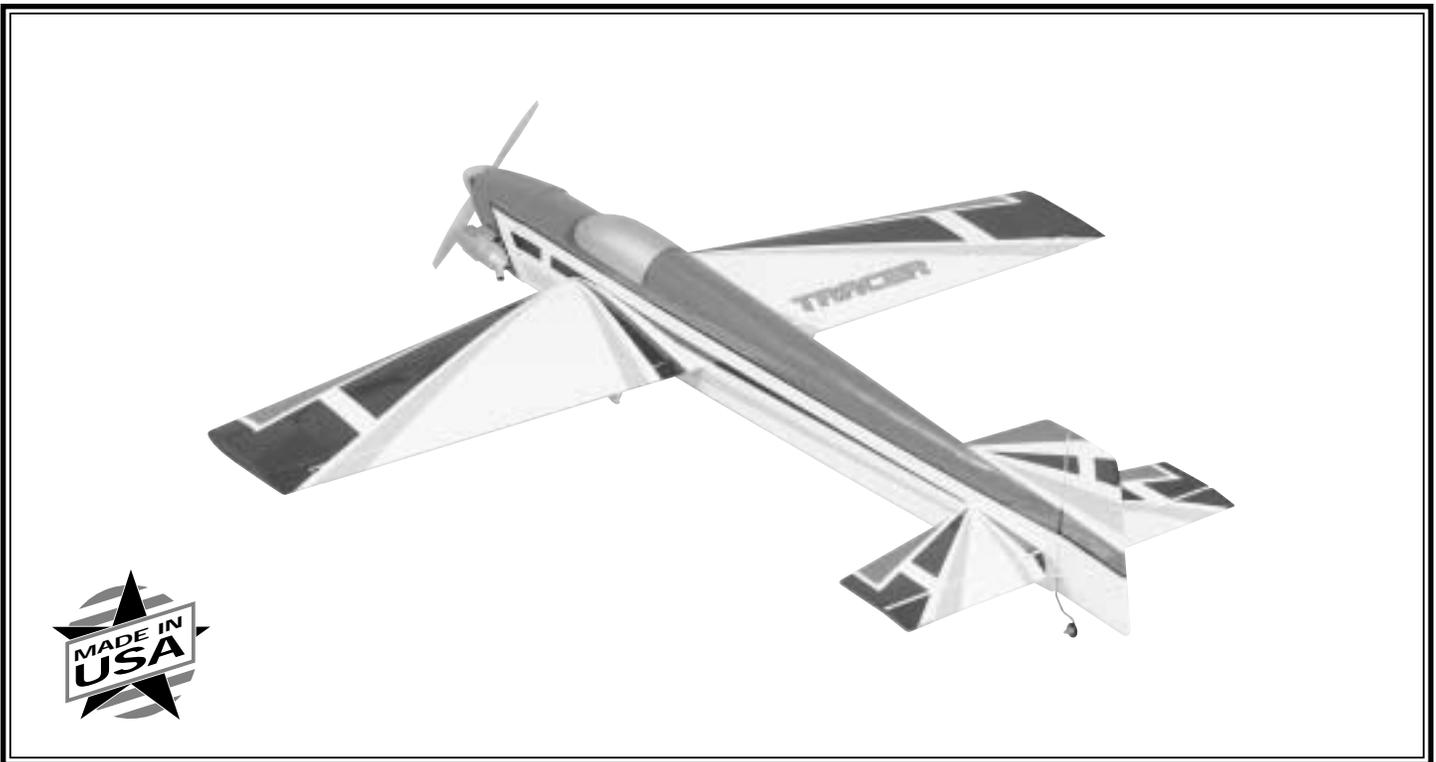


# TRACER

## INSTRUCTION MANUAL



### WARRANTY

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

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

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

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



P.O. Box 788 Urbana, IL 61803 (217) 398-8970  
[WWW.GREATPLANES.COM](http://WWW.GREATPLANES.COM)

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## SAFETY PRECAUTIONS: PROTECT YOUR MODEL, YOURSELF AND OTHERS

Your Tracer is not a toy, but rather a sophisticated, working model that functions very much like an actual airplane.

Because of its realistic performance, the Tracer, if not assembled and operated correctly, could possibly cause injury to yourself or spectators and damage property.

If this is your first low wing sport model, we recommend that you get help from an experienced, knowledgeable modeler with your first flights. You'll learn faster and avoid risking your model before you're truly ready to solo. Your local hobby shop has information about flying clubs in your area whose membership includes qualified instructors.

You may also contact the national Academy of Model Aeronautics (AMA), which has more than 2,500 chartered clubs across the country. Contact the AMA at the address or toll-free phone number below.



### Academy of Model Aeronautics

5151 East Memorial Drive  
Muncie, IN 47302-9252  
Telephone. (800) 435-9262  
Fax (765) 741-0057

Or via the internet at: <http://www.modelaircraft.org>

## PRECAUTIONS

1. Build the plane according to the plans and instructions. Do not alter or modify the model, as doing so may result in an unsafe or unflyable model. In a few cases the plans and instructions may differ slightly from the photos. In those instances the written instructions are correct.
2. Take the time to build straight, true and strong.
3. 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.
4. Properly install all components so that the model operates properly on the ground and in the air.
5. Check the operation of the model before every flight to ensure that all equipment is operating and that the model has remained structurally sound. Be sure to check nylon clevises or other connectors often and replace them if they show signs of wear or fatigue.
6. If you are not already an experienced R/C pilot, you must fly the model only with the help of a competent, well experienced R/C pilot.

NOTE: We, as the kit manufacturer, provide you with a top quality kit and great 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.**

**Please inspect all parts carefully before starting to build! If any parts are missing, broken or defective, or if you have any questions about building or flying this model, please call us at (217) 398-8970 or e-mail us at [productsupport@greatplanes.com](mailto:productsupport@greatplanes.com) and we'll be glad to help. If you are calling for replacement parts, please look up the part numbers and the kit identification number (stamped on the end of the carton) and have them ready when calling.**

For the most up to the minute "Tech Notes" check our Web site at [www.greatplanes.com](http://www.greatplanes.com).

## INTRODUCTION

Congratulations and thank you for purchasing the Great Planes Tracer. The Tracer is intended to be an easy-to-build, easy-to-fly, competition-ready first pattern plane. This aircraft builds just like any conventional sport plane you've ever built, handles like a 2-meter pattern aircraft, yet slows down and lands as easily as your first low wing.

Framing the model is very straightforward, as most of the structure features interlocking balsa and lite-ply. These fully detailed instructions include complete instructions for retract installation or fixed gear.

Flying the Tracer is a thrilling and pleasurable experience—as it should be for an aerobatic model designed specifically for pattern style flying! It doesn't take much elevator or aileron throw to put the Tracer through its paces. When you have a feel for your Tracer, the throws can be increased to high rates (see page 39) to complete the aerobatic potential. The Tracer performs surprisingly well on an inexpensive .40 and even better on a ball bearing .46 2-stroke, but seasoned experts will want to get the most out of the Tracer by strapping on a .70 4-stroke.

We hope you enjoy building and flying your Great Planes Tracer as much as we did the prototypes. Even if you never plan to compete, many modelers find the contest sequences and trimming information included on pages 42–44 beneficial for sharpening their flying skills and providing new challenges.

## DECISIONS YOU MUST MAKE

### Engine Selection

There are several engines that will work well in the Tracer, but for unlimited performance we recommend a hot 2-stroke such as an **O.S.® .46FX** or **SuperTigre® G-45**. If you prefer a 4-stroke, an **O.S. .52 Surpass™** works well and the **O.S. .70 Surpass** makes unlimited vertical lines a part of every flight experience.

### Landing Gear Configuration

This plane's design provides you the option for retractable landing gear, including complete, detailed instructions for mechanical retracts. Even if you've never worked with retracts before, if you purchase the items recommended below and follow our step-by-step instructions, you should have little difficulty.

Retractable Landing Gear (HCAP4010)  
Retract Servo (Futaba® S136G, FUTM0670)  
(2) Adjustable Axle 5/32" (GPMQ4281)  
(2) Pushrod with Clevis (GPMQ3772)  
(2) Screw-Lock Pushrod Connector (GPMQ3870)  
(8) #4 x 1/2" Sheet Metal Screw (GPMQ3154)  
1/32" x 2" x 20" Ply (For making the wheel wells)

## PREPARATIONS

### Accessories Required to Complete Your Tracer

Items in parentheses (OSMG2691) are suggested part numbers recognized by distributors and hobby shops and are listed for your ordering convenience. **GPMQ** is the Great Planes brand, **TOP** is the Top Flite® brand and **HCA** is the Hobbico® brand.

- 4-Channel Radio with Five Servos (twin aileron servos required)
- One Y-Harness (HCAM2500 for Futaba) **or** Two 12" Servo Extensions (HCAM2100 for Futaba) and Computerized Radio  
*Optional radio equipment:*
- 5-Channel Radio and Retract Servo Required for Optional Retract Installation
- Engine – See **Engine Selection** (above)
- Spare Glow Plugs (O.S. #8 for most 2-stroke engines, OSMG2691, Type-F for most 4-stroke engines, OSMG2629)

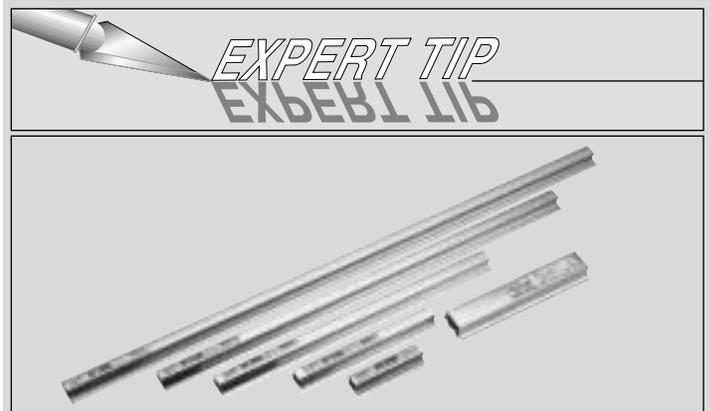
- Propeller (Top Flite Power Point®); Refer to your engine's instructions for proper size
- Top Flite Super MonoKote® Covering (Approximately 2 rolls) – See **Covering** (page 36)
- Fuel-Proof Paint – See **Painting** (page 36)
- 3' Medium Fuel Tubing (GPMQ4131)
- 1/4" Latex Foam Rubber Padding (HCAQ1000)
- 10 oz. Fuel Tank (GPMQ4104)
- Two 2" Wheels (GPMQ4221) (2-1/2" wheels desirable for grass fields)
- 2-1/4" White Spinner (GPMQ4515)
- Great Planes Easy Fueler™ Fueling System (GPMQ4160)
- 3/4" Tailwheel (GPMQ4240)

### **Suggested Building Supplies and Tools**

These are the building tools, glue, etc. that we recommend and mention in the manual.

*We recommended Great Planes **Pro**™ CA and Epoxy*

- 1 oz. Thick CA- (GPMR6014)
- 2 oz. Thin CA (GPMR6003)
- 2 oz. Medium CA+ (GPMR6009)
- CA Accelerator (GPMR6035)
- 6-Minute Pro Epoxy (GPMR6045)
- 30-Minute Pro Epoxy (GPMR6047)
- Pacer Formula 560 Canopy Glue (PAAR3300)
- #1 Hobby Knife Handle (HCAR0105)
- #11 Blades (HCAR0311, 100 Qty.)
- HobbyLite Filler (HCAR3401)
- X-Acto Razor Saw (XACR2531)
- Hobbico Builder's Triangle Set (HCAR0480)
- Small T-Pins (HCAR5100)
- Medium T-Pins (HCAR5150)
- Great Planes Plans Protector (GPMR6167)
- Masking Tape
- 1/4-20 Tap (GPMR8105, drill bit included)
- Great Planes Dead Center™ Engine Mount Hole Locator (GPMR8130)
- Electric Power Drill
- Drill Bits: 1/16", 5/64", 3/32", 7/64", 1/8", 5/32", #18 or 11/64", 3/16", #10 or 13/64" (unless purchased with 1/4-20 Tap listed above), 1/4", 17/64"
- String (for aligning wing and stabilizer)
- Screwdrivers (Phillips and Flat Blade)
- Sealing Iron (TOPR2100)
- CG Machine™ (GPMR2400)
- AccuThrow™ Deflection Meter (GPMR2405)
- Bar Sander or Sanding Block and Sandpaper (coarse, medium, fine grit)



Made of durable, lightweight aluminum, Easy-Touch™ Sanders have a uniquely contoured handle that lets you work longer with less fatigue! The incredibly flat sanding surface removes high spots with ease. The 5.5" Hand Sander is ideal for small parts and tight spaces. Use the 11" - 44" Bar Sanders for larger areas. Take the guesswork out of sanding curved or angled shapes with the Easy-Touch Multi-Sander. Available in 11" and 22" lengths. Easy-Touch adhesive-backed sandpaper is already trimmed to these tools' width...just cut it to length and press in place. Available in 4 different grits.

- |          |  |
|----------|--|
| GPMR6169 | Easy-Touch Hand Sander-5.5"            |
| GPMR6170 | Easy-Touch Bar Sander-11"              |
| GPMR6172 | Easy-Touch Bar Sander-22"              |
| GPMR6174 | Easy-Touch Bar Sander-33"              |
| GPMR6176 | Easy-Touch Bar Sander-44"              |
| GPMR6190 | Easy Touch Multi-Sander-11"            |
| GPMR6191 | Easy Touch Multi-Sander-22"            |
| GPMR6180 | Easy-Touch 80-Grit Sandpaper-12' roll  |
| GPMR6183 | Easy-Touch 150-Grit Sandpaper-12' roll |
| GPMR6184 | Easy-Touch 180-Grit Sandpaper-12' roll |
| GPMR6185 | Easy-Touch 220-Grit Sandpaper-12' roll |

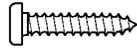
### **Part Numbers for Other Tools or Accessories You May Require**

- CA Applicator Tips (HCAR3780)
- Epoxy Brushes (GPMR8060)
- Epoxy Mixing Sticks (GPMR8055, Qty. 50)
- CA Debonder (GPMR6039)
- Clevis Installation Tool (GPMR8030)
- Hot Sock (TOPR2175)
- Trim Seal Tool (TOPR2200)
- Heat Gun (TOPR2000)
- Single Edge Razor Blades (HCAR0312, 100 Qty.)
- Razor Plane (MASR1510)
- 36" Non-Slip Straightedge (HCAR0475)
- Denatured or Isopropyl Alcohol (for epoxy clean-up)
- Dreme® Moto-Tool® or Similar w/Sanding Drum, Cutting Burr, Cut-off Wheel
- Curved-Tip Canopy Scissors (HCAR0667)
- Servo Horn Drill (HCAR0698)

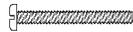
## Building Notes

There are two types of screws used in this kit:

**Sheet metal screws** are designated by a number and a length. For example #4 x 5/8"



**Machine screws** are designated by a number, threads per inch and a length. For example 2-56 x 5/8"



When you see the term "**test fit**" in the instructions, it means 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. Do **not** glue until told to do so.

When you see the term "**fit**" in the instructions, it means you should first position the part on the assembly **without using any glue**, then modify or "custom fit" the part as necessary for the best fit. Glue when you are satisfied with the fit.

Where you see the term "**glue**", it is at your option to select the thickness of CA with which you are most comfortable. If the step indicates a particular thickness of glue, be sure to use the thickness recommended for strength, penetration and/or working time.

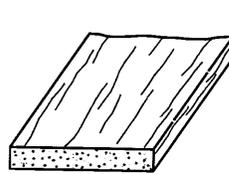
Whenever just "**epoxy**" is specified you may use **either** 30-minute epoxy **or** 6-minute epoxy. When 30-minute epoxy is specified it is highly recommended that you use only 30-minute epoxy because you will need the working time and/or the additional strength.

Several times during construction we refer to the "top" or "bottom" of the model or a part of the model. For example, during wing construction we may tell you to "glue the top main spar" or "trim the bottom of the former." It is understood that the "top" or "bottom" of the model is as it would be when the airplane is right-side-up and will be referred to as the "top" even if the model is being worked on upside-down. I.E. the "top" main spar is always the "top" main spar even when the wing is oriented upside-down.

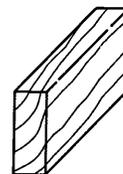
## Common Abbreviations Used in this Manual and on the Plans

Fuse = Fuselage  
Stab = Horizontal stabilizer  
Fin = Vertical fin  
LE = Leading edge (front)  
TE = Trailing edge (rear)  
LG = Landing gear  
Ply = Plywood  
Bass = Basswood  
" = Inches

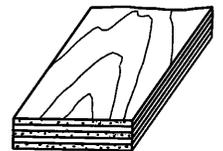
## Types of Wood



Balsa



Basswood



Plywood

## Get Ready to Build

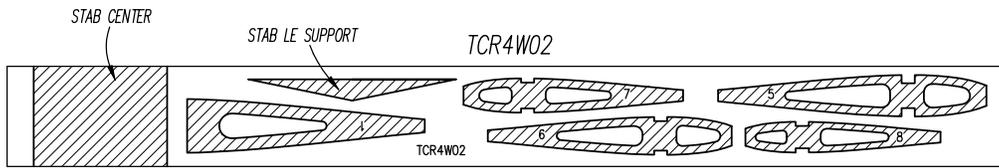
1. Unroll the plan sheets. Re-roll the plans inside out to make them lie flat.
2. Remove all parts from the box. As you do, figure out the name of each part by comparing it with the plans and the parts list included with this kit. Using a felt tip or ball point pen, lightly write the part name or size on each piece to avoid confusion later. Use the die-cut patterns shown on pages 6 and 7 to identify the die-cut parts and mark them before removing them from the sheet. Save all leftovers. If any of the die-cut parts are difficult to punch out, do not force them! Instead, cut around the parts with a hobby knife. After punching out the die-cut parts, use your Bar Sander or sanding block to lightly sand the edges to remove any die-cutting irregularities or slivers.
3. As you identify and mark the parts, separate them into groups, such as fuse (fuselage), wing, fin, stab (stabilizer) and hardware.



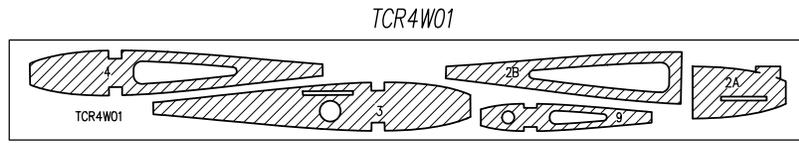
**EXPERT TIP**  
EXPERT TIP

Zipper-top food storage bags are handy to store the small parts as you sort, identify and separate them into sub-assemblies.

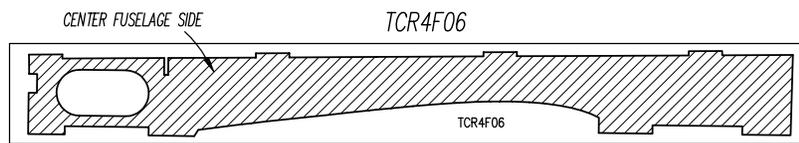
# DIE-CUT PATTERNS



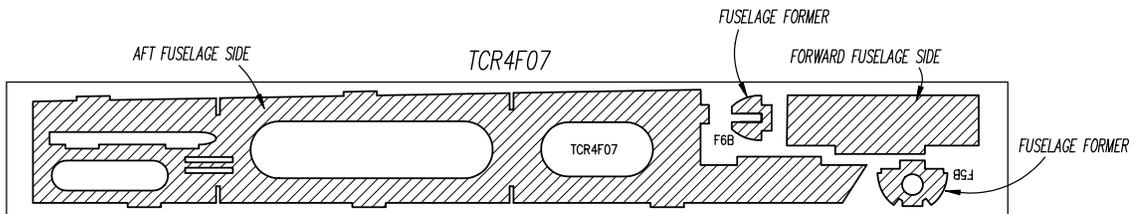
3/32" X 3" X 30" Balsa (2 PER KIT)



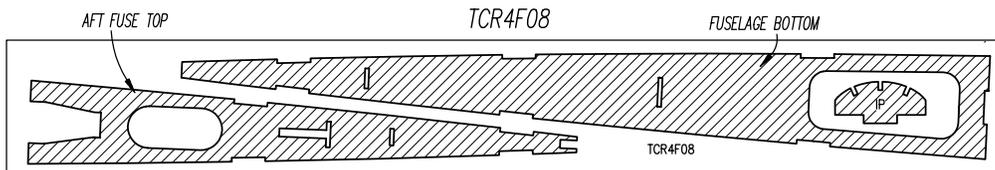
3/32" X 3" X 24" Balsa (2 PER KIT)



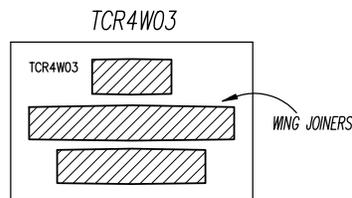
1/8" X 3" X 24" Balsa (2 PER KIT)



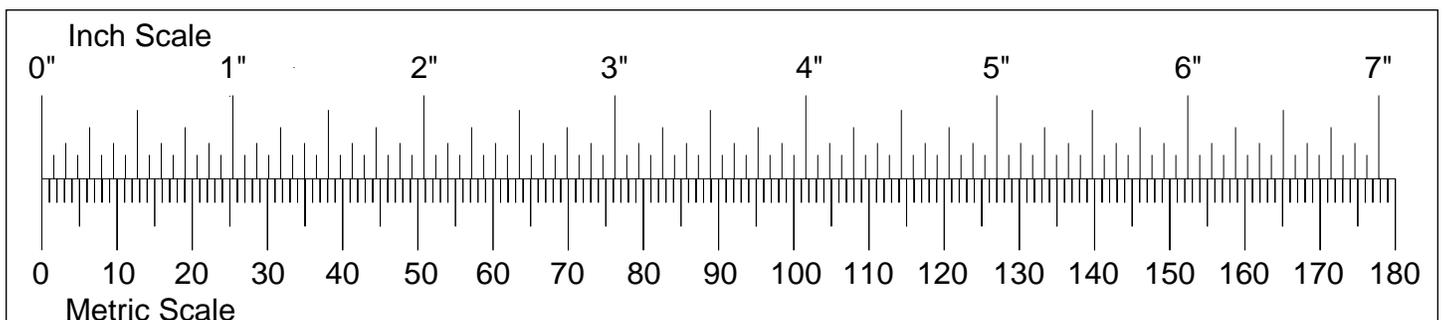
1/8" X 4" X 30" Balsa (2 PER KIT)

