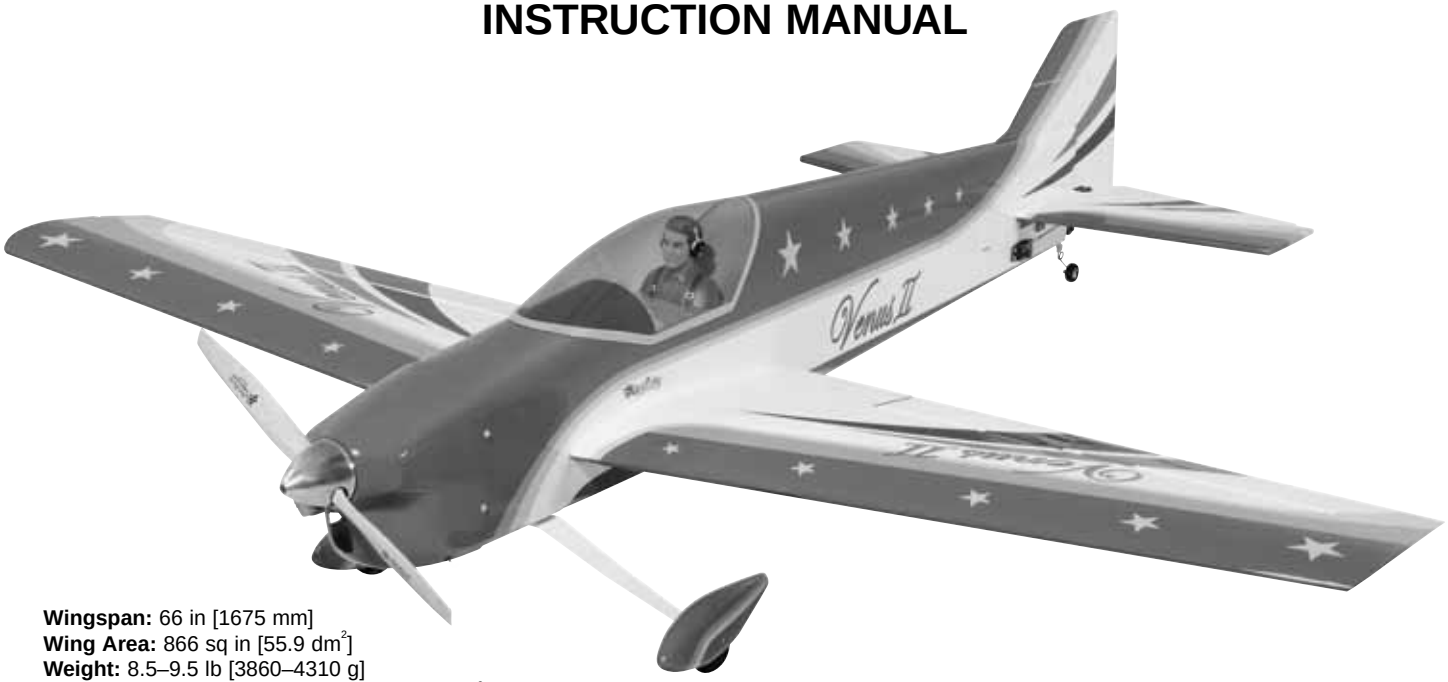
Venus II™

INSTRUCTION MANUAL



Wingspan: 66 in [1675 mm]
Wing Area: 866 sq in [55.9 dm^2]
Weight: 8.5–9.5 lb [3860–4310 g]
Wing Loading: 22.5–26 oz/sq ft [69–79 g/dm^2]
Length: 69.5 in [1675 mm]
Radio: 4-channel, 6 servos
Engine: .61–.91 cu in [10–15cc] two-stroke,
.91–1.2 cu in [10–20cc] four-stroke

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 WARNINGS AND INSTRUCTIONS CONCERNING THE ASSEMBLY AND USE OF THIS MODEL.

GREAT PLANES® MODEL MANUFACTURING COMPANY
Champaign, Illinois
(217) 398-8970, Ext 5
airsupport@greatplanes.com

GPMZ0182 for GPMA1027 V1.0

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INTRODUCTION

Thank you for purchasing the Great Planes Venus II ARF. The Venus II is an excellent plane for everyday sport flyers, or for flyers who wish to learn the basics of pattern—it would even be a great backup plane for experienced pattern flyers. The Venus II's long tail moment, large control surfaces and generous wing area make it one smooth, yet aerobatic flyer. It's also a fairly straight-forward build so you should be in the air before you know it.

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

AMA

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

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

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

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

1. Your Venus II 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 Venus II 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 and wheel pants 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.

DECISIONS YOU MUST MAKE

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

Radio Equipment

You have the option of mounting the elevator and rudder servos either "up front" in the servo tray above the wing or in the rear of the fuselage under the tail. Mounting the servos outside the fuselage under the tail is recommended for pilots who demand more precision because 4-40 pushrods are used and the connection between the servos and control surfaces is more direct. Mounting the servos in the forward location inside the fuselage is suitable for less-experienced pilots and reduces the number of elevator servos from two to one (as both elevator pushrods are joined inside the fuselage and connected to one servo). Finally, if mounting the servos in the tail the model will require little or no additional lead ballast to achieve the correct C.G., while mounting the servos up front will probably result in the requirement of a few ounces in the tail to get the model to balance.

RADIO GEAR REQUIRED IF MOUNTING THE SERVOS IN THE TAIL:

ECONOMY

Elevators: (2) *standard* torque rating (approximately 45 oz-in [3.5 kg-cm]), ball bearing servos
Rudder: (1) *medium* torque rating (minimum 50 oz-in [3.9 kg-cm]), ball bearing servo
Ailerons: (2) *standard* torque rating (approximately 45 oz-in [3.5 kg-cm]), ball bearing servos
Throttle: (1) *standard* torque rating servo

PRECISION

Elevators: (2) *medium* torque rating (minimum 50 oz-in [3.9 kg-cm]), ball bearing servos
Rudder: (1) *high* torque rating (approximately 70 oz-in [4.5 kg-cm]), ball bearing servo
Ailerons: (2) *medium* torque rating (minimum 50 oz-in [3.9 kg-cm]), ball bearing servos
Throttle: (1) *standard* torque rating servo

In addition to the servos, the following radio equipment will also be required:

- ❏ (3) 24" [610 mm] servo extensions for rudder and elevator servos (HCAM2721 for Futaba®)
- ❏ (2) 12" [300 mm] servo extensions for aileron servos (HCAM2711 for Futaba)
- ❏ (1) 6" [150 mm] servo extension from receiver for aileron connection (HCAM2701 for Futaba)
- ❏ (1) dual servo extension for aileron servos (FUTM4130)
- ❏ Minimum 1,000 mAh receiver battery (NR4F 4.8V 1,500 mAh NiCad, FUTM1285, or NR4B 4.8V 1,000 mAh NiCad, FUTM1380)

RADIO GEAR REQUIRED IF MOUNTING THE SERVOS UP FRONT:

ECONOMY

Elevators: (1) *medium* torque rating (minimum 50 oz-in[3.9 kg-cm]), ball bearing servo
Rudder: (1) *medium* torque rating (minimum 50 oz-in [3.9 kg-cm]), ball bearing servo
Ailerons: (2) *standard* torque rating (approximately 45 oz-in [3.5 kg-cm]), ball bearing servos
Throttle: (1) *standard* torque rating servo

PRECISION

Elevators: (1) *high* torque rating (approximately 70 oz-in [4.5 kg-cm]), ball bearing servo
Rudder: (1) *high* torque rating (approximately 70 oz-in [4.5 kg-cm]), ball bearing servo
Ailerons: (2) *medium* torque rating (minimum 50 oz-in [3.9 kg-cm]), ball bearing servos
Throttle: (1) *standard* torque rating servo

In addition to the servos, the following radio equipment will also be required:

- ❏ (2) 12" [300 mm] servo extensions for aileron servos (HCAM2711 for Futaba)
- ❏ (1) 6" [150 mm] servo extension from receiver for aileron connection (HCAM2701 for Futaba)
- ❏ (1) dual servo extension for aileron servos (FUTM4130)
- ❏ Minimum 1,000 mAh receiver battery (NR4F 4.8V 1,500 mAh NiCad, FUTM1285, or NR4B 4.8V 1,000 mAh NiCad, FUTM1380)

Engine Recommendations

Refer to the recommended engine size range on the front cover of the manual. The Venus II was primarily designed to fly on a 1.2 cu in [20cc] four-stroke glow engine, but other engines within the size range are suitable. Sport flyers will enjoy the Venus II if a two-stroke engine is selected, but most precision pattern flyers will probably opt for the 1.2 four-stroke. When flown by the O.S.® 1.2 Surpass™, a 15 x 8 propeller performed well. Whatever engine is selected, remember that this is an aerobatic, pattern type of model so the goal should be to use throttle management and fly smoothly and in control.

Note: A Great Planes Spinner Adapter Kit will have to be purchased separately as specified below for the engine you will be using.

O.S. 1.20 Surpass: G.P. Spinner Adapter GPMQ4588. Additionally, the included 4x25 mm spinner bolt will have to be shortened to 20 mm.
O.S. .91 Surpass, .91 FX: No adapter kit is required, but the included 4x25 mm spinner bolt will have to be shortened to 20 mm.
SuperTigre® .90: G.P. Spinner Adapter GPMQ4588.
Y.S. .91 AC, 1.10 AC: A suitable Dave Brown or TruTurn spinner adapter kit will have to be purchased separately.

ADDITIONAL ITEMS REQUIRED

Required Hardware and Accessories

In addition to the hardware already listed, this is the list of hardware and accessories required to finish the Venus II ARF. Order numbers are provided in parentheses.

- ❏ Suitable propellers
- ❏ 1/4" [6 mm] R/C foam rubber (HCAQ1000)
- ❏ 3' [900 mm] standard silicone fuel tubing (GPMQ4131)

Adhesives and Building Supplies

This is the list of Adhesives and Building Supplies that are required to finish the Venus II ARF.

- ❏ 1 oz. [30g] Thin Pro™ CA (GPMR6002)
- ❏ 1 oz. [30g] Medium Pro CA+ (GPMR6008)
- ❏ CA Applicator Tips (HCAR3780)
- ❏ Pro 30-minute epoxy (GPMR6047)
- ❏ Drill Bits: 1/16" [1.6 mm], 3/32" [2.4 mm], 1/8" [3.2 mm], 3/16" [4.8 mm], #29 Drill and 8-32 Tap ***OR*** Great Planes 8-32 Tap and Drill Set (GPMR8103)
- ❏ Tap Handle (GPMR8120)
- ❏ Small Metal File
- ❏ Stick-on Segmented Lead Weights (GPMQ4485)

❏ Silver Solder w/Flux (GPMR8070)
❏ #1 Hobby Knife (HCAR0105)
❏ #11 Blades (5-pack, HCAR0211)
❏ #11 Blades (100-pack, HCAR0311)
❏ 4 mm Allen Wrench (for Spinner Bolt)

Optional Supplies and Tools

Here is a list of optional tools mentioned in the manual that will help you build the Venus II ARF.

❏ 2 oz. [57g] Spray CA Activator (GPMR6035)
❏ 4 oz. [113g] Aerosol CA Activator (GPMR634)
❏ CA Debonder (GPMR6039)
❏ 3M 75 Repositionable Spray Adhesive (MMMR1900)
❏ Epoxy Brushes (6, GPMR8060)
❏ Mixing Sticks (50, GPMR8055)
❏ Mixing Cups (GPMR8056)
❏ Wax Paper
❏ Medium T-Pins (100, HCAR5150)
❏ Robart Super Stand II (ROBP1402)
❏ Masking Tape (TOPR8018)
❏ Milled Fiberglass (GPMR6165)
❏ Microballoons (TOPR1090)
❏ Threadlocker Thread Locking Cement (GPMR6060)
❏ Denatured Alcohol (for epoxy clean up)
❏ Switch & Charge Jack Mounting Set (GPMM1000)
❏ Panel Line Pen (TOPQ2510)
❏ Rotary Tool such as Dremel®
❏ Rotary Tool Reinforced Cut-Off Wheel (GPMR8200)
❏ Servo Horn Drill (HCAR0698)
❏ Hobby Heat™ Micro Torch (HCAR0750)
❏ Dead Center™ Engine Mount Hole Locator (GPMR8130)
❏ AccuThrow™ Deflection Gauge (GPMR2405)
❏ CG Machine™ (GPMR2400)
❏ Laser Incidence Meter (GPMR4020)
❏ Precision Magnetic Prop Balancer™ (TOPQ5700)
❏ Aluminum Fuel Line Plug (GPMQ4166)
❏ 21ST Century® Sealing Iron (COVR2700)
❏ 21ST Century Iron Cover (COVR2702)
❏ 21ST Century Trim Seal Iron (COVR2750)

IMPORTANT BUILDING NOTES

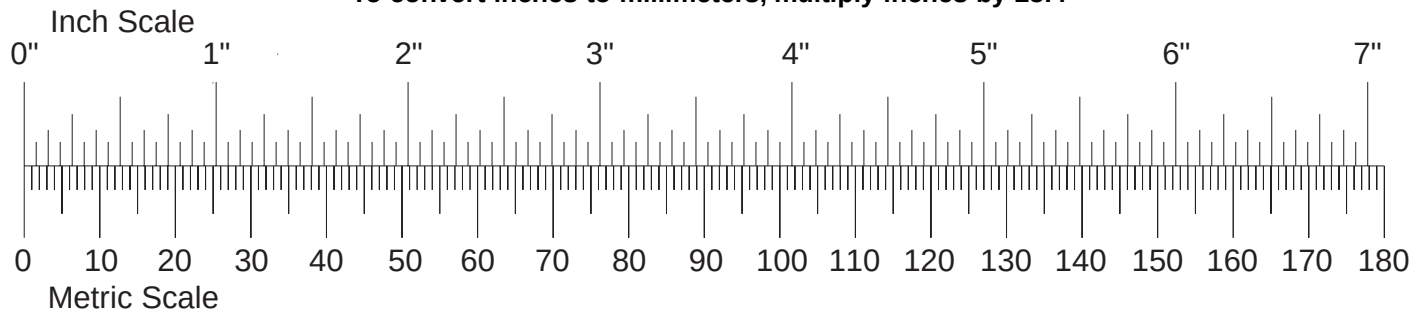
- Whenever just ***epoxy*** is specified you may use ***either*** 30-minute (or 45-minute) epoxy ***or*** 6-minute epoxy. When 30-minute epoxy is specified it is **highly** recommended that you use only 30-minute (or 45-minute) epoxy, because you will need the working time and/or the additional strength.

- The Venus II ARF is factory-covered with Top Flite® MonoKote® film. Should repairs ever be required, MonoKote can be patched with additional MonoKote purchased separately. MonoKote is packaged in six-foot rolls, but some hobby shops also sell it by the foot. If only a small piece of MonoKote is needed for a minor patch, perhaps a fellow modeler would give you some. MonoKote is applied with a model airplane covering iron, but in an emergency a regular iron could be used. A roll of MonoKote includes full instructions for application. Following are the colors used on this model and order numbers for six foot rolls.

  White (TOPQ0204)
  Royal Blue (TOPQ0221)
  Cub Yeller (TOPQ0220)
  Orange (TOPQ0202)
  True Red (TOPQ0227)
  Dark Teal (TOPQ0223)
  Metallic Plum (TOPQ0403)

- The 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.

To convert inches to millimeters, multiply inches by 25.4



ORDERING REPLACEMENT PARTS

Replacement parts for the Great Planes Venus II 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. If a hobby shop is not available, replacement parts may also be ordered from Tower Hobbies® at www.towerhobbies.com, or by calling toll free (800) 637-6050.

Parts may also be ordered directly from Hobby Services by calling (217) 398-0007, or via facsimile at (217) 398-7721, but full retail prices and shipping and handling charges will apply. Illinois and Nevada residents will also be charged sales tax. If ordering via fax, include a Visa® or MasterCard® number and expiration date for payment.

