your radio before you are able to successfully arm your ESC.

FINAL ASSEMBLY

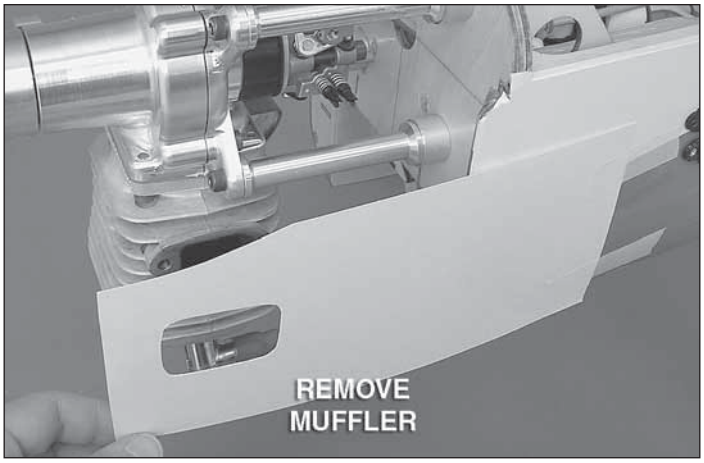
Cowl & Prop Installation

The following cowl installation instructions cover the DA-50 gasoline engine. Trimming the cowl to fit other engines may require modification of these procedures, but the basic idea is the same. For the DA-50 or similar gas engines, a template is provided in the back of this manual so that the engine does not have to be removed. Other engine installations may require removal of the engine while leaving the paper templates in place. Note: If you're using an electric motor, cut at least one 3" x 1-1/2" [76.2 x 38.1mm] slot for cooling.

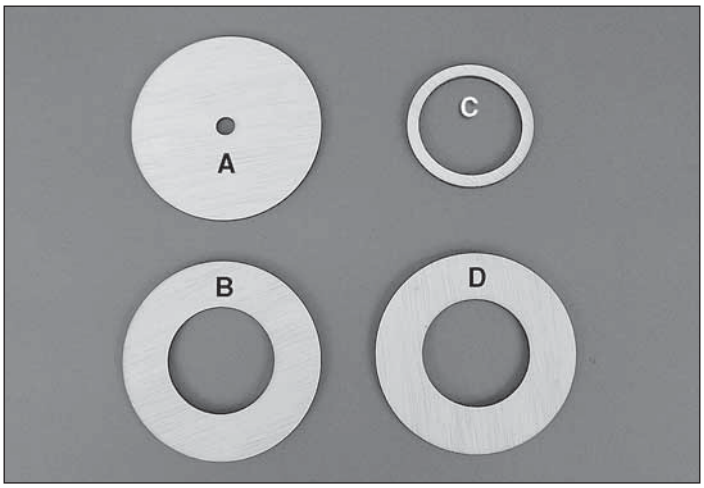
❏ 1. If you're using a gas engine inverted, turn to the back of this manual and cut out the paper template. Fold along the dotted line and center the template along the bottom of the cowl. The folded edge holds the template in position. Trace a line around the template using a felt-tip marker and trim out the clearance hole.



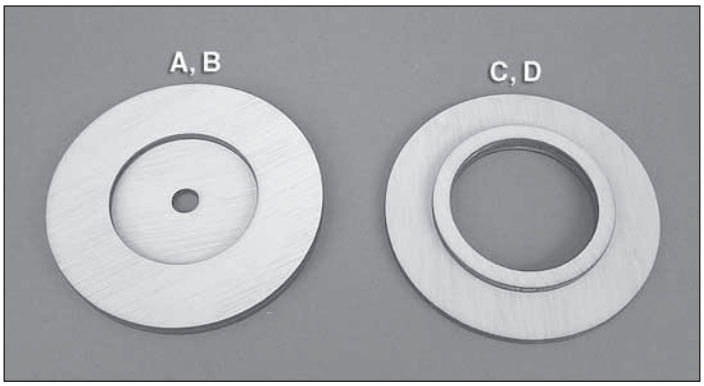
❏ 2. Tape a suitably sized piece of card stock to the fuselage side and use it as a template to trim a clearance hole for your muffler. If you're working with a side mounted glow engine, you will use this method to make a template for the cylinder head. Use cardstock to trim holes for your engine's needle valves.



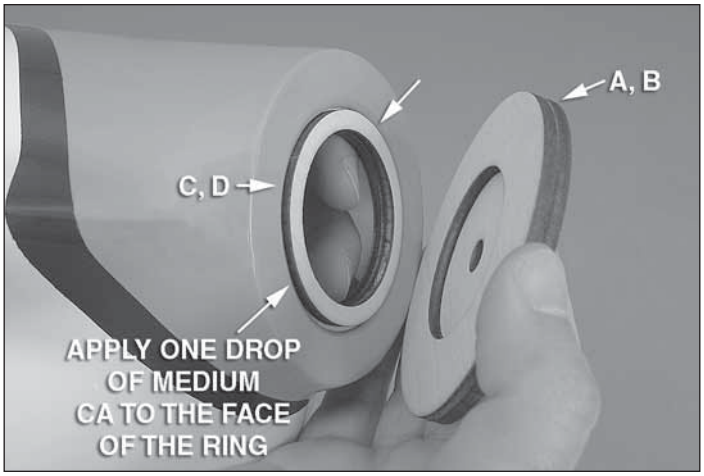
❏ 3. Remove the muffler while leaving the template in place.

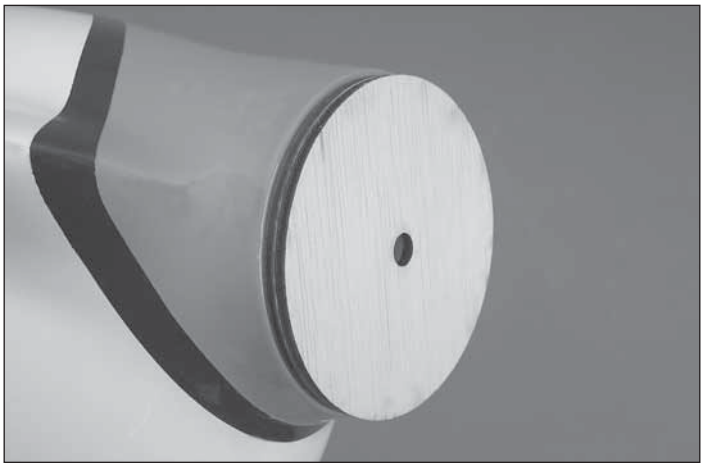


❏ 4. Locate the wood parts shown.

