Aerobatic .46-.61 Sport-Scale Kit

GILES G-202

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.

While this kit has been flight tested to exceed normal use, if the plane will be used for extremely high stress flying, the modeler is responsible for taking steps to reinforce the high stress points.

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

GREAT PLANES® MODEL MANUFACTURING COMPANY

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WWW.GREATPLANES.COM

GIL6P03 V1.0

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PROTECT YOUR MODEL, YOURSELF & OTHERS...FOLLOW THIS IMPORTANT SAFETY PRECAUTION

Your Giles G-202 is not a toy, but a sophisticated, working model that functions very much like an actual airplane. Because of its realistic performance, the Giles, 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
Tele. (800) 435-9262
Fax (765) 741-0057
Or via the internet at: http://www.modelaircraft.org

INTRODUCTION

Designed and Engineered by Michael Cross
Instruction Manual by Michael and AnnMarie Cross

Congratulations and thank you for purchasing the Great Planes Giles G-202. We'd like to provide you a bit of history on our selection of this aircraft as the newest release in the Great Planes scale aerobatic line.

Richard Giles noted a trend in the International Aerobatic Club (I.A.C.) competition arena toward bigger, heavier, more costly "super monoplanes," and he wanted to do better. The resulting "full-scale" Giles G-200 and G-202 were designed specifically to be reasonably priced, low wing loading, unlimited level performers on reasonably priced 4-cylinder engines. Likewise, the Great Planes Giles G-202 is intended to provide you unlimited level competition performance with a low wing loading and a reasonably priced power plant.

We're honored to be able to feature Mr. Bob Stark's 1998 Giles G-202 color scheme here on our Giles G-202. Mr. Stark is an avid I.A.C. competitor, judge and president of his I.A.C. chapter. Mr. Stark began competing at the advanced level in 1997, and in 1998 he and his Giles G-202 earned a position on the US Advanced Aerobatic Team, striving for the 1999 Advanced World Champion title.

The first time we laid eyes on Mr. Stark's color scheme, we found it striking and exceptional for model competition. When asked about its development, he told us that many, many hours and 24 months of color schemes displayed throughout his home led to the selection of the *"dramatic contrast between the bright yellow and the deep blue"* and that his primary concerns were *"eye appeal on the ramp and visibility in the air. I wanted a plane that would look like a winner sitting on the ramp and one that the judges could see from any angle in any light."* He feels he succeeded with his line-setting broad straight stripes for easy judging and bright contrasts. We agree.

The Giles is a rather "square shaped" airplane with well defined lines. Coincidentally, this makes it exceptionally easy to build and cover–especially for a semi-scale sport model. Framing the model is very straightforward, as most of the structure features interlocking balsa and lite-ply. The turtle deck sheeting may look a little intimidating but in actuality it is quite easy to apply if you follow the instructions.

Flying the Giles G-202 is a thrilling experience–as it should be for such an aerobatic model! It doesn't take much elevator or aileron throw to put the Giles through its paces. When you have a feel for your Giles G-202, the throws can be increased to high rates (illustrated in the instructions) to really showcase the aerobatic potential. The Giles performs surprisingly well on a ball bearing, schnuerle ported .46, and even better on a .61 2-stroke, but seasoned experts will want to get the most out of the Giles by strapping on a .91 4-stroke.

We hope you enjoy building and flying your Great Planes Giles G-202 as much as we did the prototypes.

PRECAUTIONS

1. Build the model 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 should be considered as 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 correctly 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* and we'll be glad to help. If you are calling for replacement parts, please reference the part numbers and the kit identification number (stamped on the end of the carton) and have them ready when calling.

DECISIONS YOU MUST MAKE

Engine Selection

There are several engines that will work well in your Giles G-202, but for unlimited performance we recommend a *hot* 2-stroke such as an **O.S.® .61FX (OSMG0561)** or **SuperTigre® G61 (SUPG0181).** If you prefer a 4-stroke, an **O.S. .70 Surpass™ (OSMG0870)** works well and the **O.S. .91 Surpass (OSMG0895)** makes unlimited vertical lines a part of every flight experience. ***Note:*** *Please see the "Flying" section regarding flutter, propeller selection and aerobatic performance.*

Exhaust System

If you choose to use a 2-stroke engine, you will need an in-cowl muffler for the best appearance. On our prototype Giles G-202 with the **O.S. .61FX,** we used the **Slimline #3217 Pitts Muffler (SLIG2217).** With the **O.S. Surpass .70 and Surpass .91,** we used the stock exhaust included with the engines, and a Hobbico® Exhaust Deflector (HCAP2175).

PREPARATIONS

Required Accessories

Items in parentheses (GPMQ4243) are suggested part numbers recognized by distributors and hobby shops and are listed for your ordering convenience. ***GPM*** *is the Great Planes brand,* ***TOP*** *is the Top Flite® brand, and* ***HCA*** *is the Hobbico® brand.*

❑ Four (+) channel radio with five or six servos (twin aileron servos required, twin elevator servos optional)

❑ (1) Y-harness (HCAM2500 for Futaba®) **or** (2) 12" servo extensions (HCAM1200 for Futaba) and computerized radio

Optional radio equipment:

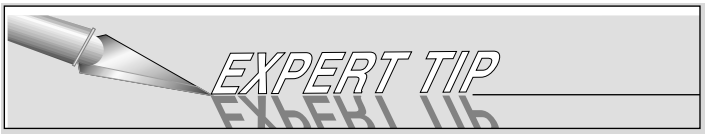
❑ (1) 18" servo extension for rear rudder mounting location
❑ 6th servo, computerized radio and **either** a Y-harness **or** (2) 12" servo extensions for dual elevator servos
❑ Engine – *See **Engine Selection** page 3*
❑ Exhaust – *See **Exhaust System** page 3*
❑ Spare glow plugs [O.S. #8 for most 2-stroke engines, (OSMG2691), O.S. Type-F for most 4-stroke engines, (OSMG2629)]
❑ Propeller (Top Flite Power Point®); Refer to your engine's instructions for proper size. **Note: We recommend staying with a six pitch and the appropriate diameter for your engine to optimize aerobatic performance on this model**
❑ Top Flite Super MonoKote® covering (approx. 3 rolls) – *See **Covering** (page 39)*
❑ Fuelproof paint, *See **Painting** (page 39)*
❑ Fuel tank 10 oz. (GPMQ4104)
❑ 3' Medium fuel tubing (GPMQ4131)
❑ Nylon reinforced packing tape
❑ 1/4" Latex foam rubber padding (HCAQ1000)
❑ (2) 2-1/2" Wheels (GPMQ4223)
❑ (1) 3/4" Tailwheel (GPMQ4240)
❑ (1) 3/16" Wheel collar (GPMQ4308)
❑ 3" Spinner (GPMQ4530, White)
❑ Pilot (DGA 1/4 scale sportsman pilot used in protype, DGAQ2010)
❑ Fueling system [Great Planes Easy Fueler™, (GPMQ4160) **or** Aluminum Fuel Line Plug, (GPMQ4166)]
❑ 12" Velcro™ non-adhesive backed hook and loop material

