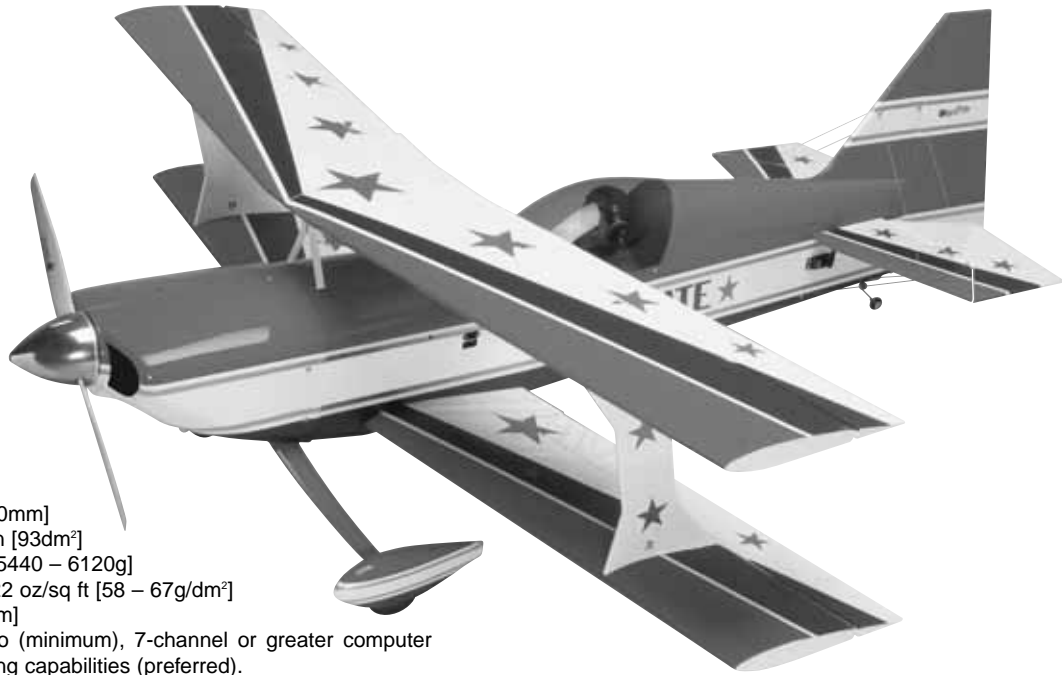


# Ultimate!

## BIPLANE ARF

### INSTRUCTION MANUAL



**Wingspan:** 65 in [1650mm]  
**Wing Area:** 1446 sq in [93dm<sup>2</sup>]  
**Weight:** 12 – 13.5 lb [5440 – 6120g]  
**Wing Loading:** 19 – 22 oz/sq ft [58 – 67g/dm<sup>2</sup>]  
**Length:** 72 in [1830mm]  
**Radio:** 4-channel radio (minimum), 7-channel or greater computer radio with mixing capabilities (preferred).  
**Engine:** 1.60 cu in [26cc] two-stroke, 43cc gasoline engine

#### WARRANTY

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

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

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

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

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

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

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



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

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## INTRODUCTION

Any model called the "Ultimate" better be as good as it sounds. The Great Planes Ultimate has been designed with an eye on high performance and light weight. You will find that there is not much this airplane cannot do. You are only limited by your own abilities. We have no doubt that you too will find it the "Ultimate" in model flying.

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

## AMA

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



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

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

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

1. Your "Ultimate" should not be considered a toy, but rather a sophisticated, working model that functions very much like

## DECISIONS YOU MUST MAKE

a full-size airplane. Because of its performance capabilities, the "Ultimate," if not assembled and operated correctly, could possibly cause injury to yourself or spectators and damage to property.

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

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

4. You must use an R/C radio system that is in first-class condition, and a correctly sized engine and components (fuel tank, wheels, etc.) throughout the building process.

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

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

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

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

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

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

This is a partial list of items required to finish the "Ultimate" that may require planning or decision making before starting to build.

### Radio Equipment

#### Radio:

4-channel radio (minimum), 7-channel or greater computer radio with mixing capabilities (preferred).

#### Receiver:

4-channel minimum. 7 channel or greater (preferred).

#### Battery:

1000mAh (minimum)

#### Servos (IMAC type aerobatics):

Ailerons – four 50 oz-in servos

Elevator – two 50 oz-in servos

Rudder – one 100 oz-in servo or two 50 oz-in servos

Throttle – one 30 oz-in servo

#### Extreme and 3D aerobatics

Ailerons – four 75 oz-in servos

Elevator – two 75 oz-in servos

Rudder – one 130 oz-in servo or two 70 oz-in servos

Throttle – one 30 oz-in servo

#### Connectors:

Two "Y" harnesses.

Four 12" extensions.

Two or four 24" extensions.

### Engine Recommendations

The Great Planes "Ultimate" has been tested and flown with the O.S. 1.60 cu in two-stroke [26cc] glow engine and the Fuji-IMVAC BT-43EIS [43cc] gasoline engine. If you choose another brand of engine, the following guidelines should be followed.

1.5 – 1.8 cu in [25 – 30cc] two-stroke glow engine

1.8 – 2.1 cu in [30 – 36cc] four-stroke glow engine

1.9 – 2.6 cu in [32 – 43cc] gasoline engine

**Note:** The model was also tested with a DA50 gas engine using a 20x8 prop. The model was considered over-powered and will require throttle management for successful operation. The use of engines weighing more than 2.5 pounds will require corresponding balancing tail weights and will raise the all-up weight accordingly.

## ADDITIONAL ITEMS REQUIRED

### Required Hardware & Accessories

This is the list of hardware and accessories required to finish the "Ultimate." Order numbers are provided in parentheses.

- 3' [900mm] Standard silicone fuel tubing (GPMQ4131)
- 2' [600mm] Large silicone fuel tubing (GPMQ4133)
- 3' [900mm] Gasoline fuel tubing (GPMQ4135)
- 1 oz. [30g] Thin Pro™ CA (GPMR6002)
- 1 oz. [30g] Medium Pro CA+ (GPMR6008)
- Pro 30-minute epoxy (GPMR6047)
- Drill bits: 1/16" [1.6mm], 3/32" [2.4mm], 1/8" [3.2mm], 9/64" [3.6mm], 5/32" [4mm], 7/32" [5.6mm], 1/4" [6.4mm]
- 8-32 Tap
- #1 Hobby knife (HCAR0105)
- #11 Blades (5-pack, HCAR0211)
- Small T-pins (100, HCAR5100)
- Alcohol (for epoxy clean up)
- Masking tape
- Paper towels
- Flat file

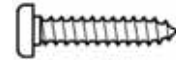
### Optional Supplies & Tools

Here is a list of optional tools mentioned in the manual that will help you build the "Ultimate."

- 2 oz. [57g] Spray CA activator (GPMR6035)
- R/C-56 canopy glue (JOZR5007)
- CA applicator tips (HCAR3780)
- CA debonder (GPMR6039)
- Epoxy brushes (6, GPMR8060)
- Mixing sticks (50, GPMR8055)
- Mixing cups (GPMR8056)
- Curved-tip canopy scissors for trimming plastic parts (HCAR0667)
- Threadlocker™ thread-locking cement (GPMR6060)
- Switch & Charge Jack Mounting Set (GPMM1000)
- Rotary tool such as Dremel® and cut-off wheel
- Dead Center™ Engine Mount Hole Locator (GPMR8130)
- AccuThrow™ Deflection Gauge (GPMR2405)
- CG Machine™ (GPMR2400)

## IMPORTANT BUILDING NOTES

- There are three types of screws used in this kit:
- **Sheet metal screws (SMS)** are designated by a number and a length. For example, #6 x 3/4" [19mm].



This is a number six screw that is 3/4" [19mm] long.

- **Machine screws (MS)** are designated by a number, **threads per inch**, and a length. For example, 4-40 x 3/4" [19mm].



This is a number four screw that is 3/4" [19mm] long with forty threads per inch.

- **Socket-head cap screws (SHCS)** are designated by a number, **threads per inch**, and a length. For example, 4-40 x 1-1/2" [38mm].



This is a number four screw that is 1-1/2" [38mm] long with forty threads per inch.

- When you see the term **test fit** in the instructions, it means that you should first position the part on the assembly **without using any glue**, then slightly modify or *custom fit* the part as necessary for the best fit.

- Whenever the term **glue** is written you should rely upon your experience to decide what type of glue to use. When a specific type of adhesive works best for that step, the instructions will make a recommendation.

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

- **Photos** and **sketches** are placed **before** the step they refer to. Frequently you can study photos in following steps to get another view of the same parts.

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

White – TOPQ0204  
Sapphire Blue – TOPQ0226  
Missile Red – TOPQ0201  
Metallic Gold – TOPQ0404

## METRIC CONVERSIONS

1" = 25.4mm (conversion factor)

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

## ORDERING REPLACEMENT PARTS

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

To locate a hobby dealer, visit the Hobbico web site at [www.hobbico.com](http://www.hobbico.com). Choose "Where to Buy" at the bottom of the menu on the left side of the page. Follow the instructions provided on the page to locate a U.S., Canadian or International dealer. If a hobby shop is not available, replacement parts may also be ordered from Tower Hobbies® at [www.towerhobbies.com](http://www.towerhobbies.com), or by calling toll free (800) 637-6050.

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

Mail parts orders and payments by personal check to:

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

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

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

## Replacement Parts List

Order Number	Description	How to Purchase
	Missing pieces	Contact Product Support
	Instruction manual	Contact Product Support
	Full-size plans	Not available
GPMA2830	Bottom Wing Set	Contact Hobby Supplier
GPMA2831	Top Wing Set	Contact Hobby Supplier
GPMA2832	Fuselage Set	Contact Hobby Supplier
GPMA2833	Tail Set	Contact Hobby Supplier
GPMA2834	Cowl	Contact Hobby Supplier
GPMA2835	Landing Gear	Contact Hobby Supplier
GPMA2836	Wheel Pants (2)	Contact Hobby Supplier
GPMA2837	Canopy	Contact Hobby Supplier
GPMA2838	Tail Wheel Assembly	Contact Hobby Supplier
GPMA2839	Aluminum Spinner	Contact Hobby Supplier
GPMA2840	Interplane Struts (2)	Contact Hobby Supplier
GPMA2841	Interplane Thumb Screws (4)	Contact Hobby Supplier
GPMA2842	Cabane Struts (2)	Contact Hobby Supplier
GPMA2843	Decal Set	Contact Hobby Supplier
GPMA2844	Flying Wire Set	Contact Hobby Supplier

## COMMON ABBREVIATIONS

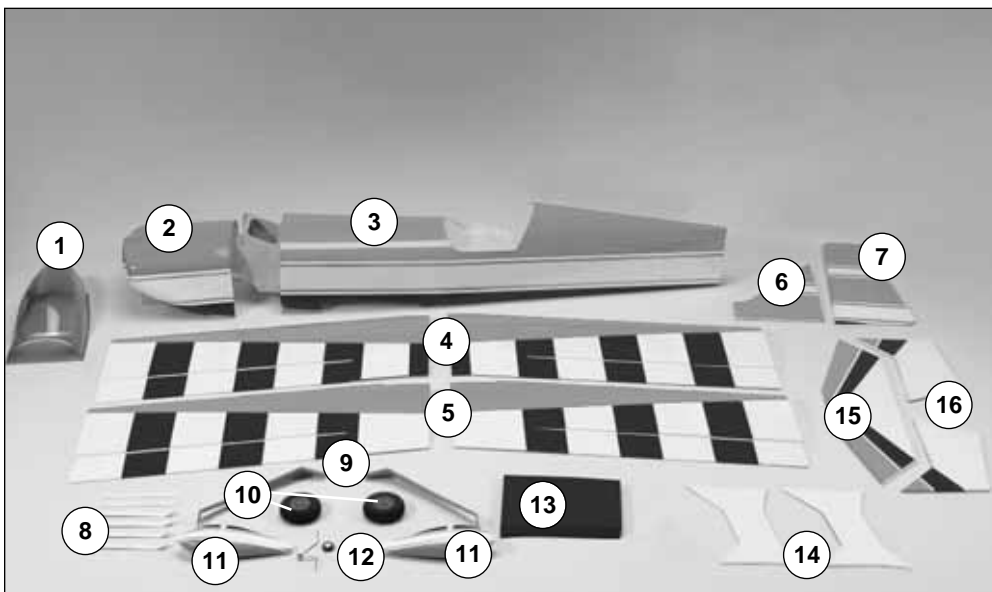
Fuse = Fuselage  
Stab = Horizontal Stabilizer  
Fin = Vertical Fin  
LE = Leading Edge  
TE = Trailing Edge  
LG = Landing Gear  
Ply = Plywood  
" = Inches  
mm = Millimeters  
SHCS = Socket-Head Cap Screw

## KIT INSPECTION

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

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

## KIT CONTENTS



### Kit Contents

1. Canopy
2. Cowl
3. Fuselage
4. Top Wing Halves (L&R)
5. Bottom Wing Halves (L&R)
6. Fin
7. Rudder
8. Cabanes (6)
9. Main Landing Gear
10. Main Wheels (2)
11. Wheel Pants (L&R)
12. Tail Wheel Assembly
13. Belly Pan
14. Interplane Struts (2)
15. Horizontal Stabilizer
16. Elevators (L&R)

### Kit Contents (Not Photographed)

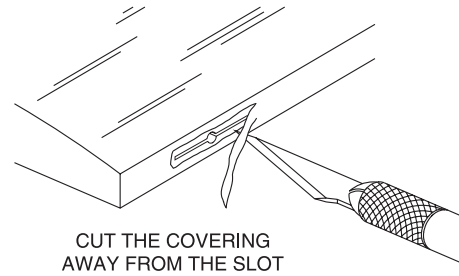
Description	Quantity	Description	Quantity	Description	Quantity
Wire Clip	4	2" x 9" Hinge Material	2	4-40 Lock Washer	12
120-180 Engine Mount Left	1	11-3/4" Gray Plastic Outer Tube	1	#6 Flat Washer	6
120-180 Engine Mount Right	1	Clevis Keeper	16	#4 Flat Washer	17
4-40 Threaded Metal Clevis	8	#4 x 1/2" SMS	33	#2 Flat Washer	8
4-40 Solder Clevis	8	#2 x 3/8" SMS	8	#8 Lock Washer	8
3/16" x 2" Axles	2	4-40 x 3/8" Machine Screw	4	#8 Flat Washer	8
Screw-Lock Pushrod Connector	2	6-32 x 1/2" SHCS	4	#6 Lock Washer	6
4-40 Blind Nuts	10	4-40 x 1" SHCS	4	2-56 x 5/8" Machine Screw	
4-40 Nut	8	4-40 x 1/2" SHCS	4	#64 Rubber Bands	2
6-32 Blind Nuts	6	4-40 x 3/4" SHCS	4	Aluminum Knurled Knobs	4
8-32 Blind Nuts	4	4-40 x 1/2" Machine Screw	4	8-32 x 2" Threaded Rod	4
5/16-24 Lock Nut	2	6-32 x 1" SHCS	6	Aluminum Engine Stand-offs	4
1/4-20 Blind Nut	2	8-32 x 1-1/4" SHCS	4	Flying Wire Hardware	1 set
4-40 Nylon Lock Nut	10	8-32 x 1" SHCS	4	Spinner Nut	1
1/4-20 Nylon Bolt	2	4-40 x 1/8" SHCS	2	Spinner Bolt	1
Large Black Control Horn	8	3/16" Wheel Collar	4	Aluminum Rib	1
Nylon Retainer	2	.074 x 12" Wire Threaded One End	1		
		.095 X 5-3/4" Wire Threaded One End	4		
		.095 X 12" Wire Threaded One End	3		

## PREPARATIONS

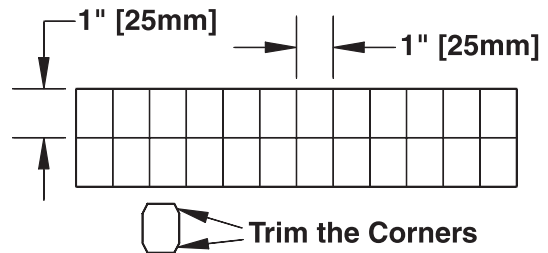
1. If you have not done so already, remove the major parts of the kit from the box and inspect for damage. If any parts are damaged or missing, contact Product Support at the address or telephone number listed in the “*Kit Inspection*” section on page 6.