Mail parts orders and payments by personal check to:

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

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

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

Replacement Parts List

Order Number	Description	How to Purchase
	Missing pieces	Contact Product Support
	Instruction manual	Contact Product Support
	Full-size plans	Not available
	Kit parts listed below	Hobby Supplier

Contact your hobby supplier to purchase these items:

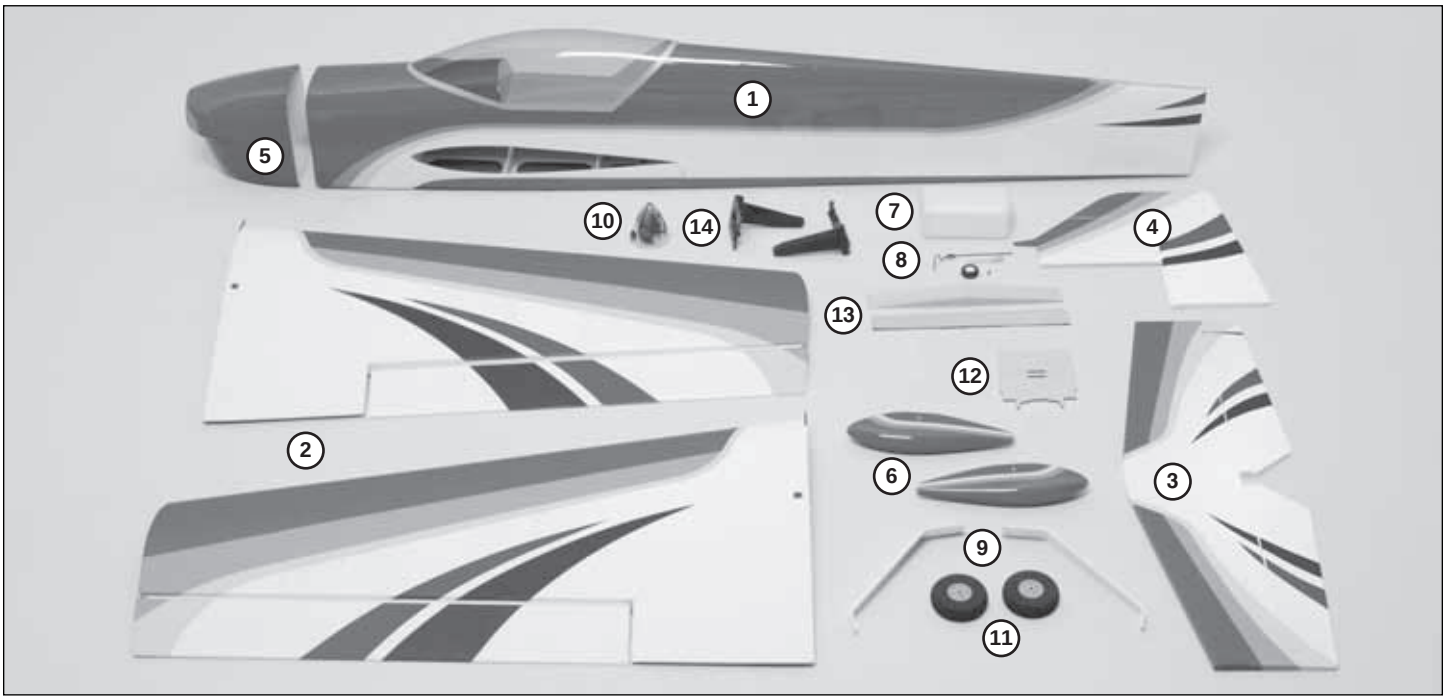
GPMA2525.....Wing Kit without Belly Pan
GPMA2526.....Fuselage Kit without Belly Pan
GPMA2527.....Tail Surface Set
GPMA2528.....Main Landing Gear Set
GPMA2529.....Cowl
GPMA2530.....Tailwheel Set
GPMA2531.....Spinner
GPMA2532.....Canopy
GPMA2533.....Belly Pan
GPMA2534.....Decal Set
GPMA2475.....Pilot

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 Great Planes **Product Support**. When reporting defective or missing parts, use the part names exactly as they are written in the Kit Contents list on the following page.

Great Planes Product Support:
Telephone: (217) 398-8970, ext. 5
Fax: (217) 398-7721
E-mail: *airsupport@greatplanes.com*

KIT CONTENTS



Kit Contents (Photographed)

1 Fuselage with canopy and belly pan [1/4-20 Blind Nuts (2), 8-32 Blind Nuts (4), 3/16" Gray Pushrod Tubes (4)]
2 Wing Halves (2)
3 Horizontal Stabilizer with Elevators
4 Vertical Stabilizer (Fin) with Rudder
5 Cowl
6 Wheel Pants (2)
7 Fuel Tank with Hardware
8 Tail Gear Wire, Tail Wheel, Aluminum Tail Gear Mount
9 Aluminum Main Landing Gear (Right and Left)
10 Spinner Cone, Back Plate Nut, Bolt, Wrench
11 70 mm Wheels (2)
12 Plywood Receiver/Battery Tray
13 Wing Joiner and Wing Joiner Brace
14 Engine Mount Halves (Right and Left)

Kit Contents (Not Photographed)

#8 Lock Washers (12)
#8 Flat Washers (8)
8-32 x 1" SHCS (Socket Head Cap Screws) (4)
8-32 x 1-1/4" SHCS (4)
8-32 Blind Nuts (8)
#4 x 5/8" Phillips Screws (4)
#4 Lock Washers (4)
#4 Flat Washers (4)
2-56 x 36" [910 mm] Pushrods (4)
Screw-Lock Connector (1)
Nylon Retainer for Screw-Lock (1)
4-40 x 1/8" SHCS (1)
Nylon Ball Link (1)
0-80 Ball Link Ball (1)
0-80 Nut (1)
Aluminum Fuel Line Plug (1)
Heat Shrink Tubing (6)
36" [910 mm] Gray Pushrod Guide Tubes (5)
#2 x 3/8" Screws (4)
8-32 x 3/4" SHCS (4)
#6 Washers (8)
1/4-20 Blind Nuts (2)
1/4-20 x 2" Nylon Wing Bolts (2)
#2 x 3/8" Button-Head Screws (4)
5-32 x 1-1/4" Axles (2)
5/16"-24 Lock Nuts (2)
5/32" Wheel Collars (4)
6-32 x 1/4" SHCS (4)
2-56 x 3/8" Phillips Screws (4)
2-56 Blind Nuts (4)
#2 Lock Washers (4)
4-40 x 12" Pushrods (3)
Large Solder Clevises (3)
4-40 Metal Clevises (3)
4-40 Nuts (3)
Silicone Clevis Retainers (12)
Giant Control Horns (3)
4-40 x 5/8" Phillips Screws (12)
Mounting Plates for Giant Control Horns (3)
#4 x 3/8" Phillips Screws (2)
3/32" Wheel Collars (2)
4-40 Set Screw (1)
4-40 x 1/4" SHCS (1)
2-56 Metal Clevises (5)
2-56 Nuts (5)
Small Solder Clevis (4)
2-56 x 6" [150 mm] Pushrods (2)
Large Control Horns (2)
#2 x 1/2" Phillips Screws (4)
Paper Tube (1)
CA Hinge Strips (2)
3/16" x 3/16" x 4" [5 x 5 x 100 mm] Hardwood Sticks
Plywood Throttle Guide Tube Holders (2)
#64 Rubber Bands (4)
8" [200 mm] Velcro Strips (2)
Pilot

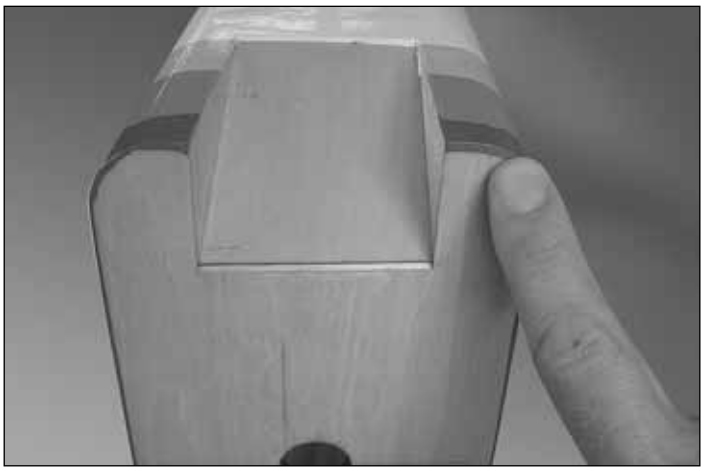
PREPARATIONS

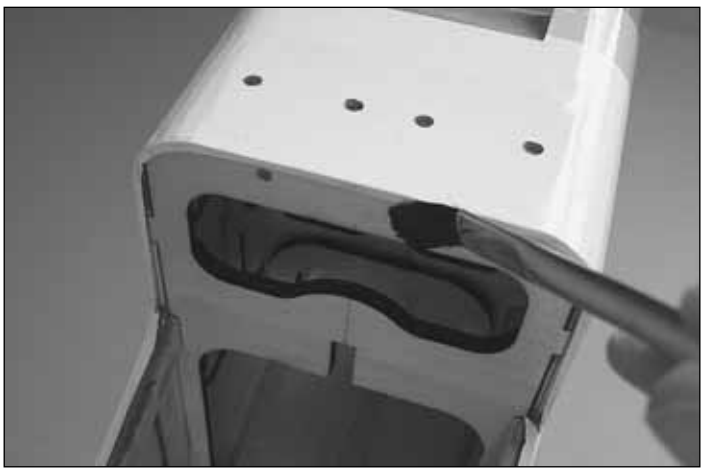
EXPERT TIP

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.

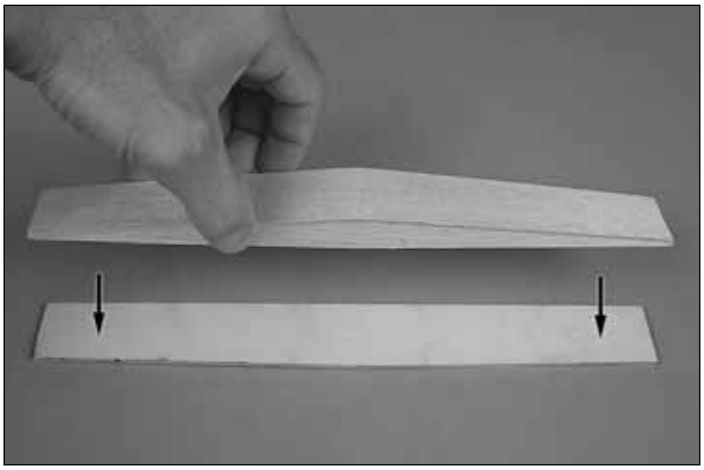
❏ 1. Examine the covering on all parts of the airframe. Where necessary, use a covering iron with a covering sock to remove any wrinkles. Over sheeted areas, first glide the iron over the wrinkle until it shrinks. Then go back over the area again, pressing hard on the iron to thoroughly bond the covering to the wood. **Hint:** Use a small T-pin to poke several holes in the covering over the lightening holes on the **bottom** of the elevators. This will allow expanding air to escape during the heating and tightening process.

❏ 2. Use a trim iron to **thoroughly** seal the covering around the firewall, around the air passage cutout at the firewall under the fuselage, and around the formers at the front and back of the wing saddle.





❏ 3. Use your finger to **lightly** spread 30-minute epoxy over the edges of the covering around the firewall—this will guarantee that the covering is thoroughly sealed and fuel-proofed. Use an epoxy brush to lightly coat the formers at both ends of the wing saddle as well.

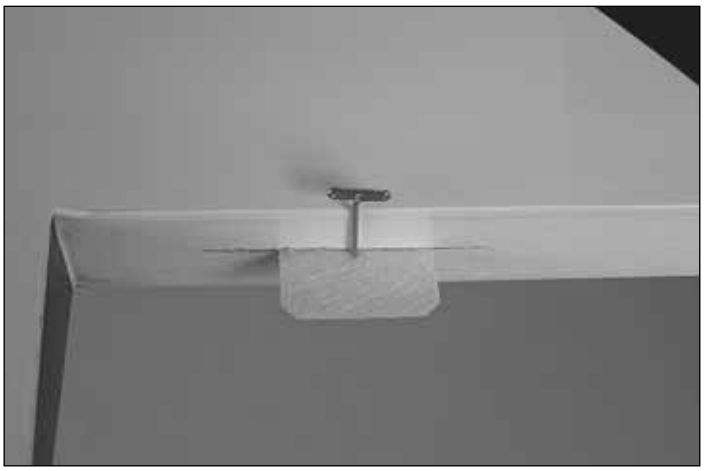


❑ 4. Use epoxy to glue the 1/8" [3 mm] plywood **wing joiner brace** to the balsa **wing joiner**. Use clamps or masking tape to hold the pieces together while the epoxy hardens. Set the joiner aside so the assembly will be ready when it's time to join the wings later.

Set the fuselage and wing joiner assembly aside while you work on the wings…

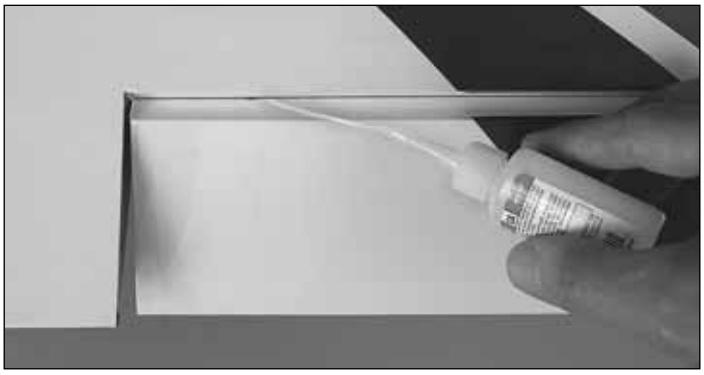
ASSEMBLE THE WING

Hinge the Ailerons



❑ ❑ 1. Cut four hinges from the precut CA hinge strip. Stick a T-pin through the middle of each hinge. Insert the hinges into the hinge slots in one of the wing halves.

❑ ❑ 2. Join the matching aileron to the wing, and then take out the T-pins. Make sure there is a **small** gap between the leading edge of the aileron and the wing—just enough to see light through or to slip a piece of paper through.

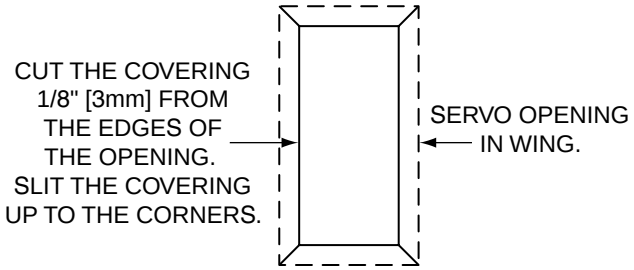


❑ ❑ 3. Apply at least eight drops of thin CA to the **top** and **bottom** of each hinge. Allow enough time between drops so the CA can soak into the hinge rather than running into the hinge gap. **Hint:** CA applicator tips are **highly recommended**.

❑ ❑ 4. After the CA has hardened for a few minutes, pull hard on the aileron to make sure it is secure. Add more CA if necessary.

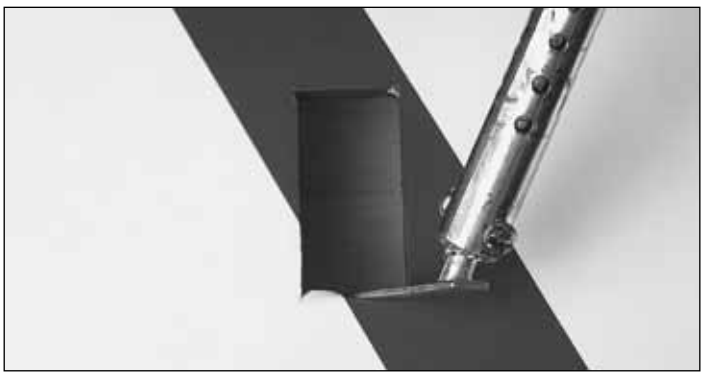
❑ 5. Join the other aileron to the other wing half the same way.

Mount the Servos and Hook Up the Ailerons

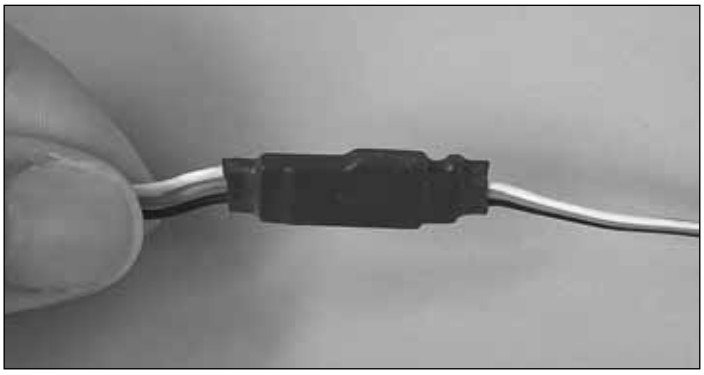


❑ 1. Use a straightedge and a hobby knife to cut the covering 1/8" [3 mm] inside the openings in the bottom of both wings for the aileron servos. Slit the covering up to the corners of the openings.

