27% EXTRA 330S 3D ARF

1.60 GLOW / 43 cc GAS PERFORMANCE SERIES™

INSTRUCTION MANUAL

Wingspan: 79.5 in [2025mm]
Wing Area: 1209 in² [77.9dm²]
Weight: 13.5 – 15.5 lbs [6125 – 7030g]
Wing Loading: 26 – 29 oz/ft² [79 – 90g/dm²]
Length: 78 in [1980mm]
Radio: 4 to 5-channel, six to seven servos
Engine: 1.50 – 1.80 cu in [25 – 29cc] two-stroke,
1.80 – 2.10 cu in [29 – 34cc] four-stroke,
1.90 – 2.60 cu in [31 – 43cc] gas
Electric Motor: 2.5 in [63mm] dia., 2772 W, 100A ESC

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
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GPMZ1413 for GPMA1413 V1.0

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INTRODUCTION

Thank you for purchasing the Great Planes Extra 330S 1.60 ARF. With the ever-increasing demands of today's R/C modeler, Great Planes has adapted and responded with this high-performance scale aerobat. Designed and built with simplicity and light weight in mind, the Extra 330S 1.60 ARF will accommodate any type of power plant you desire–glow, spark-ignition (gas) or electric–and detailed instructions for each installation and setup are included. There are also two different radio trays for mounting your receiver, throttle servo (if used) and battery in a forward or aft location, thereby minimizing any additional lead ballast required to achieve the correct C.G.–another weight-saving measure to help insure you get the most out of your Extra.

For the latest technical updates or manual corrections to this model visit the Great Planes web site at **www.greatplanes**.com. Open the "R/C AIRPLANES" pull down tab across the top of the page, then select "ARFs-GLOW." Scroll down the page and click on "Extra 330S 1.60 ARF." If there is new technical information or changes an "Important! TECH NOTICE" box will appear in the upper left corner of the page. Click on the Tech Notice box to read the info.

AMA

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

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.

IMAA

The Great Planes Extra 330S 1.60 ARF qualifies as a "giant-scale" model and is therefore eligible to fly in IMAA (International Miniature Aircraft Association) events. The IMAA is an organization that promotes non-competitive flying of giant-scale model aircraft. If you plan on attending an IMAA event refer to the IMAA Safety Code at **www.fly-imaa.org** under the "Sanctions" heading in their site index. IMAA contact information is also available in Model Aviation, the monthly newsletter magazine from the AMA. The IMAA can also be contacted at the address or telephone number below.

IMAA
205 S. Hilldale Road
Salina, KS 67401
(913) 823-5569

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

1. Your Great Planes Extra 330S 1.60 ARF should not be considered a toy, but rather a sophisticated, working model that functions very much like a full-size airplane. Because of its performance capabilities, the Great Planes Extra 330S 1.60 ARF, 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 first-class condition, and a correctly sized engine and components (fuel tank, wheels, etc.) throughout the building process.

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

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

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

8. 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.

9. **WARNING:** The cowl, wheel pants and landing gear included in this kit are made of fiberglass, the fibers of which may cause eye, skin and respiratory tract irritation. Never blow into a part (wheel pant, cowl) 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.

LITHIUM BATTERY HANDLING & USAGE

WARNING!! Read the entire instructions sheet included with this 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 use a NiCd/NiMH peak 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 the charger's output volts to match the battery volts.
- ALWAYS charge in a fireproof location.
- NEVER trickle charge.
- NEVER allow the 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.

DECISIONS YOU MUST MAKE

This is a partial list of items required to finish the Extra 330S 1.60 ARF that may require planning or decision making before beginning assembly. Order numbers are provided in parentheses.

Engine/Motor Recommendations

The recommended engine size range for the Great Planes Extra 330S 1.60 ARF is noted on the cover of this manual. Your decision basically comes down to personal preferences and how you weigh the advantages and disadvantages of each option: Glow engine installation usually tends to be the most straight-forward. Glow engines also usually provide the best power-to-weight ratio. But glow engines can also be messy (with the oily exhaust residue deposited on the bottom of the plane) and more expensive in the long run because of the cost of glow fuel. Gas engines are usually significantly heavier than glow engines, but they also tend to run cleaner. Gasoline is also less expensive than glow fuel. Aside from the task of charging and removing/installing battery packs between flights, electric power can be a convenient option with the simple "flick of a switch" which is all that is required to turn on the motor, taxi out and go fly! And of course, with electric power, there's never any clean up!

Gas Engine Accessories

These are the items shown in the manual that were used when installing the Fuji-Imvac™ BT-43EI-2 engine (FJIG0144). If using a different gas engine the same or similar items may be required.

❏ Propeller bolt that is threaded down the center for the spinner bolt (FJIG8050)
❏ 4.8V ignition battery pack with a minimum capacity of 500mAh
❏ On/off ignition switch (such as a heavy-duty radio switch–FUTM4385, HCAM2761 or similar)
❏ (4) 10-32 or 10-24 x 1" [25mm] socket-head cap screw engine mounting bolts
❏ (4) #4 lock washers
❏ (4) 10-32 or 10-24 blind nuts
❏ 1/4" [6.4mm] drill
❏ 1/8" [3mm] foam wing tape (GPMQ4424)
❏ Propeller reamer (GPMQ5007)
❏ Size "X" or 13/32" [10mm] drill for drilling out the Fuji-Imvac aluminum propeller washer

If installing a gas engine the fuel tank will also have to be converted to work with gasoline. The included stopper and fuel line must be replaced with a gas-compatible stopper and lines and measures must be taken to secure the fuel lines inside the tank. To do the conversion the following items must be purchased separately:

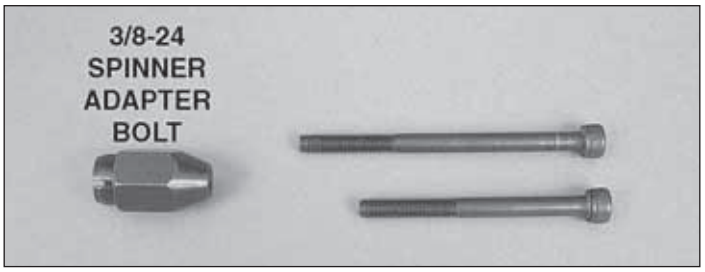
❏ (1) Sullivan #484 Gasoline/Diesel fuel tank conversion kit (SULQ2684)
❏ (2) Packages Du-Bro #813 1/8" [3.2mm] I.D. fuel line barbs (DUBQ0670)
❏ At least six small, nylon ties (available from home improvement, automotive or hardware stores)
❏ Great Planes gasoline fuel tubing (3', GPMQ4135)
–or–
❏ No. 799 3/32" I.D. Tygon Tubing (3', DUBQ0486)

If the Sullivan conversion kit is not available, a Du-Bro #400 gas conversion stopper (DUBQ0675) and one 12" [305mm] piece of K+S 1/8" [3.2mm] soft brass tubing (K+SR5128–box of 5) could also be used. Full instructions on how to do the conversion are in the manual.

Glow Engine Accessories

These are the items shown in the manual that were used with the O.S.® 1.60 FX engine (OSMG0661–ringed, without muffler). If using a different glow engine the same or similar items will also be required:

❏ Bisson O.S. 1.60 FX Pitts style muffler (BISG4116)
❏ 3/16" [4.8mm] drill
❏ Tap handle (GPMR8120)
❏ #29 drill and 8-32 tap
–or–
❏ Great Planes 8-32 tap and drill set (GPMR8103)
❏ 2' [610mm] Large silicone fuel tubing (for glow engines, GPMQ4133, 2 pkgs)



Note: This kit comes with a spinner adapter bolt with a 3/8-24 thread that fits the O.S. 1.60 FX engine. If using an engine with a different crankshaft thread, a different spinner adapter bolt with a thread that fits that fits your crankshaft that also has a 5mm or 10-32 spinner bolt thread will have to be purchased separately.

Electric Motor Accessories

These are the items shown in the manual that were used with the ElectriFly™ 63-62-250kV RimFire™ electric motor (GPMG4795).

- ❏ Great Planes Extra Large Brushless Motor Mount (GPMG1265)
- ❏ O.S. 1.60 FX locknut set (OSMG6688)
- ❏ 100 Amp ESC for brushless motors
- ❏ (4) 3 x 10mm motor mounting screws (DUBQ3227)
- ❏ (8) 3mm flat washers (DUBQ3307)
- ❏ Great Planes Threadlocker (GPMR6060)

Batteries for Electric Motor Power

There may be many different battery combinations available that will work well with the recommended brushless RimFire motor for this model. However, following are two setups recommended in this manual:

For aerobatics and sport flying the following battery, battery adapter connectors and propeller are recommended:

- ❏ (3) ElectriFly 3200mAh 11.1V LiPo battery packs (GPMP0623). The batteries will be connected in series. This is referred to as a "9S" configuration because it is comprised of three 11.1V LiPo battery packs each consisting of three individual 3.7V LiPo cells connected in series.
- ❏ (2) Great Planes ElectriFly Series Deans U 2 to 1 battery adapters (GPMM3143)
- ❏ Suitable propeller such as 20" x 10" E (electric) (APCQ4028)
- ❏ Velcro® hook & loop adhesive strips (1" x 6" [25 x 150mm], GPMQ4480)

For all-out 3D aerobatics the following battery, battery adapter connectors and propeller are recommended:

- ❏ (4) ElectriFly 3200mAh 11.1V LiPo battery packs (GPMP0623). This is a "12S" configuration.
- ❏ (3) Great Planes ElectriFly Series Deans U 2-to-1 battery adapters (GPMM3143)
- ❏ Suitable propeller such as 18" x 8" E (electric) (APCQ4021)
- ❏ Velcro® hook & loop adhesive strips (1" x 6" [25 x 150mm], GPMQ4480)

IMPORTANT: Before experimenting with different battery combinations and connecting multiple battery packs with adapter plugs, refer to the "***Battery Precautions/Connecting Batteries"*** on page 33.

Battery Charger

If using LiPo batteries, a charger specially suited for charging LiPo batteries is required. The Great Planes PolyCharge4™ (GPMM3015) is recommended. The PolyCharge4 will charge up to four LiPo batteries simultaneously. If using the PolyCharge4, a 12 Volt source will also be required for powering the charger. If you plan on charging four 3200mAh batteries simultaneously, a power source capable of delivering at least 12.8A is required. A suitable 12V auto battery could be used, or a portable source capable of converting 120V AC to 12V DC such as the Rivergate 15A DC Bulldog Power Supply (RHCP2015) is suitable. If charging only three 3200mAh batteries simultaneously, the Hobbico® 12 Volt Power Supply (HCAP0250) is also suitable.

ElectriFly LiPo batteries should not be charged through the discharge connector (that is the plug that connects to the ESC). LiPo batteries should be charged through the balance connector via a LiPo cell balancer such as a Great Planes ElectriFly Equinox™ (GPMM3150). One Equinox for each battery to be charged simultaneously will be required.

Radio Installation

As mentioned in the introduction, there is a forward and an aft radio tray for mounting the receiver, receiver battery and throttle servo in either of two locations. There are also two different options for mounting the rudder servos–either a pull/pull cable setup where the servos are mounted inside the fuselage, or a standard pushrod setup with the servos mounted outside the fuselage under the horizontal stabilizer. Whichever combination you choose depends partially on your preference, but should also depend on what type of power plant you will be using–gas, glow or electric. With gas engines (often heavier than glow engines) it is best to locate as much weight as possible as far aft as possible. Therefore, if using a gas engine it is advisable to mount the rudder servos externally in the aft location and it is virtually required that you use the aft radio tray. Even with this configuration your model may still end up slightly nose-heavy and require a few ounces of lead weight in the tail. Should you insist on using the pull/pull rudder setup with a gas engine you can expect to add approximately 10 oz. [280g] of lead to the tail.

With lighter glow engines such as the O.S. 1.60 FX, however, the weight distribution won't be as lopsided, so you will have more latitude when deciding which rudder servo and radio tray configuration to use. You could mount the rudder servos however preferred, then wait to decide where to mount the radio tray after the model has been mostly completed and you are checking the balance point.

When it comes to electric power, in most instances–depending on how many and what kind of batteries you are using–the model will be the heaviest. And, same as using a gas engine, you'll probably want to use the aft radio tray and mount the rudder servos externally in the aft location under the horizontal stabilizer.

Radio Equipment

Six servos with a minimum torque of 98 oz-in are required–one for each aileron, one for each elevator and two for the rudder. A standard servo may be used on the throttle. Futaba® S3305 servos (FUTM0045) are shown on the model in this manual because they are a suitable, relatively economical solution to the high-torque requirements, but there are also higher-precision servos available if this is your preference.

The elevator servos in the Great Planes Extra 330S 1.60 ARF move in opposition, so if the radio you will be using is not capable of electronically mixing the elevator servos (so that they may be connected to different channels in the receiver and one of them reversed), an on-board servo reverser such as the Futaba SR-10 Dual Servo Reverser (FUTM4150) will be required.

A receiver battery pack with a minimum capacity of 1500mAh must also be used. The HydriMax™ Ultra 4.8V 2000mAh battery pack (HCAM6321) is suitable.

Following are the servo extension wires, Y-harnesses and other radio gear illustrated in this manual:

❏ (2) 24" [610mm] servo extensions for the ailerons (HCAM2721 for Futaba, HCAM2720 for JR/Hitec)
❏ (2) additional 24" [610mm] servo extensions for the elevators if mounting the receiver in the aft radio tray

–or–

❏ (2) 36" [914mm] servo extensions for the elevators if mounting the receiver in the forward radio tray (HCAM2726 for Futaba, HCAM2725 for JR/Hitec)
❏ (2) more 24" [610mm] servo extensions for the rudder servos if mounting them in the aft location under the horizontal stabilizer and using the aft radio tray (HCAM2721 for Futaba, HCAM2720 for JR/Hitec)

–or–

❏ (2) 36" [914mm] servo extensions for the rudder servos if mounting them in the aft location under the horizontal stabilizer and using the forward radio tray (HCAM2726 for Futaba, HCAM2725 for JR/Hitec)
❏ (2) Dual servo connectors such as Futaba Dual Servo Extension Futaba J (FUTM4130) for rudder servos and aileron servos

This model was also designed to accommodate two Ernst Charge Receptacles (ERNM3001 for Futaba J, ERNM3004 for JR) for charging the batteries and monitoring the voltage without having to remove the canopy hatch. If not using a gas engine with an ignition battery, only one charge receptacle will be required (for the receiver battery).

ADDITIONAL ITEMS REQUIRED

In addition to the items previously mentioned in the ***"Decisions You Must Make"*** section, following is the list of hardware and accessories required to finish this model. Order numbers are provided in parentheses.

Required Hardware & Accessories

❏ Suitable propeller and spare propellers
❏ R/C foam rubber (1/4" [6mm] – HCAQ1000, or 1/2" [13mm] – HCAQ1050)
❏ (6) Large-scale servo arms (GPMM1105)

–or–

❏ (2) DuBro servo arms super strength Futaba J long (DUBM6670)

(**Note:** Only four servos arms will be required if mounting the rudder servos inside the fuselage and using the pull-pull cables.)

Adhesives & Building Supplies

This is the list of Adhesives and Building Supplies that are required to finish your Extra.

❏ Pro 30-minute epoxy (GPMR6047)
❏ 1 oz. [30g] Thin Pro CA (GPMR6002)
❏ 1 oz. [30g] Medium Pro CA+ (GPMR6008)
❏ CA applicator tips (HCAR3780)
❏ Silver solder w/flux (STAR2000)
❏ #1 Hobby knife (HCAR0105)
❏ #11 blades (5-pack, HCAR0211, 100-pack, HCAR0311)
❏ Drill bits: 1/16" [1.6mm], 3/32" [2.4mm], 1/8" [3.2mm], and if your servos have 3mm screws that hold on the servo arms (such as the Futaba 3305s) you will also need a #32 (.116" [3mm]) drill

Covering Tools

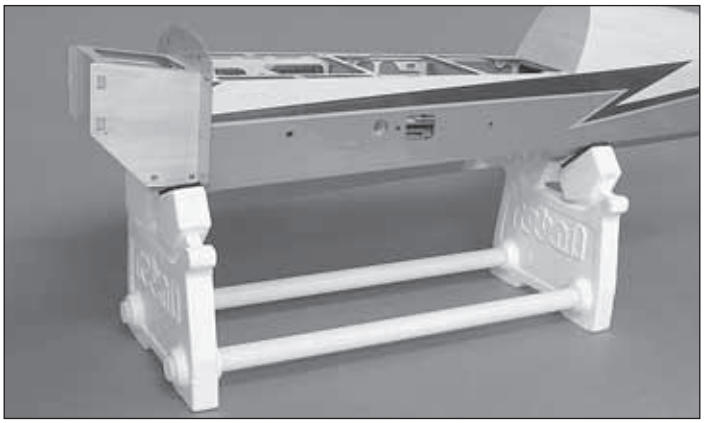
A Top Flite® MonoKote® or 21st Century® model airplane covering iron with a protective covering sock will be necessary for tightening any covering on the model that may have loosened or formed wrinkles between the time of production and your purchase. The 21st Century iron is preferred as it has a longer cord and a rounded, contoured shoe. A trim iron is not as much of a necessity, but would still be handy for sealing the edges down inside servo openings and other small areas.

❏ 21st Century sealing iron (COVR2700)
❏ 21st Century iron cover (COVR2702)
❏ 21st Century trim seal iron (COVR2750)
❏ Top Flite MonoKote sealing iron (TOPR2100)
❏ Top Flite Hot Sock™ iron cover (TOPR2175)
❏ Top Flite MonoKote trim seal iron (TOPR2200)

Optional Supplies & Tools

Here is a list of optional tools mentioned in the manual that will help you build the Extra 330S 1.60 ARF.

❏ Great Planes 4-in-1 Installation Tool (for wing bolts GPMR8035)
❏ Stick-on segmented lead weights (GPMQ4485)
❏ 2 oz. [57g] Spray CA activator (GPMR6035)
❏ 4 oz. [113g] Aerosol CA activator (GPMR634)
❏ CA debonder (GPMR6039)
❏ Epoxy brushes (6, GPMR8060)
❏ Mixing sticks (50, GPMR8055)
❏ Mixing cups (GPMR8056)
❏ Denatured alcohol (for epoxy clean up)
❏ K & S #801 Kevlar® thread or similar non-elastic line (for horizontal stabilizer alignment)
❏ Rotary tool such as Dremel®
❏ Rotary tool reinforced cut-off wheel (GPMR8200)
❏ Precision Magnetic Prop Balancer (TOPQ5700)
❏ Dead Center™ Engine Mount Hole Locator (GPMR8130)
❏ Hobby Heat™ micro torch (HCAR0750)



The Robart Super Stand II (ROBP1402) is virtually required for working on the fuselage during assembly.

Pilot Figure

A pilot figure is not included with this model. But Great Planes offers a line of 1/4-scale Sport pilot figures: (GPMQ9010–red, GPMQ9011-blue, GPMQ9012-yellow, GPMQ9013-unpainted).

Also available are 1/4-scale Civilian pilot figures: (GPMQ9058–red, GPMQ9059–blue, GPMQ9060–yellow, GPMQ9061–unpainted). (**Note:** The 1/4-scale red sport pilot is mounted in the model on the box cover.)

BUILDING NOTES

• The horizontal stabilizer and wing incidences and engine 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.

