# ULTRA-SPORT 40

## CUSTOM ARF SERIES™

*Almost Ready-to-Fly*


*Instruction Manual*

# 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, they are advised to return this kit immediately in new and unused condition to the place of purchase.**

**READ THROUGH THIS INSTRUCTION MANUAL FIRST. IT CONTAINS IMPORTANT INSTRUCTIONS AND WARNINGS CONCERNING THE ASSEMBLY AND USE OF THIS MODEL.**

GREAT PLANES® MODEL MANUFACTURING COMPANY

P.O. BOX 788 URBANA, ILLINOIS 61801 (217) 398-8970

GPMA1010 V1.2

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## Metric Conversion Chart

**Inches x** 25.4 = mm (conversion factor)

| | | |
|---|---|---|
| 1/64" | = | .4 mm |
| 1/32" | = | .8 mm |
| 1/16" | = | 1.6mm |
| 3/32" | = | 2.4 mm |
| 1/8" | = | 3.2 mm |
| 5/32" | = | 4 mm |
| 3/16" | = | 4.8 mm |
| 1/4" | = | 6.4 mm |
| 3/8" | = | 9.5 mm |
| 1/2" | = | 12.7mm |
| 5/8" | = | 15.9mm |
| 3/4" | = | 19 mm |
| 1" | = | 25.4 mm |
| 2" | = | 50.8 mm |
| 3" | = | 76.2 mm |
| 6" | = | 152.4mm |
| 12" | = | 304.8 mm |
| 15" | = | 381 mm |
| 18" | = | 457.2 mm |
| 21" | = | 533.4 mm |
| 24" | = | 609.6 mm |
| 30" | = | 762 mm |
| 36" | = | 914.4mm |

# WARNING! THIS IS NOT A TOY!
# THIS IS NOT A BEGINNER'S AIRPLANE!

This R/C kit and the model you will build is not a toy! It is capable of serious bodily harm and property damage. **IT IS YOUR RESPONSIBILITY AND YOURS ALONE** — to build this kit correctly, to properly install all R/C components and flying gear (engine, tank, pushrods, etc.) and to test the model and fly it only with experienced, competent help, using common sense and in accordance with all safety standards as set down in the Academy of Model Aeronautics Safety Code. It is suggested that you join the AMA and become properly insured before you attempt to fly this model. IF YOU ARE JUST STARTING R/C MODELING, CONSULT YOUR LOCAL HOBBY SHOP OR WRITE TO THE ACADEMY OF MODEL AERONAUTICS TO FIND AN EXPERIENCED INSTRUCTOR IN YOUR AREA.

**Academy of Model Aeronautics**
**5151 E. Memorial Drive**
**Muncie, IN 47302-8252**
**(317)289-4236**

## Introduction

Congratulations and thank you for purchasing the Great Panes **Ultra-Sport 40 ARF.** The Ultra-Sport incorporates several new design features never before found in an ARF kit. It utilizes rod-in tube pushrods, adjustable glass-filled nylon engine mount, multiple color layers with a glossy, fuel-resistant outer coating and high quality Great Planes hardware. Stronger and lighter than a conventional, built-up balsa kit, it provides even better overall performance!

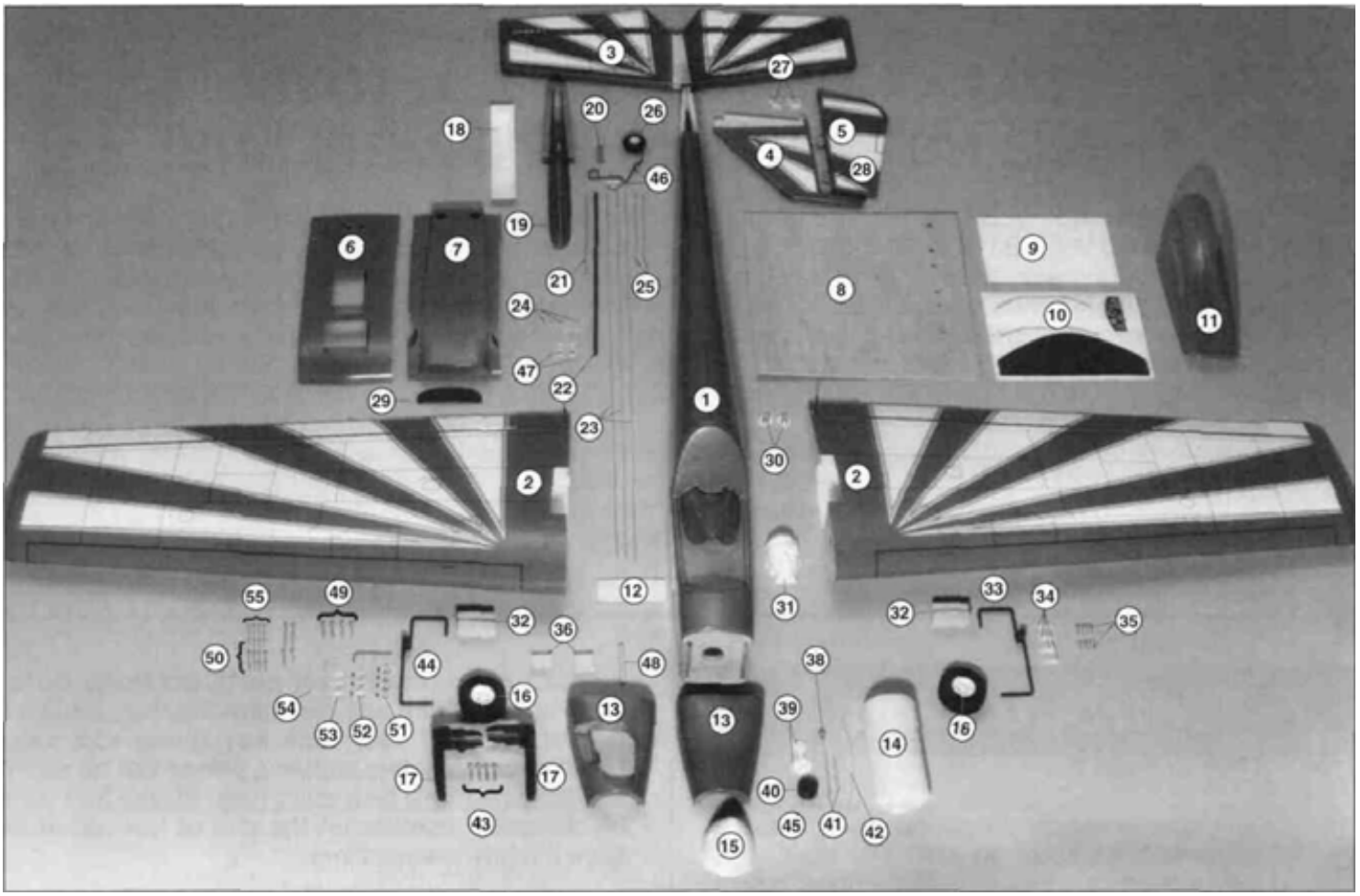
**Please inspect all parts carefully before starting to build! If any parts are missing, broken or defective, or if you have any questions about building or flying this airplane, please call us at (217) 398-8970 and we'll be glad to help. Please find the kit identification number on the end of the carton and have it ready when calling.**

The Great Planes Ultra-Sport 40 ARF is like the Ultra-Sport 40 kit. This almost ready to fly version is one of the easiest-flying, most aerobatic aircraft ever designed. It combines the design expertise and high quality standards of Great Planes kits with state-of-the-art ARF technology—for craftsmanship and performance superior to all other prebuilt models. However, **this is not a beginner's airplane!** While the Ultra-Sport 40 ARF is easy to assemble, we must discourage you from selecting this kit as your **first** R/C airplane. It is highly maneuverable, and lacks the self-recovery characteristics of a good **basic trainer** such as the Great Planes **PT Series** airplanes. On the other hand, if you are confident with your flying skills and can safely handle aileron airplanes such as the Great Planes **Big Stick Series,** the Ultra-Sport 40 ARF is an excellent choice.

## Precautions

1. You must assemble the plane **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 you should assume the written instructions are correct.

2. You must take time to build straight, true and strong. **IMPORTANT -** *Glue should never be substituted for a good-fitting joint. Take a little extra time to get a good-fitting joint and glue it properly. It will be stronger, neater, and much lighter than a poor fitting joint held together with an excess of glue!*



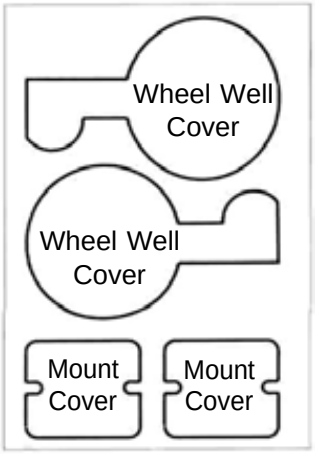
| Part# | Description | Quantity |
|---|---|---|
| 1 | Fuselage | 1 |
| 2 | Wing Right & Left | 2 |
| 3 | Horizontal Stabilizer & Elevator | 1 |
| 4 | Vertical Stabilizer | 1 |
| 5 | Rudder | 1 |
| 6 | Wing Fairing (top) | 1 |
| 7 | Wing Fairing (bottom) | 1 |
| 8 | Die-Cut Plywood | 1 |
| 9 | Die-Cut Plastic | 1 |
| 10 | Decal Sheet | 1 |
| 11 | Canopy | 1 |
| 12 | Rear Wing Joiner | 1 |
| 13 | Cowling | 2 |
| 14 | Fuel Tank | 1 |
| 15 | Spinner | 1 |
| 16 | Wheel (main gear) | 2 |
| 17 | Adjustable Engine Mount | 1 |
| 18 | Die-Cut Plastic Control Horn Backing | 1 |
| 19 | Vertical Stabilizer Fairing | 1 |
| 20 | Tail Gear Bracket | 1 |
| 21 | Splined Plastic Tubing | 1 |
| 22 | Throttle Guide Tube | 1 |
| 23 | Pushrod (throttle, elevator, rudder) | 3 |
| 24 | Clevis | 3 |
| 25 | Pushrod (ailerons) | 2 |
| 26 | Tail Wheel | 1 |
| 27 | Control Horn | 2 |
| 28 | CA Hinges | 2 |
| 29 | Foam Rubber Seal | 1 |
| 30 | Blind Nut | 2 |
| 31 | Pilot | 1 |
| 32 | Landing Gear Mounting Block | 2 |
| 33 | Main Landing Gear Strut (L) | 2 |
| 34 | Flat Nylon Strap | 4 |
| 35 | #2 x 3/8" Sheet Metal Screw | 8 |
| 36 | Wing Bolt Plate | 1 |
| 38 | Fuel Pick-up Weight (clunk) | 1 |
| 39 | Stopper Disc | 2 |
| 40 | Rubber Plug | 1 |
| 41 | Aluminum Tube | 2 |
| 42 | Fuel Tubing | 1 |
| 43 | 6-32 x 3/4" Machine Screw | 4 |
| 44 | Main Landing Gear Strut (R) | 1 |
| 45 | Tank Plug 3 x 18mm S/T Screw | 1 |
| 46 | Tail Gear | 1 |
| 47 | Swivel Clevis | 2 |
| 48 | Wing Dowel | 1 |
| 49 | #6 x 3/4" Sheet Metal Screw | 4 |
| 50 | #2 x 3/8" Sheet Metal Screw | 12 |
| 51 | 5/32" Wheel Collar | 4 |
| 52 | 3/32" Wheel Collar | 2 |
| 53 | Aluminum Spacer | 2 |
| 54 | #2 Washer | 4 |
| 55 | 2-56 x 5/8" Machine Screw | 4 |
| 56 | 1/4-20 Nylon Wing Bolt (not shown) | 2 |
| 57 | #4 **x** 1/2" Sheet Metal Screw (not shown) | 10 |

## Items Required

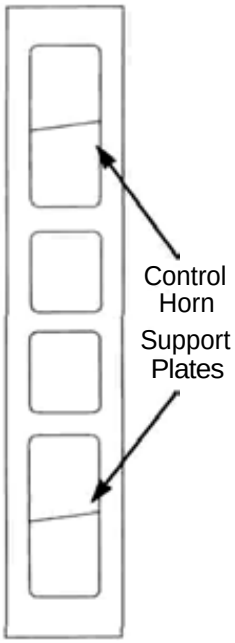
- ❑ 1 oz. Thin CA Adhesive
- ❑ 1 oz. Medium CA Adhesive
- ❑ 9 oz. 6-minute Epoxy
- ❑ 9 oz. 30-minute Epoxy
- ❑ Masking Tape
- ❑ Petroleum Jelly
- ❑ Isopropyl Rubbing Alcohol
- ❑ Thread Locking Compound
- ❑ Silicone Sealant
- ❑ Sandpaper Fine/Medium
- ❑ Pliers
- ❑ String
- ❑ Felt-Tip Pen
- ❑ Clothespins
- ❑ Mixing Sticks
- ❑ T-Pins
- ❑ Hobby Knife, #11 Blades
- ❑ Ruler
- ❑ Hand or Electric Drill
- ❑ Drill Bits 1/16", 3/32", 5/64" 7/64", 1/4"
- ❑ Foam Rubber
- ❑ Wing Seating Tape
- ❑ #64 Rubber Bands
- ❑ Epoxy Brushes
- ❑ Mixing Cups
- ❑ Paper Towels
- ❑ Files, Flat & Round
- ❑ Screwdrivers
- ❑ 5/32" Adjustable Axle
- ❑ Pushrod Connectors (opt.)
- ❑ Retract Servo (opt.)
- ❑ Retracts (HCAP4010) (opt.)
- ❑ Retract Pushrod Wire 2-56 (opt.)

# Die-Cut Parts

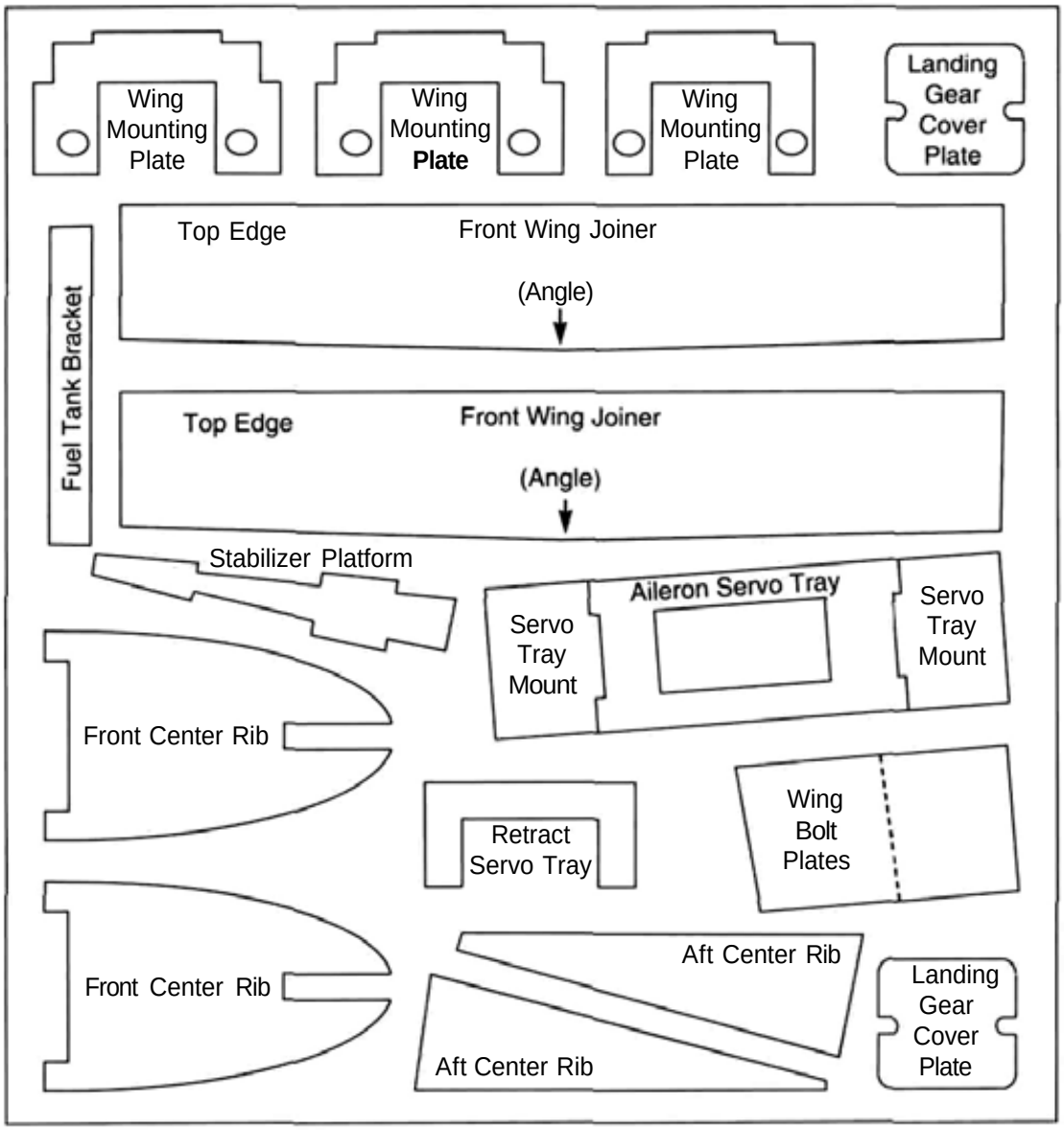
**Plastic Sheet**



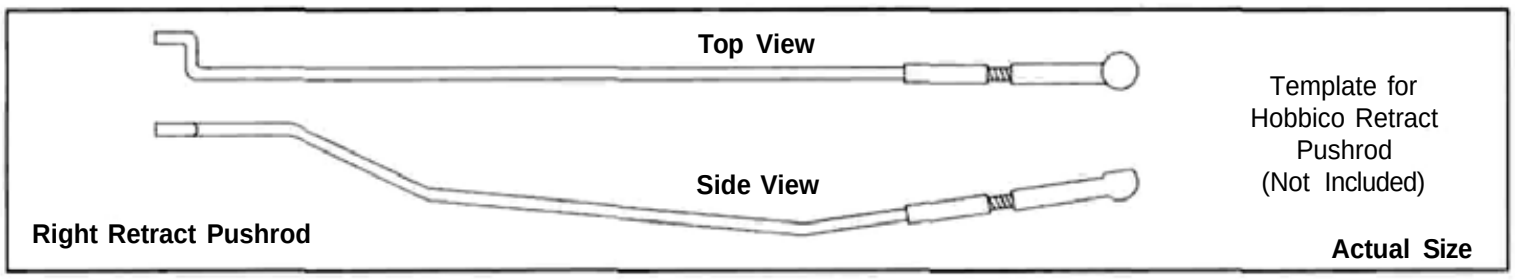

**Plastic Sheet**

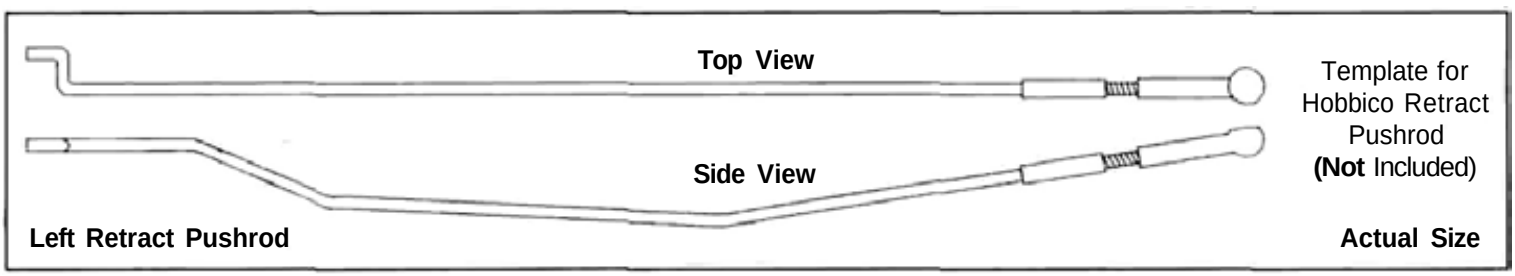



**1/8" (3mm) Plywood Sheet**




**Not Actual Size**



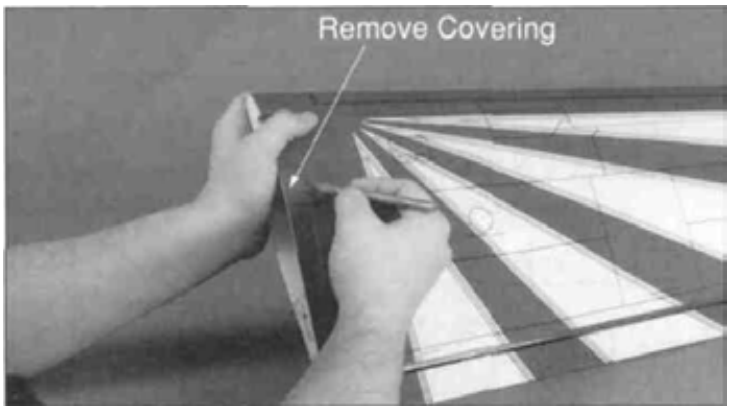



# Wing Assembly

## Center Ribs and Wing Joiners Fixed Gear (Option A)

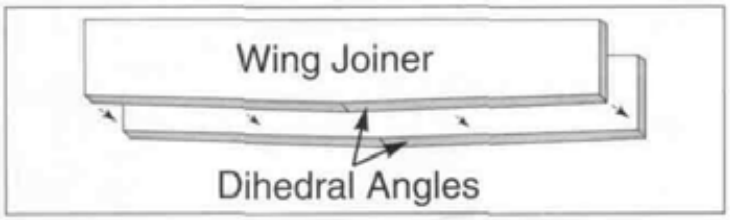
(Skip Steps 1-6 Option A if retracts are to be installed.)
(Continue on page 7.)