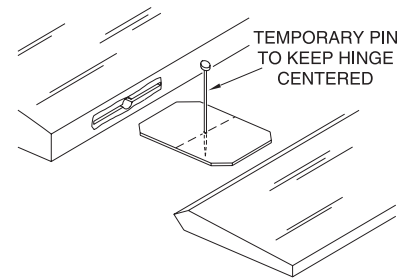
2. Remove the tape and separate the ailerons and flaps from the wing and the elevators from the stab. Use a covering iron with a covering sock on high heat to tighten the covering if necessary. Apply pressure over sheeted areas to **thoroughly** bond the covering to the wood.



3. Use a sharp #11 blade to cut a strip of covering from the hinge slots in the wing and aileron.



3. Cut sixteen 1" x 1" [25 x 25mm] hinges from a CA hinge strip. Snip off the corners so they go in easier.



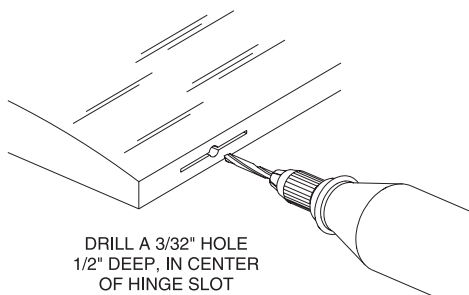
4. Test fit the ailerons to the wing with the hinges. If the hinges don't remain centered, stick a pin through the middle of the hinge to hold it in position.

5. Remove any pins you may have inserted into the hinges. Adjust the aileron so there is a small gap between the LE of the aileron and the wing. The gap should be small, just enough to see light through or to slip a piece of paper through.

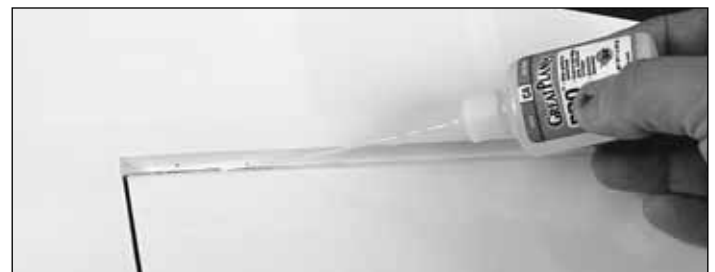
## ASSEMBLE THE WINGS

### Install the Ailerons

*Do the bottom right wing first so your work matches the photos the first time through.*



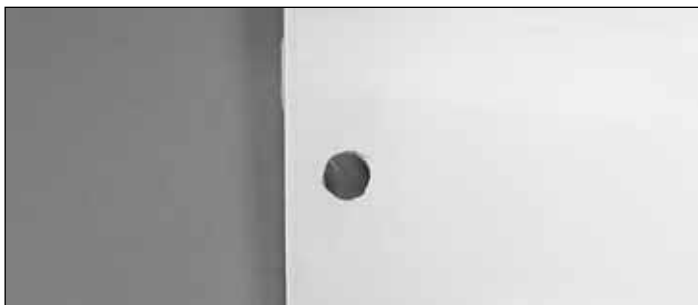
1. Drill a 3/32" [2.4mm] hole, 1/2" [13mm] deep in the center of each hinge slot to allow the CA to “wick” in. Follow-up with a #11 blade to clean out the slots. **Hint:** If you have one, use a high-speed rotary tool to drill the holes.



6. Apply six drops of thin CA to the top and bottom of each hinge. Do not use CA accelerator. After the CA has fully hardened, test the hinges by pulling on the aileron.

7. Repeat steps 1 to 6 for the left wing panel and the two wing panels for the top wing.

## Install the Aileron Servos & Pushrods



1. Cut away the covering from the servo bay in the bottom of the bottom right wing panel. Turn the wing over and cut the covering from the hole in the top of the wing at the wing root.

2. Inside the servo bay a string is taped. Carefully remove the string from the servo bay and tape it to the outside of the wing to prevent it from dropping back into the wing. The other end of the string is taped to the root rib. Remove the tape, thread the string through the small holes you cut the covering from on the bottom of the wing, and tape the string to the wing.

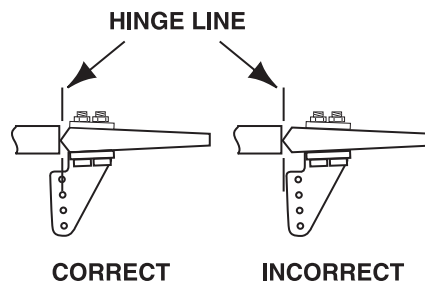
3. Install a 12" [305mm] servo extension onto the servo lead. Secure the extension to the lead with tape, a piece of shrink tube or some other method to keep them from coming unplugged.



4. Tie the string to the servo extension. Pull the string and the servo lead through the wing. Untie the string from the lead and insert the lead through the small hole you cut the covering from. Tape the lead to the wing to prevent it from falling back into the wing.



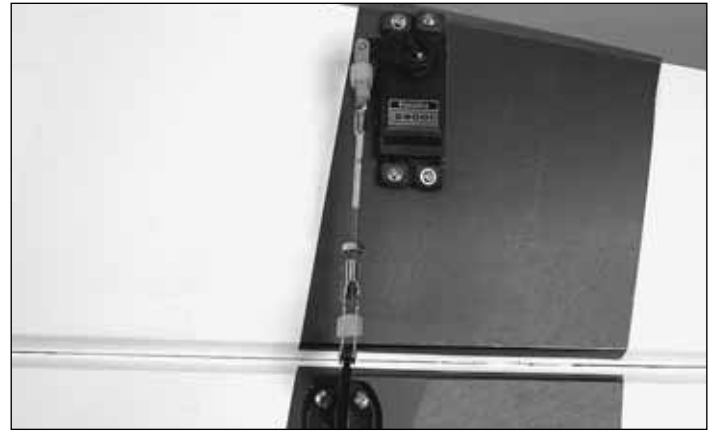
5. Install the servo into the servo opening. Drill through the servo mounting holes with a 1/16" [1.6mm] drill bit. Remove the servo from the servo opening. Install and then remove a servo mounting screw into each of the holes you have drilled. Apply a drop of thin CA into the holes to harden the threads. Once the glue has cured, install the servo into the servo opening using the hardware included with your servo. Center the servo then install a servo arm as shown. The arm should be pointing towards the wing tip.



6. Place a nylon control horn in line with the outer hole in the servo arm. When positioned properly, the control horn will rest on a hardwood plate in the aileron. Mark the location of the mounting holes onto the aileron. Drill a 3/32" [2.4mm] hole on the marks, drilling through the plywood plate *but not* through the top of the aileron. Insert and remove a #4 x 1/2" [13mm] screw into each of the holes. Apply a couple drops of thin CA into the holes to harden the threads. Once the glue has hardened attach the horn to the aileron with four #4 x 1/2" [13mm] screws.



7. Thread a 4-40 nut onto a 4-40 x 5-3/4" [146mm] threaded rod approximately twenty turns. Slide a silicone clevis retainer onto a threaded 4-40 metal clevis. Then, thread the clevis onto the rod, tightening it against the nut. Install the clevis onto the nylon control horn. Install an unthreaded clevis onto the servo arm. Center the aileron and then mark the threaded rod where it should be cut to fit the clevis. Remove all of the pushrod components from the servo and control horn. Read the **Expert Tip** that follows and then silver solder the clevis to the pushrod.



8. After the rod has cooled, install a clevis retainer onto the clevis you have just soldered. Then, install the pushrod onto the aileron and servo.

9. Repeat steps 1-8 for the left wing panel. Repeat steps 1-8 for the top wing panels. **Note:** When cutting the covering from the hole in the top wing for the servo lead, the hole is located on the bottom-middle of the wing.



### How to solder

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

B. Apply a few drops of soldering flux to the end of the pushrod. Then, use a soldering iron or a torch to heat it. Tin the heated area with silver solder (GPMR8070) by applying the solder to the end. The heat of the pushrod should melt the solder—not the flame of the torch or soldering iron—thus allowing the solder to flow. The end of the wire should be coated with solder all the way around.

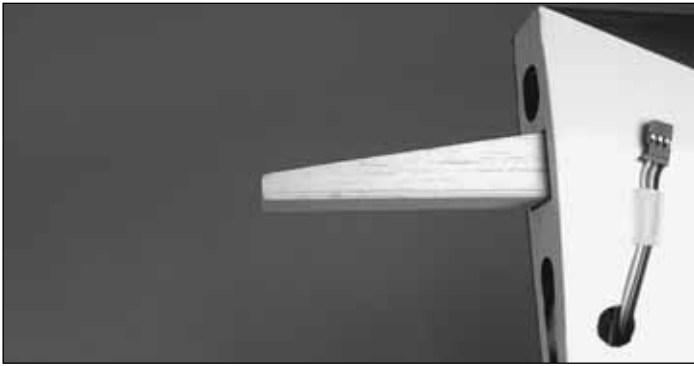
C. Place the clevis on the end of the pushrod. Add another drop of flux. Then, simultaneously heat the clevis and pushrod. Slide the clevis the rest of the way onto the pushrod as the solder melts. Apply another small amount of solder while the pushrod and clevis are still hot. The same as before, the heat of the parts being soldered should melt the solder, thus allowing it to flow. Allow the joint to cool naturally without disturbing. Avoid excess blobs, but make certain the joint is thoroughly soldered. The solder should be shiny, not rough. If necessary, reheat the joint and allow to cool.

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

### Join the Bottom Wing



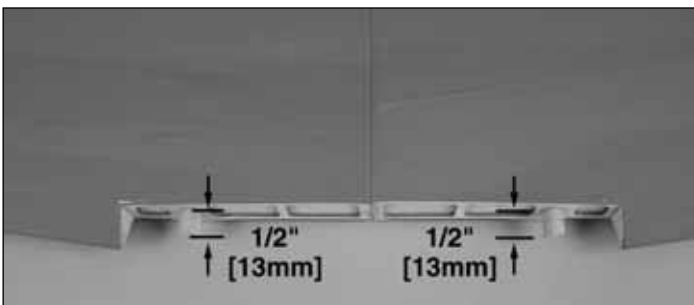
1. Epoxy a 3/16" x 1" [4.8 x 25mm] hardwood dowel into the root rib of the bottom right wing panel. (**Note:** The bottom wing can be identified by the set back at the wing center-section). The dowel should extend 1/2" [13mm] into the hole in the wing.



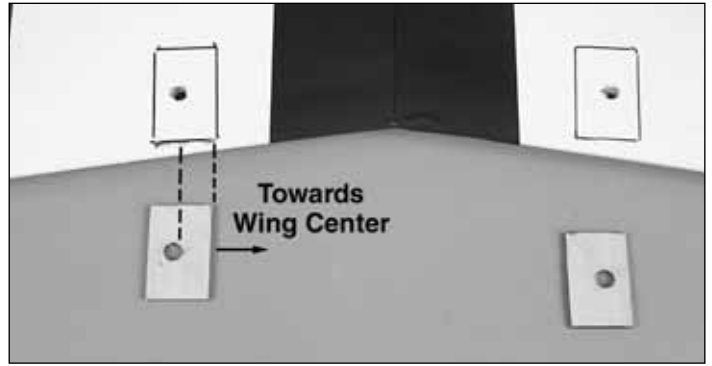
❑ 2. Test fit the plywood and balsa **wing joiner** into the joiner pocket of both wing halves. When you are satisfied with the fit of the joiners, glue the joiner into the bottom wing panels with 30-minute epoxy. When gluing the wing panels together, be sure to get glue into the joiner pockets in the wing. This can be done by applying the glue into the pocket with a small stick. Apply glue to the pocket, the joiner and the root rib of the wing.



❑ 4. Hold the wing together while the glue is curing with masking tape. Be sure that both of the root ribs are pulled tightly against one another. Excess epoxy can be cleaned away with rubbing alcohol and a paper towel.



❑ 5. Epoxy two 3/8" x 1-1/4" [9.5 x 32mm] hardwood **leading edge dowels** into the two holes in the front of the wing. The dowel should extend 1/2" [13mm] from the front of the wing. Set the wing aside until the glue fully hardens.



❑ 6. Place the plywood **wing bolt mounting plates** in position on the bottom of the wing, over the wing bolt holes. When positioning the plates be sure the widest part of the plate is towards the center of the wing. Using a fine tip marker, trace the outline of the plate onto the wing. Use a sharp #11 hobby knife or refer to the **Expert Tip** that follows to cut the covering from the wing along the lines you have marked. Use care to cut **only into the covering** and **not** into the wood.



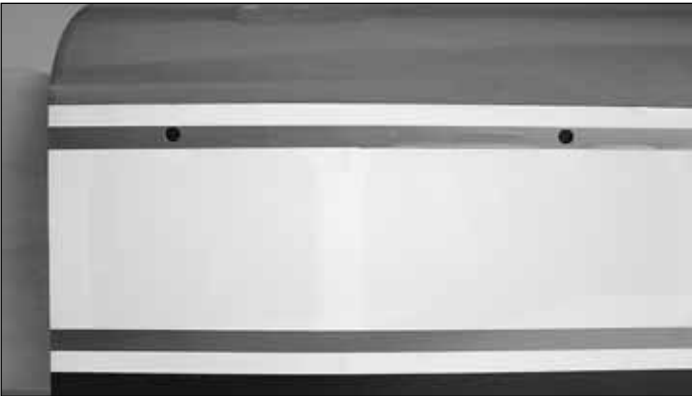
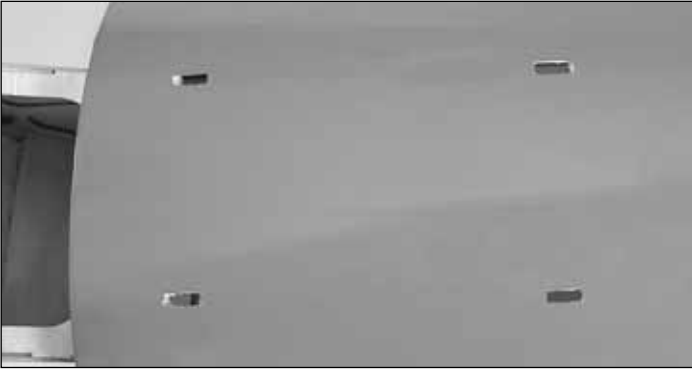
**How to cut covering from balsa**



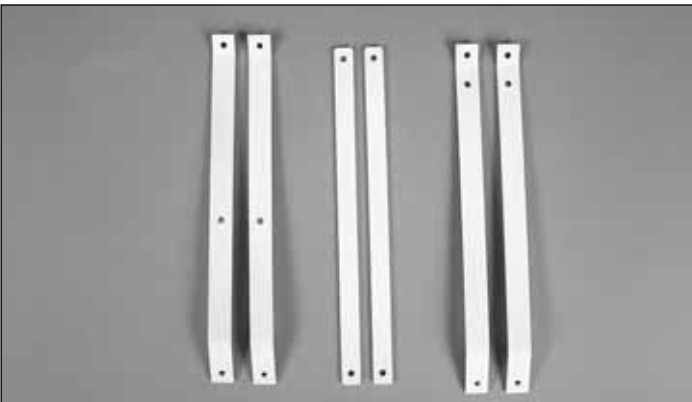
Use a soldering iron to cut the covering from a balsa sheeted surface. The tip of the soldering iron doesn't have to be sharp, but a fine tip does work best. Allow the iron to heat fully. Use a straightedge to guide the soldering iron at a rate that will just melt the covering and not burn into the wood. The hotter the soldering iron, the faster it must travel to melt a fine cut. Peel off the covering.