• Should covering repairs be required, the following colors of MonoKote® may be used:

Missile Red – TOPQ0201
Metallic Blue – TOPQ0402
Aluminum – TOPQ0205
Yellow – TOPQ0203

ORDERING REPLACEMENT PARTS

Replacement parts for the Great Planes Extra 330S 1.60 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

GPMA3061	Wing Set
GPMA3062	Fuselage
GPMA3063	Tail Set
GPMA3064	Cowl
GPMA3065	Canopy
GPMA3066	Landing Gear
GPMA3067	Wheel Pants
GPMA3068	Decal
GPMA3069	Wing Joiner

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
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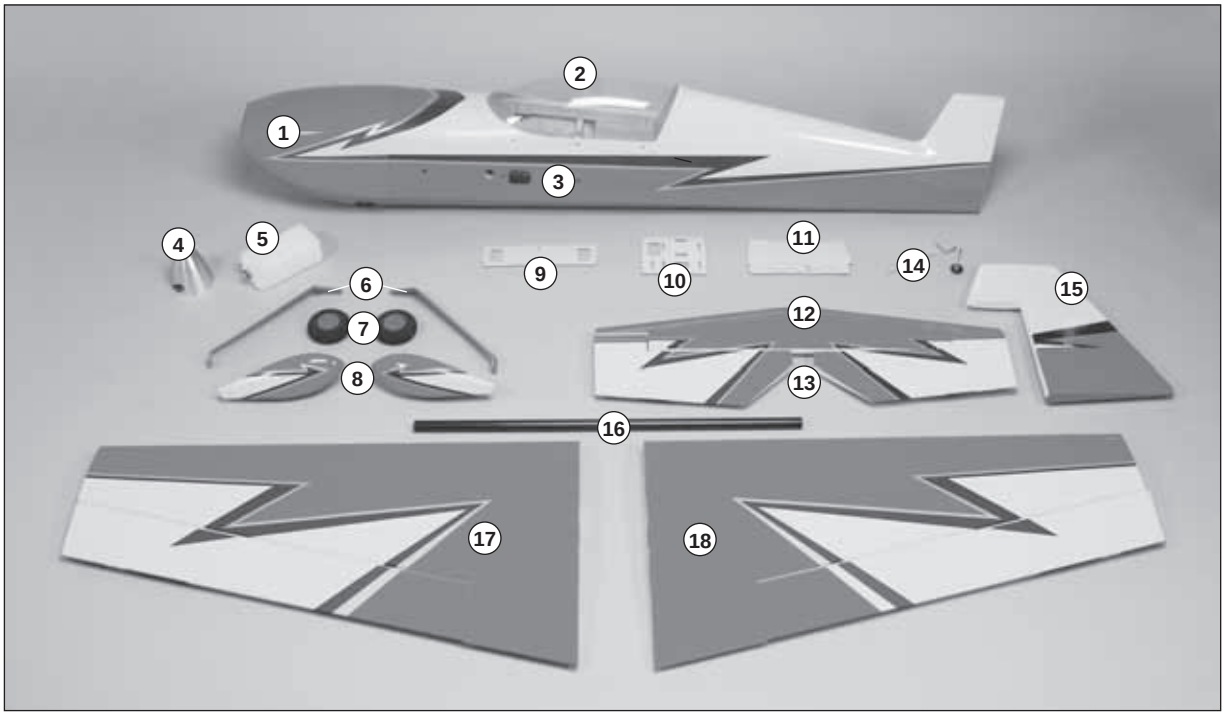
KIT CONTENTS



Kit Contents

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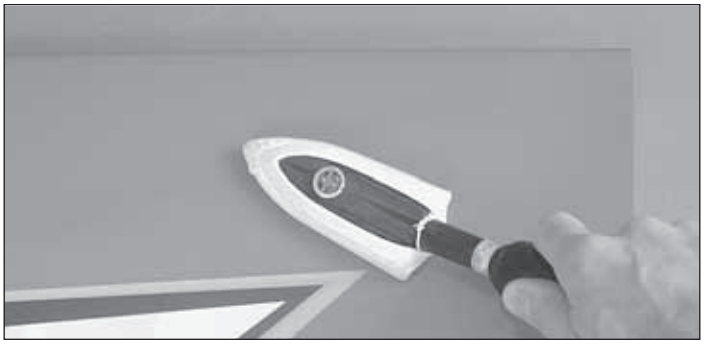
SHRINK THE COVERING

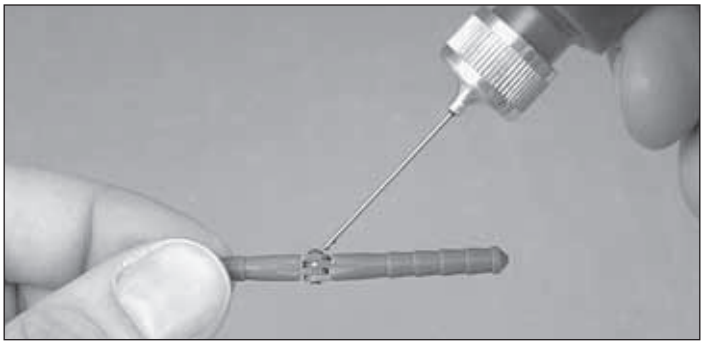


❏ 1. Examine the airframe for wrinkles in the covering or areas where the covering isn't adhered to the structure. Where necessary, use a covering iron with a protective covering sock to shrink any wrinkles and get the covering bonded to the framework–use an iron temperature setting around 250° F [120° C]. And use care over seams. If too much heat is applied over seams and edges the covering will pull away. **Note:** Naptha (lighter fluid) can be used to remove any adhesive left from the masking tape holding the control surfaces.

ASSEMBLE THE WINGS

Hinge the Ailerons

❏ 1. Test fit each **aileron** to its matching **wing** with the hinges. Note that the pivot point of the hinges should be centered on the pivot point of the control surface–each hinge should be exactly halfway in. Make any adjustments necessary for the correct fit.



❏ 2. Remove the ailerons and take out the hinges. Add a small drop of plastic-compatible oil to the pivot point of each hinge–be careful not to get any oil on any other part of the hinges.

Note: When permanently hinging the ailerons to the wings in the following step, use separate batches of 30-minute epoxy for each wing. If you try to do it all at once, the epoxy might harden before you finish.

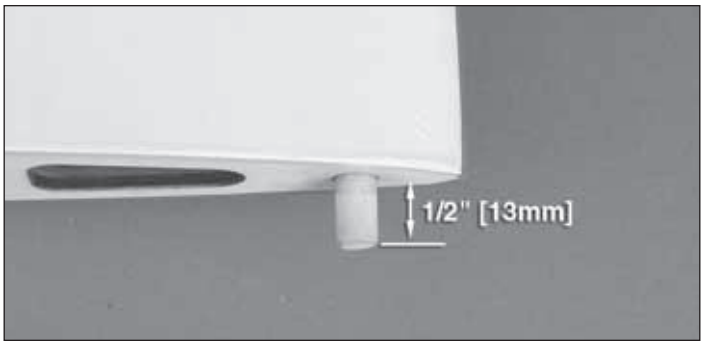
EXPERT TIP

During construction there will be several occasions where epoxy cleanup will be necessary. Instead of wasting whole paper towels, stack three or four paper towels on top of each other and cut them into small squares. This will conserve paper towels and the little squares are easier to use. For epoxy clean up dampen the squares with denatured alcohol.

❏ 3. Permanently join one of the ailerons to the matching wing with 30-minute epoxy–a good way is to use a wire or a toothpick to spread epoxy in each hinge hole of the aileron and the wing. Coat one side of a hinge with epoxy and fit it into the wing. Install the remaining four hinges in that wing half the same way. Coat the other end of the hinges that are sticking out, then push the aileron all the way on until

there is just enough space in the gap to see light through. Wipe off any excess epoxy that squeezes out and move the aileron up and down several times to center and align the hinges. Hold the aileron to the wing with masking tape until the epoxy hardens.

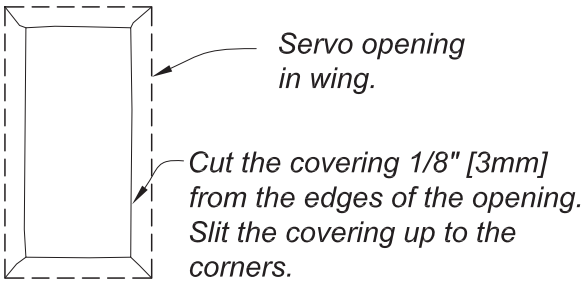
❏ 4. Hinge the other aileron to the other wing with a new batch of 30-minute epoxy.

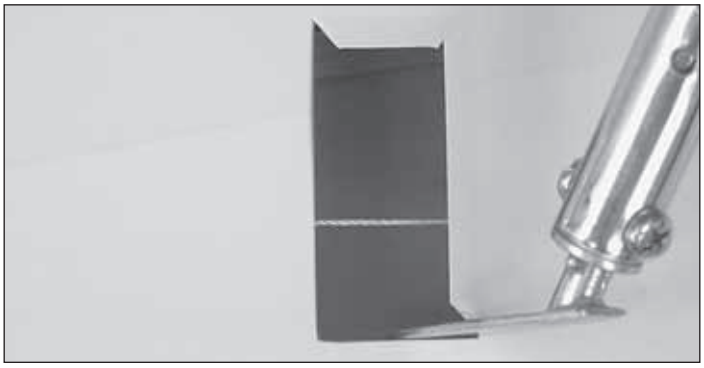


❏ 5. While you have some epoxy mixed, glue two 5/16" x 1-1/4" [8 x 33mm] hardwood **incidence dowels** into the root end of each wing so that 1/2" [13mm] of each dowel protrudes.

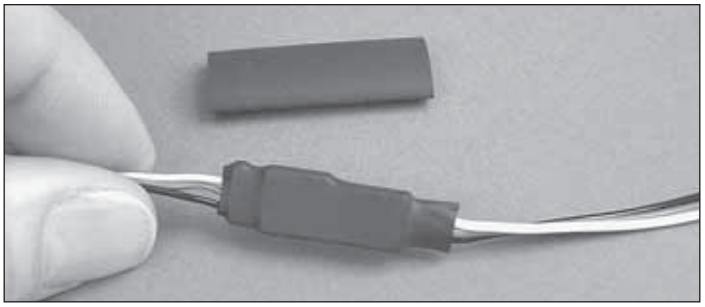
❏ 6. After the epoxy on all the hinges has hardened, remove the masking tape. Move the ailerons up and down to "break" any epoxy from the hinge pins and get them moving freely.

Hook Up the Ailerons



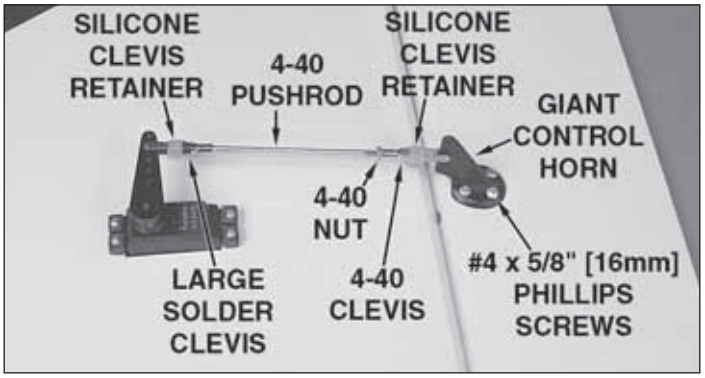


❏ 1. Cut the covering from the **servo openings** in the bottom of the wings. **Hint:** First cut the covering 1/8" [3mm] inside the edges of the opening. Then slit the covering up to the corners and use a trim iron to seal the covering down inside the opening.



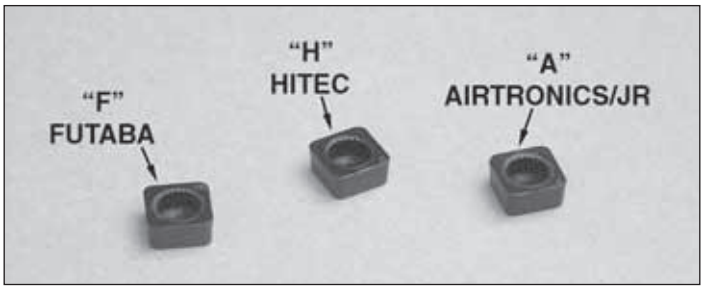
❏ 2. Connect a 12" [305mm] servo extension wire to each aileron servo (for Futaba servos, Hobbico servo extensions (HCAM2100) were used). Secure each connection with pieces of 3" [75mm] heat-shrink tubing cut in half. Use a heat gun to shrink the tubing.

Refer to this photo while mounting the aileron servos and hooking up the ailerons.



❏ 3. Use the string in the wing or a wire with a hook bent on the end to pull one of the servo wires through the servo opening and down through the ribs out the end of one of the wings. Place the servo in the opening. Fit the other servo in the other wing the same way.

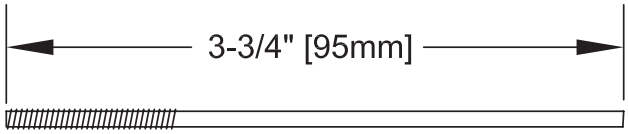
❏ 4. Drill 1/16" [1.6mm] holes in the wings for the servo mounting screws. Temporarily mount the servos with the screws that came with them. Remove the screws and take the servos out of the openings. Harden the screw holes with a few drops of thin CA. Allow the CA to harden, then mount the servos again.



❏ 5. Great Planes large-scale 1.5" [38mm] single-sided servo arms with adapters (GPMM1105) are shown in this manual. Select the plastic servo arm adapters for the servos you will be using – "F" is for Futaba, "H" is for Hitec and "A" is for Airtronics and JR.

❏ 6. If your aileron servos come with 3mm screws for mounting the servo wheels, enlarge the hole in two metal servo arms and plastic adapters included with this kit with a #32 (.116" [3mm]) drill.

❏ 7. Mount the servo arms to the aileron servos using the appropriate servo adapters–the arms "point" toward the wing tips. **Note:** If the screws that hold on the servo arms have machine threads that go into metal output shafts in the servos, use a drop of threadlocker on the screws before mounting the arms.



4-40 Pushrod

❏ 8. Make two 3-3/4" [95mm] **aileron pushrods** by cutting the unthreaded end from two 4-40 x 12" [300mm] pushrods. Solder a large metal **clevis** (the kind without threads) to each aileron pushrod as shown in the ***Expert Tip*** that follows.

HOW TO SOLDER

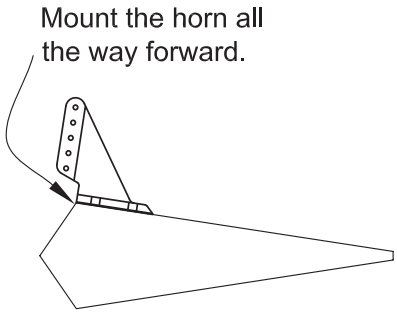
1. Use denatured alcohol or other solvent to thoroughly clean the pushrod. Roughen the end of the pushrod with coarse sandpaper where it is to be soldered.

2. Apply a few drops of soldering flux to the end of the pushrod, then use a soldering iron or a torch to heat it. "Tin" the heated area with silver solder (STAR2000) by applying the solder to the end. The heat of the pushrod should melt the solder–not the flame of the torch or soldering iron–thus allowing the solder to flow. The end of the wire should be coated with solder all the way around.

3. Place the clevis on the end of the pushrod. Add another drop of flux, then heat and add solder. The same as before, the heat of the parts being soldered should melt the solder, thus allowing it to flow. Allow the joint to cool naturally without disturbing. Avoid excess blobs, but make certain the joint is thoroughly soldered. The solder should be shiny, not rough. If necessary, reheat the joint and allow to cool.

4. Immediately after the solder has solidified, but while it is still hot, use a cloth to quickly wipe off the flux before it hardens. ***Important:*** *After the joint cools, coat with oil to prevent rust.* ***Note:*** *Do not use the acid flux that comes with silver solder for electrical soldering.*

This is what a properly soldered clevis looks like–shiny solder with good flow, no blobs, flux removed.



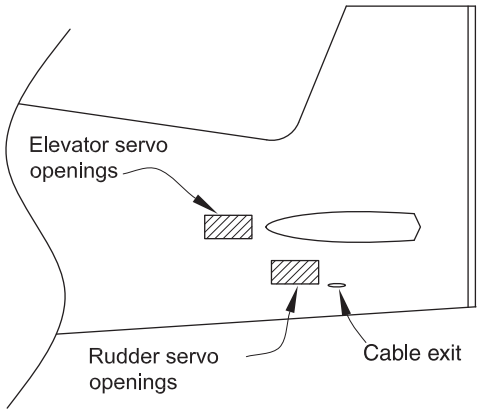
❏ 9. Connect the ailerons to the aileron servos using the hardware shown in the photo on page 10. Before mounting the horns, drill 3/32" [2.4mm] holes for the screws. Temporarily mount the horns with the #4 x 1/2" [13mm] screws. Remove the screws and add a few drops of thin CA to each screw hole. Remount the horns with the screws after the CA hardens.

Caution: Be certain you have used 4-40 threaded clevises–not solder clevises on the threaded ends of the pushrods.

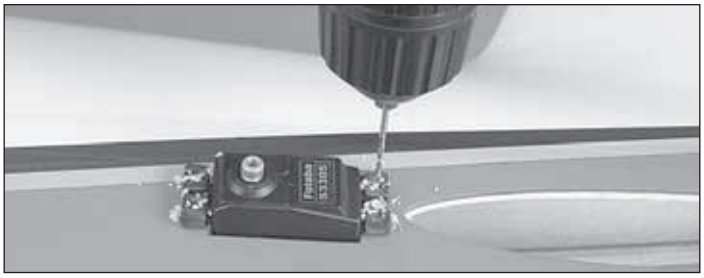
Set the wings aside while you work on the fuselage.

ASSEMBLE THE FUSELAGE

Mount the Horizontal Stabilizer



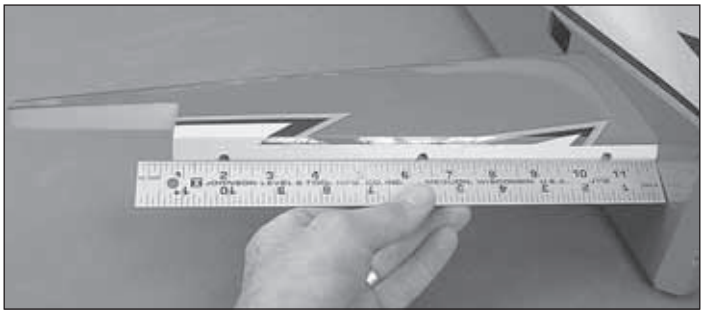
❏ 1. The same as was done for the aileron servo openings in the wings, cut the covering from the **elevator servo openings** in both sides of the fuselage and use a trim iron to seal the edges of the covering down inside. If not using the pull/pull rudder servo setup and mounting the rudder servos outside the fuselage, cut the covering from the **rudder servo openings** too. Also cut the covering from the openings for the **horizontal stabilizer** and, if mounting the rudder servos internally with the pull/pull setup, cut the slots for the **cable exits**.

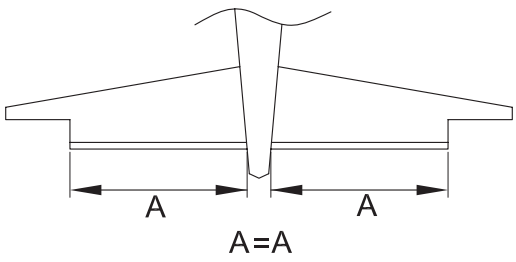


❏ 2. Place each servo in its opening and drill 1/16" [1.6mm] holes for the mounting screws.

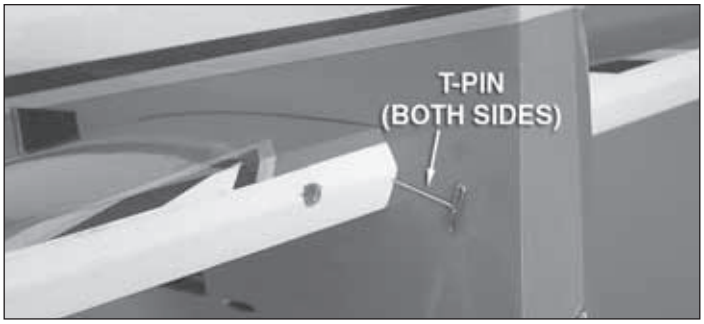
❏ 3. Temporarily mount each servo with the screws supplied with your radio system. Remove the screws and add a few drops of thin CA to each hole.

Note: The following stab alignment procedure may appear to be extensive, but these are the steps necessary to build a model with a properly-aligned horizontal stabilizer that will fly correctly. You could skip all the alignment steps and just eyeball it, but you may end up with a crooked model that won't fly straight. Please follow all of the instructions and take your time to end up with an airplane that is straight and true.

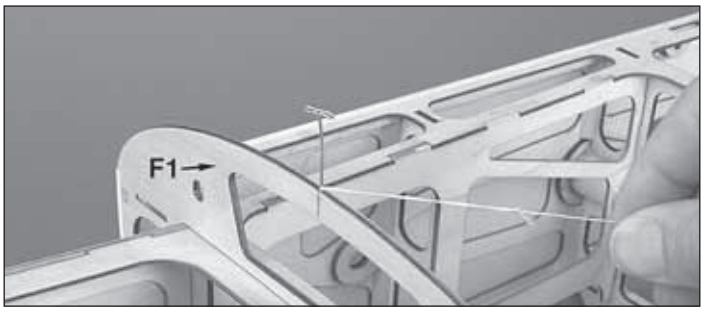


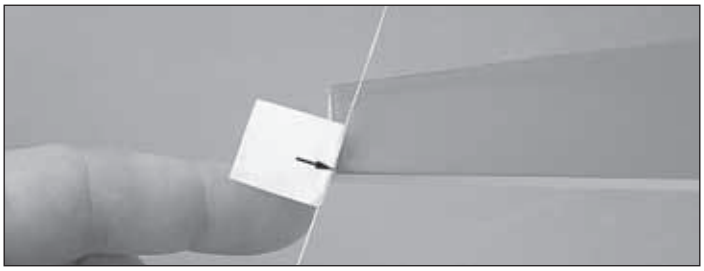


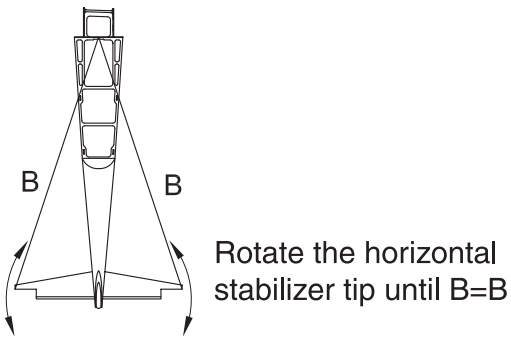
❏ 4. Slide the stab into the fuselage. Center the trailing edge (TE) in the fuselage by taking accurate measurements on both sides.