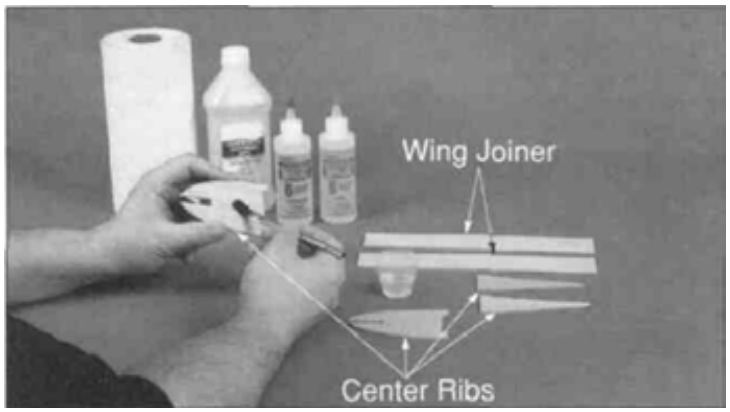
### *Remove the Foam Covering*




❑ 1. Remove the foam covering from the aileron servo opening. The covering has been partially precut for exact location.

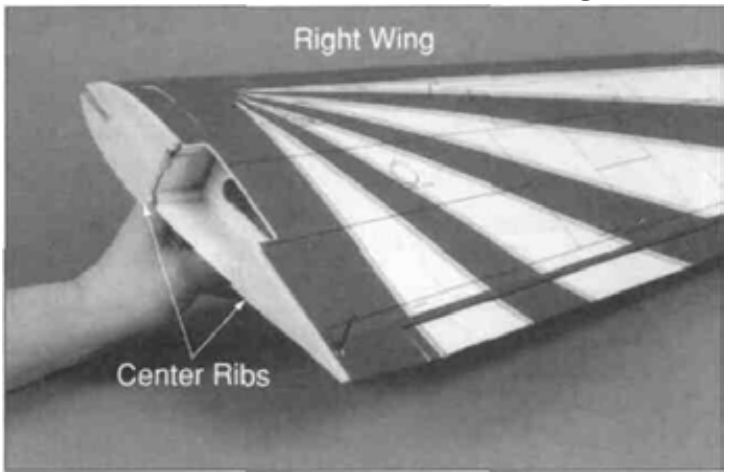
### *Glue the Center Ribs & Wing Joiners*



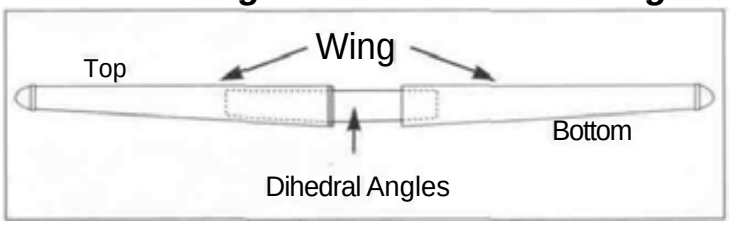

❑ 2. Carefully glue the plywood center ribs and wing joiners together using 6-minute epoxy. The plywood joiner has a slight angle on one edge. Place these angles adjacent with each other. Use clothespins to clamp the joiner and ribs together. Remove the excess epoxy on the edge of the ribs and joiner using a paper towel and rubbing alcohol.

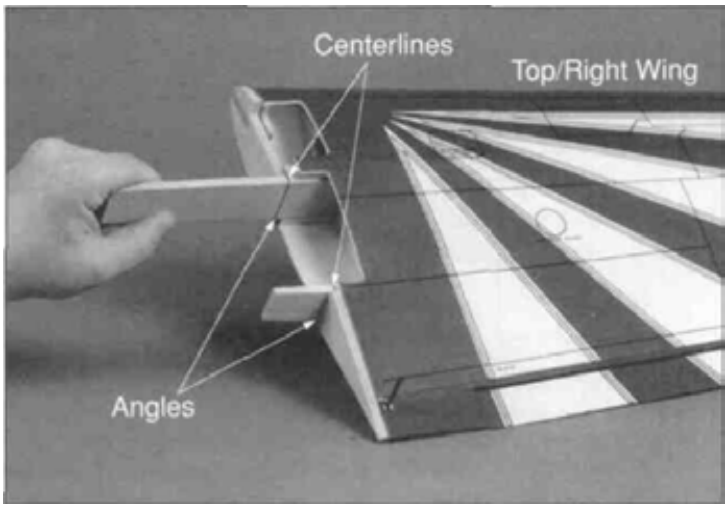
### *Glue the Center Rib on the Wing*




❑ 3. Trial fit the center ribs on both wing halves, the ribs should not protrude beyond the outer covering of the wing. Lightly sand the ribs until they are flush with the wing covering. Use 6-minute epoxy to glue the plywood center ribs to the right wing half.

### *Glue the Wing Joiners into the Wing*

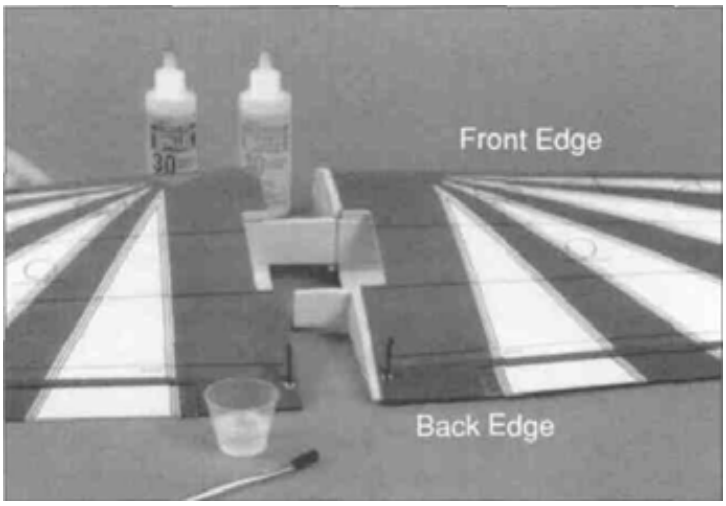



❑ 4. Draw a centerline on both of the wing joiner pieces. Trial fit the wing joiners into both wing halves. A snug fit is desirable. If the joiners do not fit properly, lightly sand the excess epoxy and uneven surface joints from the joiner edges and sides. **Note:** *The plywood and balsa wing joiners have a slight dihedral angle on one edge. This angle should be on the bottom of the wing.*

❑ 5. Use 6-minute epoxy to glue the front and rear wing joiners into the right wing half. Before the epoxy cures, make sure the joiners are straight and in good contact with the wing spars. Wipe off any excess epoxy on the ribs or on the wing covering with a paper towel and rubbing alcohol.

### *Join the Wing*

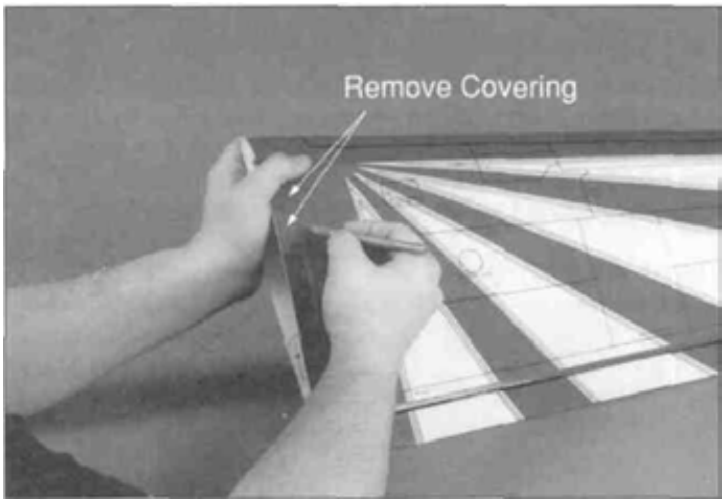



❑ 6. Trial fit the two wing halves together. The wing halves should seat together without any gaps and the front and back edges of each wing should line up with each other. Completely cover the wing joiners, spars and center ribs with 30-minute epoxy. Slide the two wing halves together, using masking tape to hold the wing in proper alignment until the epoxy cures.

## Center Ribs and Wing Joiners Retracts (Option B)

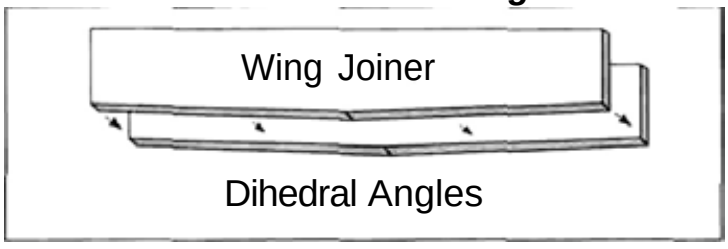
(Skip Steps 1 -7 Option B if fixed landing gear are to be installed.)
(Continue on page 8.)

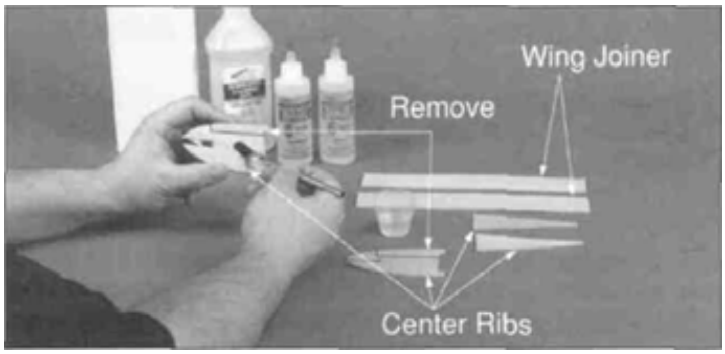
### *Remove the Foam Covering*




❑ 1. Remove the foam covering from the aileron and retract servo openings. The skin has been partially precut for exact location.

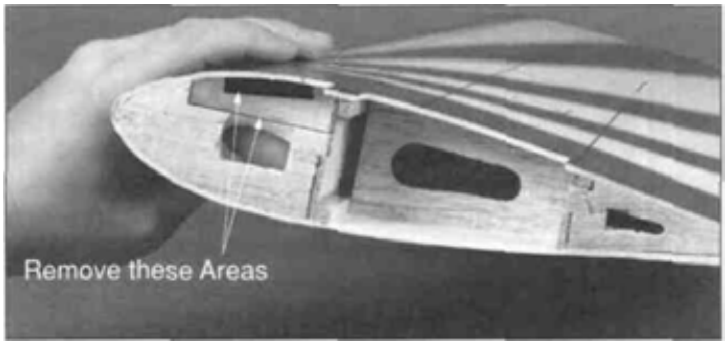
### *Glue the Center Ribs & Wing Joiners*



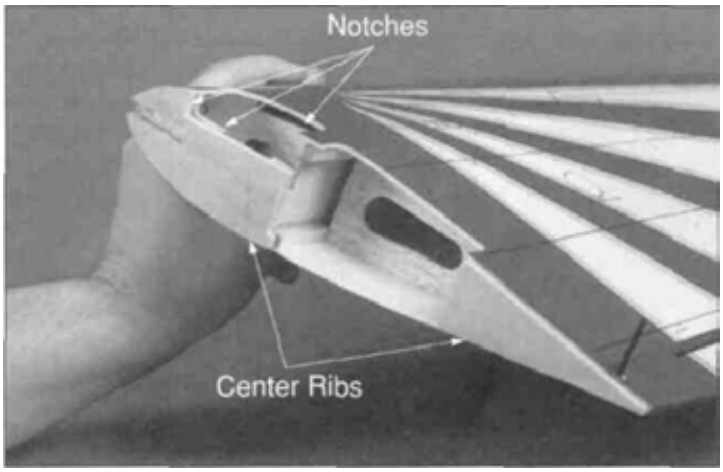

❑ 2. Remove the precut area from the front center rib before gluing. Carefully glue the plywood center ribs and wing joiner together using 6-minute epoxy. The plywood joiner has a slight angle on one edge. Place these angles adjacent with each other. Use clothespins to clamp the joiners and ribs together. Remove the excess epoxy on the edge of the ribs and joiner using a paper towel and rubbing alcohol.

### *Modify the Wing Rib*



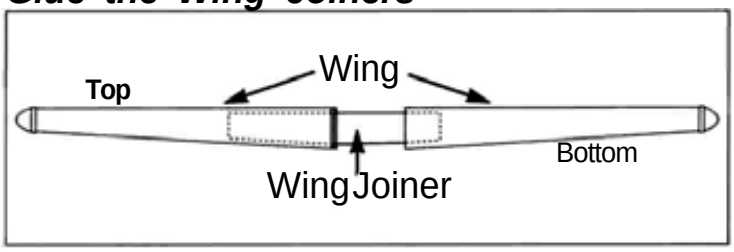

❑ 3. Using a hobby knife, remove the precut areas of the wing ribs on the two closest ribs to the wing root in both wing halves.

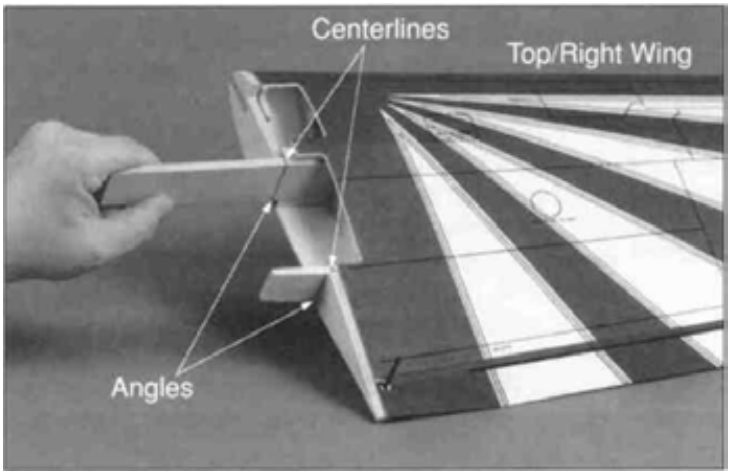
### Glue *the Center Rib on the Wing*




❑ for a proper fit. The ribs should not protrude past the outer skin of the wing. Lightly sand the edges of the center ribs until they are flush with the wing covering. Glue the plywood center ribs to the right wing half. **Note:** *Notice the positions of the notches removed from the center and wing ribs for the retract pushrods when gluing the plywood rib onto the wing.*

### *Glue the Wing Joiners*

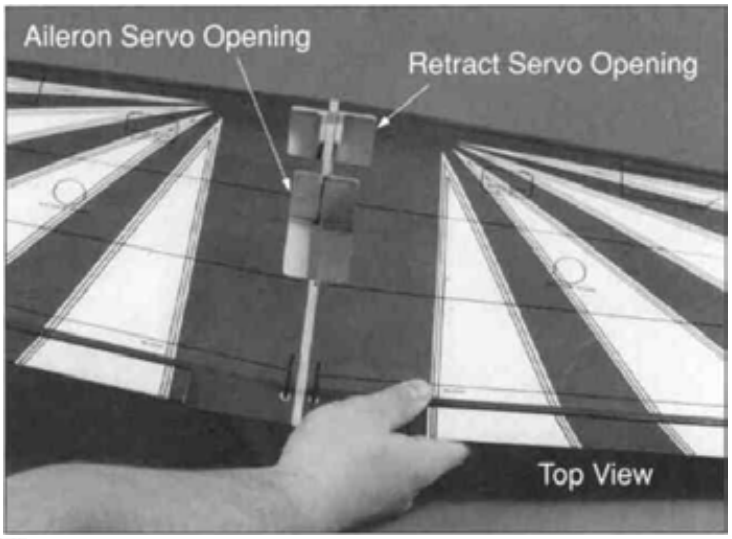



❑ 5. Draw a centerline on both of the wing joiner pieces. Trial fit the wing joiners in both wing halves. A snug fit is desirable. If the joiners do not fit properly, lightly sand the excess epoxy and uneven surface joints from the joiner edges and sides. **The plywood joiner has a slight angle on one side, which should face the bottom of the wing.**

❑ 6. Use 6-minute epoxy to glue the front and rear wing joiners into the right wing half. Before the epoxy cures, make sure the joiners are straight and in good contact with the wing spars. Wipe off any epoxy on the ribs or on the wing covering using a paper towel and rubbing alcohol.

### *Join the Wing*

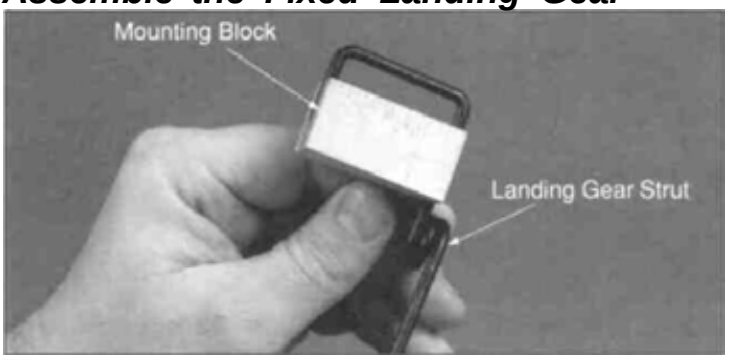



❑ *7.* Trial fit the two wing halves together. The wing halves should seat together without any gaps and the front and back edges of each wing should lineup with each other. Completely, cover the wing joiners, spars and center ribs.with 30-minute epoxy. Slide the two wing halves together, using masking tape to hold the wing in proper alignment until the epoxy cures.

# Landing Gear Assembly Fixed Gear (Option A)

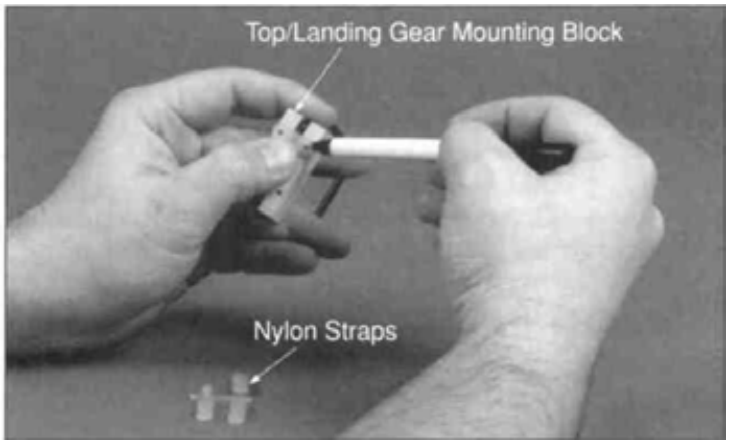
(Skip Steps 1-11 Option A if retracts are being installed.)
(Continue on page 10.)

### *Assemble the Fixed Landing Gear*



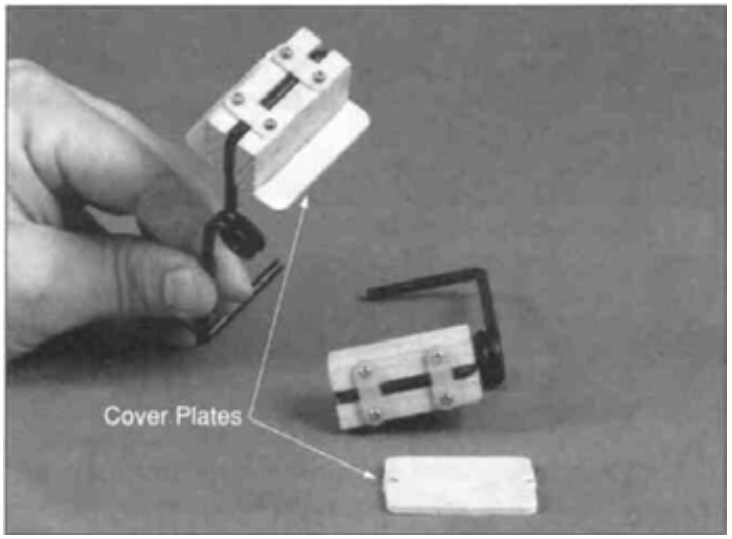

❑ 1. Place the landing gear mounting block between the U-bend on the top portion of the main landing gear strut.

### *Secure the Mounting Blocks*



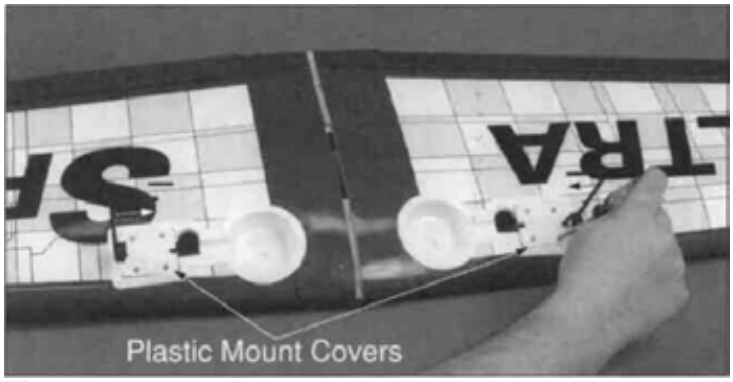

❑ 2. Using a pen, place marks on the mounting blocks using the flat nylon straps as templates. Predrill the screw holes using a 1/16" drill bit and secure the strut with two nylon straps and four #2 x 3/8" sheet metal screws.