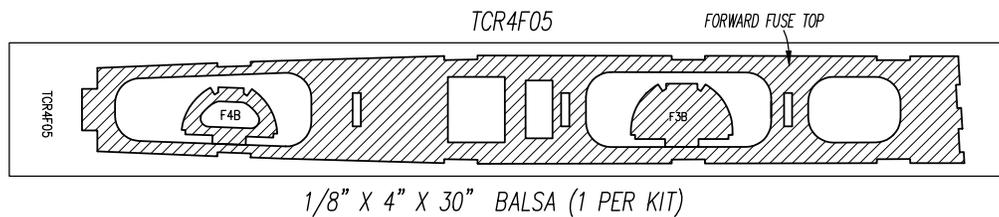
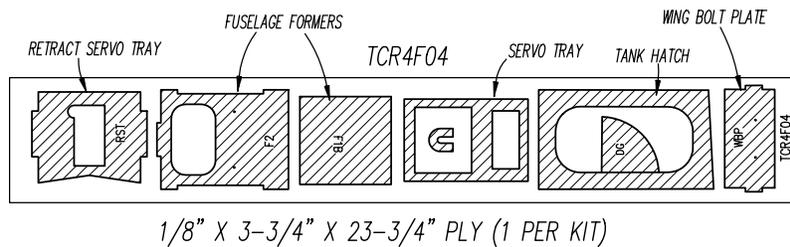
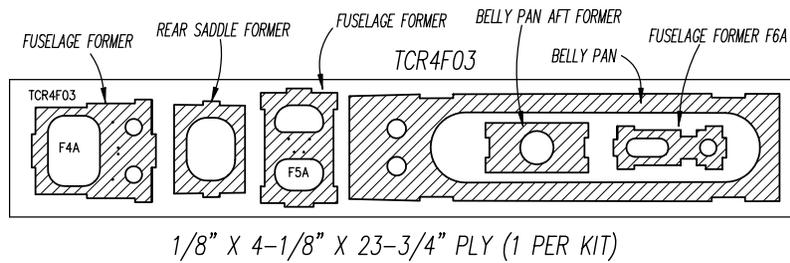
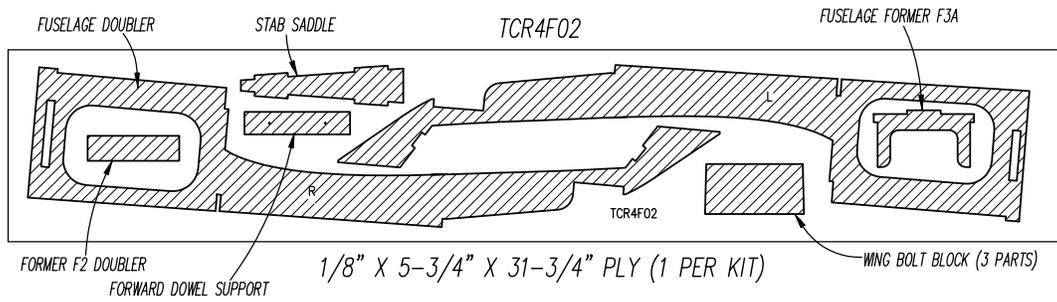
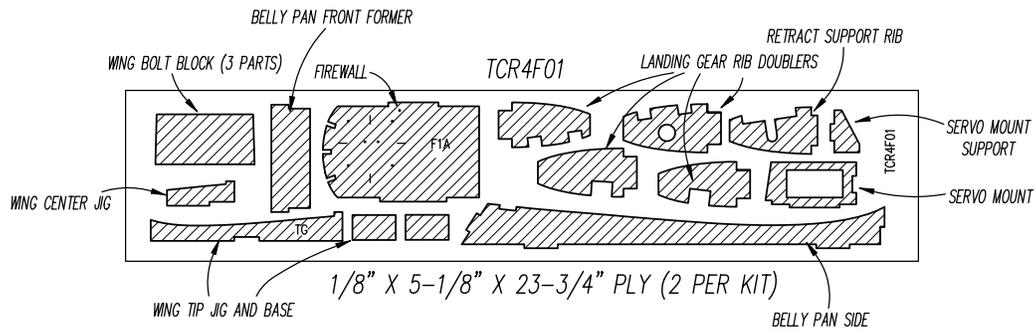


1/8" X 4" X 30" Balsa (1 PER KIT)



1/8" x 4-3/4" x 7-1/4" BIRCH (1 PER KIT)





### METRIC CONVERSIONS

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

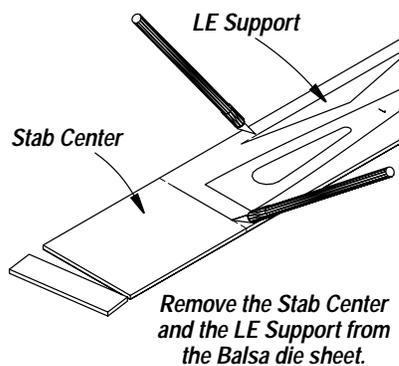
## BUILD THE TAIL SURFACES

You may remove the stabilizer and elevator drawing from the plan by cutting along the dashed line. Don't forget to cover the plan with Great Planes Plan Protector so the glue won't stick to the plan.

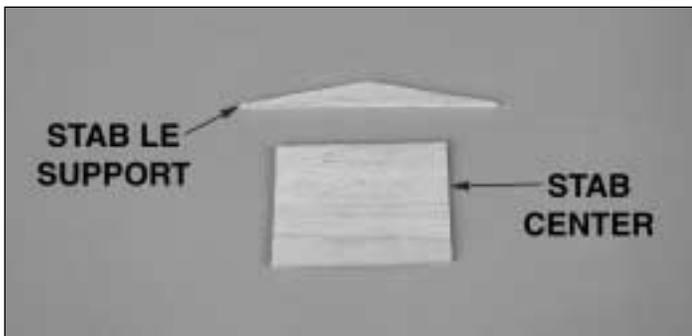
### Build the Stab and Elevators

#### EXPERT TIP

While the placement of the outer framing of any stick-built part is important, the exact placement of the internal ribs is not so critical. It is more important to have the ribs fit properly between the framework and have strong, secure glue joints than to have them placed in an exact location. If you need to slide an internal rib left or right as much as 1/8" within the Tracer's tail framework to gain a snug fit and a strong glue joint, feel free to do so.



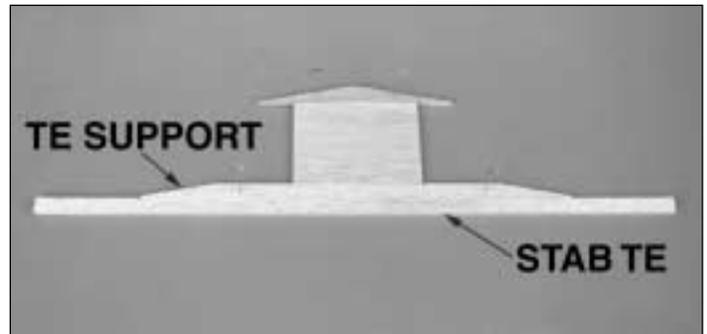
1. Remove the two die-cut 3/32" balsa **stab centers** and the two die-cut 3/32" balsa **stab LE supports** from the die sheet as shown in the sketch.



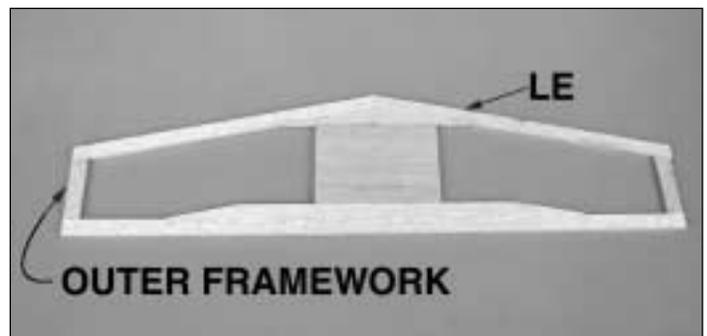
2. Laminate the stab centers and the LE supports together with medium CA, making a 3/16" stab center and a 3/16" LE support.

3. Pin the laminated 3/16" balsa stab LE support in position over the plan. Fit and glue the laminated 3/16" balsa stab center to the LE support.

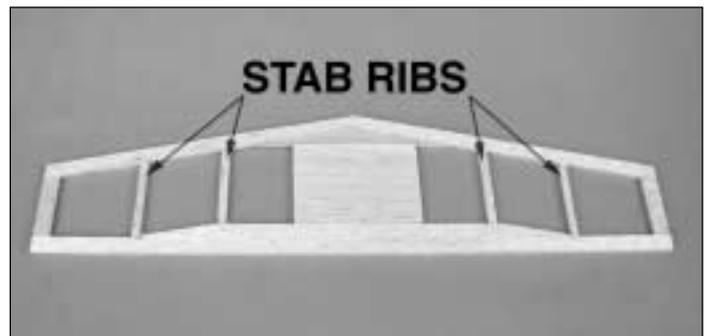
**Note:** Refrain from using excessive accelerator. Even hours after it's sprayed on, residual accelerator can prematurely and unexpectedly cure the CA you use later on nearby glue joints. Unless you must handle or remove the part from the building board right away, we recommend using no accelerator at all.



4. Using two 3/16" x 1/2" x 24" balsa sticks, cut, fit and glue the stab TE support and stab TE in place. **NOTE:** Be sure to cut the angle on the ends of the TE support as shown on the plans.



5. From a 3/16" x 1/2" x 24" balsa stick, cut, fit and glue the stab LE and remaining outer framework.



6. From a 3/16" x 1/4" x 12" balsa stick, cut, fit and glue the stab ribs in place.

7. Unpin the stab from the plan. Inspect all glue joints and re-glue with CA as necessary. Use a bar sander or a large sanding block and 220-grit sandpaper to sand the entire top and bottom surface of the stab framework until it is flat and even. Be careful while sanding so that you do not over-thin any one particular area of the stab or gouge the stab ribs by snagging the sandpaper on them.

## Build the Fin and Rudder

- ☐☐ 8. Edge glue two 1/16" x 3" x 24" balsa sheets together, making a 1/16" x 6" x 24" balsa sheet. Sand both sides of this sheet smooth.

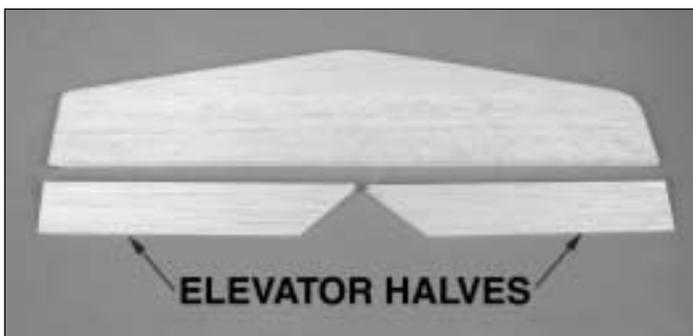


- ☐☐ 9. Glue the stab framework to the sheeting, aligning the TE and the left outer edge of the framework with the edges of the sheeting. Trim the sheeting around the stab framework. **NOTE:** It is important to glue the sheeting securely to the stab center.



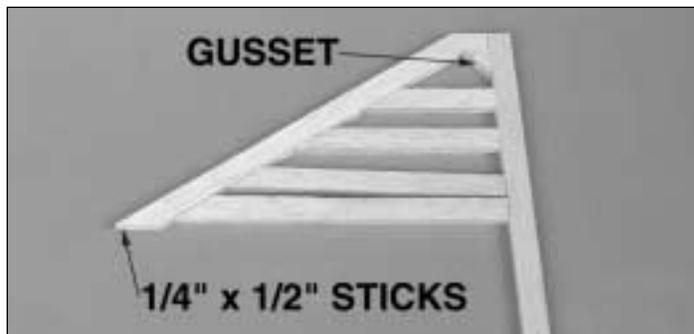
- ☐ 10. Repeat steps 8 and 9, sheeting the other side of the stab, again being sure to glue it **securely** to the stab center.

- ☐ 11. Sand the flat on the LE of the stab as shown on the plan.



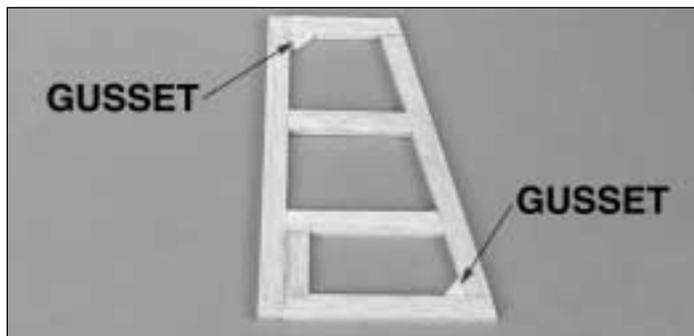
- ☐ 12. From the 1-3/4" x 24" tapered balsa elevator stock, cut two **elevator halves** to the shape shown on the plans.

- ☐ 1. Remove the stab plan from your work surface and lay out the fuselage plan. Don't forget to cover the fin and rudder areas of the plan with Great Planes Plans Protector so the glue won't stick to the plan.

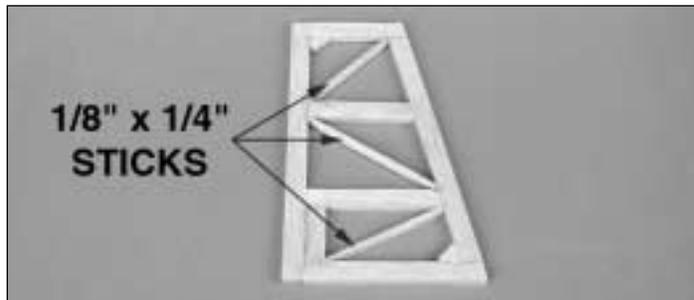


- ☐ 2. Using two 1/4" x 1/2" x 24" balsa sticks, cut, fit and glue the fin framework and ribs. Don't forget the gusset at the top of the fin. **Note:** The fin tail post goes all the way down to the bottom of the fuse.

- ☐ 3. Unpin the fin from the plans. Inspect all glue joints and reglue with CA as necessary. Sand the left and right sides until they are flat and even.



- ☐ 4. Using a 1/4" x 1/2" x 24" balsa stick, cut, fit and glue the rudder framework and ribs. It may be necessary to use the leftover 1/4" x 1/2" balsa from the fin. Don't forget the control horn support and the corner gussets.

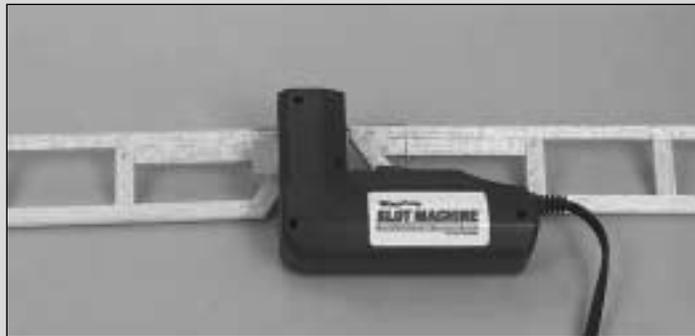


- ☐ 5. From a 1/8" x 1/4" x 12" balsa stick, cut, fit and glue the three cross braces in place.

- ☐ 6. Unpin the rudder from the plans. Inspect all glue joints and reglue with CA as necessary. Sand the left and right sides until they are flat and even.

## Hinge the Tail Surfaces

- ❑ 1. Place the stab over its location on the plan and lightly mark the hinge locations on the trailing edge with a ball point pen. Mark the hinge locations on the elevators in the same manner.

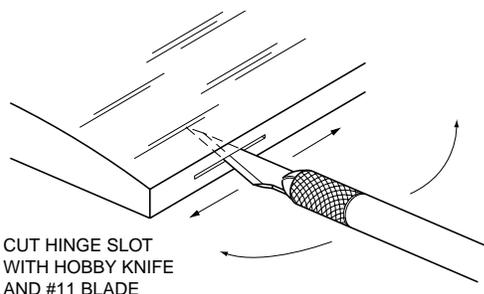


We have simplified the task of cutting hinge slots with the introduction of the **Great Planes Slot Machine™**. This simple electric tool cuts a perfect width slot for use with CA hinges.



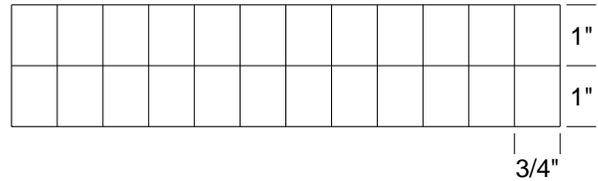
To cut the hinge slot, place the blades onto the wood where you want the slot. Lightly press the teeth into the wood. When you are satisfied with the location, press the button on the handle and the blades will cut easily into the balsa wood. Go to step 3 to complete hinging your stab.

If you choose not to purchase a Slot Machine you can make the slots by completing step 2 below:



- ❑ 2. Cut the hinge slots in the elevator and stabilizer using a #11 blade. Begin by **carefully** cutting a very shallow slit at

the hinge location to accurately establish the hinge slot. Make three or four more cuts, going a little deeper each time. As you cut, slide the knife from side to side until the slot has reached the proper depth and width for the hinge.



- ❑ 3. Cut 3/4" x 1" hinges for the elevators and rudder from the supplied 2" x 9" **hinge material**, then snip off the corners. Temporarily join the elevators to the stab with the hinges, adjusting any hinge slots if necessary so they all align. **Do not glue in the hinges until you are instructed to do so.**

- ❑ 4. Return to steps 1 and 2 and complete the same procedure to hinge the rudder and fin.

## Finish the Tail Surfaces

- ❑ 1. Shape the leading edge of the elevators and rudder to a "V" as shown on the plans.

- ❑ 2. Use a bar sander and 150-grit sandpaper to round the tail surfaces as shown on the plan. **Note:** The LE of the stab is sanded to a sharper angle than the fin is to help tracking.

That's about it for the tail surfaces. They're a little more work than sheet surfaces but they are much lighter, just as strong and a nice piece of craftsmanship. Clean off the work surface and get ready for the wing!

## BUILD THE WING

### Build the Wing Spars

1. From two 1/8" x 3/8" x 30" basswood sticks, cut four 14-1/2" long **spar doublers**.

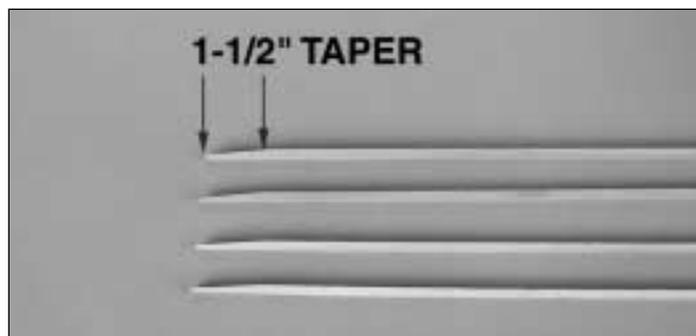


Before using the basswood spar doublers and spars, examine them carefully for possible imperfections. Look for knots, soft spots, diagonal grain and any other imperfections. If possible, position each spar doubler so the imperfections (if any) are on the outer half of the wing panel (toward the tip), where they will be least affected by high stress. If the spar doublers are warped slightly, try to "balance them out" by installing the warped spar doublers in opposite directions (see sketch).

**TWO WARPED SPARS INSTALLED  
THIS WAY WILL RESULT IN A  
STRAIGHT WING**

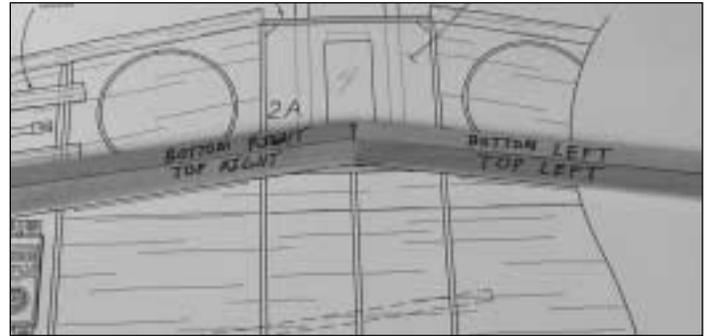


**TWO WARPED SPARS INSTALLED  
THIS WAY WILL RESULT IN A  
WARPED WING**



2. Sand a 1-1/2" taper on one end of each spar doubler as shown.

3. Glue the spar doublers to the four 1/8" x 3/8" x 30" basswood **spars**, aligning the untapered end of the spar doubler flush with the inboard end of the spar. From this point forward we will refer to this combination as a spar.

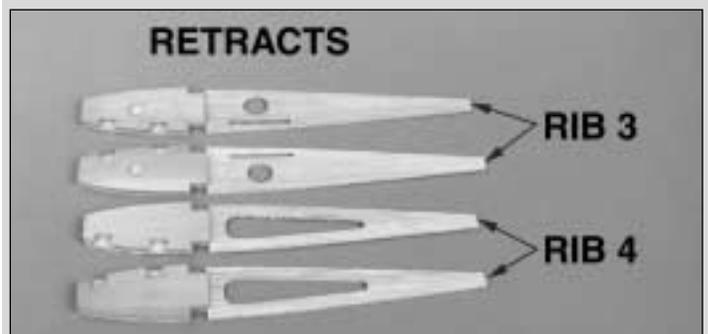


4. Position 2 spars on top of each other with the spar doublers against one another. Position the other 2 spars similarly. Sand the inboard end of all four spars to match the centerline of the wing, labeling each one as you do so. **Note:** Make sure you make a **bottom left, bottom right, top left and top right spar**. The top spars shown in the photo have been turned upside-down and the label is written on the bottom of the spar doubler.