❑ 7. Glue the plates in position onto the wing.

## Install the Center Cabanes & "I" Struts

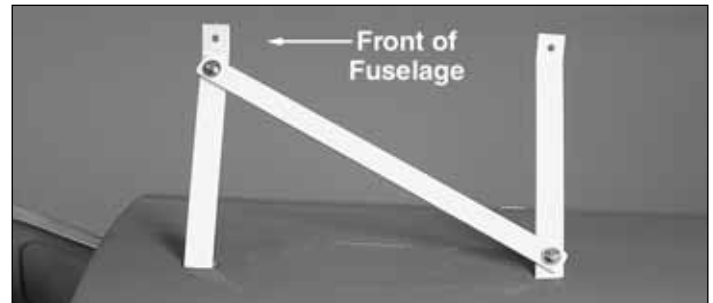


1. Cut the covering away from the openings in the top of the fuselage as well as the covering away from the holes located on both sides of the front of the fuselage.

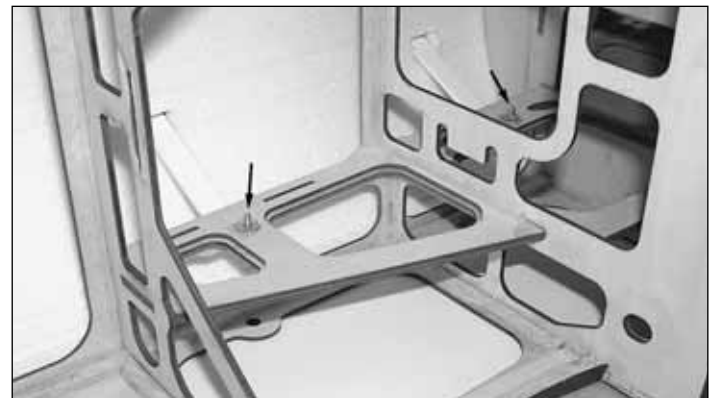


2. Identify the parts of the **cabanes**. Assemble them as shown with 4-40 x 3/8" [9.5mm] machine screws, #4 flat washers and 4-40 nylon lock nuts. When assembling the

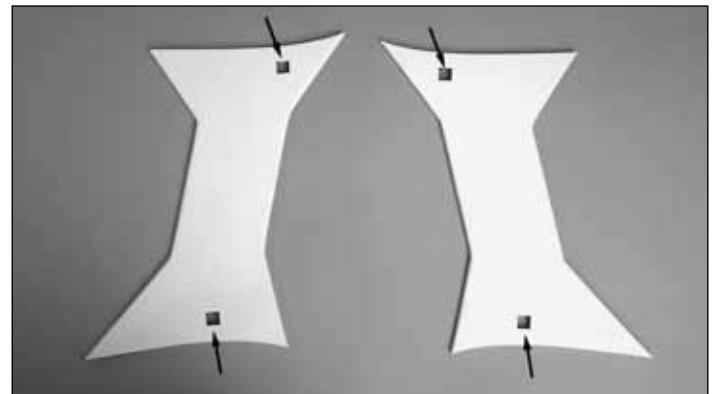
cabanes apply a couple of drops of Threadlocker to the screws. Do not fully tighten the screws; just make them snug for now.



3. Insert the cabane for the left side of the fuselage into the slots on the top, left side of the fuselage. Be sure the cabane slides into the slots located inside of the fuselage.



4. Located inside the fuselage are 4-40 blind nuts. Align the holes in the cabanes with the blind nuts. Mount the cabanes to the fuselage with 4-40 x 1/2" [13mm] socket-head cap screws and #4 lock washers. Apply a couple of drops of Threadlocker onto the screws. Install the screws through the holes you cut the covering from on the sides of the fuselage. Do this for all four of the cabane legs. Tighten all of the screws for the cabane assembly and the mounting screws.



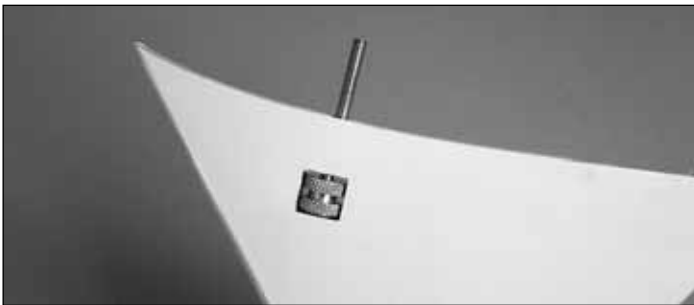
5. Cut the covering from the openings on both of the "I" struts.



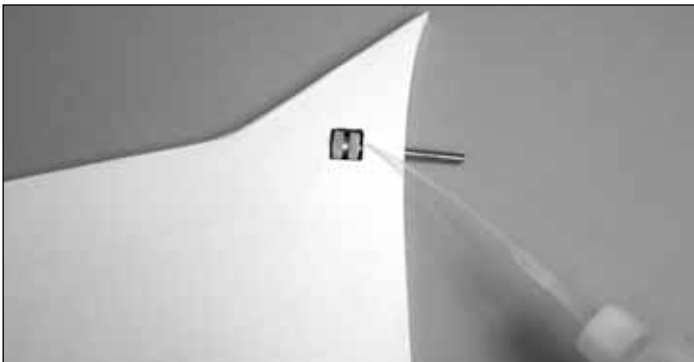
6. Locate one of the knurled knobs and an 8-32 x 2" [51mm] threaded rod.



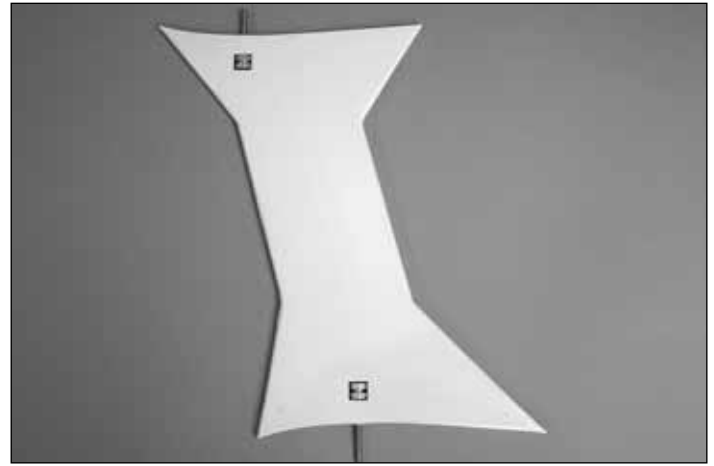
7. Insert the knurled knob into the opening on one end of the "I" strut.



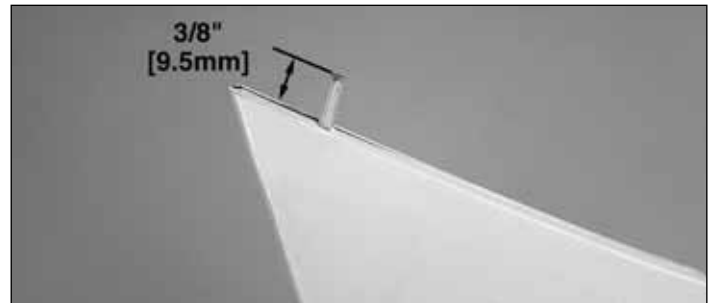
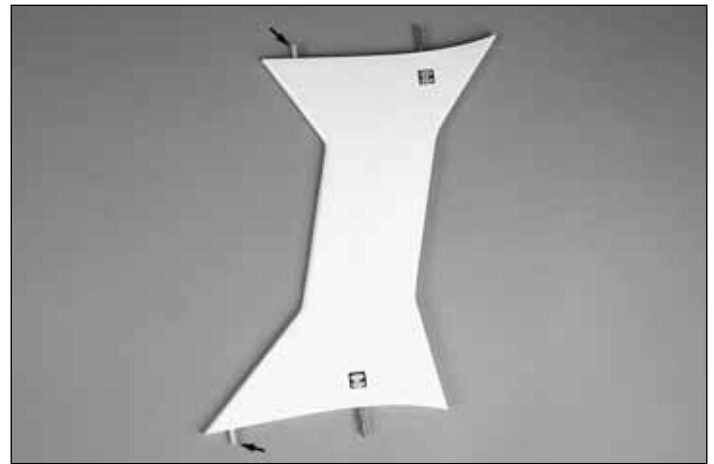
8. On each end of the "I" strut, cut the covering from the hole and insert the threaded rod into the hole in the bottom of the strut, threading the rod into the knurled knob. (The threaded rod should slip easily into the strut. If not, drill through the hole with a 5/32" [4mm] drill bit). Thread the rod into the knob until the threaded rod is flush with the face of the knob.



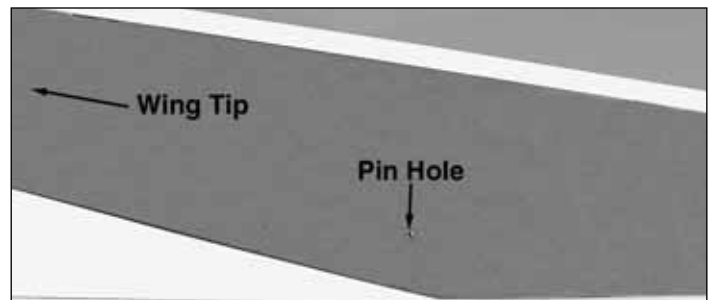
9. Carefully apply a couple of drops of thin CA to the threads of the rod and knob. This is best done with a micro tip on the bottle of CA. Only a couple of drops are required to satisfactorily bond the rod and knob together.



10. Repeat steps 6-9 for each of the knurled knobs and threaded rods, completing the assembly for each of the openings in the "I" struts.



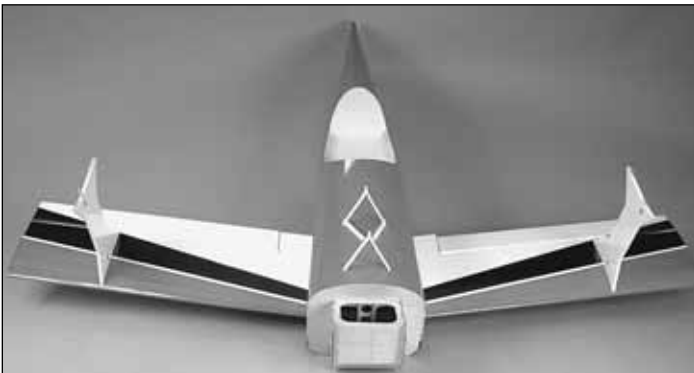
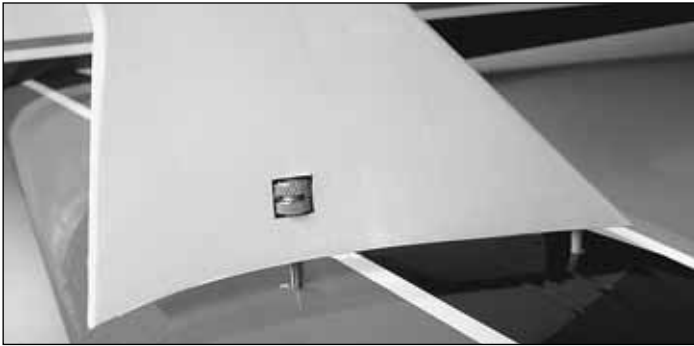
11. Glue a 1/8" x 1" [3 x 25mm] dowel into each of the holes in the bottom of the "I" Struts. Approximately 3/8" [9.5mm] of the dowel should extend from the strut.



12. On the top of the bottom wing and the bottom of the top wing you will find two pin holes located approximately 9"

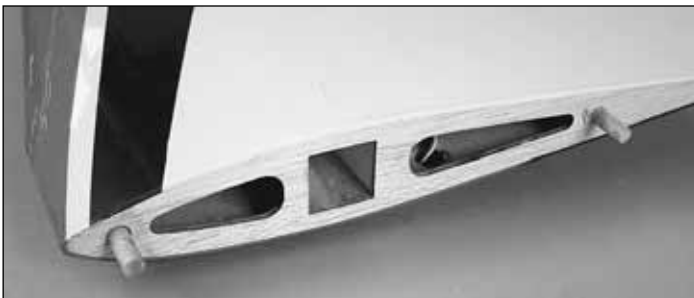
[230mm] from the wing tips. Cut the covering away from these holes.

❑ 13. Mount the bottom wing to the fuselage with two 1/4-20 x 2" [51mm] wing bolts.

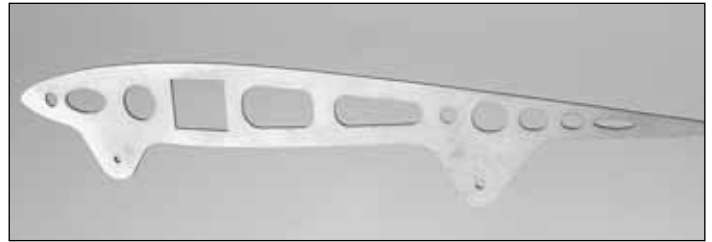


❑ 14. Using the knurled knob as a thumb screw, thread the cabane into the blind nut in the wing and align the wood dowel with the hole in the wing. Install the "I" struts onto the bottom wing.

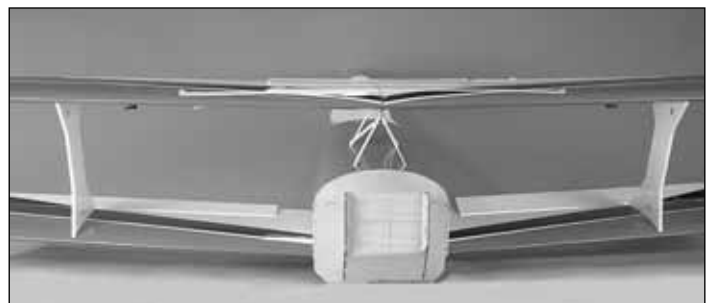
### ***Assemble the Top Wing***



❑ 1. Glue the two 3/8" x 1" [9.5 x 25mm] wood dowels into the holes located in the root rib of the right wing panel of the top wing.



❑ 2. Locate the aluminum wing rib. Test fit the components of the top wing by sliding the aluminum rib onto the dowels in the right wing panel. (Be sure that the tongue from the aluminum rib is toward the bottom of the wing). Insert the balsa and plywood wing joiner into the joiner pocket and then slide the left wing panel onto the right wing panel. Check to be sure that the root rib of the wings makes solid contact with the aluminum rib. If they do not make good contact with each other, sand a small amount off of the wing dowels. This will allow the wings to slide together completely. When you are satisfied with the fit, disassemble the wing. Glue the top wing together with 30-minute epoxy using the same method used for the bottom wing. **Move quickly to the next step before the epoxy hardens.**



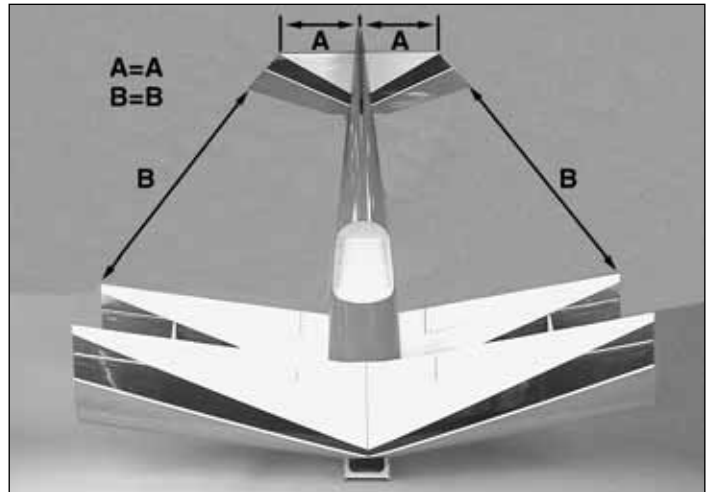
❑ 3. Mount the top wing to the "I" struts using the thumb screws. When placing the wing, be sure the small dowels align with the hole in the wing and the aluminum joiner drops between the cabane struts. Tighten the wing to the "I" struts.