### *Final Assembly*



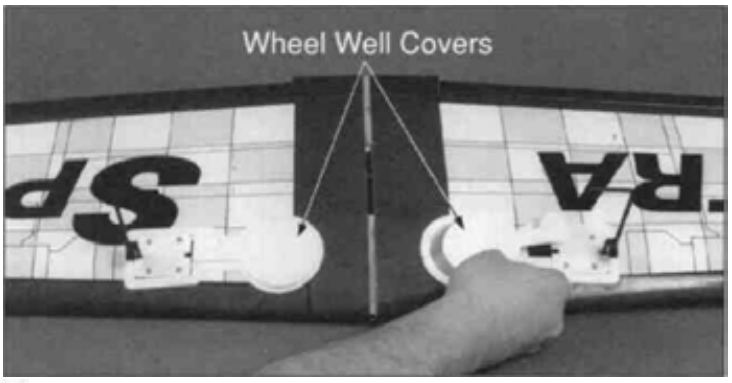

❑ 3. Use 6-minute epoxy to glue the plywood landing gear cover plate to the mounting block.

## *Install the Gear into the Wing*



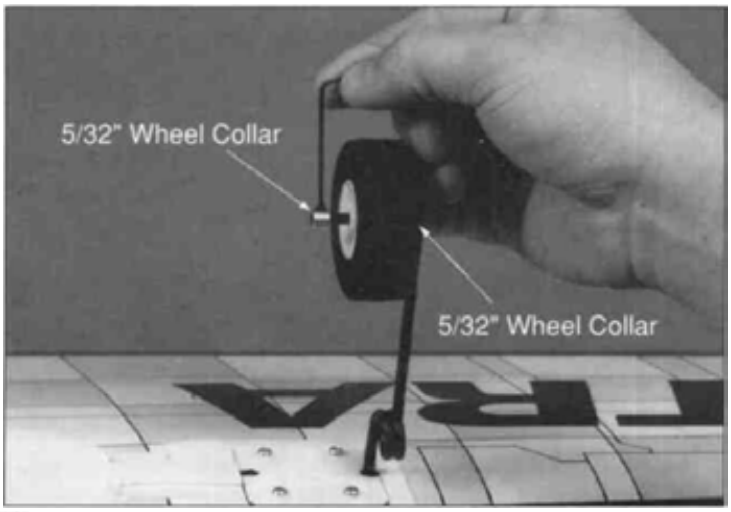

❑ 4. Place the landing gear into position in the wing. Locate the plastic landing gear mount covers and glue them to the plywood mounting plates with thick CA. Trim out and use the template on page 31 to locate and drill eight 3/32" holes in both landing gear mounts. Install eight #4 x 1/2" sheet metal screws into the holes you just drilled. **Note:** The inner four screws secure the plywood plate to the grooved landing gear block and the outer four screws secure the plywood plate to the mounting rails in the wing.

## *Install the Wheel Well Covers*



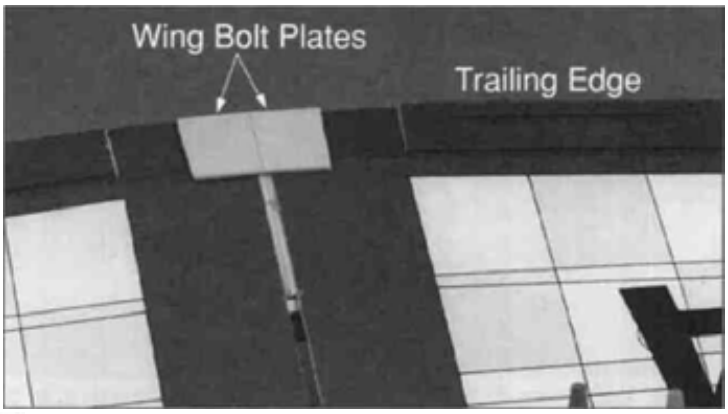

❑ 5. Locate and glue the two white plastic retract wheel well covers in place using medium CA.

## *Mount the Wheel*



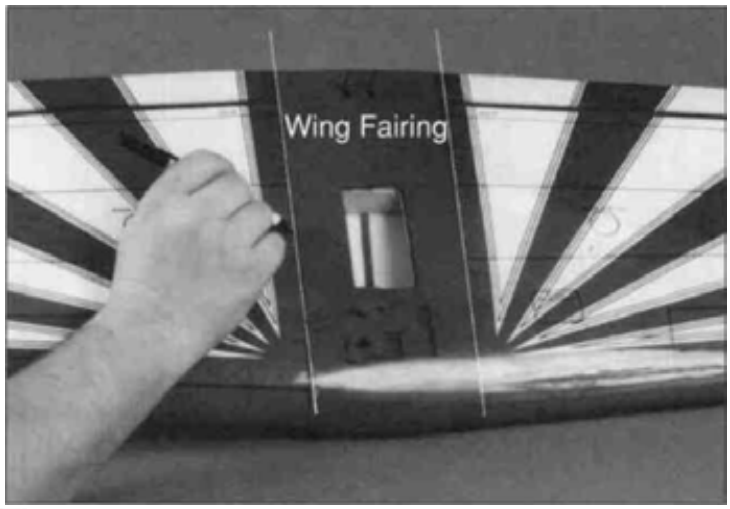

❑ 6. Mount the wheels using the four 5/32" wheel collars. (One on each side of the wheel.)

## *Mount the Wing Bolt Plates*



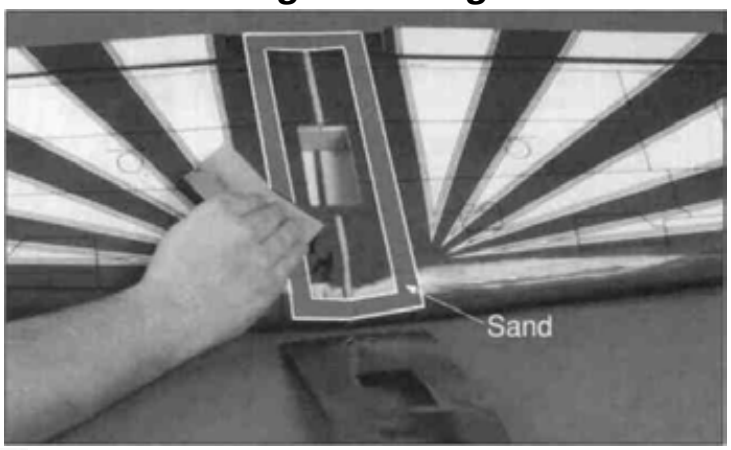

❑ 7. Using 6-minute epoxy, glue the plywood wing bolt plates to the bottom of the wing aligned with the trailing edge.

## *Prepare the Wing Fairing*



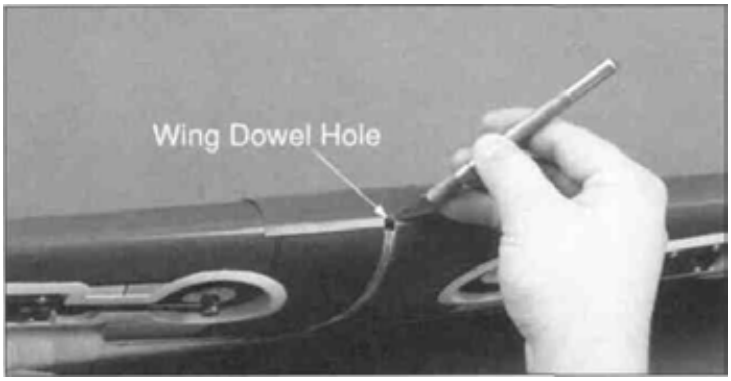

❑ 8. Individually place the top and bottom plastic wing fairings on the wing and lightly trace its outline onto the wing.

## Sand *the Fairing and Wing*



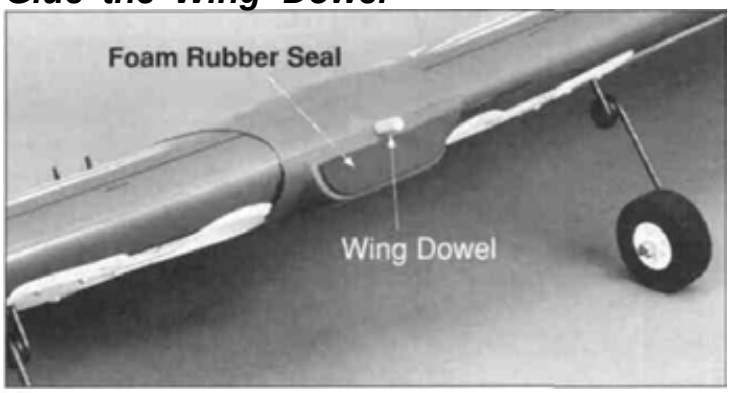

❑ 9. Use medium grit sandpaper to lightly roughen the inside of each fairing where it will be glued to the wing. The area to be sanded is shown as a lightened area in the photograph. This will insure better adhesion of the fairing to the wing.

### *Glue the Fairing to the Wing*




❑ 10. Use thick CA+ to glue the top fairing to the top of the wing. Remove the plastic that is covering the wing dowel hole on the leading edge of the wing. Proceed to glue the bottom fairing to the bottom side of the wing and remove the remaining plastic covering the dowel hole.

### *Glue the Wing Dowel*

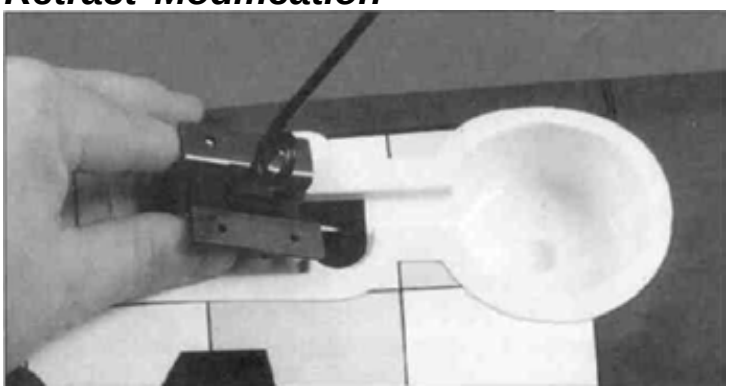



❑ 11. Use 6-minute epoxy to glue the hardwood wing dowel into the leading edge of the wing. Work epoxy into the dowel hole. Apply epoxy to the dowel itself and insert the dowel. Leave 1/2" of dowel protruding from the wing. Clean the excess epoxy from the dowel using a paper towel and rubbing alcohol. Apply the foam rubber seal to the front edge of the wing fairing. It will help prevent exhaust residue from leaking into the fuselage.

## Landing Gear Assembly Retracts (Option B)

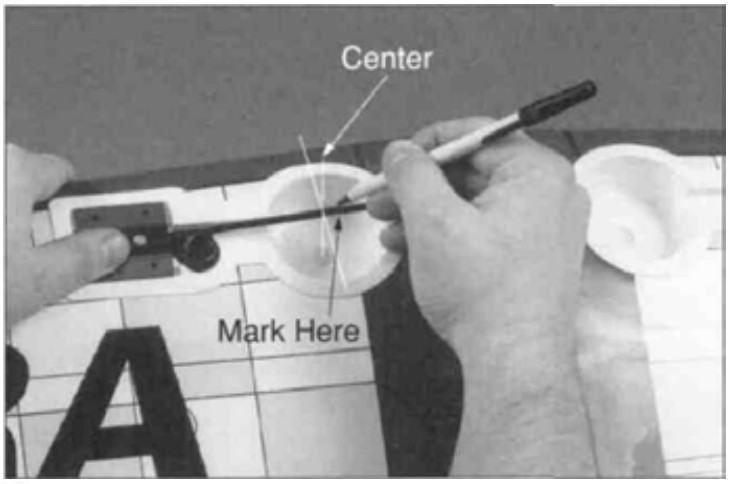
(Skip Steps 1-13 Option B if fixed gear has been installed.)
(Continue with Aileron Assembly on page 12.)

### *Retract Modification*



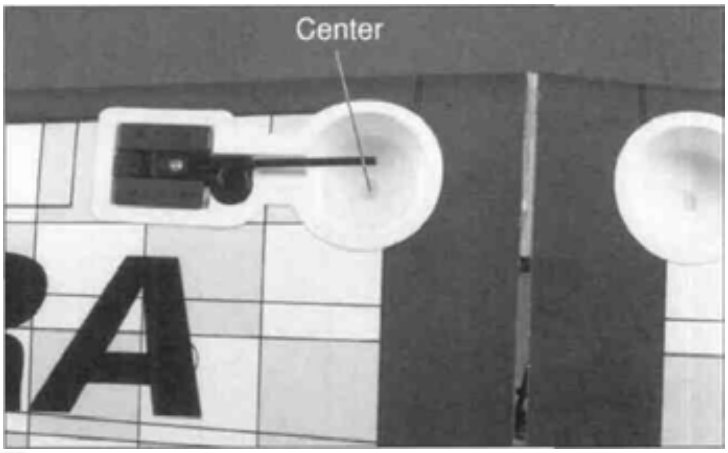
❑ 1. Insert the retract into the wing with the main landing gear wire facing toward the root of the wing when it is folded down.

### *Mark the Retract*



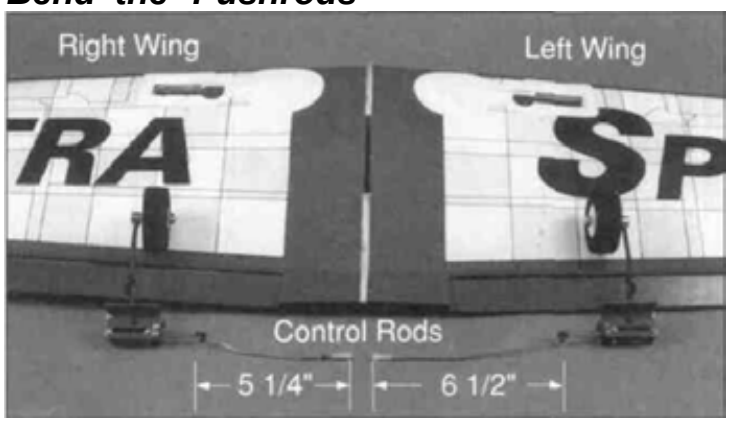

❑ 2. Using a pen, mark the landing gear wire at the center of the wheel well when the retracts are folded into the wing.

### *Cut the Gear Wire*



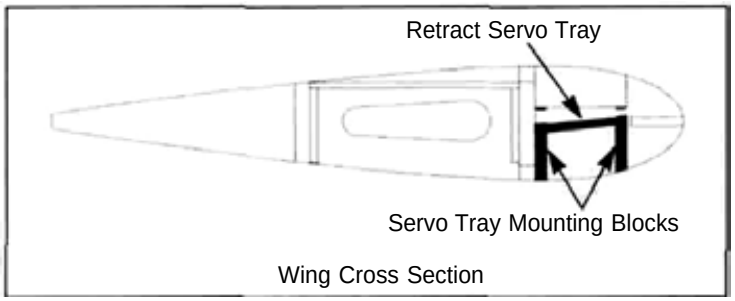

❑ 3. Bend the landing gear wire at the mark. Install the wheel on the landing gear wire securing it with a 5/32" wheel collar. Cut off the excess landing gear wire and file the end to remove any rough edges.

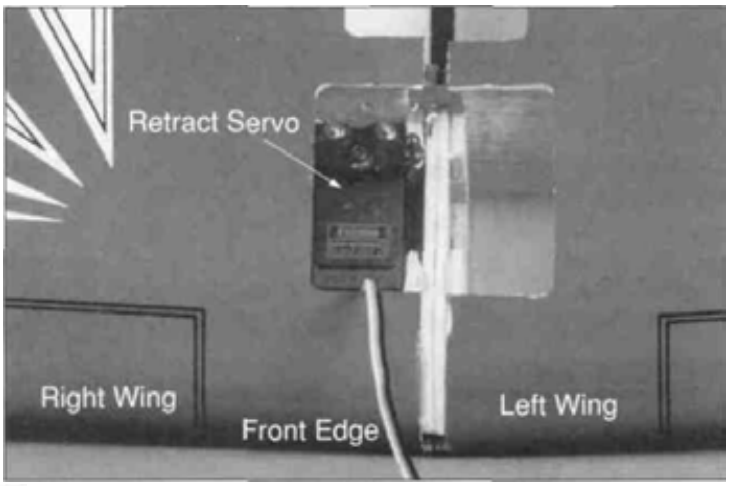
### *Bend the Pushrods*




❑ 4. Bend the pushrods to match the line drawing on page 5. The pushrods should look like the assembled retracts shown in the photograph above, if you are using Hobbico Main Retracts (HCAP4010).

## *Install the Retract Servo*



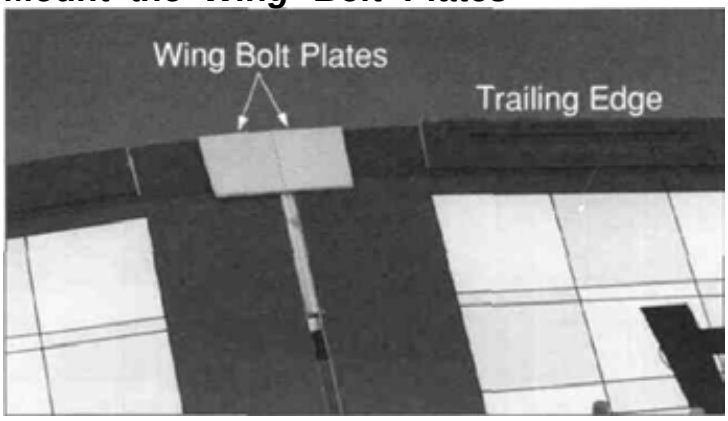

❑ 6. Glue the retract servo tray mounting blocks into **the** wing as shown in the line illustration above. The servo tray should be glued to the servo tray mounting blocks. Mount the servo into place using the screws supplied with the servo. Trial fit the retract servo in the servo tray. Enlarge if necessary.

## *Connect the Retract Linkage*

❑ 7. The linkages in the photograph have been made by using threaded ball links. **Important:** *The retract pushrods and retracts must be adjusted so the retracts lock in both the up and down positions.*

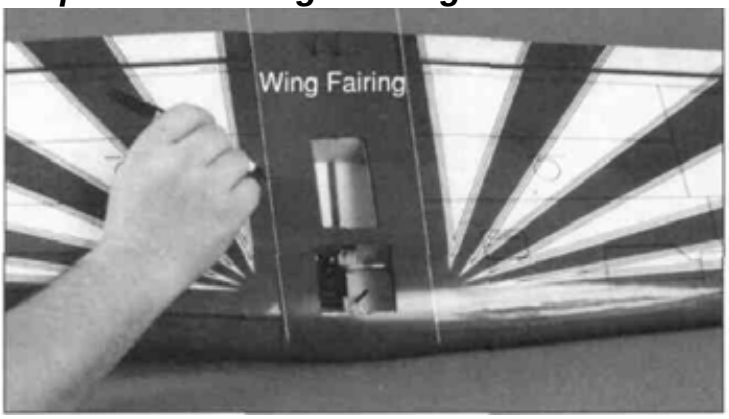
❑ 8. Secure the retract mechanism into the wing using the four #4 x 1/2" sheet metal screws provided. Drill pilot holes in the mounting rails using a 3/32" drill bit. Connect the retract servo to the radio system and check for smooth, uninterrupted action of the retracts. Adjust accordingly.

## *Mount the Wing Bolt Plates*



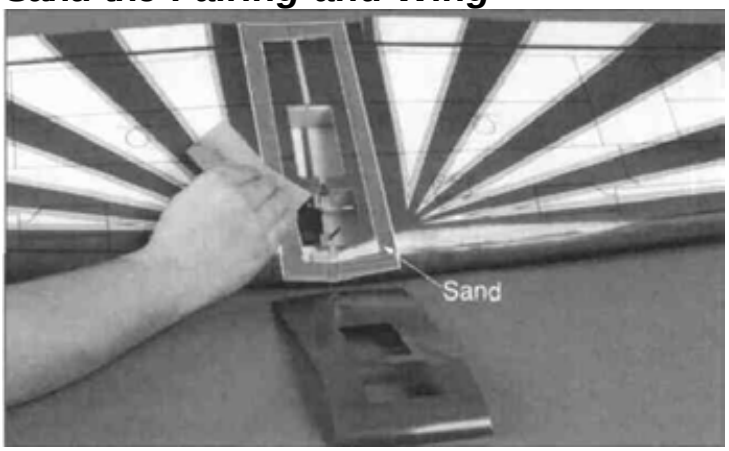

❑ 9. Using 6-minute epoxy, glue the plywood wing bolt plates to the bottom of the wing aligned with the trailing edge.

## *Prepare the Wing Fairing*



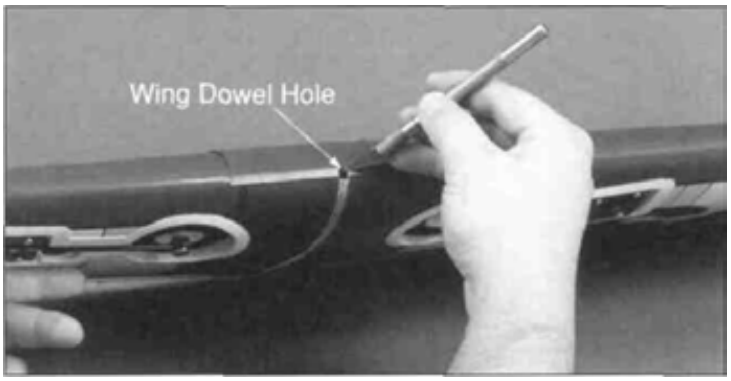

❑ 10. Individually place each wing fairing onto the wing and lightly trace its outline.