❏ 5. Once you have the trailing edge centered, stick large T-pins through the trailing edge tightly against both sides of the fuselage. This will keep the trailing edge centered while rotating the leading edge in the next step.



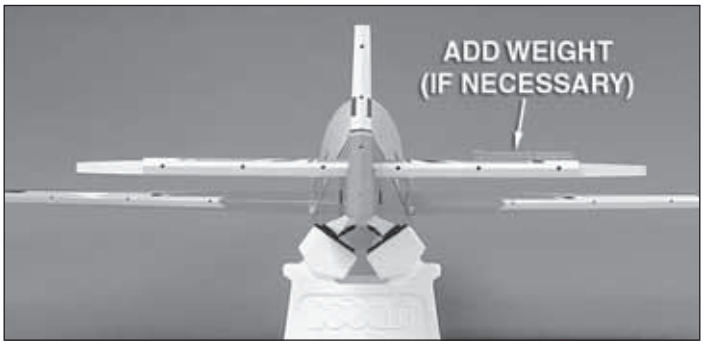




❏ 6. Push another T-pin through the top of **F1** at the centerline. Tie a small loop in one end of an approximately 60" [1.5m] piece of non-elastic string (such as K+S or Kevlar fishing string). Fold a piece of masking tape over the string near the other end and mark an arrow on it. Swing the string over to the tip on one side of the stab and slide the tape along the string until the arrow aligns with the tip. Swing the string over to the same spot on the other side of the stab and rotate the stab. Move the tape until both sides are the same and the stab is squared.

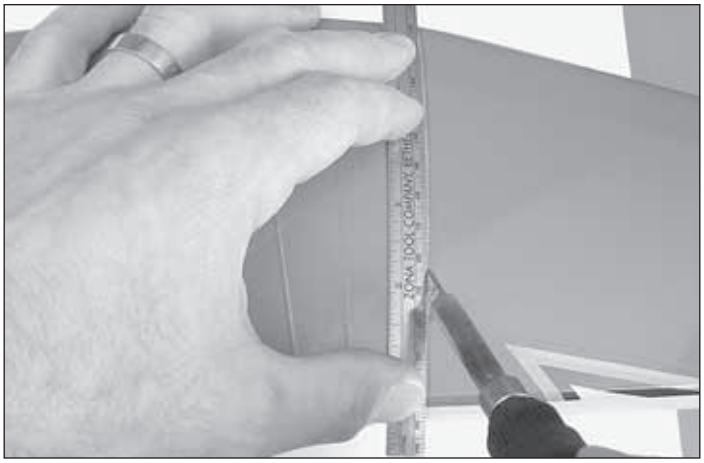
One more alignment procedure to go…

❏ 7. Now that the stab is centered, temporarily mount the wing to the fuselage with the **wing tube** and the **wing bolts**. **Suggestion:** Access to the wing bolts will be much easier with a Great Planes 4-in-1 Installation Tool (GPMR8035). This will be especially helpful when you get to the flying field and need to get the wing bolts tight.

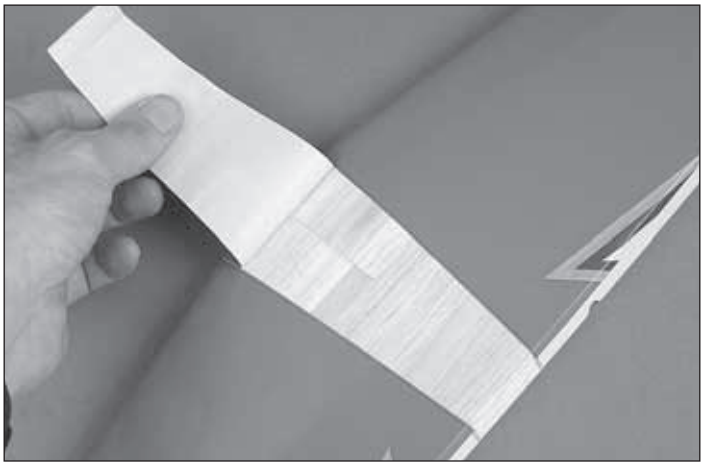


❏ 8. Standing about 6' [2m] behind the model, view the alignment of the stab and wing. If the stab is not parallel with the wing, it will take just a few ounces of weight to “dial it in.” Place incrementally increasing amounts of weight on the high side of the stab until you can get it to align with the wing.

❏ 9. Now that you know how much (if any) weight it will take to get the stab to align with the wing, take off the weight, set it aside, and use a ballpoint pen to carefully mark the sides of the fuselage all the way around both sides of the stab.



❏ 10. Take the T-pins out of the stab and take the stab out of the fuselage. Use a soldering iron with a small tip to melt through the covering 1/32" to 1/16" [.5 to 1.5mm] inside the lines you marked all the way around–use a flexible, metal straightedge to guide the soldering iron. If you don’t have a soldering iron, a sharp hobby knife could also be used to cut the covering, but great care must be used not to cut into the balsa underneath. Otherwise, the stab will be weakened.



❏ 11. Peel the covering from the middle of the stab.

Now that all the preliminary work has been done, the stab can finally be glued into position.

❏ 12. Apply liberal beads of epoxy all the way around the top and bottom of the stab just inside the edges of the covering you cut where the stab will join the fuselage. Slide the stab into position. Slide it another 1/4" [6mm] out the other side as shown. Apply more epoxy all the way around the exposed balsa, then slide the stab back into place. Wipe away excess epoxy, use the T-pins and the pin and string to re center the

stab, add any weight that may have been necessary to align the stab with the wing, wipe away more epoxy that may have dripped out, check the alignment once more, then do not disturb the model until the epoxy has hardened.

Hinge the Elevators & Rudder

Hinging the elevators and rudder is done the same as you did the ailerons, but we'll give you a brief run-through anyway.

❏ 1. If you haven't yet done so, remove the wings from the fuselage.

❏ 2. Test fit both **elevators** to the stab and the **rudder** to the **vertical stab (fin)** with the hinges. Make sure the hinges are centered and make any adjustments necessary.

❏ 3. Remove the elevators and rudder and take out all the hinges. The same way you did for the aileron hinges, add a small drop of oil to the pivot point of each hinge.

❏ 4. Permanently hinge the elevators to the stab and the rudder to the fin–don't forget to use separate batches of 30-minute epoxy for each control surface–otherwise you may run out of working time with the epoxy.

❏ 5. After the epoxy on all the hinges has hardened, remove the masking tape and rapidly move the surfaces to "break" any epoxy from the hinge pins and get the surfaces moving freely again.

If mounting the rudder servos inside the fuselage with the pull/pull cables, skip ahead to "Hook up the Elevators." (Remember, gas engine installations should use the aft, external rudder servo location.)

Hook Up the External Rudder Servos

❏ 1. If mounting the receiver to the **forward servo tray**, connect 36" [910mm] servo extension wires to the rudder servos. If mounting the receiver to the **aft servo tray**, connect 24" [610mm] servo extension wires to the rudder servos. Later, the rudder servos will be linked with a "Y" connector and connected to one channel in the receiver. If not yet certain where you will be mounting the receiver, you may connect the extensions later.

❏ 2. The same as was done for the servo extension wires on the aileron servos, secure the connections with 3" [75mm] pieces of heat-shrink tubing cut in half.

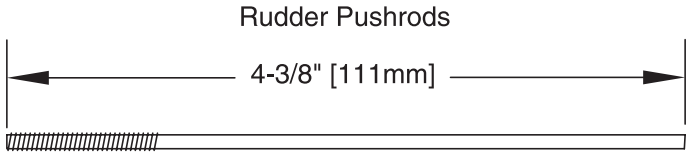
Refer to this photo while hooking up the external rudder servos and elevator servos.

❏ 3. Guide the rudder servo wires down through the fuselage and mount the servos. Note that the servo output shafts on both rudder servos are toward the aft end of the fuselage.

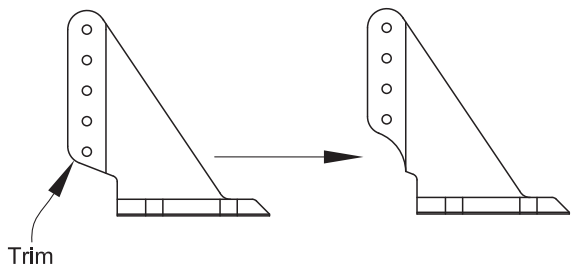
❏ 4. Select the plastic servo arm adapters for the servos you will be using – "F" is for Futaba, "H" is for Hitec and "A" is for Airtronics and JR.

❏ 5. Same as the aileron servos, use the 3mm screws supplied with your radio system to mount the servo wheels/arms. Drill out the hole in the metal servo arms and plastic adapters included with this kit with a #32 (.116" [3mm]) drill.

❏ 6. Temporarily mount the servo arms to the servos using the appropriate servo adapters and servo screws.



❏ 7. Make two 4-3/8" [111mm] **rudder pushrods** from two 4-40 x 12" [300mm] pushrods. Use the same techniques described for making the aileron pushrods to solder large metal clevises to the ends of the rudder pushrods and make sure the clevises on the threaded end of the pushrods are the threaded kind.



❏ 8. Trim the bottom hole from two control horns as shown.

❏ 9. Connect the rudder pushrods to the rudder servo arms, then connect the rudder horns to the other end of the rudder

pushrods. Hold the horns to the rudder and drill 3/32" [2.4mm] holes 1/2" [13mm] deep for the mounting screws – same as the aileron horns, the rudder horns should be mounted all the way forward. Mount the horns to the rudder with #4 x 1/2" [13mm] screws. Don't forget to remove the screws. Harden the holes with a few drops of thin CA, allow to harden, and then remount the horns.

Hook Up the Elevators

Note that, because the elevator servos move in opposition, they must be connected to two different channels and linked electronically via mixing in the transmitter (or connected to a Futaba Servo SR-10 Dual Servo Reverser (FUTM4150) so that one of the servos can be reversed).

Refer to the previous photo showing the servos while hooking up the elevators.

❏ 1. If mounting the receiver to the **forward servo tray**, connect 36" [910mm] servo extension wires to the elevator servos. If mounting the receiver to the **aft servo tray**, connect 24" [610mm] servo extension wires to the elevator servos. If not yet certain where you will be mounting the receiver, you may connect the extensions later.

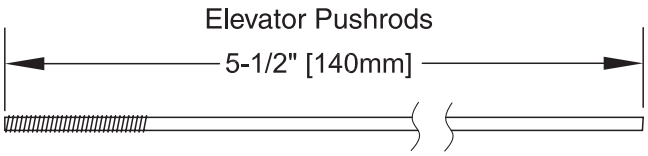
❏ 2. The same as was done for the servo extension wires on the aileron servos, secure the connections with 3" [75mm] pieces of heat-shrink tubing cut in half.

❏ 3. Guide the elevator servo wires down through the fuselage and mount the servos. Note that the servo output shafts are forward.

❏ 4. Select the plastic servo arm adapters for your servos – "F" is for Futaba, "H" is for Hitec and "A" is for Airtronics and JR.

❏ 5. Same as the aileron servos, use the 3mm screws supplied with your radio system to mount the servo wheels/arms. Drill out the hole in the metal servo arms and plastic adapters included with this kit with a #32 (.116" [3mm]) drill.

❏ 6. Temporarily mount the servo arms to the servos using the appropriate servo adapters and servo screws.



❏ 7. Make two 5-1/2" [140mm] **elevator pushrods** from two 4-40 x 12" [300mm] pushrods. If mounting the rudder servos inside the fuselage with the pull/pull setup, save the leftover pieces of pushrod you cut off for connecting the rudder servos later. Use the same techniques described for making the aileron pushrods to solder large metal solder clevises to the ends of the elevator pushrods.

❏ 8. Connect the pushrods to the servo arms. Then, connect the horns to the other end of the pushrods. Hold the horns to the elevators and drill 3/32" [2.4mm] holes 1/2" [13mm] deep for the mounting screws – same as the aileron and rudder horns, the elevator horns should be mounted all the way forward. Mount the horns to the elevators with #4 x 1/2" [13mm] screws. Don't forget to remove the screws, harden the holes with a few drops of thin CA and allow to harden before remounting the horns.

If you already mounted the rudder servos in the back of the fuselage, skip ahead to page 18 and mount the tail gear.

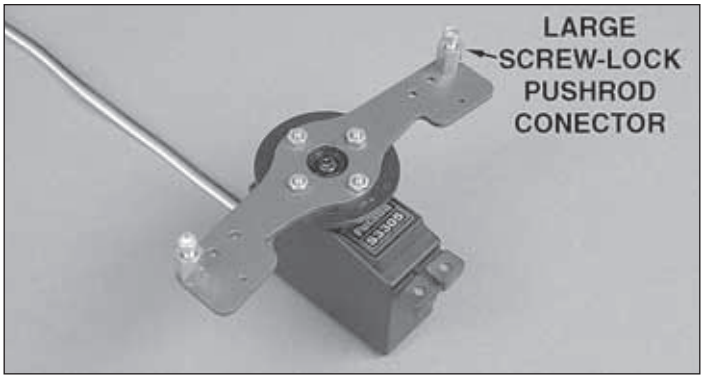
Mount the Pull/Pull Rudder Servos

❏ 1. Mount the rudder servos in the **rudder servo tray** in the fuselage by drilling 1/16" [1.6mm] holes for the screws, temporarily installing, removing, and hardening the holes with thin CA. Connect both servos to a dual servo connector. Then temporarily connect the connector into the rudder channel in your receiver. Also connect a receiver battery and an on/off switch to the receiver so you can operate the servos with the transmitter.

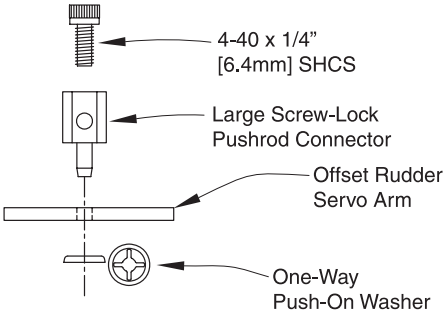
Refer to this photo for the following two steps.

❏ 2. Turn on the transmitter and receiver and center the rudder trim on the transmitter. With the rudder servos powered up and the trims centered, mount a servo wheel to each servo. Use the servo arm screws that came with the servos to mount the plywood **servo arm drilling template** to the servos over the wheels.

❏ 3. With your radio system still on, use the holes in the plywood servo arm drilling template as a guide to drill 3/32" [2.4mm] holes through the servo wheels. Now you may turn off the radio.



❏ 4. Remove the plywood servo arm drilling template. Keeping the servo wheel in the same orientation as when it was on the servo, remove the servo wheel from the aft rudder servo. Mount one of the aluminum **pull/pull rudder servo arms** to the wheel as shown with four 2-56 x 3/8" [10mm] screws and 2-56 nuts–**be certain to use threadlocker on the threads**. **Optional:** After mounting the servo arm, cut off the screws, then file the ends flat and smooth.

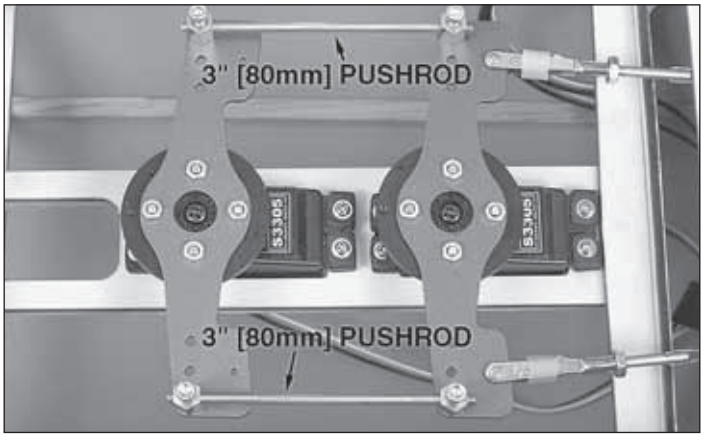


❏ 5. Mount two large screw-lock pushrod connectors in the outer holes on each end of the servo arm and secure the connectors with a one-way push-on washer. Remount the servo wheel with the aluminum servo arm to the servo.

Be certain to install the screw that retains the wheel–use threadlocker if they are machine-thread screws.

❏ 6. Mount and setup the other **rudder pull/pull servo arm** to the servo wheel on the other rudder servo.

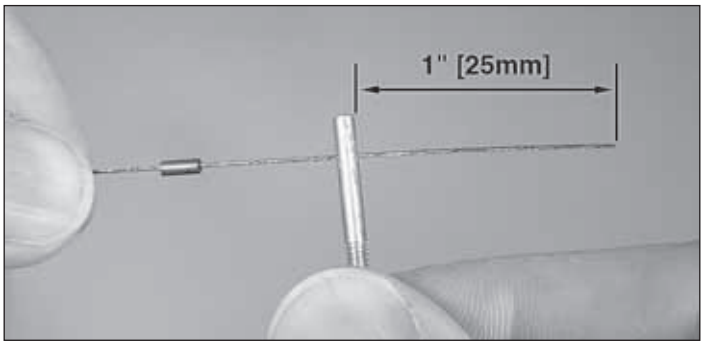
Refer to this photo of the completed rudder servo hookup while performing the installation in the following steps.



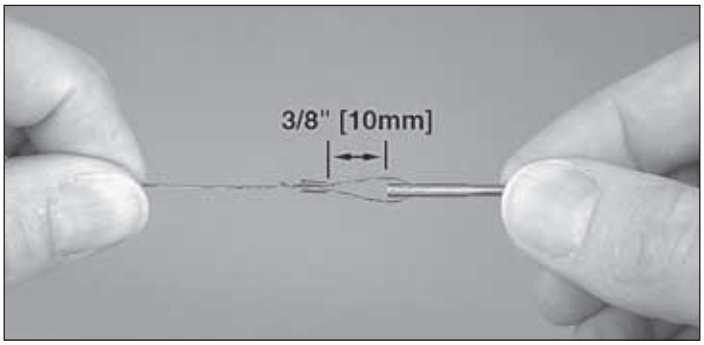
❏ 7. Make two 3" [75mm] **rudder pushrods** from the leftover 4-40 pushrod wire you saved from the elevators. Turn on the transmitter and receiver. Connect the servo arms on the rudder servos with the rudder pushrods and four 4-40 x 1/4" [6.4mm] SHCS. Turn off the radio.

Hook Up the Pull/Pull Rudder Cables

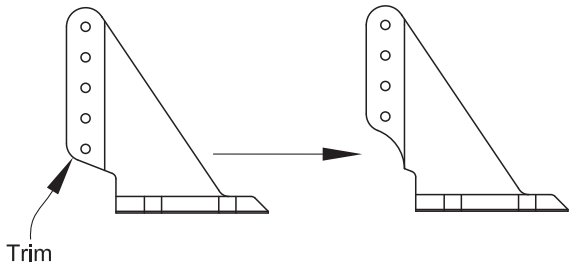
❏ 1. Cut the supplied braided steel cable into two equal-length pieces. (There should be enough cable to make two sets–in case you make a mistake.) Set one of the pieces aside in case you need it as a spare.



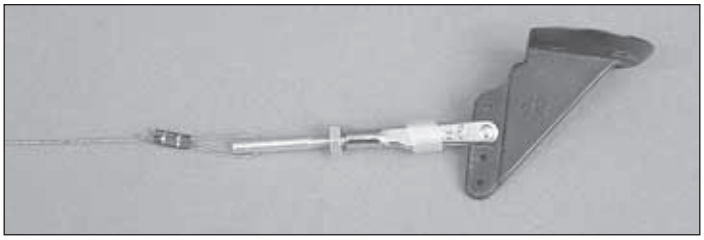
❏ ❏ 2. Cut the other piece of cable in half again. Slide a copper swage and a threaded brass coupler onto one end of one of the cables. There should be approximately 1" [25mm] of cable coming from the coupler.



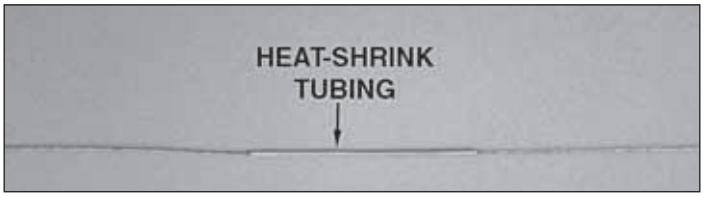
❏ ❏ 3. Loop the cable over and slip it into the swage. Adjust the position of the swage so the cable makes a loop and there is approximately 3/8" [10mm] between the end of the swage and the coupler. Squeeze the swage tightly with pliers.



❏ ❏ 4. Trim the bottom hole from two control horns as shown.



❑ ❑ 5. Thread a 4-40 nut and a 4-40 clevis onto the threaded coupler on the cable. Fit a silicone clevis retainer over the clevis. Connect the clevis to what used to be the middle hole in one of the control horns you prepared, but now is the third hole from the top.