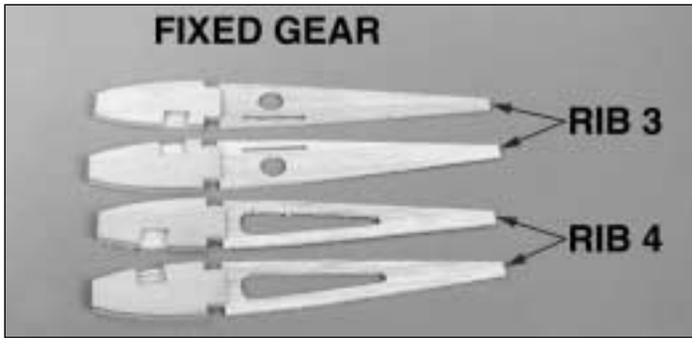
### Add the Rib Doublers

**Note:** From this point forward, steps which are for retractable gear installation will be in gray boxes. This will help clarify which steps are for fixed gear and which are for retracts. Fixed-gear-only steps will begin "If you will be installing fixed gear" again for clarification.

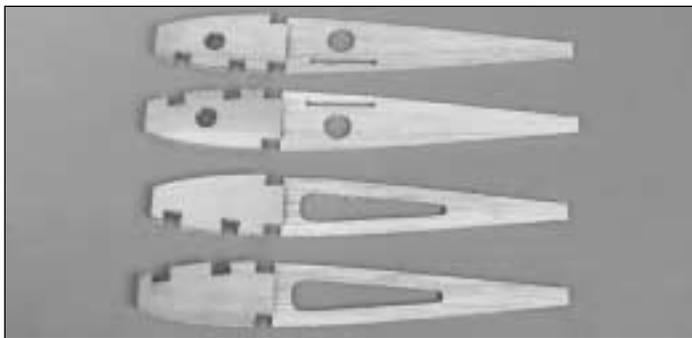
#### RETRACT INSTALLATION



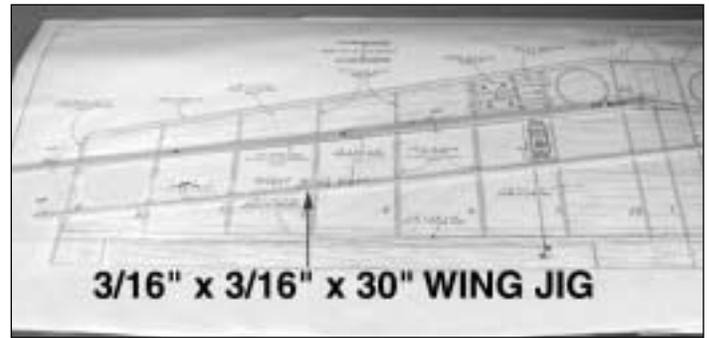
- 1a. If you will be building your Tracer with retracts, glue the four die-cut 1/8 ply **rib doublers** with two slots to the pair of die-cut 3/32" balsa **ribs 3 and 4**, being careful to make a left and a right rib 3 and 4 as shown in the photo. **Note:** Make sure the slots in the rib 3 doublers are the same direction as the servo tray slots in the ribs 3.



1b. If you will be installing fixed gear, glue the four die-cut 1/8" ply rib doublers with one slot to the pair of die-cut 3/32" balsa **ribs 3 and 4**, being careful to make a left and right rib 3 and 4. **Note:** Make sure the slot in the doubler going on rib 3 is in the same direction of the servo tray slot in rib 3.

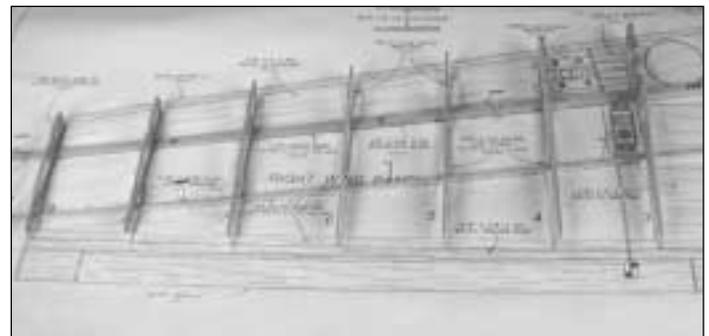


2. Trim the balsa ribs as shown, using the openings in the rib doublers as a guide. **Note:** The ribs in the photo are for retracts. If you are using fixed gear, trim your ribs in the same manner but with only one landing gear rail cutout.



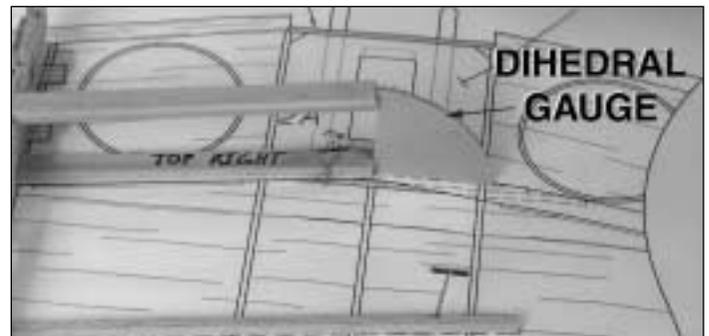
2. Pin a 3/16" x 3/16" x 30" balsa **wing jig** stick over the wing jig position shown on the plan. **Note:** Do not pin at the rib positions.

3. Align the spar labeled "right top" at the inboard end with the lettering facing up and cross-pin it in place. **NOTE:** Remember that the top spar is against the plans right now because the wing is being built upside-down.



4. Fit the die-cut 3/32" balsa ribs 3 through 9 onto the top spar. **Note:** Make sure the ply rib doublers on ribs 3 and 4 face each other and the notches are up. The ribs must be resting on the 3/16" x 3/16" wing jig.

5. Using a square to keep all the ribs perpendicular to the work surface, glue the ribs to the top spar.

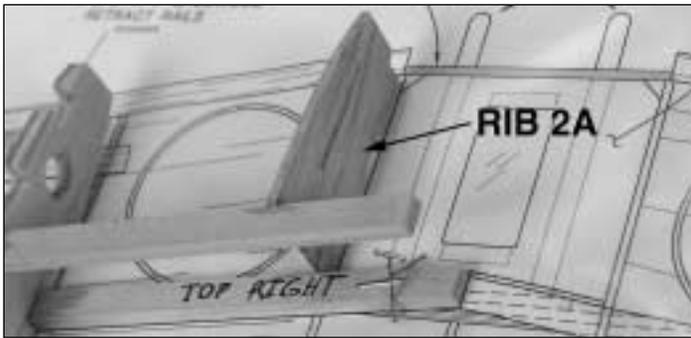


6. Use the die-cut 1/8" ply **dihedral gauge** to locate the inboard end of the bottom spar, then position the bottom spar in the ribs. Being careful not to twist the ribs, glue the bottom spar in place.

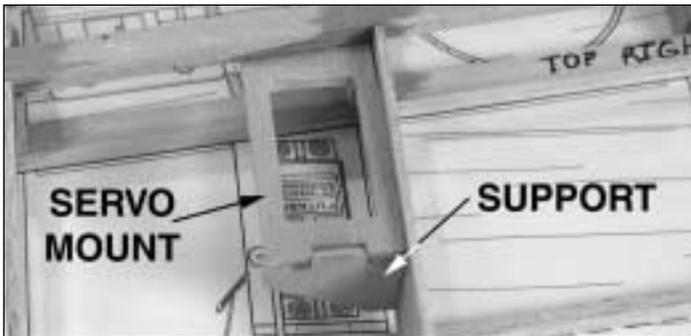
## Build the Wing Panels

**IMPORTANT NOTE:** The following instructions explain how to build the wing directly over the plans. We'll start by building the **right** wing panel **upside-down** over the **right** wing panel plan so your progress matches the photos.

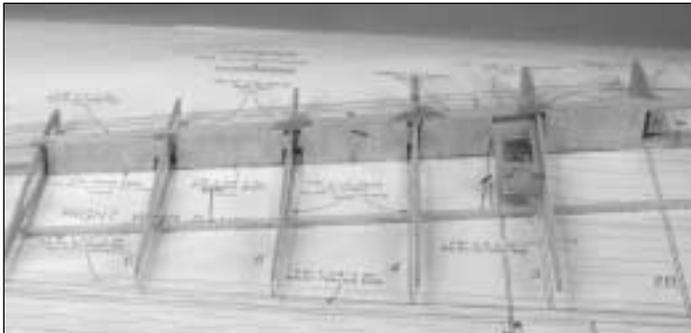
1. Tape the **right** wing plan to the work surface and cover the wing drawing with GP Plan Protector (so you won't glue the wing to the plan!) Remember, we are building the right wing over the right wing **bottom view**.



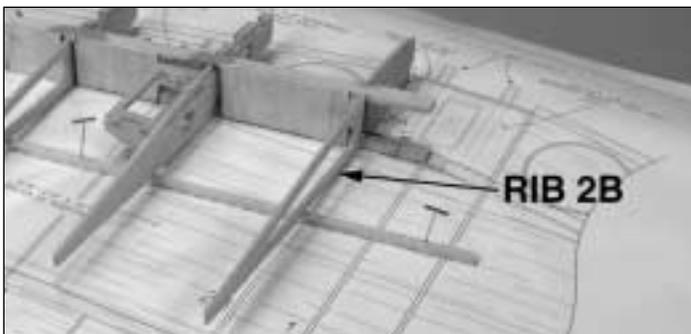
□ □ 7. Using a square to keep it perpendicular to the work surface, glue the die-cut 3/32" balsa **rib 2A** to the spars.



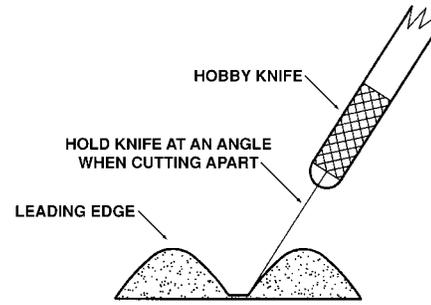
□ □ 8. Glue the die-cut 1/8" ply **servo mount** and the die-cut 1/8" ply **servo mount support** in place.



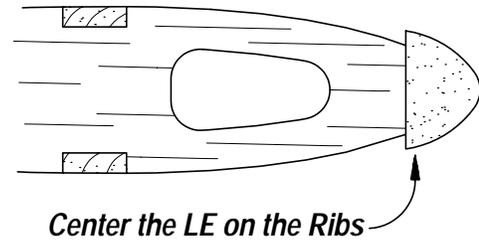
□ □ 9. From a 1/16" x 3" x 24" balsa sheet, cut, fit and glue the five **shear webs** in place. **Note:** You may have to move a T-pin or two to glue the webs in place. Just replace them behind the shear webs after the shear webs are glued in place.



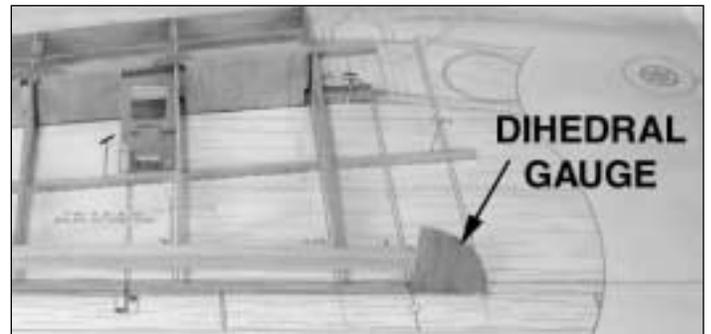
□ □ 10. Position the die-cut 3/32" balsa **rib 2B** perpendicular to the work surface and glue it to the spars.



□ □ 11. If you are building the right wing panel, trim the two shaped balsa **LE's** as shown in the sketch.



□ □ 12. Glue the shaped LE centered vertically on the front of the ribs. Trim the ends of the shaped LE flush with the inboard side of rib 2A and flush with the outboard side of rib 9.



□ □ 13. Use the dihedral gauge to position the 3/8" x 3/8" x 30" balsa **TE** at the centerline of the TE of the ribs. Glue the TE to the ribs.

If you are using fixed gear, go to step 21.

### RETRACT INSTALLATION



□ □ 14. Epoxy the two 1/4" x 3/8" x 4" basswood **retract rails** to ribs 3 and 4.



15. Using a rotary tool and a cutoff wheel, cut both retract struts so they are 4-1/8" long, measuring from the mounting plate on the retract body.



16. Place your retract in place on the rails. Drill four 5/64" pilot holes through the bass rails, using the mounting holes as a guide. Mount the retract with four #4 x 1/2" sheet metal screws (not provided).

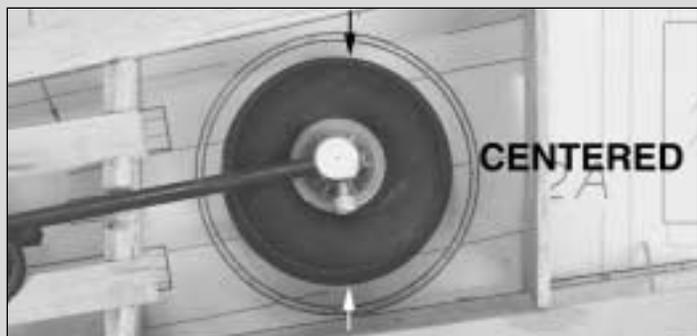


17. Remove the area of the rear landing gear rail that makes contact with the coil of the retract. Do the same where the strut makes contact with rib 3. **Hint:** Your rotary tool works well for both these tasks. Just be careful not to accidentally over trim.



18. If you are building your right wing panel, mount a 2" wheel (GPMQ4221) to each of the two adjustable axes

(GPMQ4281) with 5/32" wheel collars and 6-32 set screws. Using a rotary tool and a cutoff wheel, cut the axles flush with the wheel collars.

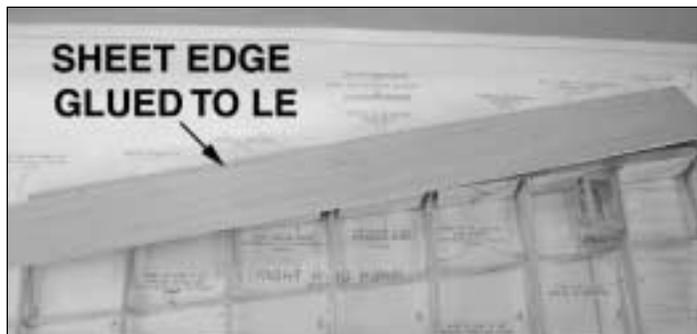


19. Mount the axle on the end of the strut, centering the wheel between the ribs. Bend the strut forward or aft as required to center the wheel between the LE and the spar.

20. Remove the retract from the rails. Harden the threads in the gear rails with thin CA. Go to step 22.



21. If you are using fixed gear, epoxy the grooved basswood landing gear rail to ribs 3 and 4.



22. Edge glue a 1/16" x 3" x 30" balsa sheet to the shaped LE, letting it contact the front edge of each rib.

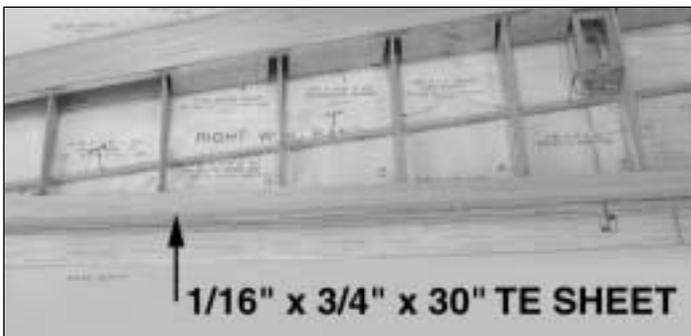


☐☐ 23. Being careful not to cut into the spar, use a straightedge as a guide and cut the sheeting along the center of the spar.



☐☐ 24. Being careful to keep the spar against the building surface and the ribs on the wing jig, use medium or thick CA to glue the sheeting to the ribs and the front half of the spar.

☐☐ 25. Cut four 1/16" x 3/4" x 30" **TE sheets** from a 1/16" x 3" x 30" balsa sheet.



☐☐ 26. Sand the TE so that it is flush with the ribs. Glue a TE sheet to the TE and the ribs, aligning it along the TE of the 3/8" TE stick.

☐☐ 27. Unpin and lift the wing from the work surface.

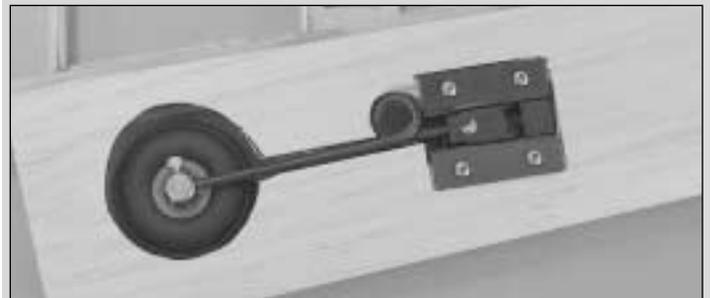


☐☐ 28. Trim the TE sheet, TE, LE, LE sheet and the spars flush with rib 9.

☐☐ 29. Trim the jig tab from rib 2A.

☐☐ 30. If you are using fixed gear, go to step 38.

### RETRACT INSTALLATION



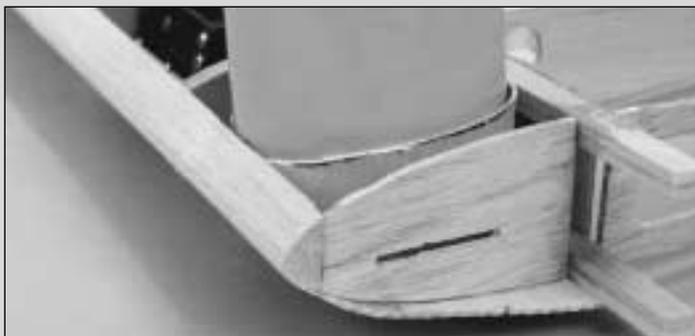
☐☐ 31. Set the wing right-side-up on your work surface. Working a little at a time, cut an opening in the LE sheet between the rails to fit the retract body. Mount the retract body, then gradually cut away the sheeting for the strut and the wheel.



☐☐ 32. Select or cut a piece of 1/32" x 2" x 8-3/4" ply (not included) with the grain running the short way. Wrap it around a soda can of your choice, allow the sheet to overlap and glue the sheet to itself. This will be the wheel well.



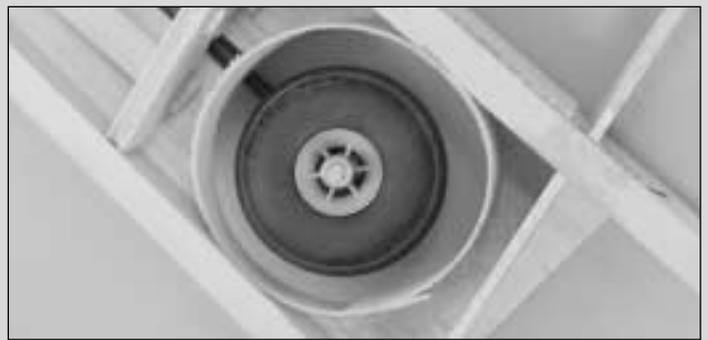
□ □ 33. Shape one end of the wheel well so that when slid in place it makes contact with the sheeting all the way around.



□ □ 34. While holding the well in place, mark a cut line around it so that the top sheeting will just touch the well when it is glued in place. Remove the well from the can and cut around the line.



□ □ 35. Double-check the shaping of the well by looking at it from the inboard end of the wing. When satisfied with the fit, glue it to the sheeting, centering it between ribs 3 and 4. **Note:** Leaving the can in the well will help the well hold its shape as it is being glued.



□ □ 36. Trim the bottom LE sheeting from within the wheel well.



□ □ 37. Epoxy the die-cut 1/8" ply **retract support rib** in place.

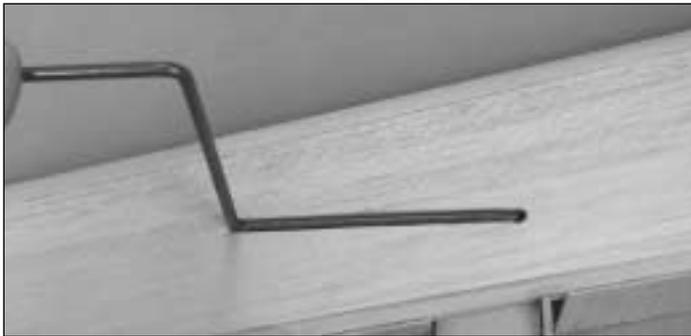
If this is your first wing panel, go back to step one and build the **left** wing half over the **left** wing plan.



□ □ 38. If you are installing fixed gear, turn your wing right-side-up and epoxy the 7/16" x 5/8" x 3/4" maple grooved **torque block** to the rib 3 doubler and the landing gear rail, with the groove facing the doubler as shown in the photo.



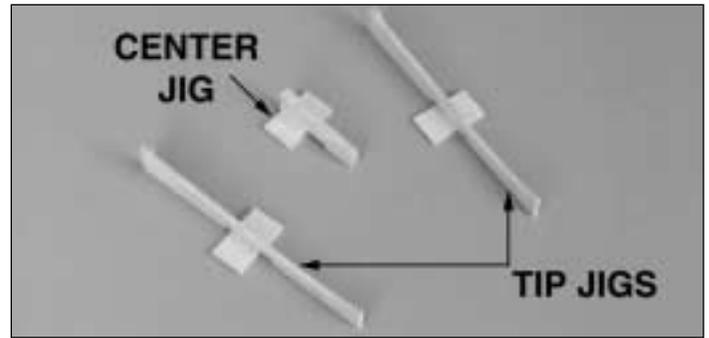
□ □ 39. Drill a 5/32" hole through the landing gear rail and bottom sheeting, using the groove in the torque block as a guide.