## Sand the *Fairing and Wing*



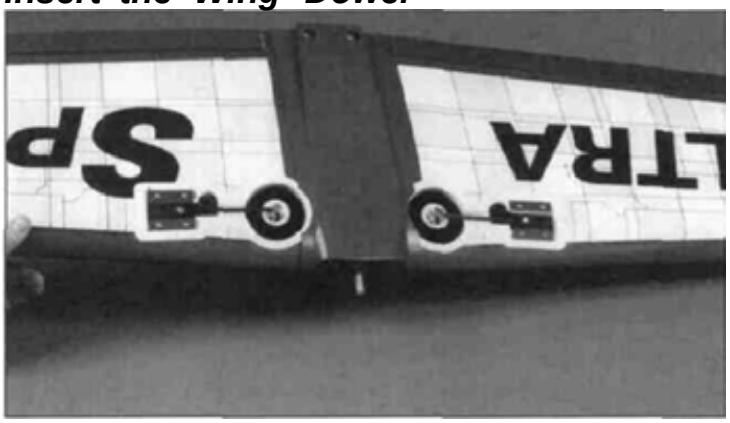

❑ 11. Use medium grit sandpaper to lightly roughen the inside of each fairing where it will be glued to the wing. The area to be sanded is shown as a lightened area in the photograph. This will insure better adhesion of the fairing to the wing.

### *Glue the Fairing onto the Wing*



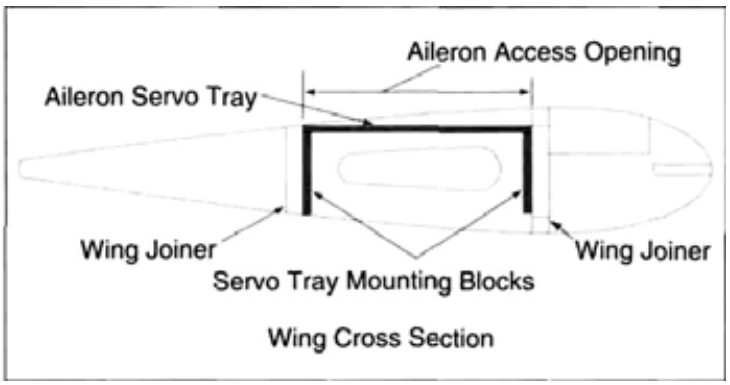

❑ 12. Use thick CA+ to glue the top fairing to the top of the wing. Remove the plastic that is covering the wing dowel hole on the leading edge of the wing. Proceed to glue the bottom fairing to the bottom side of the wing and remove the remaining plastic covering the dowel hole.

### *Insert the Wing Dowel*



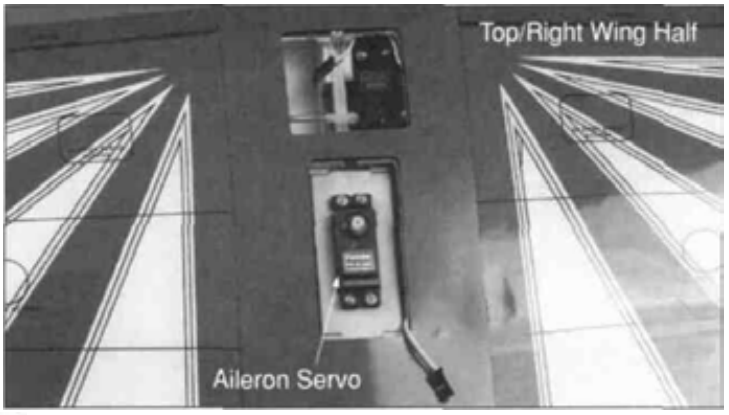
❑ 13. Use 6-minute epoxy to glue the hardwood wing dowel into the leading edge of the wing. Work epoxy into the dowel hole using a sliver of wood. Apply epoxy to the dowel and insert the dowel. Leave 1/2" of dowel protruding from the wing. Apply the foam rubber seal to the front edge of the wing fairing (see Step 11, page 10). Clean the excess epoxy from the dowel using a paper towel and rubbing alcohol.

## Aileron Assembly



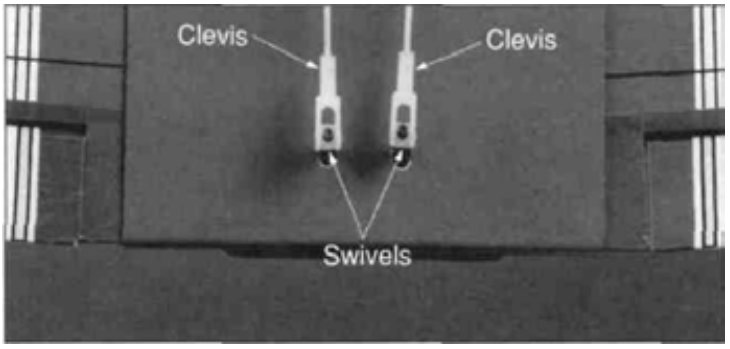

❑ 1. Trial fit the servo into the servo tray. Locate the plywood servo tray mounting blocks and glue them into the aileron servo tray opening using 6-minute epoxy. The tray should be flush with the top of the wing joiners installed earlier in Step 6, Page 7.

### *Mount the Aileron Servo*




❑ 2. Mount the aileron servo in the servo tray using the screws, grommets and rubber mounts supplied with servo. Place the control horn on the aileron servo in the neutral position.

### *Connect the Clevises*




❑ 3. Locate the nylon swivels and thread them onto the aileron torque rods until approximately 1/8" of threaded rod is showing above the swivel. Thread the clevises onto the control rods 15 full turns. Using the grooves on one side of the clevis as a guide, snap the clevis onto the swivel. (It may be necessary to use pliers to hold the control rod while threading on the clevises.)

### Connect the *Pushrods to the Servo*

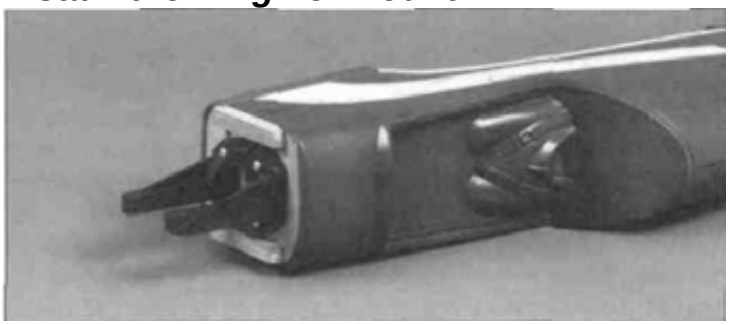
❑ 4. Mark the control rod at the point that it crosses the control horn holes, 1/2" from the center of the servo control horn. Cut the control rod 1/4" past the mark and make a L-bend at that mark. Center the servo and insert the L-bend through the servo horn. Place a Nylon Faslink Pushrod Connector on the L-bend and servo horn to secure the pushrod. It may be necessary to enlarge the holes in the servo horn using a 5/64" drill bit.

# Fuselage Assembly

## Engine Installation

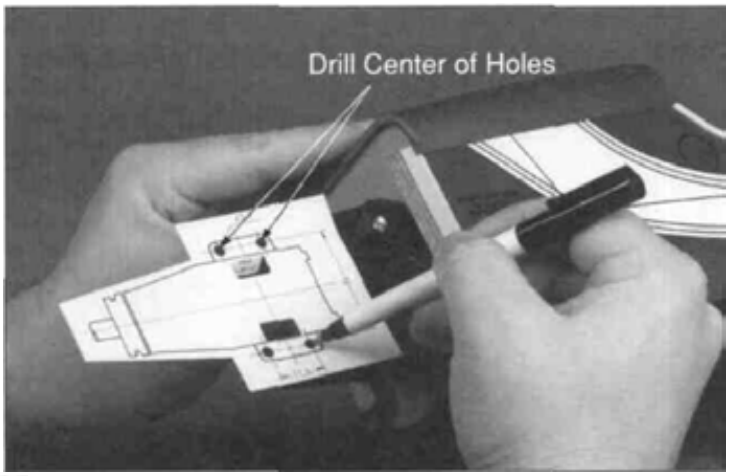
(2-stroke Engine.)

### *Install the Engine Mount*



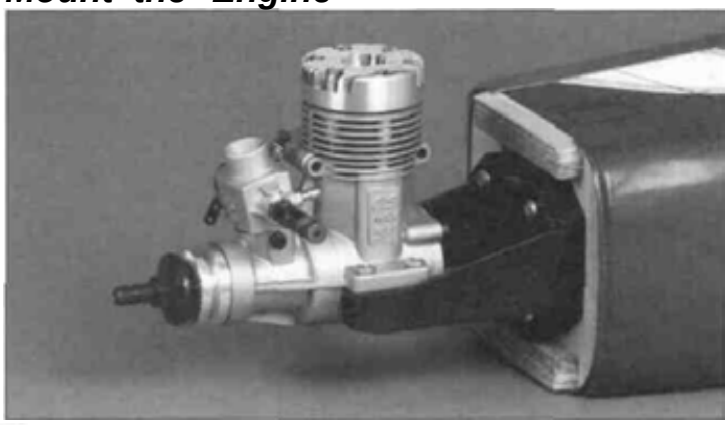
❑ 1. Fasten the adjustable engine mount to the firewall using four 6-32 x 3/4" machine screws. Slide the mount halves apart until the engine mounting lugs will sit flat on the beams. Tighten the four 6-32 x 3/4" machine screws to hold the mount halves in position. **Important:** *Use thread lock to secure the machine screws into the blind nuts.*

### *Drill the Mount*




❑ 2. The front of the drive washer should be 4-13/16" from the firewall on all two cycle engines. Trial fit the cowling and spinner and strive for approximately 3/32" clearance between the spinner backplate and the cowling. If your engine includes a template, tape the template on the mount and mark the mounting holes. If your engine does not include a template, place the engine on the mount and make a mark through the lug holes. Drill a hole using a 7/64" drill bit at each mark.

### *Mount the Engine*

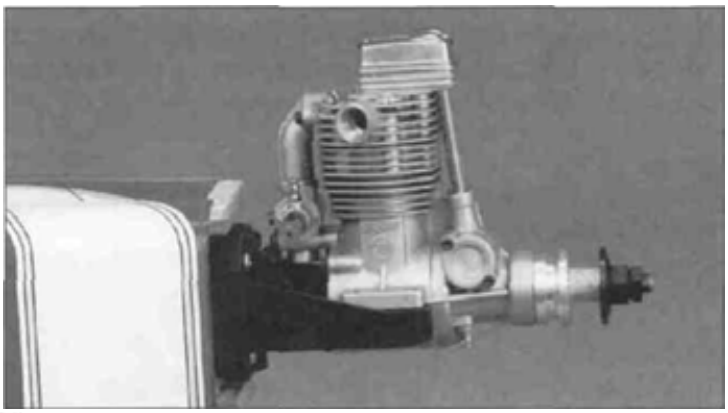


❑ 3. Put a drop of oil in each hole and install the engine using the four #6 x 3/4" sheet metal screws provided.

## Engine Installation

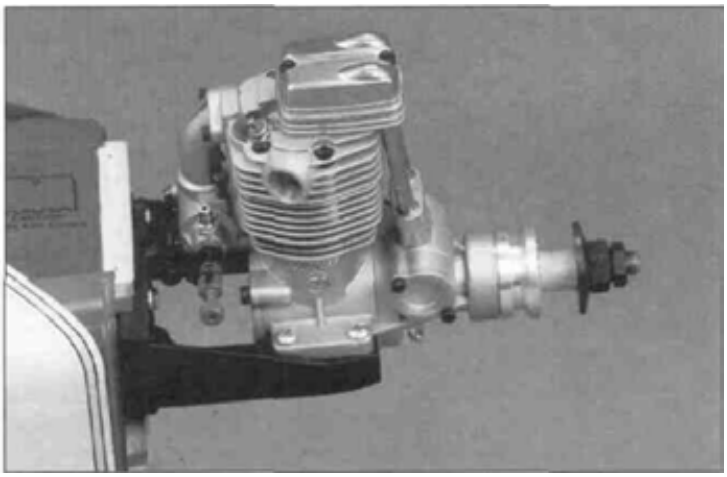
(4-stroke Engine.)

### *Drill the Mount*



❑ 1. Trial fit the cowling and spinner. Strive for approximately 3/32" clearance between the spinner backplate and the cowling. If your engine includes a template, tape the template on the mount and mark the mounting holes. If your engine does not include a template, place the engine on the mount and make a mark through the lug holes. Drill a hole using a 7/64" drill bit at each mark.

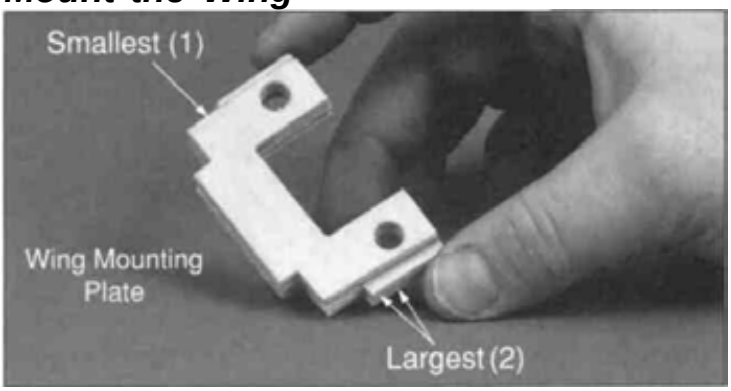
### *Mount the Engine*



❑ 2. Put a drop of oil in each hole and install the engine using the four #6 x 3/4" sheet metal screws provided.

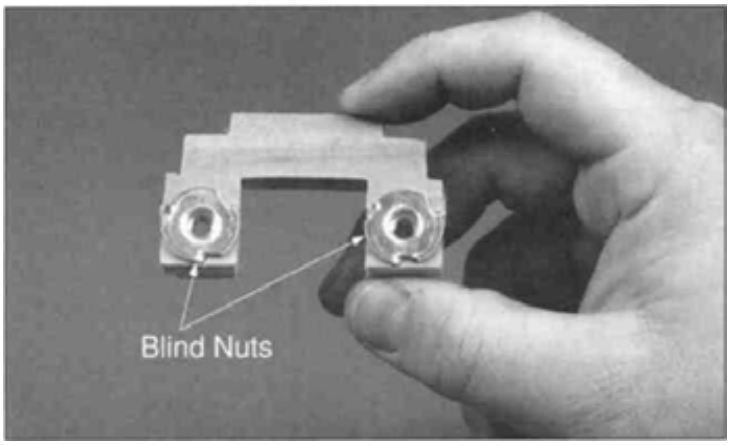
# Mount the Wing

## *Mount the Wing*



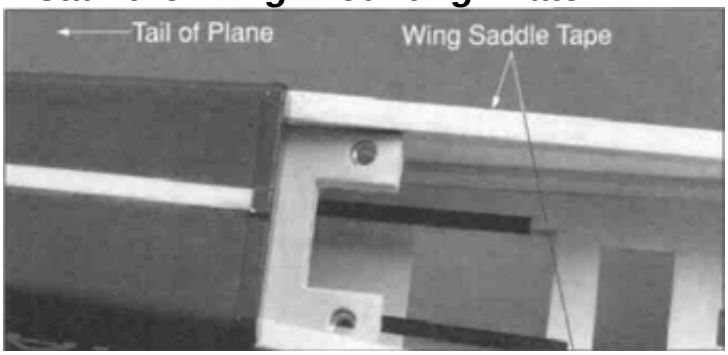

❑ 1. Locate the three plywood wing mounting **plates.** Remove them from the die cut sheet and sand off any rough edges left from the die cutting. Glue the three mounting plates together in a stack with the shortest on the top. Make sure the holes are lined up with one another and wipe off any excess epoxy. Use clothespins to clamp the wing hold down plate together while the epoxy cures.

## *Install the Blind Nuts*



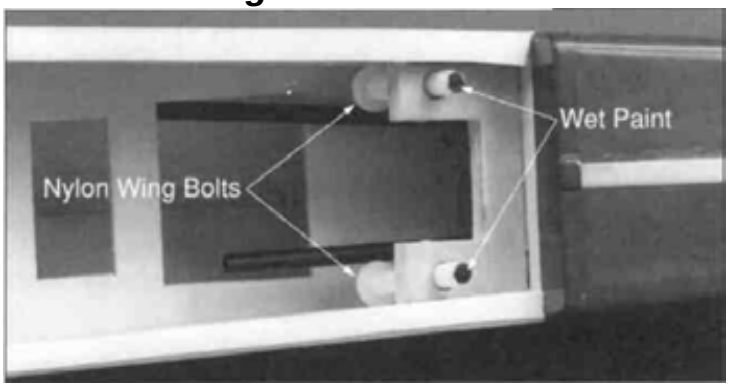

❑ *2.* Install the blind nuts into the holes from the bottom side of the mounting plate. Gently press the blind nuts into place with pliers or a vise. The holes may need to be enlarged slightly with a 5/16" drill bit. Glue the blind nuts into place with a drop of CA on the flange of the nuts. Care must be taken not to get CA into the threads of the blind nuts.

## *Install the Wing Mounting Plate*



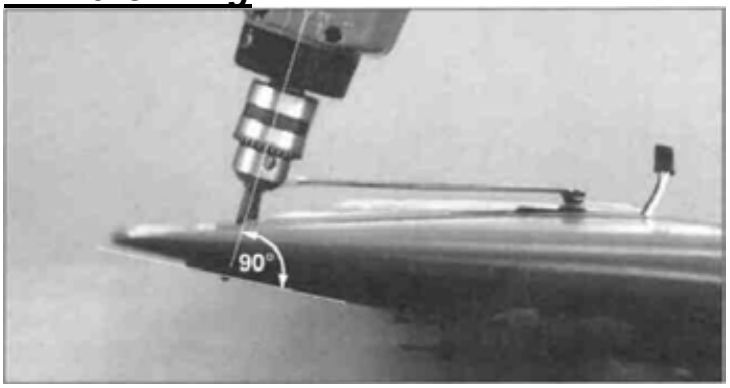

❑ 3. Install the wing mounting plate into the cut-outs in the sides of the fuselage. The tabs created by the two longest plates fit into the notch in the lightening holes in both sides of the fuselage. The back of the block fits into the bulkhead. Use 6-minute epoxy to securely install the wing mounting block into the fuselage. Apply 1/8" wing seating tape to each side of the wing saddle to prevent exhaust residue from entering the fuselage.

## *Mark the Wing*



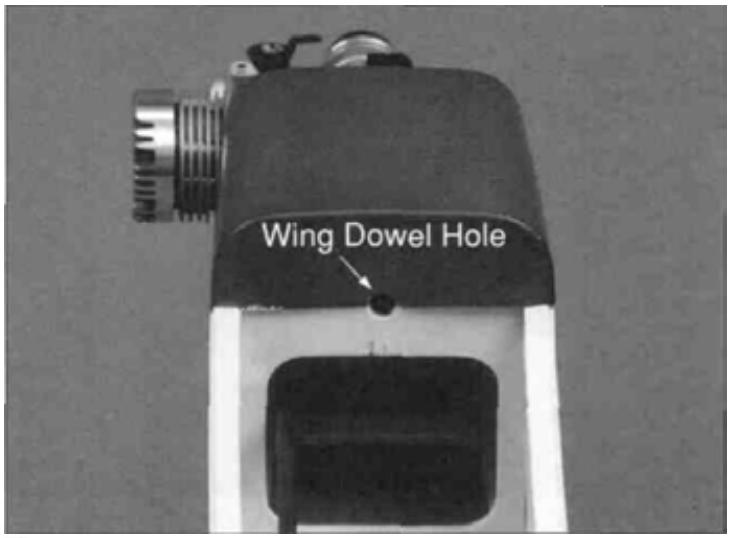

❑ 4. Insert the nylon wing bolts from the underneath side of the wing mounting plate. The bolts should be even with the wing seating tape. They should touch the wing lightly when the wing is fully seated in the wing saddle. Paint the tip of the bolts with a slow drying paint. Before the paint dries, place the wing into the wing saddle. The wet paint will mark the locations that will be drilled for the wing bolts.

## *Drill the Wing*



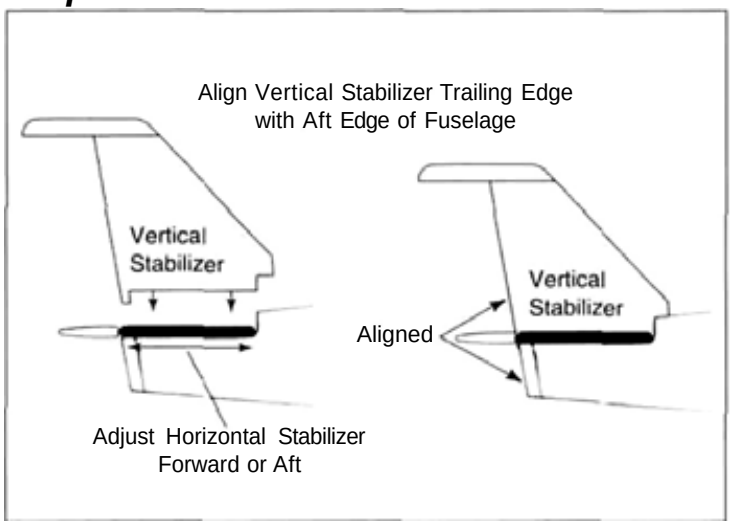

❑ 5. Drill a 1/4" hole at each paint mark. The drill should be held perpendicular to the bottom surface of the wing. The bolts must thread into the blind nuts squarely.

### *Cut-out the Wing Dowel Hole*




❑ 6. Trim away the plastic that covers the wing dowel hole in the front of the radio compartment.