## ASSEMBLE THE FUSELAGE

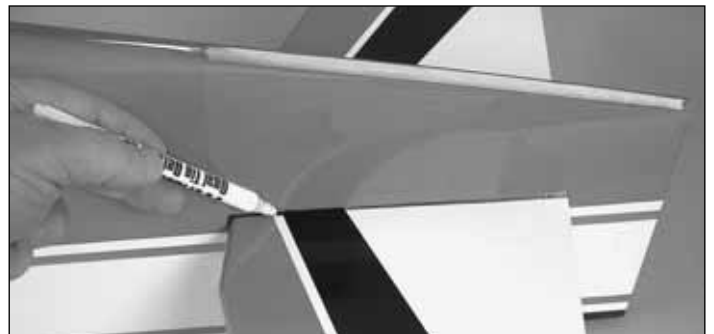
- ❑ 1. If you have removed the wings, re-install them to the fuselage. Cut the covering from the back of the fuselage to reveal the slot for the horizontal stabilizer and the vertical fin.



- ❑ 2. Slide the **horizontal stabilizer** into the slot in the fuselage. Stand back and look at the stab in relation to the wing. The stab should be parallel with the wing. If not, sand the stab saddle until the stab and wings are aligned.



- ❑ 3. Measure the distance from the tip of the stab to the tip of each wing. Adjust the position of the stab until they are equal.



- ❑ 4. Using a fine-point felt-tip pen, mark the outline of the fuselage on the top and the bottom of the stab.

- ❑ 5. Cut the covering on the top and bottom of the stab inside the line you have drawn. Use the same technique for cutting the covering as used for the wing bolt plates and the belly pan, cutting along the lines you have marked. Use care to cut **only into the covering** and **not** into the wood.



- ❑ 4. Once the wing is attached to the struts, install a 4-40 x 1/2" [13mm] socket-head cap screw into the cabane mounting holes. Set the fuselage and wing assembly aside until the glue has fully hardened.

## Mount the Belly Pan



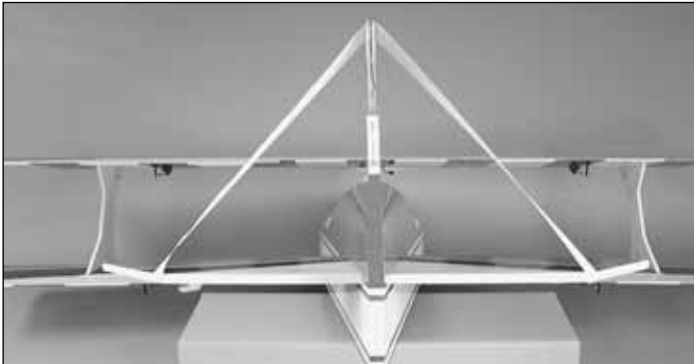
- ❑ 1. Cut the covering away from the wing bolt holes on the bottom of the **belly pan**.



- ❑ 2. Place the belly pan on the bottom wing, positioning it over the wing bolts. Trace the outline of the belly pan onto the bottom wing.

- ❑ 3. Cut the covering from the fuselage inside the lines you have drawn on the wing. Use the same technique for cutting the covering as used for the wing bolt plates. Glue the belly pan to the wing.

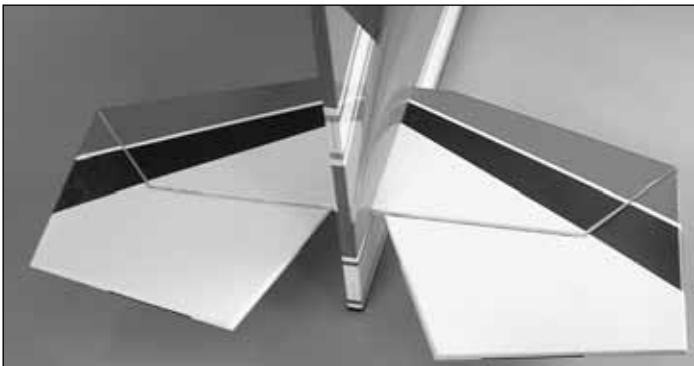
- ❑ 6. Glue the stab in place making sure that the stab is properly aligned. Allow the glue to harden before continuing with step #7.



- ❑ 7. Insert the **vertical fin** into the slot at the rear of the fuselage. Mark the outline of the fuselage to the fin. Cut the covering from the fin and glue the fin in place, making sure it is perpendicular to the stab. If needed, hold the fin in position with masking tape to assure that the fin remains perpendicular.

*You can now remove the wings and continue with the assembly of the fuselage.*

### **Install the Elevators & Rudder**

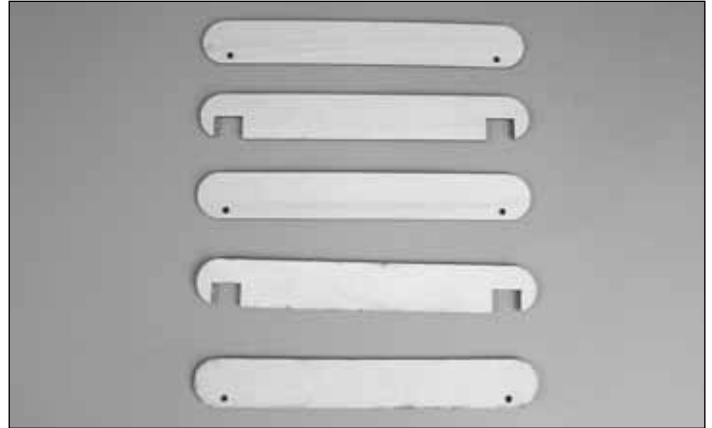


- ❑ 1. Using the same installation method used for the ailerons, install three 1" x 1" [25 x 25mm] hinges into each elevator half and then install the elevators into the stab. Glue the hinges using thin CA.

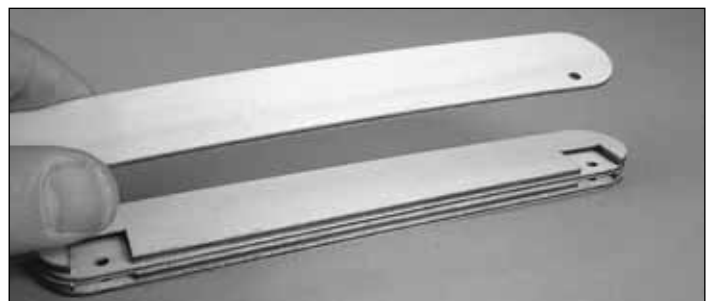
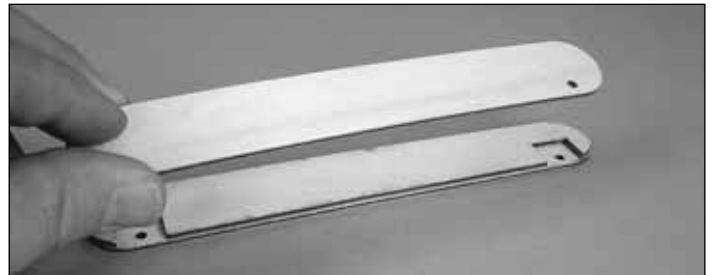
- ❑ 2. Glue four hinges to the fin and rudder with thin CA.

### **Build the Carry Handle**

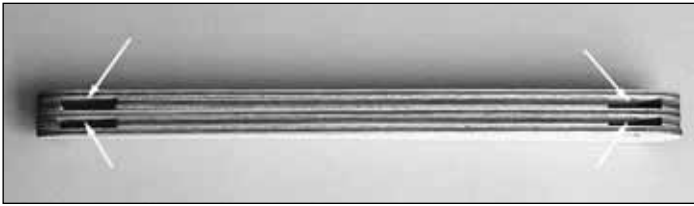
This kit comes with a convenient carrying handle for the fuselage. In addition to its use as a handle, when installed, it will allow you to turn the plane upside-down on the workbench without flexing or bending the center cabanes.



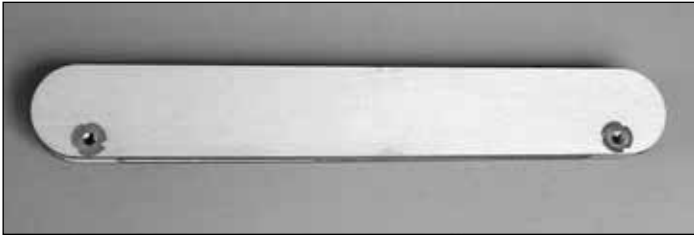
- ❑ 1. Locate all of the 1/8" [3mm] plywood parts of the **handle**.



- ❑ 2. Glue the five parts together in the sequence shown.



☐ 3. When properly assembled, four slots are formed in the handle as shown.

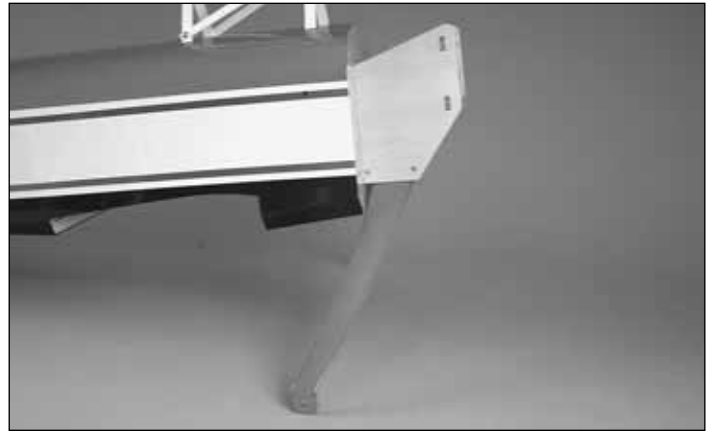
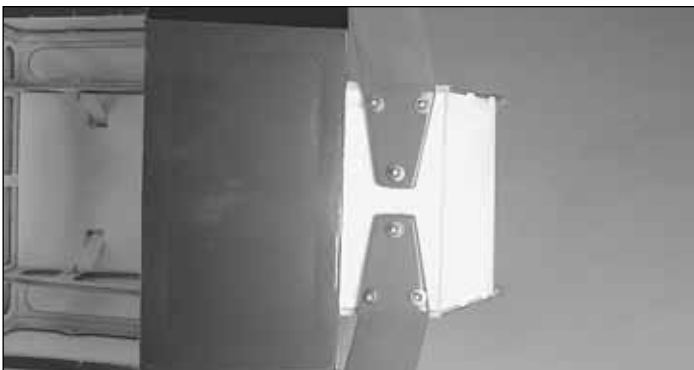


☐ 4. Install two 4-40 blind nuts into the holes on one side of the handle.

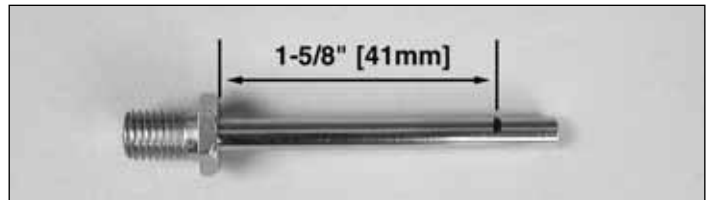


☐ 5. Position the handle onto the cabane. Fasten the handle to the cabane with two 4-40 x 3/4" [19mm] socket-head cap screws and #4 washers.

***Assemble the Landing Gear & Wheel Pants***



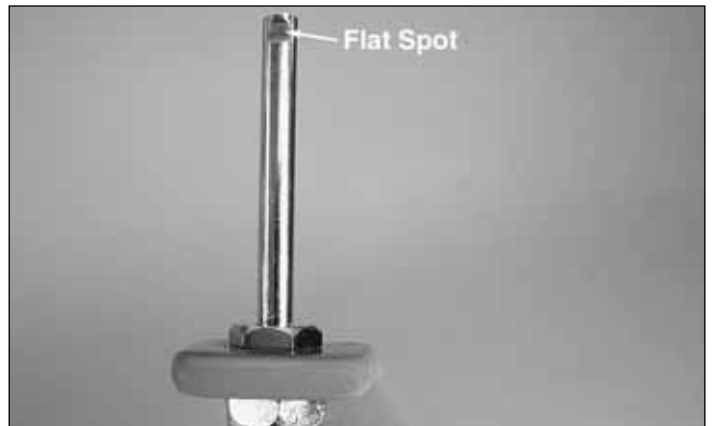
☐ 1. Bolt the **landing gear** to the fuselage with 6-32 x 1" [25mm] socket-head cap screws, #6 lock washers and #6 flat washers. When installing the landing gear, be sure the gear sweeps towards the back of the fuselage.



☐ 2. Cut the axles to a length of 1-5/8" [41mm].



☐ 3. Install the axles to the landing gear with the axle nuts.



☐ 4. File a flat spot onto the end of the axles.



5. Apply a couple of drops of threadlocker onto two 6-32 x 1/4 [6mm] socket-head cap screws. Then, thread them in the 3/32" [2.4mm] wheel collars. Slide a wheel collar onto the axle followed by a wheel and the remaining wheel collar. Tighten the wheel collars. Be sure the wheel rolls freely. Do this for both wheels.



6. Slide the wheel pant over the wheel. Apply a couple of drops of Threadlocker to the screws and then fasten the wheel pant to the landing gear with two 4-40 x 1/2" [13mm] machine screws, #4 lock washers and #4 flat washers. Repeat this for the remaining wheel.



7. Cut the covering from the hole located at the bottom rear of the fuselage.



8. Locate the nylon tail wheel bushing and glue it in place in the hole.



9. Slide the aluminum wheel collar (included in the tail wheel hardware bag) onto the tail wheel wire and secure it with the set screw. Insert the tail wheel assembly into the nylon bearing. Position the aluminum bracket to hold the tail wheel assembly to the fuselage. Drill two 1/16" [1.6mm] holes through the bracket, into the fuselage. Attach the bracket to the fuselage with two #2 washer head screws.



10. Slide the nylon retainer onto the tail wheel wire.



11. Drill a 1/8" [3mm] hole into the bottom of the rudder. Center the hole at the mid point of the bottom of the rudder.

12. Glue the nylon retainer into the hole, making sure the tail wheel wire is in the nylon retainer.

## Install the Elevator & Rudder Servos

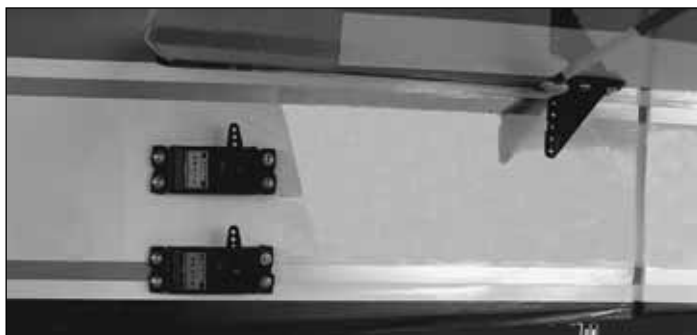
This airplane has been designed to utilize two servos for the elevator with a minimum torque of 54 oz. in. each. The rudder can utilize either one or two servos with a total torque output of at least 100 oz. in.