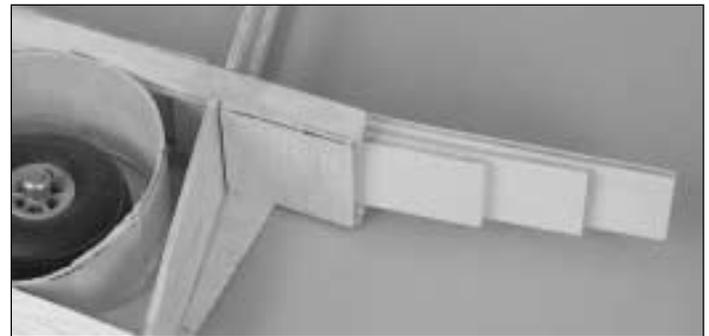
❑ 40. Turn the wing upside-down. Using the slot in the landing gear rail as a guide, cut the opening for the gear to fit. Chamfer the torque block opening to allow the radius in the landing gear leg to fit properly in the rail.

❑ 41. Mount the gear leg with two plastic straps and four #2 x 3/8" sheet metal screws, as shown on the plan.

❑ 42. Go back to step one and build the **left** wing half over the **left** wing plan.



❑ 2. Glue the die-cut 1/8" ply **center jig** and **tip jigs** together as shown.

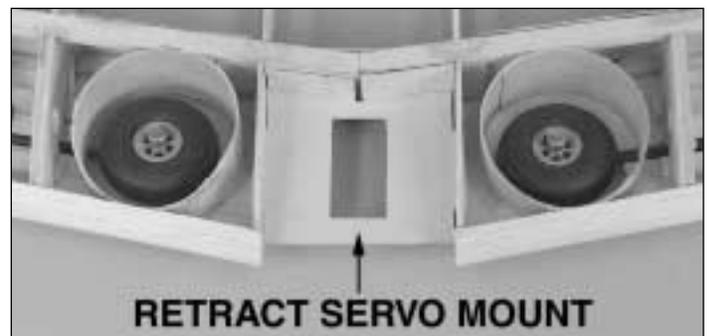


❑ 3. Temporarily fit the wing joiner into one wing half. From the remaining piece of 1/16" x 3" balsa used to make the shear webs, make a LE shear web that goes to the inboard end of the spars. Glue the web to the spars. Do the same for the other wing half. **Note:** Do not glue the joiner in yet.

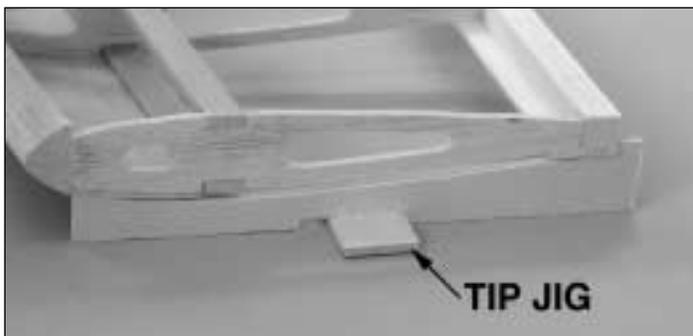
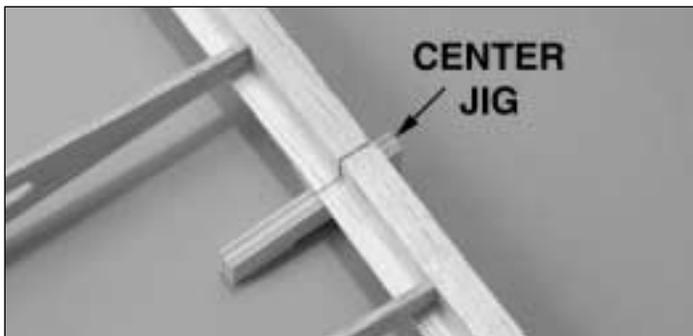
### Join the Wing Panels



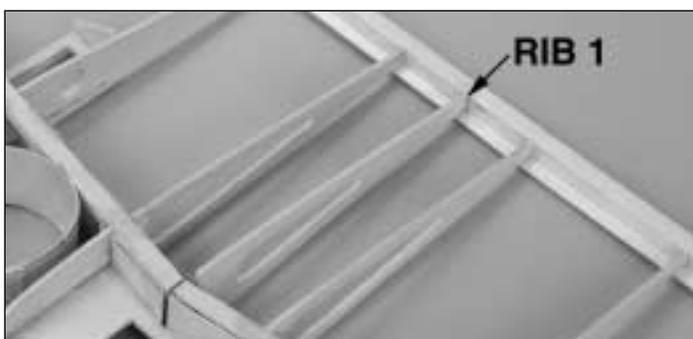
❑ 1. Using medium CA, laminate the three die-cut 1/8" ply **center spar joiners**. This complete assembly is now called the **wing joiner**.



❑ 4. Fit the wing panels to the wing joiner and the die-cut 1/8" ply **retract servo tray**. **Note:** The retract servo tray will be installed whether you are using retracts or fixed landing gear.



❑ 5. Position the wing on the jigs. When satisfied that the wing is joining properly, lift it off the work surface and liberally coat the wing joiner and spars with epoxy and position in place. Place the wing back on the jigs and glue the retract servo tray in and the TEs of the wing panels together with thin CA. Weight the wing and leave it undisturbed until the epoxy has fully cured.

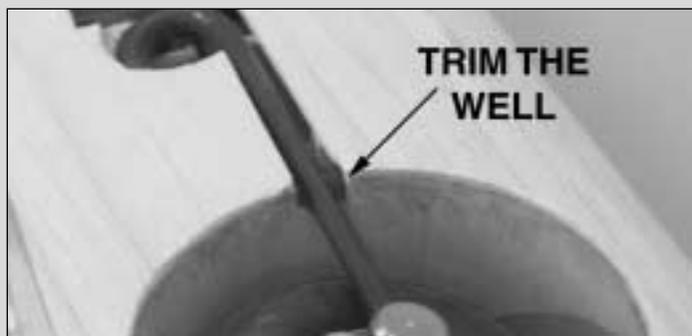


❑ 6. Glue the die-cut 3/32" balsa rib 1 in place.

If you are using fixed gear, skip to the **Finish the Top of the Wing** section.

## Retract Servo and Linkage Installation

### RETRACT INSTALLATION



❑ 1. Trim the wheel wells where the struts make contact so the retracts can lock in the "up" position.

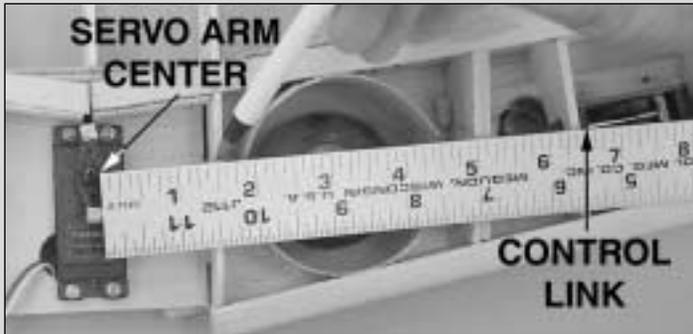


❑ 2. Find a servo horn with the outer holes at 1-1/16" to 1-1/8" from each other. Mount a **Screw-Lock Pushrod Connector** (GPMQ3870, not included) in both outer holes. **Hint:** The standard S6-arm Futaba servo horn works well — just trim off the 4 arms that are not needed.

❑ 3. Mount your retract servo, using the hardware supplied with the servo.



❑ 4. Cut 5/8" of the threads off the end of two 12" pushrods with clevises attached (GPMQ3772, not included). Bend to the shape as shown on the plans.



□ 5. Use a straightedge to mark a line from the **center of the servo arm** to the **control link** on the right retract on the right wheel well and rib 2A. Repeat for the left retract.



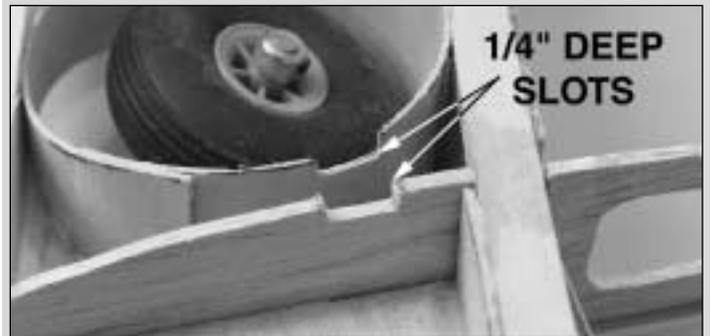
□ 6. On the right wing half, mark on the wheel well and rib 2A where a line from the **aft** screw-lock to the control link on the right retract intersects the wheel well and rib 2A.



□ 7. On the left wing half, mark on the wheel well and rib 2A where a line from the **forward** screw-lock to the control link on the left retract intersects the wheel well and rib 2A.



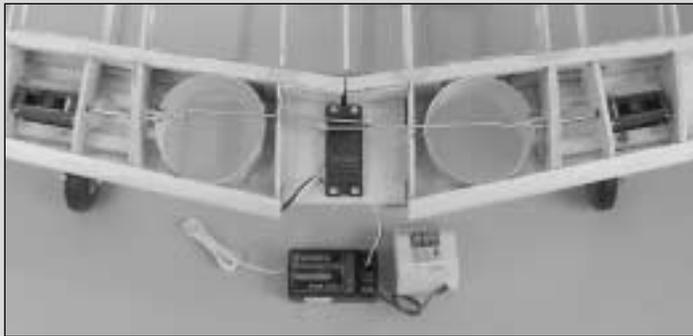
□ 8. Cut 3/8" wide by 5/8" deep slots in the outside edges of both wheel wells centered on the marks you made in steps 5-7.



□ 9. Cut a 1/4" deep slot between the marks on both ribs 2A and the inside of both wheel wells.



□ 10. Plug your retract servo into your receiver. Set it so that the servo arm, in the "up" position, is positioned rotated slightly as shown in the photo. Make sure it rotates clockwise to move the gear down.



❑ 11. Hook up the pushrods with the gear in the “down” position and the arm as shown. Pull the pushrods until the gear locks down, then tighten the set screws on the screw-lock connectors.

❑ 12. Remove the retracts and the servo from the wing.  
**Note:** Leave the pushrods attached to the retracts to make it easier to reinstall them later.

### *Finish the Top of the Wing*

❑ 1. Pin the 3/16" x 3/16" x 30" balsa wing jig to the left wing view. Align the **right wing** right-side-up over the **left wing view**. Weight the wing in place so that all ribs are touching the jig and the bottom sheeting is flat on the work surface.



❑ 2. Edge glue a 1/16" x 3" x 30" sheet to the LE the same as you did for the bottom of the wing.

❑ 3. Trim the sheeting flush with the outer edge of rib 9. Using a straightedge, cut the sheeting down the center of the spar.

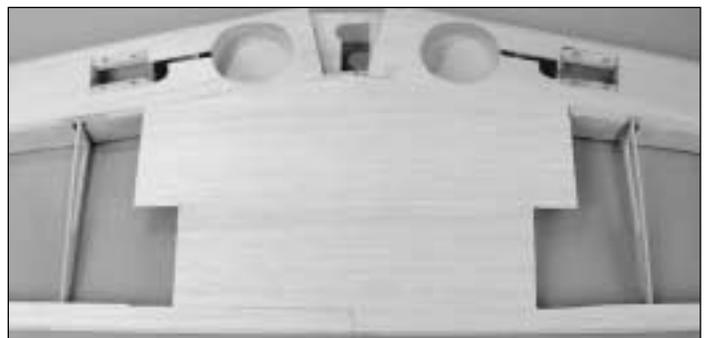


❑ 4. Lift the LE sheeting away from the ribs and put thick CA on the ribs and the front half of the spar. Roll the sheeting down and weight it in place until the glue has dried.

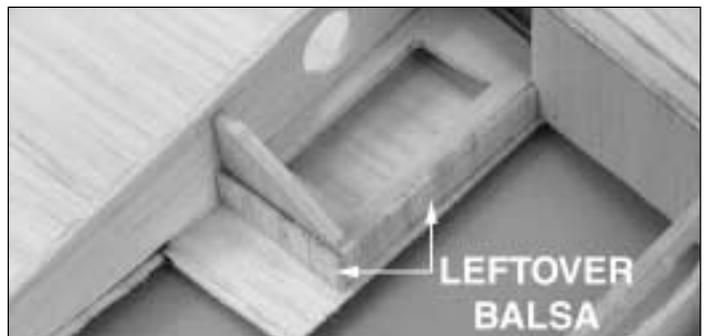
❑ 5. Sand the TE so it is flush with the tops of the ribs.

❑ 6. Glue one of the 1/16" x 3/4" x 30" balsa TE sheets to the TE and the ribs. Trim the TE sheet flush with rib 9.

❑ 7. Lift the wing off the plan. Repeat steps 1-6 to sheet the **left wing** half, remembering to position the left wing right-side-up over the **right wing plan**.



❑ 8. Use two 1/16" x 3" x 30" balsa sheets to sheet the bottom center section of the wing. **Note:** Using a straightedge aligned with the LE sheeting makes cutting the forward piece of center sheeting easy.



❑ 9. Use leftover pieces from the bottom center sheeting to support the sheeting around both aileron servo trays.



❑ 10. Cut openings in the bottom sheeting for the aileron servos.



❑ 11. Use two 1/16" x 3" x 30" balsa sheets to sheet the top center section of the wing.

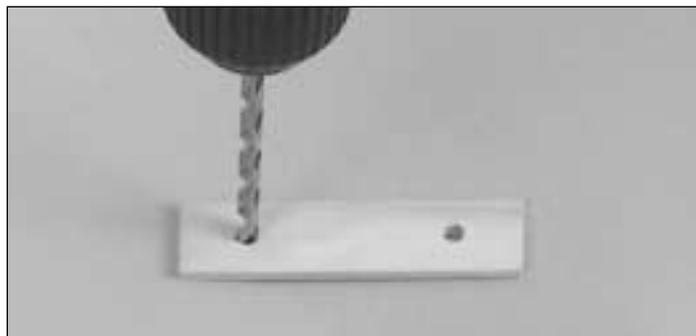


❑ 12. Using the 1/16" x 1/4" x 30" balsa sticks, cut, fit and glue **cap strips** to all of the exposed ribs, both top and bottom.



❑ 13. Cut a 1" diameter hole out of the top center sheeting for the aileron servo leads as shown on the plan. **Hint:** A quarter makes a nice template.

❑ 14. Sand the TE sheeting flush with the TE.



❑ 15. Drill two 1/4" holes, at the punch marks, in the die-cut 1/8" ply **forward dowel support**.



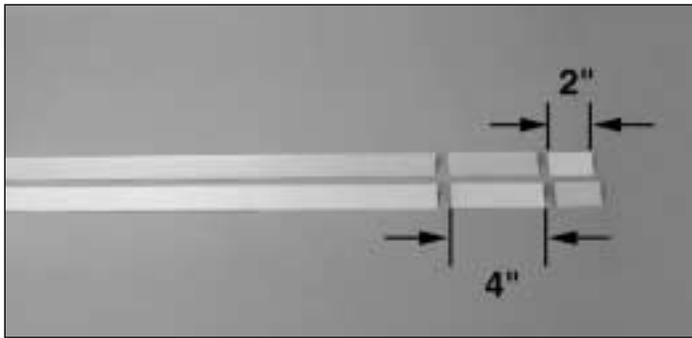
❑ 16. Trim the ends of the shaped LE so the forward dowel support will fit flush against the inboard ends of the LE and tight against the retract servo tray.

❑ 17. Position the 1/4" x 3-1/2" basswood **wing dowels** in place lying against the retract servo tray, then epoxy the forward dowel support in place. **DO NOT GLUE** the dowels at this time.

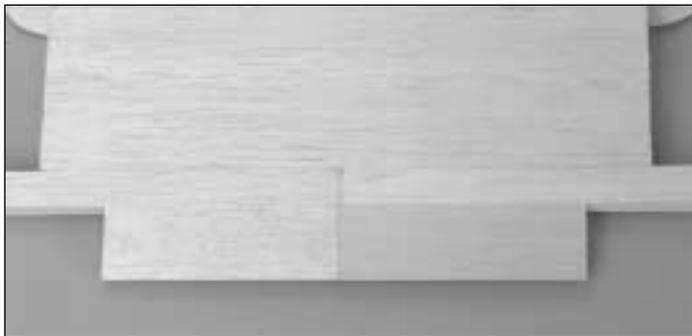


❑ 18. Remove the dowels and drill 1/4" holes through the 1/16" balsa shear webs.

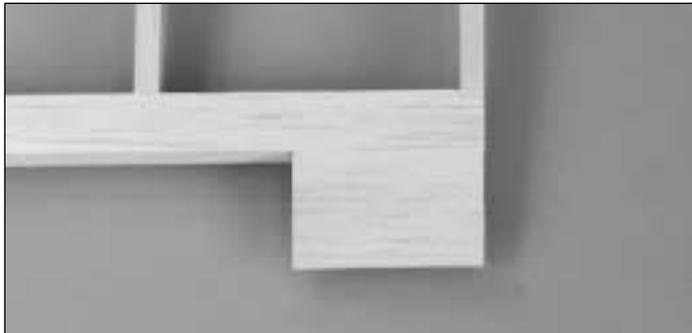
❑ 19. Round one end of each dowel. Epoxy the dowels in place with the rounded end forward so that the dowel protrudes as shown on the plan.



20. From one piece of 30" tapered balsa aileron stock, cut a 4" and a 2" length. Cut 4" and 2" lengths from the other 30" aileron stock.



21. Glue the two 4" pieces to the inboard TE of each wing panel, with the inboard ends aligned at the centerline of the wing.



22. Glue the 2" pieces to each wing tip, aligning them with the outboard edge.



23. Cap both wing tips with leftover 1/16" balsa sheet. Sand to the shape of the wing.

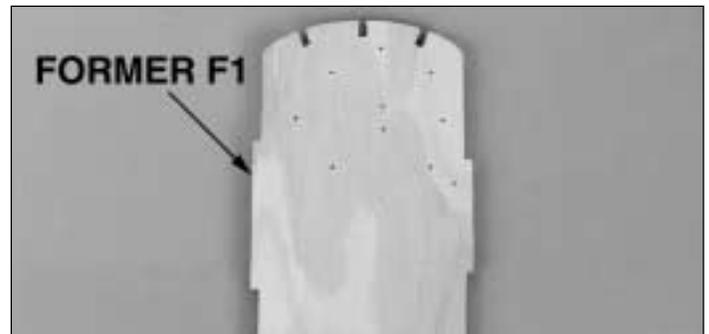
24. Sand the LE so the top and bottom are flush with the LE sheeting. **Note:** Be careful not to sand into the sheeting.

## Hinge the Ailerons

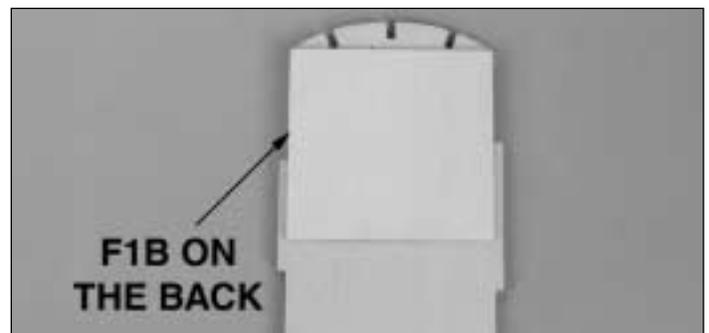
1. Trim both pieces of the aileron stock so they have 1/16" clearance on both ends when positioned in place.
2. Mark the hinge locations on the ailerons and wing and cut the hinge slots the same as was done on the tail.
3. Bevel the LE of the ailerons to a "V" shape as shown on the wing cross-section.

## BUILD THE FUSELAGE

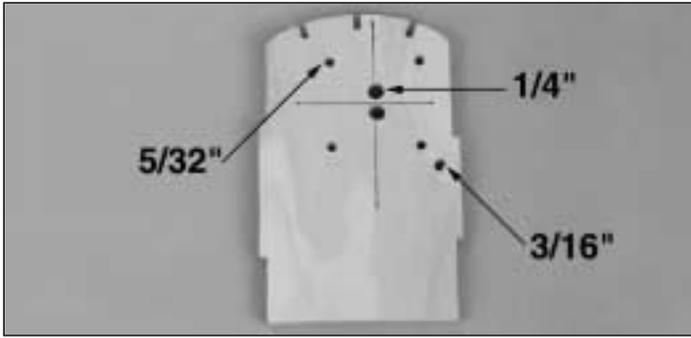
### Assemble the Fuselage Formers and Sides



1. Place one die-cut 1/8" ply **former F1** on the work surface with the front (punch marked) side facing up. Epoxy the second F-1 to the first with 6-minute epoxy, again with the punch marked side facing up. Make sure the edges all the way around are aligned. Wipe away any excess epoxy before it cures. **Note:** If the firewall formers are warped, simply clamping them together may not "cancel out" the warps. It is best to clamp the formers to a table or a flat board until the epoxy cures.



2. Glue the die-cut 1/8" ply **F1B** to the back of the F1 formers with medium CA. From now on this assembly will be referred to as the **firewall**.