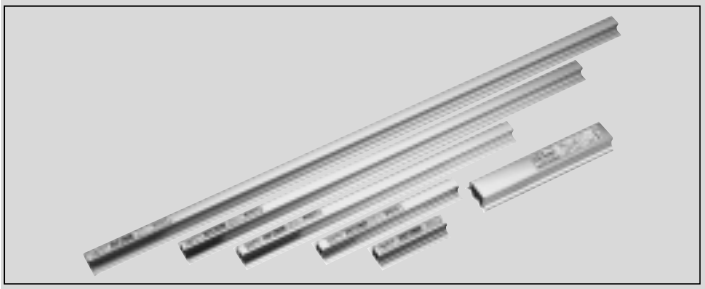
Building Supplies and Tools

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

*We recommend Great Planes **Pro**™ CA and Epoxy.*

❑ 2 oz. Pro CA (Thin, GPMR6003)
❑ 2 oz. Pro CA+ (Medium, GPMR6009)
❑ 1 oz. Pro CA- (Thick, GPMR6014)
❑ 2 oz. Pro CA accelerator (GPMR6035)
❑ 6-Minute Pro Epoxy (GPMR6045)
❑ 30-Minute Pro Epoxy (GPMR6047)
❑ Pacer Formula 560 canopy glue (PAAR3300)
❑ Hobby knife [handle (HCAR0105), #11 Blades (HCAR0311), 100 Qty.]
❑ X-ACTO® Razor Saw (XACR2531)
❑ Pliers (Common and Needle Nose)
❑ Screwdrivers (phillips and flat blade)
❑ Small T-pins (HCAR5100)
❑ Medium T-pins (HCAR5150)
❑ Masking tape (TOPR8018)
❑ Plan Protector (GPMR6167)
❑ Groove Tube™ (GPMR8140)
❑ HobbyLite™ balsa colored filler (HCAR3401)
❑ Bondo® or Squadron white putty
❑ Monofilament line for aligning wing & stabilizer
❑ Builder's triangle set (HCAR0480)
❑ 1/4-20 Tap (GPMR8105, drill bit included)
❑ Soldering iron and solder
❑ Sealing iron (TOPR2100)
❑ CG Machine™ (GPMR2400)
❑ Dead Center™ engine mount hole locator (GPMP8130)
❑ AccuThrow™ deflection meter (GPMR2405)
❑ Hand or 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", 7/32", 1/4", 17/64"
❑ 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

Optional Tools or Accessories

❑ CA Applicator tips (HCAR3780)
❑ Epoxy brushes (GPMR8060)
❑ Epoxy mixing sticks (GPMR8055, Qty. 50)
❑ CA Debonder (GPMR6039)

- ❑ Clevis installation tool (GPMR8030)
- ❑ Heat gun (TOPR2000)
- ❑ Trim Seal Tool™ (TOPR2200)
- ❑ Tack Cloth (TOPR2185)
- ❑ Hot Sock™ (TOPR2175)
- ❑ Razor plane (MASR1510)
- ❑ Single-edge razor blades (HCAR0312, 100 Qty.)
- ❑ 36" Non-slip straightedge (HCAR0475)
- ❑ Denatured or isopropyl alcohol (for epoxy clean-up)
- ❑ Dremel® Moto-Tool® or similar w/sanding drum, cutting burr and 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 #6 x 3/4"

Machine screws are designated by a number, threads per inch and a length. For example 4-40 x 3/4"

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.

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.

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.

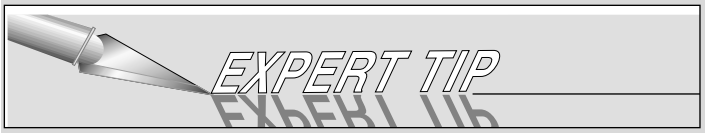
Several times during construction we refer to the "top" or "bottom" of the model or a part of the model. For example, during wing construction we tell you to "glue the top main spar" or "trim the bottom of the former." It is understood that the "top" or "bottom" of the model is as it would be when the 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 being built upside-down).

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 ballpoint pen, lightly write the part **name** or **size** on each piece to avoid confusion later. Use the die-cut patterns shown on page 6 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 to **lightly** sand the edges to remove any die-cutting irregularities or slivers.

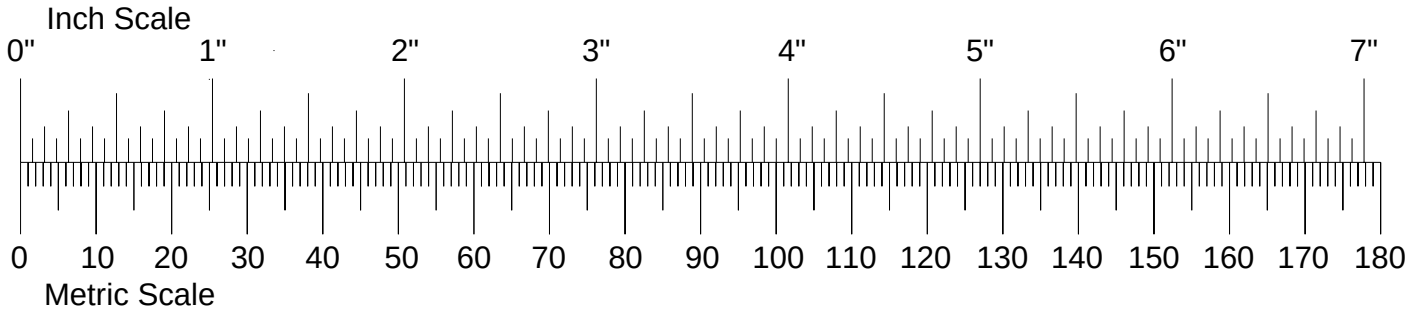
❑ 3. As you identify and mark the parts, separate them into groups, such as **fuse** (fuselage), **wing**, **fin**, **stab** (stabilizer) and **hardware**.



