38% EXTRA 330S ARF

ALMOST-READY-TO-FLY GIANT-SCALE AEROBAT

INSTRUCTION MANUAL

Scale: 38%
Wingspan: 110.5 in [2805mm]
Fuselage Length: 103 in [2595mm]
Wing Area: 2279 sq in [147dm^2]
Weight: 36–38 lb [16330–17235g]
Wing Loading: 36–38 oz/sq ft [111–117g/dm^2]
Engine: 120 – 150cc Spark-Ignition Gas

WARRANTY

Great Planes® Model Manufacturing Co. guarantees this kit to be free from defects in both material and workmanship at the date of purchase. This warranty does not cover any component parts damaged by use or modification. **In no case shall Great Planes' liability exceed the original cost of the purchased kit.** Further, Great Planes reserves the right to change or modify this warranty without notice.

In that Great Planes has no control over the final assembly or material used for final assembly, no liability shall be assumed nor accepted for any damage resulting from the use by the user of the final user-assembled product. By the act of using the user-assembled product, the user accepts all resulting liability.

If the buyer is not prepared to accept the liability associated with the use of this product, the buyer is advised to return this kit immediately in new and unused condition to the place of purchase.

To make a warranty claim send the defective part or item to Hobby Services at the address below:

Hobby Services
3002 N. Apollo Dr., Suite 1
Champaign, IL 61822 USA

Include a letter stating your name, return shipping address, as much contact information as possible (daytime telephone number, fax number, e-mail address), a detailed description of the problem and a photocopy of the purchase receipt. Upon receipt of the package, the problem will be evaluated as quickly as possible.

READ THROUGH THIS MANUAL BEFORE STARTING CONSTRUCTION. IT CONTAINS IMPORTANT INSTRUCTIONS AND WARNINGS CONCERNING THE ASSEMBLY AND USE OF THIS MODEL.

GREAT PLANES® MODEL MANUFACTURING COMPANY

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

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INTRODUCTION

Thank you for purchasing the Great Planes 38% Extra 330S ARF. Thousands of R/C modelers have already enjoyed the complete "package" that a Great Planes model delivers—thoroughly illustrated, detailed, complete instruction manuals; rugged, yet lightweight construction; complete hardware packages; and superior flight characteristics. But many serious IMAC/Freestyle 3D pilots have not yet been able to enjoy these benefits—until now! This Great Planes 38% Extra 330S ARF features all the same, high-quality features of its smaller brothers and sisters. We do realize that most pilots who will be building this model already have experience with high-performance, giant-scale airplanes. But there will still be those who are new to a plane of this size and scope, so for you, none of the details have been omitted. You'll end up with a model that is complete and properly finished, without having to figure anything out by yourself.

For the latest technical updates or manual corrections to this model visit the Great Planes web site at **www.greatplanes.com**. Open the "R/C AIRPLANES" pull down tab across the top of the page, then select "ARFs-GLOW." Scroll down the page and click on "38% Extra 330S ARF." If there is new technical information or changes an "Important! TECH NOTICE" box will appear in the upper left corner of the page. Click on the Tech Notice box to read the info.

Note: 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.

AMA

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

Academy of Model Aeronautics
5151 East Memorial Drive
Muncie, IN 47302
Tele: (800) 435-9262
Fax (765) 741-0057
Or via the Internet at:
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 38% Extra 330S 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 Extra, if not assembled and operated correctly, could possibly cause injury to yourself or spectators and damage to property.

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

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

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

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

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

7. **WARNING:** The cowl, wheel pants and landing gear fairings 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.

ITEMS REQUIRED FOR COMPLETION

Engine

The 38% Extra was designed for a 150cc engine—the Desert Aircraft 150cc in specific—but the Extra's size and weight also make it suitable for any 150cc engine and other engines down to 120cc. Instructions for installation and throttle hookup feature the "DA," so if using a different engine use the instructions as a guide. The spinner is also drilled to fit the DA.

Servos

Following are the number of servos required and the minimum torque ratings (at 6 Volts) for each:

- ❏ (4) Aileron servos with a minimum torque of 190 oz-in each (such as Futaba® S9155 – FUTM0215)
- ❏ (3) Rudder servos with a minimum torque of 120 oz-in each (such as Futaba S9155 – FUTM0215 or Futaba S9350 – FUTM0235)
- ❏ (2) Elevator servos with a minimum torque of 300 oz-in each (such as Futaba S9156 – FUTM0216 or Hobbico® CS-170 – HCAM0316) *If using Hobbico CS-170 servos, one (1) servo horn set CS/TS35-59, 63-71 (HCAM1071) must also be purchased separately for each servo.*
- ❏ (1) Ball bearing, "medium-torque" throttle servo (such as Futaba S9001 – FUTM0075)
- ❏ Receiver battery with a minimum capacity of 3000 mAh (such as HydriMax™ Ultra 6.0 Volt 4200mAh NiMH – HCAM6355)
- ❏ Ignition battery with a minimum capacity of 1000 mAh (such as HydriMax Ultra 6.0 Volt 2000mAh NiMH – HCAM6351)

Transmitter and Receiver

A minimum of 5 or 6 channels will be required. All three rudder servos may be connected to one channel in the receiver via a servo synchronizer. The aileron servos in one wing should be connected to one channel and the aileron servos in the other wing should be connected to another channel. The two channels for ailerons should be mixed electronically via mixing in the transmitter. The elevator servos may be connected to separate channels in the receiver and mixed electronically through the transmitter, or they can both be connected to a single channel in the receiver. If using one channel for the elevators, a servo reverser will also be required to get one servo to respond in the opposite direction.

Other Radio Gear

The following servo extensions were used on the model in the instruction manual:

Note: *If using digital servos, be certain to use servo extensions suitable for use with digital servos. The servo extensions listed below are suitable for both analog and digital servos.*

- ❏ (2) 6" [150mm] heavy-duty dual servo extension (coming from the receiver inside the fuselage for ailerons – FUTM4134 for Futaba)
- ❏ (2) 6" [150mm] Pro HD servo extensions (1-throttle servo, 1-servo synchronizer for rudder servos – HCAM2701 for Futaba)
- ❏ (2) 12" [305mm] Pro HD servo extensions (for inboard aileron servos – HCAM2711 for Futaba)
- ❏ (2) 36" [915mm] Pro HD servo extensions (for outboard aileron servos -- HCAM726 for Futaba)
- ❏ A servo synchronizer for the three rudder servos is also required (Such as MSA-10 used for Futaba servos – FUTM4155)

*If connecting the elevator servos to **separate** channels in the receiver (and using the mixing in the transmitter) the following servo extensions will also be required:*

- ❏ (2) 6" [150mm] Pro HD servo extensions (HCAM2701 for Futaba)
- ❏ (2) 12" [305mm] Pro HD servo extensions (HCAM2711 for Futaba)
- ❏ (2) 36" [915mm] Pro HD servo extensions (HCAM2726 for Futaba)

*If connecting the elevator servos to **the same** channel in the receiver, a servo reverser and (2) 36" [915mm] servo extensions will be required:*

- ❏ (1) servo reverser (such as Futaba SR-10 – FUTM4150)
- ❏ (2) 36" [915mm] Pro HD servo extension (HCAM2726 for Futaba)

These switches and charge receptacles were also used:

- ❏ (2) Heavy-duty on/off switches (1-ignition battery, 1-radio system such as Hobbico HD switch for Futaba J (HCAM2761)
- ❏ (2) Ernst Charge Receptacles (ERNM3001 for Futaba)

Hardware and Accessories

In addition to typical hobby tools, following is the rest of the hardware and accessories used to finish the Extra 330S ARF:

- ❏ Pro™ 30-minute epoxy (GPMR6047)
- ❏ 1 oz. [30g] Medium Pro CA+ (GPMR6008)
- ❏ CA applicator tips (HCAR3780)
- ❏ Threadlocker thread locking cement (GPMR6060)
- ❏ (2 pkgs) 3' Du-Bro 1/8" Tygon fuel tubing (DUBQ0493)
- ❏ 1/4" [6.5mm] R/C foam rubber (HCAQ1000)
- ❏ 1/8" single-sided foam tape (GPMQ4424)
- ❏ Silver solder w/flux (GPMR8070)

Covering Tools

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

- ❏ 21st Century sealing iron (COVR2700)
- ❏ 21st Century iron cover (COVR2702)
- ❏ 21st Century trim seal iron (COVR2750)

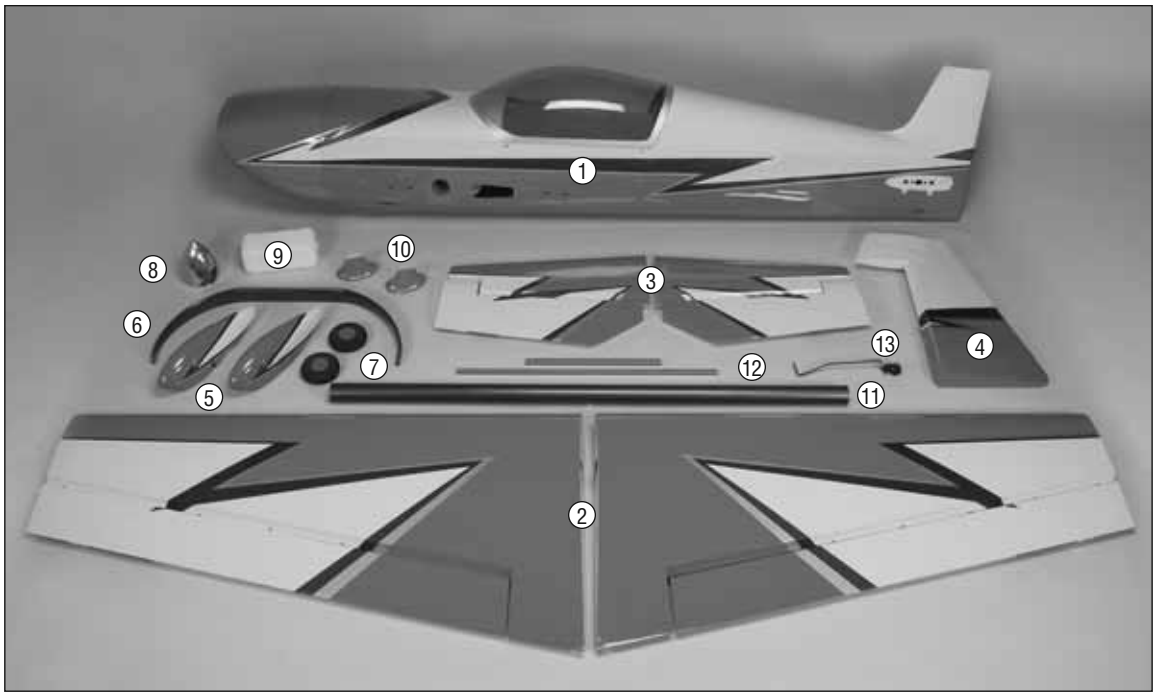
- ❏ Top Flite MonoKote® sealing iron (TOPR2100)
- ❏ Top Flite Hot Sock™ iron cover (TOPR2175)
- ❏ Top Flite MonoKote trim seal iron (TOPR2200)

KIT INSPECTION

Before starting to build, inspect the parts to make sure they are of acceptable quality. If any parts are missing or are not of acceptable quality, or if you need assistance with assembly, contact **Product Support**. When reporting defective or missing parts, use the part names exactly as they are written in the Kit Contents list.

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

KIT CONTENTS



1. Fuselage	**6.** Landing Gear	**11.** Wing Tube
2. Wing w/Ailerons	**7.** Wheels	**12.** Stab Tubes
3. Stabilizer w/Elevators	**8.** Spinner	**13.** Tail Gear
4. Rudder	**9.** Fuel Tank	
5. Wheel Pants	**10.** Landing Gear Fairings	

ORDERING REPLACEMENT PARTS

Replacement parts for the Great Planes 38% Extra 330S 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 Great Planes web site at **www.greatplanes.com**. Choose "Where to Buy" at the bottom of the menu on the left side of the page. Follow the instructions provided on the page to locate a U.S., Canadian or International dealer.

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

Mail parts orders and payments by personal check to:

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

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

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

Replacement Parts List

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

Contact your hobby supplier for the following parts:

GPMA3190 ..... Wing Set
GPMA3191 ..... Fuselage w/Canopy
GPMA3192 ..... Horizontal Stabilizer
GPMA3193 ..... Rudder
GPMA3194 ..... Hatch w/Canopy
GPMA3195 ..... Cowl
GPMA3196 ..... Wheelpants
GPMA3197 ..... Carbon Fiber Landing Gear
GPMA3198 ..... Wing Tube
GPMA3199 ..... Stab Joiners
GPMA3200 ..... Spinner
GPMA3201 ..... Canopy Only
GPMA3202 ..... Tail Gear Set
GPMQ3728..... Deluxe 6-32 Pull-Pull Set
GPMA3203 ..... 8-32 Rudder Torque Rod Mount
GPMM1107 ..... Single-Sided 1.5" Servo Arm Set
GPMM1167 ..... Double-Sided 3" Servo Arm Set
GPMA3204 ..... Rudder Servo Tray
GPMQ3760..... Turnbuckle Pushrod 3.5" x 6-32
GPMQ3754..... Turnbuckle Pushrod 2.125" x 6-32
GPMA3206 ..... Decals
GPMA3207 ..... Pilot

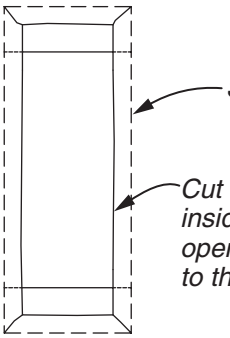
SHRINK THE COVERING

❏ 1. Where necessary, use a covering iron (set to approximately 250°F [120°C] with a covering sock to go over any parts of the model where the covering requires tightening. Over sheeted areas, press down on the iron to bond the covering to the wood. If the covering expands or bubbles, use less heat. **Note:** Naptha (lighter fluid) can be used to remove any adhesive left from the masking tape that may have been used to hold any of the parts together.

❏ 2. Make sure the elevators and ailerons are securely hinged by pulling hard on each control surface.