❑ ❑ 6. Slide one of the pieces of blue heat-shrink tubing over the cable. Shrink the heat-shrink tubing over the cable somewhere near the middle (you will still be able to slide the tubing after it has been shrunk). Position the heat-shrink tubing so the middle of the tube is 18-3/4" [475mm] from the pin in the clevis. Slide the heat-shrink tubing over a couple more inches and coat the cable with a few drops of medium CA where the tubing used to be. Slide the heat-shrink tubing back and forth a few times to get the CA inside, then reposition the tubing as previously described so it is centered 18-3/4" [475mm] from the pin.

❑ 7. While the CA in the heat-shrink tubing is hardening, repeat steps 2 through 6 for the other cable.

❑ 8. Slide the other end of one of the cables through the exit slot in the right side of the fuselage under the horizontal stabilizer. Reach down into the fuselage and pull the cable up to the rudder servos.

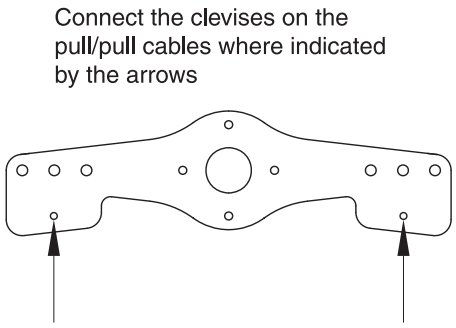
❑ 9. Hold the rudder centered with a few pieces of masking tape.

❑ 10. Using one hand to hold the cable to the left side of the servo arm on the aft rudder servo (the cables cross inside the fuselage), use your other hand to hold the control horn to the right side of the rudder so the cable aligns with the exit slot.

❑ 11. Mount the horn to the rudder in this location by drilling four 3/32" [2.4mm] holes and using four #4 x 1/2" [13mm] screws–don't forget to harden the holes with thin CA.

❑ 12. Mount the other cable to the other side of the rudder the same way.

❑ 13. Connect another 4-40 clevis, a 4-40 nut and a silicone retainer to another threaded coupler.



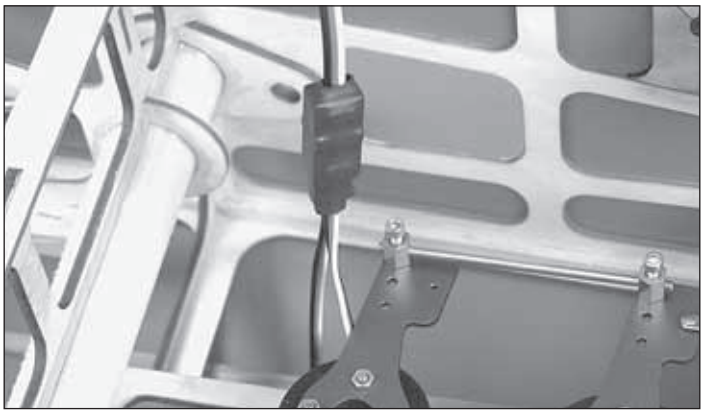
❑ 14. Turn on the transmitter and receiver. Slide a swage over the pull/pull cable in the fuselage that is connected to the horn on the **right side** of the rudder. Loop the cable through the coupler. Connect the clevis on the cable to the hole in the servo arm. With the rudder servos centered, pull the cable tight and loop the cable around the threaded coupler. Then, slide the swage over the end of the loop and squeeze the swage with pliers. Cut off the excess cable.

❑ 15. Adjust the tension in the cable by disconnecting one of the clevises on either end of the cable and threading or unthreading the clevis on the coupler. The cable should be somewhat taut–about as tight as a loose guitar string–but not so tight that it puts much strain on the servos, clevises or rudder. Reconnect the clevis.

❑ 16. Connect the other rudder cable to the other side of the rudder servo arm the same way.

❑ 17. Remove the masking tape from the rudder. Give the rudder a "test run" by working the controls with your radio. With the system powered up and the rudder trim still centered, center the rudder by adjusting the length of the cables and adjusting the cable tension. With the offset servo arm, cable tension should be about the same with the rudder centered as it is when the rudder is at full throw.

❑ 18. Once the rudder setup has been finalized, lock the clevises to the threaded couplers by tightening the 4-40 nuts.

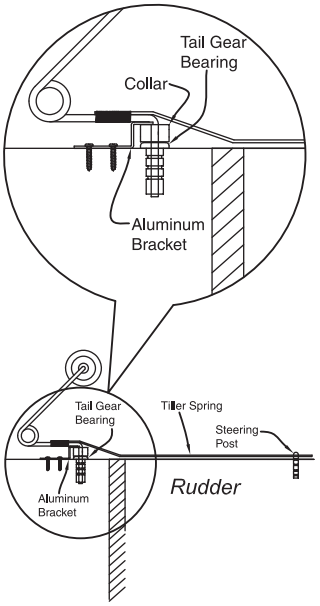


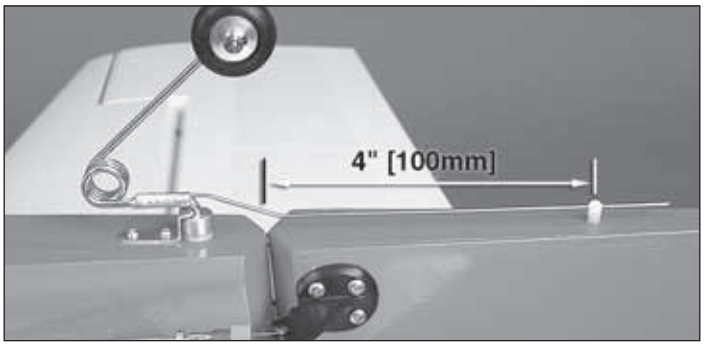
❑ 19. Cut another piece of heat-shrink tubing to secure the connection between the rudder servos and the dual servo

connector. If using a Futaba dual servo connector, the heat-shrink tubing will have to be stretched to fit over the connector by slipping it over long nose pliers and holding it open to stretch the heat-shrink tubing. Fit the heat-shrink tubing over the connector, and then shrink the tubing.

Mount the Tail Gear

Refer to this photo and the sketch while mounting the tail gear.





❏ 1. Cut the covering from the hole in the bottom of the fuselage for the nylon **tail gear bearing**. Roughen the bearing with medium-grit sandpaper. Then, use medium CA to securely glue the tail gear bearing into position. Use care not to get any glue inside the bearing.

❏ 2. Mount the aluminum collar to the tail gear wire with the set screw and a drop of threadlocker applied to the threads. Use the hex wrench included with the tail gear (or your own 1/16" [1.6mm] hex wrench) to tighten the set screw.

❏ 3. Drill 1/16" [1.6mm] holes into the bottom of the fuselage for the bracket mounting screws. Temporarily mount the bracket and the tail gear with #2 x 1/2" [13mm] screws. Remove the screws, set the bracket aside, add a drop or two of thin CA to each screw hole, and allow to harden. Then, remount the bracket with the screws.

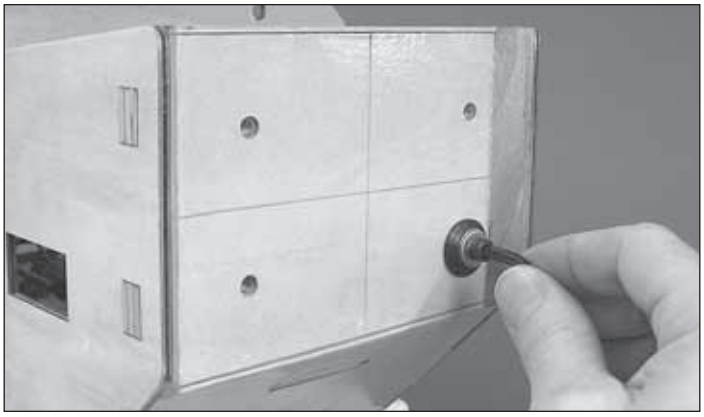
❏ 4. Drill a 5/32" [4mm] hole through the middle of the bottom of the rudder 4" [100mm] from the leading edge. Fit the tiller spring into the steering post, insert the post onto the hole in the rudder, and permanently glue in the post with thin CA.
Note: If you prefer working on the model with it resting on its landing gear rather than sitting in your building stand, you may go ahead and mount the **main landing gear** (with or without the wheels for now) at this time. If you want to mount the landing gear, use six 6-32 x 3/4" [19mm] SHCS, #6 lock washers, #6 flat washers and a drop of threadlocker on the threads. If you want to mount the wheels too skip ahead to ***"Mount the Landing Gear"*** on page 32.

Mount the Engine or Electric Motor

❏ 1. Turn to the back cover page and cut out the mounting template for the type of power system you will be using–one template is for the Fuji-Imvac BT-43EI-2 gas engine and the other is for both the included Great Planes 1.20 to 1.80 adjustable engine mount for glow engines and the ElectriFly Brushless Motor Mount for extra large motors (GPMG1265 – not included).

❏ 2. Tape the template to the **firewall** with the cross marks on the template aligned with the cross marks on the firewall. Use a piece of wire sharpened on the end or a T-pin to mark the cross marks for the bolt holes in the template onto the firewall. **Note:** If mounting a gas engine different than the Fuji-Imvac BT-43EI-2, use the mounting template that came with your engine or make your own template, or center the engine on the cross marks and use the mounting holes in the engine to mark the firewall. **Note:** If using the O.S. 1.60 FX, also mark the location for the **throttle pushrod**.

❏ 3. Remove the template. Drill 1/16" [1.6mm] pilot holes at all the marks. If mounting the Fuji-Imvac BT-43EI-2 engine, enlarge the pilot holes with a 1/4" [6.4mm] drill for 10-32 or 10-24 blind nuts. If using the included 1.20 to 1.80 adjustable engine mount for glow engines or the *ElectriFly* motor mount, enlarge the pilot holes with a 3/16" [4.8mm] drill for the included 8-32 blind nuts. If using the O.S. 1.60, also enlarge the pilot hole for the throttle with a 3/16" [4.8mm] drill.

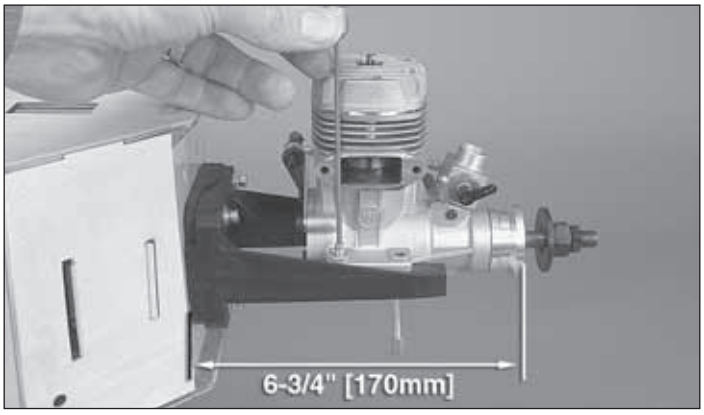


❏ 4. For the Fuji-Imvac BT-43EI-2 engine installation or other gas engines, use one of your #10 engine mounting bolts (not included) and a couple of washers to draw the blind nuts (not included) into the back of the firewall. If using the included adjustable engine mount, use an 8-32 x 1" [25mm] SHCS and a couple of washers to pull the included 8-32 blind nuts into the back of the firewall.

If mounting an electric motor skip to "Mount the Electric Motor" on page 26.

❏ 5. If using a gas engine, mount the engine with the engine mounting bolts and lock washers (not included), then skip to ***"Assemble the Fuel Tank."*** If mounting a glow engine, mount the engine mount halves to the firewall with four 8-32 x 1-1/4" [32mm] SHCS and #8 flat washers and lock washers, but do not tighten the screws all the way yet.

❏ 6. With the fuselage lying on its left side in your building stand, place the engine on the engine mount. Adjust the two halves of the engine mount to fit the engine. Then tighten the engine mount bolts.



❏ 7. Use a small C-clamp or two to hold the engine to the mount so that the front of the drive washer (or the backplate of the spinner) is 6-3/4" [170mm] from the firewall. Use a Great Planes Dead Center™ Hole Locator or a drill bit to mark the engine mounting holes into the engine mount.

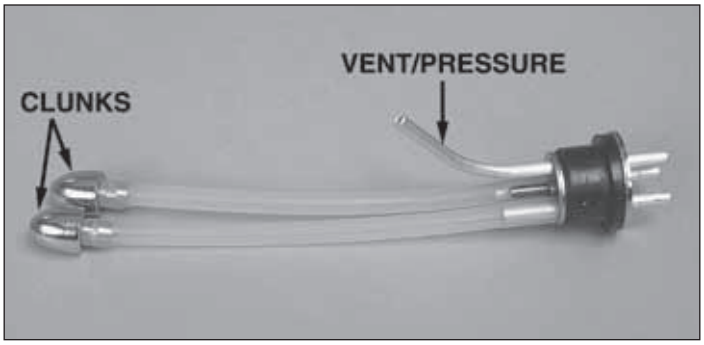
❏ 8. Take the engine off the mount. If you have a drill press that will drill the holes squarely, remove the mount from the firewall and drill #29 holes at the marks. If you don't have a drill press, you can leave the mount attached to the fuselage for drilling the holes.

❏ 9. Use an 8-32 tap to cut threads into the holes. Remount the engine mount to the firewall, but don't tighten the bolts yet. Mount the engine to the mount with four 8-32 x 1" [25mm] SHCS and #8 lock washers. Center the engine mount on the engine mount bolts, then fully tighten the engine mount bolts.

ASSEMBLE THE FUEL TANK

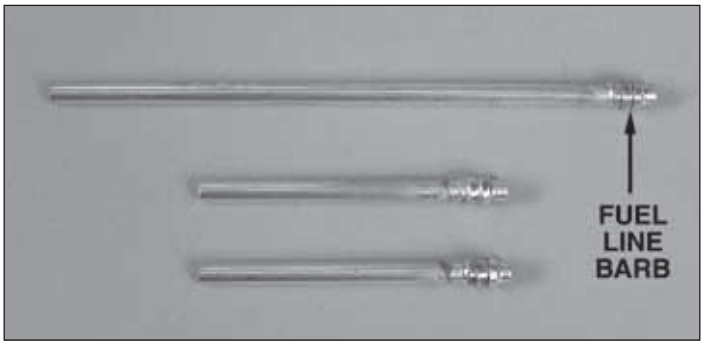
If using a gasoline-powered engine the fuel tank setup will have to be converted to work with gas using the hardware listed in the front of the manual. Follow these instructions for assembling your fuel tank for the type of engine you are using.

Glow Engines



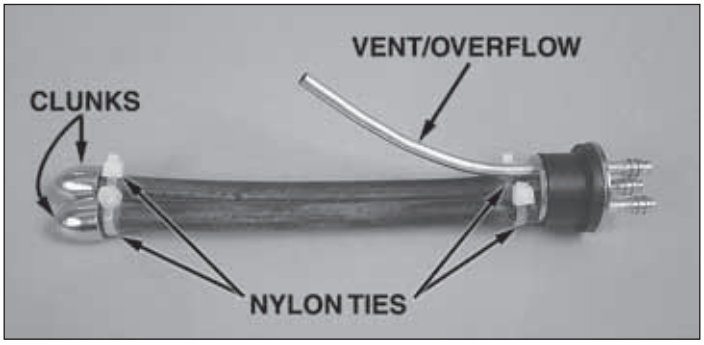
❏ 1. Cut two of the aluminum tubes that came in the fuel tank to a length of 1-1/2" [40mm]. (This can be done by rolling the tubing on your workbench with a #11 blade.) Assemble the stopper as shown in the photo. Bend the long tube so it will be at the top of the tank. Cut the fuel lines so the clunks cannot contact the back of the tank–otherwise they could get stuck. Note that one of the lines will be used for fueling and defueling and the other line will be the pickup line that goes to the carburetor. The bent tube will be connected to the vent/pressure line that will go to the pressure tap on the muffler. Proceed to step 4 to finish assembling the fuel tank.

Gas Engines

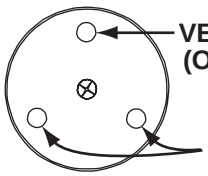


❏ 1. Cut one of the brass tubes included with the Sullivan conversion kit in half, making two approximately 1-3/4" [45mm] tubes. Solder a Du-Bro fuel line barb onto one end of each of the three tubes.

❏ 2. Assemble the stopper, tubes and metal plates. Solder another fuel line barb onto the ends of the short tubes. Bend the brass vent/overflow tube upward so it will be at the top of the tank.



❏ 3. Connect the fuel tubing to the short tubes and the clunks–cut the lines so that the clunks cannot contact the back of the tank–otherwise they could get stuck. Note that one of the lines will be used for fueling and defueling and the other line will be the pickup line that goes to the carburetor. The bent tube will be the vent/overflow line that will be connected to a line that exits the bottom of the fuselage. **Important:** Secure both ends of both fuel tubes with small nylon ties. This is an important measure that must be taken to be sure the lines remain attached inside the tank.

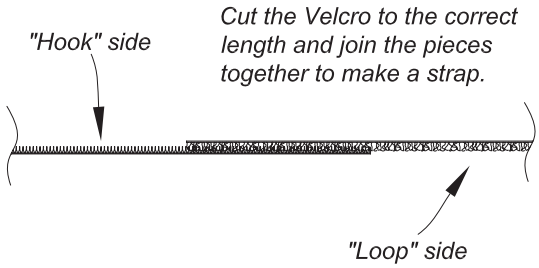


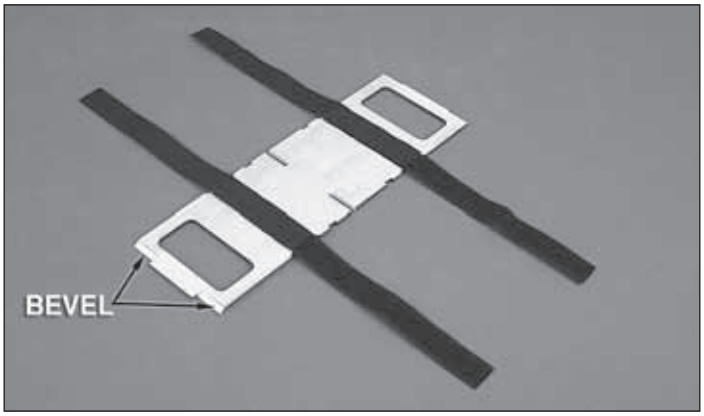
❏ 4. Write "TOP" on the back of the tank so you will know which way to install it after inserting the stopper assembly. Insert the stopper so the vent tube will be at the top of the tank. Then tighten the screw to squish the stopper and seal the tank. Shake the tank to make sure the clunks can move around and the fuel lines are not too long. If necessary, remove the stopper and shorten the lines.

Mount the Fuel Tank

❏ 1. Glue the plywood **fuel tank tray former** inside the fuselage as shown.

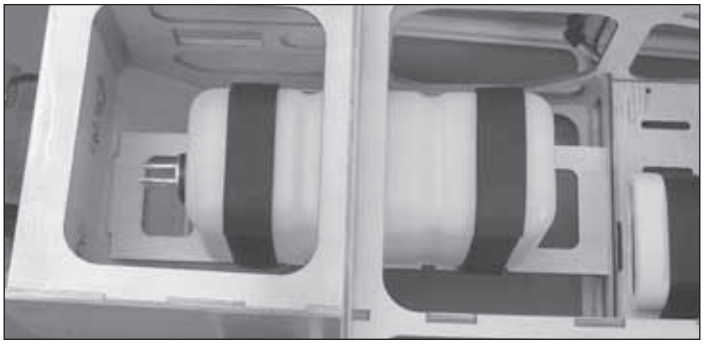
❏ 2. Use a hobby knife or sandpaper to bevel the front edges of the plywood **fuel tank tray** (the front is the end with the longer tab). The side with the beveled edges will now be the **bottom**. (There is another photo showing the bevel in step 1, on page 26.)





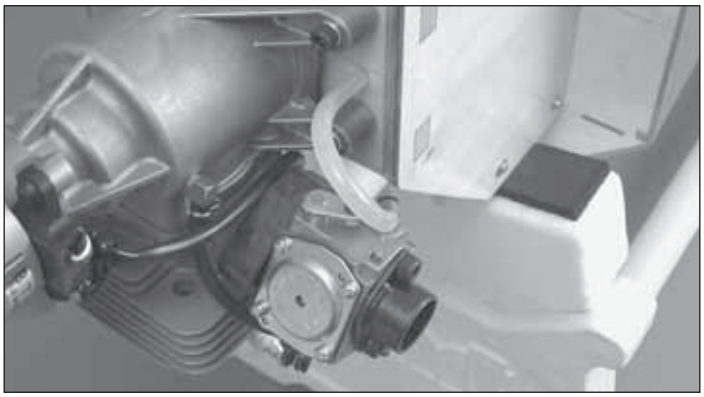
❏ 3. Cut two of the 12" [300mm] strips of the rougher "hook" side of the included Velcro material into two 8" [200mm] strips. Cut two more of the softer "loop" strips to the same length. Make two fuel tank straps by overlapping 2-1/2" [60mm] of the ends of the straps. Use medium CA to glue the straps to the **bottom** of the fuel tank tray in alignment with the cutouts in the sides.