❑ 2. Also cut the covering from the top of the wings over the holes for the servo wires (next to the root end of both wings) and from the top and bottom of the wings over the wing bolt holes.

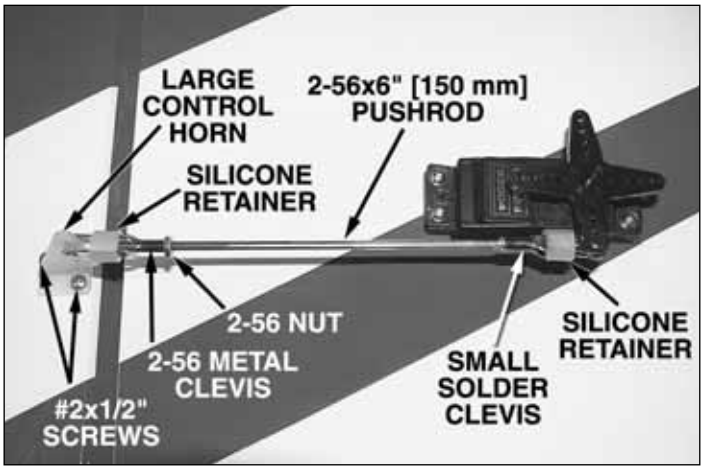


❑ 3. Use a trim iron to iron the covering down inside the aileron servo openings.

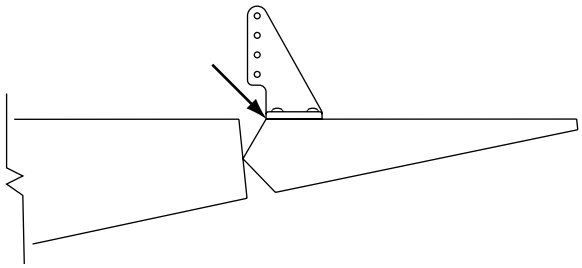


❑ 4. Connect a 12" [300 mm] servo extension wire to each aileron servo. Cut one of the included black heat shrink tubes in half, making two 1-1/2" [40 mm] pieces. Center the pieces of tubing over the connections between the servo wires and the extensions and use a heat gun to shrink the tubing, making the connections secure.

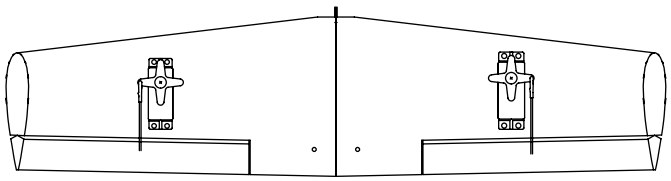
Refer to this photo while mounting the servos and hooking up the ailerons.



❑ 5. Use the string in the wings to pull the servo wires out while placing the servos in the openings. With the servos in position, drill 1/16" [1.6 mm] holes into the wing for all the servo mounting screws. Temporarily mount the servos with the servo mounting screws that came with your servos.



❑ 6. Read the **Expert Tip** below on how to solder. Then connect the aileron servos to the ailerons using the hardware shown in the photo. When mounting the horns, place the front edge at the front edge of the aileron as indicated by the arrow in the illustration. Drill 1/16" [1.6 mm] holes through the ailerons for the screws. If using new, four-arm servo arms, do not cut the extra arms off until instructed to do so when setting up the radio later.



CONNECT THE PUSHRODS TO THE SERVO ARMS SO THEY ARE OPPOSITE, AS SHOWN.

Note: Set up the ailerons so the servo arms that the pushrods will be mounted to are opposed.

HOW TO SOLDER

❑ A. 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.

❑ B. Apply a few drops of soldering flux to the end of the pushrod, and then use a soldering iron or a torch to heat it. "Tin" the heated area with **silver solder** (GPMR8070) 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.

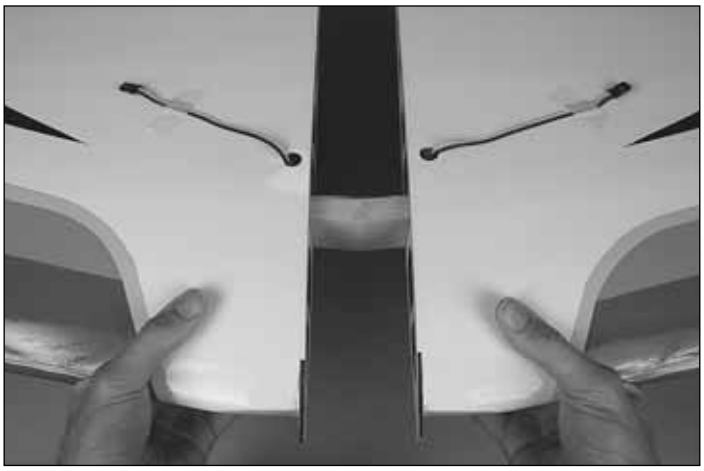
❑ C. Place the clevis on the end of the pushrod. Add another drop of flux, then heat and add solder. The same as before, the heat of the parts being soldered should melt the solder, thus allowing it to flow. Allow the joint to naturally cool without disturbing. Avoid excess blobs, but make certain the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

❑ D. 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.

❑ 7. Now that the servos and control horns have been mounted, remove the servo mounting screws and the control horn screws. Add a few drops of thin CA to each screw hole to harden the “threads” in the holes. After the CA has hardened, reinstall all the screws to securely mount the servos and the horns.

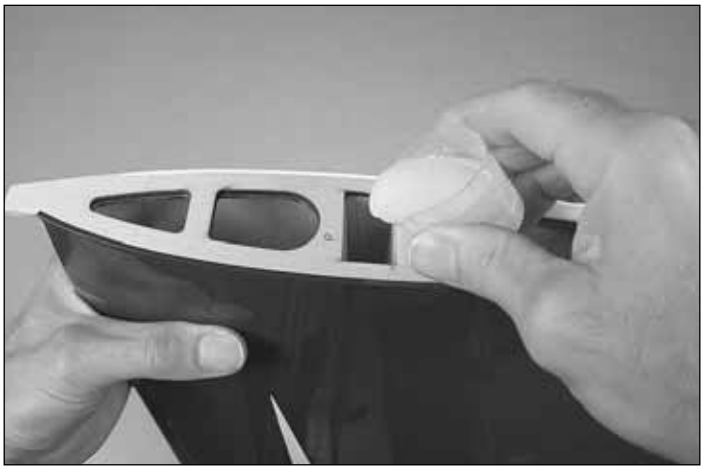
Join the Wing



❑ 1. Without using any glue, test fit the wing halves with the joiner prepared earlier. Make sure the halves fit together well. If there is a problem with the fit, look for obstructions such as glue bumps or wood slivers inside the wings where the joiners fit. Make any adjustments necessary to get a good fit.

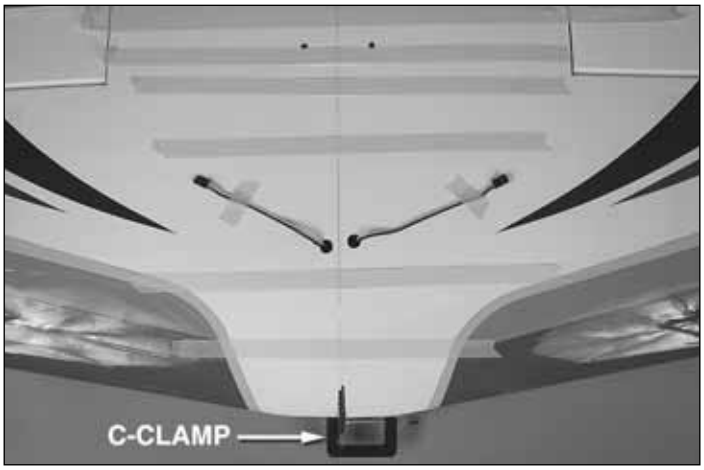
❑ 2. Place a sheet of wax paper on your workbench and gather all the items required for joining the wings, which are 30-minute epoxy, a mixing cup, an epoxy mixing stick, an epoxy brush, paper towels and denatured alcohol for epoxy clean up. **Caution:** Do not use 5-minute epoxy for joining the wing halves. It will not provide enough working time.

Read steps 3 through 5 all the way through before proceeding. It is important to use the proper technique for joining the wing halves to ensure a strong wing.



❑ 3. Separate the wings and take out the joiner. Mix approximately 3/4 oz. [20cc] of 30-minute epoxy. Pour a generous amount into the wings where the joiner goes. Working quickly, use piece of wire or a dowel to distribute the epoxy all the way around inside the wings.

❑ 4. Use an epoxy brush to coat the root ribs of both wings and one half of the joiner all the way around. **Slowly** insert the epoxy-coated half of the joiner. Wipe away excess epoxy as it is forced out. **Note:** There should be no air pockets inside the wing where the joiner fits—the cavity should be filled with epoxy. Proceed immediately to the next step.

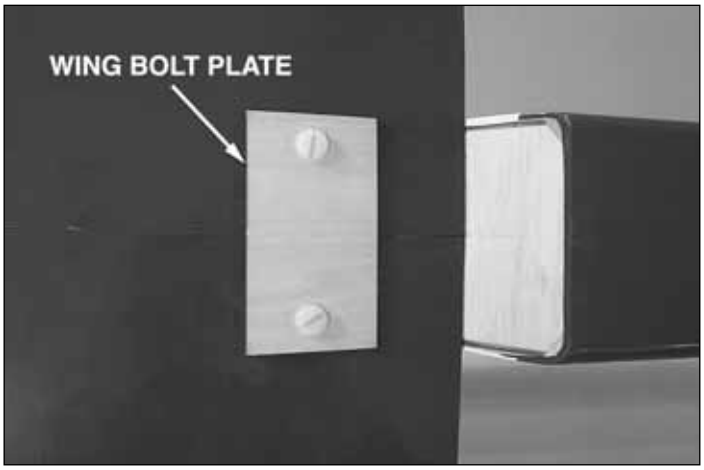


❑ 5. Coat the protruding end of the joiner all the way around with epoxy. Join the other wing, **slowly** pressing the two halves together, allowing excess epoxy to drip out as you go. When the wings come together, wipe away excess epoxy that is squeezed out, then use a C-clamp and several strips of masking tape on both the top and bottom of the wing to tightly hold the two halves together. If epoxy continues to work out of the wing under the tape, remove one strip at a time and wipe off the epoxy, then replace with another strip of tape. Do not disturb the wing until the epoxy has hardened. **IMPORTANT!** Be certain the leading and trailing edges of both wing halves align with each other where they join.

❑ 6. After the epoxy has hardened, slowly and carefully pull away the masking tape. If any of the covering loosened, iron it back down with a covering iron with a covering sock on medium heat.

ASSEMBLE THE FUSELAGE

Add the Belly Pan



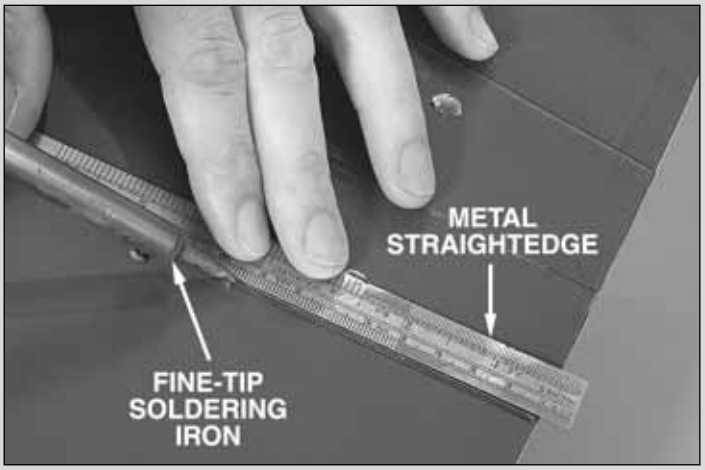
❑ 1. Bolt the wing to the fuselage with two 1/4-20 x 2" [50 mm] nylon wing bolts and the plywood wing bolt plate.

❑ 2. Place the belly pan into position. Use a fine-point felt-tip pen to mark the outline of the belly pan onto the wing.

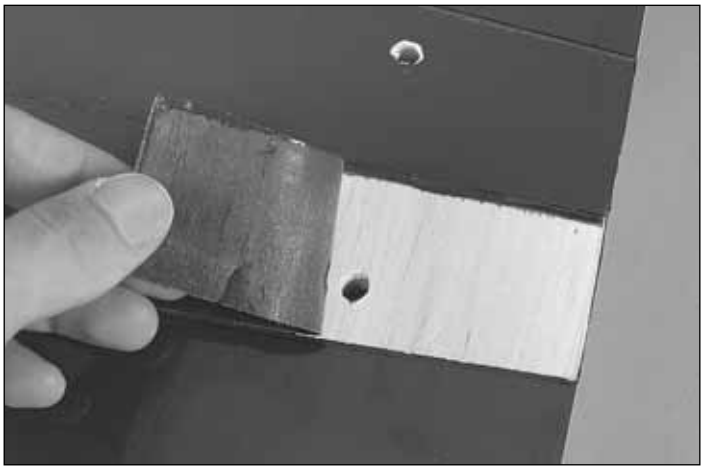
❑ 3. Use the method in the **Expert Tip** that follows, or a sharp hobby knife, to **carefully** cut the covering from the bottom of the wing 1/16" [2 mm] inside the lines you marked. **Caution:** Using the soldering iron technique to cut the covering as shown in the **Expert Tip** is recommended, but if you have to use a hobby knife be certain to use a sharp blade so it will easily cut the covering without having to apply too much pressure. Be certain not to cut into the wood or the wing will be weakened.

EXPERT TIP

HOW TO CUT COVERING FROM BALSA.

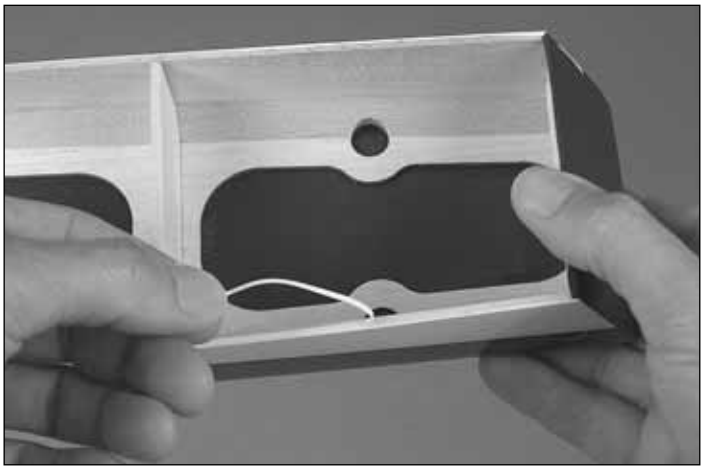


To avoid cutting into the balsa, use a soldering iron instead of a hobby knife to cut the covering. The tip of the soldering iron doesn't have to be sharp, but a fine tip does work best. Allow the iron to heat fully. Use a straightedge to guide the soldering iron at a rate that will just melt the covering and not burn into the wood. The hotter the soldering iron, the faster it must travel to melt a fine cut.

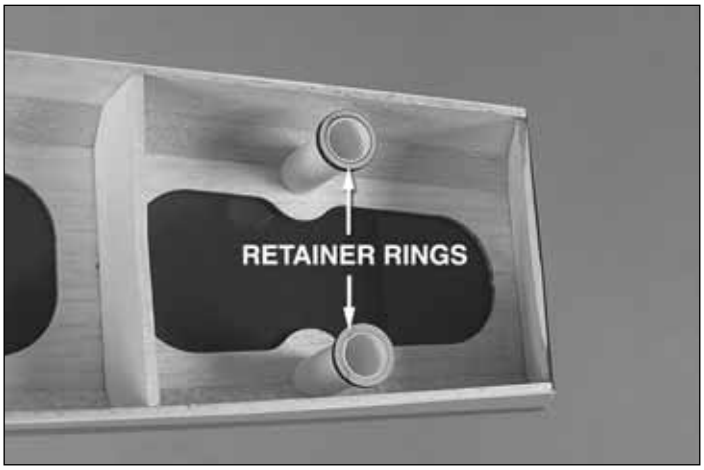


❑ 4. Peel off the covering from the bottom of the wing. Use one of your paper towel squares dampened with denatured alcohol to remove any ink.