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

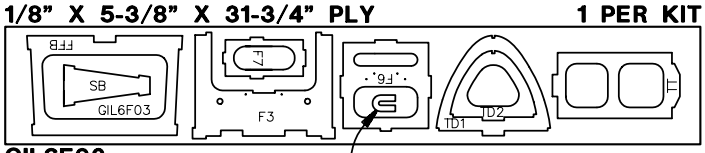
Metric Conversions

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			



DIE-CUT PATTERNS

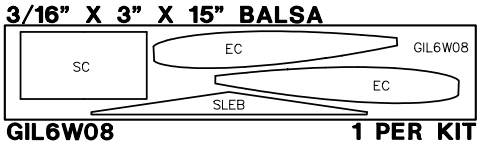
1/8" X 5-3/8" X 31-3/4" PLY — 1 PER KIT



GIL6F03

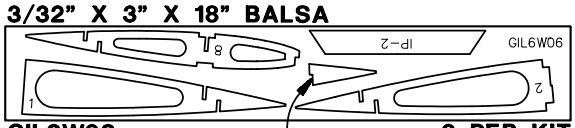
Throttle Pushrod Retainer

3/16" X 3" X 15" BALSA



GIL6W08 — 1 PER KIT

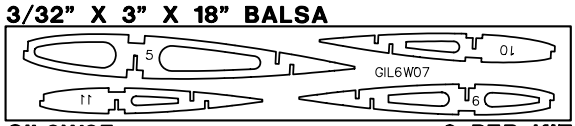
3/32" X 3" X 18" BALSA



GIL6W06 — 2 PER KIT

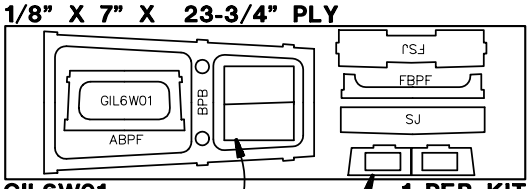
Aileron End Cap

3/32" X 3" X 18" BALSA



GIL6W07 — 2 PER KIT

1/8" X 7" X 23-3/4" PLY

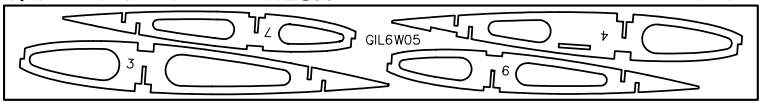


GIL6W01 — 1 PER KIT

Wing Center Web

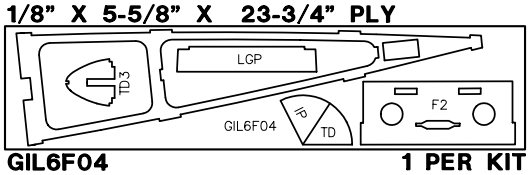
Aileron Servo Tray

3/32" X 3" X 24" BALSA — 2 PER KIT



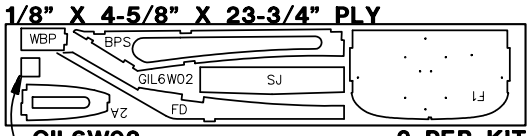
GIL6W05

1/8" X 5-5/8" X 23-3/4" PLY



GIL6F04 — 1 PER KIT

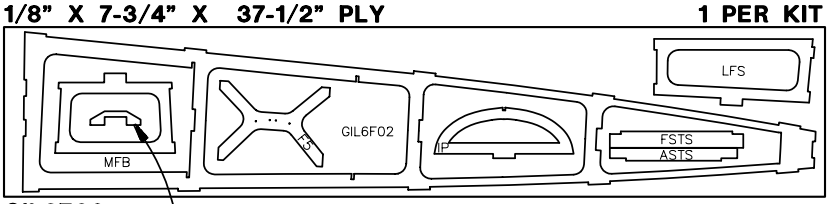
1/8" X 4-5/8" X 23-3/4" PLY



GIL6W02 — 2 PER KIT

Aileron Control Horn Support

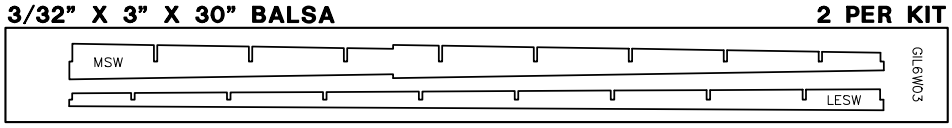
1/8" X 7-3/4" X 37-1/2" PLY — 1 PER KIT



GIL6F02

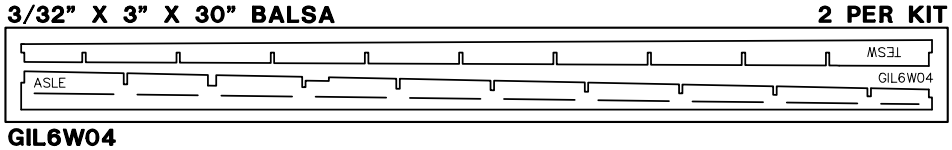
Tank Tray Retainer

3/32" X 3" X 30" BALSA — 2 PER KIT



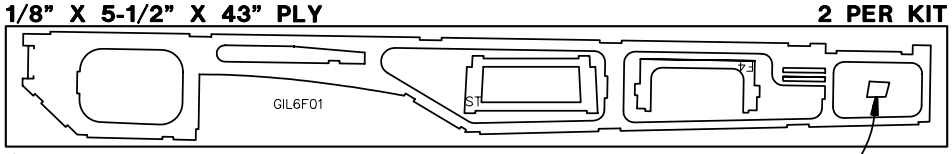
GIL6W03

3/32" X 3" X 30" BALSA — 2 PER KIT



GIL6W04

1/8" X 5-1/2" X 43" PLY — 2 PER KIT



GIL6F01

Wheel Pant Mount

BUILD THE TAIL SURFACES

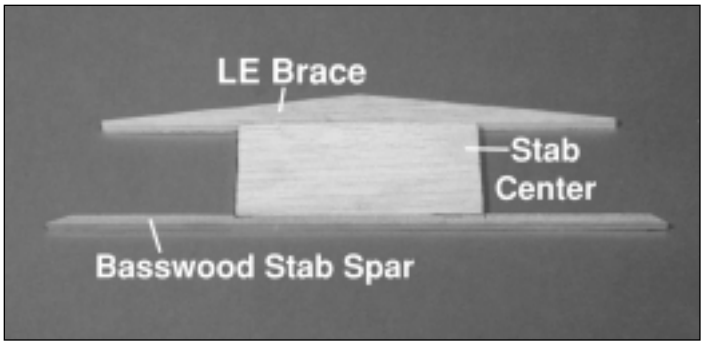
Build the Stab

You may remove the stabilizer and elevator drawing from the wing 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.

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 up or down as much as 1/8" within the Giles' tail framework to gain a snug fit and a strong glue joint, feel free to do so.

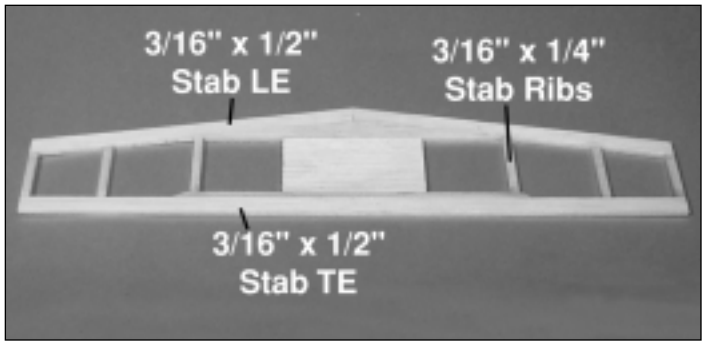
Note: Be sure to save all of the leftover pieces from building the stabilizer. These pieces will be utilized in constructing the fin. Construction photos are shown off the plans for clarity.