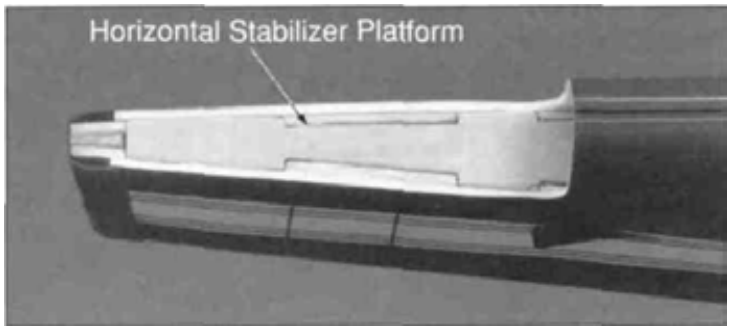
### *Prepare to Install the Stabilizer*



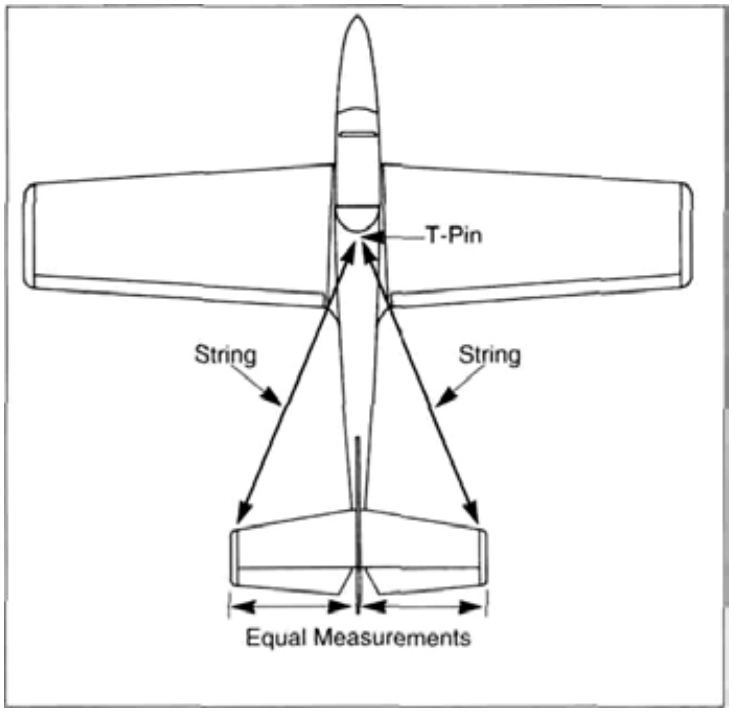

**Note:** When mounting the horizontal stabilizer do not slide the stabilizer fully forward in the saddle. Instead, position the stabilizer in the location where the trailing edge of the vertical stabilizer will line up with the aft edge of the fuselage, thus providing a straight hinge line for the rudder. Trial fit the vertical stabilizer before mounting the horizontal stabilizer to make sure you are locating the horizontal stabilizer correctly.

## Horizontal Stabilizer

### *Install the Stabilizer Platform*

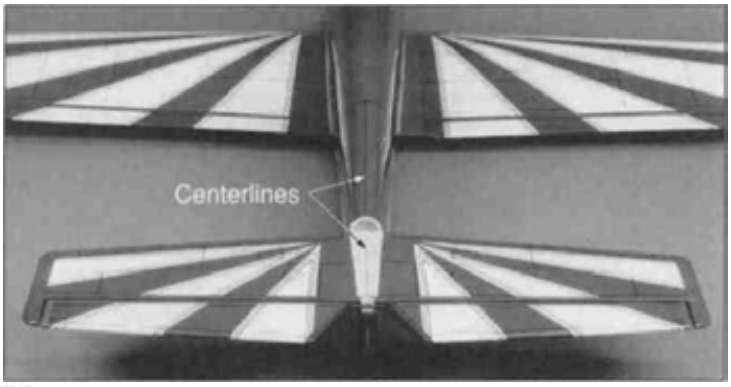



❑ 1. Locate the 1/8" plywood stabilizer platform and trial fit the platform into the fuselage tail. Lightly sand the platform if necessary to obtain a proper fit. Use 6-minute epoxy to glue the platform into place. Remove any excess epoxy that remains on the top of the platform, as well as on the outside of the fuselage, using rubbing alcohol and a paper towel. After the epoxy has cured, attach the wing, then place the horizontal stabilizer on the platform and check to see if the horizontal stabilizer is level with the wing by viewing directly from the rear. If it is not, lightly sand the stabilizer platform until a smooth, even and level surface is obtained.




❑ 2. Accurately measure the horizontal stabilizer and draw a centerline on the stabilizer. Determine if the fuselage panel line in the center of the fuselage is accurate. If not, measure and mark a centerline on the fuselage. Attach a piece of string with a pin to the fuselage centerline as shown. Stretch the string to the corner of the horizontal stabilizer. The distance from the pin to the horizontal stabilizer must be the same on both sides. This method will adjust the horizontal stabilizer perpendicular to the centerline of the aircraft. The horizontal stabilizer must be centered accurately with the fuselage centerline for this technique to work correctly.

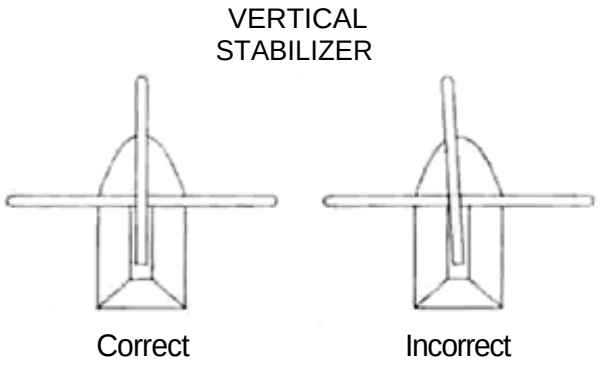
### *Attach the Horizontal Stabilizer*

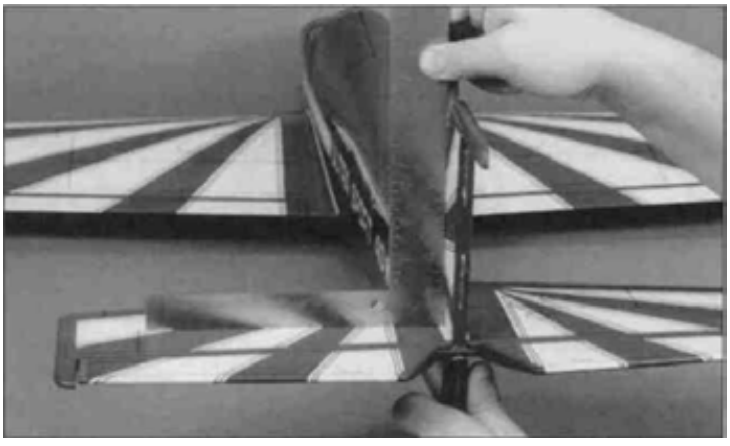



❑ 3. Mix 30-minute epoxy to securely glue the horizontal stabilizer into place. Adjust the alignment of the stabilizer as described in Steps #1 and #2. Use T-pins to hold the proper alignment until the epoxy has firmly set. Wipe off the excess epoxy using rubbing alcohol and a paper towel. Set the fuselage aside to cure before proceeding.

## Vertical Stabilizer

### *Attach the Vertical Stabilizer*



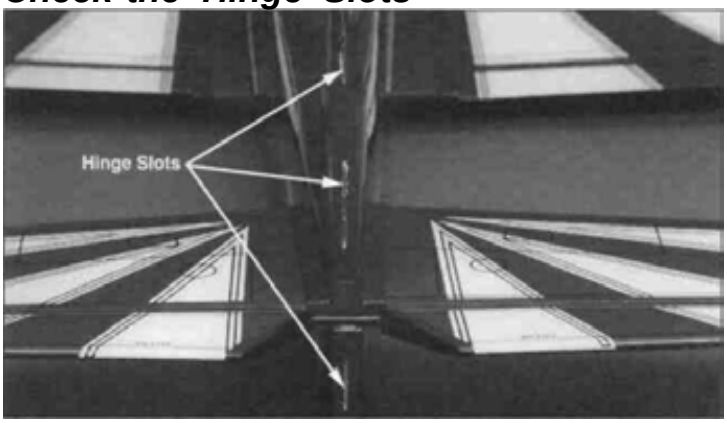



❑ 1. Carefully align the vertical stabilizer on the horizontal stabilizer. The vertical stabilizer must be perpendicular to the horizontal stabilizer and **must line up with the fuselage centerline exactly.** Using 30-minute epoxy, glue the vertical stabilizer into place. A square should be used to assure a perfect 90° angle between the horizontal and vertical stabilizer. Pin the vertical stabilizer in place and keep checking its alignment by measuring and sighting until the epoxy sets up.

### *Install the Vertical Stab Fairing*


❑ 2. Locate the plastic vertical stabilizer fairing and lightly sand the underneath side of the fairing. Slide the fairing over the vertical stab and lightly trace its outline onto the fuselage. Remove the fairing. Lightly sand the fuselage on the inside of the line. Using thick CA+, apply a bead of glue to the fuselage and slide the fairing into place, holding firmly until the glue dries. The vertical stabilizer relies on this fairing for structural support; therefore a good bond is essential.

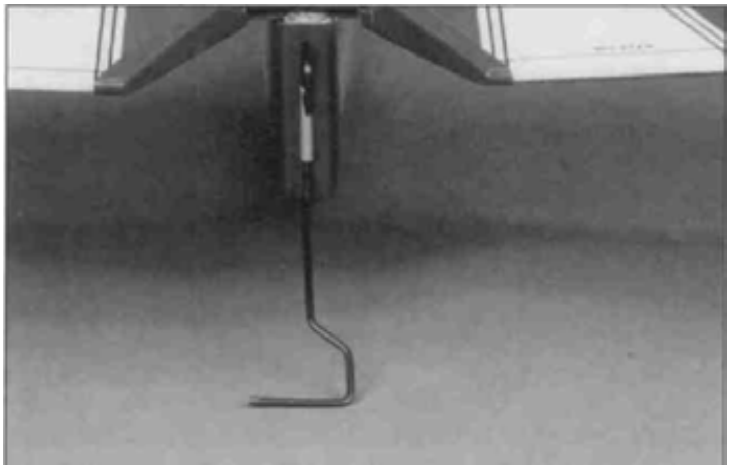
### *Check the Hinge Slots*




❑ 3. Check the rudder hinge slots to make sure they are open and receptive to the CA hinges. Clean the slots out with a hobby knife if necessary.

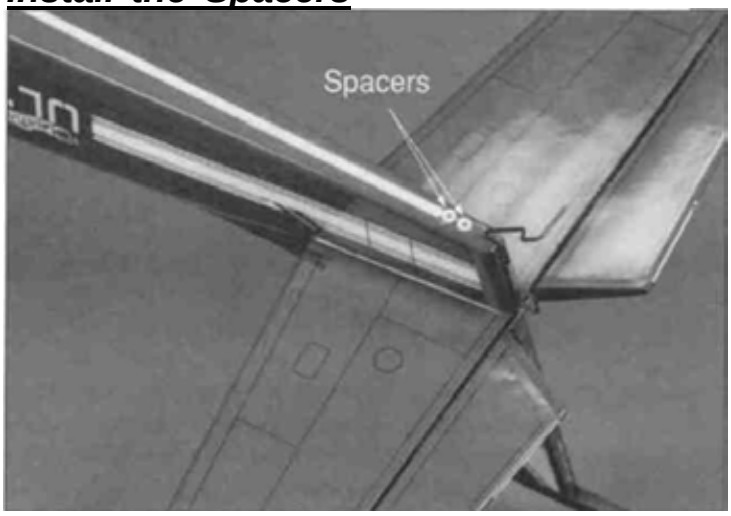
## Tail Gear

### *Mount the Tail Gear Wire*



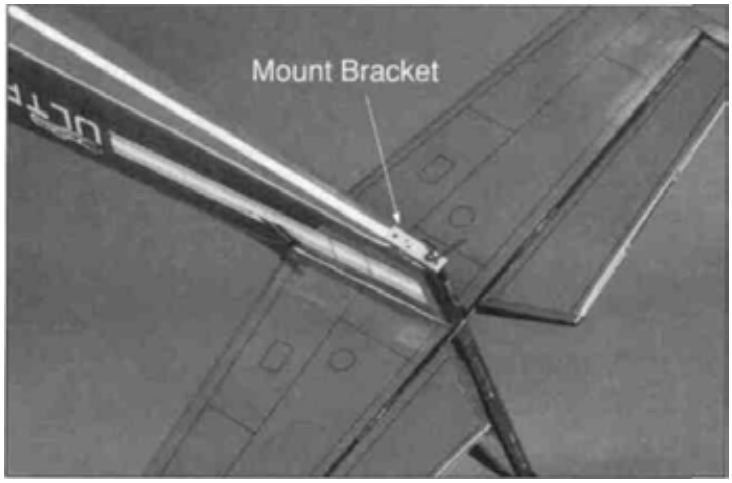
❑ 1. Apply petroleum jelly to the tail gear to prevent glue lock up. Use 30-minute epoxy to glue the tail gear guide tab into the fuselage. Complete the next two steps before the epoxy is allowed to completely set up.

## *Install the Spacers*



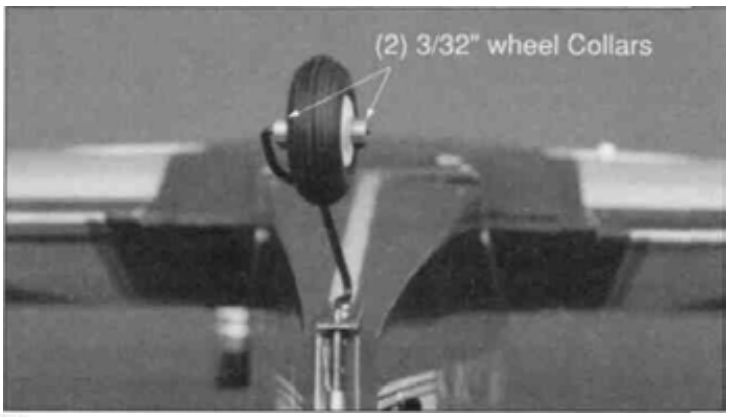

❑ 2. Locate and glue the two aluminum spacers into the bottom tail section of the fuselage.

## *Install the Tail Gear Bracket*




❑ 3. Locate the metal tail gear mount bracket and slide it over the tail gear wire. Secure the bracket to the fuselage with one #4 x 1/2" sheet metal screw. Use the hole closest to the tail gear at this time.

## *Mount the Tail Wheel*



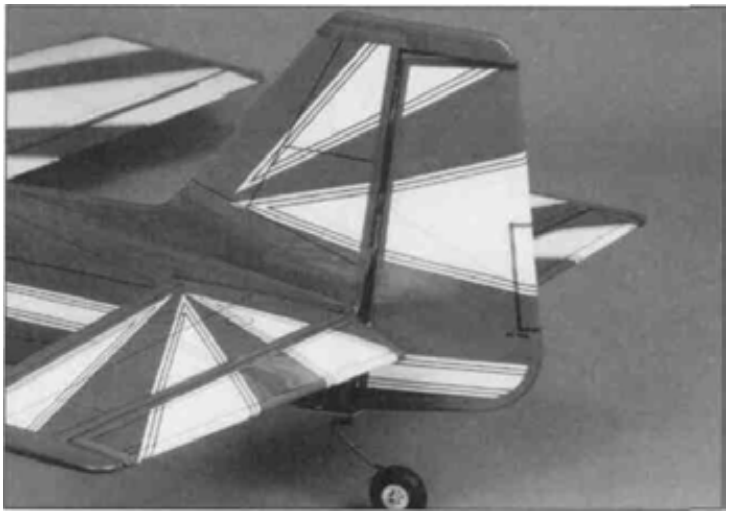

❑ 4. Mount the tail wheel using two 3/32" wheel collars.

# Gluing the Hinges

## *Check the Control Surfaces*


❑ 1. Check each of the ailerons and the elevator to be sure that they are secure. If any of them seem loose, apply a few drops of thin CA glue to both sides of the hinge as shown above. Do not remove the hinge to do this. The glue will wick into the wood and provide a strong joint.

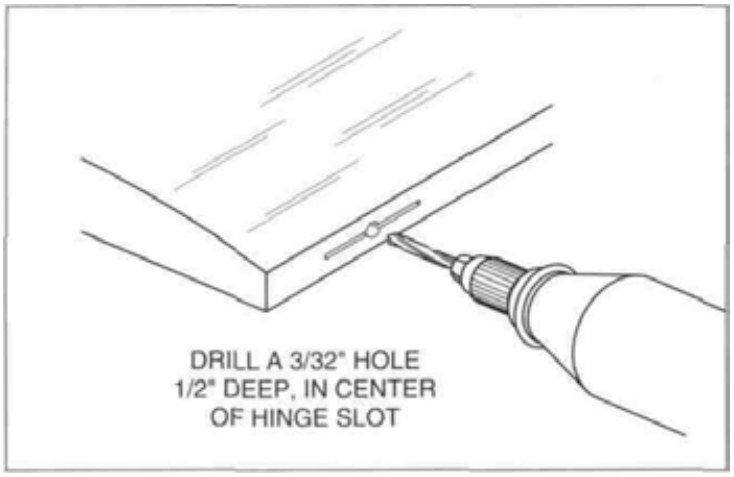
## *Glue the Rudder in Place*



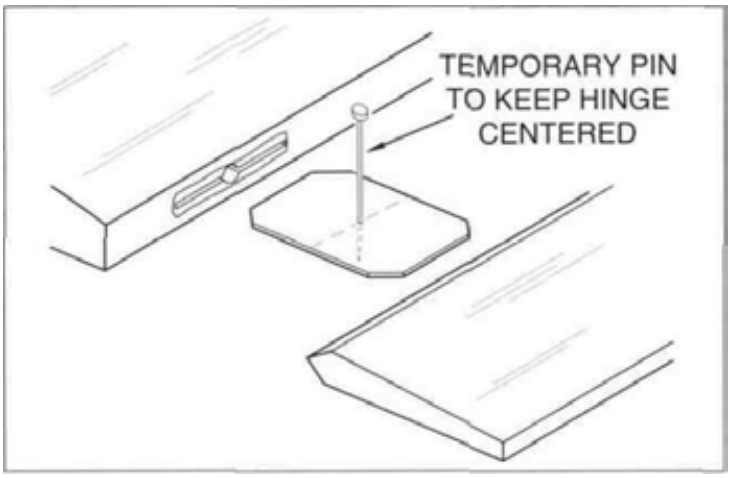
❑ 2. Before mounting the rudder, use a hobby knife to enlarge the slot in the leading edge of the rudder to provide plenty of clearance for the tail gear wire. Clean the tail gear wire off with rubbing alcohol.

**Note:** The hinge material supplied with this kit consists of a 3-layer lamination of mylar and polyester. Properly installed, this type of hinge provides the best combination of strength, durability and ease of installation. We trust even our best show models to the hinges, but it is essential to install them correctly. Please read the following instructions and follow them carefully to obtain the best results.

The most common mistake made by modelers when installing this type of hinge is not applying a sufficient amount of glue to fully secure the hinge over its entire surface area; or, the hinge slots are very tight, restricting the flow of CA to the back of the hinges. This results in hinges that are only "tack glued" approximately 1/8" to 1/4" into the hinge slots. The following technique has been developed to help ensure thorough and secure gluing.

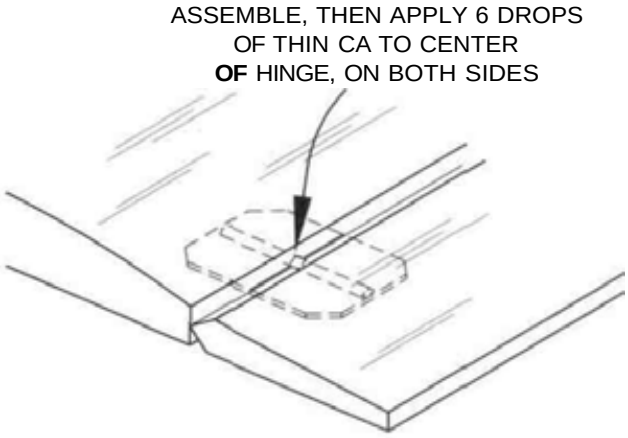



❑ 3. Drill a 3/32" hole, 1/2" deep, in the center of the hinge slot. If you use a Dremel" Moto-Tool for this task, it will result in a cleaner hole than if you use a slower speed power or hand drill. Drilling the hole will twist some of the wood fibers into the slot, making it difficult to insert the hinge. Insert a standard #11 hobby knife into the slot, working it back and forth a few times to clean out the slot.




❑ 4. Insert the hinges and install the rudder leaving a 1/32" gap between the rudder and fin. It is best to leave a very slight gap, rather than closing it up tight, to help prevent the CA from wicking along the hinge line. Make sure the rudder will deflect to the recommended throws without binding. Remove the rudder and insert a small pin through the center of each hinge. This pin will keep the hinge centered while installing the rudder. Insert the hinges into the fin.

❑ 5. Apply a small amount of 6-minute epoxy in the tail gear wire slot, in the rudder. Install the rudder on the fin wiping off any excess epoxy with rubbing alcohol and a paper towel. Before the epoxy cures, remove the pins in the CA hinges and adjust the rudder so that their is a 1/32" gap along the hinge line.



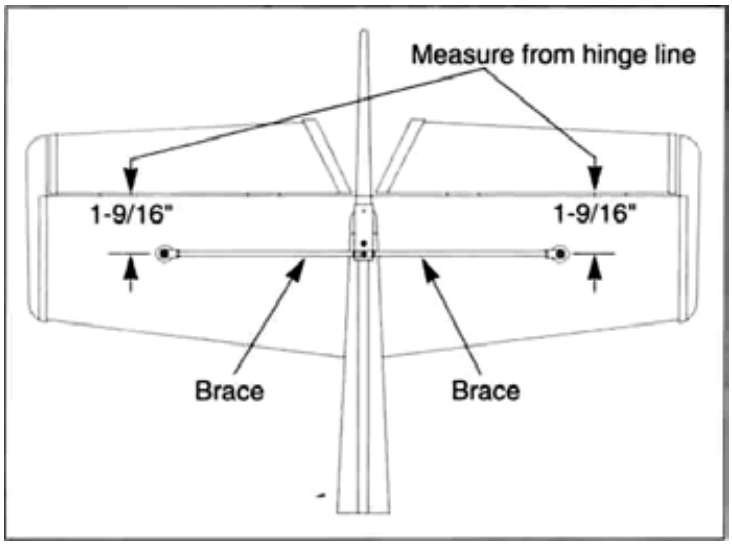

❑ 6. After the epoxy cures, apply 6 drops of thin CA to both sides of each hinge, allowing a few seconds between drops for the CA to wick into the slot. **Note:** The small "tunnels" you created by drilling the 3/32" holes allow the CA to freely travel in to the entire surface of the hinge, producing an extremely secure bond.