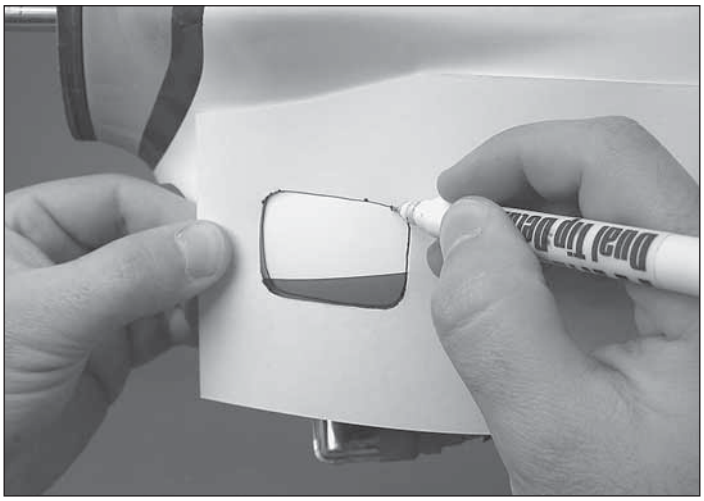


❏ 5. Build the inside portion and the outside portion of cowl centering tool as shown. Use medium CA to glue them together.



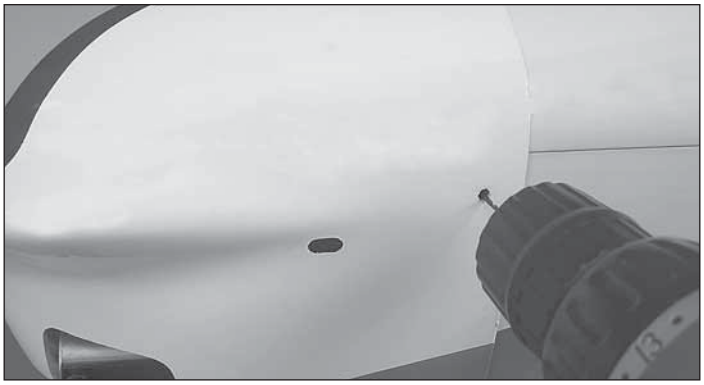


❏ 6. Fit the cowl centering tool to the cowl as shown. Use only two small drops of medium CA to tack the inside and the outside pieces together so that you can remove them easily later.



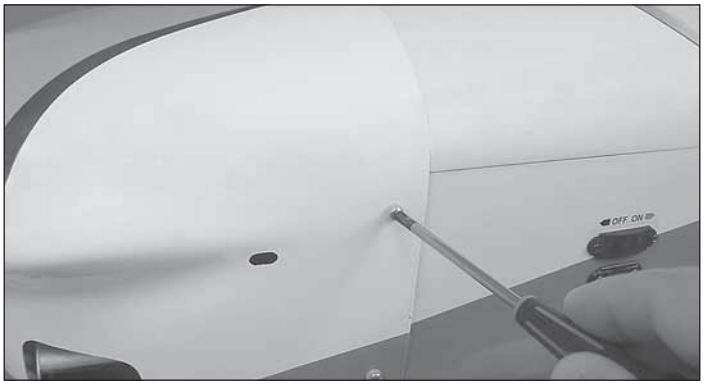
❏ 7. Fit the cowl to the plane so that the cowl centering tool bottoms out on the engine's drive washer. Position the paper template and trace the muffler cutout onto the cowl using a felt-tip pen.

❏ 8. Trim the clearance hole for the muffler. Reinstall your muffler and check the fit.



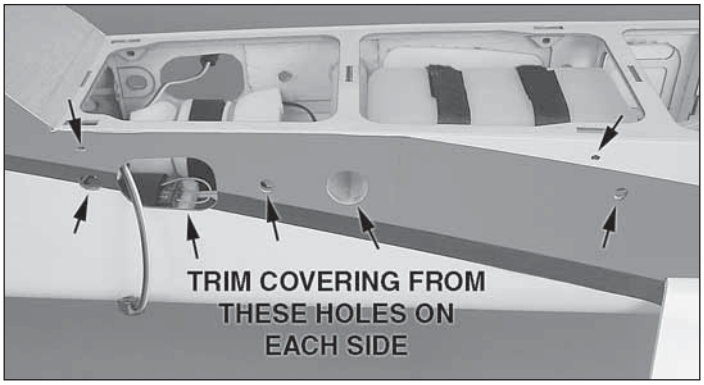
❏ 9. Temporarily fit the canopy and hatch. Fit the cowl once again, making sure to slide it back until the centering tool contacts the drive washer. Use a 1/16" [1.6mm] drill bit to make four 1/2" [13mm] deep holes in the fuselage sides (two per side). Drill them so that they are 1/2" [13mm] from the rear edge of the cowl. Apply thin CA to the holes to harden the wood.

❏ 10. Locate the four 9mm wooden reinforcement discs. Center them over the screw holes you drilled in the cowl. Glue them into position. Remove the cowl centering tool from the cowl.

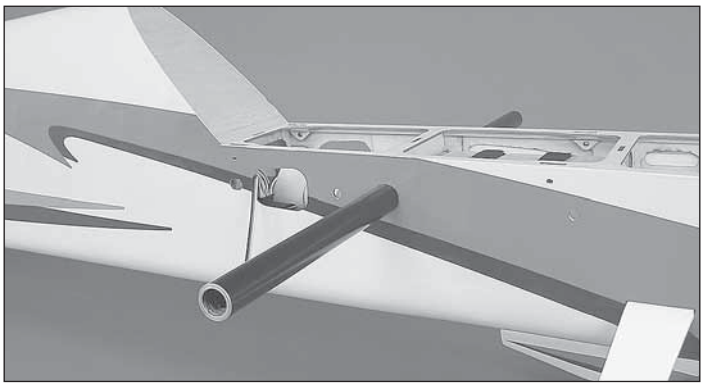


❏ 11. Use four #4 x 1/2" [13mm] sheet metal screws along with four Dubro #4 nylon washers to install your cowl.