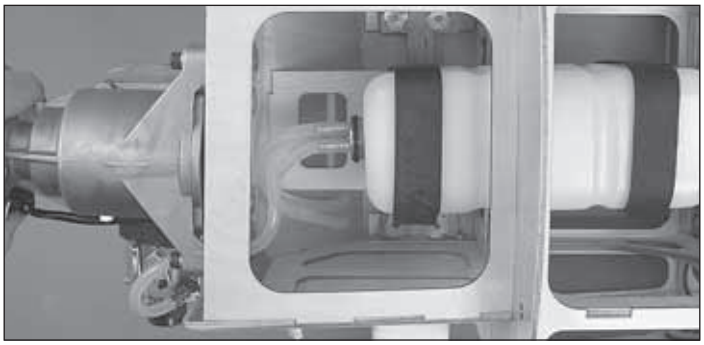
❏ 4. Securely glue the plywood fuel tank tray into position.

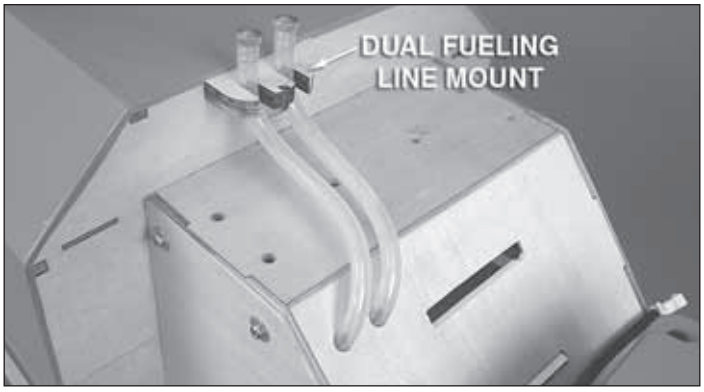


❏ 5. Mount the fuel tank to the tray with the Velcro straps and 1/4" [6mm] R/C foam rubber between the bottom of the tank and the tray.

Refer to the photos below while hooking up the fuel lines. (Photos of the gas installation are shown, but the instructions and suggestions in the photos apply to glow engines as well. Note: Tygon fuel tubing is shown in the photos.)





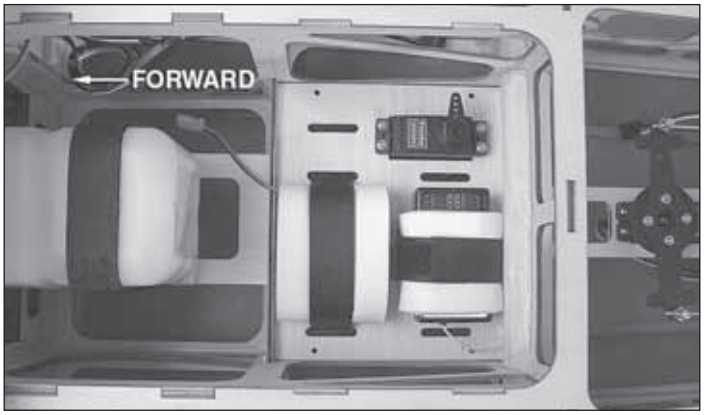


❏ 6. Plan the fuel line setup thinking about how you will be fueling the model, where the fueling and vent/pressure lines will be located, how to guide the fuel lines around the muffler and engine and where the lines will go through. There are also plywood **dual** and a **single fueling line mounts** that could be used to mount the fueling and vent lines, or you could use another method for fueling the model such as fuel line dots or a fuel filler valve. The dual mount in the photo secures the fueling line and the vent line for gas engines. Both lines are closed during transport (to keep any remaining fuel in the tank from leaking), but the vent line is open whenever the engine is running. The fueling line is open only when fueling or defueling the model.

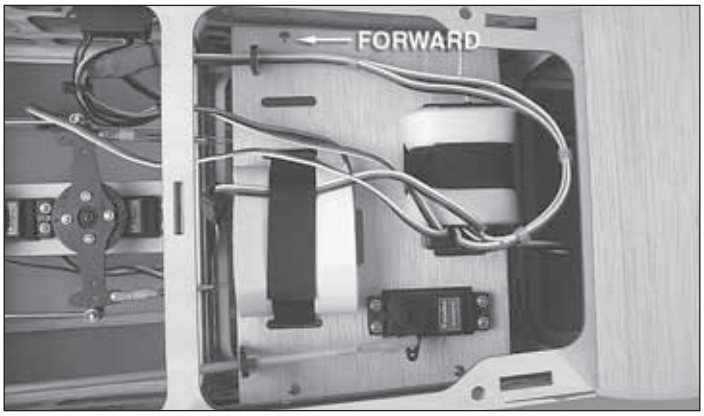
❏ 7. Once you have determined how you will be routing the fuel lines and fueling the model, remove the engine if necessary, then drill 1/4" [6.4mm] holes through the firewall or other parts of the engine box for all the lines.

❏ 8. Assemble the fueling line mounts and glue them into position. Coat the mount with epoxy or fuelproof paint, allow to dry, then connect the lines.

Hook Up the Throttle



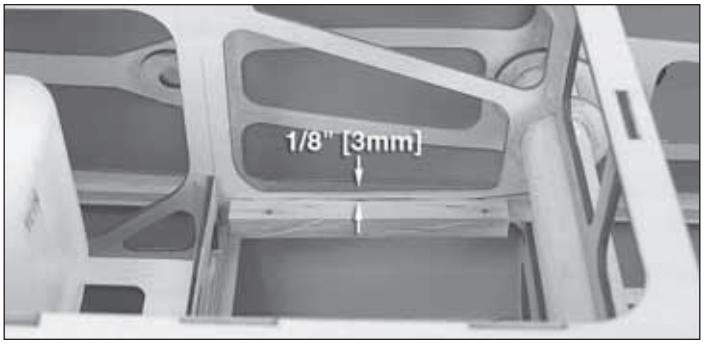
FORWARD RADIO TRAY



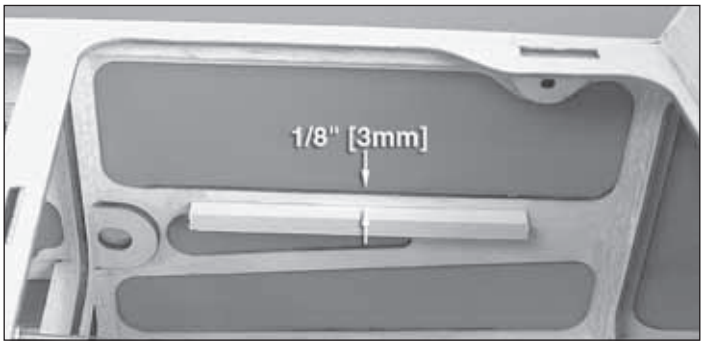
AFT RADIO TRAY

❏ 1. Determine which plywood radio tray you will be using–the **aft radio tray** should be used for gas engine installations because it positions the throttle servo, receiver battery and receiver away from any potential RF noise that may be generated by the engine. Using the aft radio tray also counter balances the extra weight of a gas engine, reducing the amount of any tail weight that may be required. For C.G. purposes, the **forward radio tray** is recommended for glow engines. The aft tray is recommended for electric motor installations.

❏ 2. Once you have decided which radio tray to use, determine which way you will be mounting the tray so the throttle servo will be on the same side as the throttle arm on the carburetor (for gas and glow engines). **Note:** There is an alternate throttle servo location on the side of the engine box. Do not mount your throttle servo on the engine box if powering this model with a spark-ignition engine–all radio components (receiver, Rx battery, switch, servos) in planes with gas engines should be a minimum of 10" [250mm] from any engine components (engine, module, ignition battery, ignition on/off switch). Otherwise, electrical "noise" from the engine may cause radio interference. If preferred, the throttle servo could be mounted on the engine box for glow engines.

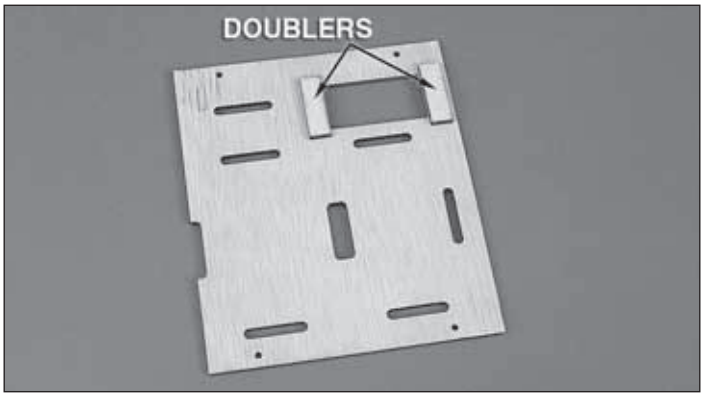


FORWARD RADIO TRAY

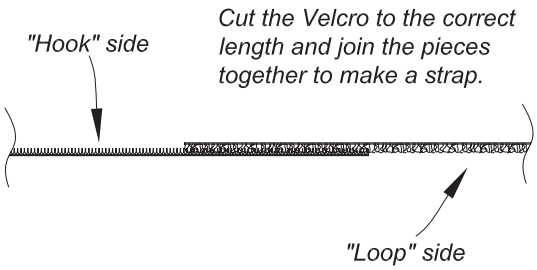


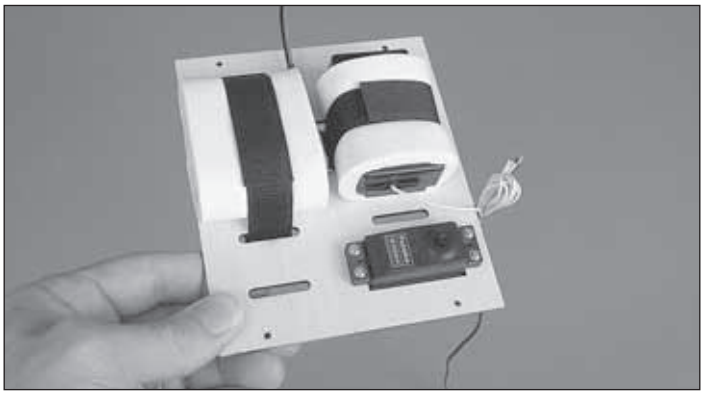
AFT RADIO TRAY

❏ 3. Securely epoxy both 3/8" x 3/8" x 4" [10 x 10 x 100mm] **radio tray mounting rails** inside the fuselage for the location you will be using. The rails should be centered across the horizontal members and approximately 1/8" [3mm] below the top edge.



❏ 4. Glue the plywood **throttle servo mount doublers** to the **bottom** of whichever radio tray you will be using. Drill 1/16" [1.6mm] holes through the tray and doublers and mount the throttle servo in the tray–as always, don't forget to harden the holes with thin CA.





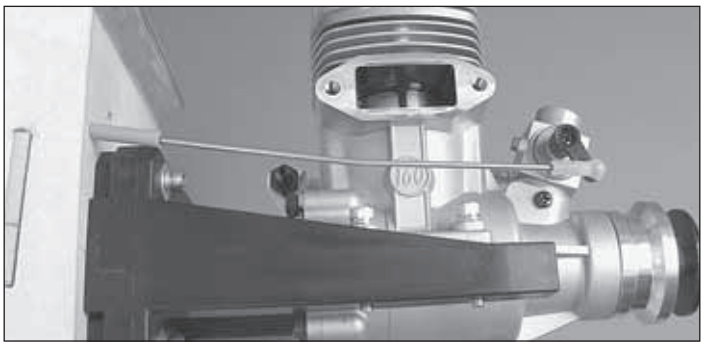
❑ 5. Make **mounting straps** from the included Velcro strips by cutting them to the correct length for the receiver and battery. Mount the receiver and battery to the tray with 1/4" [6mm] R/C foam rubber. If you want you could use CA to glue the Velcro to the bottom of the tray. This will make re-fastening the straps around the battery and receiver easier if you ever remove and re-install them later.

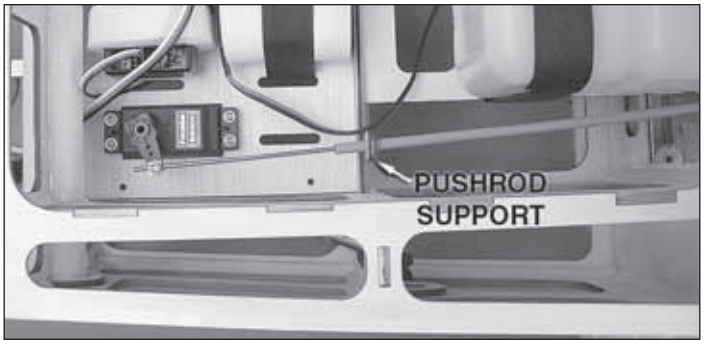
❑ 6. Mount the radio tray to the rails in the fuselage with four #2 x 1/2" [13mm] screws and #2 washers–again, don't forget to harden the screw holes with thin CA.

❑ 7. Hook up the throttle as instructed below for the type of engine you are using.

Glow Engine Throttle Hookup

❑ 1. Temporarily mount the muffler to the engine so you will know where to locate the throttle pushrod so it won't interfere with the muffler. If you haven't yet done so, mark the firewall where the throttle pushrod will go through and drill a 3/16" [4.8mm] hole at that mark (this will probably require temporary removal of the engine). Also be certain to drill the hole where the pushrod will not interfere with the fuel tank behind the firewall and do not drill into the fuel tank.





❑ 2. Hook up the throttle using the hardware listed below.

Glow engine throttle pushrod hardware:

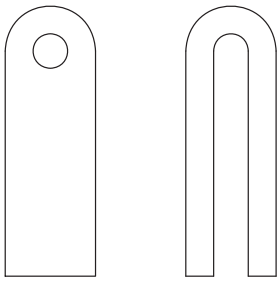
❑ 2-56 x 36" [910mm] wire pushrod
❑ 3/16" x 36" [4.8 x 910mm] gray pushrod guide tube

On the servo end:

❑ brass screw-lock pushrod connector
❑ nylon retainer
❑ 4-40 x 1/8" [3.2mm] SHCS

On the engine end:

❑ nylon ball link
❑ 0-80 ball link ball
❑ 0-80 nut

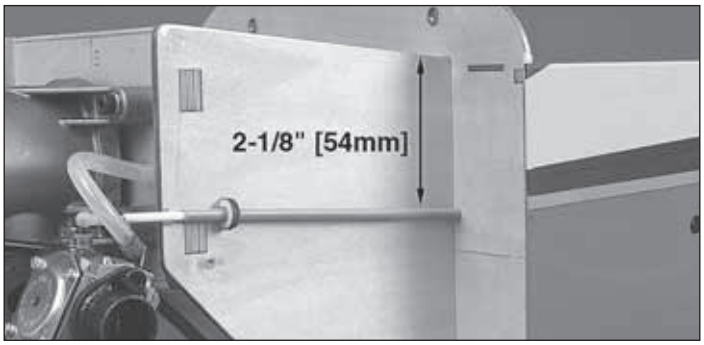


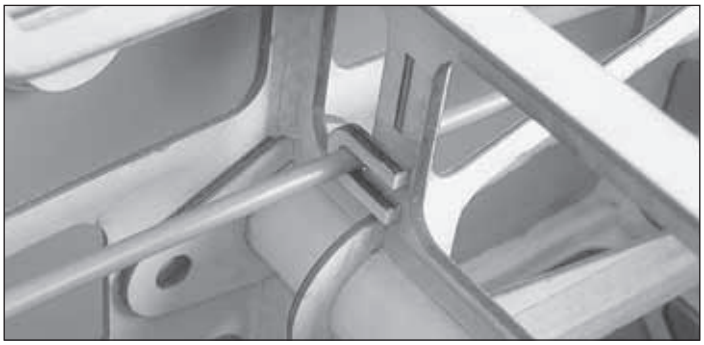
Plywood Pushrod Supports

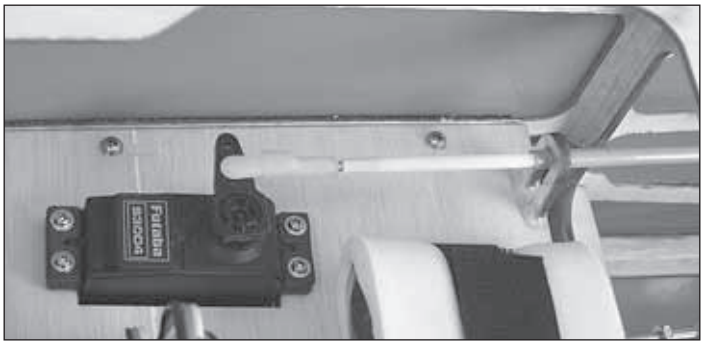
Note that, for the O.S. 1.60 FX shown, the pushrod goes through the firewall at a slight angle toward the servo, so you may need to use a hobby knife to angle the hole accordingly. Use one of the plywood **pushrod supports** to secure the aft end of the pushrod near the throttle servo. Cut the gray pushrod guide tube to the correct length, then use coarse sandpaper to roughen both ends where it goes through the firewall and the pushrod support. Glue the tube and the support into position with medium CA. Cut the pushrod wire to the correct length and make a slight bend near the end as necessary to align with the ball link ball on the carburetor arm.

Gas Engine Throttle Hookup

❏ 1. If using a Fuji-Imvac BT-43EI-2, use an extended 3/16" [4.8mm] drill bit or a 3/16" [4.8mm] brass tube sharpened on the end to drill a hole for the gray pushrod guide tube where shown in the following photo. If using a different gas engine, and if there's a chance the muffler might be in the way of the throttle pushrod, temporarily mount the muffler to the engine to make sure you locate the throttle pushrod where it won't interfere with the muffler. Mark the firewall where the throttle pushrod will go through and drill a 3/16" [4.8mm] hole at that mark (this will probably require temporary removal of the engine–also be certain to drill the hole where the pushrod will not interfere with the fuel tank behind the firewall.







❏ 2. Hook up the throttle using the hardware listed below.

Gas engine throttle pushrod hardware:

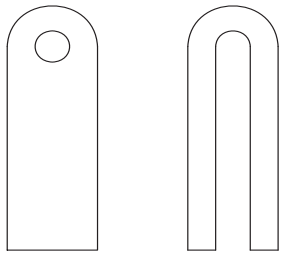
❏ 36" [910mm] white, nylon pushrod
❏ 3/16" x 36" [4.8 x 910mm] gray pushrod guide tube

On the servo end:

❏ 2-56 x 1" [25mm] threaded rod,
❏ nylon clevis
❏ silicone clevis retainer

On the engine end:

❏ 2-56 x 1" [25mm] threaded rod
❏ nylon ball link
❏ 2-56 ball link ball
❏ 2-56 nut

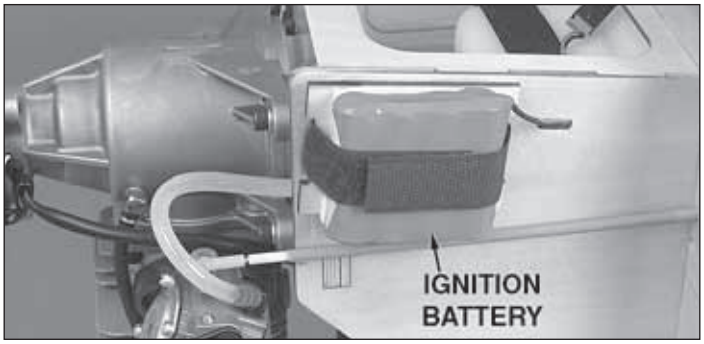


Plywood Pushrod Supports

Cut the gray pushrod guide tube to the correct length, then use coarse sandpaper to roughen both ends where it goes through the firewall and where it gets glued to the pushrod supports. Trim the plywood **pushrod supports** as necessary and use them to secure guide tube where shown. Securely glue the pushrod tube and the supports into position with medium CA.

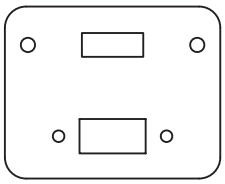
Mount the Ignition Module, Ignition Battery & Ignition On/Off Switch (gas engines only)

Refer to these photos while mounting the ignition module and ignition battery.

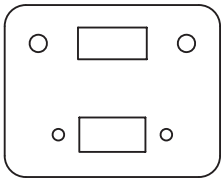


❏ 1. The same as when you were routing the fuel lines and hooking up the fuel tank, read the instructions and plan the battery and module installation, making sure all the wires will reach wherever they are supposed to go. Don't forget about the ignition on/off switch–a heavy-duty on/off switch from your radio system could be used for this. One way to

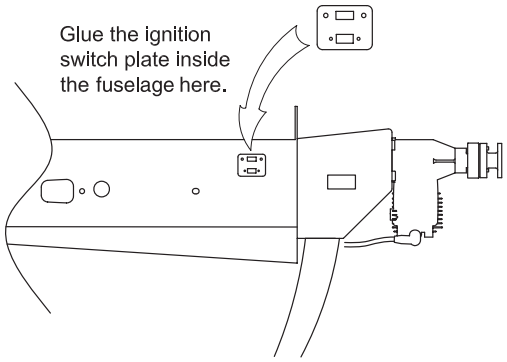
determine where to mount the battery, module and switch would be to connect all the wires and see how much distance between them is required.