❑ 1. Pin the die-cut 3/16" balsa **stab LE brace** in position over the plan. Fit and glue the die-cut 3/16" balsa **stab center**.

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.

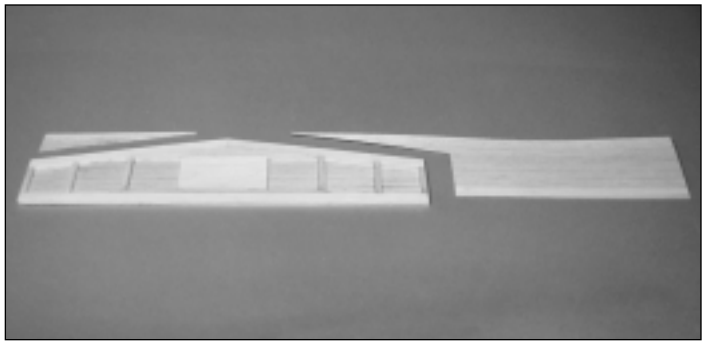
❑ 2. Position the 3/16" x 3/16" x 10" basswood **stab spar** over the plans. Sand the ends to the taper shown. Glue the stab spar to the rear of the stab center.



❑ 3. Using two 3/16" x 1/2" x 24" balsa sticks, fit and glue the **stab leading edges** and **stab trailing edge.** From a 3/16" x 1/4" x 24" balsa stick, fit and glue the **stab ribs**. (Be sure to save the leftover pieces for building the fin.) **Note:** Hold a non-slip straightedge behind the stab trailing edge while fitting and gluing the stab ribs to help ensure a straight trailing edge.

Hint: Single-edge razor blades work very well for making clean vertical cuts in sticks such as those used for the tail framework on this model.

❑ 4. Unpin the stab from the plans. Inspect all glue joints and re-glue with CA as necessary. Use a bar sander 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.

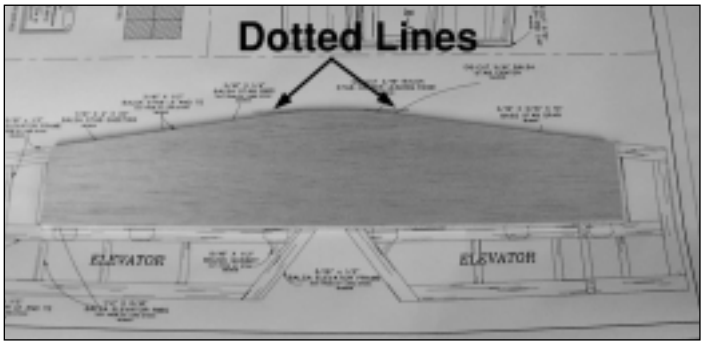


❑ ❑ 5. Position the stab on a 1/16" x 4" x 30" balsa **stab sheeting**, aligning the sheeting with the TE and one end of the stab. Using medium CA, glue the stab framework to the stab sheeting.

Note: Give the CA ample time to cure before lifting the assembly off the building board. It is essential to get a very secure and uniform bond between the stab sheets and the stab core, especially in the center.

❑ ❑ 6. Place the sheeted side of the stab on the building board and trim the sheeting around the outer edges of the framework. Save the remaining pieces.

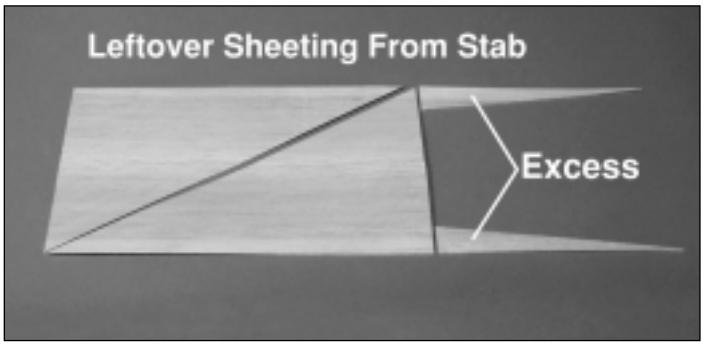
❑ 7. Repeat steps 5 and 6 to sheet the other side of the stab.



❑ 8. Using the dotted lines on the front of the stab plan as a reference, sand a flat on the front of the stab.

Build the Fin

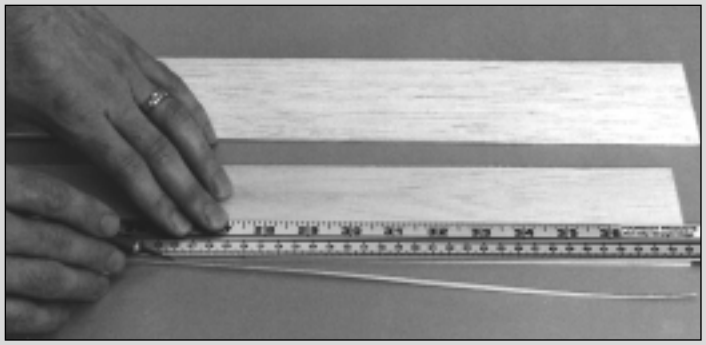
❑ 1. Remove the stab plan from your building board, and lay out the fuselage plan. Cover the fin area of the plan with Great Planes Plans Protector so the glue won't stick to the plan.



❑ 2. See the Expert Tip that follows, then use thin CA to edge glue the two leftover pieces of 4" wide sheeting from the stabilizer. Cut off the excess sheeting as shown in the photo. Cut the sheeting diagonally to create two **fin sheets.**