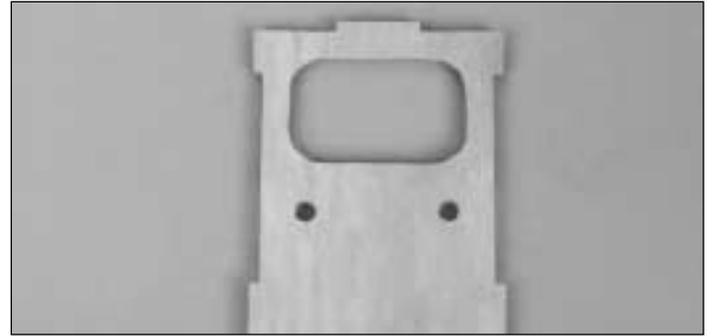
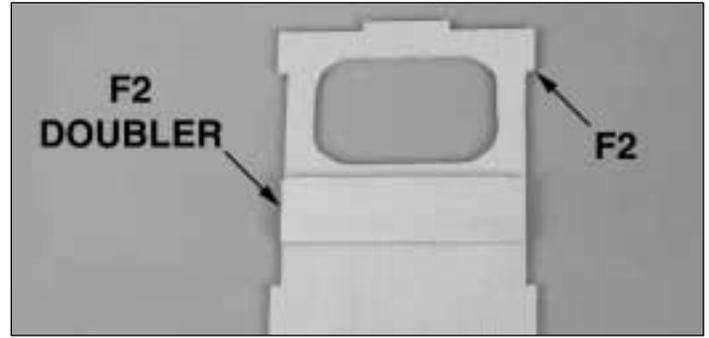


❑ 3. Using a straightedge and a pen, draw a line horizontally across the firewall from the left outer punch mark to the right outer punch mark. Draw a line vertically from the top punch mark to the bottom punch mark. The intersection of these two lines is the center of the engine mount. **Note:** The center of the engine mount is offset to compensate for the built-in right and down thrust so that the crankshaft will exit the cowl dead center on the fuselage centerline.

❑ 4. If you are using the included Great Planes adjustable .40-.70 motor mount, drill the four 5/32" holes at the punch marks as shown in the photo. Drill the two 1/4" holes and the 3/16" hole as shown in the photo. **Note:** This throttle exit placement works for the recommended 2-stroke engines, clearing the exhaust, as well as 4-stroke engines with the carburetor rotated 180-degrees.



❑ 5. Press the four supplied 6-32 blind nuts into the holes on the back of the firewall. Gently tap the blind nuts with a hammer to fully seat them into the firewall, then add a few drops of thin CA around the blind nuts to secure them.



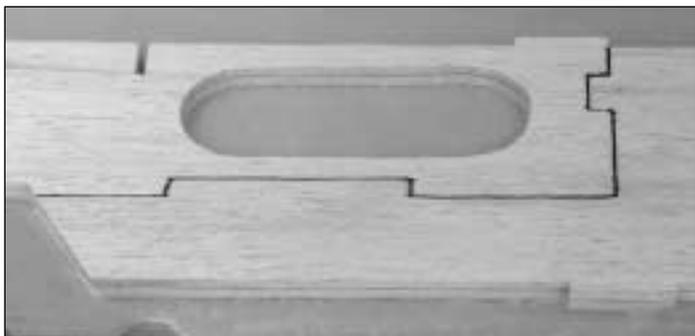
❑ 6. Glue the die-cut 1/8" ply **F2 doubler** to the **front** side of die-cut 1/8" ply **F2** as shown on the plans.

**IMPORTANT NOTE:** The front side of this one former is the side which is **NOT** embossed and which does **NOT** have punch marks. This fuse former is the only former which is installed with the embossing facing the tail of the model.

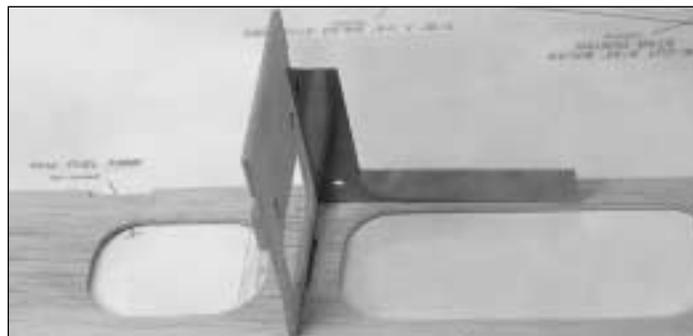
❑ 7. Drill two 1/4" holes through the punch marks in former F-2 and through the F2 doubler. **Hint:** Place the former on a leftover piece of wood and press down as you drill the hole so the former does not split when drilled.



❑ 8. Cover the fuse side view of the plans with Great Planes Plan Protector. Fit and glue the die-cut 1/8" balsa **forward, center and fuse sides** together over the plan as shown in the photo.

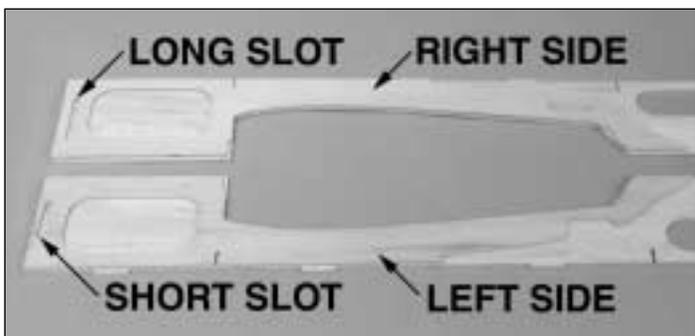


❑ 9. Cover the first fuse side with Great Planes Plan Protector and fit and glue the second side together over the first, making two identical fuse sides.

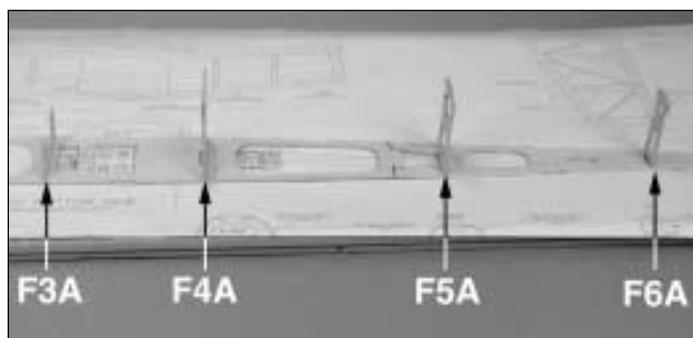


❑ 12. Glue former F2 vertically in the **front** of its slot in the fuse top. Be sure the F2 doubler you installed in step 6 is facing forward.

❑ 13. Drill 3/16" holes in formers F4A and F5A at the punch marks.



❑ 10. Position the fuse sides exactly as shown. Glue the die-cut 1/8" ply **left fuselage side doubler (L)** to the left fuse side. Glue the die-cut 1/8" ply **right fuselage side doubler (R)** to the right fuse side. **Note:** The left fuse side doubler is the one with the short slot and the right side fuse doubler is the one with the long slot.

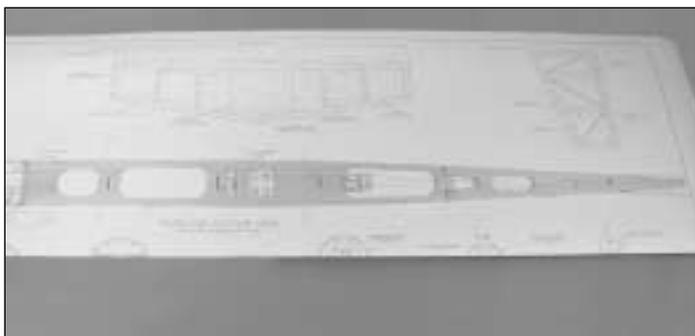


❑ 14. Glue the die-cut 1/8" ply formers **F3A, F4A, F5A** and **F6A** vertically in the **rear** of the slots in the fuse top.



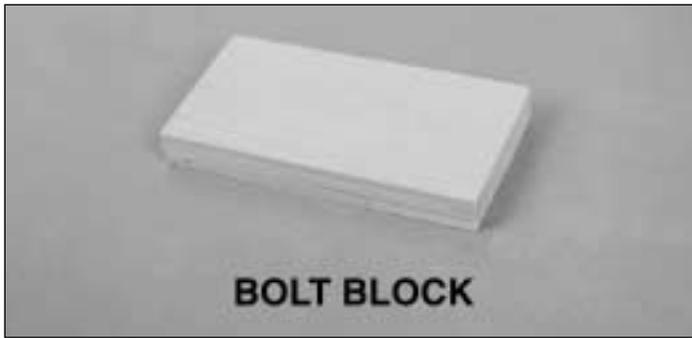
❑ 15. Fit the fuse sides and die-cut 1/8" balsa **fuse bottom** in place.

❑ 16. Using a square, make sure both sides of the fuse are perpendicular to the building surface. Using your square to double-check that the sides are vertical before gluing each former, glue formers F6A, F5A, F4A, F3A and F2 to the fuse sides, top and bottom. **Note:** Do not glue forward of F2 until instructed to do so.

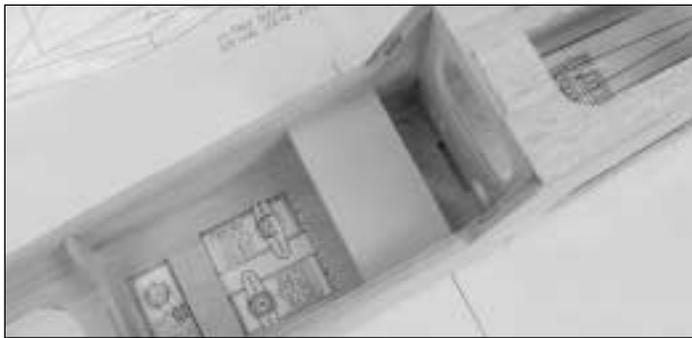


❑ 11. Align the die-cut 1/8" balsa **forward** and **aft fuse tops** together over the plan and pin in place. Glue the fuse top pieces together with thin CA, making a **fuse top**. **Note:** Make sure the fuse top is positioned upside-down so the forward edge aligns with the aft edge of the firewall on the plan.

❑ 17. Starting at F2 and working aft, glue the fuse sides to the fuse top.



18. Using 6-minute epoxy, glue the three die-cut 1/8" ply **bolt plates** together to make what is now called the **bolt block**.



19. Epoxy the bolt block securely in place in the fuse.

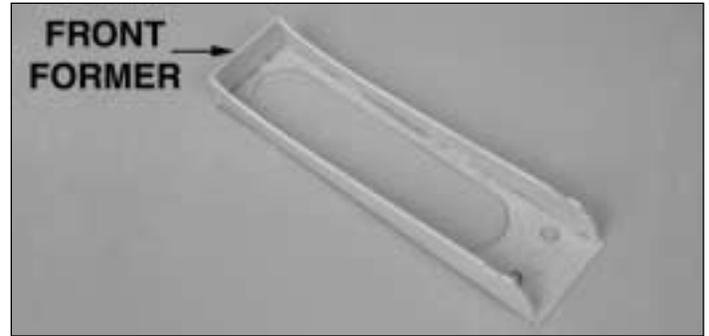


20. Sand a taper on the bottom edge of the die-cut 1/8" ply **rear saddle former**. Fit it in place, adjusting the taper until a good fit is achieved. Glue the former in place.

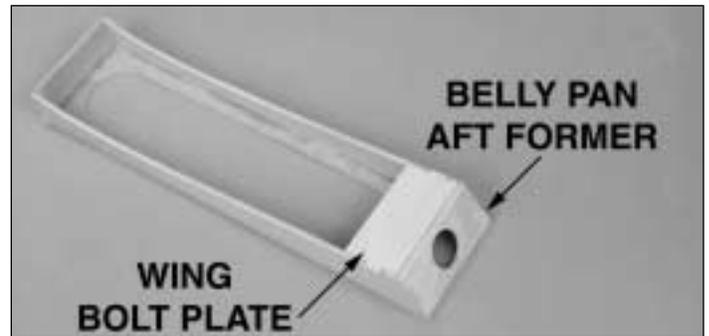


21. Sand the front of the aft fuse bottom to the angle of the rear wing saddle former.

## Assemble the Belly Pan



1. Glue the die-cut 1/8" ply **belly pan sides** and **belly pan front former** perpendicular to the **belly pan bottom**.

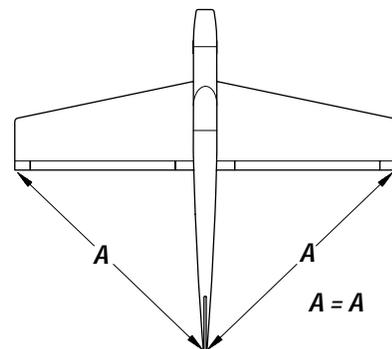


2. Glue the die-cut 1/8" ply **belly pan aft former** and **wing bolt plate** in place as shown in the photo. **NOTE:** The punch marks in the wing bolt plate must be facing down so that they will be visible through the belly pan bottom when the belly pan is upside-down.

## Mount the Wing to the Fuselage

1. Sand the entire wing saddle area lightly until the fuse side doublers and fuse sides are flush.

2. Trial fit the wing on the fuse. It may be necessary to enlarge the holes in F2 slightly to get the wing to fit correctly.



3. Stick a T-pin through the center of the aft end of the fuselage bottom. Tie a string to the T-pin. Pull the string to the TE of the wing tip and put a piece of masking tape on

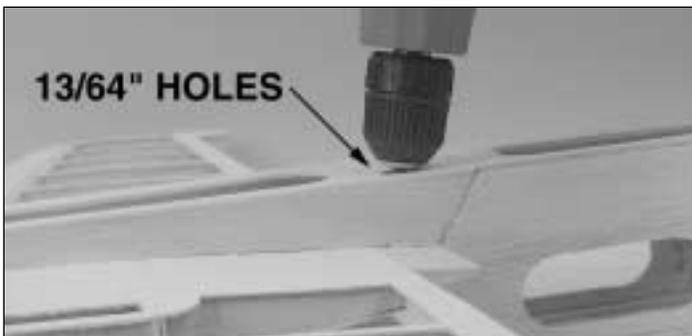
the string. Mark an arrow on the tape, then slide the tape on the string so the arrow aligns with the wing tip. Swing the string over to the other tip and see if it aligns with the same point. If necessary, shift the wing and mark the location of the tip by adjusting the position of the tape on the string. Do this until the arrow on the string aligns with both tips.



❑ 4. Now that the wing is accurately positioned, fit the belly pan to the fuselage tightly against the wing. When it is positioned and fitted properly, use a few drops of thin CA to **tack** glue the belly pan sides to the wing. Be careful to neither move the wing nor glue the wing or belly pan to the fuselage.



❑ 5. Remove the wing from the fuselage. Use medium CA to glue the rest of the belly pan to the wing at all contact points. **HINT:** Applying the CA from the inside of the belly pan helps minimize excess CA outside of the belly pan which would have to be sanded.



❑ 6. Position the wing back on the fuse after all CA is fully cured. Holding the wing firmly in place on the fuse and using the punch marks in the wing bolt plate as a guide, drill two 13/64" holes through the wing bolt plates, the wing and the bolt block (in the fuselage), keeping the drill perpendicular to the wing bolt plates and centered in the holes in the belly pan bottom.

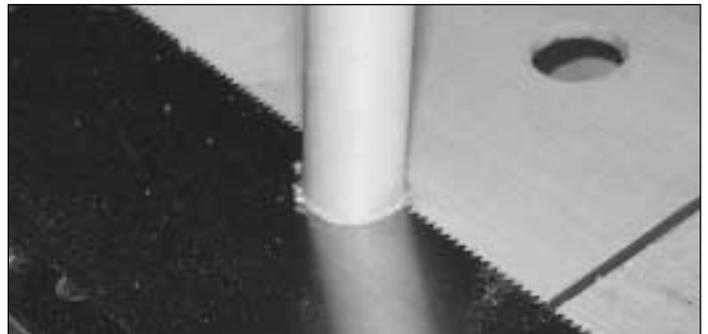
❑ 7. Remove the wing from the fuselage and re-drill both holes in the **wing only** to 17/64".

❑ 8. Use a 1/4-20 tap to cut threads in the **bolt block only** (in the fuselage). **HINT:** A cordless drill makes a great tap driver.

❑ 9. Harden the threads in the bolt block with thin CA, then re-tap the threads after the glue is **completely** dry.



❑ 10. Mount the wing to the fuse with both wing bolts. Fit the **paper tube** through the belly pan bottom and around the head of the right wing bolt, flush against the wing bolt plates. Glue the paper tube to the belly pan bottom and wing bolt plate with medium CA. **NOTE:** Be careful not to glue the wing bolts to the wing.



❑ 11. Using a razor saw, cut off the paper tube flush with the belly pan bottom.



❑ 12. Repeat steps 10 and 11 to mount the paper tube over the other wing bolt. Sand the paper tubes flush with the belly pan bottom.

❑ 13. Remove the wing from the fuse and set aside.

## Install the Firewall, Pushrod Tubes and Tank Hatch

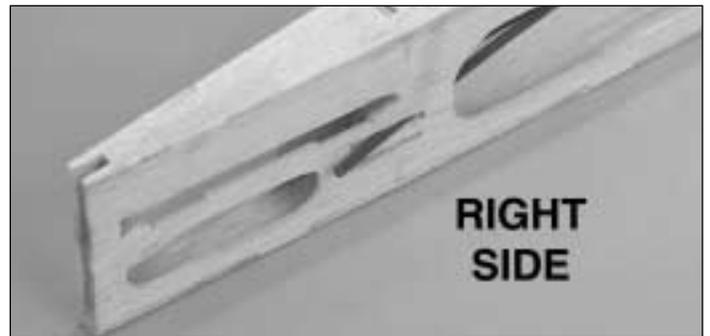
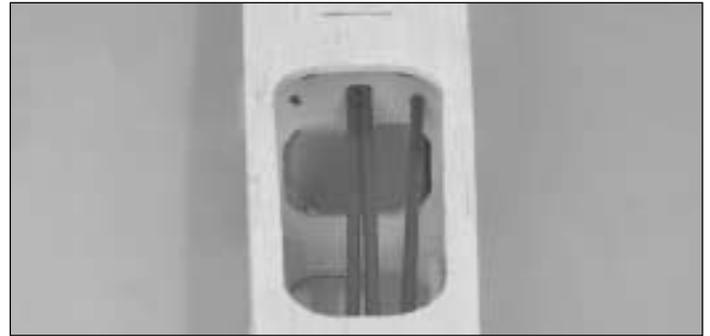
- ❑ 1. Remove the fuse from the work surface. Remove the pins from the fuse top.



- ❑ 2. Fit the firewall tabs into the slots in the fuse sides. When satisfied that the firewall can be put in place easily, epoxy it in place. **Hint:** Note the right thrust built into the firewall installation.

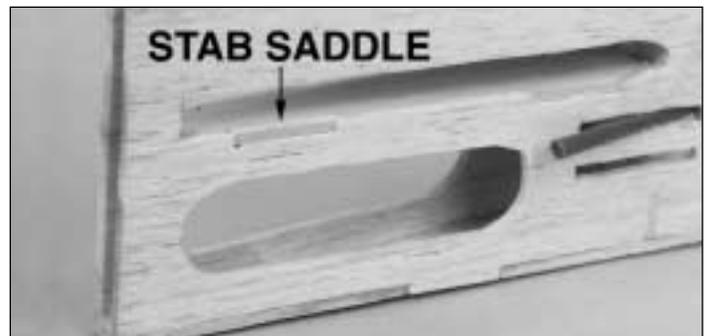
- ❑ 3. Double-check all glue joints of the entire fuselage. Reinforce with medium CA as needed.

- ❑ 4. Cut the three 3/16" x 36" pushrod tubes to 20" long. Roughen the outside of the tubes with sandpaper so glue will stick securely. **Note:** There are four holes in the formers and fuse sides. The fourth holes are for an optional antenna tube. If you choose this option, you will need to install an additional 3/16" x 36" pushrod tube like the other three (not included).



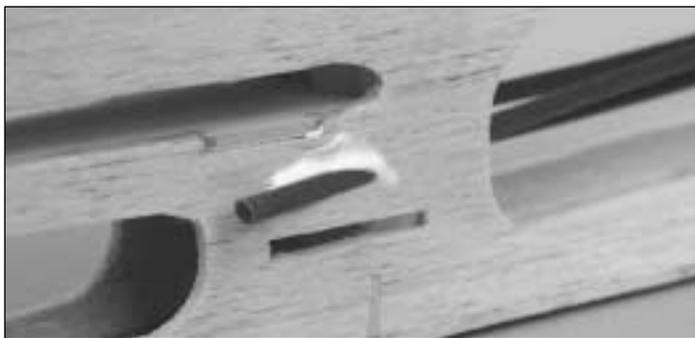
- ❑ 5. Fit the two elevator pushrod tubes in the upper holes in F4A, F5A, F6A and the fuse sides, leaving a small amount of excess extending out the fuse sides. Fit the rudder pushrod similarly into the lower right hole.

- ❑ 6. Glue the pushrod tubes to the three formers with medium CA.



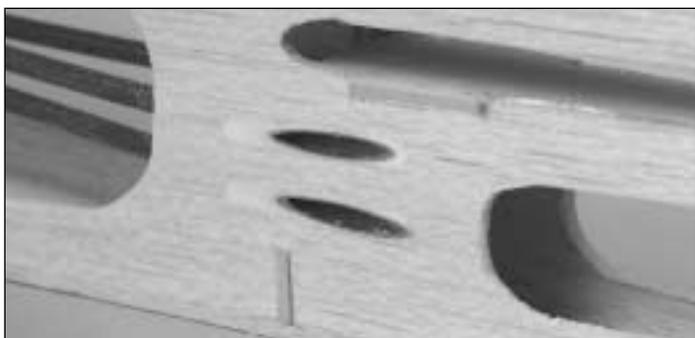
- ❑ 7. You're about to mix epoxy to work on the aft end of the fuselage. Before you do so, test fit the die-cut 1/8" ply **stab saddle**. Lightly sand as needed for a perfect fit. Temporarily remove the stab saddle.

- ❑ 8. Mix 30-minute epoxy and use some of it to install the stab saddle.



❑ 9. Mix the remaining epoxy with microballoons and epoxy the pushrod tubes to the slots in the fuse sides. Completely fill the slots with the microballoons/epoxy mix.

❑ 10. Allow the epoxy in both areas to cure completely.