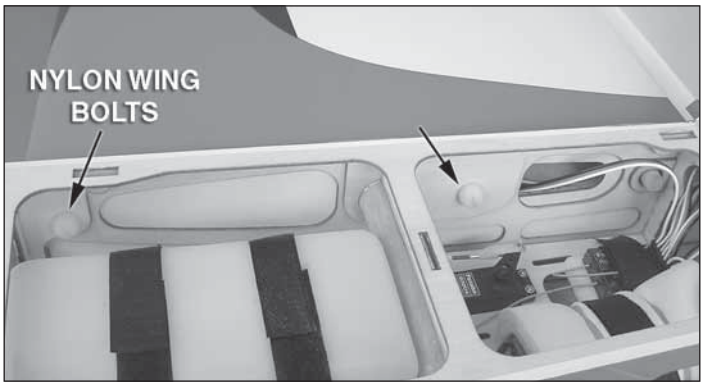
Wing Installation



❏ 1. Trim the covering from the fuselage sides in the following locations: four canopy screw holes, two wing tube holes, four wing bolt holes, two TE wing dowel holes, and two servo wire holes.

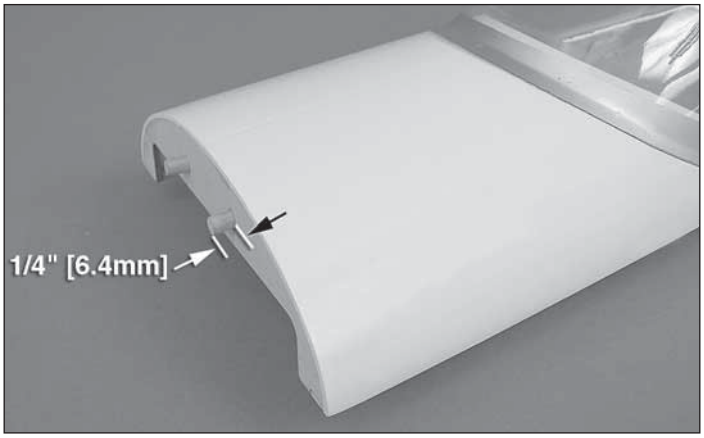


❏ 2. Locate the 24-1/2" [620mm] wing tube and slide it into the fuselage.



❏ 3. Pull the aileron servo leads into the fuselage and install the wings using four 1/4" x 1" [6.4 x 25mm] nylon wing bolts. Connect the aileron servo leads to the Y-harnesses on your receiver.

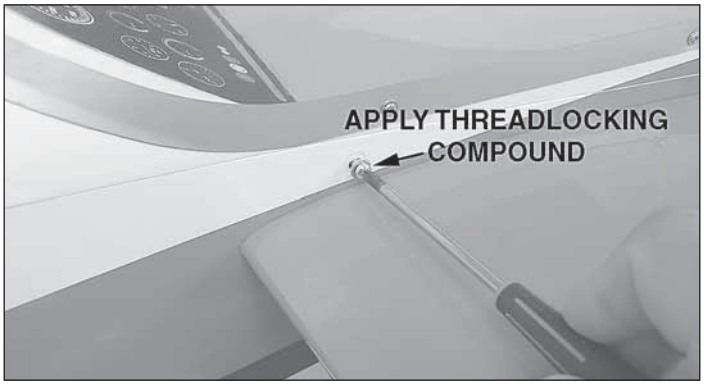
Canopy Installation



❏ 1. Locate the two 1" [25mm] wooden dowels and glue them into the canopy so that they are 1/4" [6.4mm] from the front face of the former.

❏ 2. Remove the seven canopy screws and remove the clear plastic canopy from the frame. Harden the screw holes with one drop of thin CA. More than one drop will melt the foam under the sheeting, so be careful. Apply the instrument panel decal to the instrument panel.

❏ 3. Reinstall the clear plastic canopy on the frame using the seven screws you removed earlier.

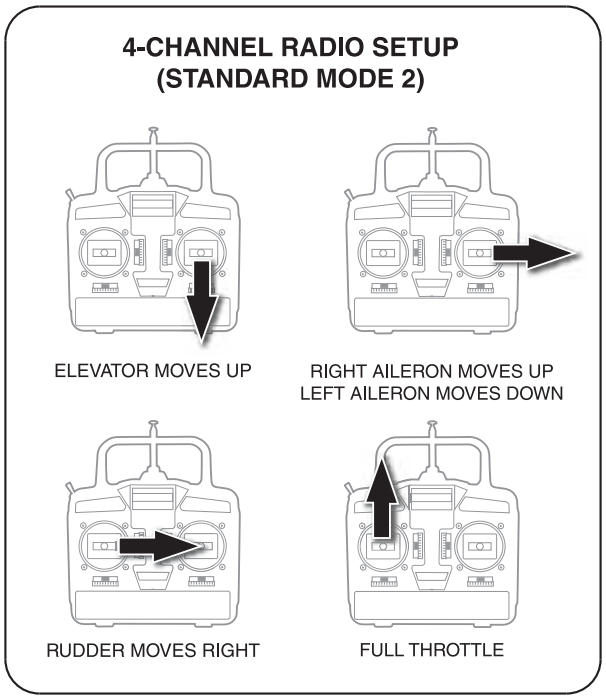


❏ 4. Fit the canopy hatch to the model and use four 4-40 x 5/8" [16mm] Phillips head screws, four #4 lock washers, and four #4 washers. Apply a drop of threadlocking compound to the screw threads periodically so that you don't lose these screws in flight.

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 using threadlocking compound.
❏ 2. With the transmitter and receiver still on, check all the control surfaces to see that they are centered. If necessary, adjust the clevises on the pushrods to center the control surfaces. Move the controls and make sure there is no mechanical binding or interference.