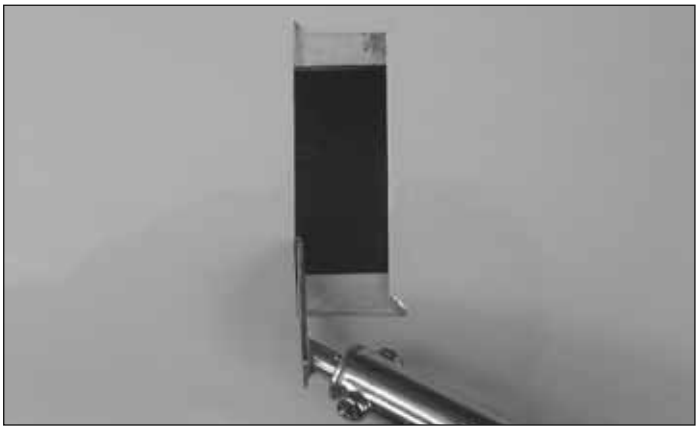
ASSEMBLE THE WINGS

Mount the Aileron Servos



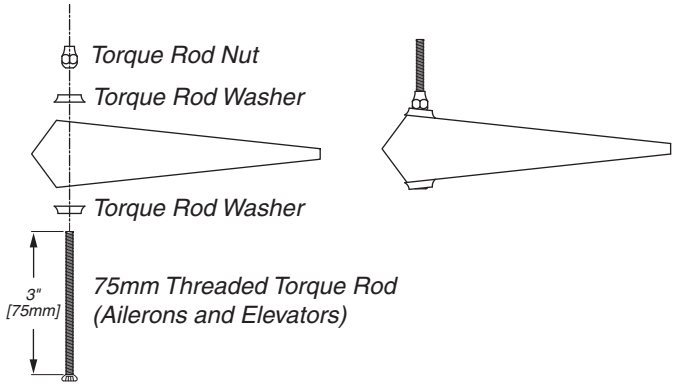
Servo opening in wing.

Cut the covering 1/8" [3mm] inside the edges of the opening. Slit the covering up to the corners.

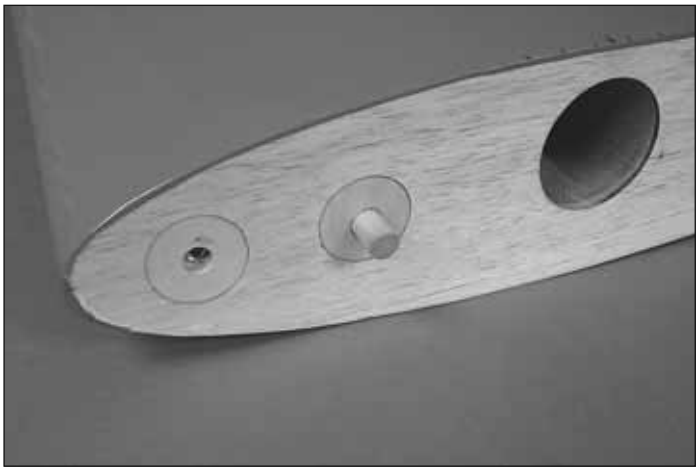


❏ 1. Cut the covering 1/8" [3mm] inside the edges of both aileron servo openings in the bottom of both wings. Slit the covering up to the corners and use a trim iron to seal the covering down inside.

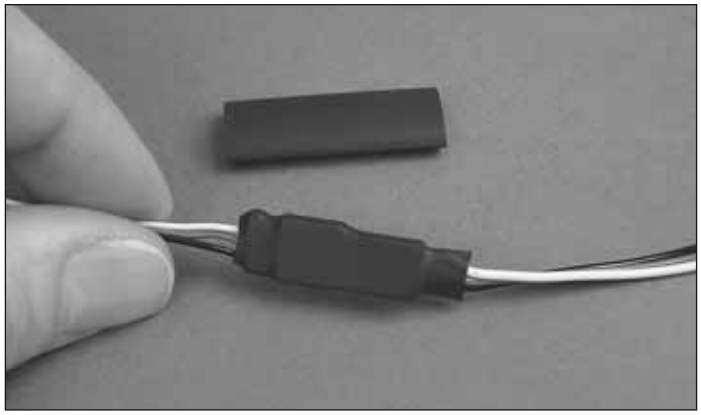
❏ 2. Also cut the covering from the holes in the top and bottom of the ailerons for the threaded torque rods.



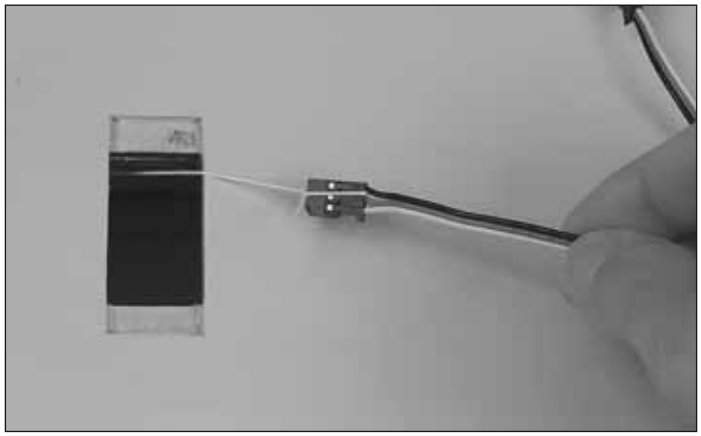
❏ 3. Use a cordless drill with a Phillips bit and a 5/16" [or 8mm] wrench or pliers to hold the plastic **torque rod nut** and mount two **3" [75mm] threaded torque rods** into each aileron with a **torque rod washer** on both sides.



❏ 4. Use epoxy to glue two 10 x 30mm hardwood **wing dowels** into the root end of each wing.



❏ 5. Connect a 12" [305mm] servo extension (HCAM2711 for Futaba) to one of the aileron servos and 36" [915mm] servo extension (HCAM2726 for Futaba) to the other aileron servo. Secure each connection with 1-1/2" [38mm] pieces of heat shrink tubing cut from one of the 3" [75mm] pieces included with this kit.



❏ 6. Tie the string in one of the wings to the servo wires as shown. Then, pull them through the tube in the wing.

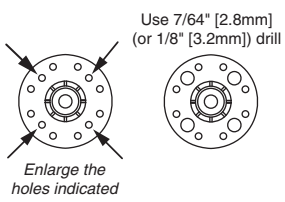
❏ 7. Place the aileron servos in the servo openings of one of the wings. Drill 1/16" [1.6mm] holes for the servo mounting screws. Temporarily mount the servos with the screws that came with them. **Note:** For some JR (or other brand) servos, the servo mounts may require slight trimming to accommodate the servos and larger holes may have to be drilled for larger servo mounting screws.

❏ 8. **IMPORTANT:** Remove the servo mounting screws and set the servos aside (without pulling the servo leads out of the wing). Add a few drops of thin CA to each screw hole to harden the "threads." Allow the CA to harden. Then, remount the servos.

Whenever screws are mounted into wood you must harden the holes with CA after installing, and then removing the screws. The complete process will not be written out every time this is necessary. Instead, you will simply be reminded to "harden the screw holes with thin CA."

❏ 9. Mount the aileron servos in the other wing the same way—don't forget to harden the screw holes with thin CA!

Hook Up the Ailerons



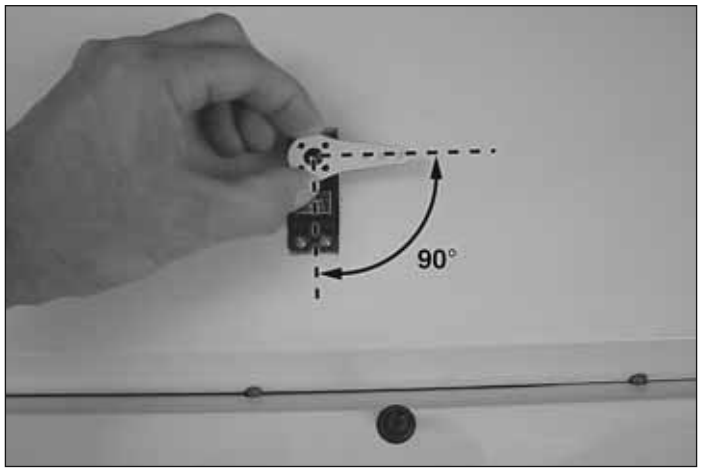
Futaba Servo Wheel

Bottom of Hobbico Servo Wheel

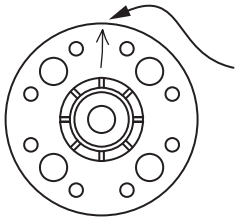
❏ 1. If using Futaba servos, drill out the holes in the servo wheel with a 7/64" [2.8mm] (or 1/8" [3.2mm]) drill. If using different servos, use one of the aluminum servo arms that came with this kit as a template for drilling the holes. All the servo wheels used for the control surfaces in this model require drilling, so if you have all your servo wheels handy you could drill them all now, or just drill them as needed.

Note: The servo wheels that come with the CS/TS35-59, 63-71 Hobbico Servo Horn set (HCAM1071) have mold marks in the bottom that happen to align with the holes in the aluminum servo arms. Double-check to make sure the mold marks align with the holes in one of the servo arms. Then, drill 1/16" [1.6mm] pilot holes at the marks. Enlarge the pilot holes with a 7/64" [2.8mm] (or 1/8" [3.2mm]) drill.

Your radio system will be required for the next step, so gather your transmitter, receiver, battery and on/off switch.

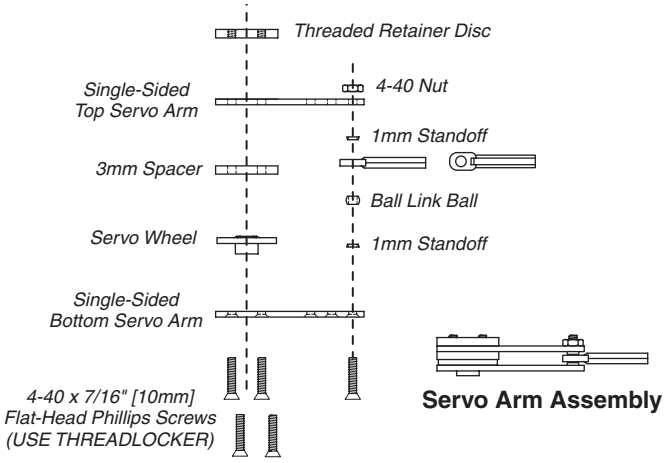


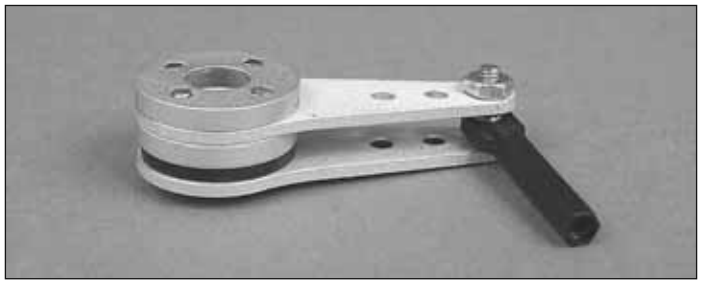
❏ 2. Connect one of the aileron servos to your receiver and turn the system on. Center the trim and position the servo wheel on the servo so that when the top servo arm will be mounted to the wheel it will be perpendicular to the servo.



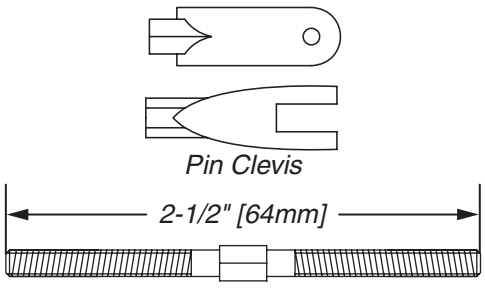
Scratch a small arrow onto the servo wheel so you will know which way is forward.

❏ 3. Once the correct orientation of the servo wheel has been determined, use a hobby knife to scratch an arrow on the wheel so you will know how to mount the arm later.



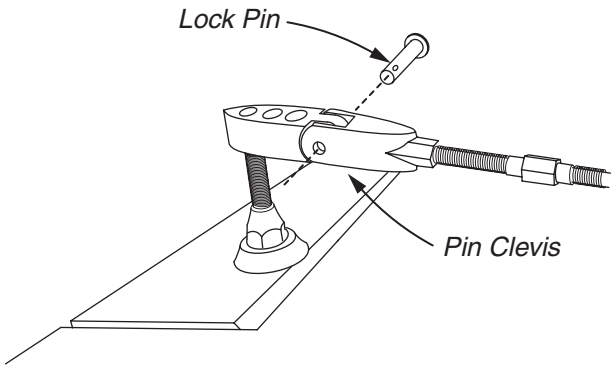


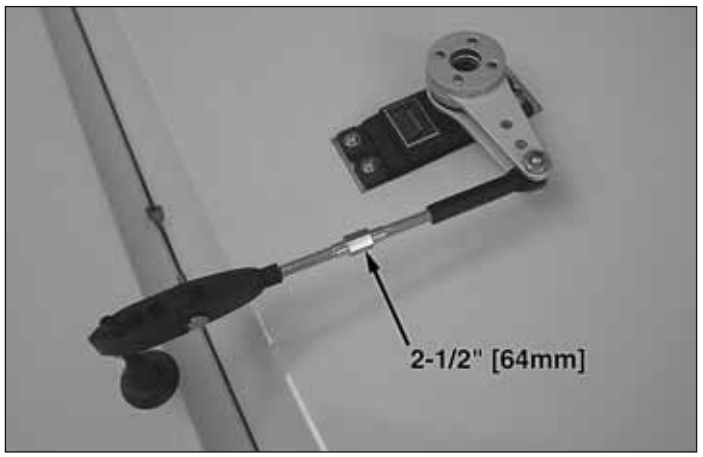
❏ 4. Assemble one of the servo arm assemblies with the parts shown—it's easiest to first mount the ball link and 1mm standoffs to the servo arms and temporarily secure with the 4-40 nut, then join the servo wheel and spacer. **IMPORTANT:** Threadlocker **must** be used on the threads of **all five** screws.



Turnbuckle Pushrod

❏ 5. Gather all the **pin clevises** included with this kit. Note that only two have a "normal" thread and the rest have a reverse thread. Test-thread each pin clevis onto the "normal" threaded end of one of the 2-1/2" [64mm] turnbuckle pushrods until you find the two that fit. Mark those as "N" and set them aside.

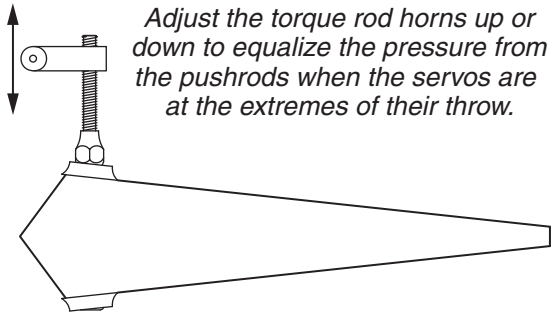




❏ 6. Thread one of the **reverse-thread** pin clevises onto the reverse-threaded end of a 2-1/2" [64mm] turnbuckle pushrod. Thread the turnbuckle pushrod to the ball link on the servo arm and connect the pin clevis to the torque rod horn with the **lock pin**.

❏ 7. Turn on your radio and adjust the turnbuckle pushrod so the aileron will be neutral when the servo is centered. The turnbuckle should be threaded equally into both the ball link and the pin clevis.