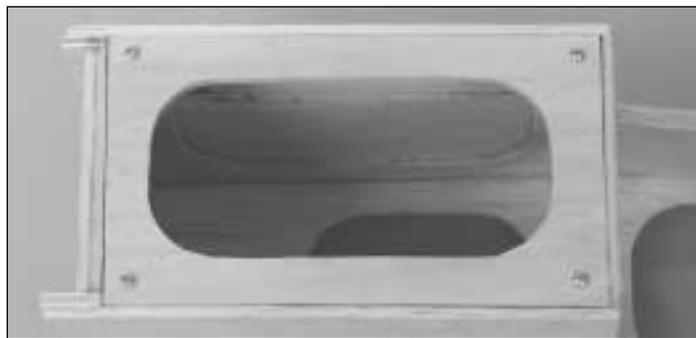
❑ 11. After the epoxy has cured, use a bar sander and 150-grit sandpaper to sand the outer pushrod tubes and filler flush with the fuselage sides.

❑ 12. From a 1/4" x 3/8" x 4" basswood stick, cut four 3/8" long **tank hatch supports**.



❑ 13. Glue one tank hatch support in each corner of the tank compartment, aligned with the bottom edge of the fuse doubler.

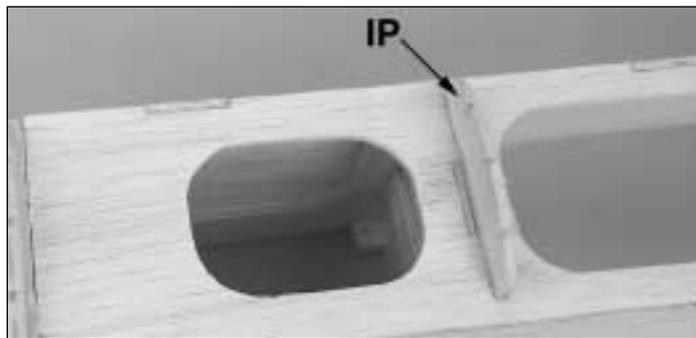
❑ 14. Temporarily position the die-cut 1/8" ply **tank hatch** over the compartment. Drill a 1/16" hole through each of the corners of the tank hatch, keeping the holes centered on the support blocks.



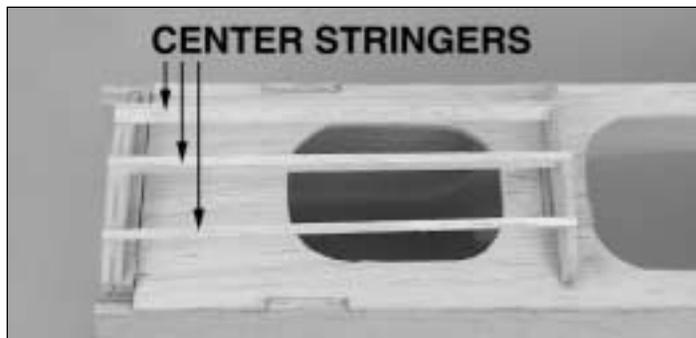
❑ 15. Temporarily mount the tank hatch to the fuse with four #2 x 3/8" sheet metal screws.

❑ 16. Remove the tank hatch and harden the threads in the blocks with thin CA. **Note:** Be careful not to fill the holes with CA — just wet them with enough CA to harden the threads.

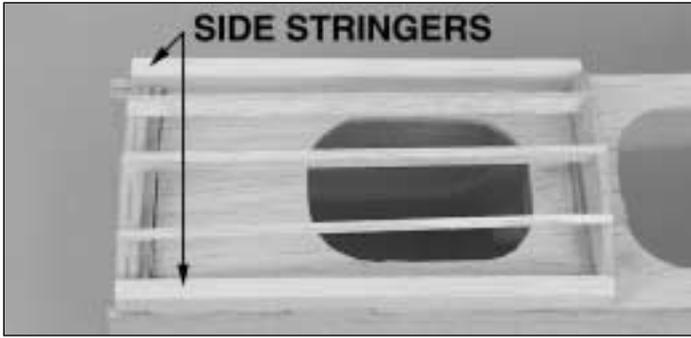
### ***Build the Fuselage Front Deck and Turtle Deck***



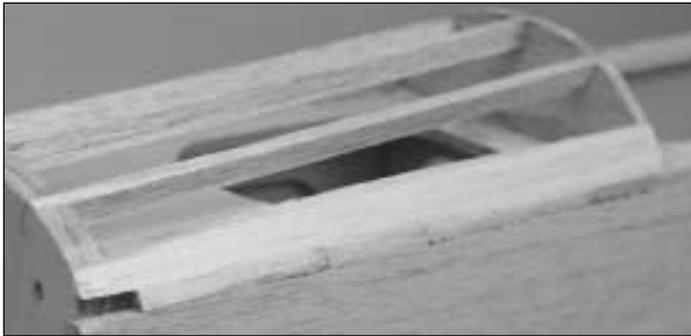
❑ 1. Glue the die-cut 1/8" balsa **instrument panel (IP)** vertically to the fuse top.



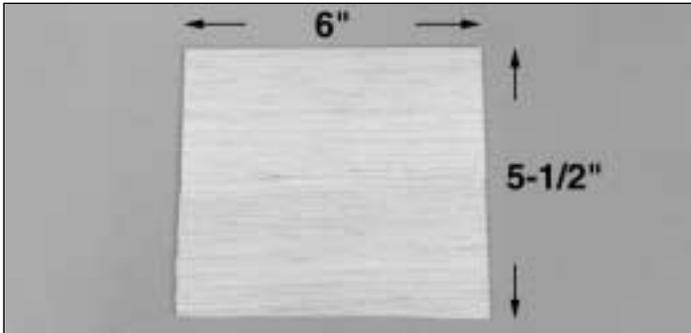
❑ 2. From a 1/8" x 1/4" x 24" balsa stick, cut, fit and glue the three **front deck center stringers** into the firewall and IP.



3. From a 1/4" x 3/8" x 18" balsa stick, cut, fit and glue the two **front deck side stringers**.



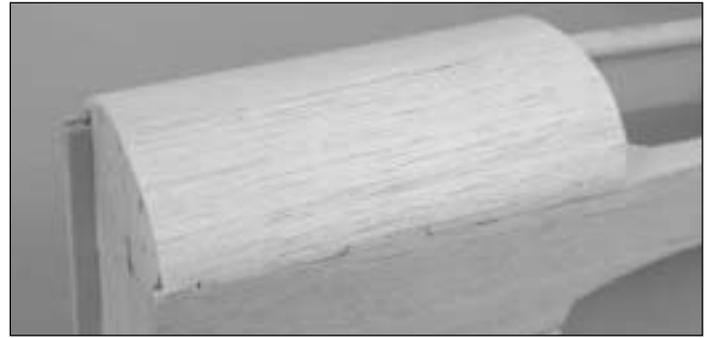
4. Round the side stringers to match the firewall and the instrument panel.



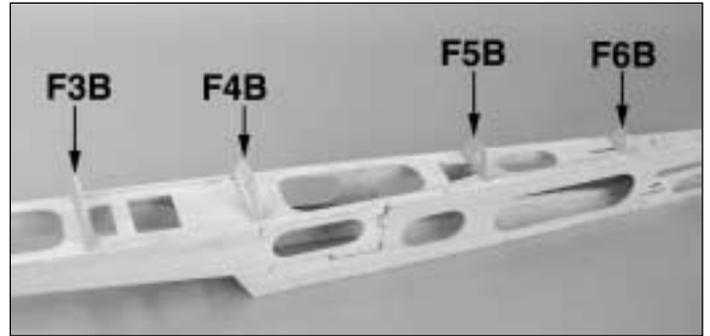
5. From a 3/32" x 2-3/4" x 24" balsa sheet, cut two 6" sheets. Edge glue these two sheets together, making one 3/32" x 5-1/2" x 6" sheet. Set the remaining 12" piece aside.



6. Wet the outside of the 5-1/2" x 6" sheet with water or a water/ammonia mix. Glue it to the firewall, instrument panel and stringers.

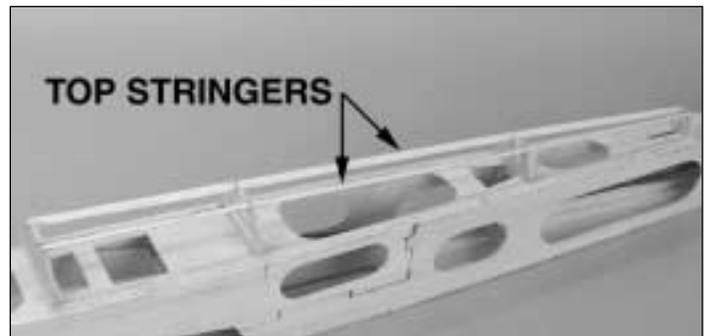


7. Shape the sides of the sheeting so it blends with the fuse side. Sand the front edge flush with the firewall. Sand the TE flush with the instrument panel.

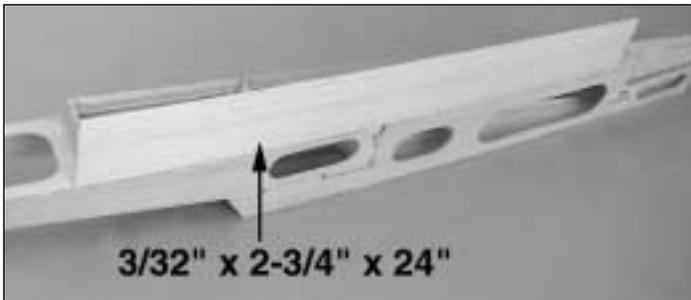


8. Glue the die-cut 1/8" balsa formers **F3B**, **F4B**, **F5B** and **F6B** vertically to the fuse top.

9. Position and glue the two 1/8" x 1/8" x 24" balsa **gluing stringers** to the fuse top, with one end butting against F6B and the other end extending beyond F3B. Trim the 1/8" x 1/8" stringers flush with the front of F3B.



10. Fit the two 1/8" x 1/4" x 24" balsa **turtle deck top stringers** in the slots in F3B, F4B and F5B. Glue the aft end to the front edge of F6B as shown. Glue the stringers to F3B, F4B and F5B. Trim the front end flush with the front of former F3B.



11. Edge glue a 3/32" x 2-3/4" x 24" balsa sheet to the fuse top, with the forward edge extending beyond F3B and the aft edge extending past F6B.



12. Wet the outside of the sheeting. Use thick CA to glue the sheeting to the formers and the top stringer.



13. Trim the sheeting flush with the top of the top stringer.

14. Repeat steps 11 through 13 to sheet the other side of the turtle deck.

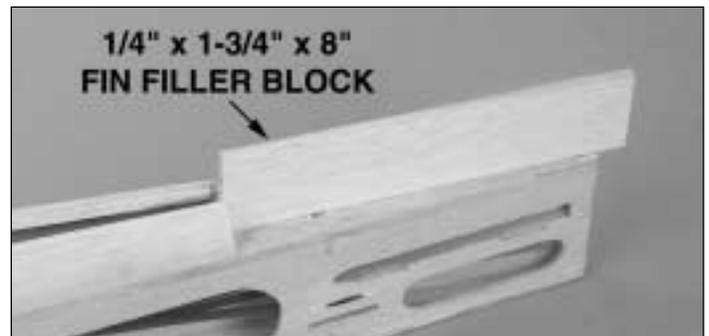


15. Sand the tops of the sheeting flush with the tops of the formers.

16. Trim the front of the sheeting flush with F3B. Trim the aft end of the sheeting flush with F6B.



17. Trim the aft end of the 1/8" x 1/4" top stringers so there is at least a 1/4" gap between them, allowing sufficient space for the fin.



18. From a 1/4" x 1-3/4" x 36" balsa stick, cut one 8" **fin filler block**. Tack glue the fin filler block where the fin will be located, aligning the TE of F6B and centered on the slot in the middle of F6B.



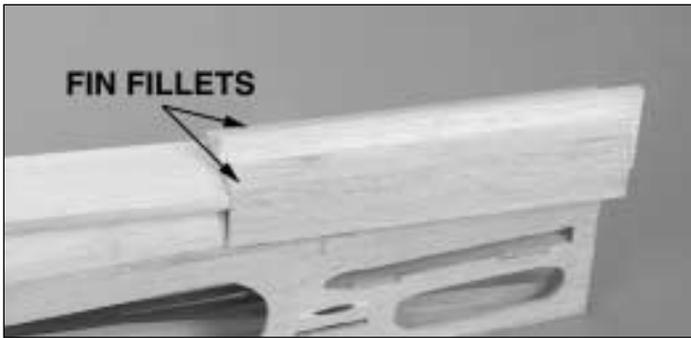
19. Glue the remaining 1/4" x 1-3/4" x 28" balsa **turtle deck top** to the top of the turtle deck sheeting and the tops of the formers. **Note:** Do not glue it to the fin filler block.



20 Trim the front of the turtle deck top flush with the front of F3B.

## Mount the Stabilizer and Fin

- ❑ 1. If you have not already done so, make sure the stab and fin are final sanded to a smooth finish, as it will be a little more difficult to do so after they are glued to the fuselage.



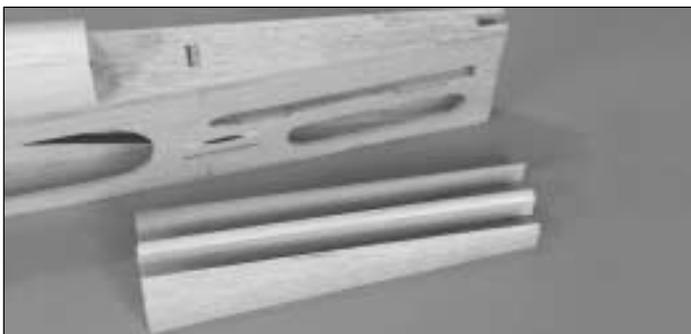
- ❑ 21. Cut the 3/4" x 1-1/4" x 15" balsa stick in half, making two 7-1/2" fin fillets. Tack glue these fillets to the fuse top and the fin filler block.

\*\*\*\*Time to make some dust!\*\*\*\*

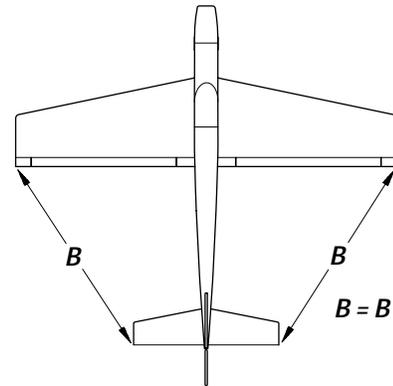


- ❑ 22. Shape the turtle deck top to the round shape of the turtle deck, using the cross sections as a reference. Do the same for the fin fillets and the fin filler block, blending everything smoothly. **Hint:** Start your shaping with a razor plane, then use a course sand paper (around 100 grit), then gradually work with finer paper until you are using 400 grit to get a really nice final shape that's cleanly sanded.

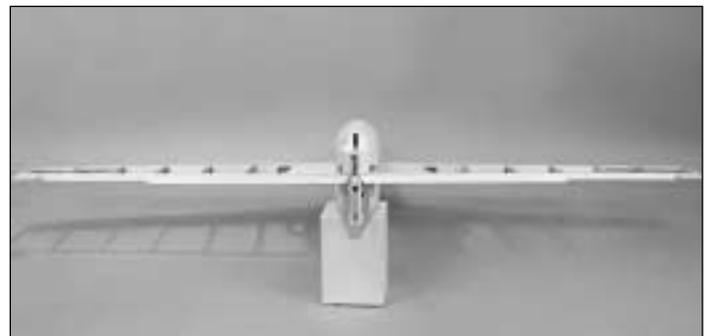
- ❑ 23. Final sand the rest of the fuse, being sure to clean up any rough spots or CA smears that will show through your covering work. Use balsa filler as necessary to fix any small nicks or dings that happened "mysteriously" during assembly.



- ❑ 24. Cut the fin fillets and the fin filler block from the fuse. Separate the fin fillets from the fin filler block.

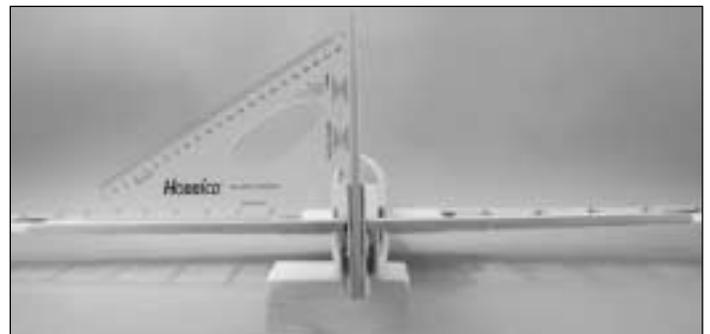


- ❑ 2. Mount the wing to the fuselage. Center the stab in the stab slot. Use a string from the center of the firewall to align the stab the same as was done with the wing.



- ❑ 3. Stand about six to ten feet behind the model and see if the stab is parallel with the wing. If necessary, sand the stab base with a thin sanding block until the stab is parallel with the wing.

- ❑ 4. Epoxy the stab in place, double-checking the alignment. Wipe any excess epoxy from the stab with a paper towel and alcohol. **Hint:** After the epoxy has cured, you may remove the wing from the fuse and set it aside if you prefer to make the model easier to handle.



- ❑ 5. Fit the fin in place and check that it is perpendicular to the stab with a square. If it is not perpendicular, small adjustments can be made by sanding a taper on the fin post,

allowing it to tilt to either side. When satisfied with the alignment of the fin, glue it in place with thin CA. **Hint:** Proper alignment of your fin to your stab is critical to proper flight performance, so take your time to be sure it is just right.



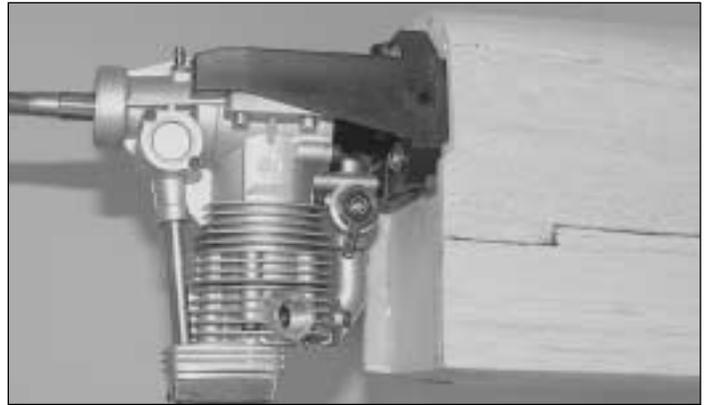
- ❑ 6. Use medium CA to glue the fin fillets in place.
- ❑ 7. Use a small amount of filler to fill the gap at the front of the fin.

### ***Mount the Engine***

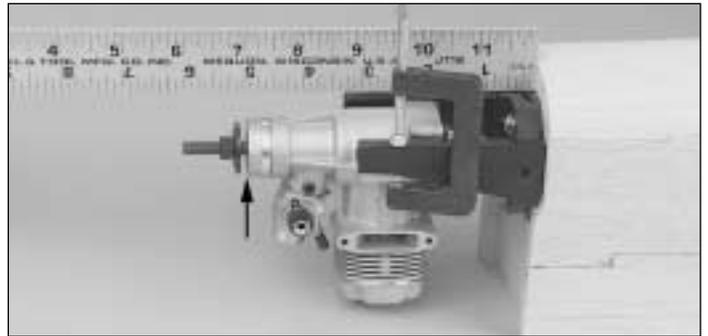
- ❑ 1. Cut the “spreader bars” from the supplied Great Planes engine mount, then use a hobby knife to remove any flashing leftover from the molding process so that the halves fit together well.
- ❑ 2. Temporarily attach the engine mount to the firewall with four 6-32 x 1" bolts and #6 flat washers. Do not tighten the screws all the way, because you still need to adjust the mount.



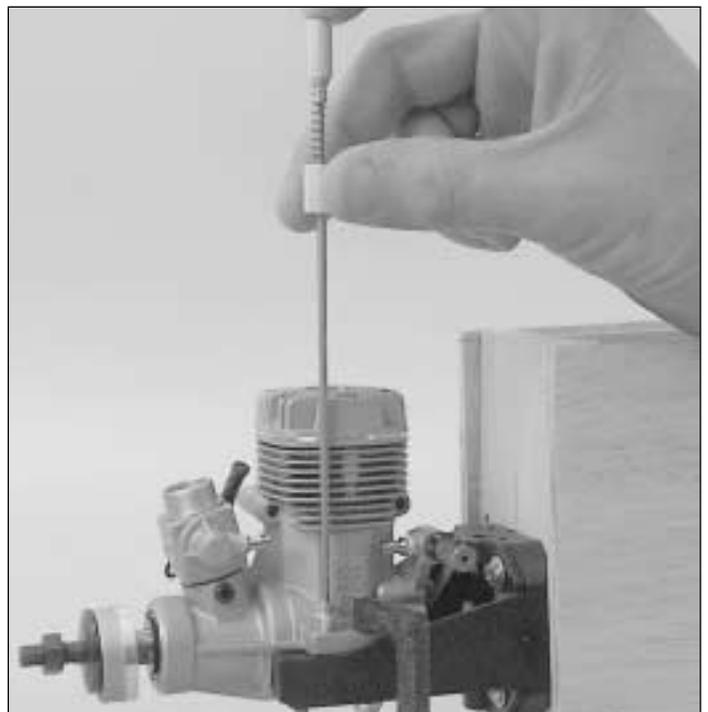
- ❑ 3. Place the engine on the mount and slide the halves in or out until the engine fits properly. Position the mount so the molded-in “tick marks” are equally spaced from the horizontal centerline you drew on the firewall. When the engine mount is adjusted and positioned, tighten the mounting screws.



**Note:** If you are using a larger engine than the .46 it may be necessary to sand the left fuse side flush with the firewall, so that the mount fits.



- ❑ 4. Position the engine on the mount so the drive washer (or the back of the spinner) is 5" away from the firewall and clamp in place.