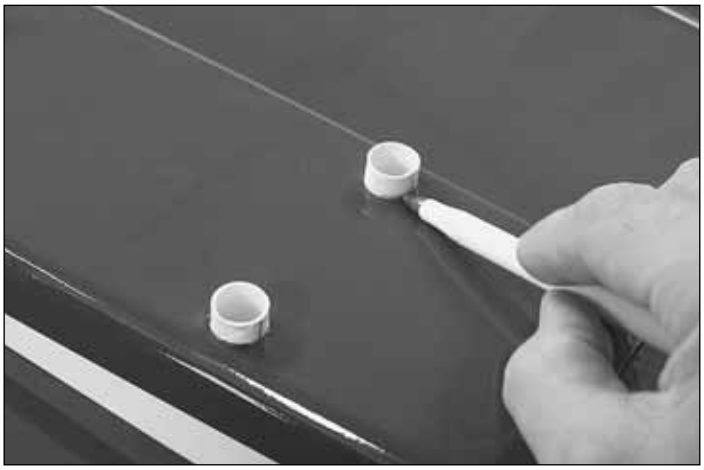
❑ 5. Bolt the wing back onto the fuselage with the wing bolt plate. Only this time, use epoxy or thick CA to glue the wing bolt plate to the bottom of the wing—be careful not to get any glue on the wing bolts.



❑ 6. Use a single-edge razor blade or a hobby knife to cut off any covering wrapped around the edges of the belly pan. Also cut the covering from the holes in the bottom of the belly pan where the wing bolts go through.



❑ 7. Cut two 2" [50 mm] pieces from the 1/2" x 8" [13 x 200 mm] paper tube. Glue the plywood **tube retainer rings** to the bottom of the paper tubes. Then, insert the tubes up through the holes in the belly pan, but do not glue them in.



❑ 8. Position the belly pan assembly on the wing. Make sure the paper tubes are fit over the heads of the wing bolts, and then press down on the paper tubes. Use a fine-point ballpoint pen to mark the bottom of the belly pan all the way around both paper tubes.

❑ 9. Remove the assembly and take out the paper tubes. Then cut them off along the bottom edge of the lines you marked.

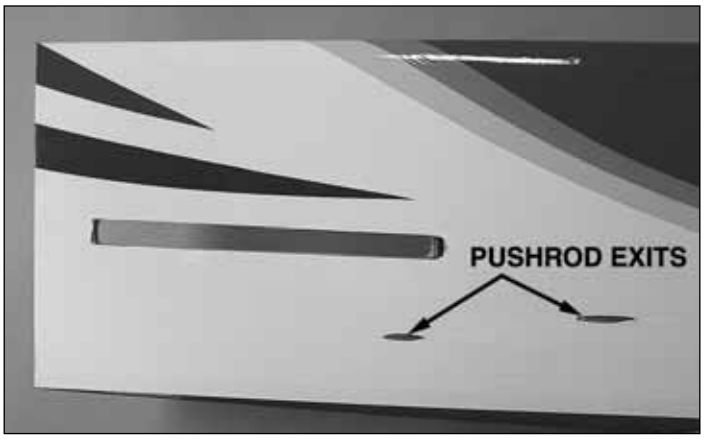
❑ 10. Reinsert the paper tubes into the belly pan and reposition the assembly on the wing. Position the tubes as necessary so the ends will be flush with the bottom of the belly pan. Make adjustments and trim where necessary. Remove the assembly and use medium CA or epoxy to glue the tubes to the belly pan from the inside.

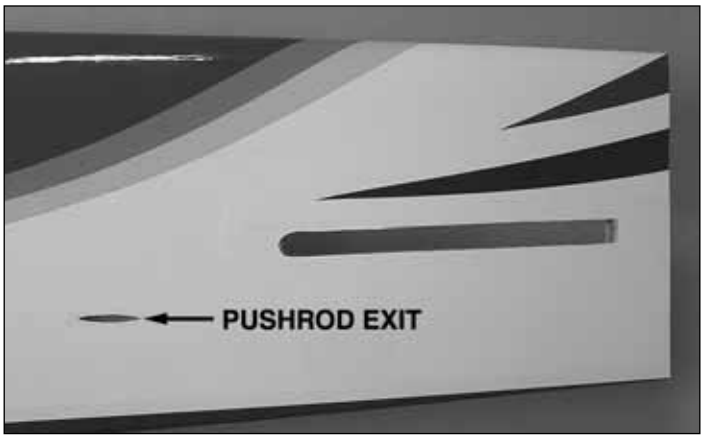
❑ 11. With the wing bolted to the fuselage and the model supported upside-down, use 30-minute epoxy mixed with microballoons to glue the belly pan and the paper tubes to the bottom of the wing—be careful not to inadvertently glue the assembly to the fuselage. Place weights on the belly pan to hold it down, wipe away excess epoxy and do not disturb until the epoxy has hardened.

Join the Stabilizer and Fin

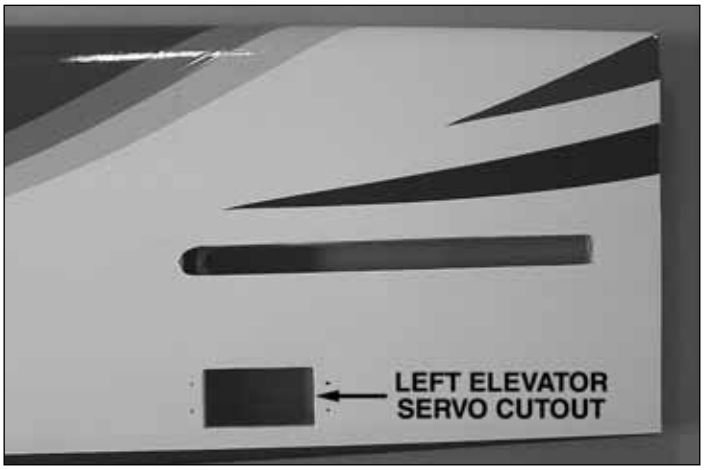
❑ 1. Cut the covering from both sides of the fuselage over the slots for the stabilizer. (The cutouts can be seen in following photos.)

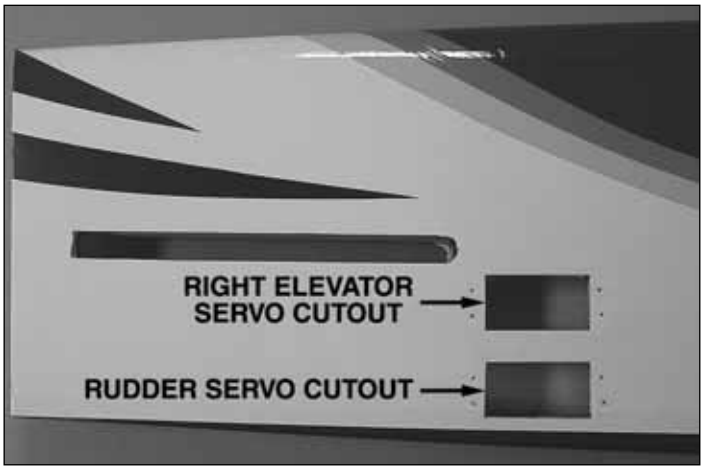
IF MOUNTING THE SERVOS OUTSIDE THE FUSELAGE, GO TO STEP 3.



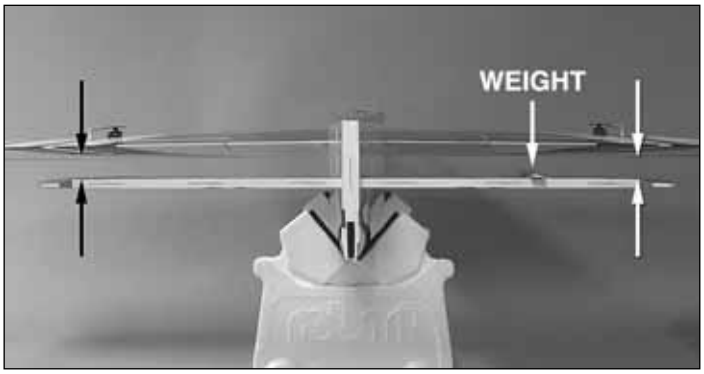


❑ 2. If mounting the servos inside the fuselage, cut the covering from the pushrod exits.

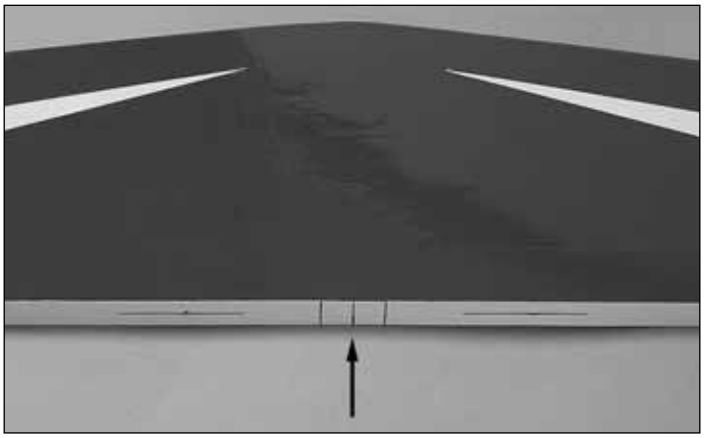




❏ 3. If mounting the servos *outside* the fuselage, the same as was done for the aileron servos, cut the covering 1/8" [3 mm] from the edges of the servo openings in the fuselage and iron the covering down inside. Temporarily mount the servos, drill 1/16" [1.6 mm] holes for the screws, install the screws, remove, and then harden the screw holes with thin CA. Do not reinstall the servos at this time.

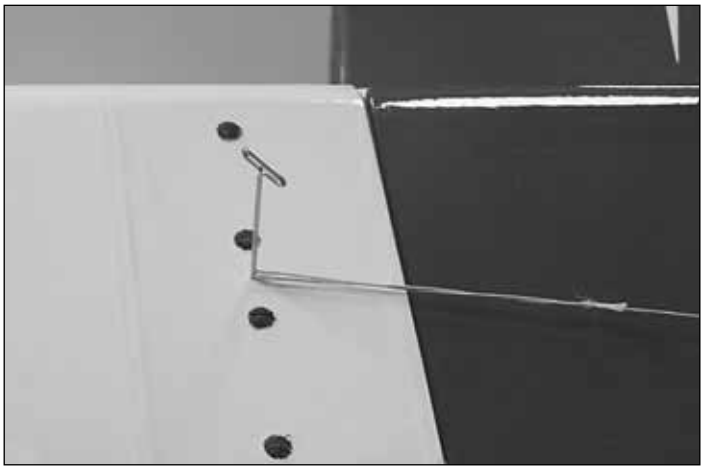


❏ 4. Temporarily slide the stabilizer into position in the fuselage. With the wing mounted, stand approximately ten feet [3 meters] behind the model and see if the stab aligns horizontally with the wing. If they do align go to the next step. If the stab and wing do not align, first try placing a few ounces of weight on the high side of the stab. If that doesn't do it, remove the stab from the fuselage and lightly sand the slots in the fuselage to get the stab to align with the wing. Reinsert the stab and check the alignment. If necessary, continue to make small adjustments until alignment is achieved.

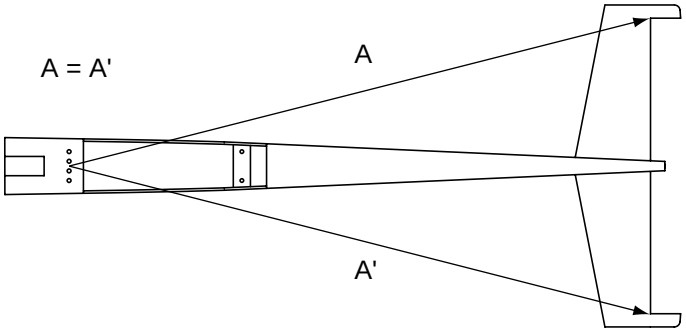


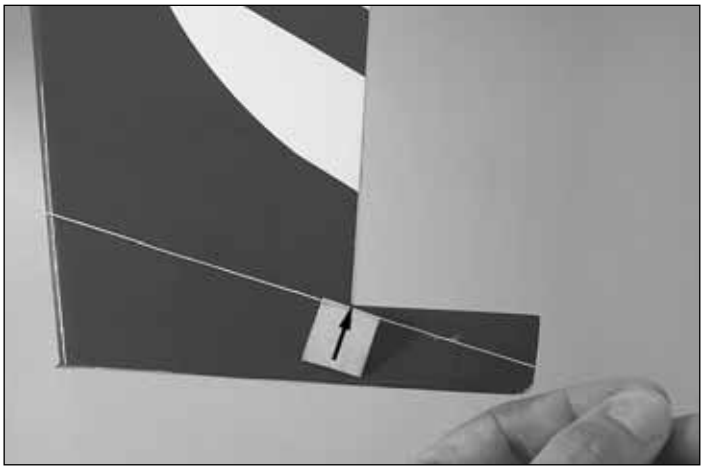
❏ 5. Remove the stabilizer from the fuselage. Taking accurate measurements, use a fine-point felt-tip pen to mark the **middle** of the stabilizer on the trailing edge. Again with accuracy, mark two more lines 7/16" [11 mm] on both sides of the centerline. Replace the stabilizer in the fuselage.

❏ 6. Using the lines you marked as an alignment cue, center the trailing edge of the stabilizer in the fuselage. Stick a T-pin through both sides of the trailing edge at the fuselage—this will temporarily lock the stab into place allowing the leading edge to pivot.

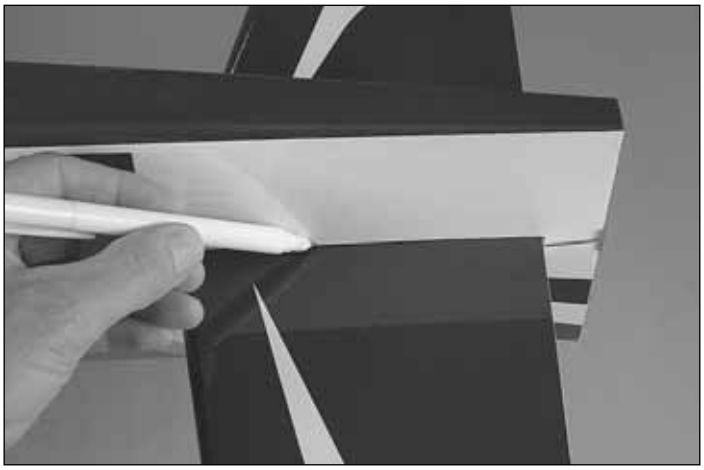


❏ 7. Stick another T-pin into the bottom of the fuselage centered between the holes for the main landing gear bolts. Tie a loop in an approximately 60" [150cm] piece of non-elastic string. Slip the loop in the string over this T-pin.



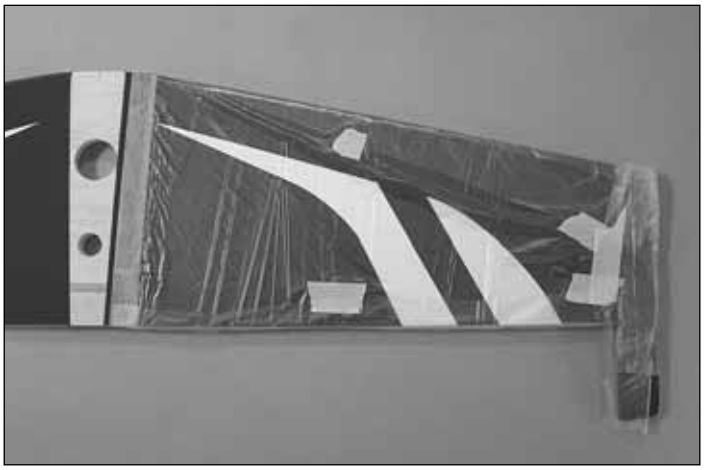


❑ 8. Fold a piece of masking tape over the string near the other end and draw an arrow on it. Slide the tape along the string and align the arrow with one end of the stab as shown. Swing the string over to the same position on the other end of the stab. Rotate the stab about the trailing edge and slide the tape along the string until the stab is centered and the arrow aligns with both ends, as shown in the sketch.