# Stabilizer Support Braces

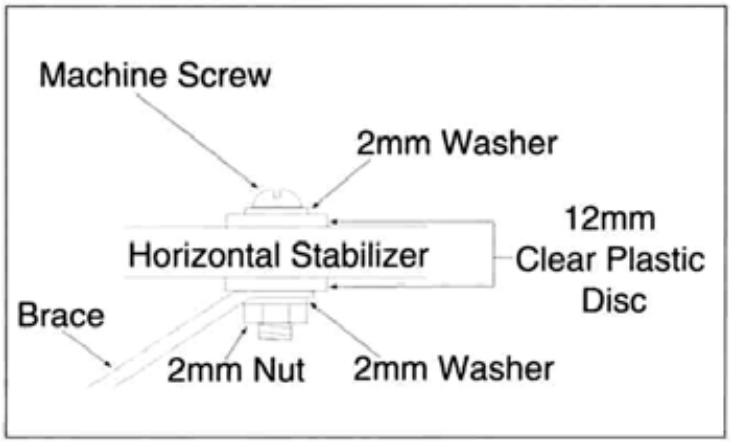
## ***Install Stabilizer Support Braces***


❑ 1. Locate the two aluminum tubes that will be used to brace the horizontal stabilizer. Attach one end of each brace in the remaining hole in the tail gear bracket using a #4 x 1/2" sheet metal screw. (Also, see the photo at Step 5, Page 20).

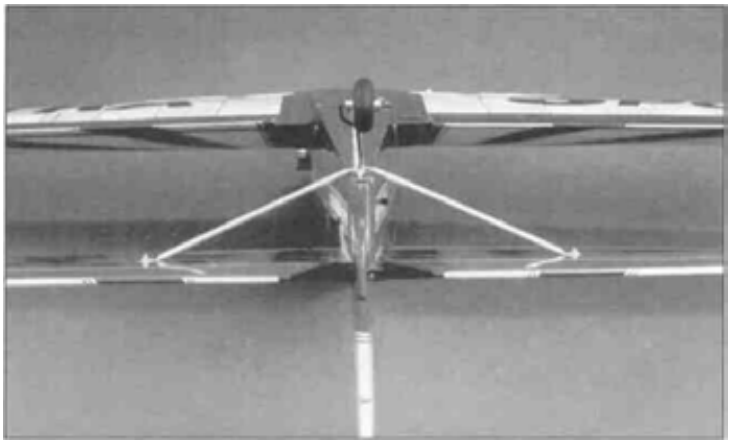
## Stabilizer Brace Positioning




## Brace Attachment Detail



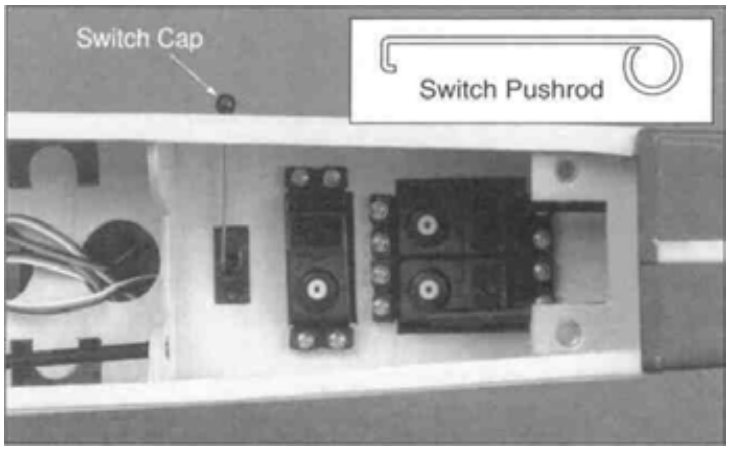

## Connect Brace to the Stabilizer



❑ 2. Drill a 5/64" hole through the horizontal stabilizer at the point where the brace touches the stabilizer. Insert the 2x15mm machine screw from the top side of the stabilizer through the 2mm washer, 12mm clear plastic disc, horizontal stabilizer, 12mm clear disc, 2mm washer, brace and 2mm nut in that sequence. The nut should be secured using thread locking compound.

# Radio Installation

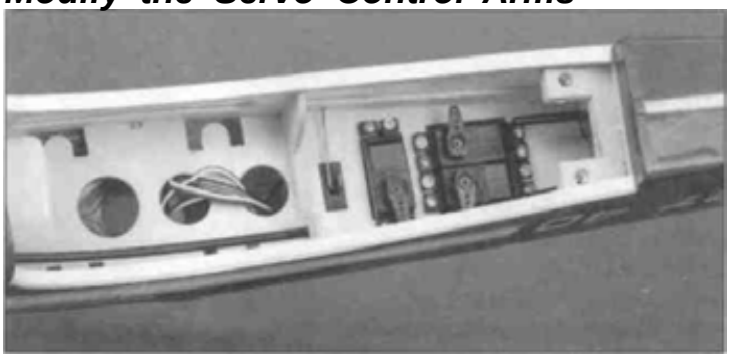
## Mount the Switch and Servos




❑ 1. Install the switch into the precut hole in the servo tray. A piece of wire can be used to access the switch from the exterior of the plane similar to the one illustrated in the photograph. A piece of wire bent in the configuration of the line illustration can also be used to access the switch from the outside of the fuselage without the use of a switch cap. The last part of the U-bend should be made in the wire after the wire has been inserted into the fuselage and the switch. A hole may need to be drilled (slightly larger than the wire used) in the switch to allow the wire to be routed through the switch.

❑ *2.* Install the three servos from your radio system as shown in the photograph above. Refer to the manufacturer's manual for more detailed information. Notice the location and orientation of each servo as well as the switch location.

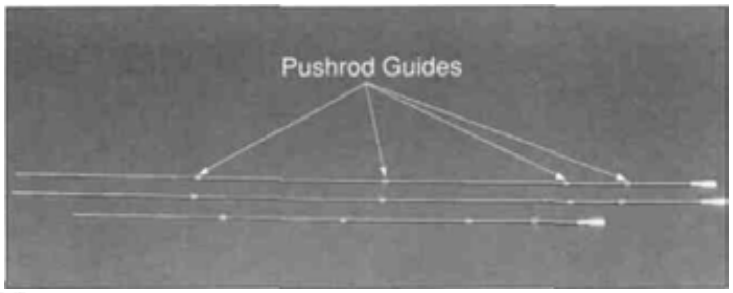
## Modify the Servo Control Arms



❑ 3. Cut three of the arms off the "cross" servo horn and mount to the servos as shown.

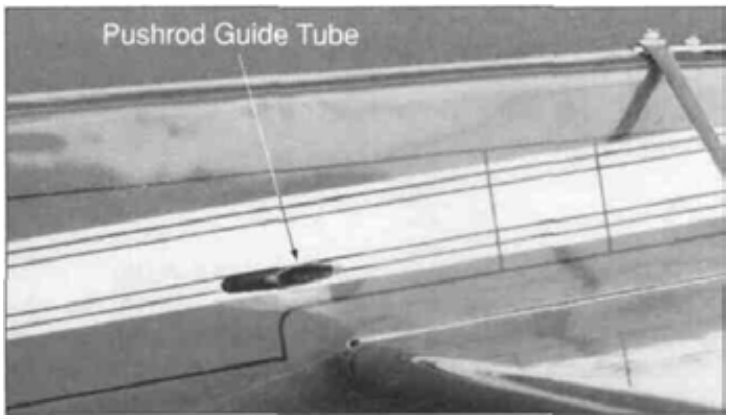
# Pushrods

## *Assemble the Pushrods*




❑ 1. Locate the splined plastic tubing and cut several 1/4" pieces. Slide at least six of these pieces onto each of the long pushrod wires and space them approximately 2-1/2" apart (do not glue yet). If these tubes do not slide on easily, cut them to a shorter length. **Note:** *While installing the pushrods, position the plastic tube guides so they always stay inside the pushrod guide tubes. If the guides are not tight on the pushrods, apply a drop of thin CA- to secure them.The* guides will prevent side to side movement of the pushrods.

## *Trim the Guide Tubes*

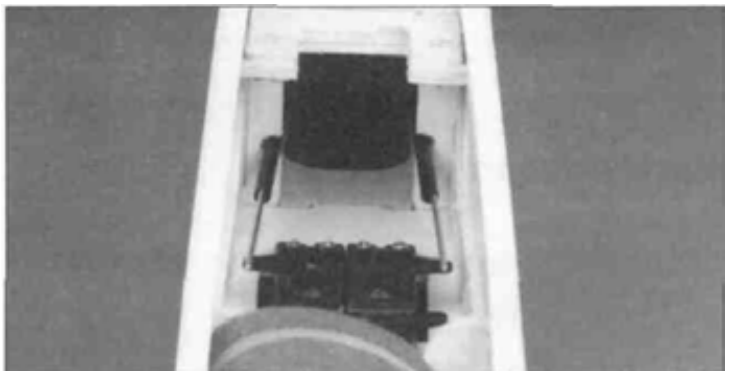



❑ 2. Apply masking tape to the fuselage next to the guide tubes to protect the fuselage skin while cutting. Roughen the end of each tube with medium sandpaper. Using 6-minute epoxy glue the tubes in place. Trim the guide tubes flush with the edge of the fuselage.

## *Mark the Fuselage Former*

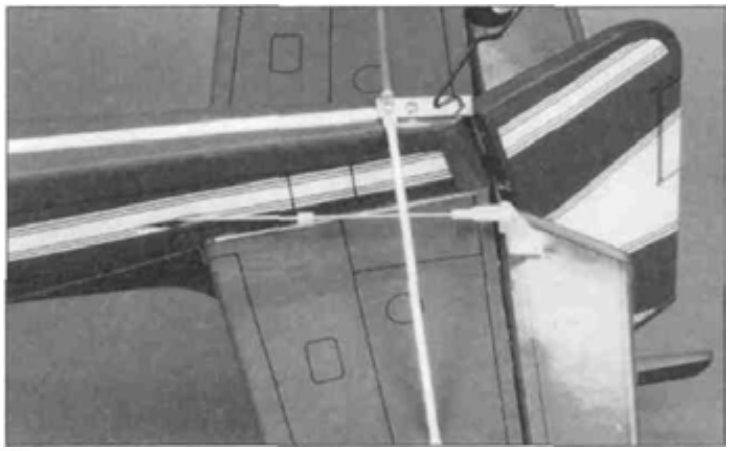
❑ 3. Temporarily insert the pushrods into the guide tubes. Lay the pushrods on top of the servo horns. Mark the fuselage formers next to the pushrod guide tubes. **Note:** *The pushrod guide tubes are intentionally installed so the tube exits the fuselage on the opposite sides of the controlling servo. They cross inside the fuselage allowing the pushrods to run nearly straight, from the servos to the control horns, for maximum rigidity.* Remove the control rods.

## Glue *the Guide Tubes In Place*



❑ 4. Remove a small portion of the fuselage former using *a* hobby knife or round file. The guide tube should fit into the former flush to the edge. **Do not** *remove any more former than necessary or it will be weakened.* Use medium CA to glue the guide tubes into place.

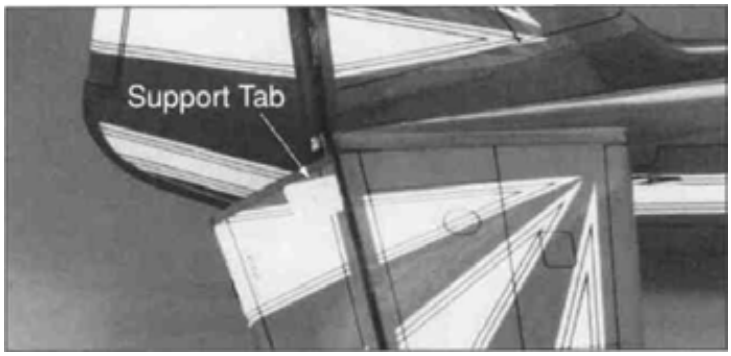
## *Assemble and Install Pushrods*



❑ 5. Thread the nylon clevises onto the pushrods 15 **full** turns. Pliers may be required to hold the rod while threading the clevis onto the rod. Use a piece of cloth to keep from scratching the pushrod. Install the pushrods into the guide tubes with the clevises at the elevator and rudder. Connect the clevises to the control horns and use the pushrods as guides to mark the control horn locations

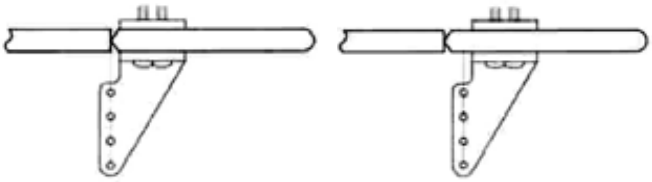
# Control Surface Linkage

### *Mount the Control Horn*

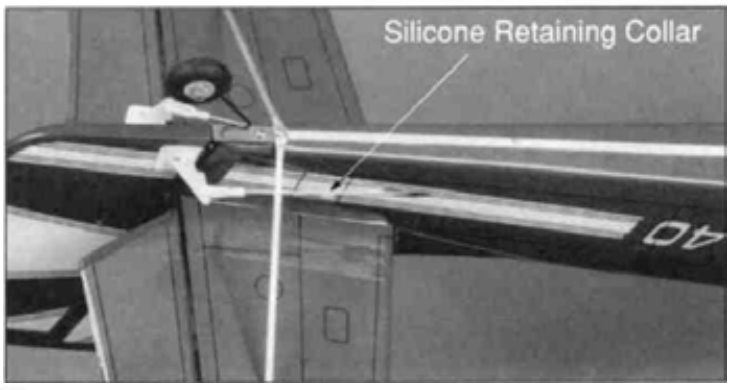



❑ 1. Glue a support tab on each side of the elevator and rudder in the location where the control horns will be mounted. **NOTE:** *The support tabs are white in the photographs for better identification, but clear tabs are supplied in the kit.* Again place the control horns on the support tabs and mark their location and remove. Drill each mark with a 3/32" drill bit.

### *Hinge Line/Control Horn Alignment*

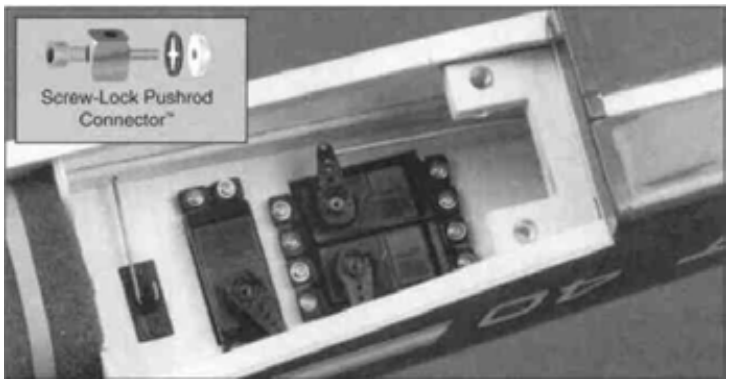



### *Connect the Control Linkages*

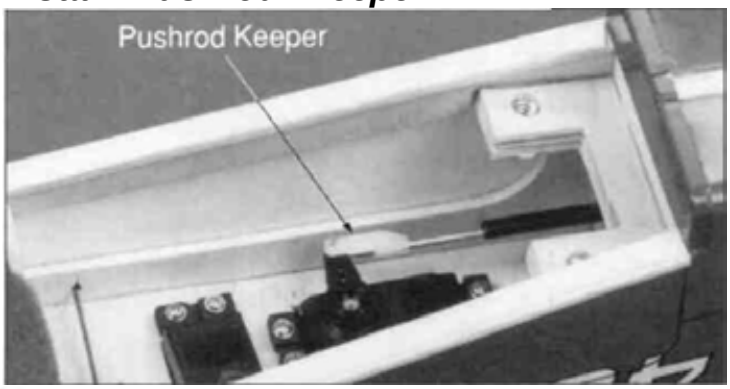

❑ 2. Fasten the control horns to the control surfaces using the four 2-56 x 5/8" machine screws and the nylon nut plates.The support tabs and nut plates can make a slight indentation in the foam covering, but ***do not*** *crush the foam covering.* Attach the clevises to the control horns. Secure the linkages by sliding 1/4" of silicone retaining collar over the clevis arms.

### *Connect the Pushrods to the Servos*




❑ 3. With the rudder and elevator servos centered, mark the pushrods. Cut the rods 1/4" past the mark and make an L-bend at the mark. Place the L-bend into the fourth or outermost hole of the servo arm. It may be necessary to enlarge the servo arm holes with a 5/64" drill bit. **Note:** *An alternate technique to make pushrod connections would be with the use of GP Screw-Lock Pushrod Connectors for easy adjustments.*

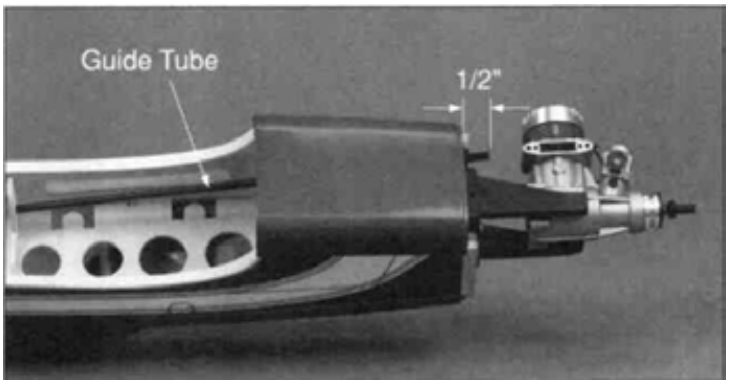
### *Install Pushrod Keeper*




❑ 4. Install the pushrod keeper over the L-bend and servo horn, and snap it onto the rod.

# Throttle Linkage

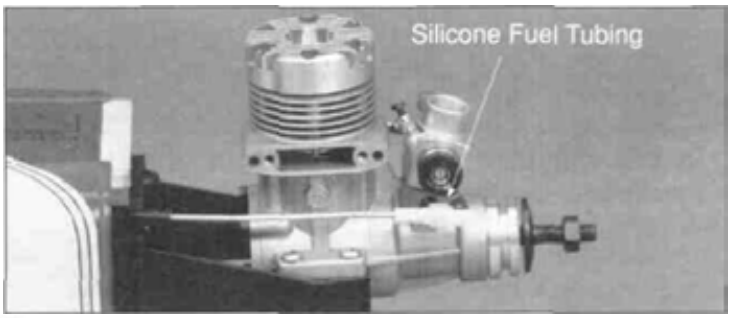
### *Glue the Throttle Guide Tube*




❑ 1. **Note:** *Read Steps 1-3 before proceeding.* There is a throttle pushrod exit hole predrilled in the firewall **to** accommodate two cycle engines and four cycle engines if

the carburetor on the four cycle is turned around. A new hole may need to be drilled if your engine throttle linkage requires a different setup. Trial fit the throttle pushrod guide tube. There should be 1/2" of tube protruding from the firewall and less than 1/8" from the fuselage former. Sand the tube near both ends and glue the tube into the fuselage with 6-minute epoxy.

### *Connect the Throttle Linkage*



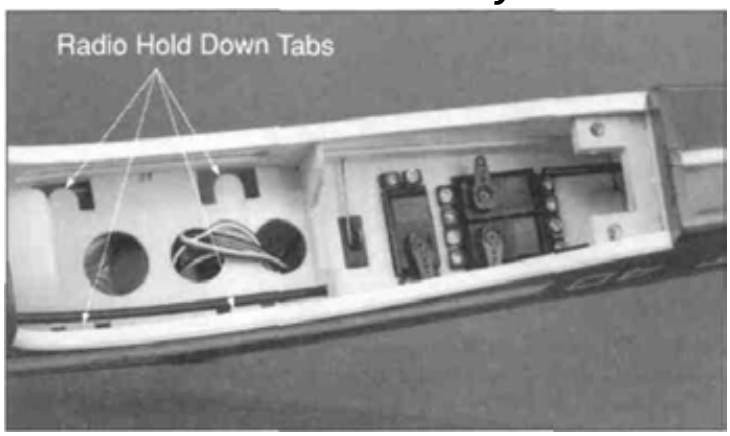

❑ 2. (2-stroke Linkage) Thread a clevis onto the throttle pushrod. Place the clevis in the outermost hole on the throttle arm and secure with 1/4" of silicone fuel tubing. Place the throttle in the half open position and place a mark above the servo arm hole in the radio compartment. Cut the pushrod 1/4" past the mark. Make an L-bend in the pushrod at the mark and insert it into the servo arm, securing it with a pushrod keeper.