❑ 1. Cut the covering away from the openings in the rear of the fuselage for the elevator and rudder servos. The elevator servos are located in the upper servo openings. The rudder servos are in the lower servo openings. When cutting the covering away for the rudder, only cut out the covering for the number of servos you will be using. It does not matter into which side of the fuselage you choose to install the rudder servo.

❑ 2. Install a 24" [610mm] servo extension onto each of the servo leads. Secure the extension to the lead with tape, a piece of shrink tube or some other method to keep them from coming unplugged.

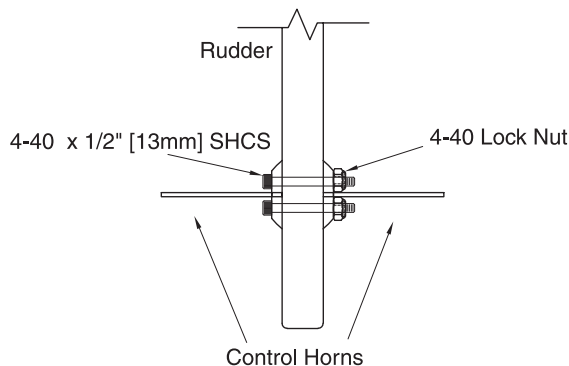
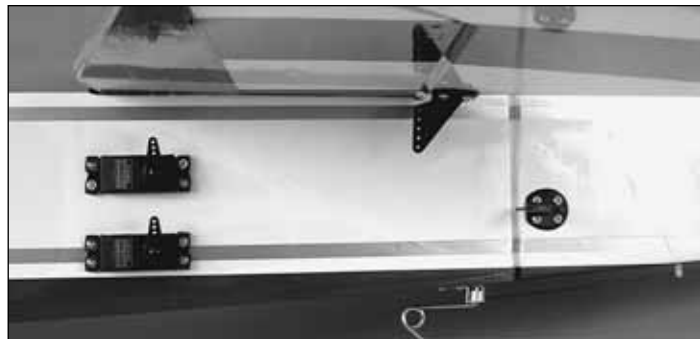


❑ 3. Install the elevator and rudder servos into the servo openings. Drill through the servo mounting holes with a 1/16" [1.6mm] drill bit. Remove the servo from the servo opening. Install and then remove a servo mounting screw into each of the holes you have drilled. Apply a drop of thin CA into the holes to harden the threads. Once the glue has hardened, install the servo into the servo opening using the hardware included with your servo. Center the servo and then install a servo arm as shown. If you want to achieve 3D throws we recommend the use of longer servo arms. The Great Planes 1-1/2" [38mm] aluminum servo arm (GPMM1105) works well for this.



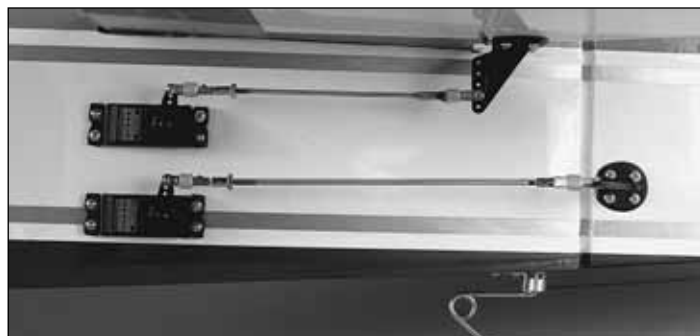
❑ 4. Place a nylon control horn in line with the outer hole in the servo arm. When positioned properly, the control horn will rest on a hardwood plate in the elevator. Mark the location of the mounting holes onto the elevator. Drill a 3/32"

[2.5mm] hole on the marks, drilling through the plywood plate *but not* through the top of the elevator. Insert and remove a #4 x 1/2" [13mm] screw into each of the holes. Apply a couple drops of thin CA into the holes to harden the threads. Once the glue has hardened, attach the control horn to the elevator with two #4 x 1/2" [13mm] screws.



❑ 5. Repeat this procedure for the rudder servo/servos. If you are installing two rudder servos, the rudder control horns will be opposite each other, making it difficult to mount them with the #4 screws. Instead mount the control horns to the rudder with four #4 x 1" [25mm] socket-head cap screws and four 4-40 lock nuts as shown in the sketch.

❑ 6. Thread a 4-40 nut onto a 4-40 x 12" [305mm] threaded rod approximately twenty turns. Slide a silicone clevis retainer onto a threaded 4-40 metal clevis. Then, thread the clevis onto the rod, tightening it against the nut. Install the clevis onto the nylon control horn. Install an unthreaded solder clevis onto the servo arm. Center the elevator and the servo. Next, mark the position the wire should be cut to fit into the solder clevis. Remove all of the pushrod components from the servo and control horn. Cut the wire and on the mark and then solder the clevis to the wire.



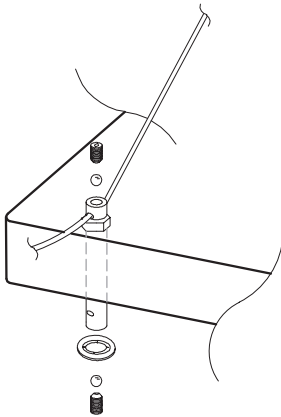
❑ 7. After the rod has cooled, install a clevis retainer onto the clevis you have just soldered. Install the pushrod onto

the elevator and servo. Follow the same procedure for the rudder pushrod.

❑ 8. Using the same method, install the pushrod linkage to the opposite elevator and the rudder (if a second rudder is to be used).

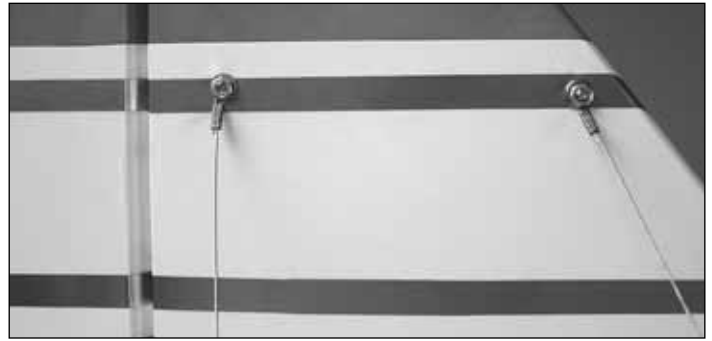
## Install the Tail Wires

*The tail wires are a functional component of this aircraft. **DO NOT** fly the plane without the wires.*



❑ 1. Examine this sketch closely. It shows the assembly of the tail wire attachment posts. The parts are bagged together and are pre-assembled. You can see that the wire threads through the holes in the post and is retained by the set screw and the small steel ball. *You will be able to assemble the wires **without** taking the components of the post apart. If you find a need to disassemble the post **be very careful** not to let any of the parts fall out where you will not be able to find them. The ball and set screw are very small! Four extra balls are included in the bag. There is no need to disassemble the post to assemble the flying wires! These are extras in case you should ever lose one in the assembly.*

**Do not** install the wires without the ball! If you simply tighten the set screw against the wire it will eventually break the wire!



❑ 2. The location of the wire attachment points are located with a pin hole in the stab and fin. Cut the covering to reveal the mounting holes. Insert a 2-56 x 5/8" [16mm] machine screw and #2 flat washer into one of the pre-assembled wires. Insert the screw, washer and wire into the forward hole in the fin. On the other side of the fin, insert another wire over the screw followed by another #2 washer and a 2-56 nut. It is a good idea to apply a drop of Threadlocker to the threads of the screw before installing the nut. Tighten the nut to the screw but **do not** overtighten it, crushing the wood. Repeat this step for the rear hole in the fin.

❑ 3. Holes for the wire attachment hardware are indicated by pin hole on the stab. Locate the hole and then run a 5/32" [4mm] drill bit through the holes. Do this for both of the holes on each half of the stab. Install a post into one of the holes located in the stab. Slide the retainer clip over the post on the bottom of the stab, pushing it snugly against the bottom of the stab.



❑ 4. Loosen the set screw. Slide the wire through the hole in the post and **under** the ball located in the post. Without removing the set screw, apply a small amount of Threadlocker onto the threads of the set screw. Do not tighten the wire yet; just lightly tighten the set screw to hold the wire in the post. Do this for all four of the posts.

❑ 5. Insert the remaining four wires into the holes in the bottom of the posts using the same procedure used on the top of the stab.

## Installation instructions for the O.S. 1.60 two-cycle engine



6. Located on the bottom of the fuselage are two plywood plates. Drill a 1/16" [1.6mm] hole in the center of each of the plates. Install a #2 x 3/8" [9.5mm] screw and a #2 washer through the end of the wire from the left and right side of the stab. Thread the screw into the plate. Repeat this for the remaining wire.

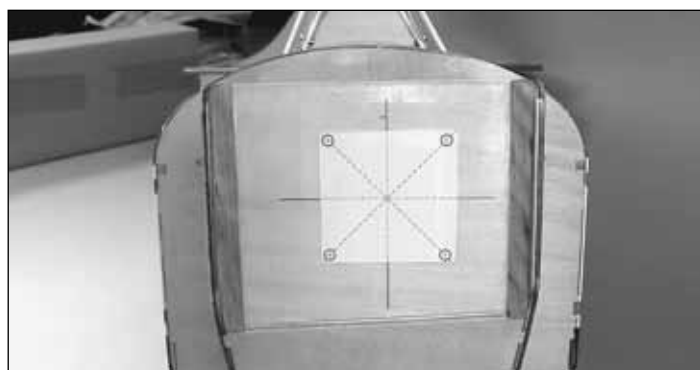


7. Proceed to loosen the set screw enough to allow the wire to be pulled through the post. Lightly tension each wire before re-tightening the set screw. The wires do not need to be overly tight; snug is adequate. When you are satisfied with the tension of the wires, cut the excess wire approximately 1/4" [6mm] from the post. This will allow enough wire to grab onto with pliers should you ever need to make further adjustments.

### Install the Engine

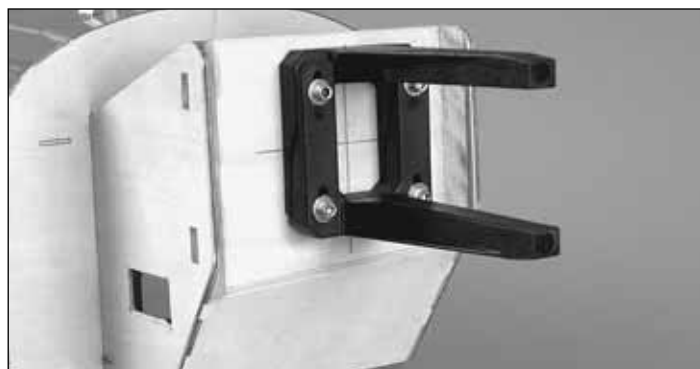
If you are installing a brand of glow engine other than the O.S.<sup>®</sup>, read through the installation instructions for the O.S. 1.60. The procedure should be similar. The most important thing is to be sure to follow the spacing dimensions from the engine drive washer back to the firewall

If you are installing the Fuji-IMVAC™ BT-43 EIS or other gasoline engine, skip ahead to the instructions for mounting that engine. If you will be using another brand of gasoline engine, read through the installation instructions for the Fuji-IMVAC. You should find the mounting instructions for the Fuji-IMVAC helpful in determining the best way to mount your particular brand of engine. Skip to page 21 for gas engine installation.

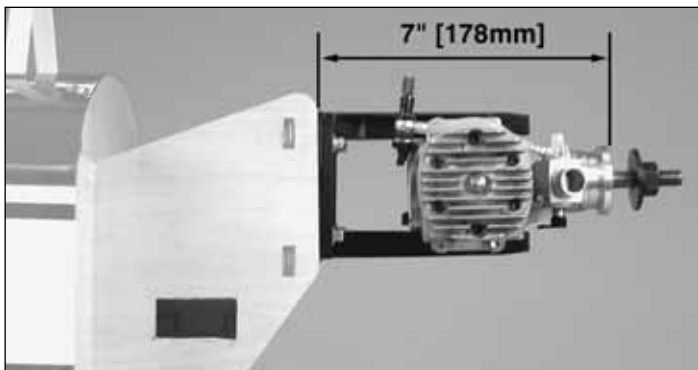


1. On page 33 of this manual you will find the engine mounting template for the O.S. 1.60 engine. Cut out the template from the manual and tape it to the firewall, aligning the lines of the template with the lines on the firewall.

2. On each of the four marks drill a 7/32" [5.6mm] hole. Install an 8-32 blind nut into each of the holes from the back of the firewall. Install a #8 flat washer onto a 8-32 x 1" [25mm] socket-head cap screw. Then, tighten the screw into the blind nut, pulling it into the firewall

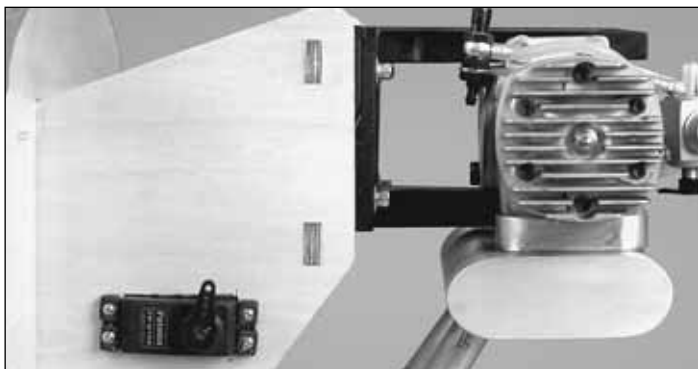


3. Cut the tabs from the **engine mount**. Install the engine mount to the firewall with four 8-32 x 1-1/4" [32mm] socket-head cap screws, #8 flat washers and #8 lock washers. When installing the mount, be sure that you have the mount positioned allowing the engine to be mounted on its side.

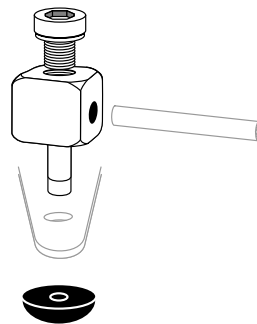


4. Position the engine on the mount so the distance from the firewall to the front of the thrust washer measures 7" [178mm]. Mark the location of the engine on the mount. The Great Planes "Dead Center"™ Hole Locator (GPMR8130) works well for this. Drill through the marks you have made with a #29 or 9/64" [3.6mm] drill bit. Tap each hole with an 8-32 tap.

5. Install the engine to the mount with four each, 8-32 x 1" [25mm] socket-head cap screws, #8 lock washers and #8 flat washers.



6. Install the muffler onto the engine. Next, install the throttle servo into the servo opening on the side of the firewall box. Drill a 1/16" [1.6mm] hole through each of the mounting holes. Remove the servo and then install and remove a servo mounting screw into each hole. Apply a couple drops of thin CA into the holes to harden the threads. When the glue has cured permanently, mount the servo.