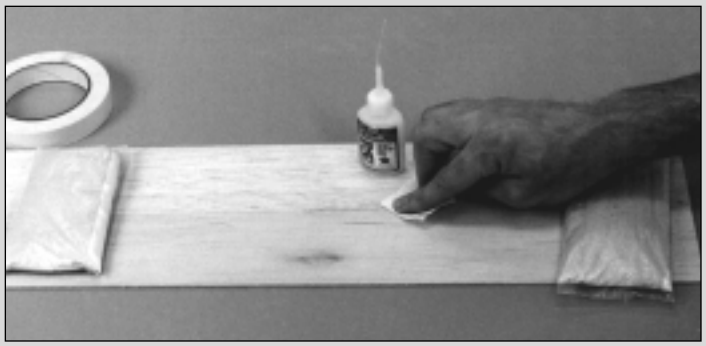
EXPERT TIP

HOW TO JOIN SHEETING



A. Use a metal straightedge as a guide to trim one edge of both sheets.

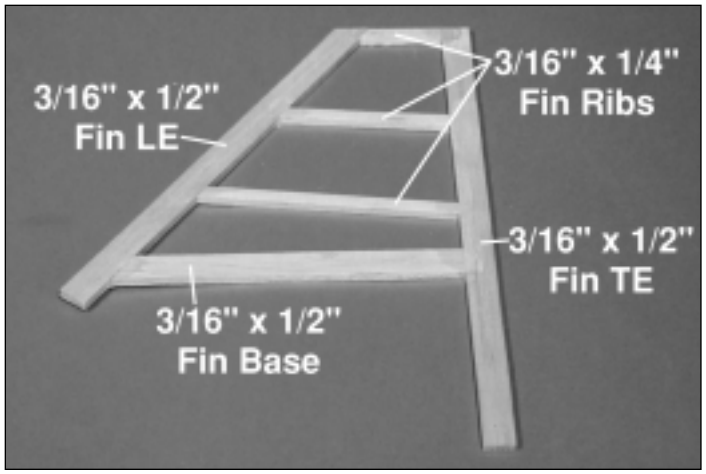
B. Use masking tape to tightly tape the two sheets together joining the trimmed edges.



C. Turn the sheet over and place weights on top of the sheet to hold it. Apply thin CA sparingly to the seam between the two places, quickly wiping away excess CA with a paper towel as you proceed.

D. Turn the sheet over and remove the masking tape, then apply thin CA to the seam the same way you did for the other side.

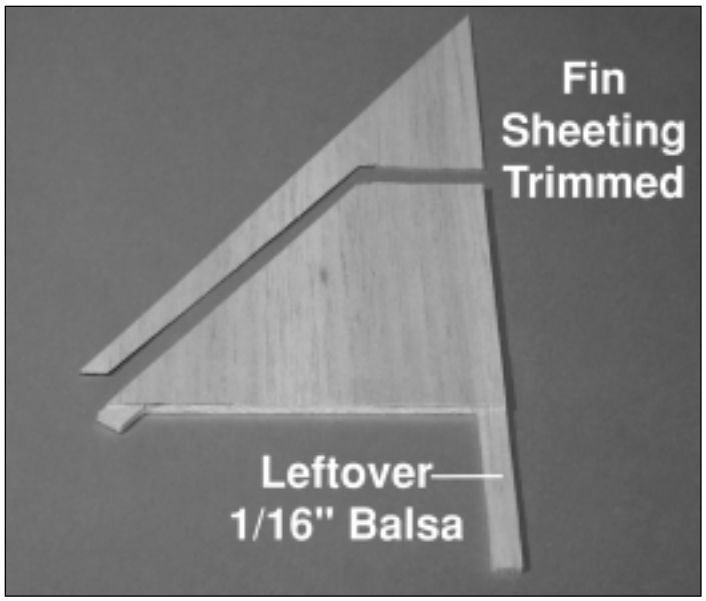
E. Sand the sheet flat and smooth with your bar sander and 150-grit sandpaper.



❑ 3. From a 3/16" x 1/2" x 24" balsa stick, cut the **fin leading edge** and **fin trailing edge.** Pin them to the plans**.** Using the leftover piece of 3/16" x 1/2" stick from the fin leading edge, fit and glue the **fin base** into position.

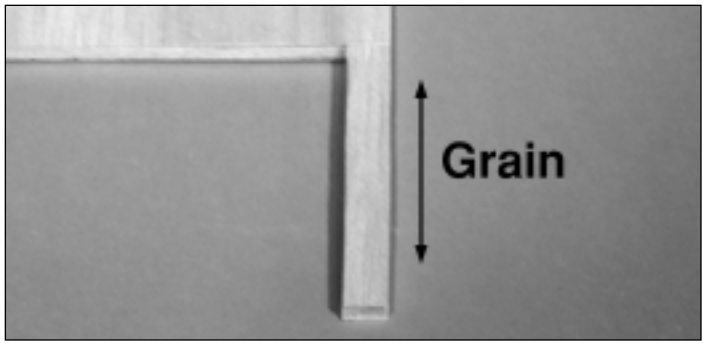
❑ 4. From the leftover 3/16" x 1/4" balsa stick, fit and glue the three **fin ribs**.

❑ 5. 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.



❑ ❑ 6. Position the fin on the fin sheeting you made in step 1, aligning the sheeting with the trailing edge and fin base. Glue it in place with medium CA.

❑ ❑ 7. Place the sheeted side of the fin on the building board and trim the sheeting around the outer edges of the framework.



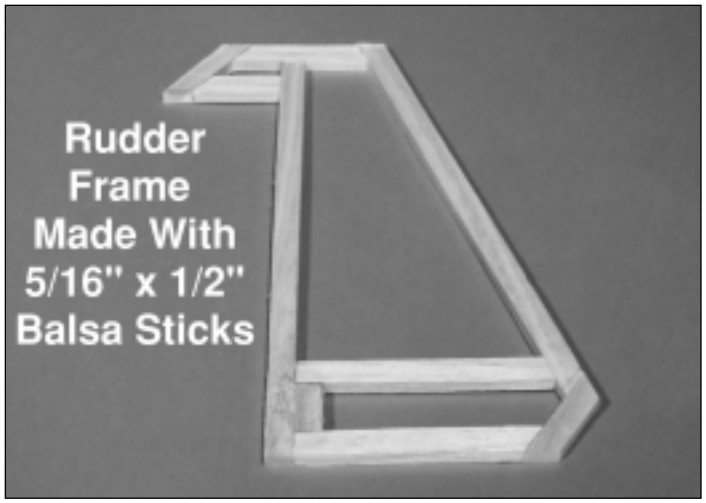
❑ ❑ 8. Using leftover 1/16" balsa sheet, sheet the vertical post with the grain of the balsa running vertically.

❑ 9. Repeat steps 6, 7 and 8 to sheet the other side of the fin.

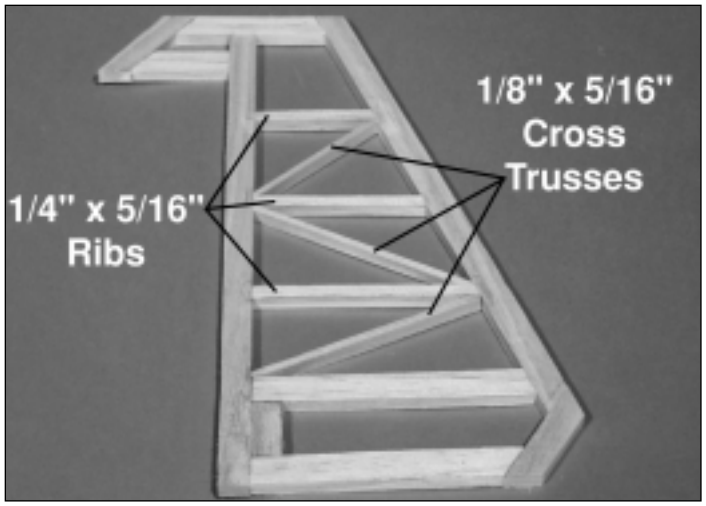
Note: The remaining wood from the fin, stab and elevators will not be required to complete this model. Now might be a good time to stash it away in your spare balsa box and dust the shavings from the building board.