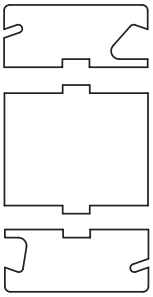
Hobbico On/Off Switch Mounting Plate



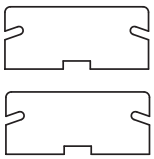
Futaba On/Off Switch Mounting Plate



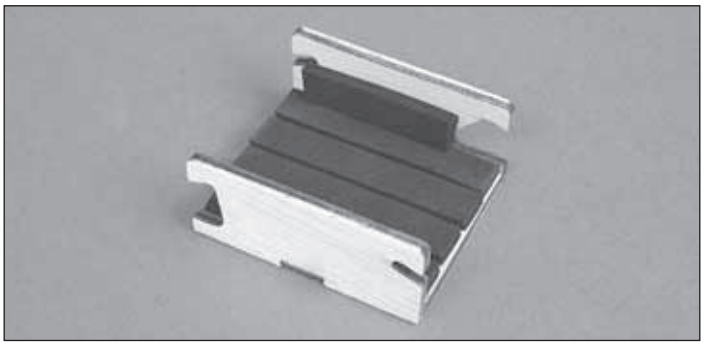
❏ 2. Glue one of the plywood **switch mounting plates** for the engine ignition switch inside the fuselage. Choose the type of mount for the on/off switch you will be using–there is one switch mounting plate for a heavy-duty Futaba switch and one for a heavy-duty Hobbico Pro switch. Both switch plates also have a mounting port for an Ernst charge receptacle for charging and checking the voltage of the ignition battery. If using a different type of on/off switch, modify one of the switch mounting plates as necessary.



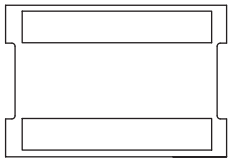
Mount for Fuji-Imvac Ignition Module



Optional mounting tabs for different ignition modules



❏ 3. If using the Fuji-Imvac BT-43EI-2 engine, glue together the plywood **ignition module mount** as shown. (There is an alternate set of mounting tab sides that don't have the cut-outs should you decide to remove the mounting tabs from the Fuji-Imvac module or if you are using a different module.) If using an ignition module that doesn't fit the mount, make your own mount or use small screw hooks (not provided) to mount the ignition module with rubber bands.



Mount for ignition battery

❏ 4. Make the **ignition battery mount** by gluing the plywood **strips** to one side of the mounting plate.

❏ 5. Fuelproof the battery mount and the ignition mount with epoxy or fuelproof paint. After the paint dries, apply strips of 1/8" [3mm] foam tape (GPMQ4424) to the mount to cushion the module.

❏ 6. Use more Velcro strips to mount your ignition battery to the battery mount with 1/4" [6mm] R/C foam rubber in between. Securely glue the ignition mount and the battery mount into position (where shown in the photo).

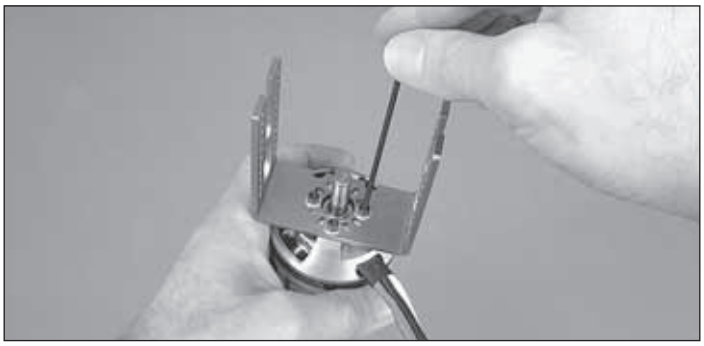
❏ 7. Mount the ignition on/off switch and a charge receptacle to the switch mounting plate.

❏ 8. Connect the wires from the ignition module to the connector plug exiting from the engine, to the spark plug, and to the on/off switch connector. Connect the ground wire to a bolt on the engine. Connect the ignition battery to the on/off switch. Make sure none of the wiring contacts anything that could melt it (especially the muffler).

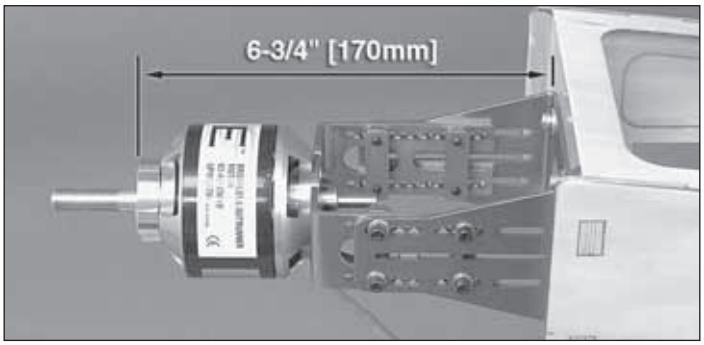
Go to "Final Assembly" on page 28.

Mount the Electric Motor

❏ 1. If you haven't yet done so, mount the **prop adapter** to the electric motor using threadlocker on the threads.



❏ 2. Separate the front and back halves of the ElectriFly motor mount. If necessary, remove the collar from the motor shaft with a 2mm hex wrench. Mount the motor to the mount with four 3 x 8mm or 3 x 10mm SHCS and 3mm flat washers and threadlocker. Replace the collar with threadlocker on the set screws.

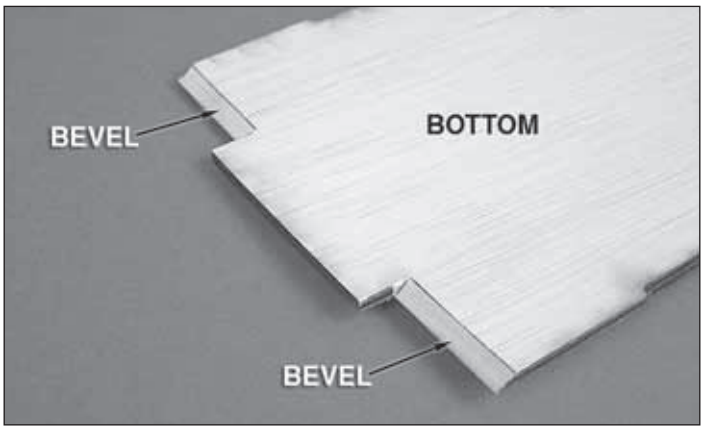


❏ 3. Mount the back half of the motor mount to the firewall with four 8-32 x 1/2" [13mm] SHCS with threadlocker and #8 flat washers. Join the front mount with the motor on it to the back of the mount on the firewall so the propeller adapter will be 6-3/4" [170mm] from the firewall. For the 63-62-250kV RimFire motor, the screws that hold the halves of the inner mount together should be in the third-from-the-front and third-from-the-back holes.

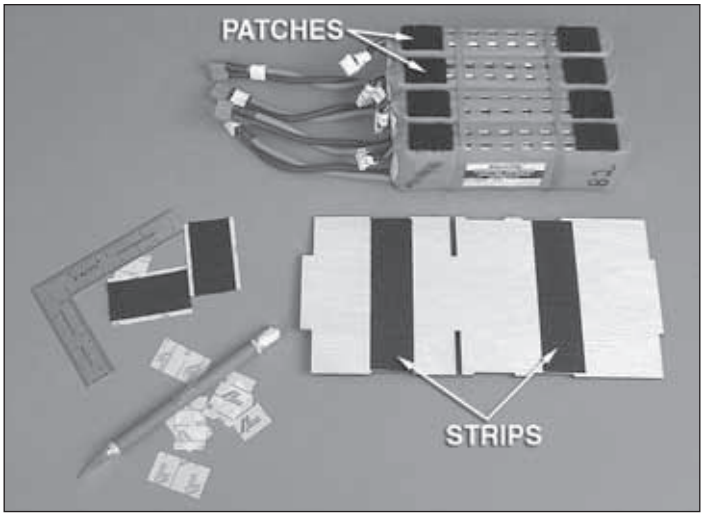
❏ 4. Glue together the plywood parts for whichever **ESC mounting platform** that best fits your ESC. There are two mounting platforms included–one is wider than the other. Mount your ESC to the platform with whatever method is intended for your ESC–Velcro and a rubber band for the narrower platform or mounting screws for the wider platform. Securely glue the mounting platform into position as shown and connect the ESC to the motor. (As you can see, the ESC will be directly in line with the air scoop in the cowl, thus receiving a flow of cooling air.)

Mount the Motor Battery

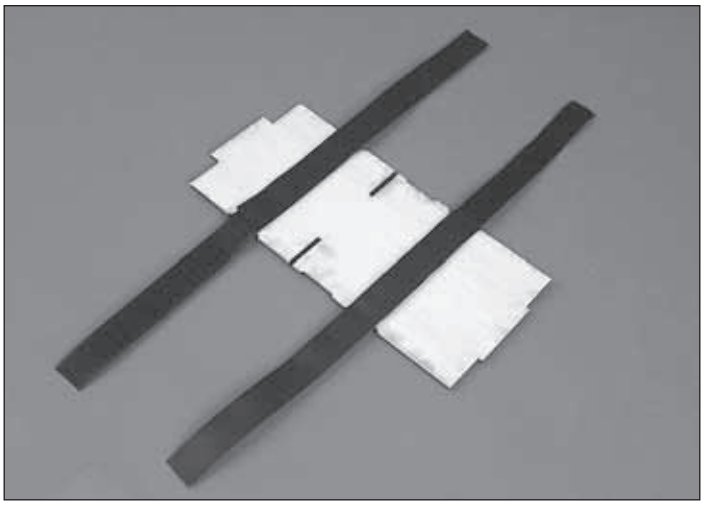
IMPORTANT: Before experimenting with different battery combinations and connecting multiple battery packs with adapter plugs, refer to the ***"Battery Precautions/Connecting Batteries"*** on page 33.



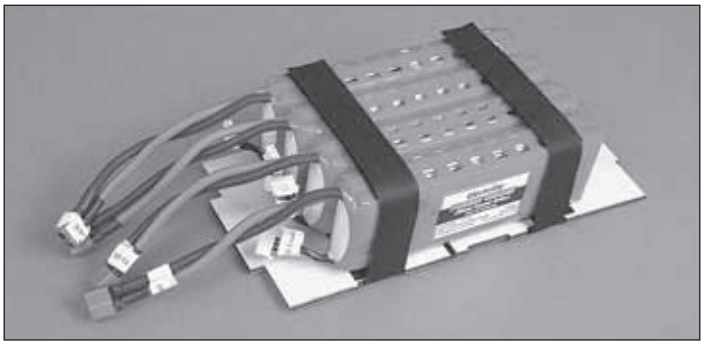
❏ 1. Bevel the front edges of the plywood **battery mounting plate** to match the angle on the front of the engine box under the firewall. This side will now be the bottom of the mounting plate.

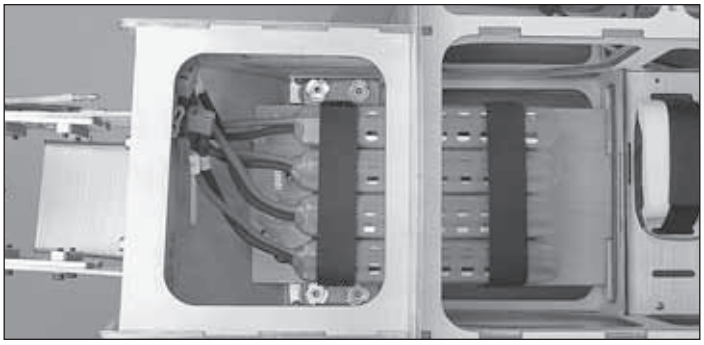


❏ 2. Temporarily hold together the batteries you will be using with a couple of rubber bands. Place 3/4" [20mm] patches of adhesive-backed Velcro across the bottom of the batteries. Place 4" [100mm] strips of the opposite side of Velcro across the **top** of the battery mounting plate that will align with the patches on the batteries–this is to keep the batteries from shifting during flight–Velcro straps made next will hold the batteries down.



❏ 3. Cut two of the 12" [300mm] strips of "hook" side Velcro material into two 10" [250mm] strips. Cut two more "loop" strips to the same length. Make two battery straps by overlapping 4" [100mm] of the ends of the straps. Use medium CA to glue the straps to the bottom of the **battery mounting plate**.





❏ 4. Temporarily mount the battery pack to the mounting plate with the straps. Test fit the assembly into the fuselage to make sure everything fits. Make adjustments as necessary.

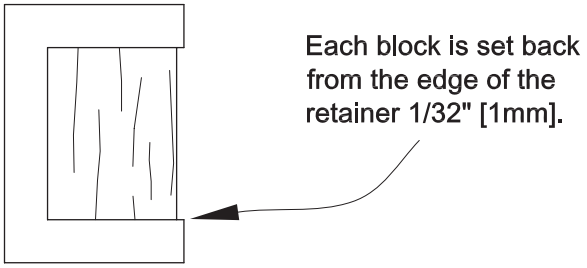
❏ 5. Use 30-minute epoxy to **securely** glue the **battery tray** into the fuselage.

❏ 6. Use a rotary tool with a carbide cutter to cut a hole in the firewall or in one side of the engine box to pass the ESC wires into the battery compartment for connecting the batteries. Temporarily connect the batteries to the ESC with whatever adapter connectors are necessary. Make sure you can connect/disconnect the batteries with the cowl in place as this is how it will be done when you are at the field.

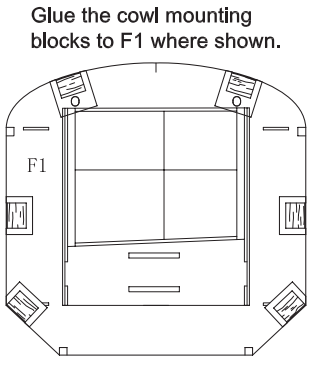
FINAL ASSEMBLY

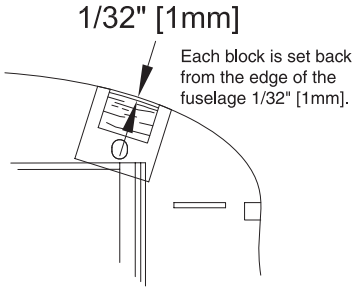
Mount the Cowl

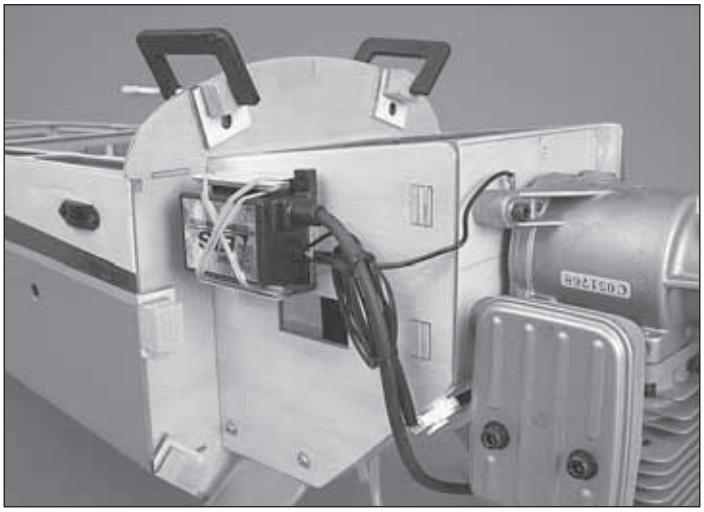
At this point your power system installation–whether it's gas, glow or electric–should be complete. For electric motors the ESC and motor should be mounted and battery installation should be finalized. For gas or glow systems, the engine should be mounted and the fuel tank should be installed with all the lines connected. For gas engines the ignition module and ignition battery should also be mounted and connected.



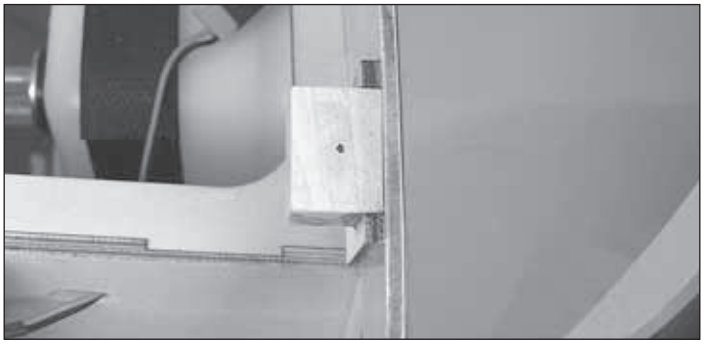
❏ 1. Glue the six 9/16" x 9/16" x 13/16" [15 x 15 x 20mm] hardwood **cowl mounting blocks** to the plywood **cowl mounting block retainers**. For the top two assemblies and the bottom two assemblies, be certain to make a **right** and **left** by making them a mirror image. Also note that the outer edge of each block is inset 1/32" [1mm] from the outer edge of the retainers.



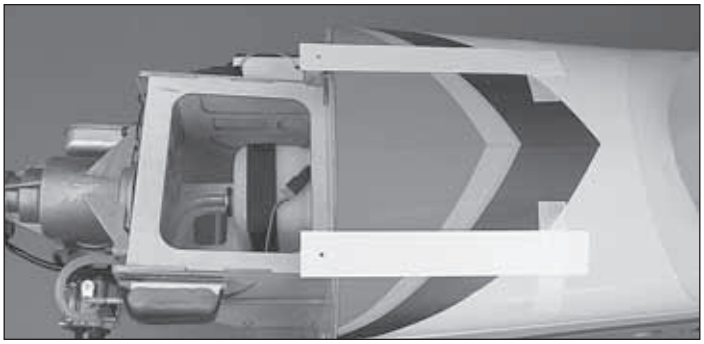




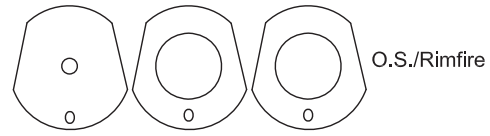
❏ 2. Use medium-grit sandpaper to roughen F1 where each cowl mounting block will be glued. Use 30-minute epoxy to glue the cowl mounting block assemblies into position as shown. Since there is no really good way to clamp the bottom four blocks, apply epoxy to both surfaces (F1 and the blocks), allow to partially harden until tacky, then position the blocks onto F1. Monitor the blocks for a few minutes and reposition them as necessary until the epoxy is tacky enough to hold them permanently.

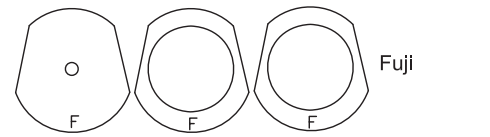


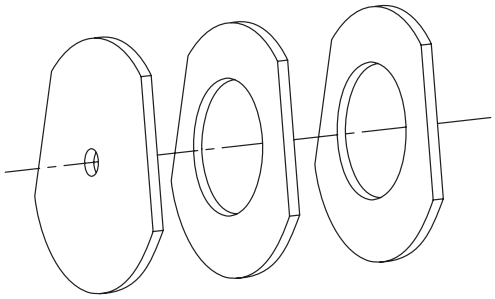
❏ 3. After the epoxy from the previous step has hardened, mark the middle of each cowl mounting block.



❏ 4. Make two templates as shown from manila folder material or other medium card stock. Place the **canopy hatch** on the fuselage, then tape the templates to the canopy hatch so the holes in the templates align with the marks on the cowl mounting blocks.







❏ 5. Glue together the three pieces of the plywood **cowl centering jig** as shown in the diagram for the engine you are using – Fuji-Imvac (labeled “F”) or O.S. 1.60/ElectriFly (labeled “O”).

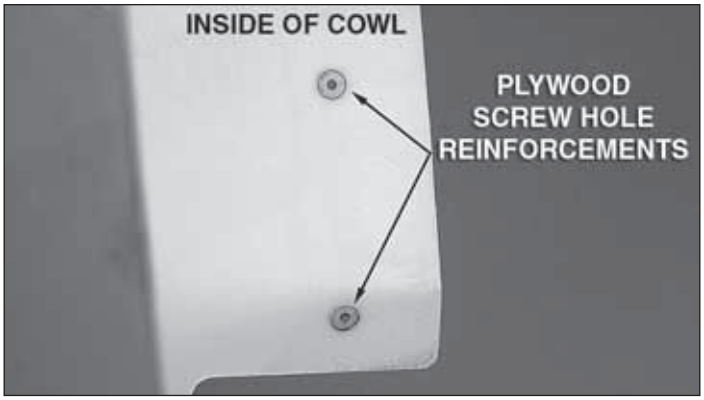
❏ 6. Fit the **cowl** onto the fuselage over the engine. Use the prop nut or the engine bolt to mount the cowl centering jig to the engine/motor–if necessary, use a cardboard tube or something similar as a spacer if the prop nut or bolt won’t go in far enough. Hold the cowl forward up against the jig, then use a fine-point felt-tip pen to mark the holes in the templates onto the cowl.

❏ 7. Remove the templates. Still holding the cowl forward against the centering jig, drill 3/32" [2.4mm] holes at the marks you made through the cowl and the mounting blocks.

❏ 8. Remove the cowl. Enlarge the holes **in the cowl only** with a 1/8" [3.2mm] drill. Retape the templates to the fuselage over the next set of cowl mounting blocks. Reposition the cowl and cowl centering jig on the fuselage. Use #4 x 1/2" [13mm] screws and #4 nylon washers to loosely mount the cowl through two top holes.