❏ 3. Make certain that the control surfaces and the carburetor 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

To ensure a successful first flight, fly your Reactor set up only according to the C.G. and control surface throws specified in this manual. The throws and C.G. are not arbitrary, but have been determined through extensive testing and accurate record-keeping. This provides you with the best chance for success and enjoyable first flights that should be surprise-free. Additionally, the throws and C.G. shown are true, real data which will allow the model to perform in the manner in which it was intended when flown by a pilot of the skill level for which it was intended. **DO NOT OVERLOOK THESE IMPORTANT PROCEDURES.** A model that is not properly setup may be unstable and possibly unflyable.

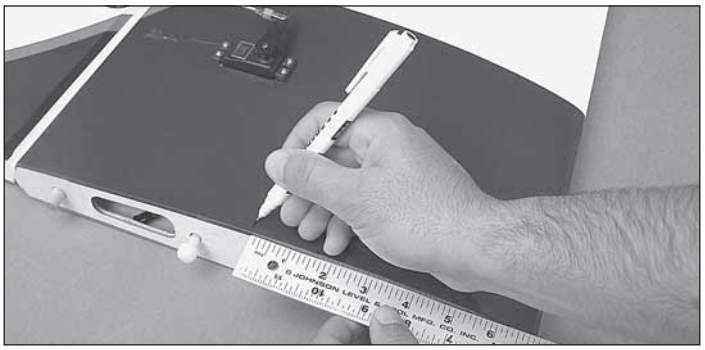
Use a ruler, an inclinometer, or a protractor to accurately measure and set the control throw of each control surface as indicated in the chart that follows. If your radio does not have dual rates, we recommend setting the throws at the **high rate** setting.

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

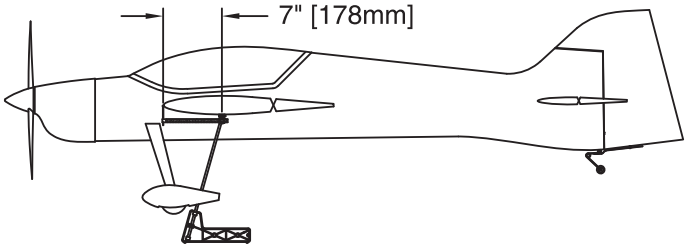
These are the recommended control surface throws:

HIGH RATE	
ELEVATOR:	1-1/2" [38mm], 15° up 1-1/2" [38mm], 15° down
RUDDER:	4-3/4" [121mm], 28° left 4-3/4" [121mm], 28° right
AILERONS:	2-1/2" [64mm], 19° up 2-1/2" [64mm], 19° down
LOW RATE	
ELEVATOR:	1" [25mm], 10° up 1" [25mm], 10° down
RUDDER:	2-3/4" [70mm], 16° left 2-3/4" [70mm], 16° right
AILERONS:	1-1/2" [38mm], 11° up 1-1/2" [38mm], 11° down
3D RATE	
ELEVATOR:	3-1/4" [83mm], 34° up 3-1/4" [83mm], 34° down
RUDDER:	5-3/4" [146mm], 35° left 5-3/4" [146mm], 35° right
AILERONS:	4-1/2" [114mm], 36° up 4-1/2" [114mm], 36° down

Balance Your Model (C.G.)



❏ 1. Using a black felt-tipped pen, make a mark on the bottom of each wing that is 7" [178mm] from the LE of the root wing rib. This is the ideal balance point and this is where your plane should balance for the first few flights. If you wish to experiment with the C.G., you may do so after you have become comfortable with the plane. The forward C.G. limit is 6.5" [165mm] from the LE of the root rib. The aft limit is 8" [203mm] from the LE of the root rib.



❏ 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 on a Great Planes C.G. Machine, 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. Moving radio equipment to achieve proper balance is an option when using the electric or glow setup. Because gasoline engines generate electrical noise, all components involved in spark generation must be kept away from radio equipment. Lead ballast weight is available to help you balance your airplane. Use Great Planes (GPMQ4485) "stick-on" lead. A good place to add stick-on nose weight is to the firewall (don't attach weight to the cowl–it is not intended to support weight). Begin by placing incrementally increasing amounts of weight on the top of the fuse over the firewall 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 ballast weight has been installed.

Balance the Model Laterally

❏ 1. With the wings level, have an assistant help you lift the model by the engine propeller shaft and the bottom of the fuselage 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 43 and place it on or inside your model.

Charge Your Radio 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. If you have installed a gasoline engine with an electronic ignition, make sure that you also charge its battery pack. Carry a voltmeter in your field box and check the voltage of your batteries before each flight.

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.

Ground Check & Range Check

Run the engine for a few minutes to make sure it idles reliably, transitions smoothly and maintains full power indefinitely. Afterward, shut the engine off and inspect the model closely, making sure all fasteners, pushrods and connections have remained tight and the hinges are secure. Always ground check the operational range of your radio before the first flight of the day following the manufacturer's instructions that came with your radio. This should be done once with the engine off and once with the engine running at various speeds. 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 in your battery pack, a defective cell, or a damaged receiver crystal from a previous crash.

ENGINE & MOTOR 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 and motors.

Do not run the engine or motor 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 or motor.

Keep these items away from the prop: loose clothing, shirt sleeves, sweater strings, 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 or igniter unit. Do not throw anything into the propeller of a running engine or motor.

Always keep your radio on when plugging the motor batteries into the ESC. Stay clear of the propeller at all times: some ESC units do not have safety arming features, so any movement of the throttle stick may cause the propeller to turn.

Always check your motor and battery setup using a watt meter. We recommend the RC Electronics Watt’s Up meter (RELP0101). When using the recommended setup you should be able to match the voltage, current, and prop rpm we have listed in this manual.

Make sure that all electrical connections are soldered properly. Run the motor for a few minutes and then check the wires and connections for excessive heat. Hot connections may indicate poor solder joints.