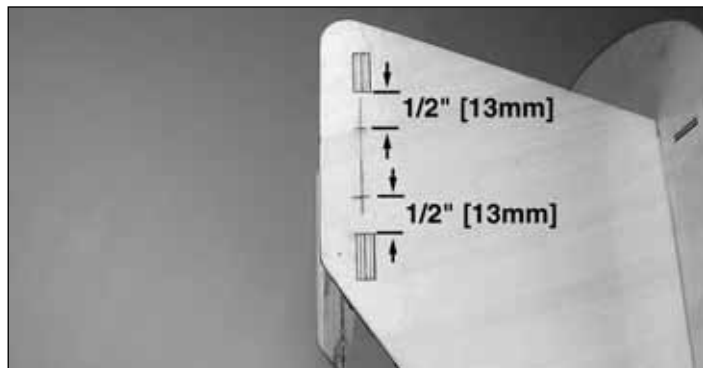
7. Install a brass screw-lock pushrod connector, nylon retainer ring and a 4-40 x 1/4" [6mm] socket-head cap screw onto the outer hole of the servo arm and the throttle servo arm. Bend a .074 x 12" [305mm] threaded rod to fit from the throttle servo arm to the throttle arm. When bending the wire be sure that you have clearance between the pushrod and any of the engine/muffler components. Metal contact may create radio interference.

**End of glow engine installation. Skip to page 23.**

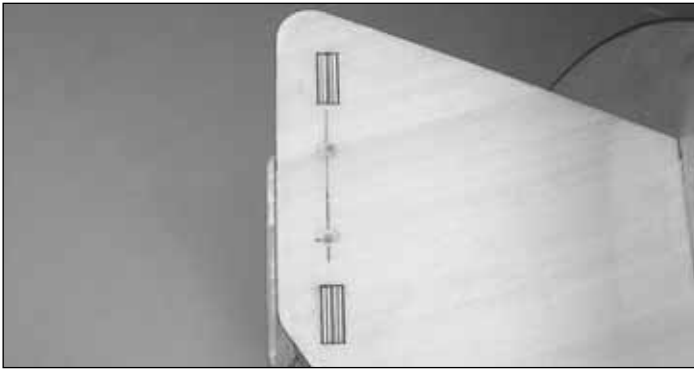
**Installation instructions for the Fuji-IMVAC BT-43 EIS (or other brands of gasoline engines)**

The following instructions are specific to the Fuji-IMVAC BT-43 EIS. Other gasoline engines may be able to use a mounting procedure very similar to the Fuji-IMVAC so take a minute to review these engine mounting instructions. Pay close attention the dimensions for spacing the engine from the firewall when mounting your particular brand of engine and be sure to use the mounting template for your particular brand of engine.

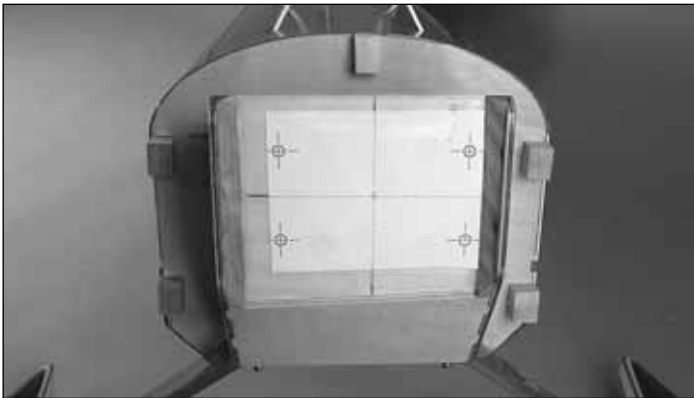
**(Please Note:** The mounting hardware and pushrods for the installation of a gasoline engine are not included in the kit. All of the bolts and pushrods are readily available at the local hobby shop).



1. Mark a line on the both sides of the engine box centering the line on the firewall tabs. Measure up from the tabs 1/2" [13mm] and make a crossing line. Drill a 1/8" [3mm] hole on the marks, drilling into the firewall approximately 1/2" [13mm].



❑ 2. Locate the 1/8" x 6" [3 x 152mm] hardwood dowel. Apply epoxy into the holes and on the dowel. Insert the hardwood dowel into the hole. Cut the dowel flush with the surface. Do this for all four holes. Apply a few drops of thin CA to fuelproof the ends of the dowels.



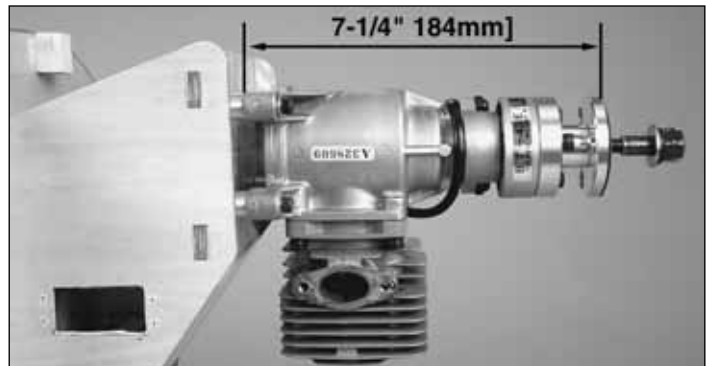
❑ 3. Cut out the Fuji-IMVAC BT-43 EIS mounting template from page 33 of this instruction manual. Tape the template, aligning the marks on the template with the lines on the firewall.



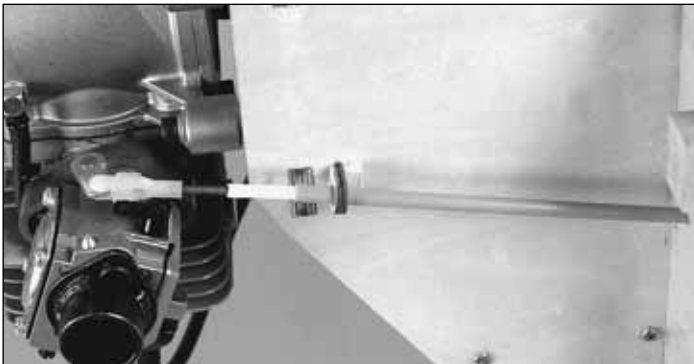
❑ 4. Drill a 1/4" [6mm] hole through each of the marks on the template. Insert a 10/24 [5mm] blind nut into the holes from the back of the firewall.



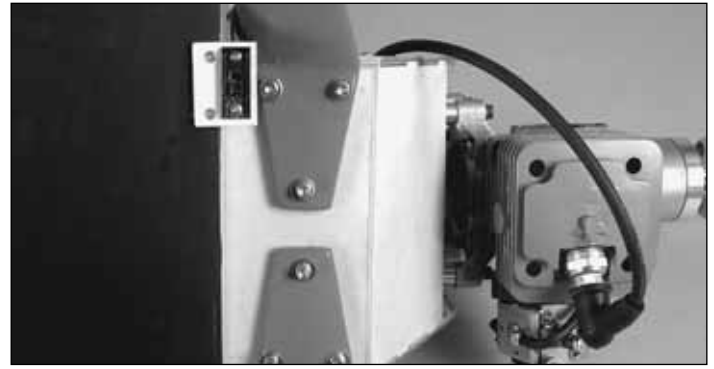
❑ 5. Included in the kit are four 1/2" [13mm] aluminum spacers. Install the engine to the firewall with four 10-24 x 1-3/4" [5 x 44mm] socket-head cap screws, #10 [5mm] flat washers and #10 [5mm] lock washers. Position the spacers between the engine and the firewall.



❑ 6. The distance from the firewall to the engine drive washer will be approximately 7-1/4" [184mm]. When installing your brand of engine, there is latitude in the exact positioning of the engine. As long as the distance from the firewall to the engine drive washer is between 6-3/4" [171mm] and 7-1/4" [184mm] the cowl alignment will be correct.



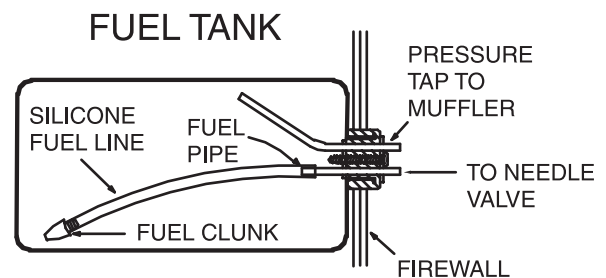
❑ 7. Install the throttle servo following the recommendation of the engine manufacturer. **IMPORTANT!!** Many gasoline engines, especially those with an electronic ignition, require the throttle servo to be located 6" [152mm] to 10" [254mm] from the engine. A generic servo tray for use on the throttle servo is included to help mount the throttle servo. This is where we located the throttle for the Fuji-IMVAC engine. You may wish to install it here or in some other location appropriate for your brand of engine. As a general rule, metal pushrods between the throttle servo and the arm on the carburetor are not acceptable due to possible transfer of electronic engine noise between the engine and the radio system. Nylon pushrods are generally a better choice. Please refer to the instructions with your particular brand of engine when choosing a throttle pushrod.



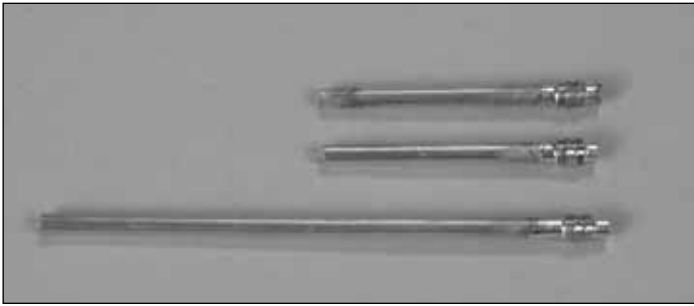
❑ 8. Install the ignition cut-off switch (refer to your engine instructions for switch recommendations) as close to the engine as possible. The bottom of the fuselage is a good location for this. You may wish to create a small plywood mounting plate to mount the switch to the fuselage.

### *Install the Fuel Tank*

The fuel tank included with this kit is suitable for use with glow fuel. However, if using a gas engine, the fuel tank must be converted to work with gasoline. This can be done by purchasing a Sullivan #484 Gasoline/Diesel fuel tank conversion kit (SULQ2684), a package of Du-Bro #813 1/8" [3.2mm] I.D. fuel line barb (DUBQ0670) and 3' of Great Planes gasoline fuel tubing (GPMQ4135). Without the fuel line barbs some types of gas-compatible fuel line may slip off the metal fuel tubes. If the Sullivan conversion kit is not available the Du-Bro #400 gas conversion stopper (DUBQ0675) and one 12" [300mm] piece of K+S 1/8" [3.2mm] soft brass tubing (K+SR5128-box of 5) could also be used to make the conversion.



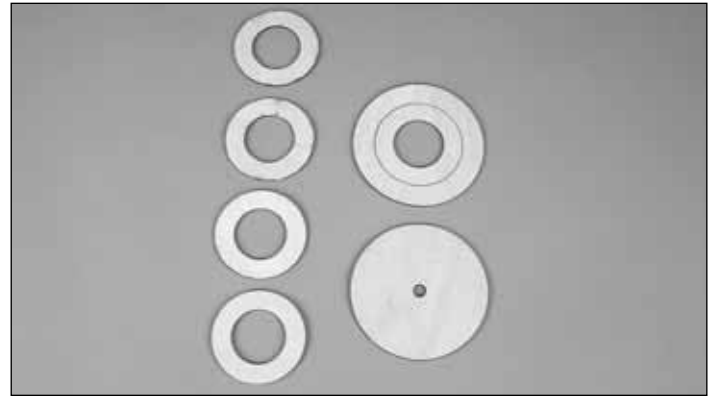
❑ 1. Assemble the **fuel tank** as shown in the sketch. When tightening the center screw be sure not to overtighten it. You just want it snug enough to pull the rubber stopper tight against the tank.



**Note:** If using fuel line barbs (as recommended for gas engines), replace the aluminum fuel tubes with 1/8" [3.2mm] brass tubing (not included). Cut the brass tubes to the correct length, and then solder the barbs onto one end of the tubes.

❑ 2. Install the tank into the fuselage with the neck of the tank through the front former. Hold the tank in place with two #64 rubber bands included in the kit.

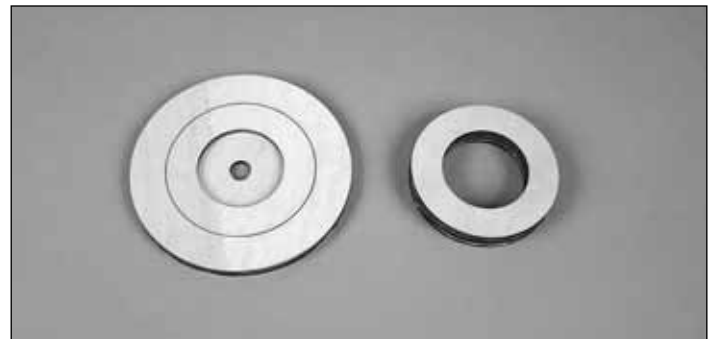
❑ 3. Install silicone fuel tubing onto the aluminum tubes from the fuel tank. *(If this is a gasoline engine installation substitute neoprene or Tygon® fuel tubing for the silicone fuel tubing. Silicone is not resistant to gasoline!)* The line with the fuel clunk will feed to the fuel inlet at the needle valve and the other will attach to the pressure tap on the muffler. If you choose to use some kind of an external fuel valve, follow the instructions with your particular brand of fuel valve. You can also install a third line to the tank and use it for filling the tank. The method you use is your choice but make your decision before moving onto mounting the cowl.



❑ 2. The following instructions are for assembling a cowl alignment tool that you will find helpful in centering the cowl onto the engine shaft. Parts are included for making this tool for use with the O.S. 1.60 and the Fuji-IMVAC BT-43 EIS engines. The tool may be used for other brands of engines if you make minor adjustments to the parts.

Included are four 1/8" [3mm] disks with an outside diameter of 2-11/16" [68mm] and a 1-1/2" [38mm] inside diameter. The inside diameter of these disks is designed to fit over the drive washer of the O. S. 1.60 two-stroke engine. Also included are four 1/8" [3mm] balsa disks with an outside diameter of 2-11/16" [68mm] and a 2" [51mm] inside diameter. The inside diameter of these disks is designed to fit over the drive washer of the Fuji-IMVAC BT-43 EIS gasoline engine. Use the appropriate disks for your engine choice when proceeding with the following instructions.

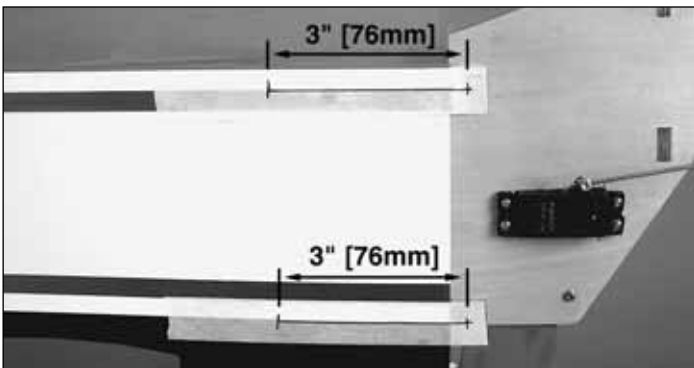
Glue the four smaller disks to each other, forming a 1/2" [13mm] thick disk. Glue the two larger disks together, placing the large disk with the embossed circle onto the large disk with the small hole.



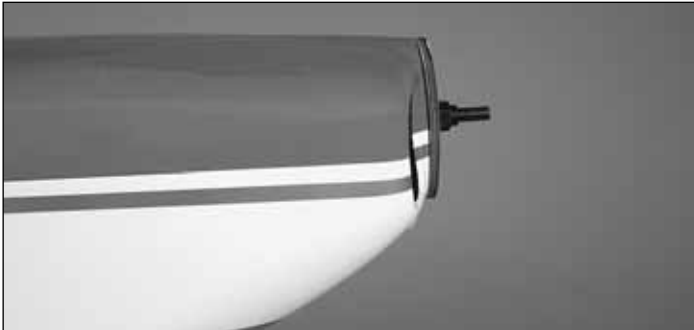
❑ 3. Glue the 1/2" [13mm] thick disk onto the large disk, centering it inside of the embossed lines. In the future this will be referred to as the **cowl tool**.