Build the Rudder

You may remove the rudder drawing from the wing plan by cutting the drawing along the dotted line.



❑ 1. Using a 5/16" x 1/2" x 24" balsa stick, cut the **rudder leading edge** and **rudder trailing edge.** Pin them to the plans. Use a second 5/16" x 1/2" x 24" balsa stick to make the **rudder frame** pieces. Pin and glue them in place.

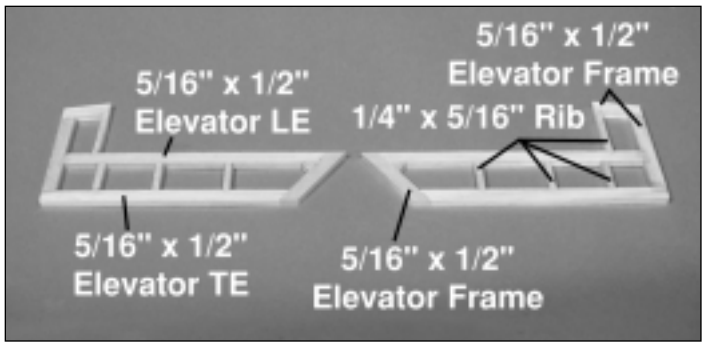


❏ 2. Using the 1/4" x 5/16" x 24" balsa stick, fit and glue the three **rudder ribs**.

❏ 3. Using the 1/8" x 5/16" x 12" balsa stick, fit and glue the three **rudder cross trusses.**

❏ 4. Unpin the rudder from your plans. Inspect all glue joints, and re-glue with CA as necessary. Sand the top and bottom until they are flat and even.

Build the Elevator



❏ 1. Using three 5/16" x 1/2" x 24" balsa sticks, fit, pin and glue the **elevator leading edge, elevator trailing edge, elevator frames,** and **elevator gussets** for each elevator half.

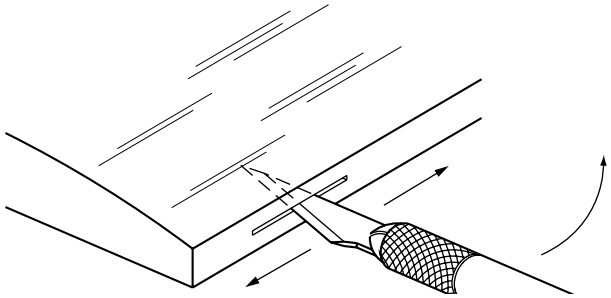
❏ 2. Using a 5/16" x 1/4" balsa stick leftover from the rudder, fit and glue the four **elevator ribs** for each elevator half.

❏ 3. Unpin the elevators from your plans. Inspect all glue joints, and re-glue with CA as necessary. Sand the top and bottom until they are flat and even.

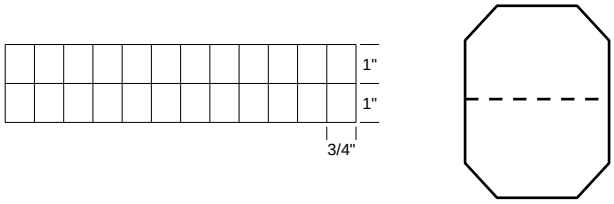
Hinge the Tail Surfaces

Note: We do not recommend using any pin style hinges on this model. In the case of hinging your elevators, drilling deep enough for pin hinges will cause you to drill through the 3/16" basswood stab spar in the stab, resulting in a weak point in the structure.

❏ ❏ 1. Place the stab over its location on the plan and *lightly* mark the hinge locations on the trailing edge with a ballpoint pen. Mark the hinge locations on the elevators in the same manner.



❏ ❏ 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.

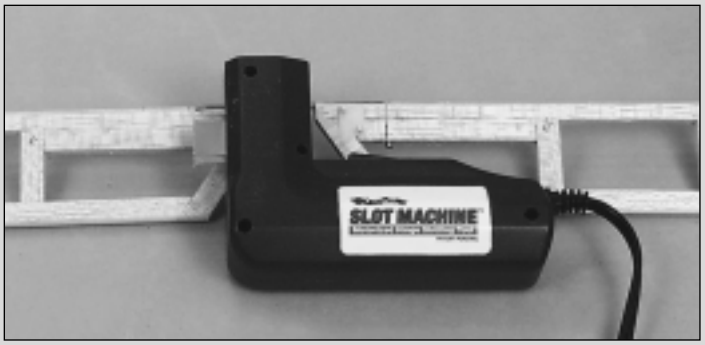


❏ ❏ 3. Cut 3/4" x 1" hinges for the elevators and rudder from the supplied 2" x 9" **hinge material**, then snip off the corners. Temporarily join the elevators to the stab with the hinges, adjusting any hinge slots if necessary so they all align. **Do not glue in the hinges until you are instructed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

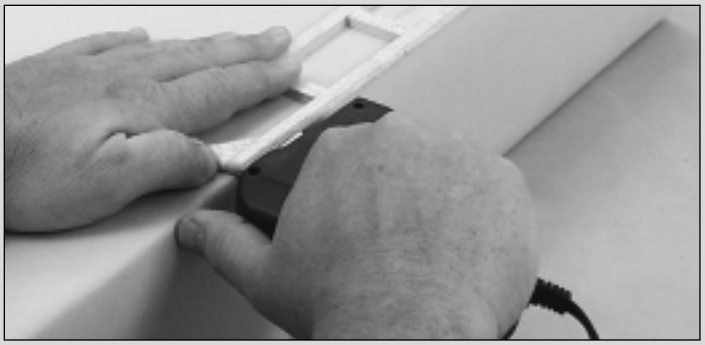
❏ 4. Repeat steps 1 through 3 to complete the procedures to hinge the rudder and fin.

EXPERT TIP

Great Planes Slot Machine™



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.