❑ 9. Use a fine-point felt-tip pen to mark the outline of the fuselage on the top and bottom of both sides of the stab.

❑ 10. The same as was done when mounting the belly pan to the bottom of the wing, use a heated soldering iron to cut the covering 1/16" [2 mm] inside the lines you marked, then peel the covering from the stab.



❑ 11. When gluing two parts together, one of the things that can be done to achieve the strongest bond possible is to apply glue to **both** parts being joined (as was done when joining the wing halves). And like the wing, this is important when gluing in the stabilizer—epoxy should be applied liberally in the stab slot in the fuselage and to the stab. But to keep the stab clean while sliding it in, wrap one half with a thin plastic bag or food wrap.

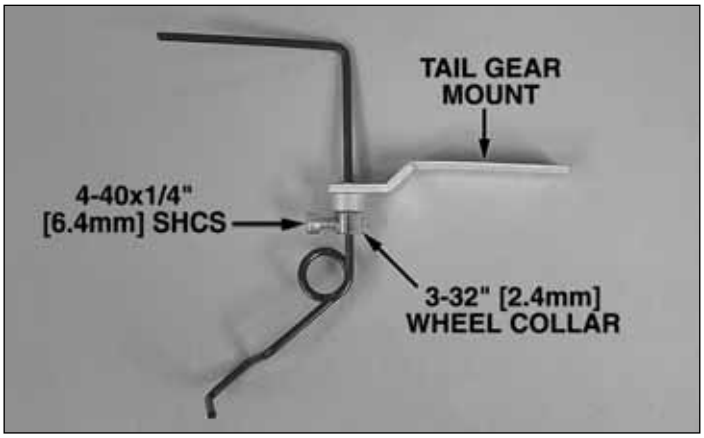
Finally! Time to glue in the stab…

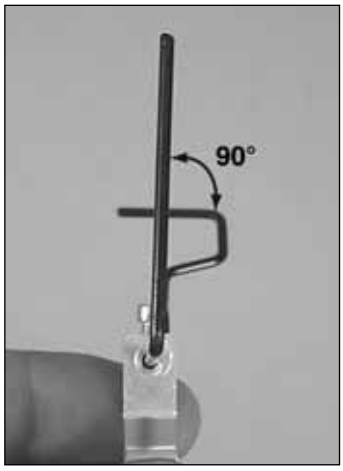
❑ 12. **Thoroughly** coat all joining areas of the stabilizer and fuselage with 30-minute epoxy. Then immediately slide the stab into position. Use more paper towel squares and denatured alcohol to wipe off excess epoxy. Take off any protective wrapping around the stab and continue to clean off epoxy. Reinsert the T-pins through the back of the stab on both sides of the fuselage and use the pin-and-string to permanently center the stab. Position any weight used to align the stab with the wing. Do not disturb the model until the epoxy has hardened.

❑ 13. The same as was done for the stabilizer, slide the fin into position, mark the outline of the fuselage on both sides, cut and peel off the covering, then use 30-minute epoxy to glue the fin into position.

❑ 14. After all the epoxy has hardened, join the elevators to the stab with the CA hinges and thin CA. Don't forget to use T-pins to keep the hinges centered.

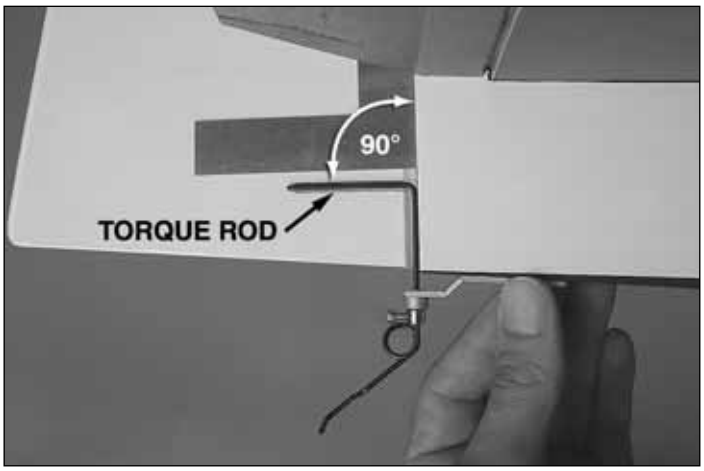
Before joining the rudder to the fin, the tail gear has to be put together…





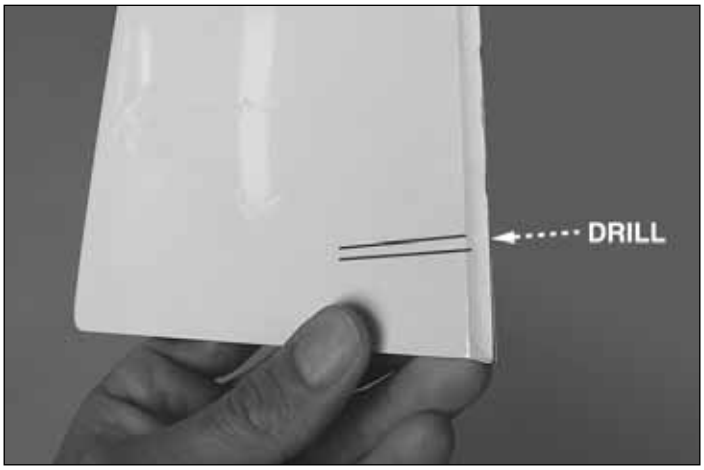
❑ 15. Slide a 3/32" [2.4 mm] wheel collar onto the tail gear wire and tighten it down with a drop of threadlocker and a 4-40 x 1/4" [6.4 mm] SHCS (socket-head cap screw). Install the tail gear mount as shown, and then use pliers to bend the wire. Viewed from above, the bend should be 90-degrees to the axle part of the wire where the wheel goes. If the bend has to be adjusted, hold the wire with pliers at the coil and bend the wire as necessary to achieve the 90-degree angle.

Refer to this photo for the next two steps.

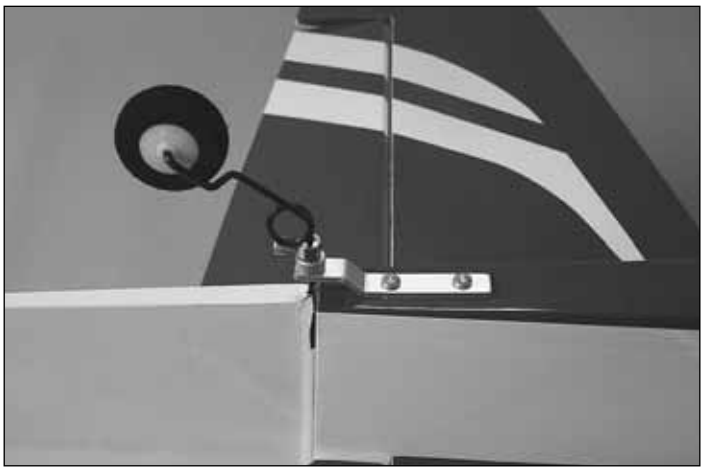


❑ 16. **Temporarily** join the rudder to the fin and fuselage with three hinges. Lay the tail gear wire on the fuselage as shown. Make sure the "torque rod" part of the wire is perpendicular to the leading edge of the rudder. Bend the wire as necessary.

❑ 17. Use a fine-point felt-tip pen to mark the rudder on both sides of the wire.



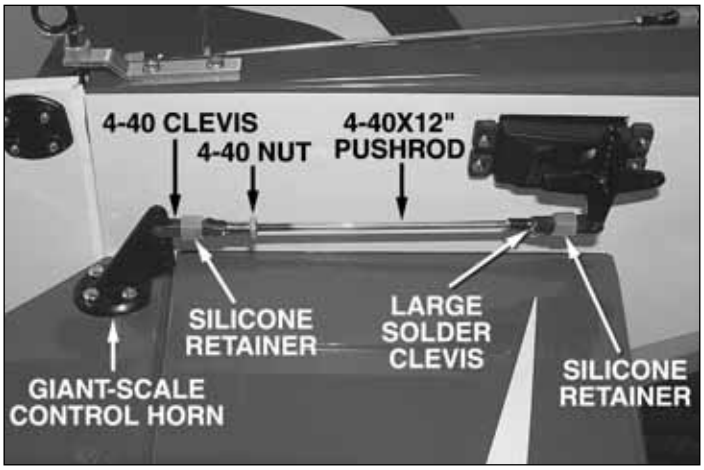
❑ 18. Set the tail gear wire aside and take out the rudder. Using the marks on the rudder for alignment, drill a 3/32" [2.4 mm] hole into the rudder for the torque rod part of the wire. Use a 3/32" [2.4 mm] brass tube sharpened on the end or a hobby knife to cut a groove in the leading edge of the rudder to accommodate the tail gear wire.



❑ 19. Use epoxy to glue the tail gear wire into the rudder. Then before the epoxy hardens, join the rudder to the fin and fuselage with the hinges. Permanently glue in the hinges with thin CA. Mount the tail gear bracket by drilling two 3/32" [2.4 mm] holes for two #4 x 3/8" [9.5 mm] screws. Temporarily mount the bracket with the screws, remove the screws and harden the holes with thin CA. After the holes have hardened, mount the bracket.

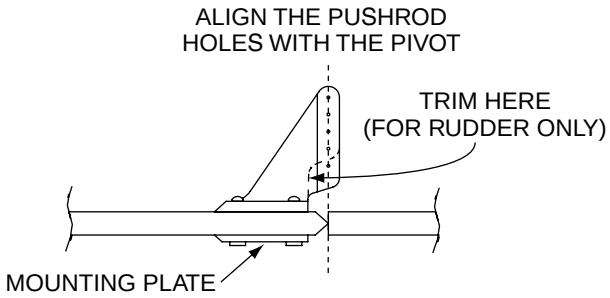
Mount the Servos and Hook Up the Controls

EXTERNALLY MOUNTED SERVOS



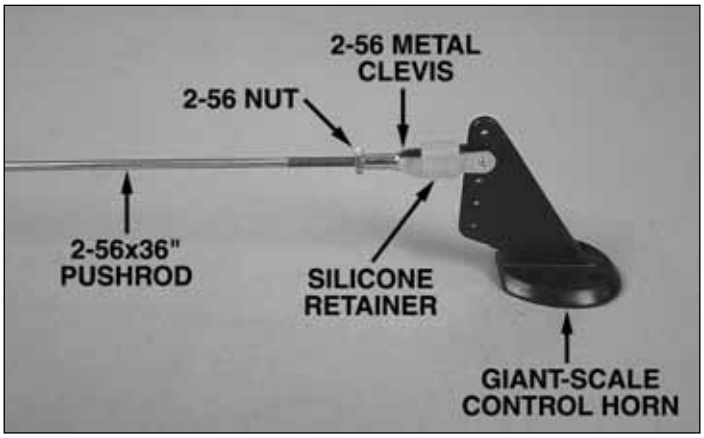
❑ 1. Connect 24" [610 mm] servo extensions to the rudder servo and both elevator servos. Secure the connections with the heat shrink tubing provided with this kit.

❑ 2. Guide the servo wires through the fuselage up into the radio compartment and mount the servos using the screws that came with them (the holes should have been previously drilled and hardened).



❑ 3. Make the pushrods and connect the servos to the control surfaces using the hardware shown in the photos. When mounting the horns, locate the pushrod holes over the pivot point and use 4-40 x 5/8" [16 mm] Phillips screws and the mounting plates to mount the horns. Drill 1/8" [3.2 mm] holes through the rodder for the screws. **Note:** Trim the rudder horn as shown so it will not interfere with the fuselage.

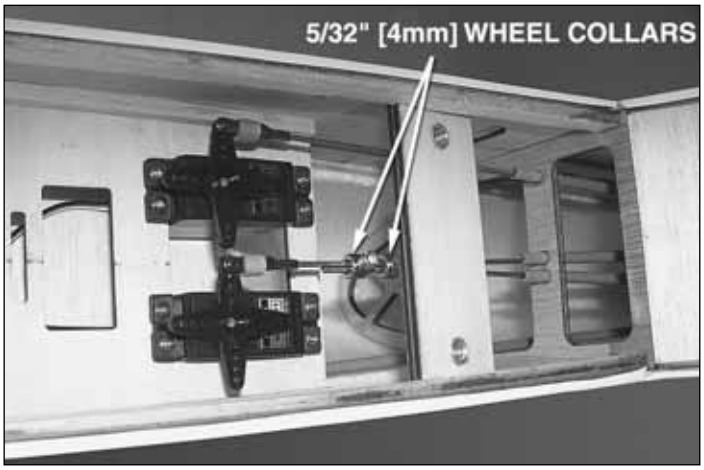
INTERNALLY MOUNTED SERVOS

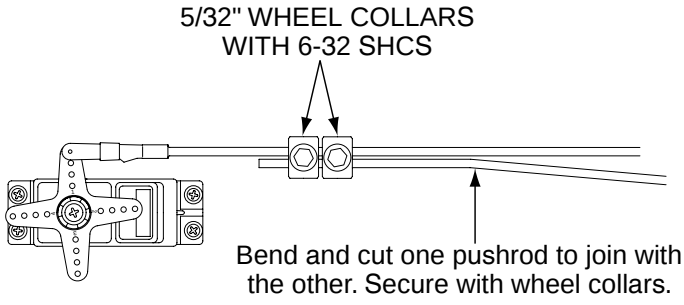


❑ 1. Make three identical pushrod assemblies like the one shown in the photo. (Turn the clevises approximately fifteen full turns onto the pushrods.)

❑ 2. Guide the pushrods through the guide tubes in the back of the fuselage and mount the horns with 4-40 x 5/8" [16 mm] Phillips screws and the back plates on the other side. Use a 1/8" [3.2 mm] drill for the screws.

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





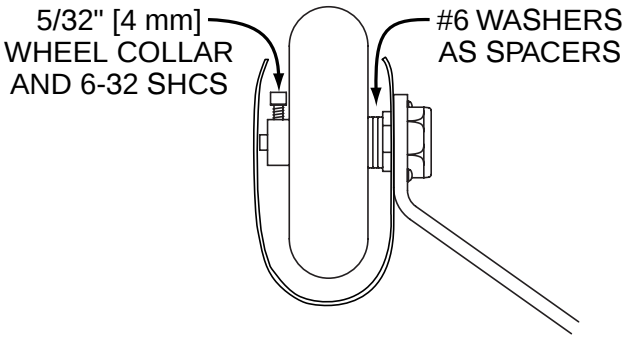
❏ 3. Place the elevator and rudder servos in the servo tray, but do not screw them in yet. Bend and cut one of the elevator pushrods to join up with the other elevator pushrod as shown. With both elevators centered, connect the elevator pushrods with two 5/32" [4 mm] wheel collars and 6-32 x 1/4" [6 mm] SHCS and a few drops of threadlocker on the threads. **Note:** Do not cut off the unused servo arms until setting up the radio later.

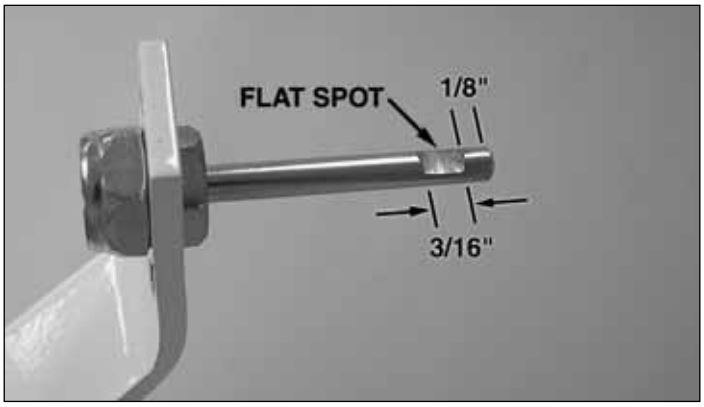
❏ 4. Cut the pushrods to the correct length, and then solder a small, metal clevis onto the end of each pushrod. (This will be easier to do if the pushrods are disconnected from the control horns on the elevators and rudder.)

❏ 5. Reconnect the pushrods to the control horns and connect them to the servo arms. Mount the servos in the servo trays by drilling 1/16" [1.6 mm] holes for the screws and using the screws that came with the servos. Remove the screws, harden the holes with thin CA, allow to harden, and then mount the servos again with the screws.