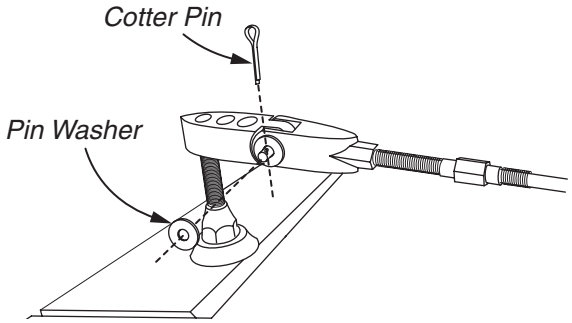
❏ 8. Connect the outboard aileron to your receiver. With the radio on, connect the outboard servo to the outboard torque rod arm using the same hardware as the inboard servo.



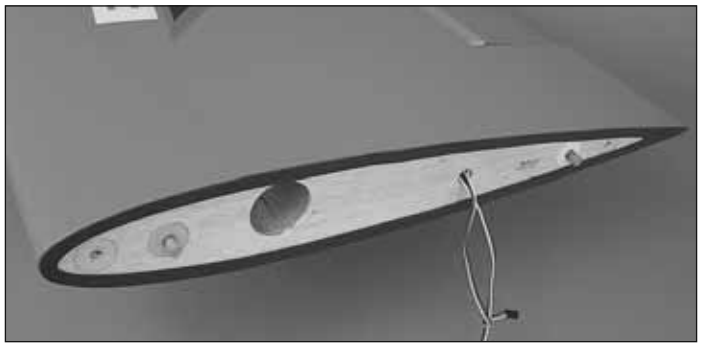
Adjust the torque rod horns up or down to equalize the pressure from the pushrods when the servos are at the extremes of their throw.

❏ 9. With the radio on and both servos still connected to the receiver, adjust the position of the torque rod horns on the torque rods so the servos will not be "fighting" each other and will be applying the same pressure on the horns when the servos are at the extremes of their throw.

❏ 10. Hook up the aileron on the other wing the same way.



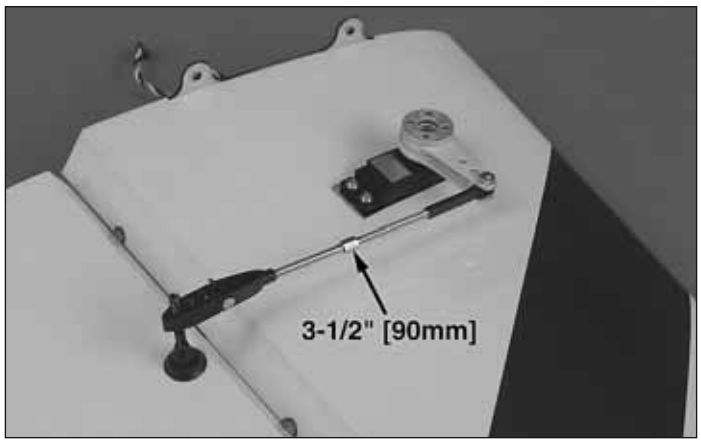
❏ 11. While you have your wings on your workbench and the servos operating, you could go ahead and set the control throws as indicated on page 21 now, or wait until the model has been completed. Once the aileron throws have been set, fasten the lock pins to the clevises and control horns with a **pin washer** followed by a **cotter pin**. Bend the cotter pins over so they won't come out. Secure all the servo wheels to the servos with the screws that came with them. **Note:** If your servos have metal output shafts, **use threadlocker** on the threads of the servo arm screws.



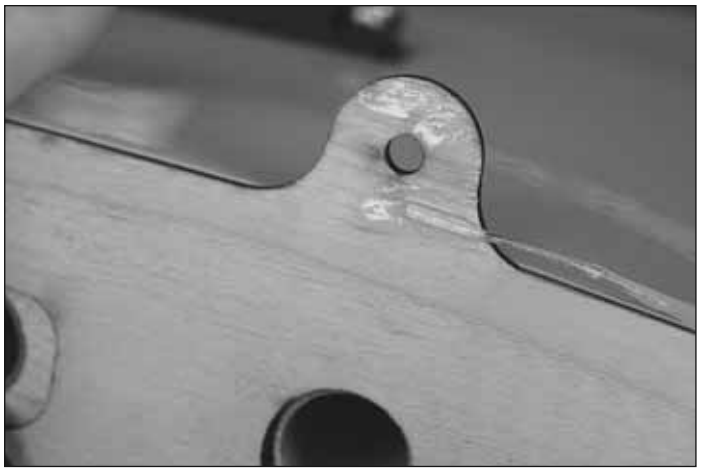
❏ 12. Use CA or rubber cement to glue the black, foam rubber strips to the end of both wings.

ASSEMBLE THE HORIZONTAL STABS

❏ 1. Install a 3" [75mm] torque rod in both elevators with the torque rod washers and torque rod nuts. Also cut the covering from the elevator servo openings in the horizontal stabilizers (stabs).



❏ 2. Mount the elevator servos and hook up the elevators—all the hardware is the same as was used for the ailerons except the turnbuckle pushrods are 3-1/2" [90mm] in length. Also remember to harden the screw holes for the servo mounting screws.



❏ 3. Wet the mounting tabs on the ends of both stab halves with thin CA. Allow the CA to penetrate into the wood and harden.

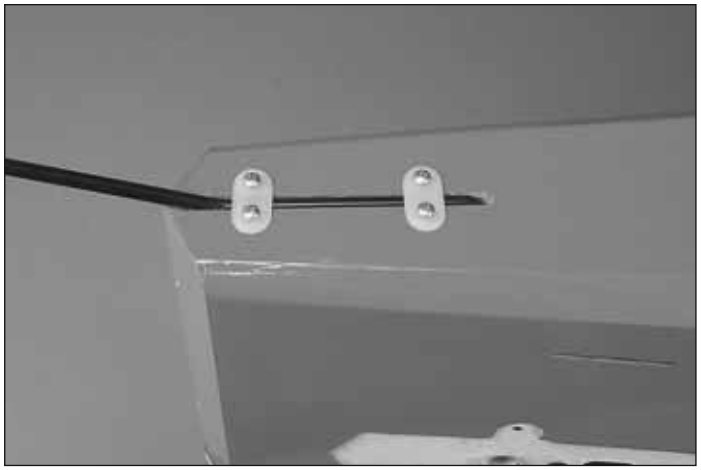
❏ 4. When ready to set the throws or check the C.G. and you need to mount the stab halves to the fuselage, use the carbon fiber stabilizer tubes and two 4-40 x 1/2" [13mm] SHCS, #4 lock washers and #4 flat washers in each stab. When mounting the stabs for flying, **use threadlocker** on the threads of the screws.

ASSEMBLE THE FUSELAGE

Mount the Landing Gear

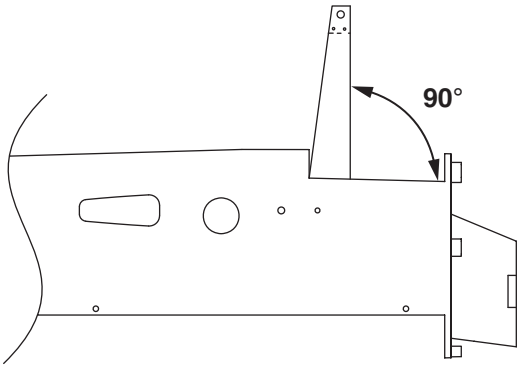
First the tail gear…

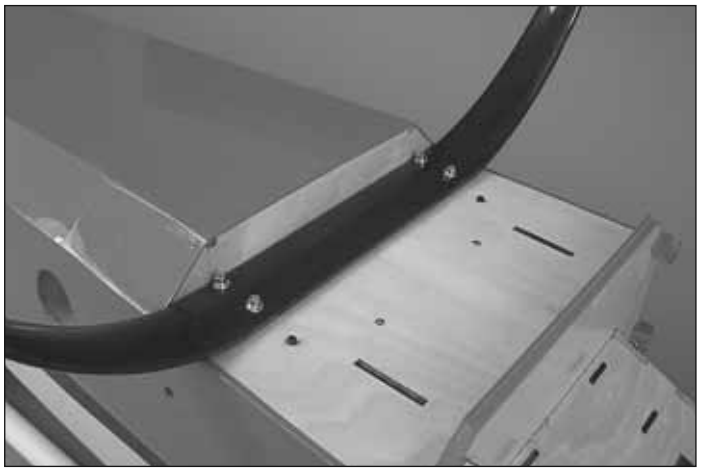
❏ 1. Temporarily remove the tail wheel bracket from the tail gear wire with a 1.5mm Allen wrench. File a flat spot in the wire for the set screw in the bottom collar. Reassemble the tail gear with a drop of threadlocker on the threads of the set screws.



❏ 2. Using the nylon straps as a guide, drill 3/32" [2.4mm] holes for the mounting screws. Mount the tail gear in the fuselage with the straps and four #4 x 1/2" [12mm] screws—don't forget to harden the holes with thin CA.

Now the main gear…





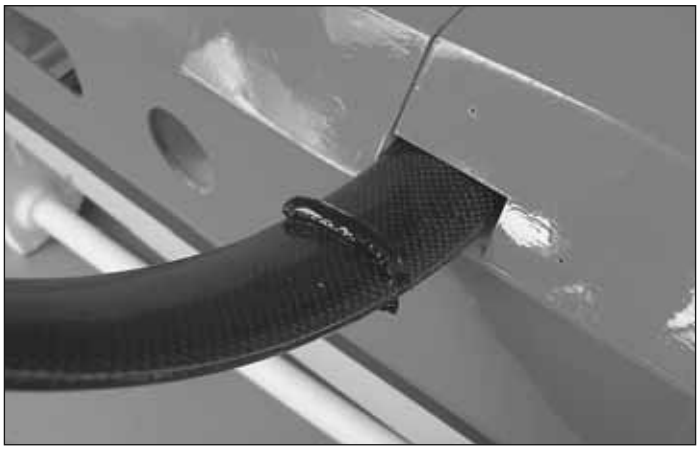
❏ 3. Add a few drops of threadlocker to four 8-32 x 1-1/4" [32mm] SHCS (socket-head cap screws) and mount the main landing gear to the fuselage with the screws and four #8 lock washers and flat washers. **Note:** The edge of the landing gear that's 90° goes forward.

❏ 4. Mount the landing gear cover to the bottom of the fuselage with two 1/4-20 x 2" [50mm] nylon bolts.

❏ 5. Slip the fiberglass landing gear fairings over the main gear all the way to the fuselage. **Note:** There is right and a left.

❏ 6. Fit both wings to the fuselage with the wing tube. Use a fine point felt-tip pen to mark the outline of the wings directly onto both fairings.

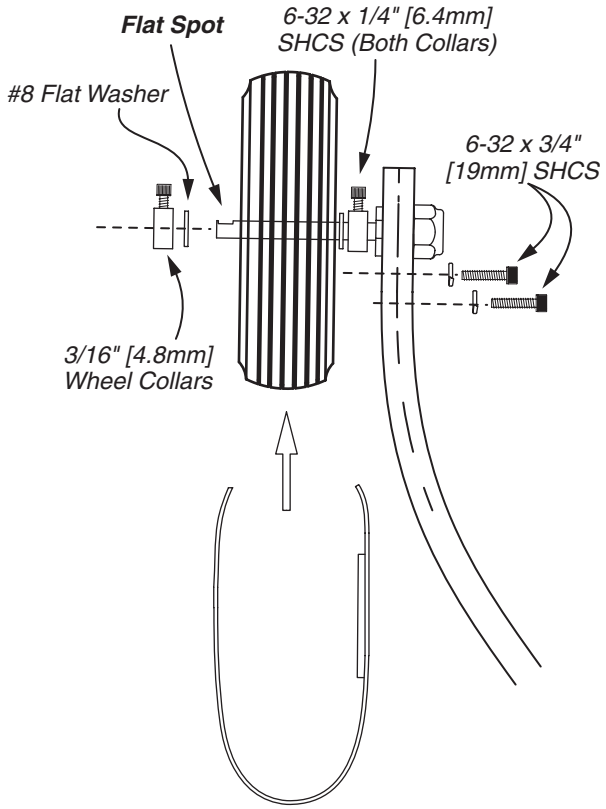
❏ 7. Slide the wings part way off the fuselage and remove the fairings. Use a rotary tool with a sanding drum to trim the fairings to the lines you marked. Test fit and trim the fairings as necessary for a good fit. **CAUTION:** Always wear safety goggles, a particle mask and rubber gloves when grinding, drilling and sanding fiberglass parts—wearing a long-sleeve shirt and working outdoors is also a good idea. Vacuum the parts and the work area thoroughly after working with fiberglass parts.

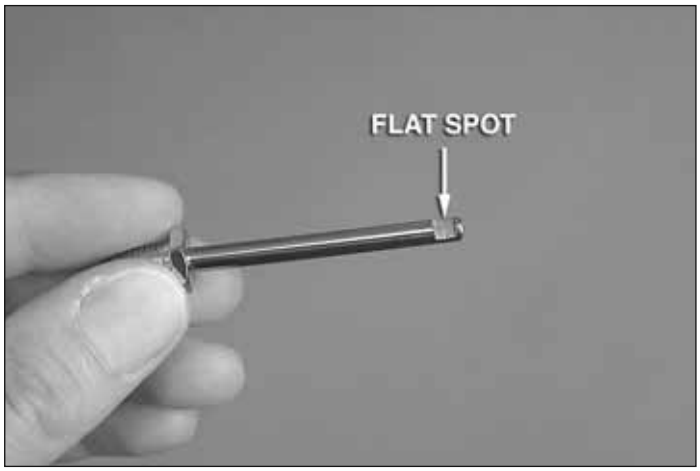


❏ 8. Use large beads of RTV silicone rubber to securely, but not permanently, glue the fairings to the landing gear. This way, the fairings may be removed if ever necessary.

NOW THE WHEELS…

Refer to the illustration while mounting the wheels.





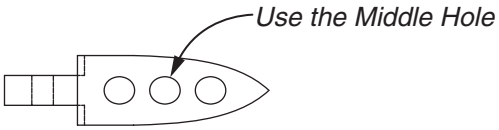
❑ 9. Use a rotary tool with a cutoff wheel to grind a flat spot about 1/16" [1.5mm] from the end of both 3/16" x 2" [4.8 x 50mm] bolt-on axles. For perfection, use a small metal file to "square-up" the flat spots.

❑ 10. Mount each axle to the gear with a 5/16-24 lock nut. Use a 1/2" and 7/16" wrench to tighten the axles and nuts.

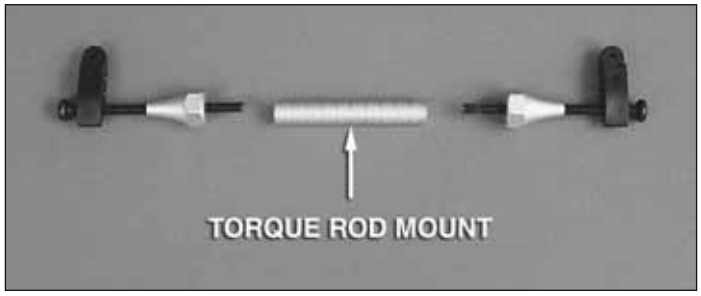
❑ 11. Mount the wheels to the axles with the hardware shown—be certain to use threadlocker.