Finish the Tail Surfaces

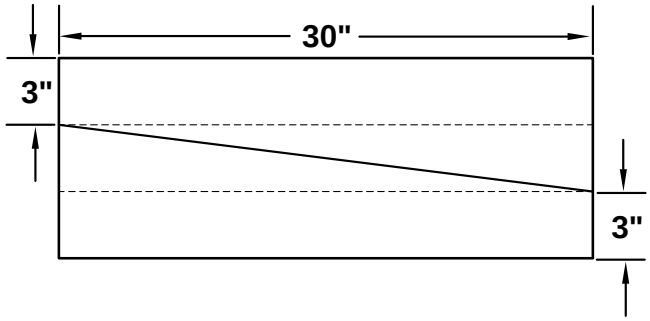
❏ 1. Shape the leading edge of the elevators and rudder to a “V” as shown on the plans.

❏ 2. Use a bar sander and 150-grit sandpaper to round the tail surfaces as shown on the plan.

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 building board and get ready for the wing!

BUILD THE WING

Assemble the Wing Sheeting

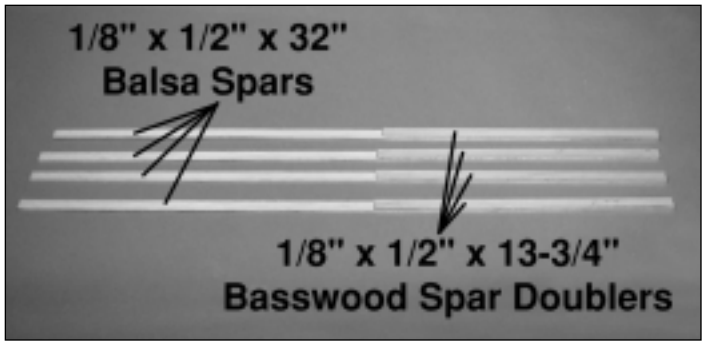


Right now, while the building board is clear, is a great time to assemble the wing sheeting.

❏ ❏ 1. Edge glue three 1/16" x 3" x 30" balsa sheets together. Cut the sheets as shown above, cutting the center sheet diagonally corner to corner, creating two **LE sheets**.

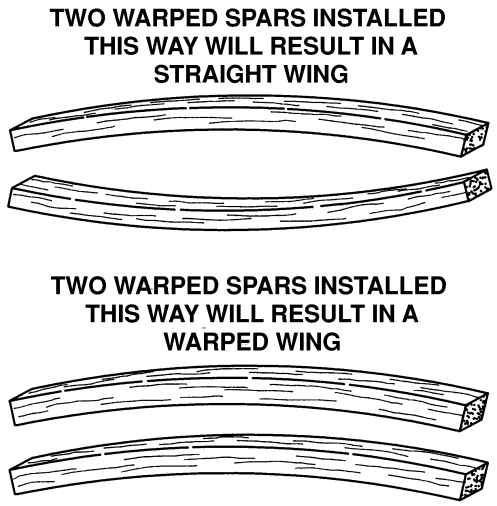
❏ 2. Repeat step 1 to build the LE sheets for the second wing panel.

Build the Wing Spars



❏ 1. From the two 1/8" x 1/2" x 30" basswood sticks, cut four 13-3/4" long **spar doublers**.

❏ 2. Before using the 1/8" x 1/2" x 13-3/4" basswood spar doublers, 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).



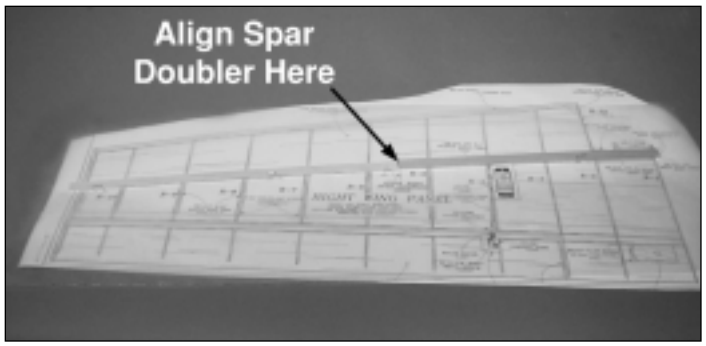
❏ 3. Align the end of each spar doubler with the inboard end of one of the 1/8 x 1/2" x 30" balsa **spars.** Glue the spar doublers to the spars. From this point forward we refer to this combination as a spar.

Build the Wing Panels

The construction of these wings is engineered specifically to provide a perfectly straight and true wing panel with minimum effort on your part. To do so, the building sequence and pieces are quite different from what you may be accustomed to. Be sure to read all steps carefully and pay particular attention to instructions of when and where to apply adhesives.

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 plan so your progress matches the photos.

❏ ❏ 1. Tape the **right** wing plan to the building board, and cover the wing drawing with Great Planes Plan Protector. Remember, we are building the right wing upside-down over the right wing bottom view.

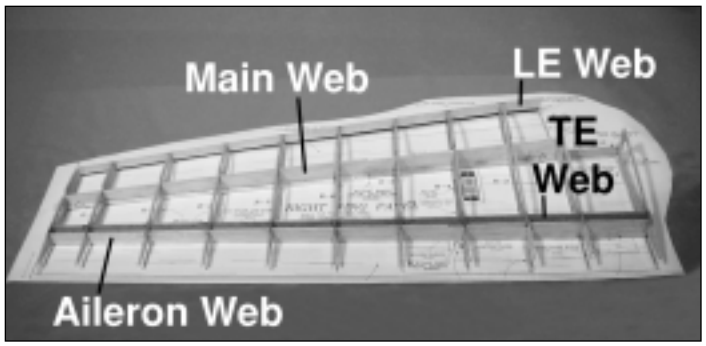


❏ ❏ 2. Position the top spar on top of the plan with the spar doubler visible, aligning the end of the spar doubler with the ***"ALIGN BASS SPAR DOUBLER HERE"*** marks on the plan. The spar will overhang both R-1 and R-11. **Do not** cut them at this time. Pin them in place as shown in the photo. **Note**: The pins are offset the aft side to leave space for the main web.

❏ ❏ 3. Carefully punch out the four die-cut 3/32" balsa **webs** and the die-cut 3/32" balsa **wing ribs.** Sand the edges **slightly** to remove any die-cutting irregularities. Be careful not to alter the shapes or angles of any of the pieces.

Note: **Do not glue** until instructed to do so.

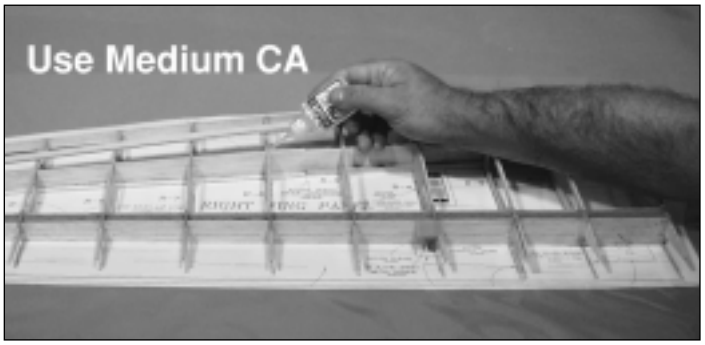
❏ ❏ 4. Select the die-cut 3/32" balsa **rib R-3, main web,** and **aileron web** (with support jig attached). Slide R-3 into its slots in the main web and the aileron web. Align the main web, centering it on the spars and aligning the notch on the top of the main web with the spar doubler. Align the aileron web in position on the plans with the root end flush with the wing centerline. Pin the root end of the aileron web in place as shown.