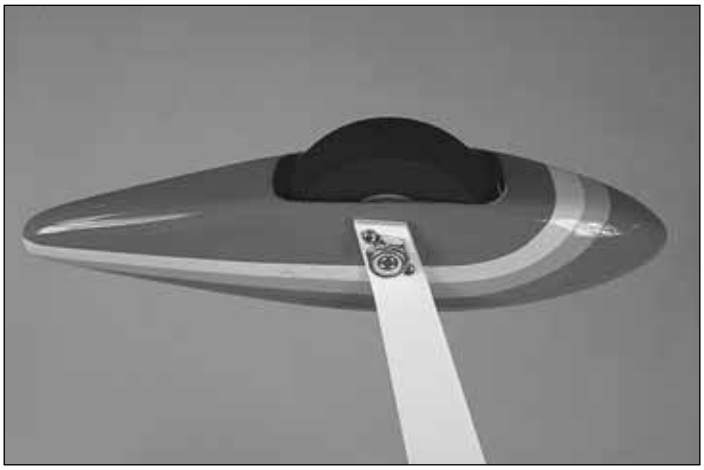
Mount the Main Landing Gear

Refer to this sketch while mounting the wheels.





❏ 1. Use a 1/2" and a 7/16" wrench to bolt both axles to both main landing gears. Use a reinforced cutoff wheel or metal file to file an approximately 3/16" [5 mm] long flat spot approximately 1/8" [3 mm] from the end of both axles.

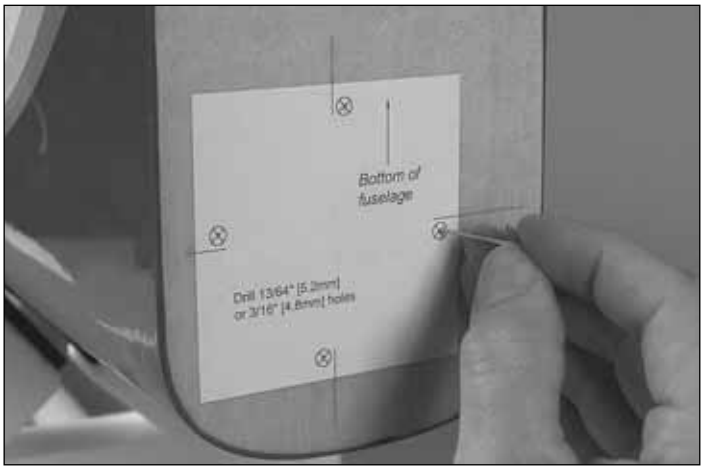


❏ 2. With #6 washers to center the wheel in the pant, use two 2-56 x 3/8" [10 mm] screws and #2 lock washers to mount the pants to the landing gear with the wheel and a 5/32" [4 mm] wheel collar. Secure the collar to the axle with a 6-32 x 1/4" [6 mm] SHCS (socket-head cap screw) and a drop of threadlocker on the threads.

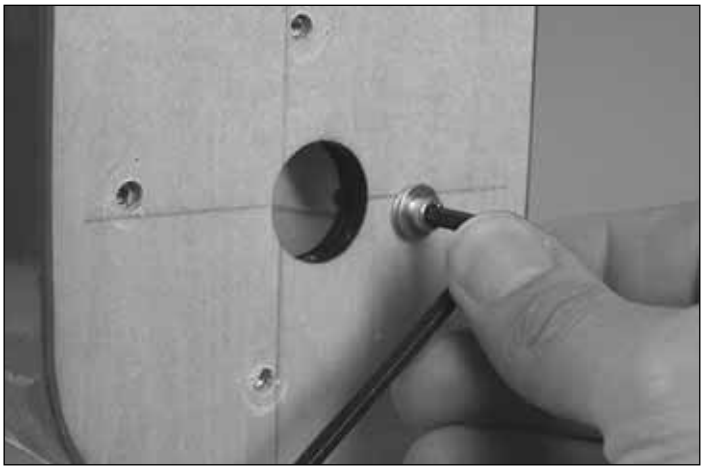
❏ 3. Mount the landing gear to the bottom of the fuselage with four 8-32 x 3/4" [19 mm] SHCS, #4 lock washers and #4 flat washers.

Mount the Engine

❏ 1. Determine which **Engine Mounting Template** from the back of the manual you will use. *Angled* templates are provided for the O.S. 1.20 Surpass and the O.S. .91FX. Mounting the engine at an angle will locate the exhaust in the exhaust cut out on the bottom of the fuselage—partially avoiding the deposit of oily exhaust residue all over the model. If standard side or inverted mounting is preferred, use the regular template.

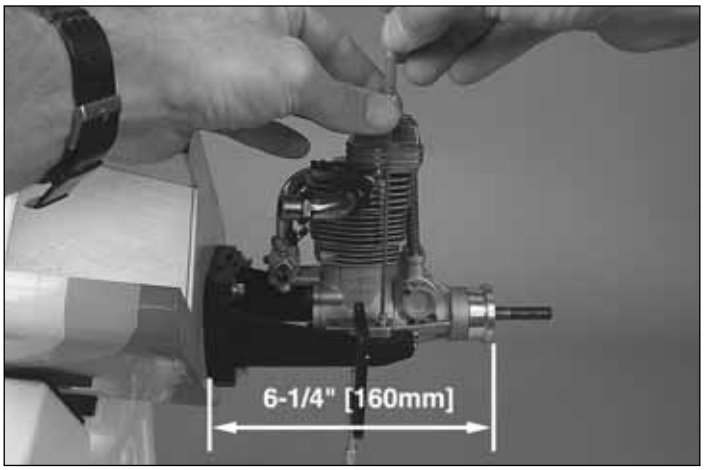


❏ 2. Cut out whichever template you have decided to use. Temporarily attach the template to the firewall with tape or repositionable spray adhesive so the lines on the template align with the cross marks on the firewall. Use a large T-pin or a sharpened piece of wire to transfer the cross marks in the template to the firewall. Before drilling the holes in Step 3, check that the engine and muffler you will be using will fit on the plane.



❏ 3. Remove the template. Then drill 1/16" [1.6 mm] pilot holes through the firewall at the marks. Enlarge the holes with a 13/64" [5.2 mm] or 3/16" [4.8 mm] drill. Put a few dabs of epoxy on the front of four 8-32 blind nuts where they will go into the firewall. Use an 8-32 x 1" [25 mm] SHCS with two or three #8 washers to draw the blind nuts into the back of the firewall. Wipe away any excess epoxy.

❏ 4. Mount the engine mount to the firewall with four 8-32 x 1-1/4" [32 mm] SHCS, four #4 lock washers and four #4 flat washers, but do not tighten the screws yet.

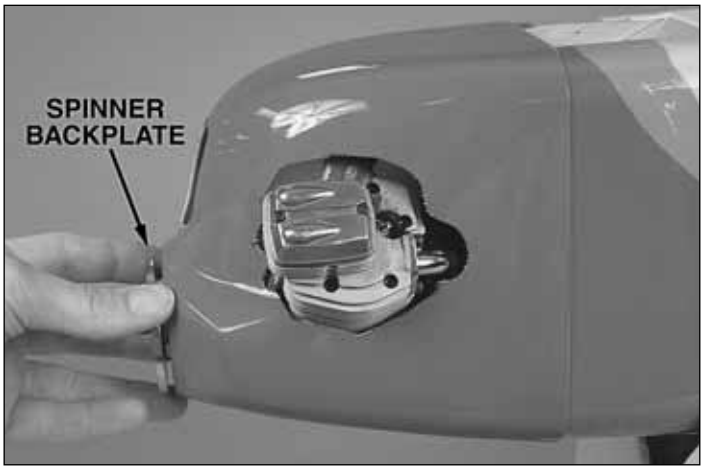


❏ 5. Place your engine on the mount, adjust the mount to fit your engine, and tighten the screws. Position the engine on the mount so the back plate of the spinner will be 6-1/4" [160 mm] from the firewall. Use small C-clamps or just hold the engine down while marking the engine mounting bolt holes in the mount—a Great Planes Dead Center™ Engine Mount Hole Locator (GPMR8130) works the best.

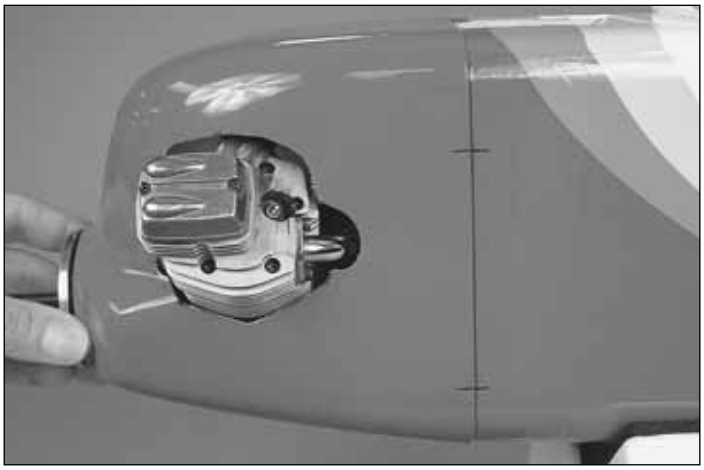
❏ 6. Remove the engine from the mount. If you have access to a drill press, remove the mount from the firewall and drill #29 holes at the marks you made. If you don't have a drill press, just drill the holes in the mount while it is on the firewall. Use an 8-32 tap to tap threads in the holes. Mount the engine to the mount with four 8-32 x 1" [25 mm] SHCS and #4 lock washers.

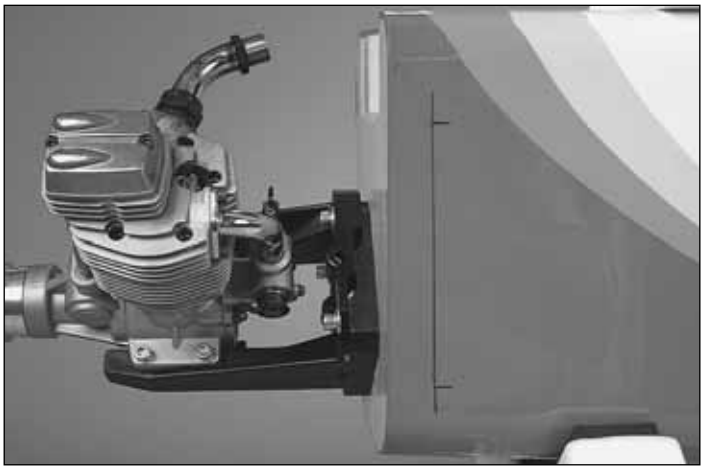
Mount the Cowl

These are the cutting bits recommended for cutting the holes in the cowl.

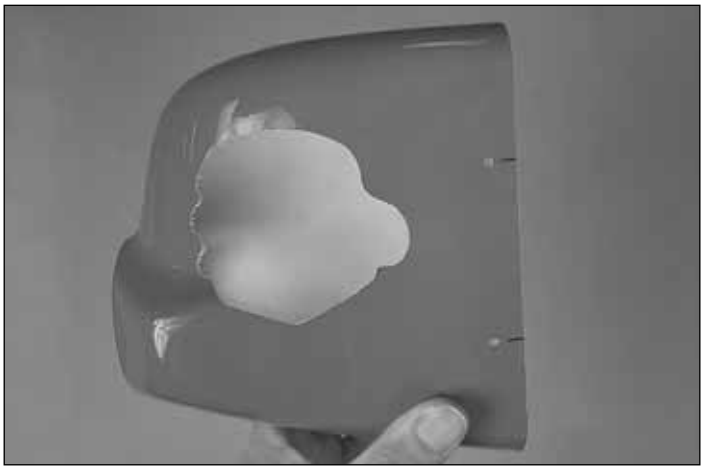


❏ 1. Estimate the size, shape and location of the engine cutout in the cowl. Use a fine-point felt-tip marker to draw a rough shape of the cutout directly on the cowl. Use a carbide cutter or similar high-speed rotary cutting tool to cut the hole—start by making the hole small. Test fit the cowl to the fuselage and enlarge the hole where necessary to get it to fit. Use the backplate of the spinner to accurately position the cowl so you will know where the cutout should be. **Hint:** Until you have finalized the size and shape of the engine cutout, it may be easier to remove and install the cowl if the valve cover (for four-strokes) or engine head (for two-strokes) is temporarily removed.





❏ 2. With the cowl in position, use a fine-point felt-tip pen to mark both sides of the aft edge of the cowl onto the fuselage. Also mark four locations for the cowl mounting screws on both the cowl and the fuselage. Remove the cowl.

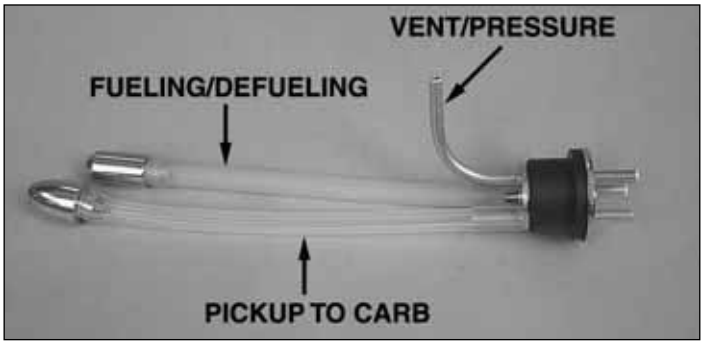


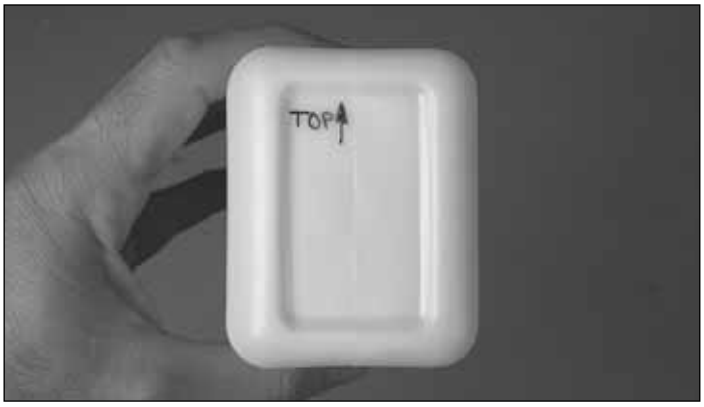
❏ 3. Using the lines on the sides of the fuselage as a reference, drill 3/32" [2.4 mm] holes in the cowl at the four marks so that the holes will be 3/16" [5 mm] aft of the firewall—this will center the screws in the edges of the firewall.

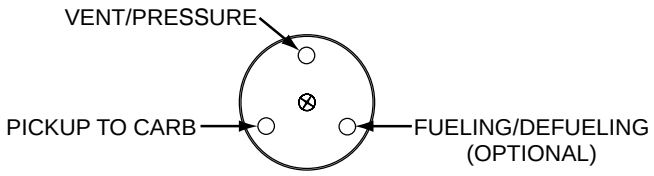
❏ 4. Reposition the cowl onto the fuselage and “center it up” using the backplate of the spinner. Using tape or an assistant to hold the cowl in position, drill 3/32" [2.4 mm] holes through the holes you already drilled in the cowl into the sides of the firewall.

❏ 5. Remove the cowl. Enlarge the holes **in the cowl only** with a 1/8" [3.2 mm] drill. Then, mount the cowl to the fuselage with four #4 x 5/8" [16 mm] screws, #4 lock washers and #4 flat washers. As you have been doing all along, remove the screws, harden the holes with a few drops of thin CA and allow to harden.

Now is a good time to install the fuel tank…







FRONT VIEW

❏ 6. While we've got the cowl off, assemble the fuel tank. Cut the aluminum tubes and the fuel lines that go into the tank to the correct length and fit them into the stopper as shown—later, you can refer to the sketch so you will know how to connect the lines outside the tank. Also write "TOP" on the back of the tank near one edge so you will know how to install the stopper and mount the tank into the fuselage. An optional, second clunk is provided should you decide to use a third line for fueling/defueling. Outside the tank this line will have to be closed off during flight with the included aluminum fuel line plug. When the tank is assembled, be certain the clunk on the fuel lines inside cannot contact the back of the tank—otherwise they may become stuck.