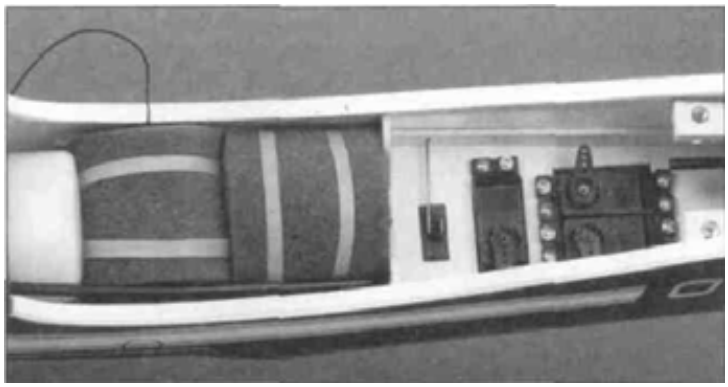
### Connect the *Throttle Linkage*

❑ 3. (4-stroke Linkage) Thread a clevis onto the throttle pushrod. Place the clevis in the inside hole on the throttle arm and secure with 1/4" of silicone fuel tubing. Place the throttle in the half open position and place a mark above the servo arm hole in the radio compartment. Cut the pushrod 1/4" past the mark. Make an L-bend in the pushrod at the mark and insert it into the servo arm, securing it with a pushrod keeper.

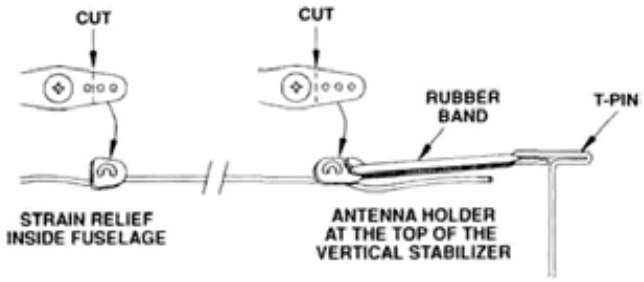
# Receiver Installation

### *Install Receiver and Battery*

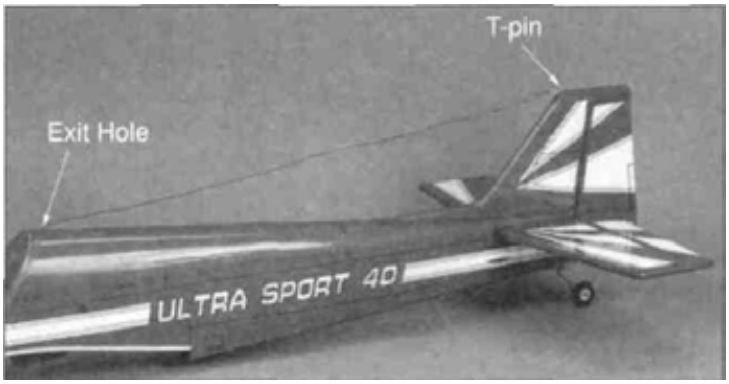


❑ 1. Wrap the radio receiver and battery in protective foam. Using #64 rubber bands secure the receiver and battery in the radio compartment. There are four radio hold down tabs in the radio compartment to attach the rubber bands to.




### *Attach the Antenna*

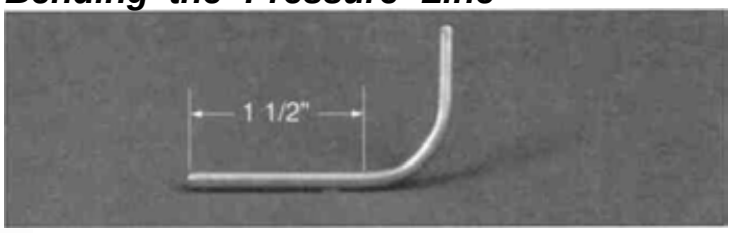



❑ 2. Route the antenna under the servo tray and up through an exit hole made with a T-pin behind the pilot in

the covering. **Note:** *A partial servo horn arm should be used to relieve tension on the antenna right before it exits the fuselage behind the pilot.* Use a medium T-pin to attach a small rubber band to the top portion of the vertical stabilizer. Tie the antenna to the rubber band using tension to keep the antenna tight. **Use caution not to damage the antenna.** A servo horn can be cut and used to hold the antenna in place with less likelihood of damage to the wire.

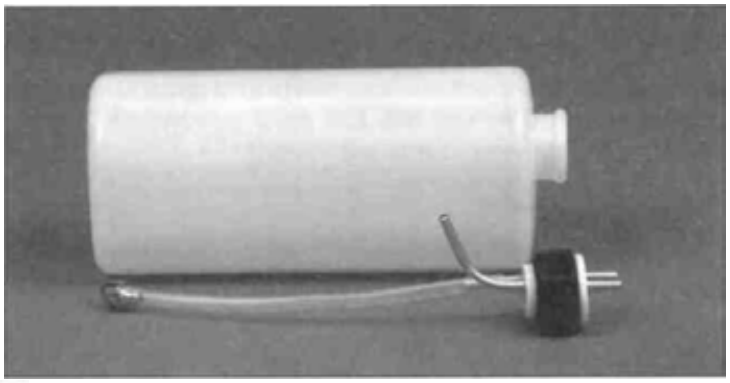
# Fuel Tank Installation

## Bending the Pressure Line



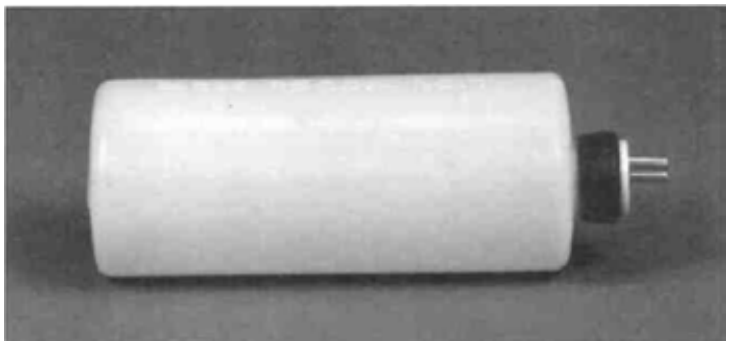

❑ 1. Being careful not to kink the tube, bend one end of the tube in a 90° angle. It may be helpful to find a rigid object that can be used as a form to bend the tube around. Leave 1-1/2" of straight tube at one end so it can easily be inserted through the tank plug.

## Assemble the Tank Plug



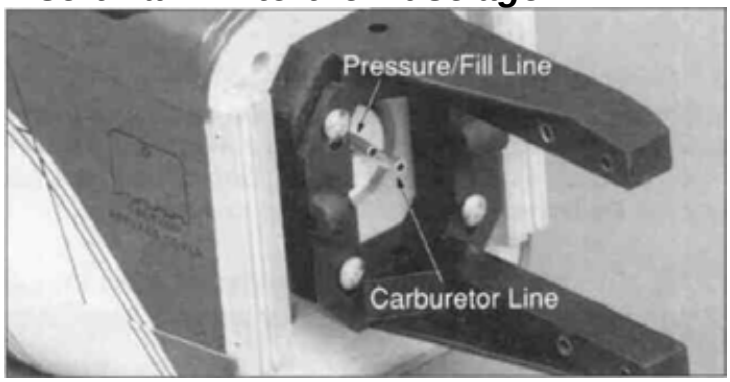
❑ 2. Locate the two plastic plug discs. Push the aluminum tubes through the smaller stopper disc and the back of the rubber plug. Place the larger stopper disc on the opposite side and insert the 3 x 18mm self tapping screw through the larger disc, rubber plug and then into the smaller disc. Locate the metal fuel pick-up weight (clunk) and the medium silicone fuel tubing. Insert the fuel pick-up weight into the fuel tubing. Compare the length of the fuel tank to the length of the fuel tubing and cut the tubing so that the fuel pick-up weight on the end of the tubing will not touch the end of the tank. Do not tighten the screw at this time.

## Final Assembly



❑ 3. The plug assembly can now be inserted into the tank. The pressure tube should be adjusted so the tube is pointed straight up just under the top of the tank. **Caution:** *The pressure tube should not touch the top of the tank or fuel shut off and engine failure may occur.* The stopper discs on the rubber plug must be tightened by turning the self tapping screw. Do not over-tighten the plastic stopper plates or damage to the tank may occur.

## Insert Tank into the Fuselage

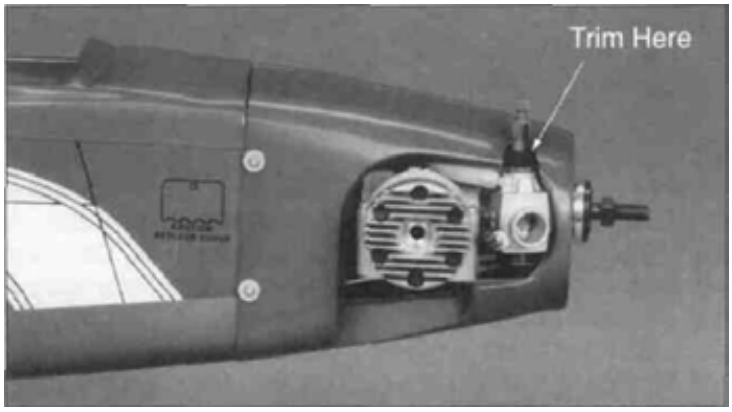




❑ 4. Insert the fuel tank into the fuselage. Use medium CA to glue the tank bracket into the fuselage behind the tank. The bracket will fit into the lightening hole in both sides of the fuselage.

# Final Assembly

## Mount the Cowling

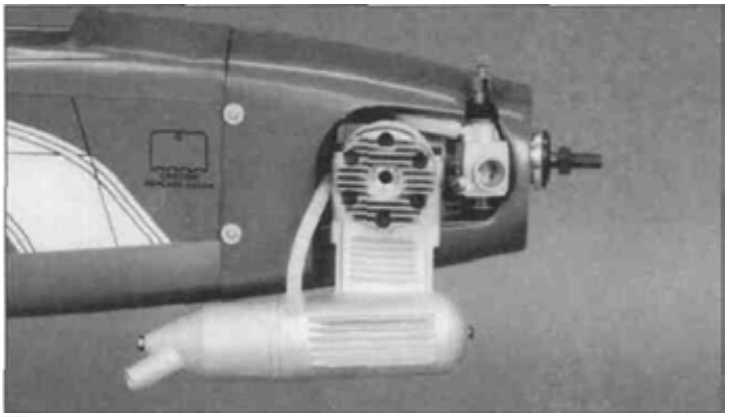



❑ 1. Trial fit the cowling into place on the fuselage and mark the cowl where it interferes with the needle valve and any part of the engine or muffler. Cut an undersized hole in the marked areas on the cowl and trial fit it again. Continue to carefully cut and fit the cowl until it fits properly without touching the engine. Only a small portion of the cowl should need to be removed for a proper fit.

Sand the lip on both sides of the cowling halves. Place the cowling halves in position over the engine and apply small pieces of tape to the outside of the cowling. Tack glue the cowling with a few drops of thin CA in between the pieces of tape and remove the cowling from the fuselage. Remove the tape and apply thin CA to the seams from the inside of the cowling.

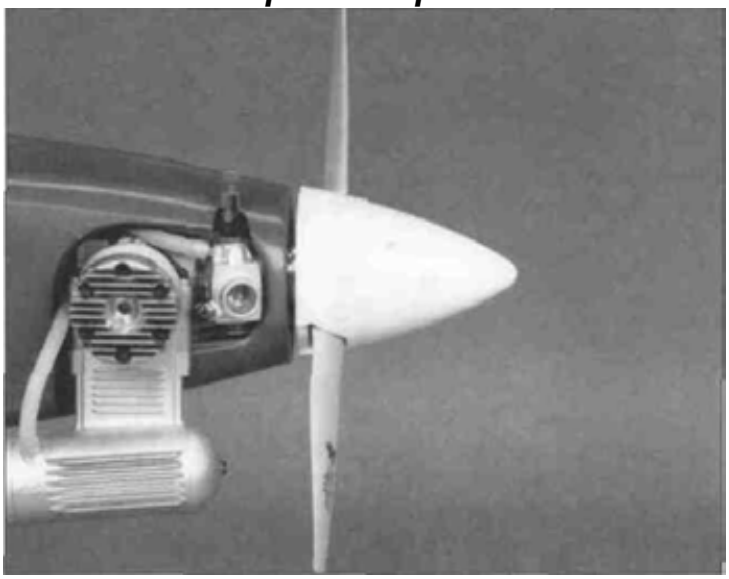
❑ 2. Fasten the cowling to the fuselage using four #2 washers and four #2 x 3/8" sheet metal screws. Mark the screw location as shown in the photograph and drill two holes on each side of the fuselage using a 1/16" drill bit. Enlarge the holes (in the cowling only) to 3/32".

## Install the Muffler



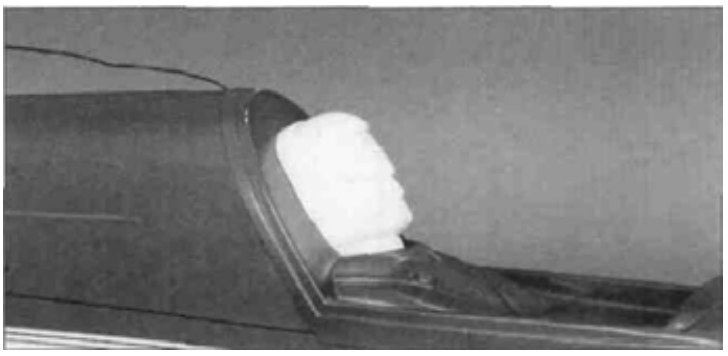
❑ 3. Install the muffler according to the manufacturer's recommendations. Attach the fill/pressure line to the muffler. Notice how the exhaust is pointed down and away from the fuselage and wing to help keep the aircraft clean.

## Mount the Prop and Spinner



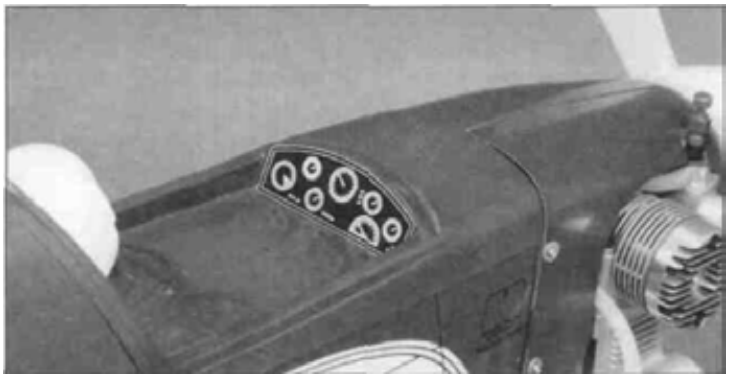
❑ 4. Place the spinner backplate onto the engine shaft followed by the propeller. Secure the propeller in place with the engine driver washer. Snap the spinner into place onto the backplate. Check the area on the spinner around the propeller for contact between the spinner and the propeller. If there is contact, trim the spinner a little at a time until it is eliminated.

## Install the Pilot



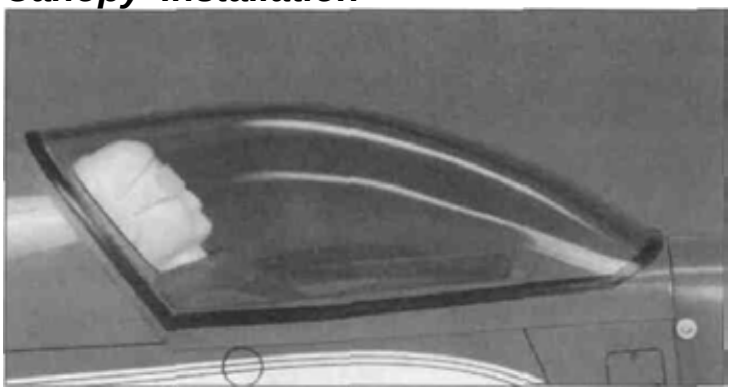
❑ 5. Paint the pilot as you wish and glue it into the cockpit using CA. Let the CA cure completely before attaching the canopy to prevent fogging.

## Mount the Instrument Panel



❑ 6. Place the instrument panel decal into the cockpit.

### *Canopy Installation*



❑ 7. Glue the canopy in place on the fuselage. We have had good luck using RC-56 glue when installing canopies. It takes a few hours to dry, but it is very clear and looks good in the end. To hide the canopy glue joint and to seal out fuel residue, you can use 1/8"-1/4" wide striping tape as a border around the canopy.

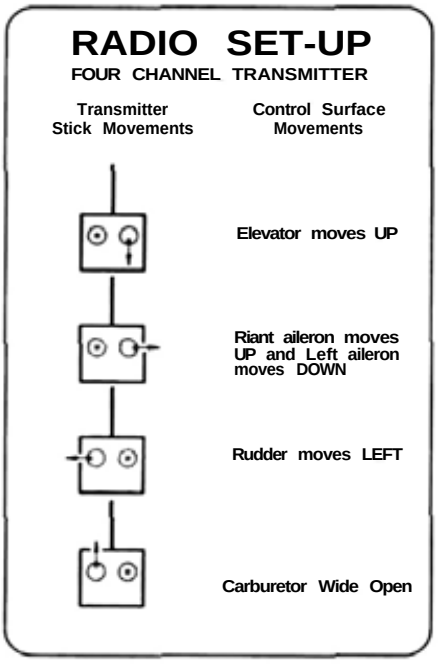
## Control Throws

The following control throws are recommended for your first flights. They are measured at the widest part of the control surface.

| | Low Rate | High Rate |
|---|---|---|
| **ELEVATOR:** | 3/8" | 9/16" |
| **RUDDER:** | 1" | 1-3/8" |
| **AILERONS:** | 3/16" | 5/16" |

### Final Checks

❑ 1. Make sure the control surfaces move in the proper direction as illustrated in the following sketches:

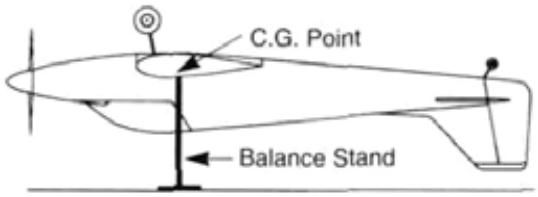



## Balance the Airplane Laterally

***SPECIAL NOTE: Do not confuse this procedure with "checking the C.G." or "balancing the airplane fore and aft." That very important step will be covered next in the manual.***

❑ 1. With the wing level, lift the model by the engine propeller shaft and at the centerline of the fin (this may require two people). Do this several times.

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




### Balance Your Model

***NOTE: This section is VERY important and must not be omitted! A model that is not properly balanced will be unstable and possibly unflyable.***

❑ 1. Accurately mark the balance point on the top of the wing on both sides of the fairing. The balance point is located approximately 4 inches back from the leading edge. This is the balance point at which your model should balance for your first flights. Later, you may wish to experiment by shifting the balance up to 3/8" forward or back to change the flying characteristics. Moving the balance forward may improve the smoothness and arrow-like tracking, but it may then require more speed for takeoff and make it more difficult to slow down for landing. Moving the balance aft makes the model more agile, with a lighter and snappier "feel". If you move the balance aft, the elevator will have more authority, possibly resulting in a plane that is too maneuverable. If this happens, you should reduce the maximum elevator throw slightly. In any case, do not balance your model outside the recommended range.

❑ 2. Balance the airplane with the fuel tank *empty.* If it balances outside the "balance range," you must either shift the location of radio components or add weight to the nose or tail until it balances within the range. **NOTE:** Nose weight may be easily installed by using a "Spinner Weight" (available in assorted weights, up to 2 ounces), or by gluing strips of lead onto the front of the firewall. Tail weight may be added by using "stick-on" lead weights.

# Pre-Flight

## Charge the Batteries

Follow the battery charging procedures in your radio instruction manual. 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.

## Find a Safe Place to Fly

The best place to fly your R/C model is an AMA (Academy of Model Aeronautics) chartered club field. Ask your hobby shop dealer if there is such a club in your area and join. Club fields are set up for R/C flying which makes your outing safer and more enjoyable. The AMA can also tell you the name of a club in your area. We recommend that you join AMA and a local club so you can have a safe place to fly and also have insurance to cover you in case of a flying accident. (The AMA address is listed on the front cover of this instruction book.)

If there is no flying club in your area, you need to find a large area, free of obstructions, with a smooth surface that can be used as a runway. It should be located at least 6 miles away from any other R/C airplane operation and away from houses, buildings and streets. A schoolyard may look inviting but it is too close to people, power lines and possible radio interference.

## Ground Check the Model

If you are not thoroughly familiar with the operation of R/C models, ask an experienced modeler to check to see that you have the radio installed correctly and that all the control surfaces do what they are supposed to. The engine operation must also be checked and the engine "broken in" on the ground by running the engine for at least two tanks of fuel. *Follow the engine manufacturer's recommendations for break-in.* Check to make sure all screws remain tight, the hinges are secure and the prop is on tight.

## Range Check the Radio

Check the operation of the radio before every time you fly. This means with the transmitter antenna collapsed and the receiver and transmitter on, you should be able to walk at least 100 feet away from the model and still have control. Have someone help you. Have them stand by your model and, while you work the controls, tell you what the various control surfaces are doing.

Repeat this test *with the engine running* at various speeds with an assistant holding the model. If the control surfaces are not acting correctly at all times, **do not fly!** Find and correct the problem first.

## Engine Safety Precautions

***NOTE: 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: Remember that the 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, as 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 items such as these away from the prop: loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects (pencils, screw drivers) that may fall out of shirt or jacket pockets into the prop.

Use a "chicken stick" device or electric starter; follow instructions supplied with the starter or stick. 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 after operation. Make sure fuel lines are in good condition so fuel is not leaked onto a hot engine, causing a fire.

To stop the engine, cut off the fuel supply by closing off the fuel line or follow the engine manufacturer's recommendations. Do not use hands, fingers or any body part to try to stop the engine. Do not throw anything into the prop of a running engine.

# Flying

The Great Planes Ultra-Sport ARF is a great flying airplane that flies smoothly and predictably, yet is highly maneuverable. It does not have the self-recovery characteristics of a primary trainer. Therefore you must either have mastered the basics of R/C flying or seek the assistance of a competent R/C pilot to help you with your first flights.