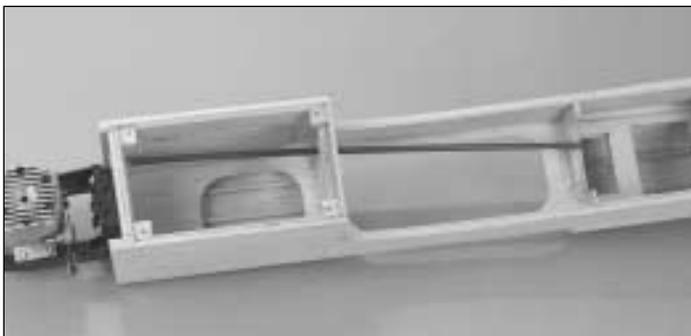


- ❑ 5. Use the **Great Planes Dead Center™ Engine Mount Hole Locator** (GPMR8130) to mark the locations of the bolt holes. Remove the engine from the mount and drill four 7/64" holes. Tap the four holes with a 6-32 tap. Mount the engine with the four 6-32 x 1" socket head bolts.

## Install the Servos and Make the Pushrods



- ❑ 1. Glue the die-cut 1/8" ply **servo tray** in place in the fuse.



- ❑ 2. Select one of the remaining grey outer pushrod tubes. Use coarse sandpaper to roughen the outside of the tube so glue will stick. Slide it through its hole in the firewall, until it protrudes 1/8" past F3A. Glue it into the firewall. Cut the pushrod outer tube 1/4" in front of the firewall.



- ❑ 3. Mount the throttle, elevator and rudder servos, using the hardware supplied with the radio.

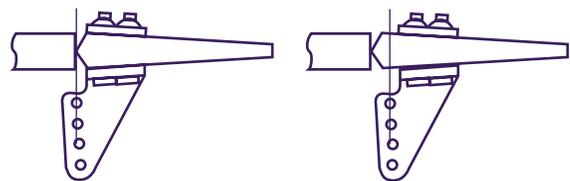


- ❑ 4. Bend and cut a 36" throttle pushrod wire to fit your engine installation, using the drawing on the fuselage plan as a guide. Install a nylon clevis and insert the pushrod through the guide tube. Make adjustments to the bends in the wire so the pushrod aligns with the carburetor arm on the engine, then temporarily connect the clevis to the carburetor arm. Temporarily mount the muffler and confirm that the muffler will not interfere with or touch the throttle pushrod. Make adjustments to the bends in the wire if necessary.

- ❑ 5. Temporarily install the brass Screw Lock Pushrod Connector into the throttle servo arm, then adjust the bend in the throttle pushrod if necessary and fit it into the connector. Remove the engine mount with the engine still attached.

- ❑ 6. Thread a nylon clevis about 20 turns onto the end of one of the 36" pushrods, making one elevator pushrod assembly. Remove the **backing plate** from a nylon **control horn** and connect the horn to the clevis in the outer hole. Make another identical elevator pushrod assembly from another 36" pushrod.

- ❑ 7. Slide the elevator hinges into the elevator halves and then into the stab. **DO NOT** glue the elevators to the stab at this time.



Correct

Incorrect

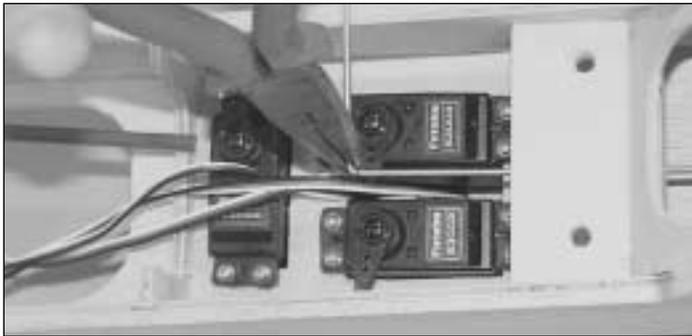


- ❑ 8. Insert both elevator pushrods into the upper pushrod tubes. Position the control horns on the elevators as shown

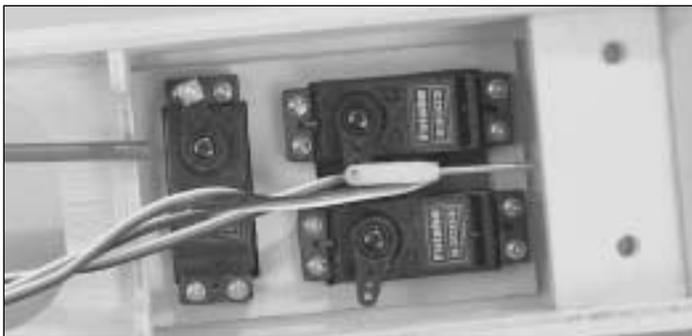
in the sketch and on the plan. Use a ballpoint pen to mark the location of the control horn mounting holes and drill 3/32" holes at the marks. Temporarily mount the control horns to the elevators with the backing plates and 2-56 x 5/8" screws.



❑ 9. With the elevator servo in place, the servo arm perpendicular to the pushrod and the control surfaces in neutral position, use a felt tip pen to mark where one pushrod crosses the mounting holes in the servo arm.



❑ 10. Disconnect the clevis from the control horn on the wire you marked. Make a 90-degree bend at the mark you made. Temporarily install a nylon Faslink on this pushrod, then cut the wire so it slightly protrudes out of the Faslink. **Hint:** If you prefer to bend and cut the pushrod outside the fuselage, remove the pushrod, then make the 90-degree bends and cut the wire. Unscrew the clevis and reinstall the pushrod in the guide tube from the front, then screw the clevis back on.



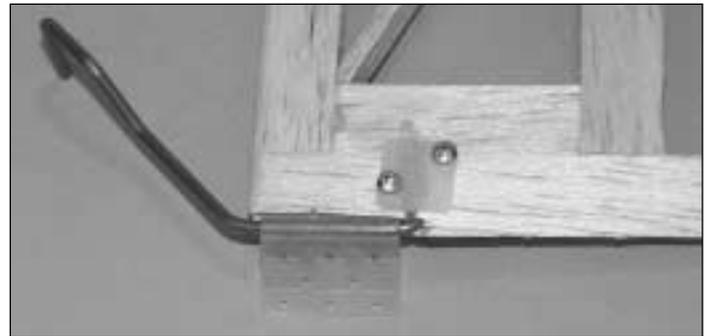
❑ 11. Connect the bent pushrod to the servo with the Faslink. If necessary, enlarge the hole in the servo arm with a 5/64" drill bit (or a #48 bit for precision). Cut the second pushrod 1/8" behind the Faslink (being sure the elevator half is neutral).



❑ 12. While keeping both elevators centered, connect the two elevator pushrods to each other with two 5/32" wheel collars and 6-32 x 1/4" hex head cap screws as shown in the photo. We recommend using thread locking compound on the cap screw threads.

❑ 13. Temporarily mount the rudder with the hinges the same as you did with the elevators. **DO NOT GLUE.**

❑ 14. Mark the location of the tail gear wire on the rudder and the nylon tail gear bearing on the fuselage. Remove the rudder and drill a 7/64" hole in the leading edge of the rudder at the mark you made for the tail gear wire. Cut a groove in the LE of the rudder for the nylon tail gear bearing. Test fit the tail gear wire in the rudder.

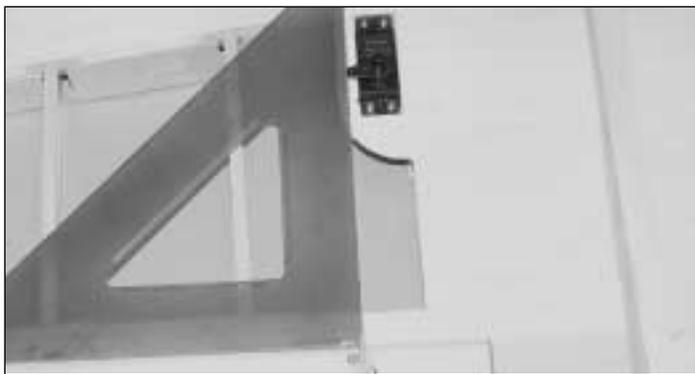


❑ 15. Mount the control horn to the rudder, trapping the tail gear wire between the screws.

❑ 16. Cut a slot in the aft edge of the fuse (the fin post) at the marks you made for the nylon tail gear bearing. **Without using any glue,** join the rudder to the fin with the tail gear bearing and hinges.

❑ 17. Hook up the rudder pushrod the same as you did with the first elevator.

❑ 18. Mount the aileron servos in the wing with the screws provided with the radio.



❑ 20. Locate the control horn on the aileron using a square so that the pushrod will be perpendicular to the hinge line. Mount the control horn and back plate with the 2-56 x 5/8" screws.

❑ 21. Screw the two remaining clevises twenty turns onto two 12" pushrods.

❑ 22. Connect the clevis to the control horn. Center the aileron and the servo arm. Mark the pushrod where it crosses the servo arm. Bend the pushrod and connect it to the servo arm with a Faslink. Trim the excess wire that sticks out past the Faslink.



❑ 5. Glue leftover plastic strips to both halves overlapping the center joint.



❑ 5. Use your hobby knife or a rotary tool with a sanding drum to clean up the crankshaft opening and air inlet.



❑ 6. If you are using the O.S. .46FX, cut along the cut lines provided for the needle, glow plug, muffler and muffler screws. If you are using a different engine, working carefully, trim and fit the cowl to your specific engine.

❑ 7. Mount the engine mount with engine to the firewall. Align the cowl with the 2-1/4" spinner. Attach the cowl to the fuse with four #2 x 3/8" sheet metal screws.

## Assemble the Cowl

❑ 1. Trim the cowl halves along the cut lines provided. **Note:** Save the strips that are cut off for joining the cowl halves.

❑ 2. Use your bar sander to carefully true the edges where the halves will be joined.

❑ 3. Test fit the cowl halves and make adjustments where necessary for the best possible fit.



❑ 4. Join the halves and carefully glue them together with thin CA. **Note:** Do not use CA accelerator on the ABS plastic as it may develop cracks and/or keep the paint from adhering.

8. Remove the cowl and engine mount with engine. Harden the threads in the fuse with thin CA.

9. Use Bondo or other filler on all seams and blemishes. When dry, wet sand with 400-grit sand paper until you are satisfied it is prepared for paint. **Hint:** You may want to begin the process of priming and wet sanding your cowl now so it is ready for paint when you are.

### **Balance the Model Laterally**

**Do not confuse this procedure with “checking the C.G.” which will be discussed later in the manual.**

An airplane that is laterally balanced will track better during aerobatic maneuvers. Taking your time with this procedure will make a difference in your models' all around performance from spins to loops, from inverted flight to slow speed handling.

1. With the wing level and attached to the model (and the engine and muffler installed), lift the model by the propeller shaft and the aft bottom of the fuse. This may require an assistant. Do this several times.

2. The wing that consistently drops indicates the heavy side. Balance the model by adding weight to the light wing tip.

### **Prepare the Model for Covering**

1. If you've hooked up the pushrods to the servos before covering the model, disconnect and remove all the pushrods and remove the hinges and control horns from the ailerons, elevators and rudder. Remove the engine mount and any other hardware you may have installed.

2. Most of the model should be rough-sanded by now with all the tabs and rough edges sanded even. Fill all dents, seams, low spots and notches with HobbyLite™ balsa-colored filler.

3. After the filler has dried, use progressively finer grades of sandpaper to even all the edges and seams and smooth all surfaces. Remove all balsa dust from the model with compressed air or a vacuum with a brush and a tack cloth.

## **Finish the Model**

### **COVERING TECHNIQUE**

Cover the model with **Top Flite MonoKote Film**. Here are a few suggestions to gaining a really professional appearance:

Since the tips of the elevators and stab are squared off, it is easiest to cover the tips before you cover the tops and bottoms. Do the same for the fin, rudder and the wing.

Before you cover the fuselage, first apply 1/4" wide strips of MonoKote film in the bottom corners of the stab and fuse and strips which are oversized by a 1/4" to cover the fin/fillet/stab transitions. Then proceed to cover the fin and stab with pre-cut pieces that meet in the corners and overlap the 1/4" strips. **Never cut the covering on the stab and fin after it has been applied except around the leading and trailing edges at the tips.** Modelers who do this may cut through the covering and into the stab or fin. This will weaken the structure to a point where it may fail during flight.

Some modelers drill a small hole in each stab rib and the trailing edge of the stab to allow expanded gas to exit while heating the MonoKote film. This keeps the covering from “ballooning” and allows you to securely bond it to the entire stab. The same thing can be done with the fin and rudder.

Since the ailerons are long “strip” ailerons some modelers prefer to cover the top and bottom with one strip of MonoKote film by covering the bottom first, then wrapping it around the leading edge over the top.

### **PAINTING**

After the model is covered, use fuelproof model paint, 30-minute epoxy thinned with alcohol or finishing resin to coat areas that may be exposed to raw fuel or exhaust residue. These are areas such as the firewall, front and back of the belly pan, fuse openings for the wing and fuse doubler and the tank hatch.

Top Flite LustreKote® fuelproof paint is recommended for painting the ABS cowling. At least one coat of LustreKote primer is highly recommended to fill all the small scratches left from sanding as well as small pin holes in any filler you applied. Wet sand between coats with 400-grit sandpaper and apply a second coat of primer if necessary. If the parts are primed properly, only one coat of color should be required.



## EXPERT TIP

### Painting Butyrate Canopies With Top Flite LustreKote®

Top Flite LustreKote is a high quality, fuelproof paint that perfectly matches Top Flite MonoKote. The paint is well suited to putting a high quality finish on ABS but does have a tendency to curl materials such as styrene and butyrate.

**Do not paint the clear butyrate canopy or styrene with LustreKote directly from the can. It can cause the plastic to curl. We recommend Formula-U for painting the clear canopy directly from the can, or the following procedure can be used for successful results with LustreKote.**

The following procedure allows you to airbrush LustreKote with good results. The recommended procedure requires that the paint be sprayed into a jar or plastic mixing cup.

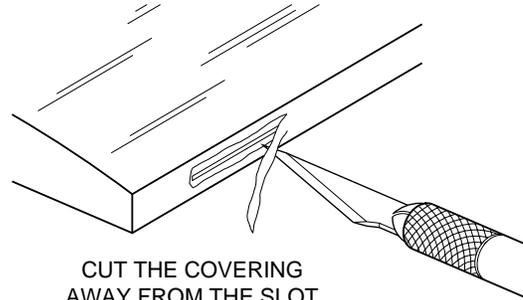
This is best done by spraying the paint through a small brass tube or straw into the jar. For best results spray no more than 1/2 oz. of paint into the jar at a time. As the propellant “boils off” it will cause the paint to foam slightly. Leave the paint in the open container, stirring every 15 minutes until no more foam appears on the surface of the paint and the paint has warmed to room temperature. This allows the propellant and some of the thinner to evaporate out of the paint. Depending on the amount of paint in the jar, this process may take about 1 hour.

After allowing the propellant to boil off, use an airbrush to spray paint the canopy. If the paint is too thick to spray properly, it can be thinned with a small amount of lacquer thinner. Do not thin with more than 40% thinner. In general about 10% thinner will adequately thin the paint for airbrushing. The paint can also be brushed on, but brushing will not produce the high quality finish of spraying.

If you have any doubt about the material you are painting we suggest that you try painting on a small piece of leftover material to be sure that you are satisfied with the end result.

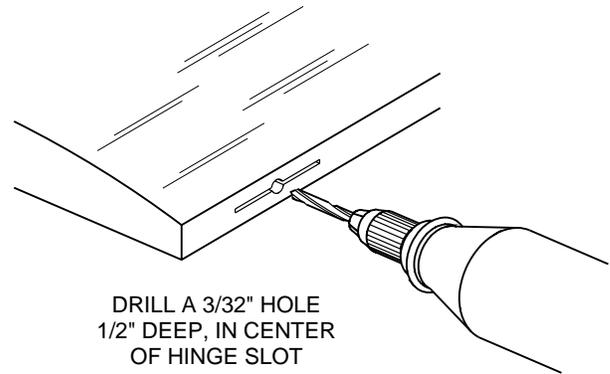
## FINAL HOOKUPS AND CHECKS

### Join the Control Surfaces



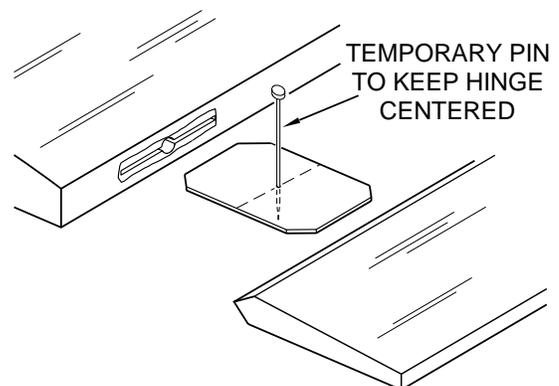
CUT THE COVERING  
AWAY FROM THE SLOT

- 1. Start with the elevators and stab. Cut the covering from the hinge slots – don't just slit the covering but remove a small strip the size of the hinge slot.



DRILL A 3/32" HOLE  
1/2" DEEP, IN CENTER  
OF HINGE SLOT

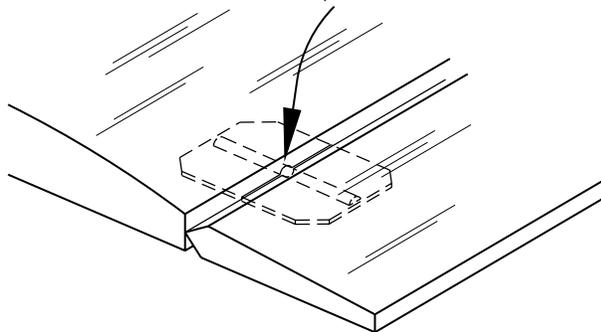
- 2. Drill a 3/32" hole 1/2" deep in the center of each hinge slot. A high speed Moto-Tool works best for this. If you use a regular drill, clean out the hinge slots with your #11 blade.



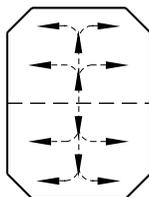
TEMPORARY PIN  
TO KEEP HINGE  
CENTERED

- 3. Without using any glue, fit the hinges in the elevators or stab. **Do not glue the hinges yet.** As you join the elevators to the stab, confirm that the hinges are equally inserted in the elevators and the stab. Insert a small pin in the center of the hinges to keep them centered.

ASSEMBLE, THEN APPLY 6 DROPS  
OF THIN CA TO CENTER  
OF HINGE, ON BOTH SIDES



THE CA WICKS  
ALONG THE "TUNNELS"  
TO THE ENTIRE  
HINGE SURFACE



- 4. Remove the pin and add 6 drops of thin CA to the center of all the hinges on both the top and the bottom.

**Do not use accelerator on any of the hinges. Do not glue the hinges with anything but thin CA and do not attempt to glue one half of the hinge at a time with medium or thick CA. They will not be properly secured and the controls could separate while the model is in flight.**

- 5. Join the rudder to the fin with the hinges and use 30-minute epoxy to simultaneously glue the tail gear wire in the rudder and the tail gear bearing in the fuse. **Do not glue the nylon bearing to the rudder.** Glue the hinges in position with thin CA.

- 6. Prepare the hinge slots in the ailerons the same way you did for the tail surfaces. Glue the hinges with thin CA.

### ***Install the Hardware***

- 1. Assemble the fuel tank per the manufacturer's instructions. Install in the fuse with approximately 12" of fuel line each for the pickup and the vent lines on the tank.
- 2. Install a 1" tail wheel with a 3/32" wheel collar.
- 3. Reinstall your retracts or fixed gear in the manner you trial fitted them earlier.
- 5. Install the elevator, rudder and throttle pushrods, then install the control horns and hook them up the same way you did earlier.

- 6. Wrap the receiver and battery pack in at least 1/4" of foam rubber, then test fit them in the location shown on the plan. Do not permanently mount your receiver or battery pack until you have verified the C.G. (page 39).

- 7. Mount the receiver switch in a convenient location that will not interfere with the servos and pushrods inside the fuselage.

- 8. Route the receiver antenna. On our prototype we used the fourth pushrod tube to route the antenna to the rear of the fuse, then taped it to the fuse.

- 9. Some modelers prefer to cushion the wing with wing seating foam tape on the wing saddle of the fuselage. Apply 1/16" seating tape on the wing saddle of the fuselage if you choose.

- 10. Prepare the engine compartment for installing the cowl by connecting the fuel lines, installing a fueling valve (not provided), mounting the muffler and connecting the throttle pushrod. Install the cowl, then mount the spinner back plate, prop, prop washer and prop nut. Install the spinner.

### ***Attach the Canopy***

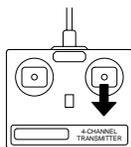
- 1. Place the canopy on the fuselage in the location shown on the plan, then temporarily hold it in position with tape. **Hint:** We chose to paint the canopy and thus avoid the added weight of a pilot. If you wish to select and install a pilot, do so now. You may want to mount it on a small balsa base, which can be glued to the MonoKote cockpit covering without additional weight.

- 2. Use a felt tip pen to **accurately** trace the canopy outline onto the MonoKote film covering.

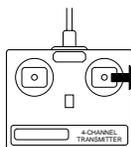
- 3. Using the lines you just drew as a reference, glue the canopy to the fuselage using rubber bands or masking tape to hold it in position until the glue dries. We recommend a glue specifically formulated for gluing on canopies such as Pacer "Formula 560" canopy glue. Formula 560 is like regular white glue (aliphatic resin) in that it dries clear and cleans up with water but sticks extremely well to butyrate and dries overnight (to allow for accurate positioning).

## Set the Control Throws

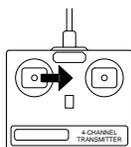
### 4-CHANNEL RADIO SETUP (STANDARD MODE 2)



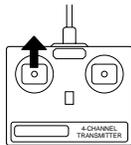
ELEVATOR MOVES UP



RIGHT AILERON MOVES UP  
LEFT AILERON MOVES DOWN



RUDDER MOVES RIGHT  
NOSE WHEEL TURNS RIGHT



CARBURETOR WIDE OPEN

We recommend the following control surface throws:

**NOTE:** The throws are measured at the **widest part** of the elevators, rudder and ailerons. Adjust the position of the pushrods at the control horns and servo horns to adjust the amount of throw. You may also use the ATV's if your transmitter has them, but the mechanical linkages should still be set so the ATV's are near 100% for the best servo resolution (smoothest, most proportional movement).