LITHIUM BATTERY HANDLING & USAGE

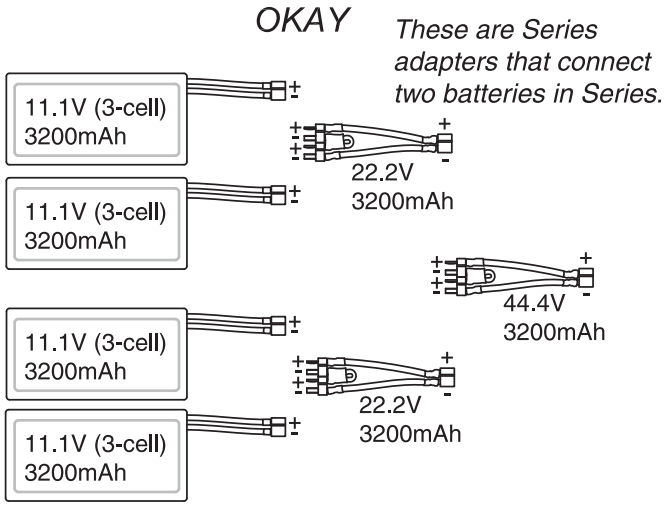
WARNING!! Read the entire instruction sheet included with the battery. Failure to follow all instructions could cause permanent damage to the battery and its surroundings, and cause bodily harm!

- ONLY use a LiPo approved charger.
- NEVER charge in excess of 4.20V per cell.
- ONLY charge through the “charge” lead. NEVER charge through the “discharge” lead.
- NEVER charge at currents greater than 1C.
- ALWAYS set charger’s output volts to match battery volts.
- ALWAYS charge in a fireproof location.
- NEVER trickle charge.
- NEVER allow battery temperature to exceed 150° F [65° C].
- NEVER disassemble or modify pack wiring in any way or puncture cells.
- NEVER discharge below 2.5V per cell
- NEVER place on combustible materials or leave unattended during charge or discharge.
- ALWAYS KEEP OUT OF REACH OF CHILDREN.

Battery Precautions/Connecting Batteries

This is how to connect four batteries in Series:

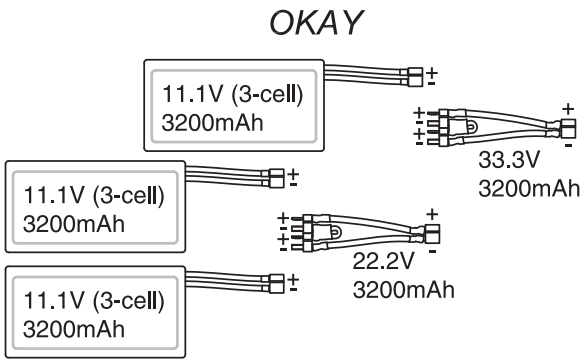
These are four 11.1V, 3200mAh batteries. When joined in Series, the result will be a 44.4V, 3200mAh battery.



Connecting batteries in **"Series"** means to connect the +'s to the –'s and the –'s to the +'s. This combines the batteries' voltages, but the capacity remains the same.

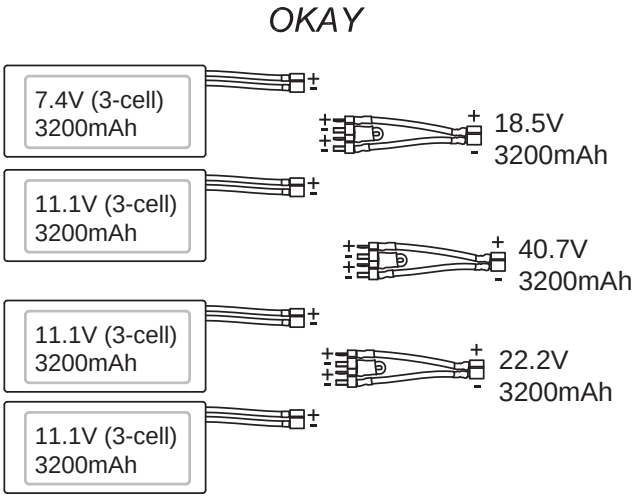
This is how to connect three batteries in Series:

These are three 11.1V, 3200mAh batteries. When joined in Series, the result will be a 33.3V, 3200mAh battery.

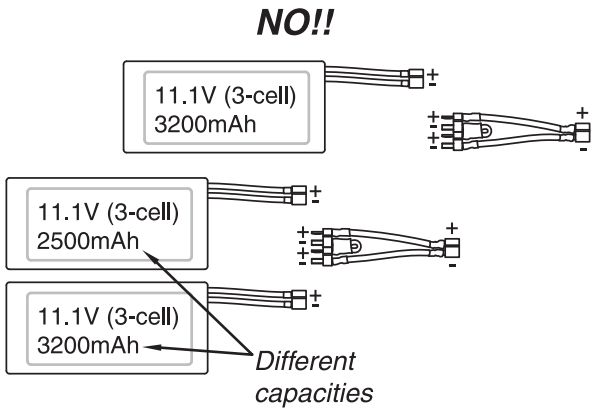


Batteries of different voltages, but not different capacities may also be connected in Series:

These are three 11.1V, 3200mAh batteries and one 7.4V, 3200mAh battery. When joined in Series, the result will be a 40.7V, 3200mAh battery.



It's okay to connect batteries with different Voltages in Series to achieve the new, desired Voltage.



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 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.
❏ 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 fuselage. 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 in the instructions.
❏ 6. Use threadlocking compound to secure critical fasteners such as the set screws that hold the wheel axles to the struts, screws that hold the carburetor arm (if applicable), 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, cowl mounting screws, etc.).
❏ 10. Confirm that all controls operate in the correct direction and the throws are set up according to the manual.
❏ 11. Set up and check a throttle cutoff on your radio.
❏ 12. 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.
❏ 13. Tighten all jam nuts against the threaded clevises on your control surfaces.
❏ 14. Secure connections between servo wires and Y-connectors or servo extensions, and the connection between your battery pack(s) and the on/off switch with vinyl tape, heat shrink tubing or special clips suitable for that purpose.
❏ 15. Make sure any servo extension cords you may have used do not interfere with other systems (servo arms, pushrods, etc.).
❏ 16. Secure the pressure tap (if used) to the muffler with high temp RTV silicone, threadlocking compound or J.B. Weld.
❏ 17. Make sure the fuel lines are connected and are not kinked.
❏ 18. Balance your propeller (and spare propellers).
❏ 19. Tighten the propeller nut and spinner.
❏ 20. Place your name, address, AMA number and telephone number on or inside your model.
❏ 21. Cycle your receiver battery pack (if necessary) and make sure it is fully charged.
❏ 22. Range check your radio at the field at the start of each flying day. Check it with the engine/motor operating.