## Install the Cowl

❑ 1. Epoxy five 1/2" x 3/4" x 3/4" [13 x 19 x 19mm] hardwood cowl mounting blocks to the front fuselage former. Use two blocks on each side and one block at the top center.



❑ 2. Place masking tape onto the side of the fuselage aligned with each of the mounting blocks. Draw a line from the center of the mounting block back 3" [76mm]. Do this for all five mounting blocks.



❑ 4. Slide the cowl over the engine. Remove the muffler, needle valve, etc. if they prevent the cowl from sliding over the engine. Install the cowl tool onto the prop shaft. Tighten the prop nut and washer against the cowl tool. When properly installed, the cowl tool will rest tightly against the drive washer.



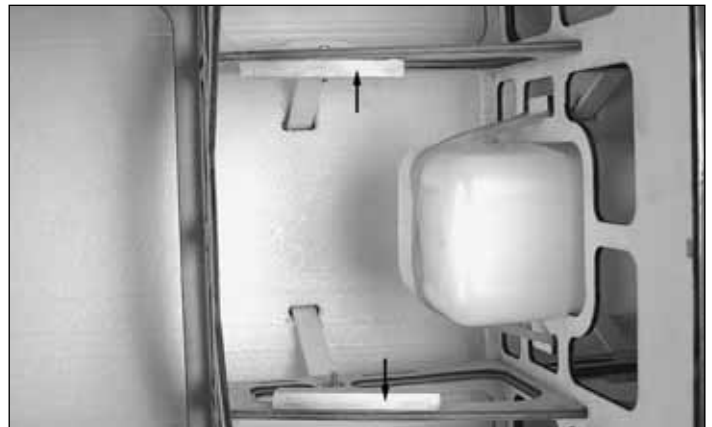
❑ 5. Press the cowl tightly against the cowl tool. Align the paint lines of the cowl with the covering on the fuselage. Starting with the top right cowl block, measure forward on the line you have drawn 3" [76mm] and mark the cowl. On the mark drill a 3/32" [2.4mm] hole through the cowl and the mounting block. Insert a #4 x 1/2" [13mm] screw into the hole. Continue this for all five mounting blocks.

❑ 6. Remove each of the screws; apply a couple of drops of thin CA into each of the holes in the cowl mounting block to harden the threads.



❑ 7. Cut the cowl as needed to allow clearance for the muffler and needle valve, access to the glow plug, etc. When you have completed this, mount the cowl with five 1/2" [13mm] screws and five #4 flat washers. As you can see here, the cowl tool has provided the proper spacing for the spinner.

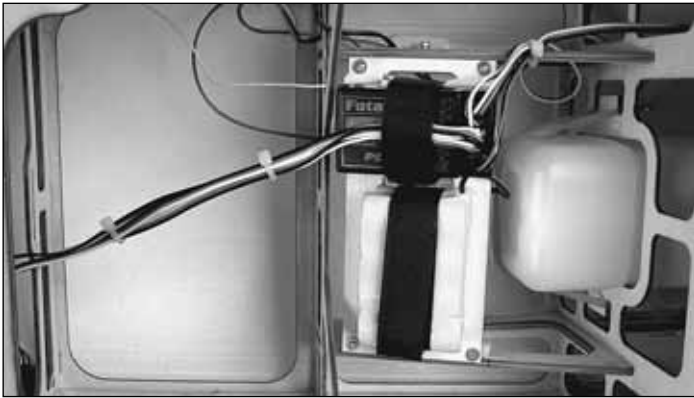
### ***Install the Receiver, Battery & Complete the Aileron Connections***



❑ 1. Glue two 1/4" x 3/8" x 2-1/2" [6 x 9.5 x 64mm] hardwood sticks onto the inside of the fuselage formers.



❑ 2. Drill a 1/16" [1.6mm] hole through the corners of the tray and into the hardwood stick. Use four #2 x 3/8" [9.5mm] screws and #2 flat washers to mount the tray to the sticks.



❑ 3. Install the battery and receiver onto the tray. Protect the battery and receiver from vibration by putting 1/4" [254mm] R/C foam rubber between them. Cut the Velcro® to length and use it to hold the receiver and battery in place. Push the receiver antenna wire into the antenna tube inside of the fuselage.

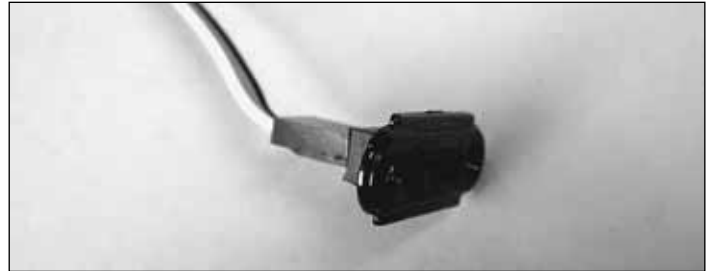
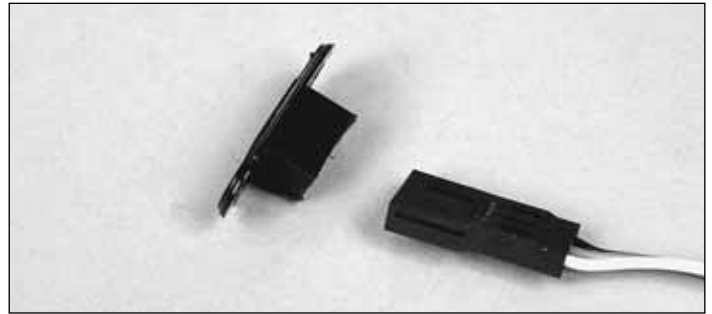
❑ 4. Install the radio switch harness and charge jack into the fuselage. A location for this is provided on both sides of the fuselage. Always locate this as far from the exhaust flow as possible.

❑ 5. Install a "Y" harness onto the aileron servos for both the top and bottom wing. Secure the extension to the lead with tape, a piece of heat-shrink tube or some other method to keep them from coming unplugged.

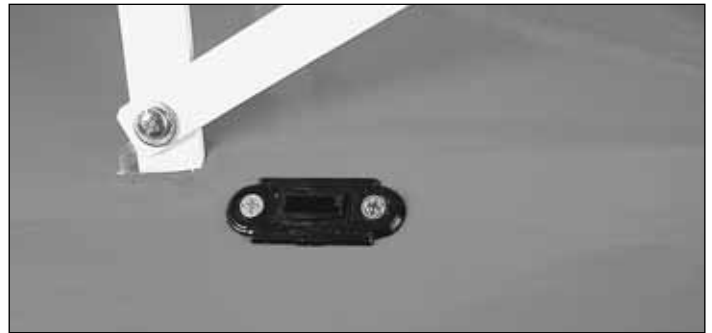
❑ 6. The bottom wing will simply plug into the receiver when mounting the bottom wing. A servo extension needs to be installed in the receiver and routed to the top wing. To provide a plug into the receiver, we have used a slightly modified Ernst Charge Receptacle (ERN3124 for Futaba) and a 12" [305mm] servo extension.



❑ 7. Cut the charge receptacle in half just above the locking fingers.



❑ 8. Put a couple of small drops of medium CA on the sides of the female end of the servo extension. Then, slide the servo extension into the charge receptacle.



❑ 9. Near one of the cabanes, cut a hole in the top of the fuselage just large enough for the servo extension and the charge receptacle to fit into. Drill a 1/16" [16mm] hole into the fuselage through each of the mounting holes in the charge receptacle. Thread and remove the screws from the charge receptacle into the holes you drilled. Apply thin CA into the holes to harden the threads. Glue the charge receptacle to the fuselage with R/C 56 canopy glue. Install the mounting screws in the charge receptacle, into the holes you have drilled.



❑ 10. An alternative to the modified charge jack is to simply run the servo extension along side of the cabane and secure it to the cabane with heat-shrink, tape, or using epoxy to glue it to the cabane.

## FINISHING TOUCHES

1. Paint the cockpits flat black. After the paint has dried, apply the instrument panel decal.
2. If you will be installing a pilot, install it into the cockpit.



3. The canopy can either be mounted to the fuselage with screws or it can be glued with Z56 canopy glue. If you choose to install the canopy with screws, look closely at the inside of the cockpit walls and you will see two plywood plates on each side of the fuselage. Position the canopy. Drill a 1/16" [1.6mm] hole through the canopy and the fuselage at the location of the plywood plates. Use four #2 x 3/8" [9.5mm] screws and #2 flat washers to mount the canopy to the fuselage.

## Apply the Decals

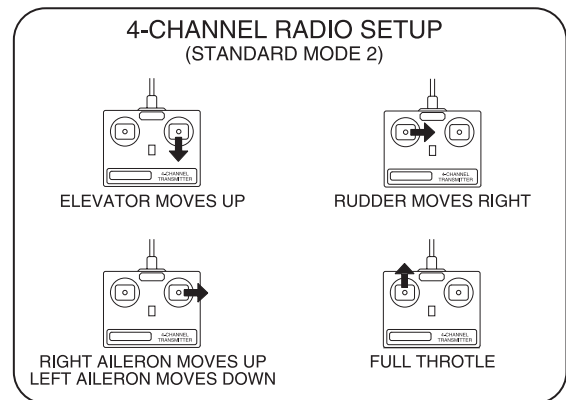
The box photographs show the location of the decals on the airplane. Refer to the box for the exact placement of the decals. The following tips may be useful for applying them.

1. Use scissors or a sharp hobby knife to cut the decals from the sheet.
2. Be certain the model is clean and free from oily fingerprints and dust. Prepare a dishpan or small bucket with a mixture of liquid dish soap and warm water—about one teaspoon of soap per gallon of water. Submerge the decal in the soap and water and peel off the paper backing. **Note:** Even though the decals have a “sticky-back” and are not the water transfer type, submersing them in soap & water allows accurate positioning and reduces air bubbles underneath.
3. Position decals on the model. Holding the decal down, use a paper towel to wipe most of the water away.
4. Use a piece of soft balsa or something similar to squeegee remaining water from under the decal. Apply the rest of the decals the same way.

## GET THE MODEL READY TO FLY

### Check the Control Directions

1. Turn on the transmitter and receiver and center the trims. If necessary, remove the servo arms from the servos and reposition them so they are centered. Reinstall the screws that hold on the servo arms.
2. With the transmitter and receiver still on, check all the control surfaces to see if they are centered. If necessary, adjust the clevises on the pushrods to center the control surfaces.



3. Make certain that the control surfaces and the carburetor respond in the correct direction as shown in the diagram. If any of the controls respond in the wrong direction, use the servo reversing in the transmitter to reverse the servos connected to those controls. Be certain the control surfaces have remained centered. Adjust if necessary.

### Set the Control Throws

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

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

**These are the recommended control surface throws:**

	<b>High Rate</b>	<b>Low Rate</b>
<b>ELEVATOR:</b>	1-1/2" [38mm] up 1-1/2" [38mm] down	7/8" [22mm] up 7/8" [22mm] down
<b>RUDDER:</b>	3" [76mm] right 3" [76mm] left	2" [51mm] right 2" [51mm] left
<b>AILERONS:</b>	1" [25mm] up 1" [25mm] down	3/4" [19mm] up 3/4" [19mm] down

**3D RATES**

<b>3D ELEVATOR:</b>	2-3/4" [70mm] up 2-3/4" [70mm] down
<b>3D RUDDER:</b>	5" [127mm] right 5" [127mm] left
<b>3D AILERONS:</b>	1-3/8" [35mm] up 1-3/8" [35mm] down

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

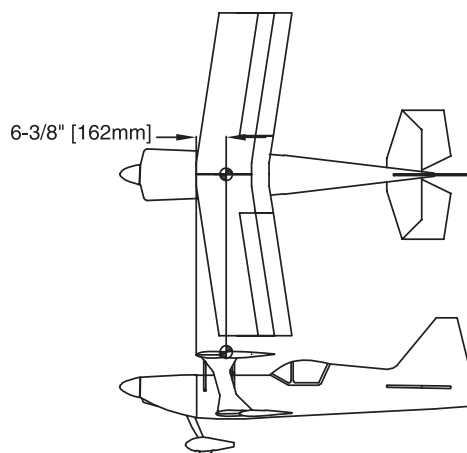
***Balance the Model (C.G.)***

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

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

❑ 1. Use a felt-tip pen or 1/8" [3mm]-wide tape to accurately mark the C.G. on the bottom of the top wing at the center of the wing. The C.G. is located 6-3/8" [162mm] back from the leading edge of the wing measured at the center of the top wing.

This is where your model should balance for the first flights. Later, you may wish to experiment by shifting the C.G. up to 3/8" [9.5mm] forward or 3/4" [19mm] back to change the flying characteristics. Moving the C.G. forward may improve the smoothness and stability, but the model may then require more speed for takeoff and make it more difficult to slow for landing. Moving the C.G. aft makes the model more maneuverable, but could also cause it to become too difficult to control. In any case, **start at the recommended balance point** and do not at any time balance the model outside the specified range.



❑ 2. With the wing attached to the fuselage, all parts of the model installed (ready to fly) and an empty fuel tank, lift it at the balance point you marked.

❑ 3. If the tail drops, the model is "tail heavy" and the battery pack and/or receiver must be shifted forward or weight must be added to the nose to balance. If the nose drops, the model is "nose heavy" and the battery pack and/or receiver must be shifted aft or weight must be added to the tail to balance. If possible, relocate the battery pack and receiver to minimize or eliminate any additional ballast required. If additional weight is required, nose weight may be easily added by using a "spinner weight" (GPMQ4645 for the 1 oz. [28g] weight, or GPMQ4646 for the 2 oz. [57g] weight). If spinner weight is not practical or is not enough, use Great Planes (GPMQ4485) "stick-on" lead. A good place to add stick-on nose weight is to the firewall (don't attach weight to the cowl—it is not intended to support weight). Begin by placing incrementally increasing amounts of weight on the fuse over the firewall until the model balances. Once you have determined the amount of weight required, it can be permanently attached. If required, tail weight may be added by cutting open the bottom of the fuse and gluing it permanently inside.

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

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

## ***Balance the Model Laterally***

- ❑ 1. With the wing level, have an assistant help you lift the model by the engine propeller shaft and the bottom of the fuse under the TE of the fin. Do this several times.
- ❑ 2. If one wing always drops when you lift the model, it means that side is heavy. Balance the airplane by adding weight to the other wing tip. **An airplane that has been laterally balanced will track better in loops and other maneuvers.**

## ***PREFLIGHT***

### ***Identify Your Model***

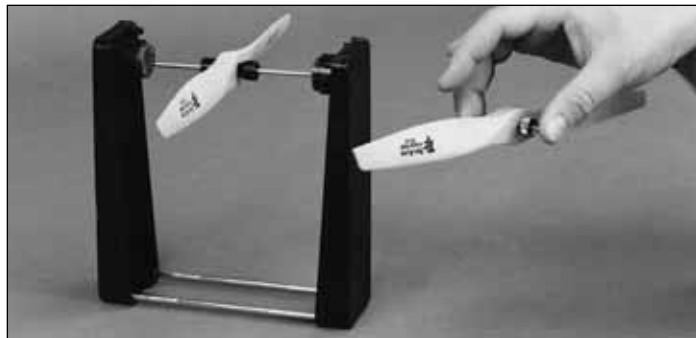
No matter if you fly at an AMA sanctioned R/C club site or if you fly somewhere on your own, you should always have your name, address, telephone number and AMA number on or inside your model. It is **required** at all AMA R/C club flying sites and AMA sanctioned flying events. Fill out the identification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

### ***Charge the Batteries***

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

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

## ***Balance the Propellers***



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

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

### ***Ground Check***

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

### ***Range Check***

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

## ENGINE SAFETY PRECAUTIONS

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

Keep all engine fuel in a safe place, away from high heat, sparks or flames, as fuel is very flammable. Do not smoke near the engine or fuel; and remember that engine exhaust gives off a great deal of deadly carbon monoxide. Therefore, **do not run the engine in a closed room or garage.**

Get help from an experienced pilot when learning to operate engines.