❑ 12. Mount the wheel pants to the gear with 6-32 x 3/4" [19mm] SHCS and #6 lock washers (and a drop of threadlocker on the threads). If necessary, reposition the wheels on the axles so they do not rub on the pants.

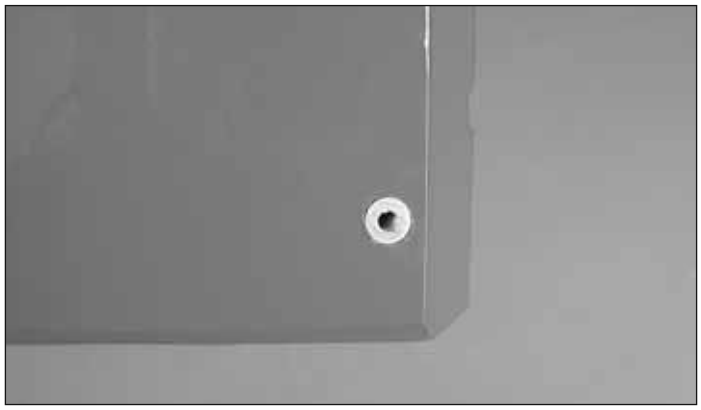
Attach the Rudder



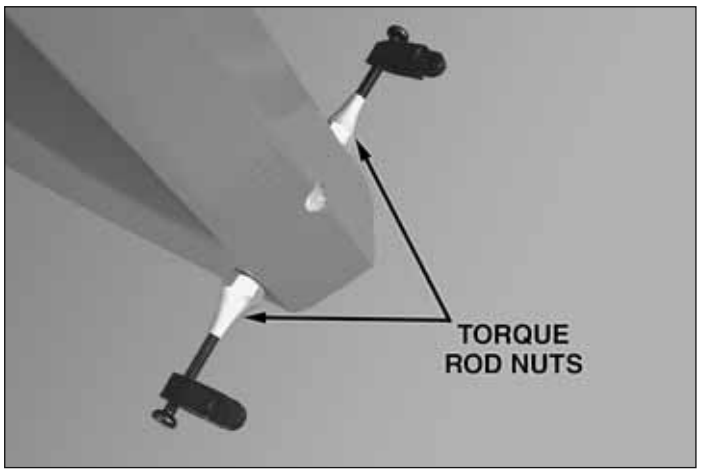
Torque Rod Horn (For Rudder)



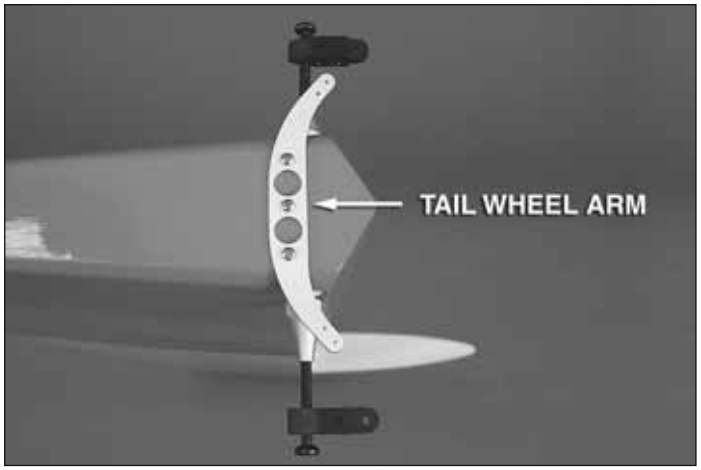
❑ 1. Assemble two **rudder torque rod assemblies** using the hardware shown. **Note:** Install the torque rod in the **middle** hole of threaded torque rod horns.



❑ 2. Use coarse sandpaper to roughen the aluminum **rudder torque rod mount** so glue will adhere. Use epoxy to securely glue the rudder torque rod mount, centered, into the rudder.

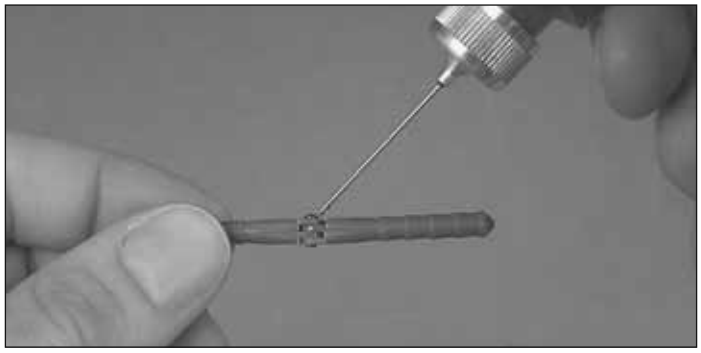


❑ 3. Mount the torque rod assemblies to the torque rod mount in the rudder—be sure to use threadlocker on the threads. Use two 12mm wrenches to tighten both aluminum **torque rod nuts** simultaneously.



❏ 4. Mount the aluminum **tail wheel arm** where shown by drilling 1/16" [1.6mm] holes for the three #2 x 3/8" [10mm] mounting screws—don't forget to harden the "threads" in the holes with thin CA.

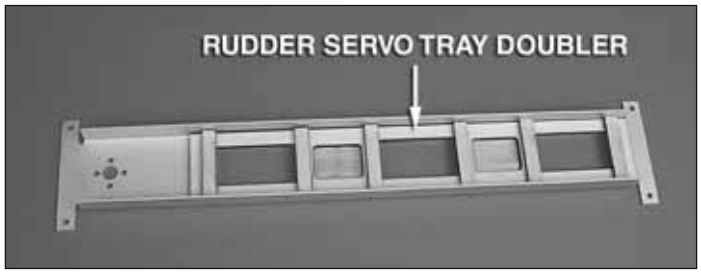
❏ 5. Test fit the rudder to the fuselage with all five hinges. Make sure the hinges fit and align—each hinge should be exactly halfway in both parts and there should be a small hinge gap—just enough to see light through or to slip a piece of paper through. Make any adjustments necessary for a good fit.



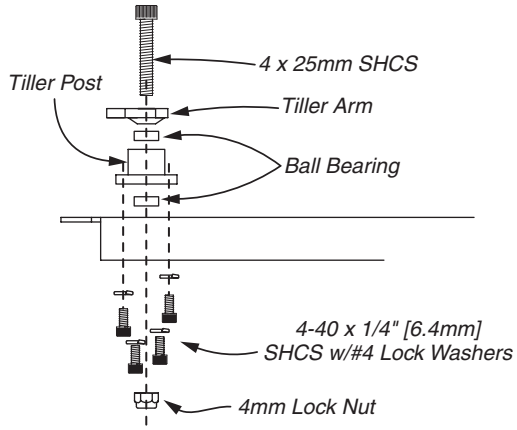
❏ 6. Take out all the hinges. Add a few drops of plastic-compatible oil to the pivot point of each hinge using care not to get any oil on the rest of the hinge.

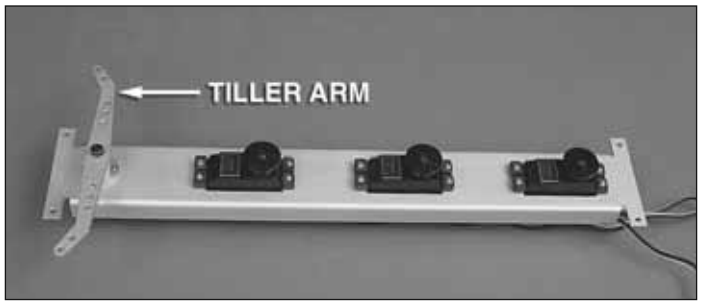
❏ 7. Use 30-minute epoxy to permanently join the rudder to the fuselage with all the hinges—use a piece of wire to **thoroughly** coat the inside of each hinge hole and the hinges before inserting them. Do not use 5-minute or 15-minute epoxy for hinging—otherwise, you may run out of working time!

Install the Rudder Servos

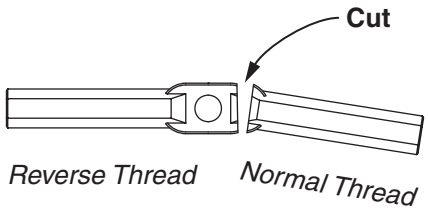


❏ 1. Use coarse sandpaper to roughen the bottom of the aluminum rudder servo tray so glue will adhere. Glue the plywood **rudder servo tray doubler** to the bottom of the tray with medium CA or epoxy. Glue six 1/4" x 1-1/2" [6 x 38mm] plywood strips across the bottom of the doubler for the servo screws.





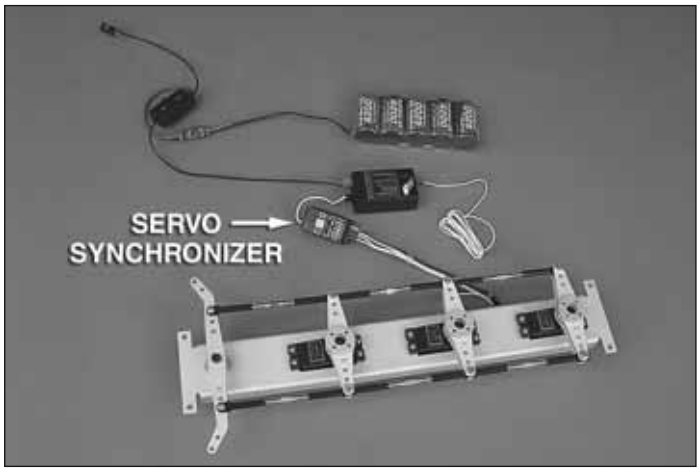
❏ 2. Mount the rudder servos in the tray. Harden the the holes with CA. Mount the **tiller arm** using the hardware shown—be certain to use threadlocker on the threads of the 4-40 screws. Tighten the 4mm bolt in the tiller arm until there is no more free play, but the arm still rotates freely.

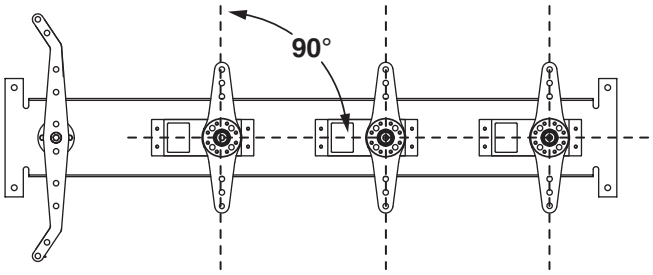


❏ 3. Cut the "normal" threaded end off two dual-ended ball links.

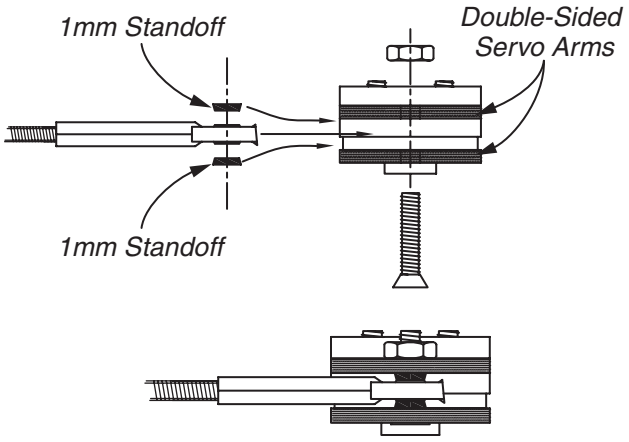
❏ 4. Assemble two **rudder pushrod assemblies** using the hardware shown in the ***Rudder Pushrod Assembly*** illustration on page 26.

Refer to the following photo to finish mounting the rudder servos.





❏ 5. Same as was done for the aileron and elevator servo wheels, drill the holes in the three rudder servo wheels with a 7/64" [2.8mm] (or 1/8" [3.2mm]) drill and mount the double-sided servo arms to the servo wheels. Place the arm assemblies on the servos and use a servo synchronizer to center all the servo arms.



❏ 6. Connect only the **front** of both rudder pushrods to the front rudder servo arm using the same hardware that was used to connect the aileron and elevator pushrods (that is two 1mm brass standoffs, a 4-40 x 7/16" [11mm] flat-head Phillips screw and a 4-40 nut with threadlocker).

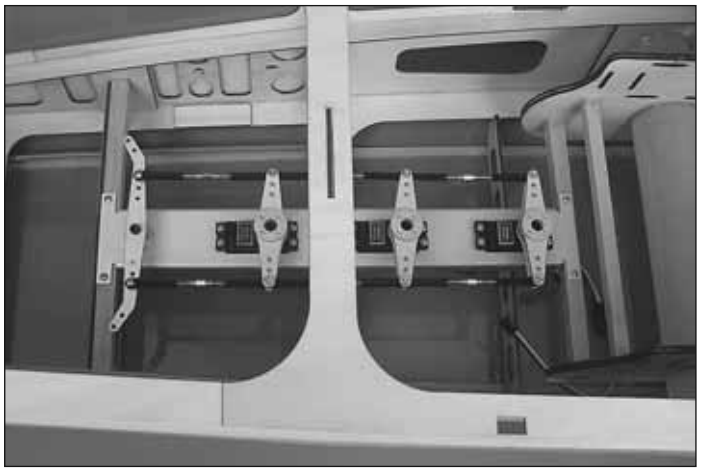
❏ 7. Connect the pushrods to the middle rudder servo arm using the servo synchronizer to align the holes in the arm with the ball link balls in the pushrod. Using the servo synchronizer, also make sure the servo arms are synchronized at the ends of their throw.

❏ 8. Connect the rudder pushrods to the aft rudder servo using the synchronizer again. Don't forget to use threadlocker on the threads of all the screws.

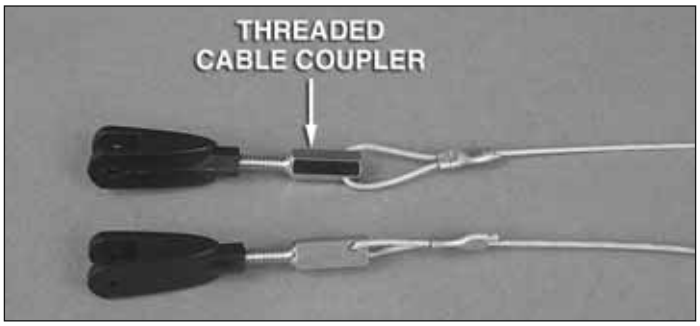
❏ 9. Finally, connect the last ball links on the end of the rudder pushrods to the tiller arm with two 4-40 x 1/2" [12mm] Phillips screws and 4-40 lock nuts.

❏ 10. Secure the servo arm assemblies to the servos with the servo wheel screws that came with the servos—if the screws go into metal output shafts be certain to use threadlocker on the threads.