**TAKEOFF:** If you have dual rates on your transmitter, set the switches to "high rate" for takeoff, especially when taking off in a cross wind. Although the Ultra-Sport ARF has good low speed characteristics, you should always build up as much speed as your runway will permit before lifting off, as this will give you a safety margin in case of a "flame-out." When the plane has sufficient flying speed, lift off by smoothly applying a little up elevator (don't force it off into a vertical climb!), and climb out gradually.

**FLYING:** We recommend that you take it easy with your Ultra-Sport ARF for the first several flights and gradually "get acquainted" with this fantastic ship as your engine gets fully broken-in. As you will quickly learn, the Ultra-Sport ARF behaves like a "dream ship." It is incredibly smooth and predictable, yet, still very maneuverable. Your confidence will grow to the point that aerobatics are more fun than ever. Just remember to take your time. Add and practice only one maneuver at a time, learning how it behaves during each one.

**LANDING:** When it's time to land, do a couple of slow flybys at a safe altitude and get familiar with the plane's slow flying characteristics.

**CAUTION** (THIS APPLIES TO ALL R/C AIRPLANES): If, while flying, you notice any unusual sounds, such as a low-pitched "buzz", this may be an indication of control surface "flutter." Because flutter can quickly destroy components of your airplane, any time you detect flutter you must **immediately** cut the throttle and land the airplane! Check all servo grommets for deterioration (this will indicate which surface fluttered), and make sure all pushrod linkages are slop-free. If it fluttered once, it will probably flutter again under similar circumstances unless you can eliminate the slop or flexing in the linkages. Here are some things which can result in flutter: Excessive hinge gap; not mounting control horns solidly; sloppy fit of clevis pin in horn; elasticity present in flexible plastic pushrods; side-play of pushrod in guide tube caused by tight bends; sloppy fit of Z-bend in servo arm; insufficient glue used when gluing the torque rods into the control surfaces; excessive flexing of aileron, caused by using too soft balsa aileron; excessive "play" or "backlash" in servo gears; and insecure servo mounting.

# AMA Safety Code

Read and abide by the Academy of Model Aeronautics Official Safety Code, a portion of which is reprinted here:

## 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 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 in the proximity of full-scale aircraft.

3. Where established, I will abide by the safety rules for the flying site I use and will not willfully and deliberately fly my models in a careless, reckless and/or dangerous manner.

7. 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 flown indoors.

9. I will not operate models with pyrotechnics (any device that explodes, burns, or propels a projectile of any kind) including, but not limited to rockets, explosive bombs dropped from models, smoke bombs, all explosive gases (such as hydrogen-filled balloons), ground mounted devices launching a projectile.

## RADIO CONTROL

1. I will have completed a successful radio equipment ground range 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. I will perform my initial turn after takeoff away from the pit or spectator areas and I will not thereafter fly over pit or spectator areas, unless beyond my control.

4. I will operate my model using radio control frequencies currently allowed by the Federal Communications Commission. (Only properly licensed Amateurs are authorized to operate equipment on Amateur Band Frequencies.)

5. I will not knowingly operate an R/C system within 3 miles of a pre-existing model club flying site without a frequency sharing agreement with that club.

6. I will not fly my model aircraft in any racing competition which allows models over 20 pounds unless that competition event is AMA sanctioned. (For the purposes of this paragraph, competition is defined as any situation where a winner is determined.)

AMA
SINCE 1936

**For *further information call or write to the Academy of Model Aeronautics at the following address:***

**Academy of Model Aeronautics**
**5151 E. Memorial Drive**
**Muncie, IN 47302-8252**
**(317)289-4236**

# FLIGHT TRIMMING

A model is not a static object. Unlike a car, which you can only hunt left or right on the road (technically, a car does yaw in corners, and pitches when the brakes are applied), a plane moves through that fluid we call air in all directions simultaneously. The plane may look like it's going forward, but it could also be yawing slightly, slipping a little and simultaneously climbing or diving a bit! The controls interact. Yaw can be a rudder problem, a lateral balance problem or an aileron rigging problem. We must make many flights, with minor changes between each, to isolate and finally correct the problem.

The chart accompanying this article is intended to serve as a **handy** field reference when trimming your model. Laminate it in plastic and keep it in you flight box. You just might have need to consult it at the next contest! The chart is somewhat self-explanatory, but we will briefly run **through** the salient points.

First, we are assuming that the model has been C.G. balanced according to the manufacturer's directions. There's nothing sacred about that spot — frankly, it only reflects the balance point where a prototype model handled the way the guy who designed it thought it should. If your model's wing has a degree more or less of incidence, then the whole balance formula is incorrect for you. But, it's a good ballpark place to start.

The second assumption is that the model has been balanced laterally. Wrap a strong string or monofilament around the prop shaft behind the spinner, then tie the other end to the tail wheel or to a screw driven into the bottom of the aft fuse. Make the string into a bridle harness and suspend the entire model inverted (yes, with the wing on!). If the right wing always drops, sink some screws or lead into the left wing tip, etc. You may be surprised to find out how much lead is needed.

At this point the model is statically trimmed. It's only a starting point, so don't be surprised if you wind up changing it all. One other critical feature is that the ailerons must have their hinge gap sealed. If shoving some Scotch tape or Monokote into the hinge gap to prevent the air from slipping from the top of the wing to the bottom, and vice-versa, bothers you, then don't do it.

To achieve the maximum lateral trim on the model, the hinge gap on the ailerons should be sealed. The easiest way to do this is to disconnect the aileron linkages, and fold the ailerons as far over the top of the wing as possible (assuming they are top or center hinged). Apply a strip of clear tape along the joint line. When the aileron is returned to neutral, the tape will be invisible, and the gap will be effectively sealed. Depending on how big the ailerons are, and how large a gaping gap you normally leave when you install hinges, you could experience a 20 percent increase in aileron control response just by this simple measure.

Your first flights should be to as certain control centering and control feel. Does the elevator always come back to neutral after a 180 turn or Split-S? Do the ailerons tend to hunt a little after a rolling maneuver? Put the plane through its paces. Control centering is either a mechanical thing (binding servos, stiff linkages, etc.). an electronic thing (bad servo resolution or dead band in the radio system), or C.G. (aft Center of Gravity will make the plane wander a bit). The last possibility will be obvious, but don't continue the testing until you have isolated the problem and corrected it.

Let's get down to the task of trimming the model. Use the tachometer every time you start the engine, to insure consistent results. These trim flights must be done in calm weather. Any wind will only make the model weather vane. Each "maneuver" on the list assumes that you will enter it dead straight-and-level. The wings must be perfectly flat, or else the maneuver will not be correct and you'll get a wrong interpretation. That's where your observer comes in. Instruct him to be especially watchful of the wings as you enter the maneuvers.

Do all maneuvers at full throttle. The only deviation from this is if the plane will routinely be flown through maneuvers at a different power setting.

Let's commence with the "engine thrust angle" on the chart. Note that the observations you make can also be caused by the C.G., so be prepared to change both to see which gives the desired result. Set up a straight-and-level pass. The model should be almost hands-off. Without touching any other control on the transmitter, suddenly chop the throttle. Did the nose drop? When you add power again, did the nose pitch up a bit? If so, you need some down thrust, or nose weight. When the thrust is correct, the model should continue along the same flight path for at least a dozen plane lengths before gravity starts to naturally bring it down.

Do each maneuver several times, to make **sure that you are getting a** proper diagnosis. Often, a gust, an accidental nudge on the controls, or just a poor maneuver entry can mislead you. The thrust adjustments are a real pain to make. On most models, it means taking the engine out, adding shims, **then** reassembling the whole thing. Don't take shortcuts.

Don't try to proceed with the other adjustments until you have the thrust line and/or C.G. correct. They are the basis upon which all other trim settings are made.

Also, while you have landed, take the time to crank the clevises until the transmitter trims are at neutral. Don't leave the airplane so that the transmitter has some odd-ball combination of trim settings. One bump of the transmitter and you have lost everything. The trim must be repeatable, and the only sure way to do this is to always start with the transmitter control trims at the middle.

The next maneuver is somewhat more tricky than it looks. To verify C.G., we roll the model up to a 45 bank, then take our hands off the controls. The model should go a reasonable distance with the fuse at an even keel. If the nose pitches down, remove some nose weight, and the opposite if the nose pitches up. The trick is to use only the ailerons to get the model up at a 45-degree bank. We almost automatically start feeding in elevator, but that's a no-no. Do the bank in both directions, just to make sure that you are getting an accurate reading of the longitudinal balance.

We now want to test the correct alignment of both sides of the elevator (even if they aren't split, like a Pattern ship's, they can still be warped or twisted). Yaw and lateral balance will also come into play here, so be patient and eliminate the variables, one-by-one. The maneuver is a simple loop, but it must be entered with the wings perfectly level. Position the maneuver so that your assistant can observe it end-on. Always loop into the wind. Do several loops, and see if the same symptom persists. Note if the model loses heading on the front or back side of the loop. If you lose it on the way up, it's probably an aileron problem, while a lose of heading on the way back down is most likely a rudder situation.

After you get the inside loops going correctly, do the same maneuver to the outside, entering from an inverted position. Before making too many dramatic changes,glance at the remainder of the chart and note the myriad combination of things we can do with just the ailerons. Each change you make will affect all other variables!

Note that the Yaw test is the same looping sequences. Here, however, we are altering rudder and ailerons, instead of the elevator halves. We must repeat that many airplanes just will not achieve adequate lateral trim without sealing the hinge gaps shut. The larger you make the loops (to a point), the more discernable the errors will be.

The Lateral Balance test has us pulling those loops very tightly. Actually, we prefer the Hammerhead as a better test for a heavy wing. Pull straight up into a vertical and watch which wing drops. A true vertical is hard to do, so make sure that your assistant is observing from another vantage point. Note that the engine torque will affect the vertical fall off, as will rudder errors. Even though we balance the wing statically before leaving for the field, we are now trimming it dynamically.

The Aileron Coupling (or rigging), is also tested by doing Hammerheads. This time, however, we want to observe the side view of the model. Does the plane want to tuck under a bit? If so, then try trimming the ailerons down a small bit, so that they will act as flaps. If the model tends to want to go over into a loop, then rig both ailerons up a few turns on the clevises. Note that drooping the ailerons will tend to cancel any washout you have in the wing. On some models, the lack of washout can lead to some nasty characteristics at low speeds.

The effects noted with the Aileron Coupling tests can also be caused by an improperly set wing incidence. The better test for this is knife-edge flight. If the model tends to pull upward, i.e., it swings toward a nose up direction, then reduce the wing incidence. If the model tries to go off heading toward the bottom side of the plane, then increase incidence.

Again, we reiterate that all of these controls are interactive. When you change the wing incidence, it will influence the way the elevator trim is at a given C.G. Re-trimming the wing will also change the rigging on the ailerons, in effect, and they may have to be readjusted accordingly.

The whole process isn't hard. As a matter of fact it's rather fun — but very time consuming. It's amazing what you will learn about why a plane flies the way it does, and you'll be a better pilot for it. One thing we almost guarantee, is that your planes will be more reliable and predictable when they are properly trimmed out. They will fly more efficiently, and be less prone to doing radical and surprising things. Your contest scores should improve, too.

We wish to acknowledge the Orlando, Florida, club newsletter, from which the basics of the chart presented here were gleaned.

Reprinted in part by Great Planes Model Manufacturing Company, courtesy of Scale R/C Modeler magazine, Pat Potega, Editor, August 1983 issue.

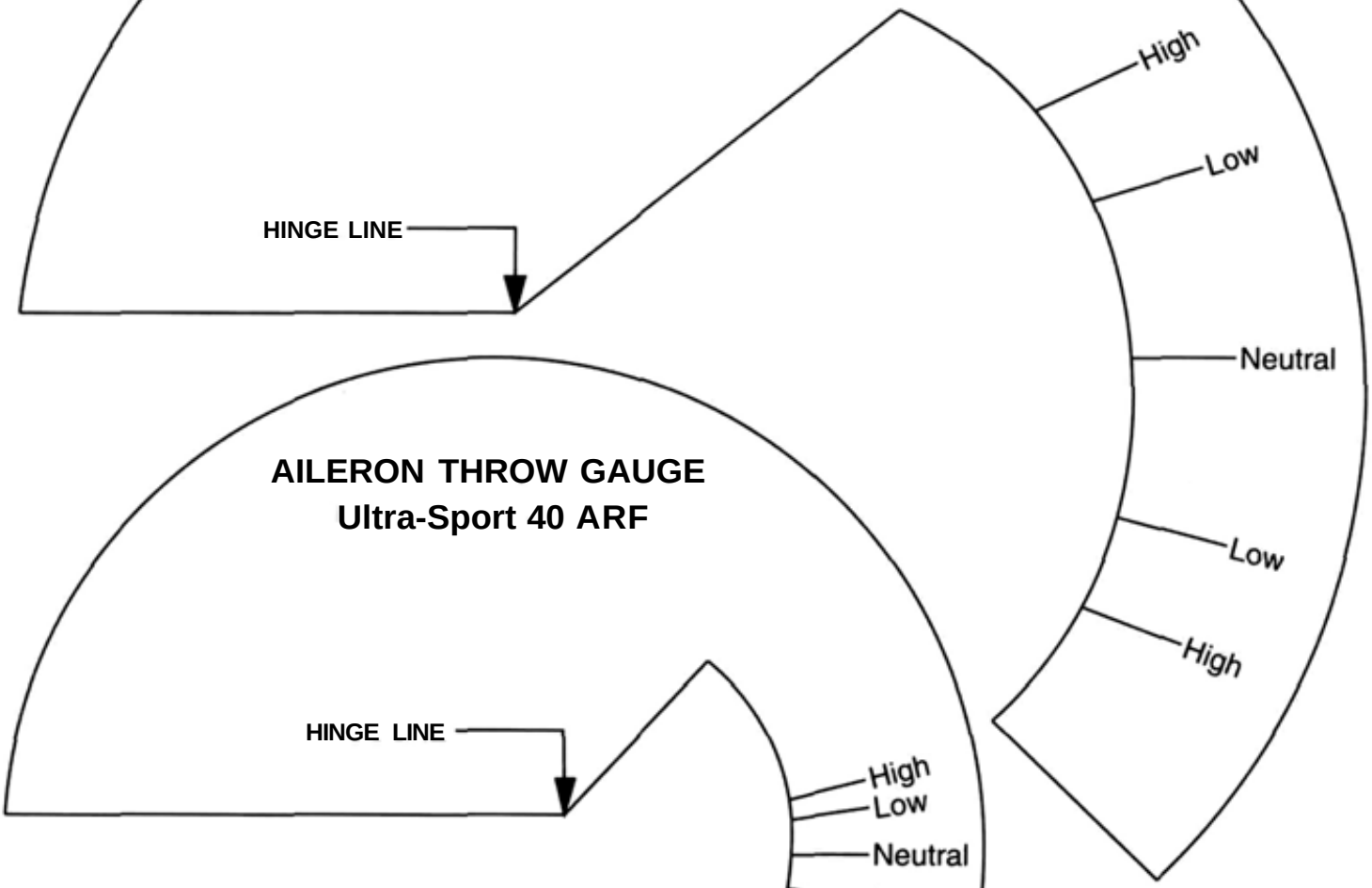
**See the Flight Trimming Chart on Page 30.**

| TRIM FEATURE | MANEUVERS | OBSERVATIONS | CORRECTIONS |
|---|---|---|---|
| CONTROL CENTERING | Fly general circles and random maneuvers, | Try for hands off straight and level flight. | Readjust linkages so that Tx trims are centered. |
| CONTROL THROWS | Random maneuvers | A. Too sensitive, jerky controls,<br>B. Not sufficient control. | If A, change linkages to reduce throws.<br>If B, increase throws. |
| ENGINE THRUST ANGLE | From straight flight, chop throttle quickly, | A. Aircraft continues level path for short distance.<br>B. Plane pitches nose up. If B, decrease downthrust.<br>C. Plane pitches nose down. | If A, trim is okay.<br><br>If C, increase downthrust. |
| CENTER OF GRAVITY LONGITUDINAL BALANCE | From level flight roll to 45-degree bank and neutralize controls. | A. Continues in bank for moderate distance.<br>B. Nose pitches up.<br>C. Nose drops. | If A, trim is good.<br>If B, add nose weight.<br>If C, remove nose weight. |
| SPLIT ELEVATORS (also Yaw and C.G.) | Into wind, pull open loops, using only elevator. Repeat tests doing outside loops to inverted entry. | A. Wings are level throughout.<br>B. Plane tends toward outside when right side up, and to inside when inverted.<br>C. Plane goes in on regular loops, and out on inverted.<br>D. Plane goes out on both types of loops.<br>E. Plane goes in on both types of loops. | If A, trim is fine.<br>If B, add weight to right wing, or add right rudder.<br>If C, add weight to left wing, or add left rudder.<br>If D, raise right half of elevator (or lower right).<br>If E, raise left half of elevator (or lower right). |
| YAW[2] | Into wind, do open loops, using only elevator. Repeat tests doing outside loops from inverted entry. | A. Wings are level throughout.<br>B. Yaws to right in both inside and outside loops.<br>C. Yaws to left in both inside and outside loops.<br>D. Yaws right on insides, and left on outside loops.<br>E. Yaws left in insides, and right on outside loops. | If A, trim is correct.<br>If B, add left rudder trim.<br>If C, add right rudder trim.<br>If D, add left aileron trim.<br>If E, add right aileron trim. |
| LATERAL BALANCE | Into wind, do tight inside loops, or make straight up climbs into Hammerheads. Do same from inverted entry. | A. Wings are level and plane falls to either side randomly in Hammerhead.<br>B. Falls off to left in both inside and outside loops. Worsens as loops tighten.<br>C. Falls off to right in both loops. Worsens as loops tighten.<br>D. Falls off in opposite directions on inside and outside loops. | If A, trim is correct.<br>If B, add weight to right wing tip.<br>If C, add weight to left wing tip.<br>If D, change aileron trim.[3] |
| AILERON RIGGING | With wings level, pull to vertical climb and neutralize controls. | A. Climb continues along same path.<br>B. Nose tends to go to inside loop.<br>C. Nose tends to go to outside loop. | If A, trim is correct.<br>If B, raise both ailerons very slightly.<br>If C, lower both ailerons very slightly. |
| WING INCIDENCE | Knife edge flight. | A. Model tends to veer in nose up direction.<br>B. Model veers in nose down direction. | If A, reduce wing incidence.<br>If B, increase wing incidence. |

1. Engine thrust angle and C.G. interact. Check both.
2. Yaw and lateral balance produce similar symptoms. Note that fin may be crooked. Right and left references are from the plane's vantage point.
3. Ailerons cannot always be trimmed without sealing the hinge gap.

**RUDDER THROW GAUGE**

**Ultra-Sport 40 ARF**



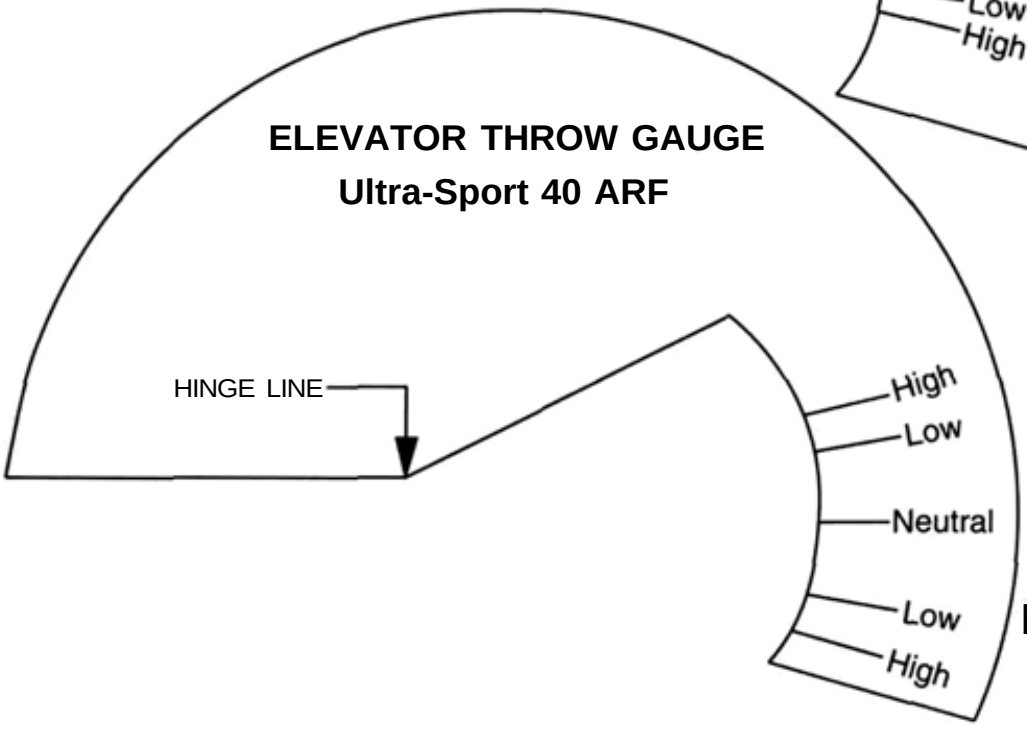

**AILERON THROW GAUGE**

**Ultra-Sport 40 ARF**

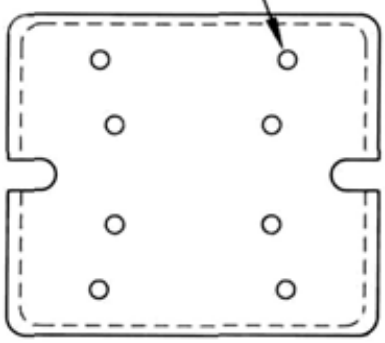



**ELEVATOR THROW GAUGE**

**Ultra-Sport 40 ARF**




DRILL 3/32" PILOT HOLES (8 PLACES)



MAIN LANDING GEAR DRILL TEMPLATE