FLYING

Fuel Mixture Adjustments

A fully cowled engine may run at a higher temperature than an un-cowled engine. For this reason, the fuel mixture should be richened so the engine runs at about 200 rpm below peak speed. By running the engine slightly rich, you will help prevent dead-stick landings caused by overheating.

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 "up" elevator to keep the tail wheel on the ground. If necessary, adjust the tail 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.

Remember to takeoff into the wind. When you're ready, point the model straight down the runway, hold a bit of up elevator to keep the tail on the ground to maintain tail wheel steering, and then gradually advance the throttle. As the model gains speed, decrease up elevator, allowing the tail to come off the ground naturally. One of the most important things to remember with a tail dragger is to always be ready to apply **right rudder** to counteract engine torque. Gain as much speed as your runway and flying site will practically allow before gently applying up elevator, lifting the model into the air. At this moment it is likely that you will need to apply more right rudder to counteract engine torque. 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 your airplane 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. Make a few more runs minding your field's current traffic pattern and try executing a few straight-ahead stalls. 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, hold up elevator to place the tail on the ground, regaining tail wheel 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!

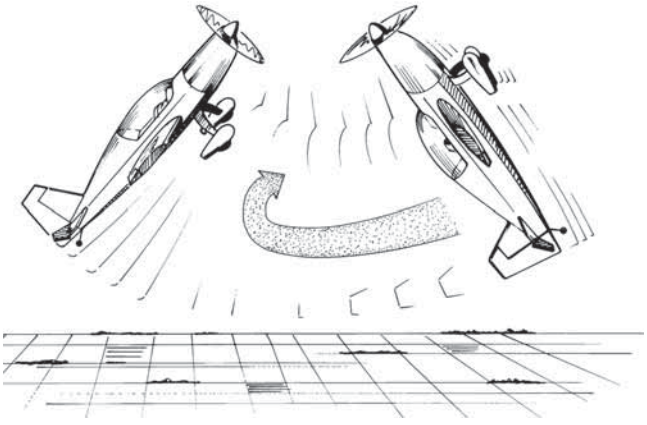
This model belongs to:
Name
Address
City, State Zip
Phone number
AMA number

Make a copy of this identification tag and put it on or inside your model.

3D FLYING

Because of the power-to-weight ratio on 3D planes, straight-and-level flight should be at a reduced throttle and full power should be used only when the airplane is “loaded” during a maneuver. Learn to manage the throttle and experiment while in the maneuver. The power needed will depend on the maneuver being performed. C.G. also plays a large role in the 3D capability of models as well. Experiment, but keep in mind that being tail heavy is not always the best way to go. Another thing to remember is that maximum control throw is not necessary for all 3D maneuvers. Occasionally, too much throw can place the model too far into a stall, causing it to become uncontrollable. Practice your maneuvers at a higher altitude while you become accustomed to your particular plane’s stall characteristics.

WATERFALLS



With the model pointing vertically (almost in a hover), push full down elevator and full throttle. As the model rotates and begins to point downwards, reduce the throttle (to keep the model from being pulled downwards). As the model flattens out, add power to pull the model around. Many models will require some rudder correction (usually right rudder) during this maneuver. Some planes will require aileron correction to keep the wings level.

UPRIGHT FLAT SPINS

Pull the nose up slightly and slowly decrease power. As the model slows to a few mph, slowly apply full left rudder and power. Next, start adding up elevator as needed to keep the model flat in the spin. Most airplanes will require some aileron as well to keep the wings level. This is one of the maneuvers to experiment on; try different C.G. positions and different amounts of throw and power to see how flat the spin will go. It is possible to maintain altitude in the flat spin and in some cases it is also possible to climb during the spin.

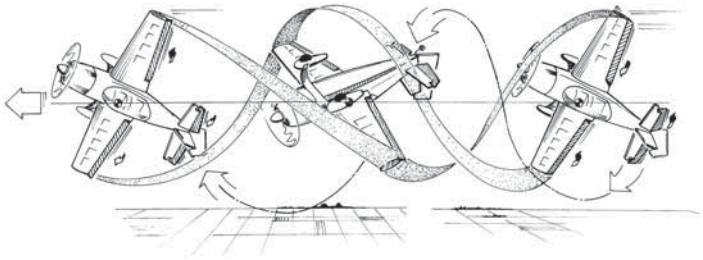
INVERTED FLAT SPINS

This is the same as the upright flat spin except most planes like to spin in the opposite direction, for example: right rudder and down elevator.

THE WALL

Fly straight across the field at a moderate speed and simply pull full up until vertical. Adjust the power as necessary to maintain a hover.

KNIFE EDGE TUMBLE



This is an impressive looking maneuver that really isn’t as difficult as it looks. (Before learning this maneuver you must be able to confidently Snap and Tumble your plane and stop the aircraft exactly, without over rotating.) Fly the model Knife Edge from the right at a moderate airspeed, using just enough rudder to maintain Knife Edge, not climbing or diving. Perform one full right negative Tumble by maintaining your rudder setting while applying full throttle, full down elevator, and full right aileron, releasing in time to end again flying Knife Edge to the right. Note that you may need to use some positive elevator and/or left aileron to stop the Tumble at exactly Knife Edge. This maneuver is easier to the right because torque helps stop the Tumble and it can be done at varied airspeeds with proper throttle and rudder modulation.

VERTICAL HOVER

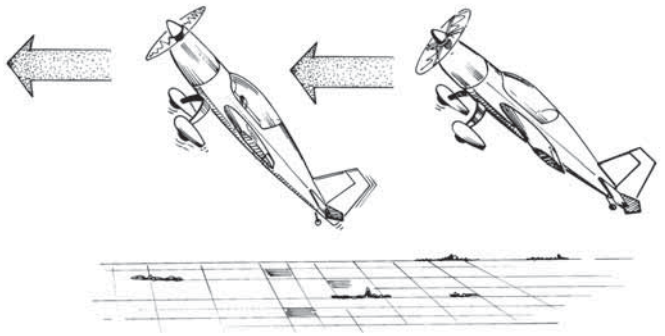
Fly a straight pass across the field at 75ft high and 100ft out and pull the model vertical. Roll the model until the top of it is facing you and slowly begin to reduce power. As the model begins to slow down to 10 mph or so, slowly add a little bit of power back in. You will have to adjust the throttle as needed,

but make your adjustments smooth. Some right aileron may be needed to keep the model from torque rolling. Use the rudder and elevator to keep the nose pointing straight up. Be patient as this maneuver will take a while to learn.