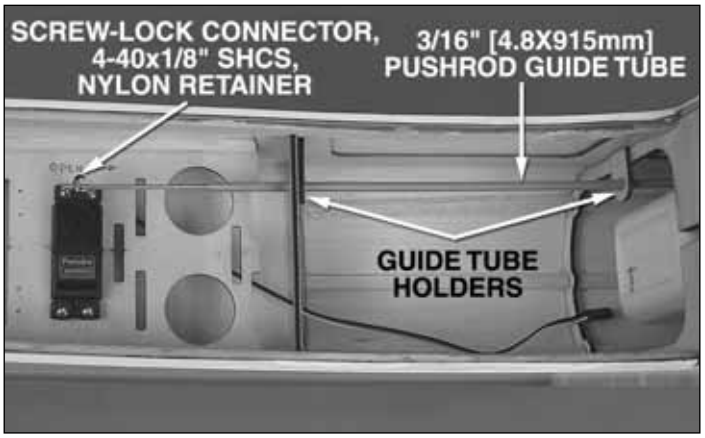
❏ 7. Hook a rubber band or two around the plywood tabs in the fuel tank former, then stretch the rubber bands toward the top of the fuselage and slide the tank into position. The neck of the tank should protrude through the hole in the firewall.

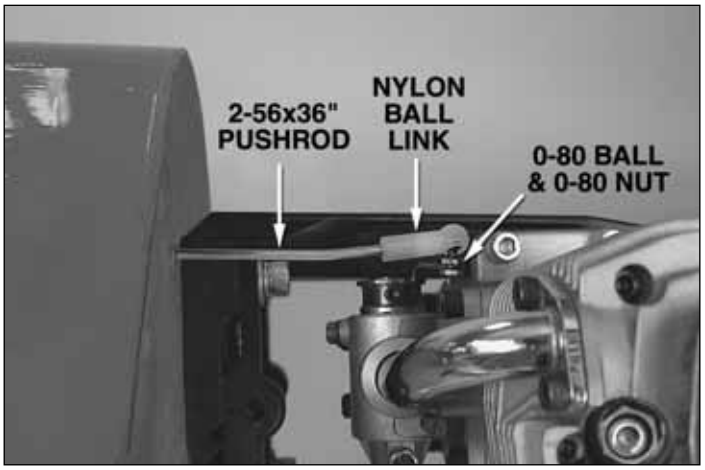
❏ 8. Cut any other holes necessary in the cowl for the glow plug igniter, muffler, needle valve, low-end needle, etc.

Hook Up the Throttle

❏ 1. Use a wire sharpened on the end or something similar to mark the firewall where the throttle pushrod should protrude to align with the carburetor arm.

❏ 2. If necessary, remove the engine. Then, **using care not to drill into the fuel tank**, drill a 3/16" [4.8 mm] hole through the firewall.

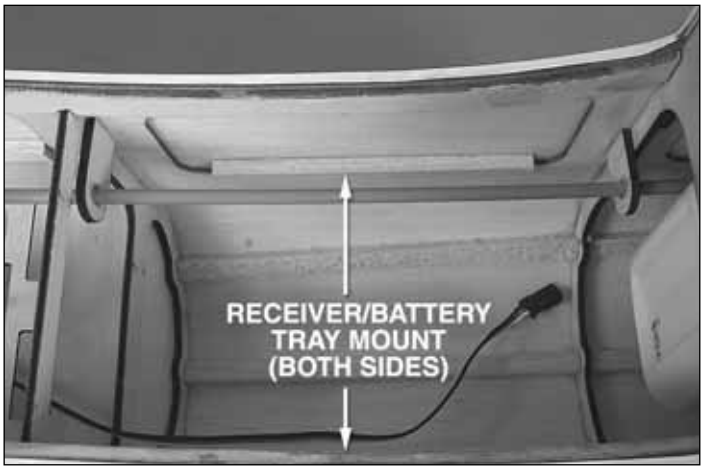




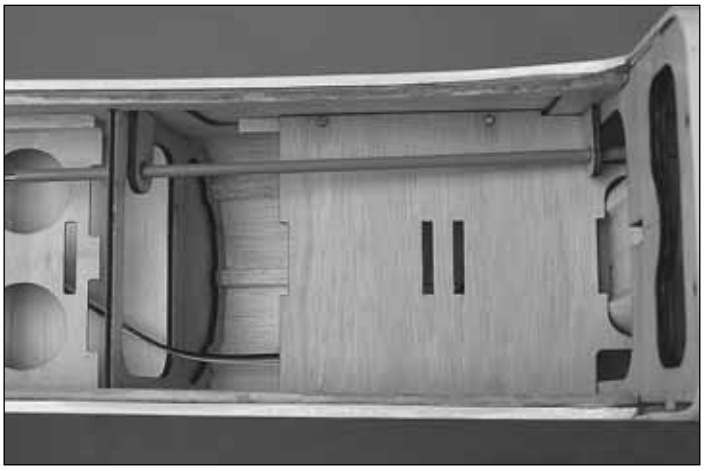
❏ 3. Re-mount the engine, and then hook up the throttle using the hardware shown. Fit, but **do not glue** the plywood **guide tube holders** into position where shown.

FINAL ASSEMBLY

Finish Radio Installation



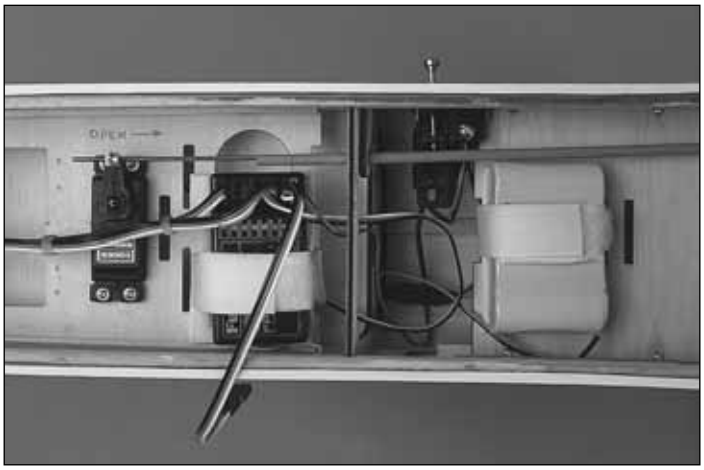
❑ 1. Glue both 3/16" x 3/16" x 4" [5 x 5 x 100 mm] hardwood **receiver/battery tray mounts** into position where shown—be certain the forward throttle guide tube holder will not interfere with the plywood **receiver/battery tray**.



❑ 2. Position the plywood receiver battery tray on the tray mounts you just glued in. Drill 1/16" [1.6 mm] holes through the tray and the rails. Remove the tray, enlarge the holes in the tray only with a 3/32" [2.4 mm] drill, and then mount the tray to the rails with four #2 x 3/8" [10 mm] screws. Remove the screws and the tray, harden the screw holes with thin CA, allow to harden, then mount the tray.

❑ 3. Now you may glue the guide tube holders into position.

Refer to the following photo while completing the radio installation.



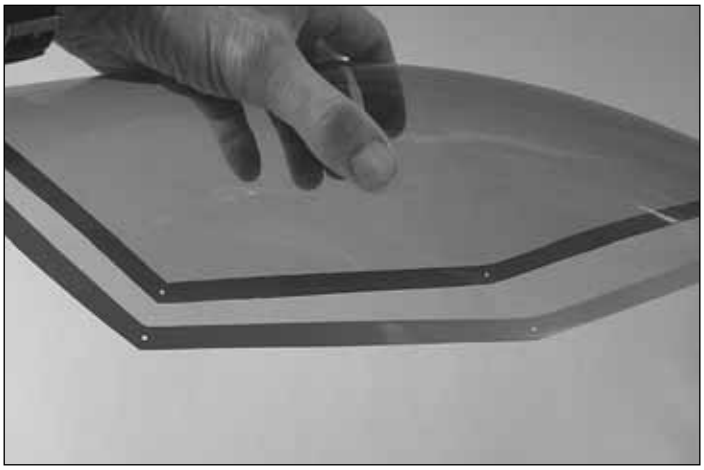
❑ 4. Mount the receiver and battery pack to the forward or aft radio trays with 1/4" [6 mm] R/C foam (not included) and the Velcro strips.

❑ 5. Mount the on/off switch in a location that will be easy to reach from outside the model and will not get coated with engine exhaust.

❑ 6. Guide the receiver antenna through the antenna tube down the fuselage.

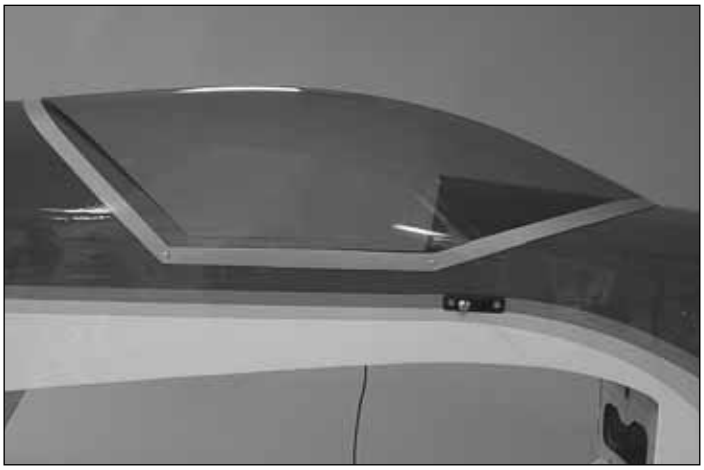
Mount the Pilot and Canopy

❑ 1. Trim the base of the pilot so he will fit under the canopy when both are in poistion on the fuselage. The same as was done for the covering over the stabilizer and belly pan, mark, then cut and remove the covering from the cockpit floor for the pilot. **Securely** glue the pilot into position with CA.



❑ 2. Drill 3/32" [2.4 mm] holes through the canopy at the four locations shown.

❑ 3. Place the canopy on the fuselage. Using the holes in the canopy as a guide, drill 1/16" [1.6 mm] holes into the fuselage.



❏ 4. Mount the canopy to the fuselage with four #2 x 3/8" [9.5 mm] button-head screws. Remove the screws and canopy, harden the holes with thin CA, allow to harden, and then mount the canopy.

Apply the Decals

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

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

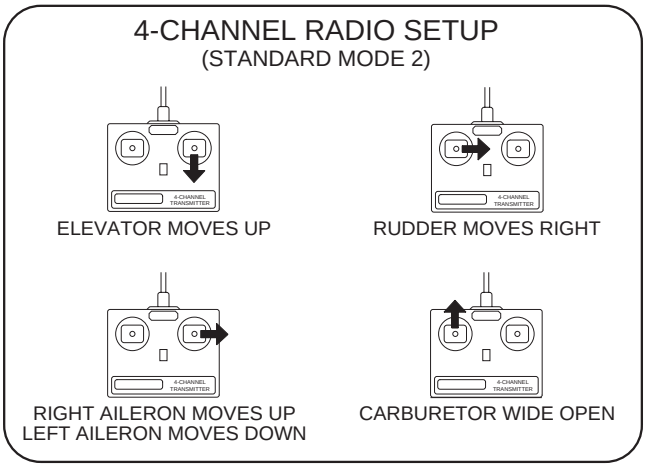
3. Position decal on the model where desired. Holding the decal down, use a paper towel to wipe most of the water away.

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

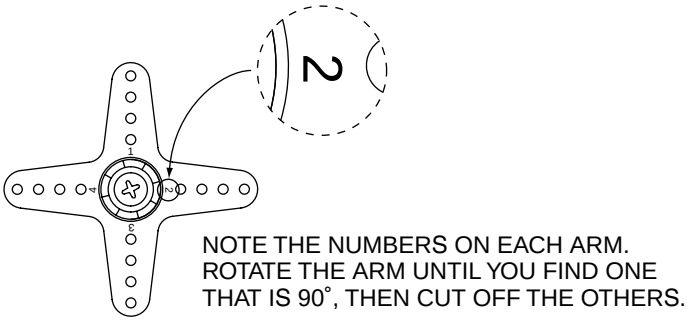
GET THE MODEL READY TO FLY

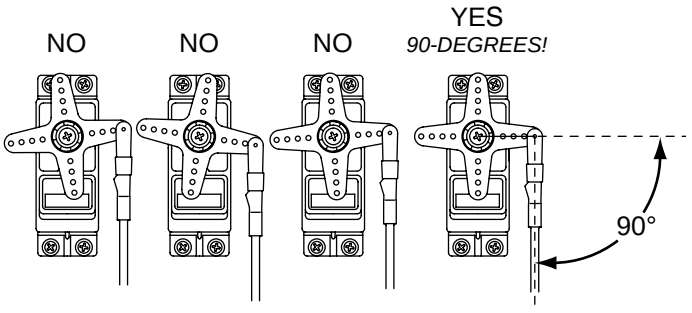
Check the Control Directions and Center the Servos

❏ 1. With the radio system connected and operating, turn on the transmitter and receiver.



❏ 2. Make certain that the control surfaces and the carburetor respond in the correct direction. If necessary, use the servo reversing to reverse any servos that are going the wrong way.





❏ 3. Center all the trims on the transmitter. Starting with the **rudder** servo and with the radio on, test-fit the four-arm servo arm in one of the four positions until you find the one that is 90-degrees. Cut off the remaining arms. Repeat for the rest of the servos.

Set the Control Throws

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

These are the recommended control surface throws:

	High Rate	Low Rate
ELEVATOR:	9/16" [14 mm] up	3/8" [10 mm] up
	9/16" [14 mm] down	3/8" [10 mm] down
RUDDER:	3" [76 mm] right	1-3/4" [44 mm] right
	3" [76 mm] left	1-3/4" [44 mm] left
AILERONS:	7/8" [22 mm] up	1/2" [13 mm] up
	7/8" [22 mm] down	1/2" [13 mm] down

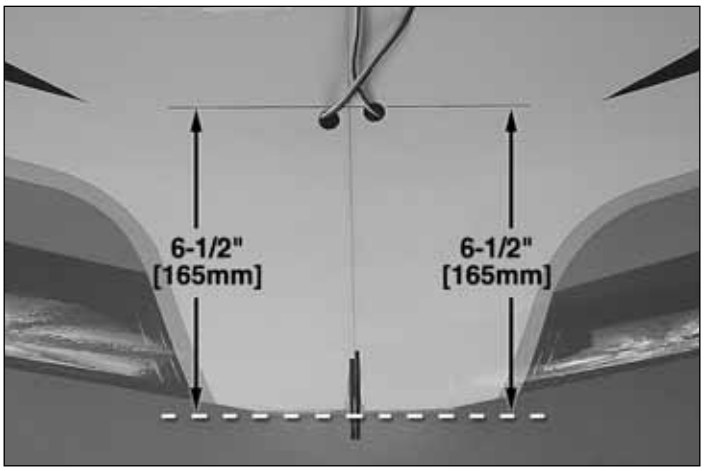
NOTE: The throws are measured at the **widest part** of the elevators, rudder and ailerons.

IMPORTANT: The Venus II 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 Venus II 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, cowl, propeller, spinner and all components of the radio system.



❏ 1. If you will be using a Great Planes C.G. Machine to balance the model, mount the wing to the fuselage and proceed to the next step. If you will not be using a C.G. Machine, use a fine-point felt-tip pen to accurately mark the C.G. on the top of the wing 6-1/2" [165 mm] back from the flat part of leading edge at the middle. Lay a piece of narrow (1/8" [2 mm]) tape over the line so you will be able to feel it with your fingers when lifting the model to check the C.G.

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" [13 mm] forward or 1/2" [13 mm] back to change the flying characteristics. Moving the C.G. forward may improve the smoothness and stability, but the model will then be less aerobatic and may require more speed for takeoff and make it more difficult to slow for landing. Moving the C.G. aft makes the model more maneuverable, but could also cause it to become too difficult to control. In any case, **start at the recommended balance point** and do not at any time balance the model outside the specified range.

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

❏ 3. If the tail drops, the model is "tail heavy" and weight must be added to the nose to balance. If the nose drops, the model is "nose heavy" and 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 still required and you are using a glow engine, nose weight may be easily added by using a "spinner weight" (GPMQ4645 for the 1 oz. [28g] weight, or GPMQ4646 for the 2 oz. [57g] weight). If spinner weight cannot be used or is not enough, use Great Planes (GPMQ4485) "stick-on" lead. To find out how much weight is needed, begin by placing incrementally increasing amounts of weight on the fuselage where needed until the model balances. Once you have determined the amount of weight required, it can be permanently attached. A good place to add stick-on nose weight is to the firewall or inside the fuel tank compartment as close to the firewall as possible.