<b>ELEVATOR:</b>	High Rate	Low Rate
	7/16" up 7/16" down	5/16" up 5/16" down
<b>RUDDER:</b>	2-1/2" right 2-1/2" left	1-1/2" right 1-1/2" left
	<b>AILERONS:</b>	1/4" up 1/4" down

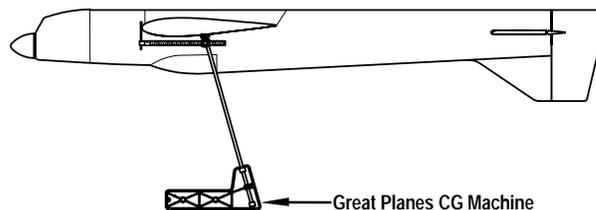
**NOTE:** If your radio does not have dual rates, then set the control surfaces to move **between** the high rate and low rate throws.

**NOTE:** The balance and control throws for the Tracer have been extensively tested. We are confident that they represent the settings at which the Tracer flies best. Please set up your model to the specifications listed above. If, after you become comfortable with your Tracer, you would like to adjust the throws to suit your tastes, that's fine. Too much throw can force the plane into a stall, so remember, "more is not better."

## Balance Your Model

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

**Balance the plane at 5-3/4" (146mm) back from the LE against the fuselage.**



1. Accurately mark the balance point on the **top** of the wing on both sides of the fuselage. Use thin strips of tape or a felt tip pen to make the marks. The balance point (**C.G.**) is located **5-3/4" [146mm] back from the leading edge** at the fuselage as shown in the sketch and on the wing plan. (**Hint:** Reference the full-size wing plan to help you locate the proper balance point.)

This is the balance point at which your model should balance for your first flights. After initial trim flights and when you become more acquainted with your Tracer, you may wish to experiment by shifting the balance up to **1/4" forward or back** to change the flying characteristics. Moving the balance **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 balance **aft** makes the model **more agile** with a lighter, snappier "feel" and often improves knife-edge capabilities. In any case, **please start at the location we recommend and do not at any time balance your model outside the recommended range.**

2. With the wing attached to the fuselage, all parts of the model installed (ready to fly) and an **empty** fuel tank, hold the model upside-down with the stabilizer level.

3. Lift the model at the balance point. If the **tail** drops when you lift, the model is "tail heavy" and you must add weight\* to the nose to balance the model. If the **nose** drops, it is "nose heavy" and you must add weight\* to the tail to balance the model. **NOTE:** Nose weight may be easily installed by using a "spinner weight" or gluing lead weights to the firewall. Tail weight may be added by using Great Planes (GPMQ4485) "stick-on" lead weights. Later if the balance is O.K., you can open the fuse bottom and glue the weights in permanently.

*\*If possible, first attempt to balance the model by changing the position of the receiver battery and receiver. If you are unable to obtain good balance by doing so, then it will be necessary to add weight to the nose or tail to achieve the proper balance point.*

□ 4. Once you have achieved your desired C.G., permanently secure your battery pack and receiver in their current location. We recommend securing your receiver and battery pack to pieces of leftover ply, using Velcro® strap so that the battery and receiver can be easily accessed for maintenance.

## PRE-FLIGHT

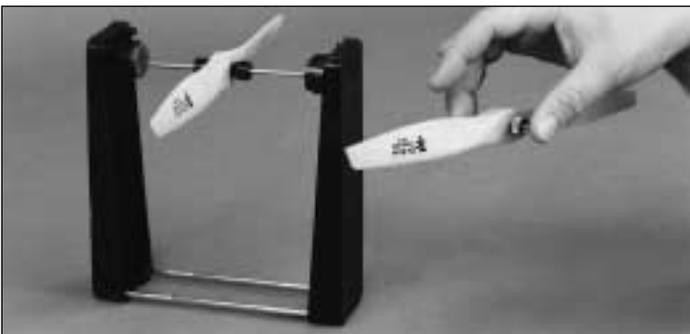
At this time check all connections including servo arm screws, Faslinks, clevises and servo cords. Make sure you have installed the **nylon retainer** on the Screw-Lock Pushrod Connector on the throttle pushrod at the servo arm and the **silicone retainers** on all the clevises.

## Charge the Batteries

Follow the battery charging procedures in your radio instruction manual. You should **always** charge your transmitter and receiver batteries the night before you go flying and at other times as recommended by the radio manufacturer.

## Balance the Propeller

Balance your propellers carefully before flying. An unbalanced prop is the single most significant cause of vibration. Not only may engine mounting screws vibrate out, possibly with disastrous effect, but vibration may also damage your radio receiver and battery. Vibration may cause your fuel to foam, which will, in turn, cause your engine to run lean or quit.



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

## Find a Safe Place to Fly

Since you have chosen the Tracer we assume that you are an experienced modeler. Therefore, you should already know about AMA chartered flying fields and other safe places to fly. If, for some reason you are a relatively inexperienced modeler and have not been informed, we strongly suggest that the best place to fly is an AMA chartered club field. Ask the AMA or your local hobby shop dealer if there is a club in your area and join. Club fields are set up for R/C flying and that makes your outing safer and more enjoyable. The AMA address and telephone number is in the front of this manual.

If a club and flying site are not available, find a large, grassy area at least 6 miles away from houses, buildings and streets and any other R/C radio operation like R/C boats and R/C cars. A schoolyard may look inviting but is too close to people, power lines and possible radio interference.

## Ground Check the Model

If you are not thoroughly familiar with the operation of R/C models, ask an experienced modeler to inspect your radio installation and confirm that all the control surfaces respond correctly to transmitter inputs. The engine operation must also be checked by confirming that the engine idles reliably and transitions smoothly and rapidly to full power and maintains full power indefinitely. The engine must be "broken-in" on the ground by running it for at least two tanks of fuel. **Follow the engine manufacturer's recommendations for break-in.** Make sure all screws remain tight, that the hinges are secure and that the prop is on tight.

## Range Check Your Radio

Whenever you go to the flying field, check the operational range of the radio before the first flight of the day. First, make sure no one else is on your frequency (channel). With your 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. While you work the controls have a helper stand by your model and tell you what the control surfaces are doing.

Repeat this test **with the engine running** at various speeds with a helper holding the model. If the control surfaces are not always responding correctly, **do not fly!** Find and correct the problem first. Look for loose servo connections or corrosion, loose bolts that may cause vibration, a defective on/off switch, low battery voltage or a defective cell, a damaged receiver antenna, or a receiver crystal that may have been damaged from a previous crash.

## Engine Safety Precautions

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

Keep all engine fuel in a safe place, away from high heat, sparks or flames as fuel is very flammable. Do not smoke near the engine or fuel; and remember that the engine exhaust gives off a great deal of deadly carbon monoxide. **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 and screw drivers that may fall out of shirt or jacket pockets into the prop.

Use a "chicken stick" or electric starter; follow instructions supplied with the starter or stick. Make certain the glow plug clip or connector is secure so that it will not pop off or otherwise get into the running propeller.

Make all engine adjustments from **behind** the rotating propeller.

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

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

## AMA Safety Code (Excerpt)

Read and abide by the following Academy of Model Aeronautics Official Safety Code:

### 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 to and avoid flying in the proximity of full scale aircraft. Where necessary an observer shall be used 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.

4. I will not fly my model unless it is identified with my name and address or AMA number, on or in the model.

5. 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. I will perform my initial turn after takeoff away from the pit or spectator areas and I will not thereafter fly over pit or spectator areas, unless beyond my control.

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

## FLYING

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

The Great Planes Tracer is a great flying pattern trainer that flies smoothly and predictably, yet is highly aerobic. The

Tracer does not, however, possess the self-recovery characteristics of a primary R/C trainer and should only be flown by experienced R/C pilots. This plane is fully capable of performing a full range of aerobatics - from simple loops and rolls to impressive horizon-to-horizon slow rolls. The Tracer is limited only by your abilities and imagination. Have Fun!

## Takeoff

Takeoff on "low" rates if you have dual rates on your transmitter—especially if you are taking off in a crosswind. For all models it is good practice to gain as much speed as the length of the runway will permit before lifting off. This will give you a safety margin in case the engine quits. When you initially advance the throttle and the tail begins to lift, the Tracer will begin to turn to the left (due to the torque of the engine—a characteristic of all taildraggers). Be prepared for this by applying sufficient right rudder to keep the Tracer running straight down the middle of the runway (or flying field). The left turning tendency will decrease as the plane picks up speed. Be sure to allow the tail to rise off the ground before lifting the model into the air. Depending on the surface you are taking off from, you will need to apply little or no up elevator until flying speed is reached. Don't hold the tail on the ground with too much up elevator, as the Tracer will become airborne prematurely and may stall. When the plane has gained enough flying speed to safely lift off, gradually and smoothly apply up elevator and allow the model to climb at a shallow angle (do not yank the model off the ground into a steep climb!).

## Flying

We recommend that you take it easy with your Tracer for the first several flights, gradually "getting acquainted" with this great pattern trainer as your engine gets fully broken in. If you feel as though you have your hands full, keep this one thing in mind: **pull back on the throttle stick to slow the model down.** This will make everything happen a little slower and allow yourself time to think and react. Add and practice one maneuver at a time, learning how the Tracer behaves in each. For smooth flying and normal maneuvers, use the low rate settings as listed on page 39. High rate elevator may be required for crisp snap rolls and spins.

Sometime well before it's time to land you should climb your Tracer to a safe altitude and cut the throttle to an idle and check out the model's low speed characteristics. Do this a few times so you know what to expect upon landing.

## Landing

When it's time to land, fly a normal landing pattern and approach. Keep a few clicks of power on until you are over

the runway threshold. For your first few landings, plan to land slightly faster than stall speed. Later, with a little practice you will find you can make slow 3-point landings. You'll notice that this pattern trainer model lands more like a typical sport model, to take the scare out of the 'glides forever' behavior of most pattern aircraft.

**Have a ball! But always remember to think about your next move and plan each maneuver before you do it. Impulsively "jamming the sticks" without any thought is what gets most fliers in trouble rather than lack of flying skill.**

## Pattern Flying

Now that you're feeling comfortable with taking off and landing your Tracer, the following maneuver sequences and trimming information will be of great benefit to you in getting your Tracer flying at its absolute finest, as well as challenging your own skills and giving you something fun to do on the flight line!

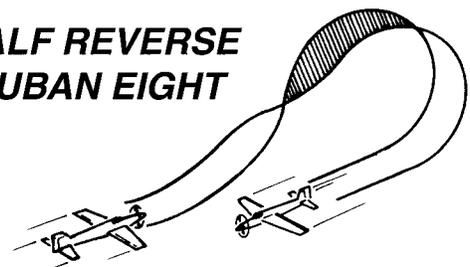
**NOTE:** The sequences provided are a great starting point whether you are thinking about flying pattern (be sure to join NSRCA and acquire the current year's sequences) or just looking for something different to fly.

The following is an excerpt from the Academy of Model Aeronautics *Competition Regulations 1999-2001* handbook. **Note:** (U) means upwind; (D) means downwind.

### SPORTSMAN PATTERN MANEUVERS

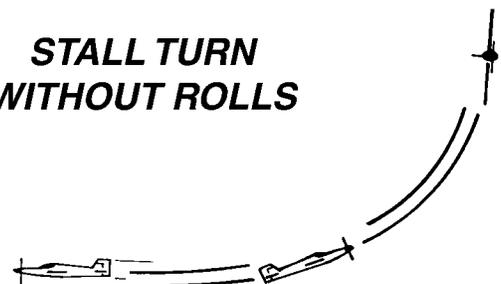
1. Takeoff (U)
2. Straight Flight Out (U)

### HALF REVERSE CUBAN EIGHT

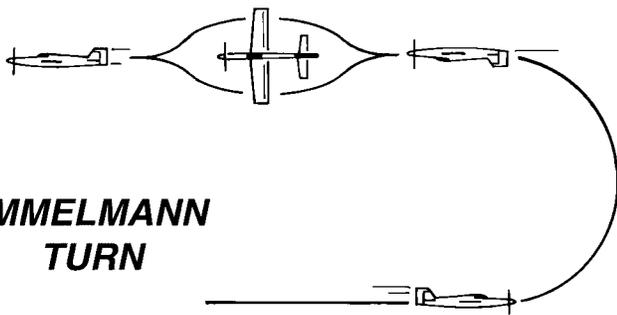


3. Half Reverse Cuban Eight
4. Straight Flight Back (D)

### STALL TURN WITHOUT ROLLS

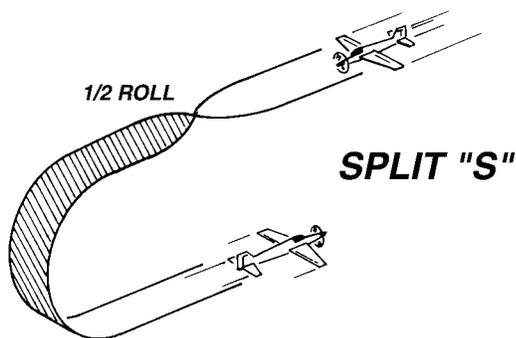


5. Stall Turn without Rolls (U)



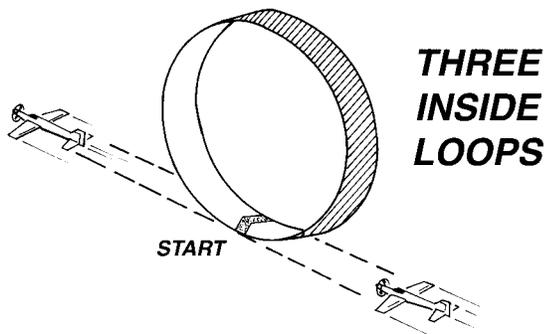
**IMMELMANN  
TURN**

6. Immelmann Turn (U)



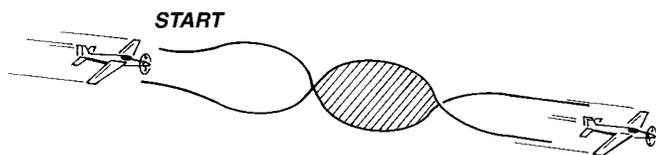
**SPLIT "S"**

7. Split "S"



**THREE  
INSIDE  
LOOPS**

8. Three (3) Inside Loops (U)



**ONE HORIZONTAL ROLL**

9. One (1) Horizontal Roll (D)

10. Landing (U)

**APPENDIX**

**FLIGHT TRIMMING**

**Note:** *The following article has been reprinted in part for future reference and also as a guide for your flight instructor or experienced flying partner to help you with trimming your*

*model. If further information is required, please contact your local hobby dealer, local flying club or call Great Planes at (217) 398-8970.*

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

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

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

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

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

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

Your first flights should be to ascertain control centering and control feel. Does the elevator always come back to neutral after a 180° turn or Split-S? Do the ailerons tend to hunt a little after a rolling maneuver? Put the plane through

its paces. Control centering is either a mechanical thing (binding servos, stiff linkages, etc.), an electronic thing (bad servo resolution or dead band in the radio system), or C.G. (aft Center of Gravity will make the plane wander a bit). The last possibility will be obvious, but don't continue the testing until you have isolated the problem and corrected it.

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

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

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

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

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

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

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

We now want to test the correct alignment of both sides of the elevator (even if they aren't split, like a Pattern ship's,

they can still be warped or twisted). Yaw and lateral balance will also come into play here, so be patient and eliminate the variables, one-by-one. The maneuver is a simple loop, but it must be entered with the wings perfectly level. Position the maneuver so that your assistant can observe it end-on. Always loop into the wind. Do several loops and see if the same symptom persists. Note if the model loses heading on the front or back side of the loop. If you lose it on the way up, it's probably an aileron problem, while a loss of heading on the way back down is most likely a rudder situation.

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

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

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

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

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

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

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

<b>TRIM FEATURE</b>	<b>MANEUVERS</b>	<b>OBSERVATIONS</b>	<b>CORRECTIONS</b>
CONTROL CENTERING	Fly general circles and random maneuvers.	Try for hands off straight and level flight.	Readjust linkages so that Tx trims are centered.
CONTROL THROWS	Random maneuvers	A. Too sensitive, jerky controls. B. Not sufficient control.	If A, change linkages to reduce throws. If B, increase throws.
ENGINE THRUST ANGLE <sup>1</sup>	From straight flight, chop throttle quickly.	A. Aircraft continues level path for short distance. B. Plane pitches nose up. C. Plane pitches nose down.	If A, trim is okay. If B, decrease downthrust. If C, increase downthrust.
CENTER OF GRAVITY LONGITUDINAL BALANCE	From level flight roll to 45-degree bank and neutralize controls.	A. Continues in bank for moderate distance. B. Nose pitches up. C. Nose drops.	If A, trim is good. If B, add nose weight. If C, remove nose weight.
YAW <sup>2</sup>	Into wind, do open loops, using only elevator. Repeat tests doing outside loops from inverted entry.	A. Wings are level throughout. B. Yaws to right in both inside and outside loops. C. Yaws to left in both inside and outside loops. D. Yaws right on insides and left on outside loops. E. Yaws left in insides and right on outside loops.	If A, trim is correct. If B, add left rudder trim. If C, add right rudder trim. If D, add left aileron trim. If E, add right aileron trim.
LATERAL BALANCE	Into wind, do tight inside loops.	A. Wings are level and plane falls to either side randomly. B. Falls off to left in loops. Worsens as loops tighten. C. Falls off to right in loops. Worsens as loops tighten.	If A, trim is correct. If B, add weight to right wing tip. If C, add weight to left wing tip.
AILERON RIGGING	With wings level, pull to vertical climb and neutralize controls.	A. Climb continues along same path. B. Nose tends to go to inside loop. C. Nose tends to go to outside loop.	If A, trim is correct. If B, raise both ailerons very slightly. If C, lower both ailerons very slightly.

1. Engine thrust angle and C.G. interact. Check both.

2. Yaw and lateral balance produce similar symptoms. Note that fin may be crooked. Right and left references are from the plane's vantage point.

3. Ailerons cannot always be trimmed without sealing the hinge gap.



## EXPERT TIP

### COMPUTER RADIOS.

As you prepare to fly the Tracer for the first time, there are a few features on computer radios we'd like to mention. There are many others, of course, but these are commonly used features on most computer radios. If you are using a non-computerized radio, this information may still be of interest to you for future installations.

**ATV or Travel Volume:** ATV is a wonderful feature of computer radios which allows you to make minor adjustments to how far a servo travels at its extremes. For example, you install the throttle pushrod and it's almost perfect, except you have some binding at wide open. Instead of struggling with the clevises to try to keep full throttle but not have the binding, you can turn down the ATV slightly until the binding is gone.

Why only adjust ATV slightly? Control linkages are really just a lesson in leverage. The less distance the servo is moving for a given throw at the surface, the less leverage you have given the servo to do the job. Thus the lower you set the ATV the less power you are leaving for the servo to apply to the surface. Additionally, a servo has only so many points within its range of motion. By cutting its range in half, you've also diminished the precision of the servo by 50%. Because of both of these issues, we strongly recommend setting the high rates as close as possible to 100% on the ATV.

**Dual Rates:** Setting dual rates helps make your model easier to fly in a variety of situations. For example, an expert pilot who wants to do torque rolls will need a large amount of control throw. However, s/he does not want that same huge volume of throw when executing perfectly smooth loops or slow rolls. Low rates give your model a soft feel, with aggressive responsiveness just a flip of a switch away.

**Exponential, the Best of Both Rates:** Exponential is a feature which modelers tend to either love or hate. The benefits of exponential are that they make the elevator, for example, feel like it is on low rates when you are moving the stick near center; however, when you get farther from center the model gets progressively more responsive. The reason this is helpful is that it allows you to make soft, minor adjustments when small corrections are needed, but still allows you sufficient throw to make major changes at full stick. For example, you can smoothly level the wings while flying along straight and level without over-controlling, yet still have enough aileron throw at full stick to complete a one-second roll.

**Idle Down and Throttle Kill:** Idle down allows you to have a switch set for a high idle, ideal for most aerobatics where you have little or no risk of dead sticking, as well as a lower idle setting for, say, landings, taxiing and minimum throttle maneuvers such as spins. The throttle kill setting on most computer radios will idle your engine down whatever percent you set it so that your engine will shut off when the switch is thrown AND the throttle stick is in the idle position. This is an excellent safety feature to shut off your engine in emergency situations.

## OTHER KITS AVAILABLE FROM GREAT PLANES



Great Planes® Giles G-202

With a mild .46, this kit flies slowly enough to be a good second model. Use a hot .46 FX and it's a MiniMAC terror. Install a 4-stroke .91, and performance is unlimited! Designed by 2-time U.S. IMAC National Freestyle Champion Mike Cross, the Giles G 202 takes maximum advantage of self-aligning, slot and tab construction to build fast, straight and strong. Longitudinal ply rails inside the fuselage absorb "touchdown" stress from the included, heavy-duty aluminum landing gear. Dual aileron servos deliver swift, sure input for greater control authority—and the radio compartment offers room to install optional twin elevator servos that simplify radio set-up, tighten linkages and boost servo power. **GPMA0238**



Great Planes Extra 300S .40-size

Ideal for MiniMAC, Great Planes' sport-scale Extra 300S kit requires no more experience, expense or assembly work than the average mid-size sport model. It minimizes building challenges with CAD-engineered, perfectly interlocking parts, a photo-illustrated instruction manual and accurate, full-size plans. The fully symmetrical wing comes with preshaped and notched leading and trailing edges and D-tube construction to maximize strength. Economize by using the engine from your .40-size sport trainer...or use a "hot" .40 engine to fly unlimited vertical! **GPMA0235**



# TWO VIEW DRAWING

*Use copies of this page to plan your trim scheme*