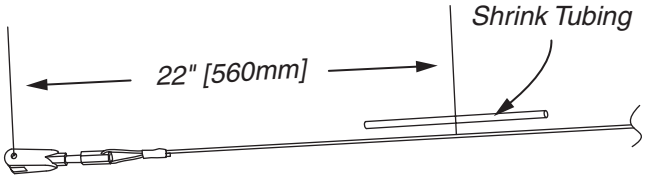
Hook Up the Rudder



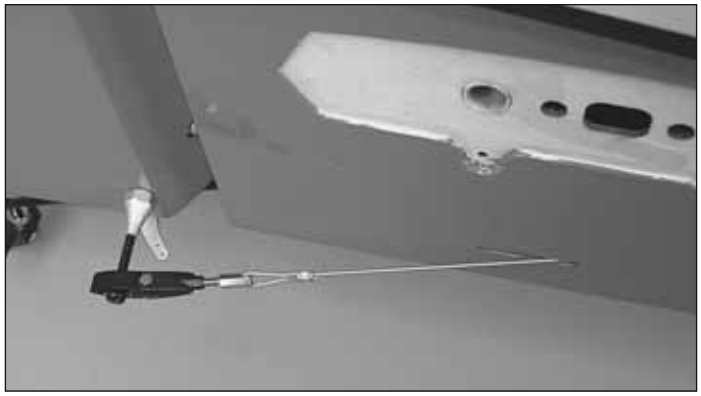
❏ 1. Center the rudder servo tray assembly on the mounting rails in the fuselage. Drill 3/32" [2.4mm] holes in the rails for the mounting screws. Mount the tray with four #4 x 1/2" [13mm] screws. Don't forget to harden the screw holes with thin CA.



❏ 2. Cut the braided rudder cable into two equal-lengths. Make the aft end of both rudder cables from the hardware shown (the "normal-thread" pin clevises are used here).



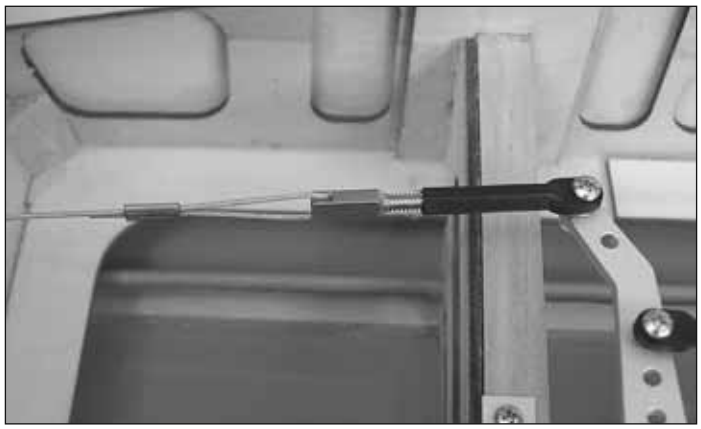
❏ 3. Cut the included 1/8" [3.2mm] diameter heat shrink tubing into two equal lengths. Slide one tube over each cable until the middle of each one is 22" [560mm] from the end of the pin clevis. Shrink the tubing over the cables and glue it into position with thin CA.



❏ 4. Guide the cables through the slots in the fuselage and temporarily connect the pin clevises to the horns on the rudder.

❏ 5. Use masking tape to temporarily hold the front of the balance tab on the rudder centered to the vertical stab.

Refer to this photo for steps 6 & 7.

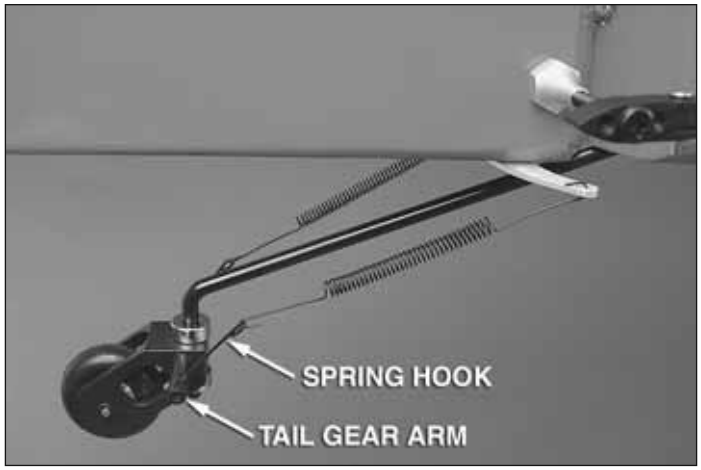


❏ 6. Mount a ball link with a threaded cable coupler to the outer holes in both ends of the tiller arm with 4-40 x 1/2" [12mm] Phillips screws, a 1mm standoff under each ball link and 4-40 lock nuts.

❏ 7. Cross the rudder cables once inside the fuselage—the cable on the right side of the rudder should go to the left side of the tiller arm and vice-versa. Slide a brass swage over each cable. With the rudder servos connected to the receiver and the radio on, loop one of the cables through one of the threaded cable couplers on the tiller arm. Permanently connect the cable to the cable coupler with the swage. Cut off any excess wire.

❏ 8. Connect the other cable to the cable coupler on the other side of the tiller arm the same way.

❏ 9. Remove the masking tape that was holding the rudder centered. If necessary, adjust the tension in one or both cables by removing the locking pin on the rudder and turning one of the threaded inserts in or out. **CAUTION:** If, in the future, the cables ever require tightening or loosening, **always disconnect one end of the cable** you will be tightening before turning the threaded couplers. This way, you will not be twisting the cable (which could otherwise untwist). **Never twist the cables when tightening them.**



❏ 10. Connect the tail wheel to the tail wheel arm on the bottom of the rudder with the springs and spring hooks. Use an .050" allen wrench to lock the spring hooks into the tail gear arm with 4-40 set screws and a drop of threadlocker on the threads. Center the tail wheel to the rudder by adjusting the position of the spring hooks in the arm.

Mount the Engine

Instructions are provided for mounting the Desert Aircraft 150cc engine. If using a different engine, use the instructions as a guide. The centerlines on the firewall note where the centerline of your engine should be mounted so the spinner will align with the cowl.

❏ 1. If mounting the DA 150, drill 1/8" [3.2mm] pilot holes through the four crossmarks in the firewall for the engine mounting bolts. If using a different engine, use the template that came with your engine or take measurements from your engine to mark the location of the engine mounting bolts, and then drill the pilot holes.

❏ 2. Enlarge the pilot holes in the firewall with a 19/64" [7.5mm] (or 9/32" [7mm]) drill.

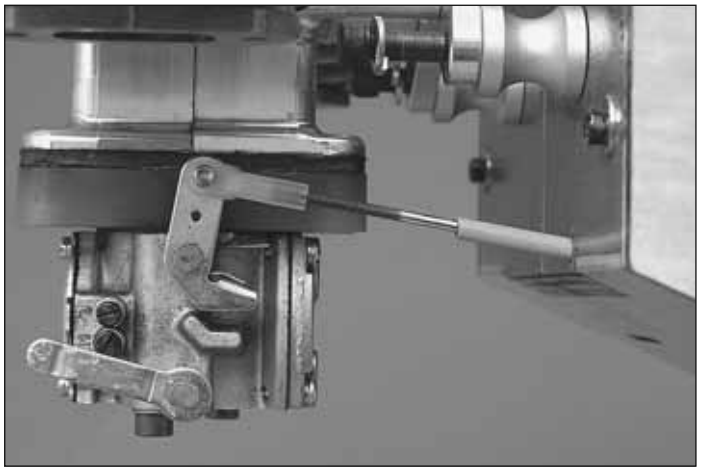
❏ 3. Use a 3/16" Allen wrench to draw the blind nuts into the back of the firewall with one of the included 1/4-20 x 2-1/2" [60mm] SHCS and included aluminum engine spacers.

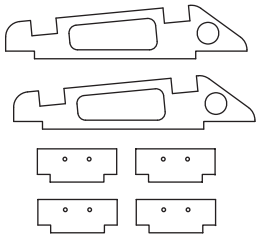
❏ 4. Temporarily mount the engine to the firewall with the spacers and the 1/4-20 x 2-1/2" [60mm] SHCS and 1/4" [6.4mm] lock washers. (During assembly, you will probably end up removing and remounting the engine a couple of times, so no need to fully tighten the mounting bolts at this time.)

The ignition battery and ignition module will be mounted later.

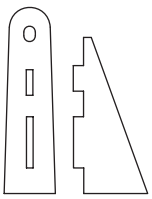
Hook Up the Throttle

Refer to these photos of the completed throttle servo installation while hooking up the throttle.

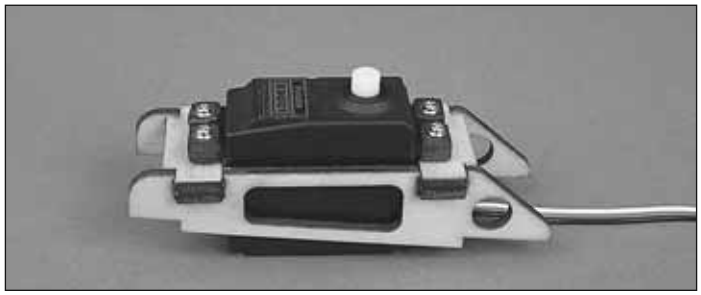




Throttle Servo Mount



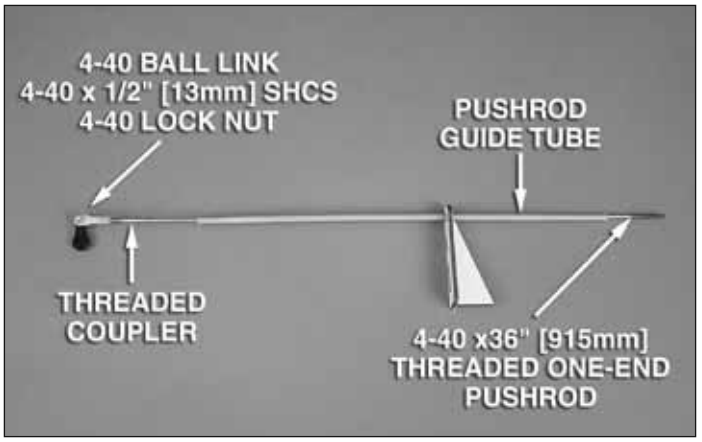
Guide Tube Support



❏ 1. Glue together the plywood **throttle servo mount** using the parts shown. Mount the throttle servo in the mount. Harden the screw holes with thin CA.

❏ 2. Place the mount with the servo in the fuselage where shown so it will align—as closely as possible—with the carburetor arm on the engine.

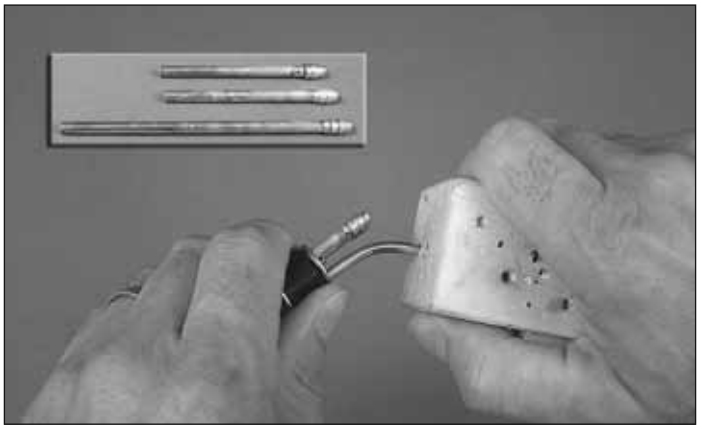
❏ 3. Drill a 3/16" [4.8mm] hole through the firewall for the throttle pushrod guide tube.

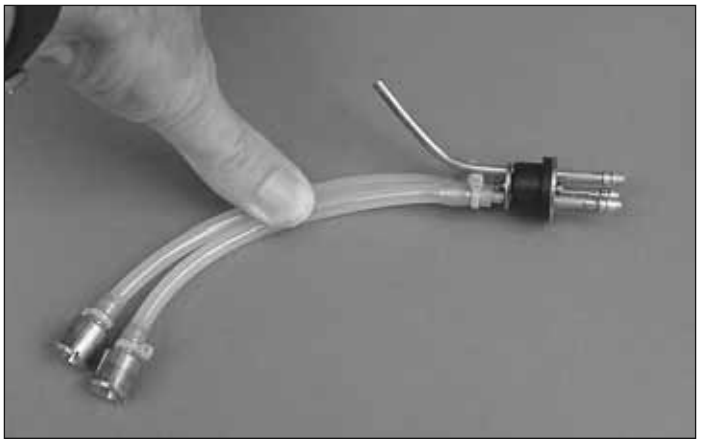


❏ 4. Cut the throttle pushrod and the guide tube to the correct length and make the throttle pushrod from the parts shown—silver solder is recommended for soldering the threaded coupler to the pushrod.

❏ 5. Connect the throttle pushrod to the servo and engine and securely glue the throttle servo mount in the fuselage.

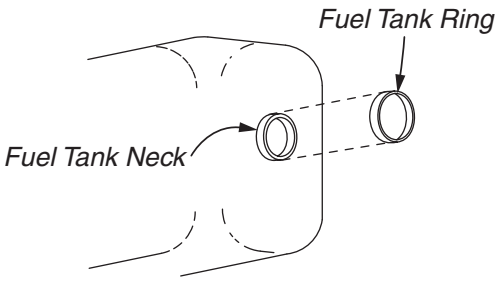
Assemble/Install the Fuel Tank



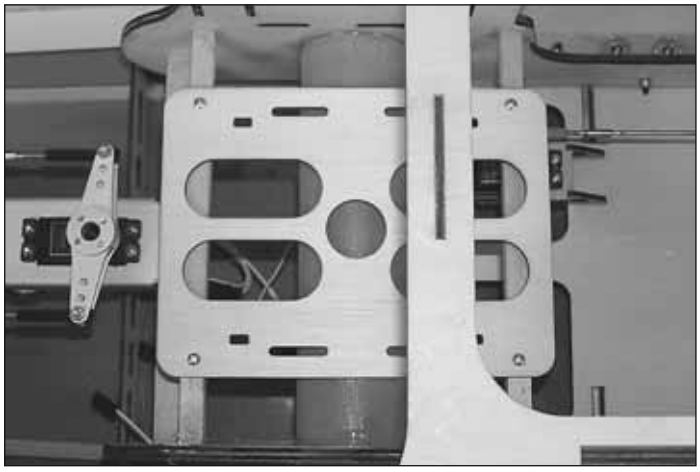


❏ 1. Assemble the stopper assembly with the fuel tubes as shown—the easiest way is to first solder a fuel line barb onto one end of all three tubes. Insert the tubes into the stopper with the metal plates, and then solder a barb onto the other

end of the two short tubes. The tubing is pretty hard, so use a block of wood with a 5/32" [4mm] hole drilled in it to bend the vent tube. Connect the pickup and fueling/de-fueling lines (not included) to the short tubes and connect the clunks to the lines.



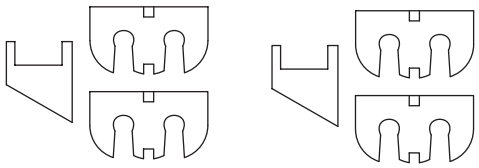
❏ 2. Press the **fuel tank ring** over the neck of the tank. Then, insert the stopper assembly into the tank and tighten the screw.