Note: If attaching weight to the firewall, 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. Turn the model upright and set it on your workbench. 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 fin. Do this several times.

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

PREFLIGHT

Identify Your Model

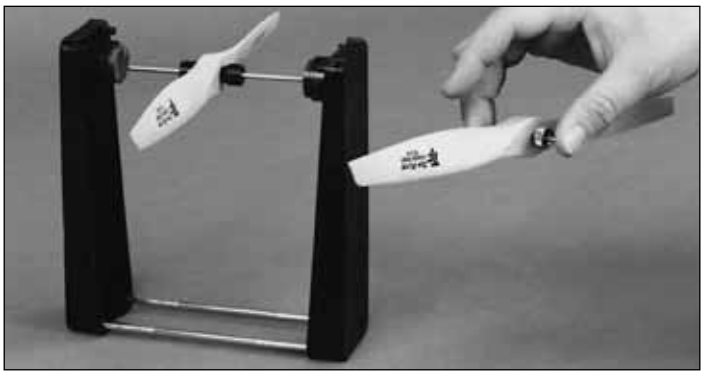
No matter if you fly at an AMA sanctioned R/C club site or if you fly somewhere on your own, you should always have your name, address, telephone number and AMA number on or inside your model. It is **required** at all AMA R/C club flying sites and AMA sanctioned flying events. Fill out the identification tag on page 29 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 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 [30m] 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.

ENGINE SAFETY PRECAUTIONS

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

- Keep all engine fuel in a safe place, away from high heat, sparks or flames, as fuel is very flammable. Do not smoke near the engine or fuel; and remember that engine exhaust gives off a great deal of deadly carbon monoxide. Therefore **do not run the engine in a closed room or garage**.
- Get help from an experienced pilot when learning to operate engines.
- Use safety glasses when starting or running engines.
- Do not run the engine in an area of loose gravel or sand; the propeller may throw such material in your face or eyes.
- Keep your face and body as well as all spectators away from the plane of rotation of the propeller as you start and run the engine.
- Keep these items away from the prop: loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects such as pencils or screwdrivers that may fall out of shirt or jacket pockets into the prop.
- Use a “chicken stick” or electric starter to start the engine. Do not use your fingers to flip the propeller. Make certain the glow plug clip or connector is secure so that it will not pop off or otherwise get into the running propeller.
- Make all engine adjustments from behind the rotating propeller.
- The engine gets hot! Do not touch it during or right after operation. Make sure fuel lines are in good condition so fuel will not leak onto a hot engine, causing a fire.
- To stop a glow engine, cut off the fuel supply by closing off the fuel line or following the engine manufacturer’s recommendations. Do not use hands, fingers or any other body part to try to stop the engine. To stop a gasoline powered engine an on/off switch should be connected to the engine coil. Do not throw anything into the propeller of a running engine.

AMA SAFETY CODE (EXCERPTS)

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

CHECKLIST

During the last few moments of preparation your mind may be elsewhere anticipating the excitement of the first flight. Because of this, you may be more likely to overlook certain checks and procedures that should be performed before the model is flown. To help avoid this, a check list is provided to make sure these important areas are not overlooked. Many are covered in the instruction manual, so where appropriate, refer to the manual for complete instructions. Be sure to check the items off as they are completed.

❏ 1. Fuelproof all areas exposed to fuel or exhaust residue such as the wing saddle area, the wing mounting tabs, 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 into the antenna tube inside the fuselage.
❏ 5. Balance your model *laterally* as explained in the instructions.
❏ 6. Use threadlocking compound to secure critical fasteners such as the set screws on the wheel collars, screws that hold the carburetor arm (if applicable), screw-lock pushrod connectors, etc.
❏ 7. Add a drop of oil to the axles so the wheels will turn freely.
❏ 8. Make sure all hinges are **securely** glued in place.
❏ 9. Reinforce holes for wood screws with thin CA where appropriate (servo mounting screws, cowl mounting screws, etc.).
❏ 10. Confirm that all controls operate in the correct direction and the throws are set up according to the manual.
❏ 11. Make sure there are silicone retainers on all the clevises and that all servo arms are secured to the servos with the screws included with your radio.
❏ 12. Secure connections between servo wires and Y-connectors or servo extensions, and the connection between your battery pack and the on/off switch with vinyl tape, heat shrink tubing or special clips suitable for that purpose.
❏ 13. Make sure the fuel lines are connected and are not kinked.
❏ 14. Balance your propeller (and spare propellers).
❏ 15. Tighten the propeller nut and spinner.
❏ 16. Place your name, address, AMA number and telephone number on or inside your model.
❏ 17. Cycle your receiver battery pack (if necessary) and make sure it is fully charged.
❏ 18. If you wish to photograph your model, do so before your first flight.
❏ 19. Range check your radio when you get to the flying field.

FLYING

The Venus II ARF is a great-flying model that flies smoothly and predictably. It 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

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 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 relax before the maiden flight, turn the engine off and bring the model back into the pits. Top off the fuel, then check all fasteners and control linkages for peace of mind.

The Venus II is a stable, honest flier (as any pattern-type plane should be). Takeoff is straightforward—just remember to hold a bit of down elevator until she gets up-to-speed to keep the tail on the ground. Get ready to apply a little right rudder when the model rotates and lifts into the air. Otherwise, be smooth on the controls and make a gentle climbout to a safe altitude before making the first turn.

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. If a bit more time is needed to think and react, throttle back once you get to a comfortable altitude—full throttle is usually desirable for takeoff, but the Venus will fly well at reduced speeds too.

Take it easy with the Venus 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 a few stalls to see how the model handles. 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

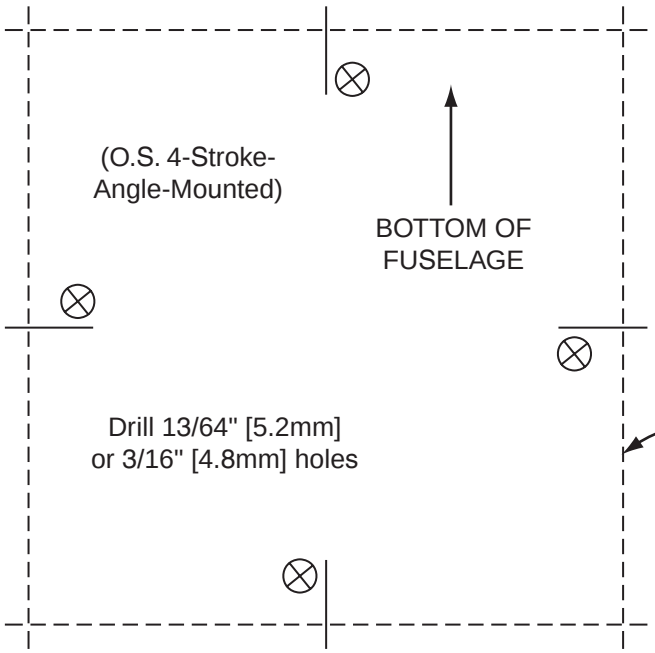
The same as takeoff, landing is routine and straightforward. Cut the throttle (to idle) on the downwind leg, allow the nose to pitch downward, bleed off altitude and maintain airspeed, then make the final turn toward the runway. Level the plane when it reaches the threshold modulating the throttle as necessary to hold your glide path and airspeed. 3-point landings are done with ease—just continue to increase up elevator allowing the model to stall at the same time the main gear touches. Once the model is on the runway, hold up elevator to keep the tail wheel on the ground.

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.**

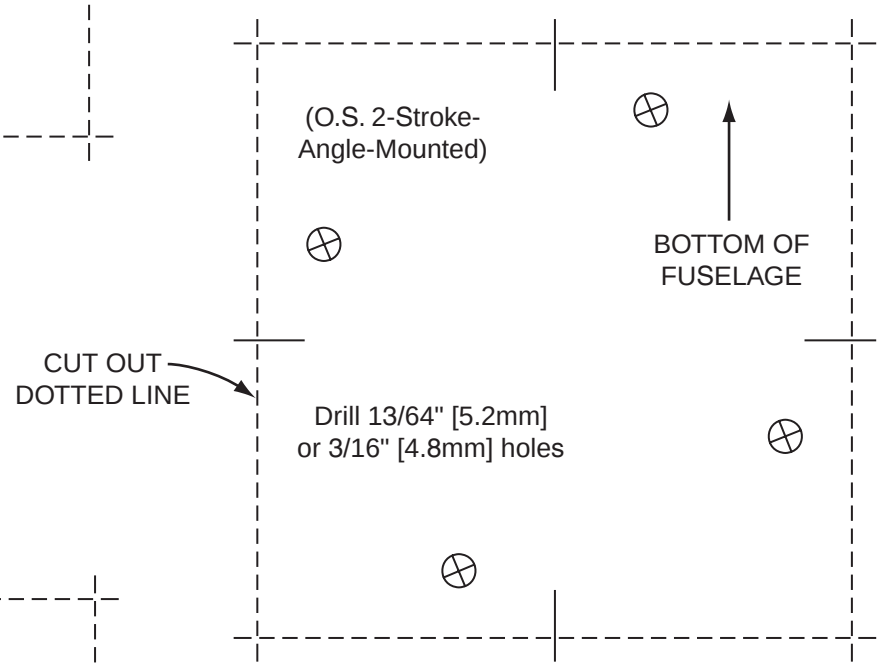
Have a ball!
But always stay in control and fly in a safe manner.

GOOD LUCK AND GREAT FLYING!

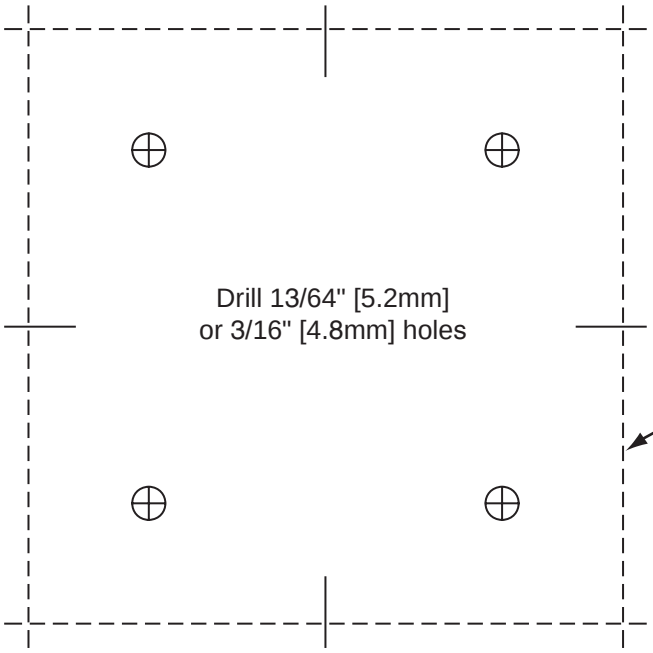
ENGINE MOUNTING TEMPLATES



Angled Engine Mounting Template
For O.S. 1.20 Surpass



Angled Engine Mounting Template
For O.S. .91 FX



Standard engine mounting template
(Use this template if mounting the engine
inverted or horizontally)

This model belongs to:

Name

Address

City, State Zip

Phone number

AMA number

OTHER HOBBY ITEMS AVAILABLE

O.S.® FS-120S-E Surpass™ (OSMG0930)

Bore: 1.22 in (30.4 mm)
Stroke: 1.08 in (27.5 mm)
Power Output: 1.9 bhp @ 11,000 rpm
Weight (with muffler): 33.3 oz (944g)
Practical RPM Range: 2,000-11,000

For dependable power, fuel efficiency, and realistic sound, match your Venus II with the O.S. FS-120S-E Surpass 4-stroke engine! This ringed piston powerhouse features an aluminum crankcase; ball bearings to support the crankshaft and helix gear driven camshaft; plus a rear-mounted, updraft carburetor. O.S. includes exhaust header, muffler, and a #F glow plug. Fuel with 5-15% nitro content and 18% lubricant is recommended.

O.S.® .91 FX (OSMG0591)

Bore: 27.7 mm (1.090")
Stroke: 24.8 mm (0.976")
Practical rpm range: 2000-16,000
Output: 2.8 bhp @ 15,000 rpm
Weight w/muffler: 24.3 oz (689g)

The .91's dual ball bearings offer durability and smooth operation, and the low-profile crankcase allows for a proportionately taller head to increase the cooling fin area. The remote needle valve features a ratchet spring that holds settings securely, and an O-ring to prevent air leaks. Plus, the needle valve and fuel inlet can both be repositioned for convenience. Extended crankshaft threads give you extra room for attaching your prop, spinner and nut. Includes muffler and #8 glow plug.

Futaba® Coreless BB Servos
S9001 (FUTM0075)
S9292(FUTM0090)

S9202
Dimensions: 1.6" x 0.8" x 1.4"
Weight: 1.8 oz (50g)
Torque: 76 oz-in @ 4.8V;
98 oz-in @ 6V
Transit Time: .26 sec/60 deg @ 4.8V;
.21 sec/60 deg @ 6V

S9001
Dimensions: 1.6" x 0.8" x 1.4"
Weight: 1.7oz (48g)
Torque: 54 oz-in @ 4.8V;
72 oz-in @ 6V
Transit Time: .22 sec/60 deg @ 4.8V;
.18 sec/60 deg @ 6V

Ideal for a wide range of applications, these servos both feature a coreless motor for smooth, speedy response and improved resolution. S9001 for airplanes has a single ball bearing, and comes with one attached servo horn and three extra servo horns; S9202 is ideal for both planes and helis, and boasts dual ball bearings for even more smoothness.

OTHER HOBBY ITEMS AVAILABLE

Great Planes Venus .40 ARF
(GPMA1025)

Wingspan: 55 in (1397 mm)
Wing Area: 568 sq in (36.6dm2)
Weight: 4.8-5.3 lb (2177-2404g)
Wing Loading: 19.5-21.5 oz/sq ft (60-66g/dm2)
Length: 54 in (1372 mm)
Requires: 2-stroke .40-.51 or 4-stroke .52-.70 engine, 4-channel radio w/5 standard servos

Make the most of your low-wing flying skills! The Venus 40 offers precise handling for master F3A type contest maneuvers - but with its easy maneuverability, slow landings and 10-12 hour assembly, this model is also a great choice for everyday flying. The factory-built, wood main sections and wing arrive covered in NINE dazzling hues of MonoKote film. Prepainted fiberglass forms the cowl and wheel pants. Only standard servos are required...making the Venus 40 exciting AND economical to fly!

Futaba 4EXA
(FUTK40)**

The 4EXA Includes:
R127DF Receiver
Four S3004 Servos
600mAh Tx and Rx NiCds.

If you're a new pilot, the 4EXA is a good deal - and a good deal for the future, too. You'll enjoy the performance edge and ease of computer design, beginning with simple programming: navigate menus and select your set-ups using just two keys (Mode and Select), and then lock-in those digitally accurate settings with the Data Input Lever. You can save up to four set-ups in the 4EXA's memory...a big time-saver as you add more planes to your personal hangar.

You'll also enjoy the 4EXA's versatility. With more channels than 2- or 3-channel systems and more features than most "start up" 4-channel radios, the 4EXA "grows" with you as your skills and experience increase. EPA for servos, automatic trim memory, exponential, wing mixing for V-tail and elevon - the 4EXA has them. You'll be able to experiment with new types of flying, with the familiar layout and feel of a system you already know.

Futaba 9C Super Computer Radios
9C Super FM w/R148DF (FUTK75)**
9C Super PCM w/R149DP (FUTK77)**

Enjoy 9-channel PCM and 8-channel FM capacity, easy programming - and with the included 16K CAMPac module, the memory capacity for a whopping 18 models! The 9C's up- and down-timer has a third function that keeps track of total flying time for any particular model. Besides Basic offset trim, there are three other glider offset trims to choose from. With a selectable switch through channels 5, 7 or 8, you can set up a 2-rate or 3-rate GYA gyro system for your airplanes. Plus, the heli mode's Throttle and Pitch Curves feature a delay that smoothes the transition from hover to idle-up. Comes with full NiCds, and is available in FM and PCM modulations.

BUILDING NOTES

Kit Purchased Date: _____

Where Purchased: _____

Date Construction Started: _____

Date Construction Finished: _____

Finished Weight: _____

Date of First Flight: _____

FLIGHT LOG