Use safety glasses when starting or running engines.

Do not run the engine in an area of loose gravel or sand; the propeller may throw such material in your face or eyes.

Keep your face and body as well as all spectators away from the plane of rotation of the propeller as you start and run the engine.

Keep these items away from the prop: loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects such as pencils or screwdrivers that may fall out of shirt or jacket pockets into the prop.

Use a "chicken stick" or electric starter to start the engine. Do not use your fingers to flip the propeller. Make certain the glow plug clip or connector is secure so that it will not pop off or otherwise get into the running propeller.

Make all engine adjustments from behind the rotating propeller.

The engine gets hot! Do not touch it during or right after operation. Make sure fuel lines are in good condition so fuel will not leak onto a hot engine, causing a fire.

To stop a glow engine, cut off the fuel supply by closing off the fuel line or following the engine manufacturer's recommendations. Do not use hands, fingers or any other body part to try to stop the engine. To stop a gasoline powered engine an on/off switch should be connected to the engine coil. Do not throw anything into the propeller of a running engine.

## AMA SAFETY CODE (excerpts)

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

## General

1) I will not fly my model aircraft in sanctioned events, air shows, or model flying demonstrations until it has been proven to be airworthy by having been previously, successfully flight tested.

2) I will not fly my model aircraft higher than approximately 400 feet within 3 miles of an airport without notifying the airport operator. I will give right-of-way and avoid flying in the proximity of full-scale aircraft. Where necessary, an observer shall be utilized to supervise flying to avoid having models fly in the proximity of full-scale aircraft.

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

5) I will not fly my model unless it is identified with my name and address or AMA number, on or in the model. **Note:** This does not apply to models while being flown indoors.

7) I will not operate models with pyrotechnics (any device that explodes, burns, or propels a projectile of any kind).

## Radio Control

1) I will have completed a successful radio equipment ground check before the first flight of a new or repaired model.

2) I will not fly my model aircraft in the presence of spectators until I become a qualified flier, unless assisted by an experienced helper.

3) At all flying sites a straight or curved line(s) must be established in front of which all flying takes place with the other side for spectators. Only personnel involved with flying the aircraft are allowed at or in the front of the flight line. Intentional flying behind the flight line is prohibited.

4) I will operate my model using only radio control frequencies currently allowed by the Federal Communications Commission.

**5) I will not knowingly operate my model within three miles of any pre-existing flying site except in accordance with the frequency sharing agreement listed [in the complete AMA Safety Code].**

9) Under no circumstances may a pilot or other person touch a powered model in flight; **nor should any part of the model other than the landing gear, intentionally touch the ground, except while landing.**

## CHECK LIST

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

- 1. Fuelproof all areas exposed to fuel or exhaust residue such as the cowl mounting blocks, wing saddle area, etc.
- 2. Check the C.G. according to the measurements provided in the manual.
- 3. Be certain the battery and receiver are securely mounted in the fuse. Simply stuffing them into place with foam rubber is not sufficient.
- 4. Extend your receiver antenna and make sure it has a strain relief inside the fuselage to keep tension off the solder joint inside the receiver.
- 5. Balance your model *laterally* as explained in the instructions.
- 6. Use thread-locking compound to secure critical fasteners such as the set screws that hold the wheel axles to the struts, screws that hold the carburetor arm (if applicable), screw-lock pushrod connectors, etc.
- 7. Add a drop of oil to the axles so the wheels will turn freely.
- 8. Make sure all hinges are **securely** glued in place.
- 9. Reinforce holes for wood screws with thin CA where appropriate (servo mounting screws, cowl mounting screws, etc.).
- 10. Confirm that all controls operate in the correct direction and the throws are set up according to the manual.
- 11. Make sure there are silicone retainers on all the clevises and that all servo arms are secured to the servos with the screws included with your radio.
- 12. Secure connections between servo wires and Y-connectors or servo extensions, and the connection between your battery pack and the on/off switch with vinyl tape, heat-shrink tubing or special clips suitable for that purpose.
- 13. Make sure any servo extension cords you may have used do not interfere with other systems (servo arms, pushrods, etc.).
- 14. Secure the pressure tap (if used) to the muffler with high temp RTV silicone, thread-locking compound or J.B. Weld.
- 15. Make sure the fuel lines are connected and are not kinked.
- 16. Balance your propeller (and spare propellers).
- 17. Tighten the propeller nut and spinner.
- 18. Place your name, address, AMA number and telephone number on or inside your model.

- 19. Cycle your receiver battery pack (if necessary) and make sure it is fully charged.
- 20. If you wish to photograph your model, do so before your first flight.
- 21. Range check your radio when you get to the flying field.

## FLYING

**IMPORTANT!!!** Flying a model with too few rubber bands can be dangerous. If the wing momentarily lifts from the fuselage and acts as though a large amount of "up" elevator has suddenly been applied because there are not enough rubber bands or they are too weak, internal structural damage may result. Even worse, the wing could actually detach from the fuselage, resulting in a crash. If the model exhibits any tendencies that indicate there are not enough rubber bands, immediately reduce power, land, and closely inspect the model for damage. If no damage is found, add more rubber bands.

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

## Fuel Mixture Adjustments

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

**CAUTION (THIS APPLIES TO ALL R/C AIRPLANES):** If, while flying, you notice an alarming or unusual sound such as a low-pitched "buzz," this may indicate control surface *flutter*. Flutter occurs when a control surface (such as an aileron or elevator) or a flying surface (such as a wing or stab) rapidly vibrates up and down (thus causing the noise). In extreme cases, if not detected immediately, flutter can actually cause the control surface to detach or the flying surface to fail, thus causing loss of control followed by an impending crash. The best thing to do when flutter is detected is to slow the model **immediately** by reducing power, then land as soon as safely possible. Identify which surface fluttered (so the problem may be resolved) by checking all the servo grommets for deterioration or signs of vibration. Make certain all pushrod linkages are secure and free of play. If it fluttered once, under similar circumstances it will probably flutter again unless the problem is fixed. Some things which can cause flutter are; Excessive hinge gap; Not mounting control horns solidly; Poor fit of clevis pin in horn; Side-play of wire pushrods caused by large bends; Excessive free play in servo gears; Insecure servo mounting; and one of the most prevalent causes of flutter; Flying an over-powered model at excessive speeds.

## Takeoff

Before you get ready to takeoff, see how the model handles on the ground by doing a few practice runs at **low speeds** on the runway. Hold “up” elevator to keep the tail wheel on the ground. If necessary, adjust the tail wheel so the model will roll straight down the runway. If you need to calm your nerves before the maiden flight, shut the engine down and bring the model back into the pits. Top off the fuel and then check all fasteners and control linkages for peace of mind.

Remember to takeoff into the wind. When you're ready, point the model straight down the runway, hold a bit of up elevator to keep the tail on the ground to maintain tail wheel steering, and then gradually advance the throttle. As the model gains speed decrease up elevator, allowing the tail to come off the ground. One of the most important things to remember with a taildragger is to always be ready to apply **right** rudder to counteract engine torque. Gain as much speed as your runway and flying site will practically allow before gently applying up elevator, lifting the model into the air. At this moment it is likely that you will need to apply more right rudder to counteract engine torque. Be smooth on the elevator stick, allowing the model to establish a **gentle** climb to a safe altitude before turning into the traffic pattern.

## Flight

For reassurance and to keep an eye on other traffic, it is a good idea to have an assistant on the flight line with you. Tell him to remind you to throttle back once the plane gets to a comfortable altitude. While full throttle is usually desirable for takeoff, most models fly more smoothly at reduced speeds.

Take it easy with the “Ultimate” ARF for the first flight, gradually getting acquainted with it as you gain confidence. Adjust the trims to maintain straight and level flight. After flying around for a while, and while still at a safe altitude with plenty of fuel, practice slow flight and execute practice landing approaches by reducing the throttle to see how the model handles at slower speeds. Add power to see how she climbs as well. Continue to fly around, executing various maneuvers and making mental notes (or having your assistant write them down) of what trim or C.G. changes may be required to fine tune the model so it flies the way you like. Mind your fuel level, but use this first flight to become familiar with your model before landing. With the plane properly trimmed you will want to get started with some aerobatics. This plane is capable of just about every aerobatic maneuver you can do. Become familiar with the high and low rate settings before using the 3D rates. If you have not flown an airplane with 3D rates you should work your way into these higher 3D rates cautiously. The extreme throws can stall the airplane if you are not careful. Over controlling could also result in unwanted snaps. If you have not flown 3D you might want to consider getting help from an experienced 3D pilot. When executing down line maneuvers

it is important to use good throttle management. Full power down lines could result in over stressing of the aircraft.

## Landing

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

One final note about flying your model. Have a goal or flight plan in mind for **every** flight. This can be learning a new maneuver(s), improving a maneuver(s) you already know, or learning how the model behaves in certain conditions (such as on high or low rates). This is not necessarily to improve your skills (*though it is never a bad idea!*), but more importantly so you do not surprise yourself by impulsively attempting a maneuver and suddenly finding that you've run out of time, altitude or airspeed. Every maneuver should be deliberate, not impulsive. For example, if you're going to do a loop, check your altitude, mind the wind direction (anticipating rudder corrections that will be required to maintain heading), remember to throttle back at the top, and make certain you are on the desired rates (high/low rates). A flight plan greatly reduces the chances of crashing your model just because of poor planning and impulsive moves. **Remember to think.**

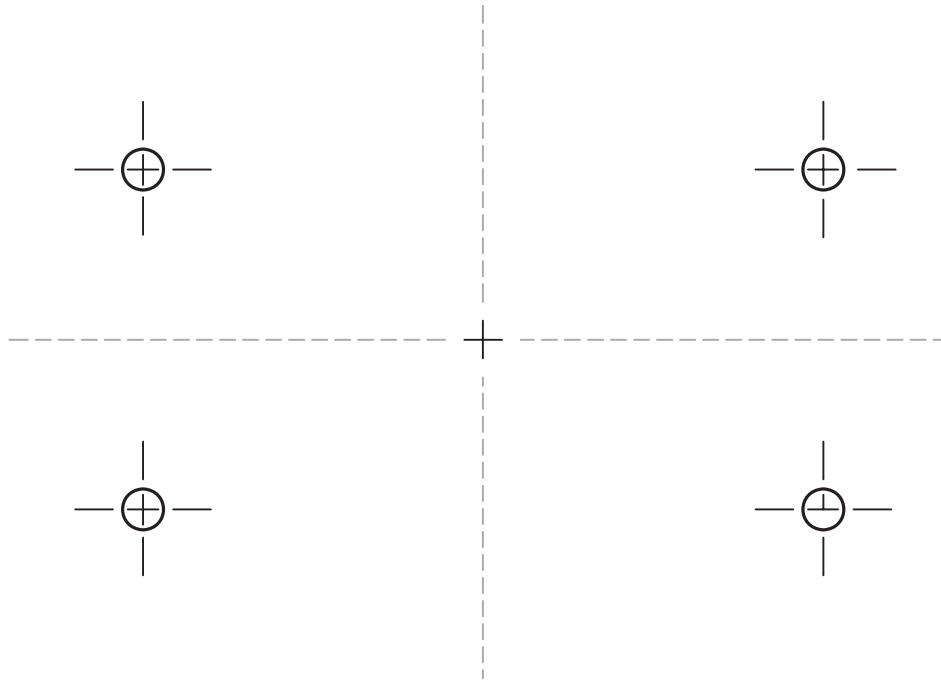
***Have a ball! But always stay in control and fly in a safe manner.***

**GOOD LUCK AND GREAT FLYING!**

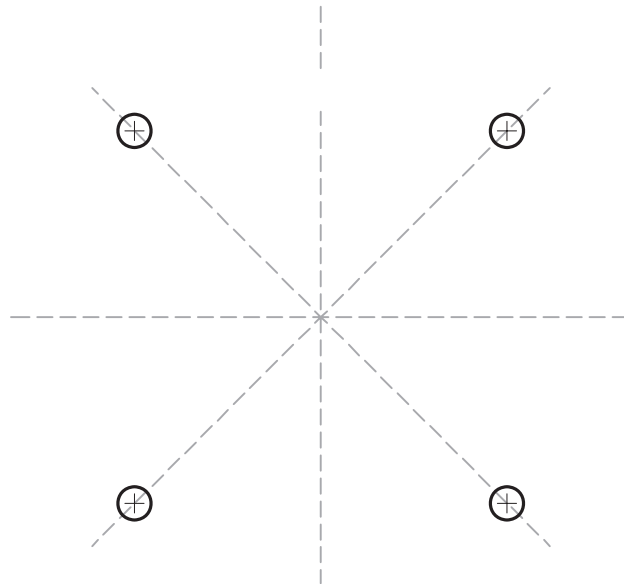
This model belongs to:

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AMA number

***Fuji-IMVAC BT-43 EIS Engine Mounting Template***



***O.S. 1.60 Engine Mounting Template***





## OTHER ITEMS AVAILABLE FROM GREAT PLANES



### Great Planes 1/3-Scale Matt Chapman Cap 580 ARF

Though almost 100" in wingspan, this IMAA-/IMAC-legal version of Matt Chapman's aerobat can be ready for its first flight in as little as 15 hours. It arrives with the all-wood airframe already assembled and expertly covered in Top Flite® MonoKote®, complete with a generous hardware package. A painted fiberglass cowl and wheel pants are included, too, for no-finish/no-shaping ease. And its ability to perform 3D stunts is nothing short of amazing. There are two positions for the aluminum wing joiner tube, so CG can be fine-tuned by a change in wing location. Dual rudder servos and two servos per aileron provide the swift, strong response that precision flying demands. **GPMA1285**



### Great Planes 1/4-Scale Extra 300S ARF

World Champion aerobatic pilot Patty Wagstaff dazzles crowds with her airshow performances...now you can do the same at your local airfield with this 1/4-scale ARF version of her famous aircraft! It features IMAA-/IMAC-legal size, scale looks, stunning maneuverability and fast, 15-hour assembly. The all-wood main structures are covered in MonoKote, with durable aluminum tube mounts to attach the wings and stabilizers. All flying surfaces are fully airfoiled for optimum smoothness. Lightweight fiberglass forms the cowl and wheels pants. **GPMA1305**



### Great Planes 1/3-Scale Christen Eagle II ARF

True to the homebuilt original, the Christen Eagle II pushes the design envelope – making it Great Planes' most realistic biplane ever. In just 25-30 hours this bird is flight-ready, with scale details such as fairings, struts and cowl made of painted fiberglass, authentic flying wire locations and the distinctive "Eagle" trim scheme. Hand-selected woods, MonoKote covering and genuine Great Planes hardware complete the quality picture. The cowl ring glued inside strengthens the cowl and ensures perfect spinner alignment. Short, direct linkages and independent servos for each control surface give this giant-scale ARF the agility of a mid-size aerobat – and it performs equally well with a gasoline or glow engine. **GPMA1217**



### O.S. Engines 1.60 FX Ringed Engine

The 1.60 FX features dual ball bearings for durability and smooth operation, plus a low crankcase profile that allows for a proportionally taller, semi-squared head – a design refinement that increases cooling fin area and improves heat dispersion. The threaded portion of the crankshaft is extra-long for more secure prop and spinner nut engagement, and the needle valve is remotely mounted for safety during adjustments. The high-speed needle can also be mounted horizontally, vertically, or separate from the engine for more installation options! Includes glow plug and 2-year warranty. **OSMG0660**