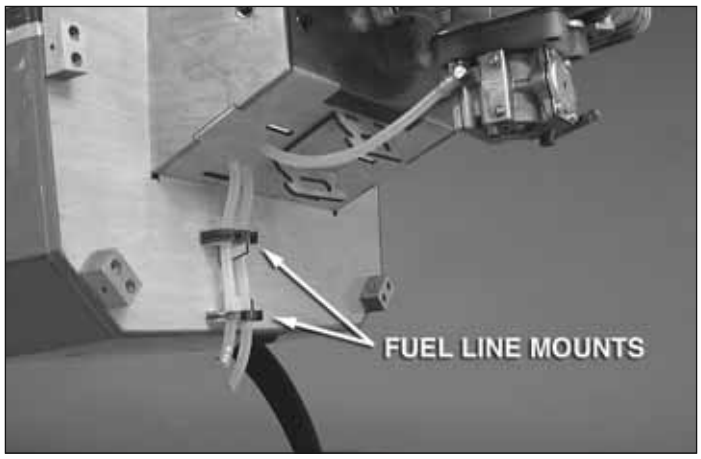


❏ 3. Center the plywood **fuel tank tray** over the mounting rails in the fuselage. Use the holes in the tray as a template to drill 3/32" [2.4mm] holes through the rails. Temporarily mount the tray with four #4 x 1/2" [13mm] screws and #4 washers. As always, don't forget to remove the screws and tray and harden the holes with thin CA.

❏ 4. **Securely** mount the fuel tank to the tray with the included hook and loop strips and a 4" x 7" [100 x 180mm] sheet of 1/4" [6.4mm] R/C foam rubber (not included) under the tank. Remount the fuel tank tray in the fuselage with the screws.

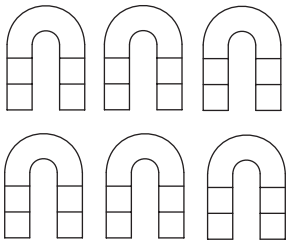
Fuel Line Mounts



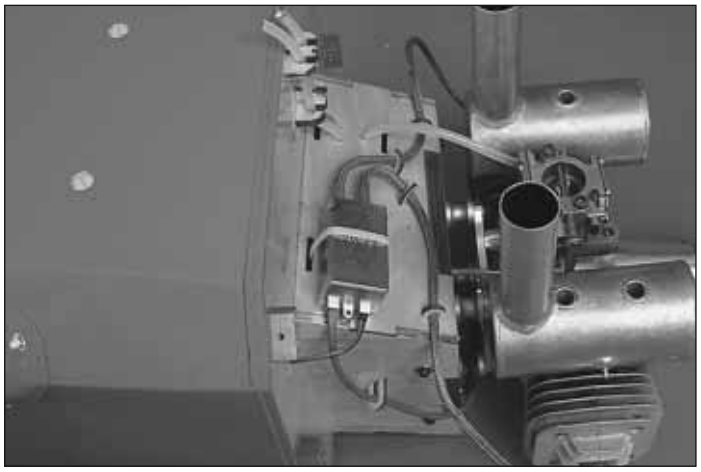


❏ 5. Drill holes for the fuel lines where necessary and connect the lines. The included plywood **fuel line mounts** may be used to mount the fueling/de fueling and the vent lines so they come out the bottom of the fuselage.

While we're still working "under the cowl," go ahead and mount the ignition module…

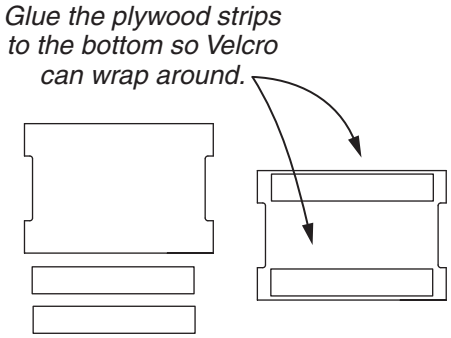


Ignition Wire Guides



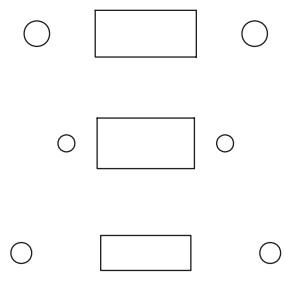
❏ 6. Mount the ignition module where preferred. There are slots in the bottom of the "engine box" for hook and loop or

nylon tie straps (not included). In addition to hook and loop or tie straps, use adhesive foam mounting tape to cushion the module and to keep it from shifting. Plywood **ignition wire guides** are also provided for routing the spark plug wires, or you could also use J'Tec *clamp loks* (not included).



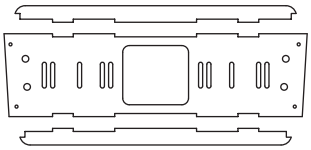
Mount the Ignition Battery

❑ 7. Glue the plywood strips to one side of the plywood **ignition battery mount**. Mount the ignition battery to the mount with R/C foam and a strap made from the included hook and loop. Securely glue the battery mount into position.



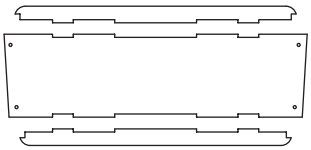
❑ 8. Connect the battery to a heavy-duty on/off switch and an external charge receptacle. Secure the connections with heat shrink tubing and mount the switch and charge receptacle to the pre cut switch holes in the front of the fuselage for the type of switch you are using.

Finish the Radio Installation

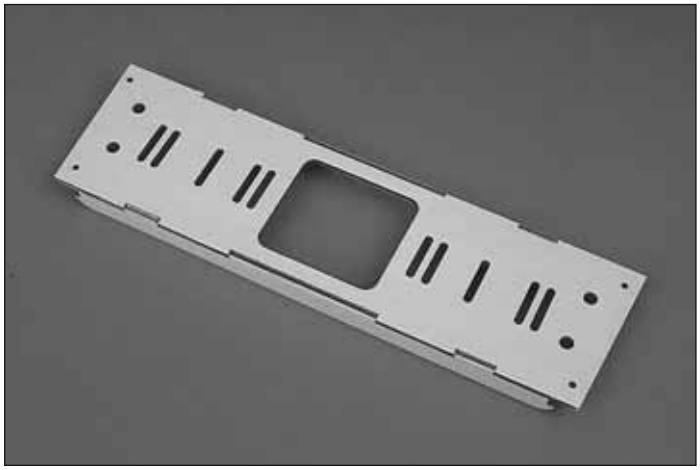


Pre-Cut Receiver Tray

Receiver Tray
Mount Doublers

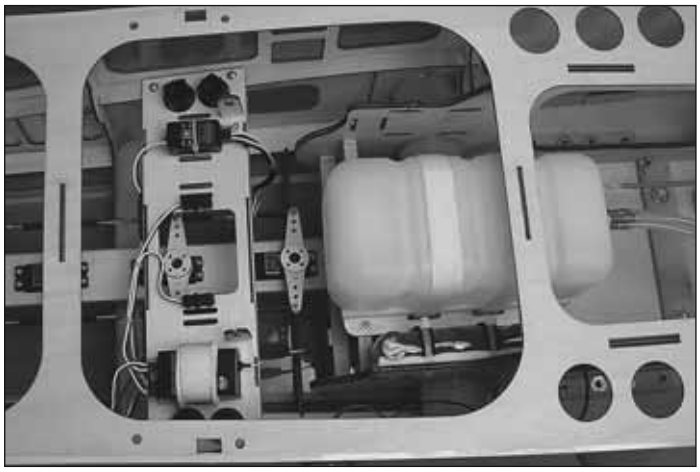


Blank Receiver Tray



❑ 1. Glue together whichever of the two plywood **receiver trays** you will be using—the one photographed has slots cut in it for hook and loop straps or nylon tie wraps (not included) for mounting the receiver and servo synchronizer. If you will be mounting your receiver and servo synchronizer differently, or if you will be using different or additional equipment, you could use the blank receiver tray and fashion it the way you like.

Refer to this photo while finishing the rest of the radio installation.



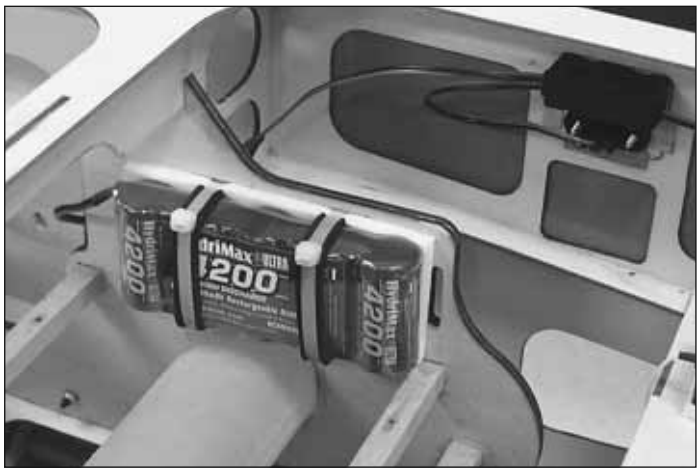
❏ 2. Glue the plywood **receiver tray mount doublers** to the bottom of the side stringers—the hole in each doubler aligns with each hole in the side stringer.

❏ 3. Mount the receiver tray to the side stringers with four #4 x 1/2" [13mm] screws and #4 washers—don't forget to remove the screws and the tray, apply a few drops of thin CA in the screw holes and allow to harden. Remount the tray.

❏ 4. Mount your receiver and servo synchronizer to the receiver tray using straps from the included hook and loop or nylon tie wraps (not included) and foam cushioning to protect them from vibration. Guide the receiver antenna down through the antenna tube in the fuselage.

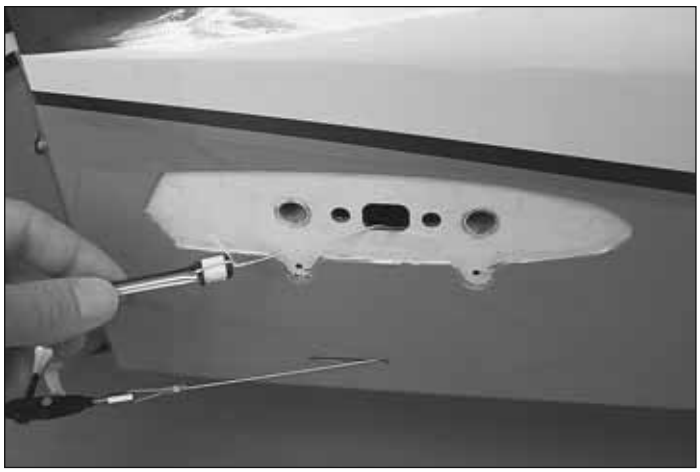
❏ 5. Connect the aileron servo extensions, the throttle servo and rudder servo synchronizer to the receiver. As shown in the photo, the dual servo extensions used were glued to the receiver tray.

❏ 6. Same as the on/off switch and charge receptacle were mounted for the ignition battery, mount the on/off switch for the receiver—the switch mounting holes are just ahead of the receiver tray.

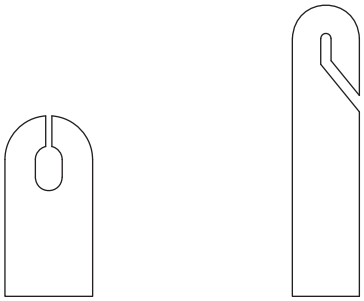


❏ 7. Temporarily unscrew the fuel tank tray from the mounting rails and move the tank forward. Use nylon tie straps (not included) or the included hook and loop strap material to mount the Rx battery to one of the sub fuselage sides on either side of the fuselage as shown. Note the foam wing tape (not included) used to keep the tie straps from slipping. Secure the connections between the battery and on/off switch and the switch and charge receptacle with heat shrink tubing. Remount the fuel tank tray.

❏ 8. Refer to the illustration on page 26 for the elevator servo extensions. Make up the extensions for the way you will be hooking up your servos.



❏ 9. Pull the extensions down through the tube in the fuselage and connect the elevator servos to the receiver.



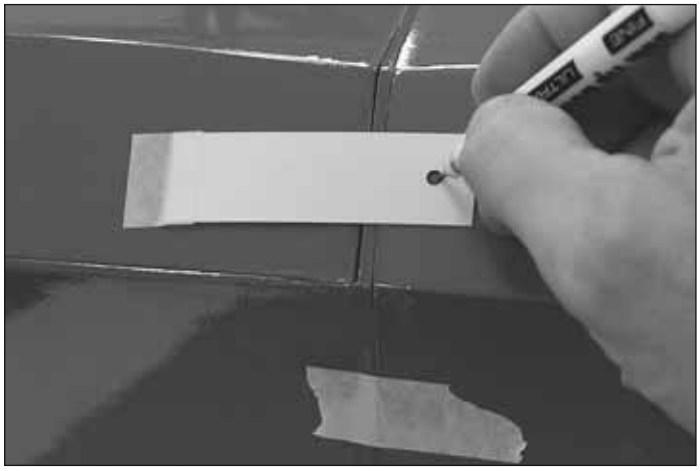
Servo Wire Guide *Servo Wire Hanger*

❏ 10. After all the radio extensions, batteries, switches, etc. have been installed, use the provided plywood **servo wire guides** and **servo wire hangers** (or more J'Tec *clamp loks*) to suspend or guide any servo wires out of the way that could interfere with the rudder servos or anything else.

❏ 11. Test fit the canopy hatch with six 4-40 x 1/2" [13mm] Phillips screws and #4 flat washers. When ready to fly the model and mounting the canopy hatch at the field, use threadlocker on all the screws.

Mount the Cowl

❏ 1. Use manilla folder material or thin cardstock to make templates for the bottom two cowl mounting screws. Tape the templates to the fuselage with the hole in the templates centered over the cowl mounting screws.

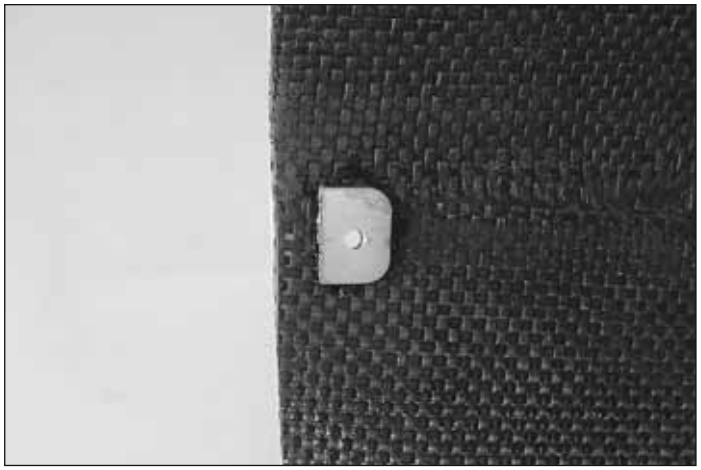


❏ 2. Remove the screws. With the mufflers off the engine, tape the cowl into position. Mark the holes in the screw templates directly onto the cowl.