TORQUE ROLL

This is the same as the vertical hover but without the use of right aileron to keep the model from rolling. If needed, you can use a little left aileron to speed the roll up. As the model rotates around, the controls will appear to be reversed to you but only the orientation of the model has changed.

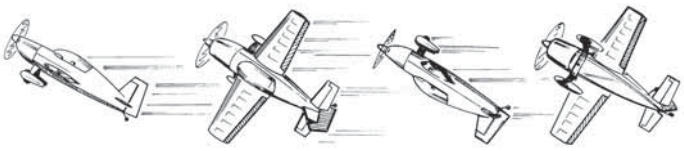
HARRIER



The harrier is nothing more than a high angle of attack flying stall. Check the stall characteristics of your plane before proceeding with this maneuver. Bring your plane across the field at 75ft high and 100ft out away from yourself. Slowly pull back on the elevator while reducing throttle. The nose of the plane should come up. Depending on the plane/setup, you may have to make constant aileron (wing walking) and rudder corrections for this maneuver. As the nose of the plane comes up, start adding in a little bit of power to help maintain airspeed. The rudder is now used to turn the model. This maneuver will take some practice as there are a lot of small corrections made to keep most planes in the maneuver.

This is one maneuver where less control is needed. Too much elevator and the model goes into an uncontrollable stall. The C.G. of the plane will have a large effect on the stability of the model during this maneuver. Some planes perform better with more elevator deflection and a farther forward C.G. while other planes prefer a further aft C.G. and less elevator deflection. Elevator to flap mixing can be used on airplanes with marginal wing area, and some planes won't stall so elevator to spoileron mixing will be needed.

ROLLING HARRIER

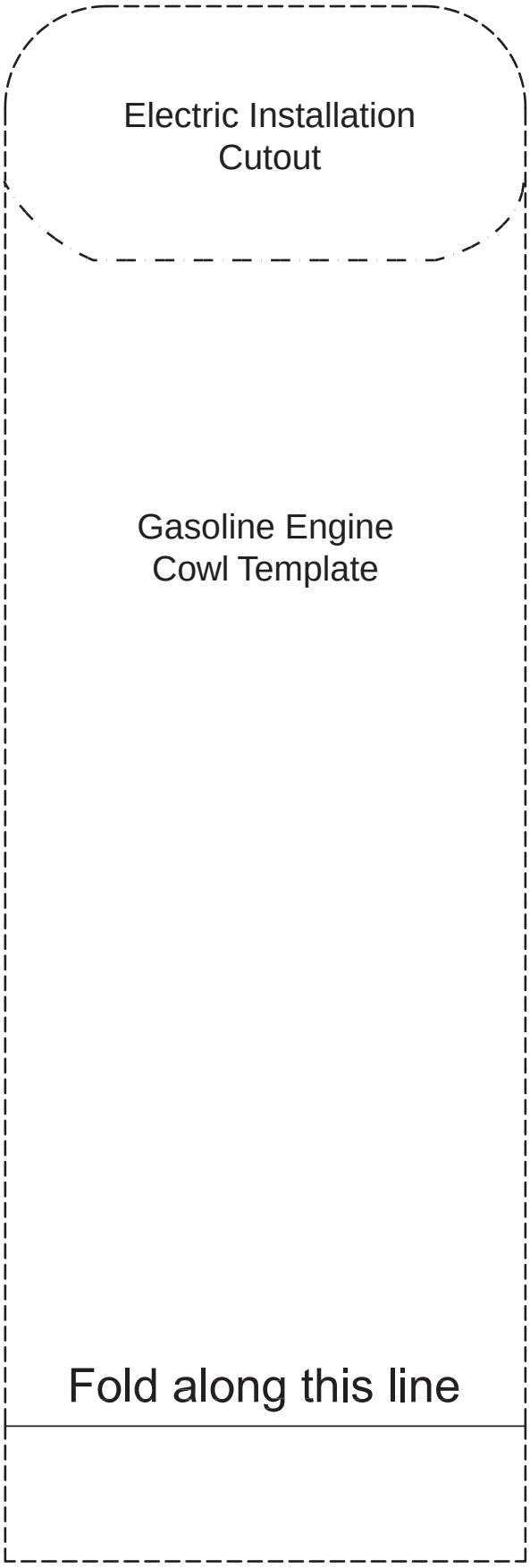


Once you get comfortable with the upright harrier, it's time to work rolls into the mix. From an upright harrier, add in left aileron and change from up elevator to down elevator when inverted. If you are comfortable with four point rolls and slow rolls, inputting rudder on the knife edges can improve the maneuver considerably. To turn the model, simply input the elevator or rudder a little sooner or later in the rotation. It's all a matter of timing.