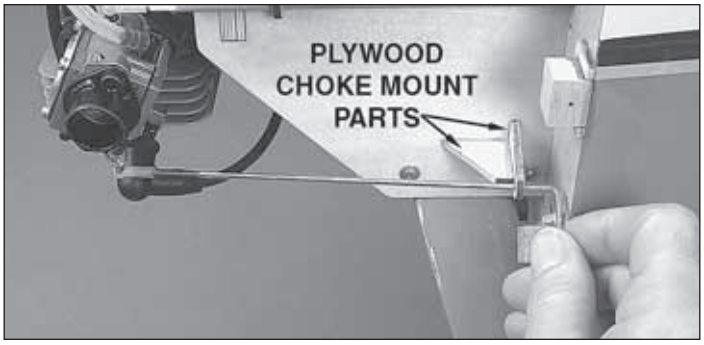
❏ 9. Exchange the 1/8" [3.2mm] drill bit in your drill with the 3/32" [2.4mm] bit. Repeat the process by holding the cowl to the jig, marking and drilling the next two holes, removing the cowl and enlarging the holes in the cowl only with the 1/8" [3.2mm] bit.

❏ 10. Repeat once more for the final two cowl mounting screws–don’t forget to exchange the 1/8" [3.2mm] drill with the 3/32" [2.4mm] drill before drilling the holes in the mounting blocks!



❏ 11. Use coarse sandpaper to roughen the inside of the cowl around each screw hole. Use medium CA or epoxy to glue the 1/32" [1mm] plywood **screw hole reinforcements** inside the cowl centered on each hole.

❏ 12. Mount the cowl to the fuselage with six #4 x 1/2" [13mm] screws and #4 nylon washers. If using the O.S. 1.60 FX or RimFire electric motor, place the spinner backplate on the engine, then mount the propeller and spinner using the O.S. propeller washer and prop nut that came with the engine and the spinner adapter nut and spinner bolt that came with this kit. (If using the RimFire motor, the propeller washer and prop nut that comes with the O.S. 1.60 FX locknut set (OSMG6688) will have to be purchased separately.) If using the Fuji-Imvac BT-43EI-2 engine, mount the spinner and propeller using the brass adapter collar ring that came with the spinner and the Fuji-Imvac special propeller bolt (FJIG8050, not included). **Note:** The large, aluminum propeller washer that came with the Fuji-Imvac engine will have to be drilled out with a size "X" or 13/32" [10mm] drill. For either engine, the propeller will have to be reamed out as well.

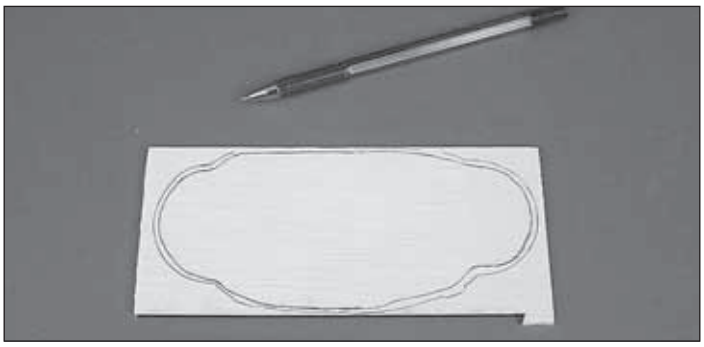


❏ 13. If you haven't yet done so, cut the **air inlet hole** in the front of the cowl below the spinner. Cut any other holes necessary for the needle valve (on glow engines), mixture screws and choke (on gas engines), exhaust, etc. The best way to neatly cut holes in fiberglass is to use a rotary tool with a carbide cutter. Smooth the edges of each hole with medium-grit sandpaper. A choke for the Fuji-Imvac BT-43EI-2 engine can also be fashioned using the included plywood mount and pushrod hardware shown (the nylon ball link was re-threaded with a 4-40 tap).

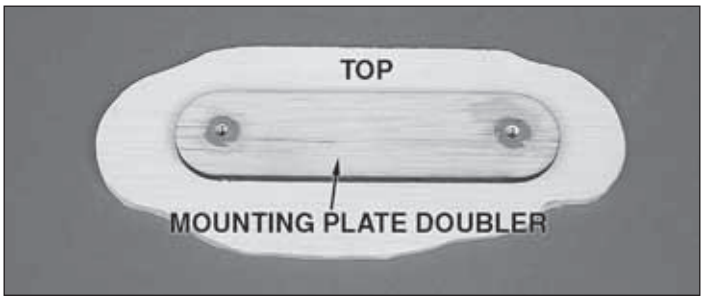
Mount the Pilot

❏ 1. Remove the six screws that hold on the **canopy**. Add a drop of thin CA to each screw hole that the screws came from.

❏ 2. Test fit the pilot (not included) in the cockpit with the canopy to make sure he fits. If necessary, trim the base of the pilot to fit. This can be done with plastic-cutting scissors, a hobby knife or a belt sander if one is available to you.

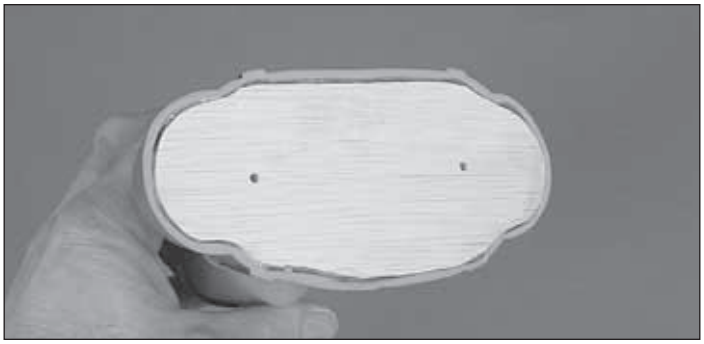


❏ 3. Make a **pilot mounting plate** from the 1/8" x 3-1/8" x 6" [3 x 80 x 150mm] plywood sheet (included).



❏ 4. Glue one of the plywood **mounting plate doublers** to the top (inside) of the pilot mounting plate. Press 4-40 blind nuts into the doubler. Add a few drops of CA around the edges of the blind nuts so they won't fall out.

❏ 5. Place the mounting plate on the cockpit floor in the location where the pilot will be mounted. Transfer the holes in the mounting plate to the cockpit floor. Drill 1/8" [3.2mm] holes through the cockpit floor at the marks.



❏ 6. Securely glue the mounting plate in the pilot with CA.

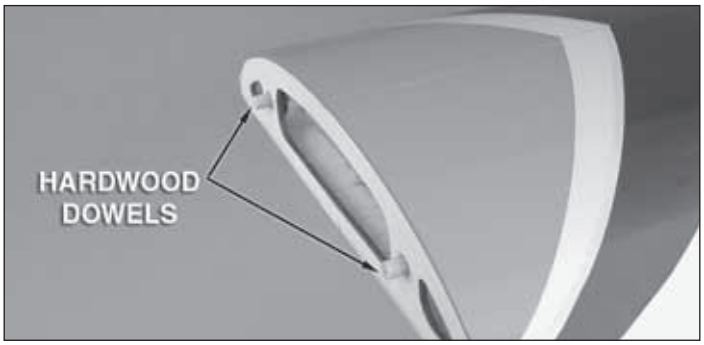
❏ 7. Mount the pilot to the cockpit floor with two 4-40 x 5/8" [16mm] Phillips screws, #4 lock washers, #4 flat washers and another mounting plate doubler. Glue the doubler to the bottom of the cockpit floor. Now the pilot will be secure, but easily removable.

❏ 8. While you're working on the inside of the cockpit, cut the **instrument panel decal** from the **decal sheet** and stick it into position on the instrument panel in the cockpit.

❏ 9. Mount the canopy to the canopy hatch with the screws you removed before.

Mount the Canopy Hatch

❏ 1. Use a sharp hobby knife to cut the covering from the four canopy hatch screw holes in both sides of the fuselage.

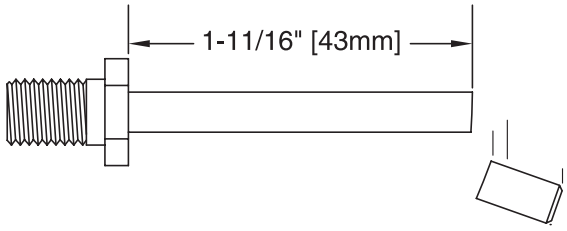


❏ 2. Glue both 1/4" x 5/8" [6 x 15mm] hardwood **dowels** into the front of the canopy hatch.

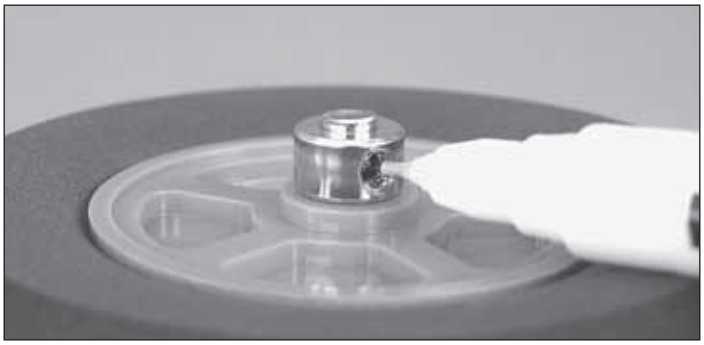
❏ 3. Cut the covering from the four holes in the fuselage for the canopy hatch mounting screws.

❏ 4. Test fit the canopy hatch to the fuselage with four 4-40 x 5/8" [16mm] Phillips screws and #4 nylon washers. **Note:** When mounting the canopy hatch at the flying field, use a small drop of threadlocker on each screw so they don't loosen from engine vibration. Threadlocker doesn't need to be reapplied every time the cabin top is mounted, but should be applied as necessary to keep the screws from coming loose.

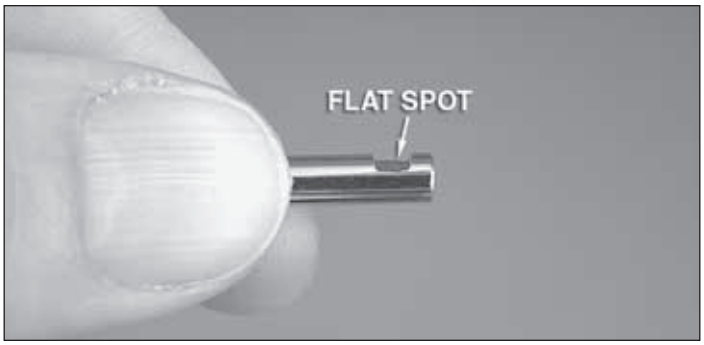
Mount the Landing Gear



❏ 1. Cut both 3/16" x 2" [4.8 x 50mm] axles to a length of 1-11/16" [43mm]–a rotary tool with a fiber reinforced cutoff wheel works best, but a metal saw could also be used.



❏ 2. Slip a 3/16" [4.8mm] wheel collar followed by a wheel, then another wheel collar onto one of the axles. Use a fine-point felt-tip pen to mark the screw hole in the outer wheel collar onto the axle.



❏ 3. Use your rotary tool with a cutoff wheel or a metal file to grind a flat spot at the mark.

❏ 4. Mark and grind a flat spot on the other axle the same way.

❏ 5. If you haven't yet done so, mount the main landing gear to the fuselage with three 6-32 x 1" [25mm] SHCS, #6 lock washers, #6 flat washers and a drop of threadlocker on the threads.

❏ 6. Use a 1/2" and 7/16" wrench to mount the axles to the main landing gear with a 5-16/24 lock nut.

❏ 7. Mount the wheels to the axles with a wheel collar on both sides of each wheel. Secure the outer wheel collars to the axles with a 6-32 set screw and a drop of threadlocker on the threads. (The inner collars serve only as spacers, so no set screws are required on them). Add a few drops of oil to both sides of both wheels where they contact the collars.

❏ 8. Mount the **wheel pants** to the main landing gear with 4-40 x 1/2" [13mm] SHCS, #4 lock washers, #4 flat washers and a drop of threadlocker on the threads.

❏ 9. Spin the wheels to make sure they roll freely. Make any adjustments necessary–if the wheels contact the edge of the opening in one (or both) wheel pants use a rotary tool with a sanding drum to enlarge the opening.

Apply the Decals

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

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

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

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

GET THE MODEL READY TO FLY

If you've assembled your Extra 330S 1.60 ARF with a glow or gas engine, skip directly to "Check the Control Directions" on page 34.

Install & Connect the Motor Battery

❑ 1. **Remove the propeller. IMPORTANT:** Whenever setting up or working on an electric-powered model, **always remove the propeller** in case of accidentally providing power to the motor.

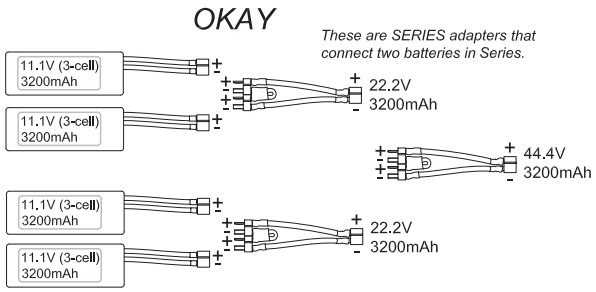
❑ 2. Before you can power the radio system and set up the controls, the motor batteries will need to be charged. Never charge the motor batteries while they are in the model. Always remove the motor batteries from the model while charging.

IMPORTANT: If using multiple battery packs that are connected with an adapter, never charge the batteries together through the adapter. Always charge each battery pack separately. Charge the batteries, then read the following precautions on how to connect multiple packs for flying the model:

Battery Precautions/Connecting Batteries

This is how to connect four batteries in Series:

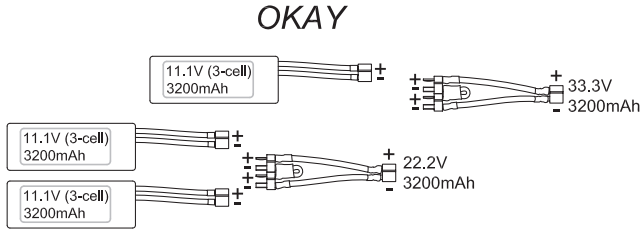
These are four 11.1V, 3200mAh batteries. When joined in Series, the result will be a 44.4V, 3200mAh battery.



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.

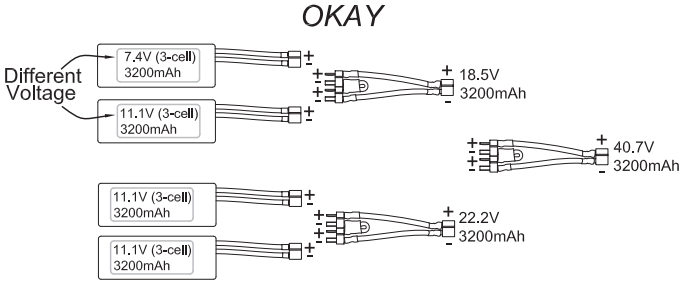
This is how to connect three batteries in Series:

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:

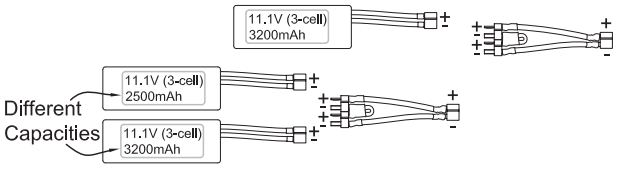
These are three 11.1V, 3200mAh batteries and one 7.4V, 3 200mAh battery. When joined in Series, the result will be a 40.7V, 3200mAh battery.



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

NO!

NEVER connect batteries that have different capacities!



Check the Control Directions

❏ 1. **IMPORTANT:** If your Extra 330S 1.60 ARF is powered by an electric motor, remove the propeller if you haven't done so already.

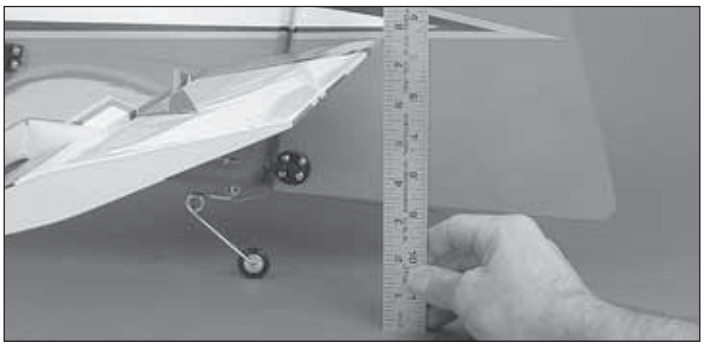
❏ 2. If you haven't done so already, connect all the servos and the ESC (if using an electric motor), to the receiver. Route the receiver antenna down through the antenna tube in the fuselage.

❏ 3. 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.**

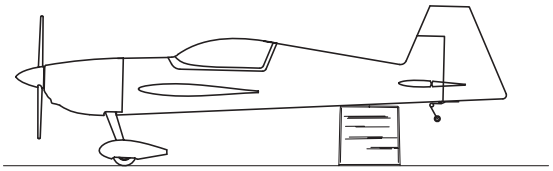
❏ 4. With the transmitter and receiver still on, check all the control surfaces to see if they are centered. If necessary, adjust the clevises on the pushrods to center the control surfaces. **Be certain to tighten the 4-40 nuts down to the clevises on the threaded ends of the pushrods.**

❏ 5. Make certain that the control surfaces and the carburetor respond in the correct direction. If any of the controls respond the wrong way, use the servo reversing in the transmitter to reverse the servos. Be certain the control surfaces have remained centered. Adjust if necessary.

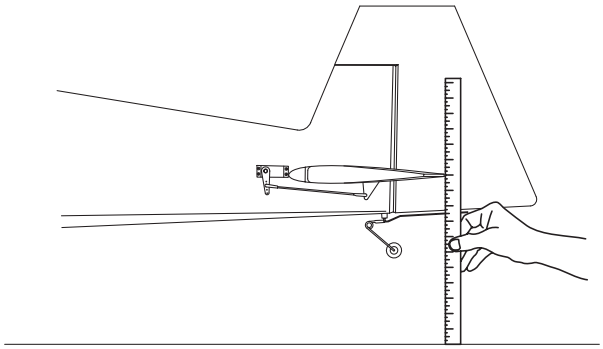
Set the Control Throws



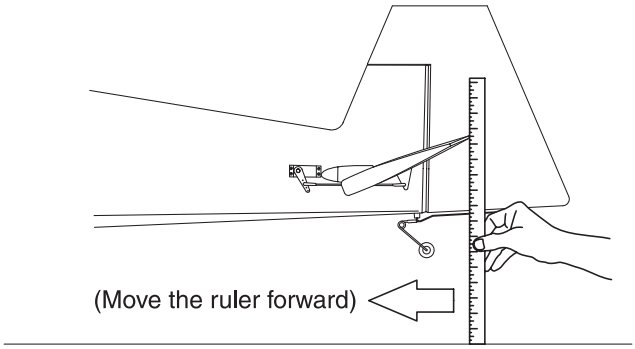
Perform the following procedures to measure and set the control throws according to the measurements in the chart. The illustrations depict measuring elevator throw, but the procedure is the same for measuring the ailerons and rudder. If your radio does not have dual rates, set the throws to the low-rate settings until you become more familiar with how the model flies. **Note:** The throws are measured at the **widest part** of each control surface.



❏ 1. Use a small box or something similar to prop up the fuselage until the wings and horizontal stab are level.



❏ 2. With the surface centered, take the initial reading at the **widest part** of the surface you are measuring.



❏ 3. Deflect the control surface and move your ruler forward so it will be contacting the trailing edge. Read the measurement to get the throw.

These are the recommended high and low rate control surface throws. If setting up your model with 3D throws for extreme aerobatics, refer to the 3D chart on the opposite page:

	High Rate	Low Rate
ELEVATOR:	1" [25mm] up	5/8" [16mm] up
	1" [25mm] down	5/8" [16mm] down
RUDDER:	4-1/2" [115mm] right	3" [76mm] right
	4-1/2" [115mm] left	3" [76mm] left
AILERONS:	1-1/4" [32mm] up	3/4" [19mm] up
	1-1/4" [32mm] down	3/4" [19mm] down

3D Control Throws
Unless you are an extremely experienced 3D pilot, if setting up your Extra 330S 1.60 ARF with 3D throws, you should be able to switch to high or low rate throws during flight in case you find the 3D throws too extreme.