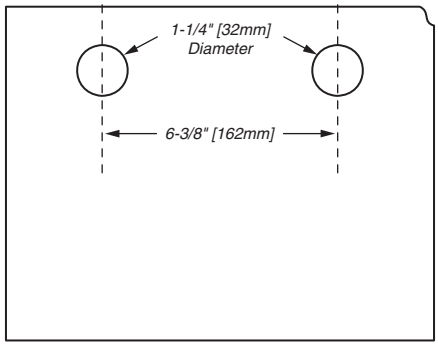
❏ 3. Remove the cowl and drill 1/8" [3.2mm] holes through the cowl where you made the marks for the screws.

❏ 4. Reposition the templates over the screw holes in the next two blocks. Mount the cowl with the bottom two 4-40 x 1-1/4" [32mm] SHCS and nylon washers. Mark the holes in the templates onto the cowl.

❏ 5. Remove the cowl, drill the next two holes, and repeat until all seven cowl screw holes have been drilled.

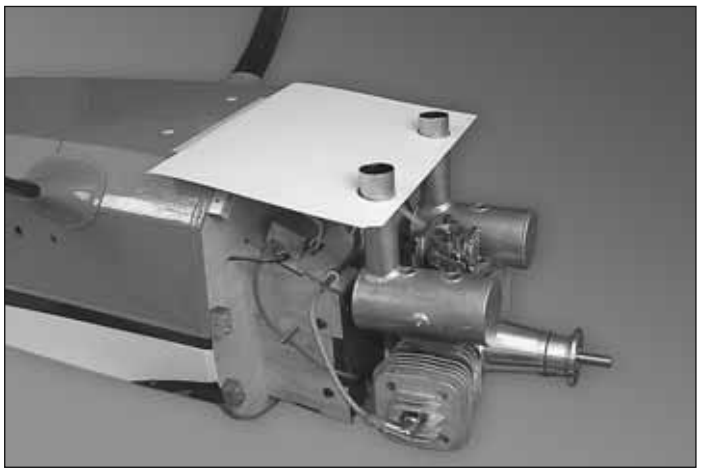


❏ 6. Use coarse sandpaper to roughen the inside of the cowl over each screw hole. Use medium CA to glue the 1/32" [.8mm] plywood **cowl reinforcements** centered over each hole.

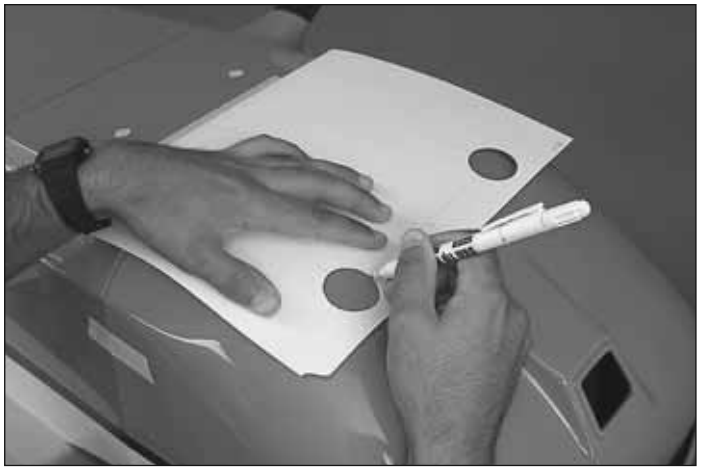


DA 150 Exhaust Pipe Template
(From Manilla Folder)

❏ 7. If using the DA 150cc engine, use the dimensions in the illustration to make a template for the exhaust pipe cutout from thin cardstock or manila folder material. If using a different engine, make a template from measurements taken from your engine.



❏ 8. Temporarily mount the mufflers to the engine. Tape the template to the bottom of the fuselage over the exhaust pipes.



❏ 9. Remove the mufflers. Mount the cowl to the fuselage. Use a fine-point felt-tip pen to mark the holes for the exhaust pipe cutouts directly onto the cowl.

❏ 10. Remove the cowl. Use a rotary tool with cutting bits to rough-cut the exhaust pipe holes in the cowl. **CAUTION:** Always wear safety goggles, a particle mask and rubber gloves when grinding, drilling and sanding fiberglass parts—wearing a long-sleeve shirt and working outdoors is also a good idea. Vacuum the parts and the work area thoroughly after working with fiberglass parts.

❏ 11. Remount the mufflers. Fit the cowl to the fuselage noting where the cowl must be trimmed to neatly fit over the exhaust pipes with plenty of clearance. Continue to cut and mark the cowl as necessary until you can get it to fit over the pipes. Also make a generous cutout for cooling air flow. Smooth the edges of all the holes you have cut with 400-grit sandpaper.

GET THE MODEL READY TO FLY

Apply the Decals

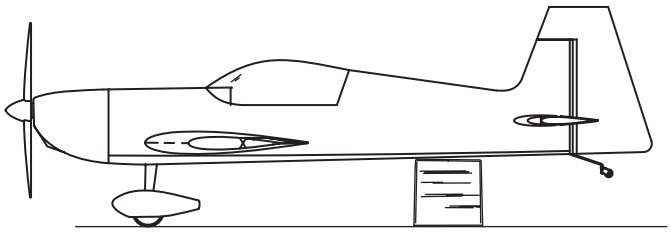
1. Use paper towels and window cleaner to wipe oily fingerprints and dust from the model. Cut out the decals.

2. "Float" the decals into position by dipping them in a solution of liquid dish soap and warm water—just a few drops of soap per gallon of water.

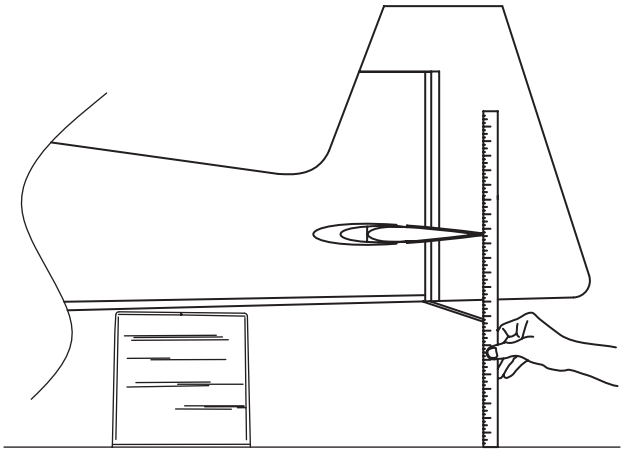
3. Use a piece of soft balsa or something similar to squeegee the water from under the decals.

Set the Control Throws

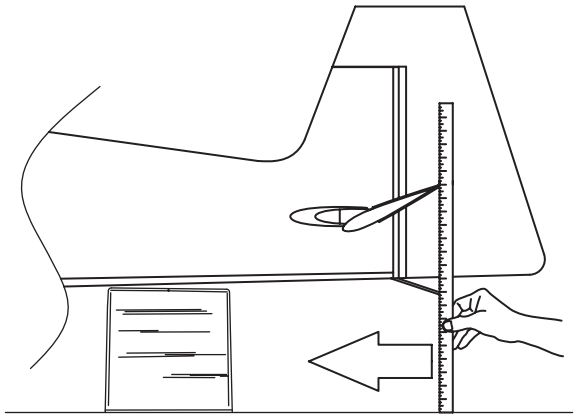
Perform the following procedures to measure and set the control throws according to the measurements on page 21. The illustrations depict measuring elevator throw, but the procedure is the same for measuring the ailerons and rudder. **Note:** The throws are measured at the **widest part** of each control surface.



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



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



(Move the ruler forward)

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

These are the recommended control surface throws:

HIGH RATES

	Inches	Millimeters	Degrees
ELEVATOR:	1-3/4" up	45mm up	16° up
	1-3/4" down	45mm down	16° down
RUDDER:	7" right	180mm right	29° right
	7" left	180mm left	29° left
AILERONS:	2" up	50mm up	20° up
	2" down	50mm down	20° down

LOW RATES

	Inches	Millimeters	Degrees
ELEVATOR:	1" up	25mm up	9° up
	1" down	25mm down	9° down
RUDDER:	5" right	130mm right	22° right
	5" left	130mm left	22° left
AILERONS:	1-3/8" up	35mm up	14° up
	1-3/8" down	35mm down	14° down

3D RATES

	Inches	Millimeters	Degrees
ELEVATOR:	4-3/4" up	120mm up	42° up
	4-3/4" down	120mm down	42° down
RUDDER:	8" right	200mm right	32° right
	8" left	200mm left	32° left
AILERONS:	3-1/2" up	90mm up	40° up
	3-1/2" down	90mm down	40° down

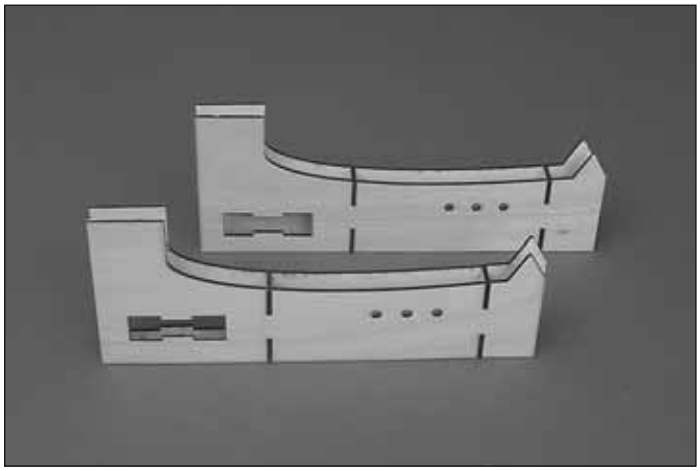
IMPORTANT: The 38% Great Planes Extra 330S ARF has been **extensively** flight tested to arrive at the throws at which it flies best. Flying your model at these throws will provide you with the greatest chance for successful first flights. If, after you have become accustomed to the way the Extra flies, 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."

Note: We have also found that approximately 5% up elevator-to-rudder mixing will improve mild down-pitch coupling that occurs during rudder inputs.

Balance the Model (C.G.)

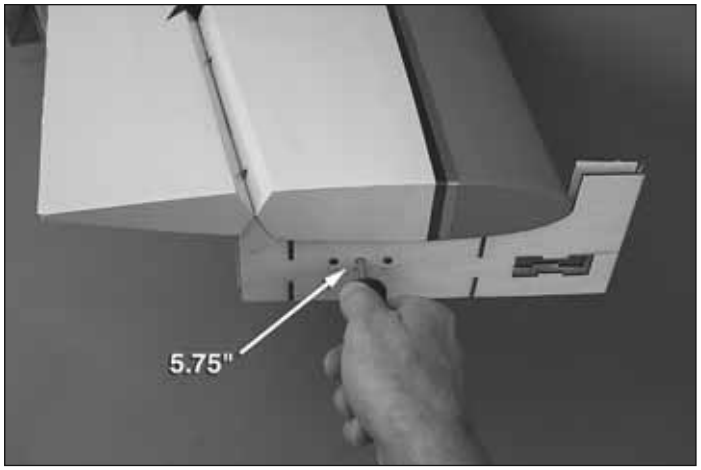
More than any other factor, the **C.G.** (balance point) can have the **greatest** effect on how a model flies, and may determine whether or not your first flight will be successful. If you value this model and wish to enjoy it for many flights, **DO NOT OVERLOOK THIS IMPORTANT PROCEDURE.** A model that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

At this stage the model should be in ready-to-fly condition with all of the systems in place including the engine, propeller and spinner and the complete radio system.



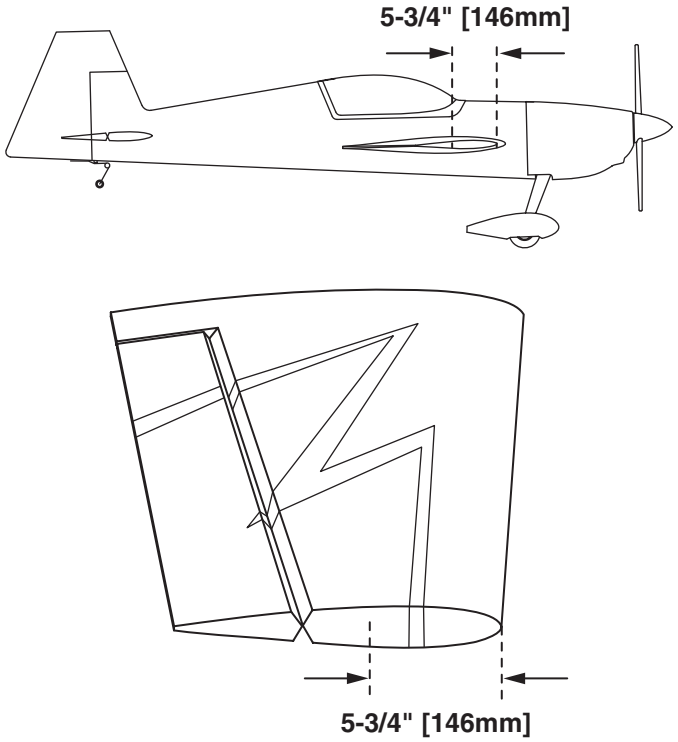
❏ 1. Assemble the plywood **C.G. cradles** as shown.

❏ 2. Bolt the wings to the fuselage with the wing tube.



❏ 3. Using an assistant, lift the model with the C.G. cradles under the tips of the wings with screwdrivers in the middle holes that are marked **5.75"**.

*For initial flights, the plane should balance 5-3/4" [146mm] from the leading edge of the wing measured at the **WING TIPS.***



5-3/4" [146mm] (from the leading edge of the wing at the tips) is the ideal, beginning balance point for your first flights. Balanced here, it has been proven that the model will be aerobatic, but won't get you into trouble or react unexpectedly (provided the control throws are also set to the high and low rates on page 21). The model could be flown balanced at or between the forward (5.0") or aft (6.5") holes, but for the first few flights try to get it to balance at the recommended 5.75" marks.

❏ 4. If, when lifting the model with the C.G. cradles, the nose pivots downward, the model is nose-heavy. If possible, shift and remount internal components aft to get the model to balance and, if necessary, add lead ballast to the tail. If, when lifting the model with the C.G. cradles, the nose pivots upward, the model is tail-heavy. If possible, shift and remount internal components forward to get it to balance and, if necessary, add lead ballast to the nose.

❏ 5. IMPORTANT: Recheck the C.G. after any adjustments have been made.

Balance the Model Laterally

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

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

PREFLIGHT

Identify Your Model

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

Ground Check

If the engine is new, follow the engine manufacturer's instructions to break it in. 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

Follow the manufacturer's instructions that came with your radio to ground check the operational range of your radio before the first flight of the day—both with the engine off and with **the engine running** at various speeds with an assistant holding the model. If the control surfaces do not respond correctly, **do not fly!** Find and correct the problem first.