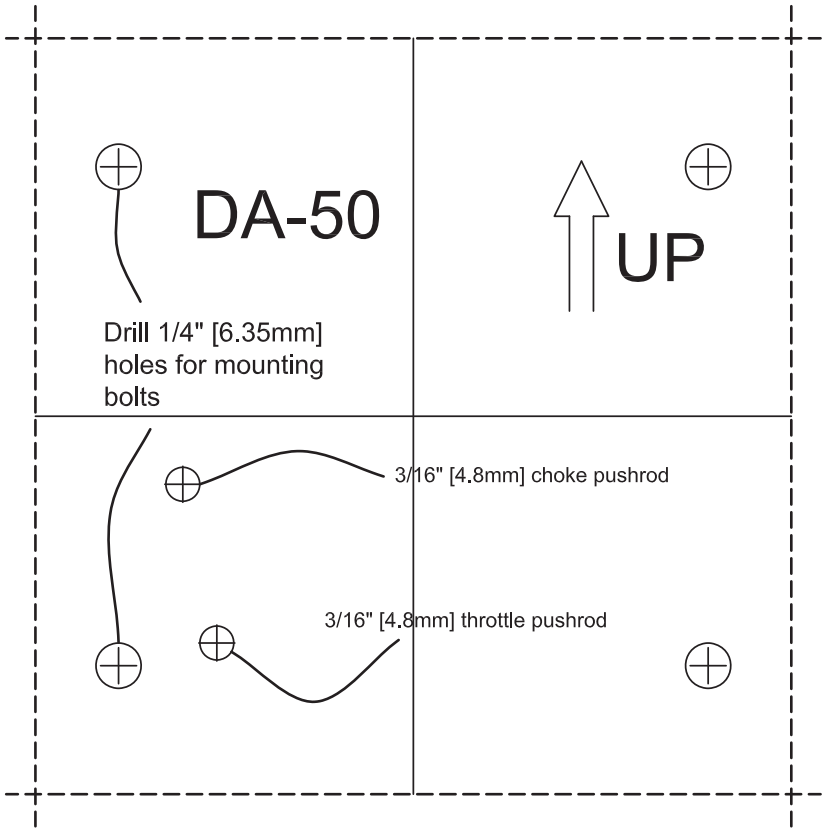
PINWHEEL

Climb vertically and bring the model to a vertical hover, but do not stop long enough to let the torque pull the model around (climbing or sliding slightly will not be noticeable to spectators but will keep air flowing over the ailerons and provide you roll authority to stop the torque). When the model is hanging, rock the plane left with rudder, then apply full throttle and full right rudder and hold both, completing 3/4 of a VERY tight Knife Edge Loop and flying out Knife Edge. When done correctly, the plane pivots around the wingtip in a very small area. This maneuver can be done either direction.

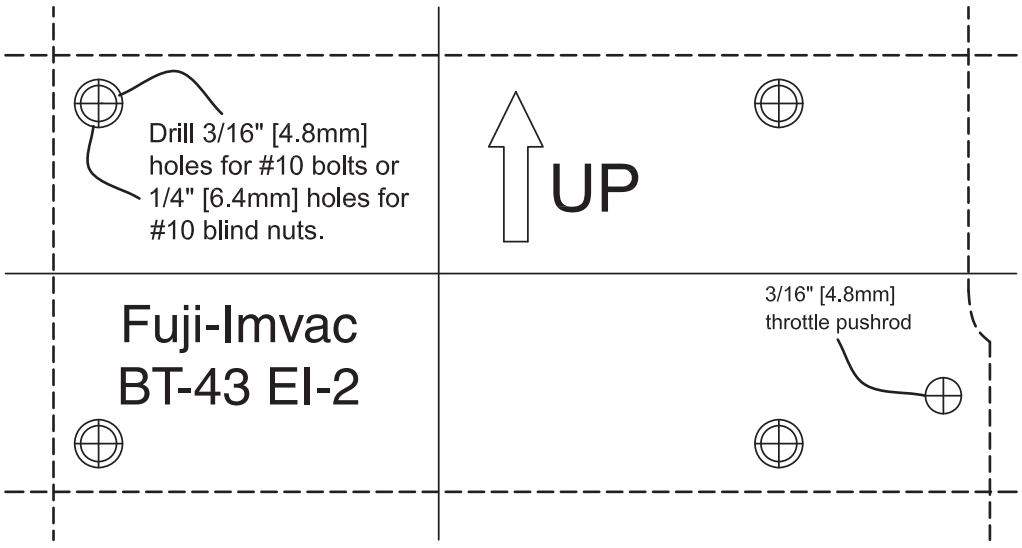
COWL TRIMMING TEMPLATE

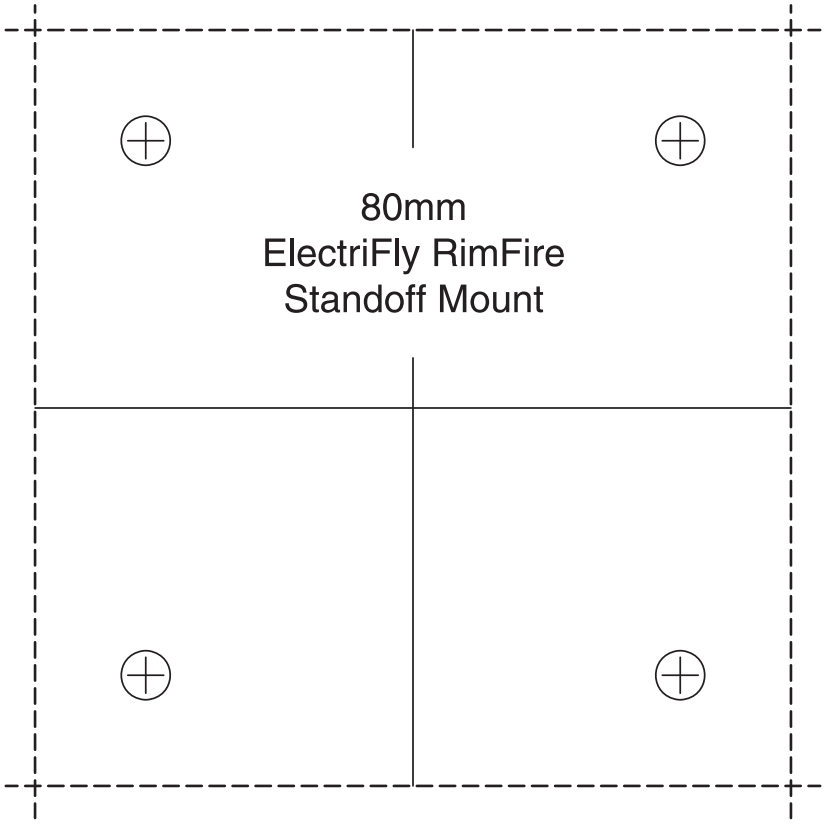


DA-50-R 50cc Gasoline Engine with rear mounted carburetor



Fuji-Imvac BT-43 EI-2 Engine Mounting Template





1.2 - 1.8 Adjustable Engine Mount - GPMG1101