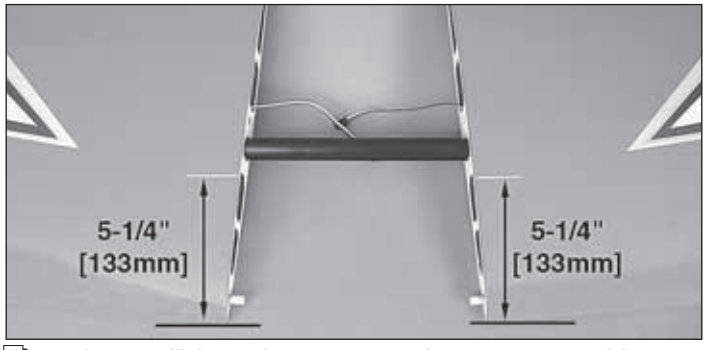
	3D Rates
ELEVATOR:	2" [50mm] up
	2" [50mm] down
RUDDER:	6" [150mm] right
	6" [150mm] left
AILERONS:	1-1/2" [38mm] up
	1-1/2" [38mm] down

IMPORTANT: The Great Planes Extra 330S 1.60 ARF has been **extensively** flown and tested to arrive at the throws at which it flies best. Flying your model at these throws will provide you with the greatest chance for successful first flights. If, after you have become accustomed to the way the Extra 330S 1.60 ARF flies, you would like to change the throws to suit your taste, that is fine. However, too much control throw could make the model difficult to control, so remember, "more is not always better."

Balance the Model (C.G.)

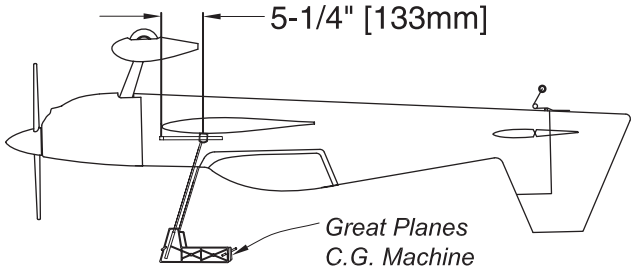
More than any other factor, the **C.G.** (balance point) can have the **greatest** effect on how a model flies, and may determine whether or not your first flight will be successful. If you value this model and wish to enjoy it for many flights, **DO NOT OVERLOOK THIS IMPORTANT PROCEDURE.** A model that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

At this stage the model should be in ready-to-fly condition with all of the systems in place including the engine, propeller and spinner, landing gear, pilot, and the complete radio system. Electric-powered models should be balanced with the flight batteries installed.



❏ 1. If you will be using a Great Planes C.G. Machine, set the rulers to 5-1/4" [133mm]. If not using a Great Planes C.G. Machine, slide the wings together with the aluminum joiner. Use a straightedge and a fine-point felt-tip pen to mark the balance point on the top of both wings 5-1/4" [133mm] back from the leading edge where they meet the fuselage. Place 1/16" to 1/8" [1.5 to 3mm] strips of tape over the lines you marked so you will be able to feel the balance point with your fingers when lifting the model to balance.

This is where your model should balance for the first flights. Later, you may wish to experiment by shifting the C.G. up to 1/2" [13mm] forward or 1/2" [13mm] back to change the flying characteristics. Moving the C.G. forward may improve the smoothness and stability, but the model may then require more speed for takeoff and make it more difficult to slow for landing. Moving the C.G. aft makes the model more maneuverable, but could also cause it to become too difficult to control. In any case, **start at the recommended balance point** and do not at any time balance the model outside the specified range.



❏ 2. Join the wings to the fuselage. With all parts of the model installed (ready to fly) and an empty fuel tank (or with the batteries installed for electric models), place the model upside-down on a Great Planes C.G. Machine; or, turn it over and lift it upside-down, placing your fingers on the thin strips of tape at the balance point you marked.

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

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

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

Balance the Model Laterally

❑ 1. With the wing level, have an assistant help you lift the model by the engine propeller shaft and the bottom of the fuselage under the trailing edge of the horizontal stabilizer. 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

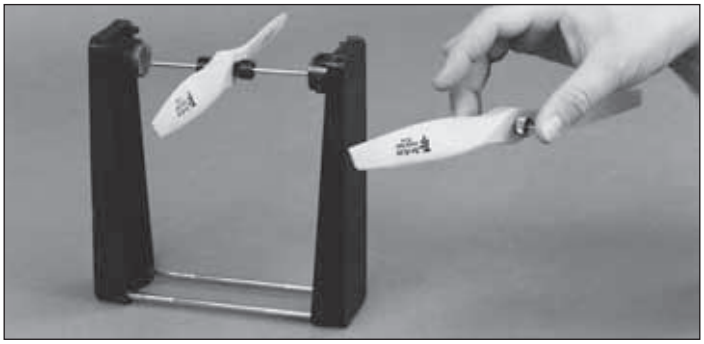
No matter if you fly at an AMA sanctioned R/C club site or if you fly somewhere on your own, you should always have your name, address, telephone number and AMA number on or inside your model. It is **required** at all AMA R/C club flying sites and AMA sanctioned flying events. Fill out the identification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

Charge the Batteries

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

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

Balance the Propellers



Carefully balance your propeller and spare propellers before you fly. An unbalanced prop can be the single most significant cause of vibration that can damage your model. Not only will engine mounting screws and bolts loosen, possibly with disastrous effect, but vibration may also damage your radio receiver and battery. Vibration can also cause your fuel to foam, which will, in turn, cause your engine to run hot or quit.

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

Ground Check

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

Range Check

Ground check the operational range of your radio before the first flight of the day. With the transmitter antenna collapsed and the receiver and transmitter on, you should be able to walk at least 100 feet away from the model and still have control. Have an assistant stand by your model and, while you work the controls, tell you what the control surfaces are doing. Repeat this test **with the engine running** at various speeds with an assistant holding the model, using hand signals to show you what is happening. If the control surfaces do not respond correctly, **do not fly!** Find and correct the problem first. Look for loose servo connections or broken wires, corroded wires on old servo connectors, poor solder joints in your battery pack or a defective cell, or a damaged receiver crystal from a previous crash.

ELECTRIC MOTOR & ENGINE SAFETY PRECAUTIONS

The following precautions apply both to electric motors and gas and glow engines. 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/motors.
- Use safety glasses when starting or running engines.
- Do not run the engine in an area of loose gravel or sand; the propeller may throw such material in your face or eyes.
- Keep your face and body as well as all spectators away from the plane of rotation of the propeller as you start and run the engine.
- Keep these items away from the prop: loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects such as pencils or screwdrivers that may fall out of shirt or jacket pockets into the prop.
- Use a “chicken stick” or electric starter to start the engine. Do not use your fingers to flip the propeller. Make certain the glow plug clip or connector is secure so that it will not pop off or otherwise get into the running propeller.
- Make all engine adjustments from behind the rotating propeller.
- The engine gets hot! Do not touch it during or right after operation. Make sure fuel lines are in good condition so fuel will not leak onto a hot engine, causing a fire.
- To stop a glow engine, cut off the fuel supply by closing off the fuel line or following the engine manufacturer’s recommendations. Do not use hands, fingers or any other body part to try to stop the engine. To stop a gasoline powered engine an on/off switch should be connected to the engine coil. Do not throw anything into the propeller of a running engine.
- For electric models, the ESC should always be setup so that lowering the throttle stick will turn off the motor. If this fails, disconnect the battery.

The following precautions apply only to electric-powered models.

- Always remove the LiPo battery from the plane before charging.
- Always use a charger designed to charge LiPo batteries for charging the LiPo flight battery.
- Never leave the LiPo battery unattended while charging. If the battery becomes hot, discontinue charging.

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 moisture, fuel or exhaust residue such as the fuel line mounts, the choke mount, the ignition battery and ignition module mount, etc.
❏ 2. Check the C.G. according to the measurements provided in the manual.
❏ 3. Be certain the battery and receiver are securely mounted. Simply stuffing them into place with foam rubber is not sufficient.
❏ 4. Extend your receiver antenna all the way down the antenna tube in the fuselage.
❏ 5. Balance your model *laterally* as explained in the instructions.
❏ 6. Use thread-locking compound to secure critical fasteners such as the set screws on the wheel collars, 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. Make sure there are silicone retainers on all the clevises.
❏ 12. Make sure all servo arms are secured to the servos with the screws included with your radio.
❏ 13. Secure connections between servo wires and Y-connectors or servo extensions, and the connection between your battery pack and the on/off switch with vinyl tape, heat-shrink tubing or special clips suitable for that purpose.
❏ 14. Make sure any servo extension cords you may have used do not interfere with other systems (servo arms, pushrods, pull/pull rudder cables, etc.).
❏ 15. Secure the pressure tap (if used) to the muffler with high temp RTV silicone, thread-locking compound or J.B. Weld.
❏ 16. Make sure the fuel lines are connected and are not kinked.
❏ 17. Balance your propeller (and spare propellers).
❏ 18. Tighten the propeller nut and spinner.
❏ 19. Place your name, address, AMA number and telephone number on or inside your model.
❏ 20. Cycle your receiver battery pack (if necessary) and make sure it is fully charged.
❏ 21. If you wish to photograph your model, do so before your first flight.
❏ 22. Range check your radio when you get to the flying field.

FLYING

Mount the Wing

Mount the wings to the fuselage. It will be helpful to have a Great Planes 4-in-1 installation tool (GPMR8035) for tightening the wing bolts. Don't forget to connect the aileron servo extensions to the Y-connector coming from the aileron channel in the receiver. Be sure the wires will not get caught on any of the servos or pushrods inside the fuselage. If your Extra is powered by an electric motor be certain the batteries are securely strapped into place. Mount the canopy hatch with the screws and a drop of threadlocker on the threads.

The Extra 330S 1.60 ARF is a great-flying model that flies smoothly and predictably. The Extra 330S 1.60 ARF does not, however, possess the self-recovery characteristics of a primary R/C trainer and should be flown only by experienced R/C pilots.

Fuel Mixture Adjustments (for gas & glow engines)

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 for peace of mind.

Remember to takeoff into the wind. When you're ready, point the model straight down the runway, hold a bit of up elevator to keep the tail on the ground to maintain tail wheel steering, then gradually advance the throttle. As the model gains speed decrease up elevator allowing the tail to come off the ground. One of the most important things to remember with taildraggers that have big engines 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 Extra 330S 1.60 ARF for the first few flights, gradually getting acquainted with it as you gain confidence. Adjust the trims to maintain straight and level flight. After flying around for a while, and while still at a safe altitude with plenty of fuel, practice slow flight and execute practice landing approaches by reducing the throttle to see how the model handles at slower speeds. Add power to see how she climbs as well. Continue to fly around, executing various maneuvers and making mental notes (or having your assistant write them down) of what trim or C.G. changes may be required to fine tune the model so it flies the way you like. Mind your fuel level, but use this first flight to become familiar with your model before landing.

Landing

To initiate a landing approach, lower the throttle while on the downwind leg. Allow the nose of the model to pitch downward to gradually bleed off altitude. Continue to lose altitude, but maintain airspeed by keeping the nose down as you turn onto the crosswind leg. Make your final turn toward the runway (into the wind) keeping the nose down to maintain airspeed and control. Level the attitude when the model reaches the runway threshold, modulating the throttle as necessary to maintain your glide path and airspeed. If you are going to overshoot, smoothly advance the throttle (always ready on the right rudder to counteract torque) and climb out to make another attempt. When you're ready to make your landing flare and the model is a foot or so off the deck, smoothly increase up elevator until it gently touches down. Once the model is on the runway and has lost flying speed, 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

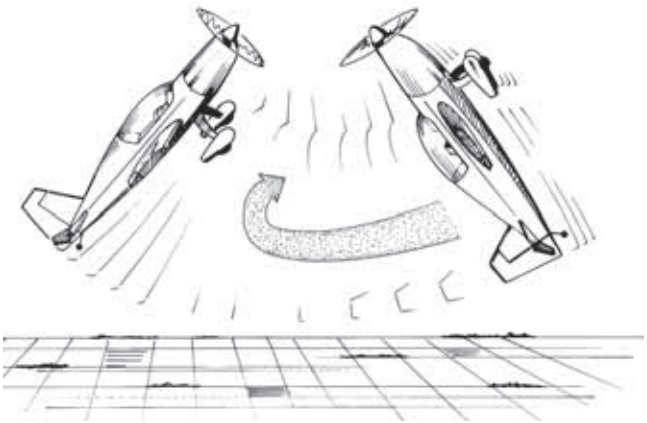
Make a copy of this identification tag and put it on or inside your model.

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.

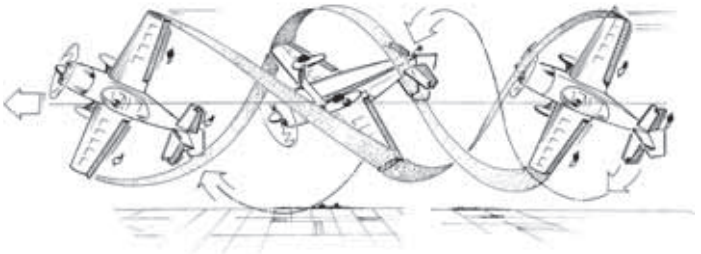
INVERTED FLAT SPINS

This is the same as the up-right 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

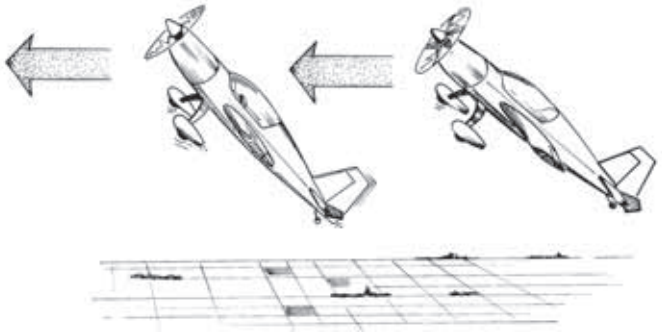
Fly a straight pass across the field at 75ft high and 100ft out and pull the model vertical. Roll the model until the top of it is facing you and slowly begin to reduce power. As the model begins to slow down to 10mph or so, slowly add a little bit of power back in. You will have to adjust the throttle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

ROLLING HARRIER

Once you get comfortable with the up-right harrier, it's time to work rolls into the mix. From an up-right 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

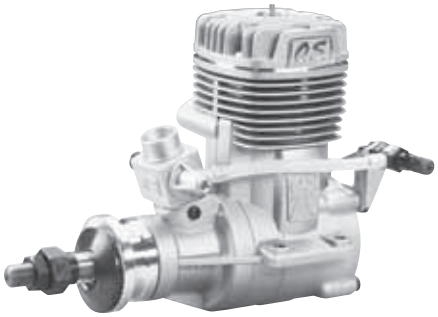
Climb vertically and bring the model to a vertical hover, but do not stop long enough to let the torque pull the model around (climbing or sliding slightly will not be noticeable to spectators but will keep air flowing over the ailerons and provide you roll authority to stop the torque). When the model 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 wing tip in a very small area. This maneuver can be done either direction.

OTHER ITEMS AVAILABLE FROM GREAT PLANES

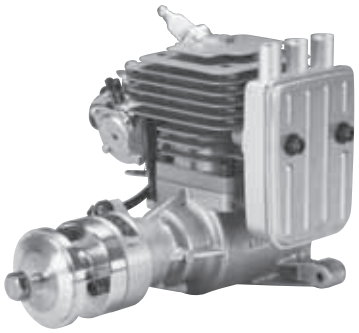
Great Planes® 25% YAK 54 3D Glow/Gas ARF

It's BIG – and designed for totally "out there" aerobatics! The YAK 54 is a favorite among 3D pilots, and this 25% ARF model captures every nuance of the Unlimited Class competitor. Put yourself at the controls, and experience the thrills of performing precision maneuvers with ease and attitude! The perfect combination of light weight and "in-flight" durability, the YAK 54 is an excellent sport flyer – but also capable of any 3D and IMAC aerobatic maneuver you can think of. A lot of ARFs come with such unreliable hardware that you wouldn't dream of using it, and some don't include hardware at all. But the YAK 54 includes a complete package of well-made hardware that saves you shopping trips and keeps it performing like a champion! **GPMA1411**

Great Planes ElectriFly™ Extra 330S 3D ARF
Performance equals fun – and the Extra 330S EP ARF offers plenty of both! What's more, performance can be tailored to the pilot's preference. Drop in an out-runner and it's a 3D thriller, ready for an afternoon of torque rolls, waterfalls, and harriers. And best of all, pilots can have the performance they want after just 6-8 hours of simple, straightforward assembly! The cowl, landing gear and wheel pants are painted to match the high-quality, iron-on covering on prebuilt wood sections. Hardware is included and designed to bring out the best in E-Performance planes! **GPMA1543**



O.S. Engines® 1.60 FX Ringed Engine
The 1.60 FX features dual ball bearings for durability and smooth operation, plus a low crankcase profile that allows for a proportionally taller, semi-squared head – a design refinement that increases cooling fin area and improves heat dispersion. The threaded portion of the crankshaft is extra-long for more secure prop and spinner nut engagement, and the needle valve is remotely mounted for safety during adjustments. The high-speed needle can also be mounted horizontally, vertically, or separate from the engine for more installation options! Includes glow plug and 2-year warranty. **OSMG0661**



Fuji-Imvac™ BT-43EI-2 Gasoline Engine w/Electronic Ignition System
The BT-43EI-2 design results in an engine that's small and light, but still delivers excellent power-to-weight ratio. It features Fuji-Imvac's popular Electronic Ignition System, which offers reliable starting in a much smaller size and weight than typical magneto systems. A Velocity Stack on the Walbro carb increases air flow to help push fuel into the chamber. Three bearings – one front, two center – help to lessen vibration. The spinner bolt is predrilled and tapped for attaching a prop adapter. The Friction Disk Pad is an added safety feature that helps keep the prop from slipping on the prop hub. With its innovative back plate, you can bolt the engine directly to the firewall – no mounting plate required! That makes mounting easier, as well as lowering overall weight and vibration. **FJIG0144**

Fuji-Imvac is not related to the original Fuji Engines sold by Mecoa.

Great Planes ElectriFly RimFire™ 63-62-250kV Out-Runner Brushless Motor
ElectriFly RimFire brushless motors are designed and produced with high quality, power, precision and efficiency in mind. The out-runner design eliminates the need for an external gear drive for many applications, reducing cost, all-up weight and complexity. And the RimFire's prop saver design eliminates the need for a prop adapter – simply strap the prop onto the motor with a rubberband and that's it! **GPMG4795**

- Exceptionally high power-to-weight ratio.
- Maximum rated efficiency of 89%
- Extremely strong neodymium "rare earth" magnets for high output torque, with one of the highest temperature ratings in R/C at 302° F (150° C). They won't break down like lower quality magnets.
- Very reliable and virtually maintenance-free. No brushes to wear out. Dual ball bearings are shielded on both sides to keep out dirt and debris.

Futaba® 6EX 2.4GHz Computer Radio
Once you've experienced the 6EX 2.4GHz FASST system, you won't want to fly any other way! The secret is the all-

in-one R606FS receiver: its compact size and light weight makes it super-easy to mount and perfect for any type of R/C aircraft, including helis. You can fly without fear of signal conflict or the need for a frequency pin, because Continuous Channel Shifting makes interference virtually impossible, and Pre-Vision™ scans incoming data and applies corrections in advance. With Easy Link™ your receiver will be locked securely to your transmitter, and you'll enjoy a strong signal regardless of your plane's attitude because Dual Antenna Diversity seamlessly selects the best reception between two antennas. Equip your model with whatever Futaba servos it requires – the 6EX 2.4GHz FASST system is compatible with them all. **FUTK6900**

Futaba® S3305 Standard High-Torque Servo
With metal gears and two ball bearings, the S3305 Standard High-Torque Servo is able to crank out impressive muscle. **FUTM0045**

ElectriFly by Great Planes 3200mAh Power Series LiPo Battery with Balance Connector
Ideal for scale aircraft, bigger sport aerobats, 3D planes, and larger electric models, the Power Series 3200mAh LiPo pack enables you to enjoy the benefits of balancing. The cells are conditioned to last longer, and can be fully charged to 4.20V, ensuring maximum power from the pack. A LiPo Cell Balancer (like ElectriFly's Equinox LiPo Balancer GPMM3160) or a Balancing Charger is required. **GPMP0623**

ElectriFly PolyCharge4™
For convenience with multiple LiPo packs, there's the DC PolyCharge4. Each of its four independent outputs can charge a one-to-four cell Lithium-Polymer pack. It's ideal if you don't have the time for one-at-a-time charging – and don't want the expense and hassle of multiple chargers. Each output can handle packs from 300 to 3000mAh. Set the capacity, and PolyCharge4 will automatically set the charge rate to get you started – and use light and sound cues to tell you when your pack is done. **GPMM3015**

ElectriFly Triton™2 Charger
Like the popular original Triton charger, the Triton2 offers easy programming. But the adjustable charge current has been increased from 5.0A maximum to 7.0A, and the Triton2 can handle LiPo packs with up to 5 cells in series. A cool blue backlight on the 2 x 16 LCD screen makes for easier reading in any conditions, and the rotating dial has been raised for enhanced feel and more precise fingertip control. The Triton2 is more versatile too: you get alligator clips that mate onto the banana plugs, for quick connection to 12V batteries or power supplies. You'll still be able to charge 1-4 cell lithium-ion and lithium-polymer batteries, and peak 1-24 cell NiCd and NiMH packs at rates you set to peak detection values you choose – before discharging them at custom rates and then repeating the cycle up to 10 times. **GPMM3150**

BUILDING NOTES

Kit Purchased Date: _____

Where Purchased: _____

Date Construction Started: _____

Date Construction Finished: _____

Finished Weight: _____

Date of First Flight: _____

FLIGHT LOG