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, scarves, long hair or loose objects such as pencils or screwdrivers that may fall out of shirt or jacket pockets into the prop.
- Always use an assistant or a secure retention device to anchor the plane while starting the engine and operating it on the ground.
- Always shut off the engine and turn off the ignition battery switch before making engine adjustments.
- 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.
- 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**.

CHECK LIST

During the last few moments of preparation your mind may be elsewhere, anticipating the excitement of the first flight. Or you may be staying up late at night trying to finish your model for the next day. Because of this, you may be more likely to forget or overlook something that could cause a crash. Review this check list to make sure you haven't missed anything and the model is truly ready to fly.

❏ 1. Make sure you have "C.G.'d" the model per the manual.

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

❏ 3. Be certain the batteries, receiver and all other radio components are securely mounted.

❏ 4. Make sure your receiver battery, ignition battery and transmitter batteries are fully charged. It would also be a good idea to cycle new batteries and note their discharge capacity to make sure they are at or close to their rated capacity.

❏ 5. Extend the receiver antenna down through the antenna tube in the fuselage.

❏ 6. Make sure all the servo arms/wheels are secured to the servos with the screws. Any servo arm/wheel mounting screws that go into metal output shafts should have threadlocker.

❏ 7. Make sure any other screws that go into metal are threadlocked.

❏ 8. Strongly pull on each control surface to make sure all the hinges are **securely** glued in place.

❏ 9. Make sure holes for wood screws are reinforced with thin CA where appropriate (servo mounting screws, etc.).

❏10. Make sure servo extensions or other wires do not interfere with other systems (servo arms, pull/pull rudder cables, etc.).

❏11. Make sure the fuel lines are connected and are not kinked.

❏12. Balance your propeller and spare propellers.

❏13. Tighten the propeller bolts/nut and spinner.

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

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

FLYING

CAUTION: Because of the power of the engine and the size of the propeller and the injury that they could inflict, **extraordinary** care must be taken during operation of this model—both on the ground and in the air! While the Great Planes 38% Extra 330S has been tested to withstand the stresses of 3D flight, **you still must exercise common sense and proper throttle management**. This is a high-performance, aerobatic "thoroughbred," not an over-built sport model for the undisciplined flyer. "Hack" maneuvers such as high-speed dives with sudden pullouts and the like are to be avoided and the throttle must be reduced during descending components of all maneuvers (such as on the downside of loops or during down lines). **Failure to practice common sense and exercise restraint could result in high-speed control surface flutter or structural failure.** If these general, safe, common-sense flying practices are not in your nature, one way to keep them in mind would be to fly the plane as though **you** are **actually** in the cockpit. If you are not capable of flying this model with proper control, set it aside and learn on something smaller.

Mount the Wings and Fasten the Canopy Hatch

Mount the wings to the fuselage with the wing tube and four 1/4-20 nylon wing mounting bolts. Don't forget to connect the aileron servos to the extensions coming from the receiver. Then, mount the canopy hatch with the 4-40 x 1/2" [13mm] Phillips screws, #4 flat washers and threadlocker on all the screws. **Important:** Check the four nylon wing mounting bolts frequently to make certain they remain tight.

Start the Engine

Always use an assistant or a secure retention device to hold the plane while starting the engine. Adjust the carburetor so the engine idles smoothly and transitions rapidly and without hesitation to full-throttle. Be certain you can stop the engine from the radio by shutting off the throttle.

Takeoff

Whenever flying—and especially during the first flight—it's always a good idea to have a "spotter" with you to keep an eye on other R/C traffic so you can taxi, takeoff, fly and land without getting too close to another model. Before taking off, perform a few practice runs at **low speeds** on the runway to see if the tail wheel needs adjusting. If necessary, adjust the spring hooks so the model rolls straight.

Double-check the control directions before every flight. And for the first flight, takeoff on low rates. Remember to takeoff into the wind, point the model straight down the runway, hold a bit of up elevator to keep the tail down, and then gradually advance the throttle. Do not use full-throttle for takeoff until you have become familiar with the engine power. As the model gains speed decrease up elevator, allowing the tail to come off the ground. Be ready to apply right rudder to counteract engine torque. When the plane has reached flying speed gently apply up elevator, being ready on the ailerons and rudder to keep the wings level and the nose pointed straight-ahead. Establish a gentle climb and make your first turn away from the pits.

CAUTION: 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; worn or loose-fitting control linkages; Worn servos or excessive free play in servo gears; Insecure servo mounting; and one of the most prevalent causes of flutter; Flying at excessive speeds.

Flight

When the plane has become airborne, have your assistant keep an eye on other traffic and remind you to throttle back if necessary—do not use full throttle until you have become familiar with the model and it has been trimmed! Once at cruise, the first thing you should do is reach a safe altitude and trim the model for "hands-off," straight-and-level flight. Then you may test different control throw rates one at a time. While still at a safe altitude, slow the model to see how it reacts. Take it easy with your 38% Extra for the first few flights, gradually getting acquainted with it as you gain confidence. 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

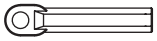
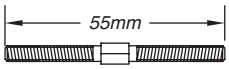
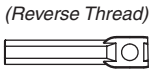
When ready to land, make a few "test passes" at reduced throttle settings learning how the model glides and the rate it bleeds off air speed. To initiate a landing approach, lower the throttle while on the downwind leg and allow the nose to pitch downward to gradually bleed off altitude. Continue to lose altitude, but maintain airspeed by keeping the nose down as you turn onto the crosswind leg. Make your final turn toward the runway (into the wind) keeping the nose down to maintain airspeed and control. Level the attitude when the model reaches the runway threshold, modulating the throttle as necessary to maintain your glide path and airspeed. If you are going to overshoot, smoothly advance the throttle (always ready to apply right rudder to counteract torque) and climb out to make another attempt. When you're ready to make your landing flare and the model is a foot or so off the deck, continue to gradually increase up elevator until it gently touches down. Once the model is on the runway and has lost flying speed, switch to high elevator and rudder rates so the model will be easier to taxi. If necessary, hold up elevator to hold the tail on the ground.

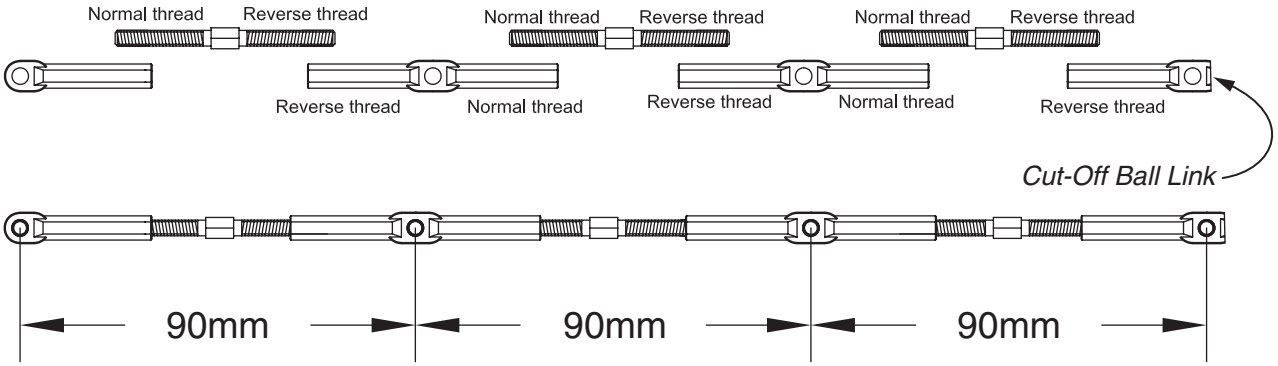
One final note about flying. Have a goal or flight plan in mind for **every** flight. This can be learning a new maneuver(s), improving a maneuver(s) you already know, or learning how the model behaves in certain conditions (such as on high or low rates). This is not necessarily to improve your skills (*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 altitude or airspeed. Every maneuver should be calculated and 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!

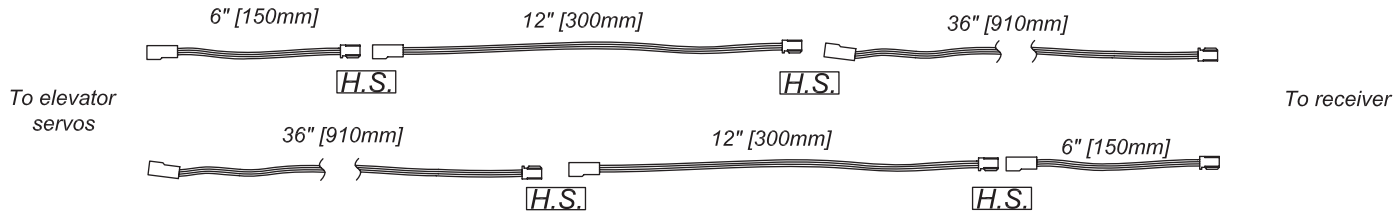
RUDDER PUSHROD ASSEMBLY

				
Regular Ball Link (x2)	*Turnbuckle Pushrod (x6)*	*Dual-Ended Ball Link (x6)*	*Cut-Off Ball Link (x2)*	*Brass Ball Link Ball (x8)*

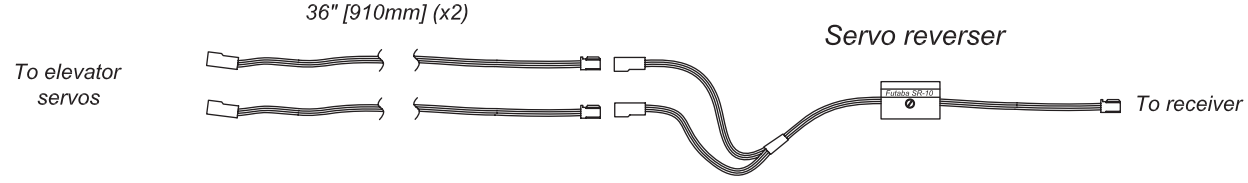


ELEVATOR SERVO EXTENSIONS

*Make the servo extensions this way if connecting the elevator servos to **separate** channels.*



*Make the servo extension this way if connecting the elevator servos to **the same** channel.*



3D FLYING

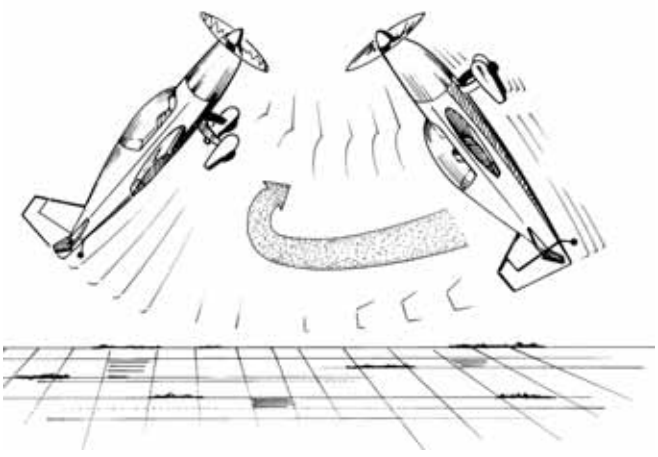
Because of the power to weight ratio on 3D planes, straight and level flight should be at a reduced throttle and full power should only be used when the airplane is "loaded" during a maneuver. Learn to manage the throttle and experiment while in the maneuver. The power needed will depend on the maneuver being performed. C.G. also plays a large role in the 3D capability of models as well. Experiment, but keep in mind that being tail heavy is not always the best way to go.

Propeller thrust and thrust vectoring need to be considered for 3D aerobatics. A large diameter prop with a low pitch will provide a lot of pull for the aircraft but will not offer enough air moving across the tail surfaces (thrust vectoring) for 3D. Due to the large number of factors involved, some experimentation will be necessary to find the right propeller pitch and diameter for your model.

Higher RPM engines such as a .46 two-stroke require a low pitch propeller and lower RPM motors such as a 1.60 will require a higher pitch propeller. If you feel that the effectiveness of the tail surfaces is not enough, try a smaller propeller with a higher pitch.

Another thing to remember is that maximum control throw is not necessary for all 3D maneuvers. Occasionally, too much throw can place the model too far into a stall causing the model to become uncontrollable. Practice your maneuvers at a higher altitude while you become accustomed to your particular plane's stall characteristics.

WATERFALLS



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

UPRIGHT FLAT SPINS

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

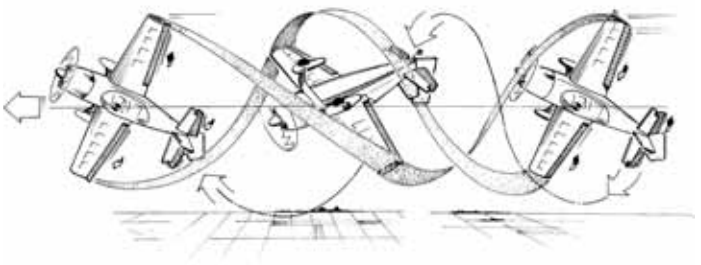
INVERTED FLAT SPINS

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

THE WALL

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

KNIFE EDGE TUMBLE



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

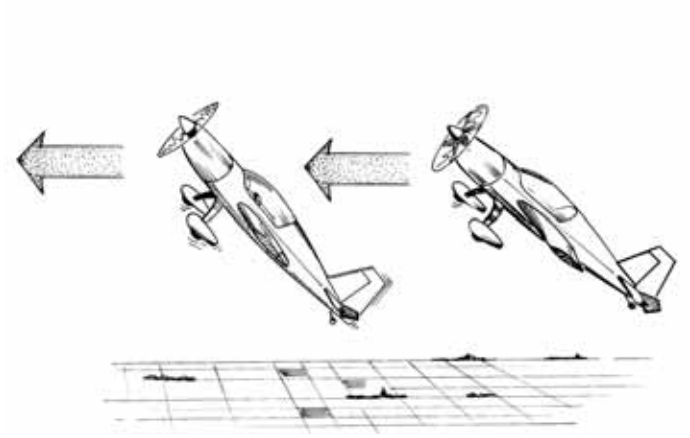
VERTICAL HOVER

Fly a straight pass across the field at 75ft high and 100ft out and pull the model vertical. Roll the model until the top of it is facing you and slowly begin to reduce power. As the model begins to slow down to 10mph or so, slowly add a little bit of power back in. You will have to adjust the throttle as needed, but make your adjustments smooth. Some right aileron may be needed to keep the model from torque rolling. Use the rudder and elevator to keep the nose pointing straight up. Be patient as this maneuver will take a while to learn.

TORQUE ROLL

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

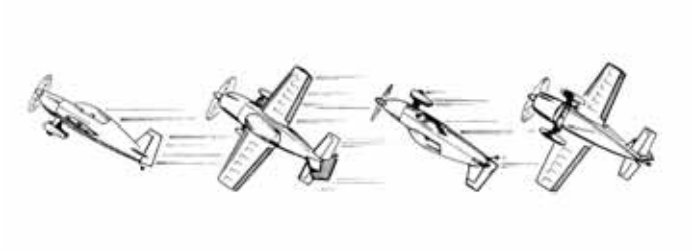
HARRIER



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

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

ROLLING HARRIER



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

PINWHEEL

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