❏ ❏ 5. Position **R-10** in its slots to lock the webs in place. Insert all of the remaining ribs **except R-2A** into their locations. **Note:** If you happen to break one of the ribs during installation, simply take it out of the wing, position the pieces together and glue with thin CA. Allow to dry and reinstall.

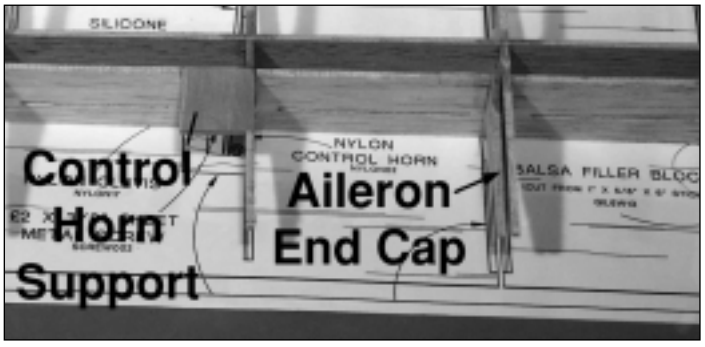
Designer's Note: Occasionally outside forces such as humidity and dramatic temperature changes can result in slight inaccuracies in the dimensions of printed plans. One of the many advantages of a fully interlocking wing such as this one is that exact alignment over a printed plan is not necessary to ensure a straight wing. If the ribs do not align perfectly over the plans, don't worry! As long as the spar doubler is aligned as shown and the aileron web is aligned with the centerline of the wing, the wing will be true.

❑ ❑ 6. Carefully slide the die-cut 3/32" balsa **TE web** and the die-cut 3/32" balsa **LE web** over the ribs in their notches until the top of the webs are flush with the top of each rib. Take your time and be gentle; this balsa structure is still fragile at this point, but when finished will provide you a strong, light platform. When everything is aligned, use thin CA to glue all joints **except** any joints connecting to R-1.



❑ ❑ 7. Test fit **(do not glue)** the bottom spar into the ribs, fitting the spar doubler into the notch in the main web. When you are confident you can fit the spar in place, remove the spar. Lay a bead of medium CA along the bottom of the main web and the corners of the rib slots, and reinstall the bottom spar.

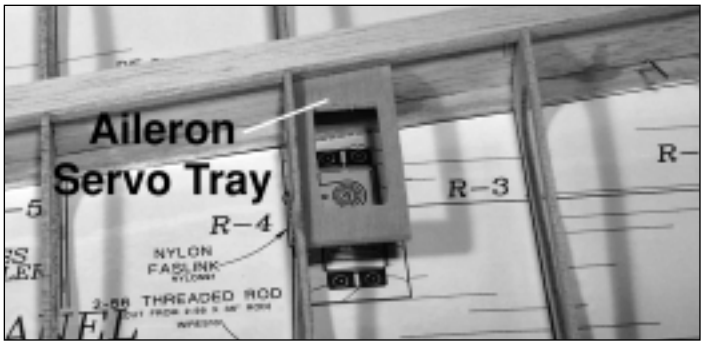
❑ ❑ 8. Use a builder's square to be sure R-1 is square to the building board, then glue R-1 to the spars and the webs with thin CA. **Note:** Be sure not to press down on the spars. The top of the top spar must align with the top of R-2A, and the bottom of the bottom spar must align with the bottom of R-2A.



❑ ❑ 9. Align and glue the die-cut 1/8" plywood **control horn support** to R-4 and the aileron web.

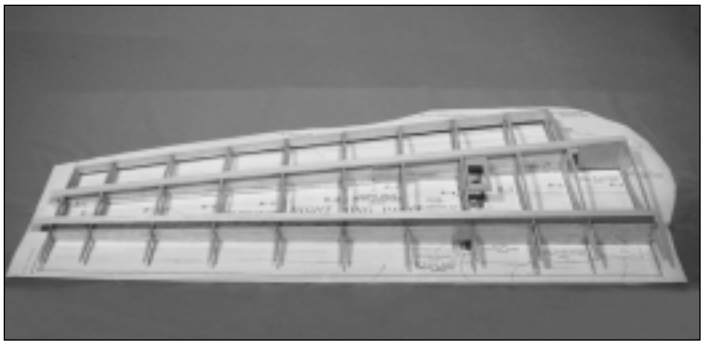
❑ ❑ 10. Align the die-cut 3/32" balsa **aileron end cap** parallel with R-3 and glue it to the TE web.

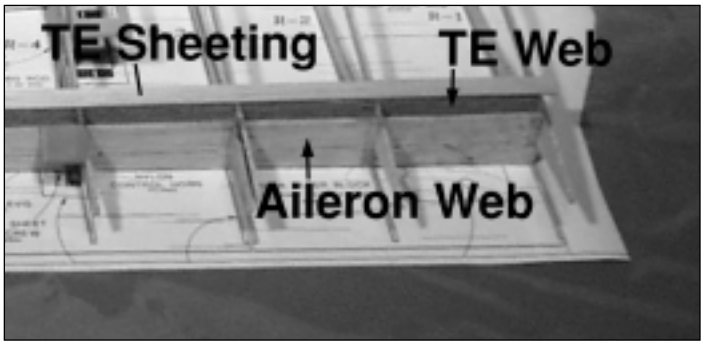
❑ ❑ 11. Position and glue the die-cut 1/8" ply rib **R-2A**.



❑ ❑ 12. Fit the die-cut 1/8" ply **aileron servo tray** in the slot in R-4, holding tight against the top of the bottom spar. Glue in place with thin CA.

❑ ❑ 13. Fit the die-cut 1/8" ply **center web** tight against both spars and R-1. Glue in place with medium CA.



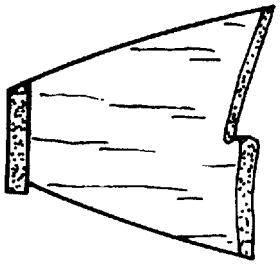


❑ ❑ 14. Align the 1/16" x 1/2" x 30" **TE sheeting** with the back of the TE web, allowing at least 1/8" excess to overhang each end of the wing panel. (Leaving the excess will allow you to sand the sheeting perfectly flush with R-1 and the balsa end cap later.) Glue it in place. **Hint:** Lay the TE sheeting over the TE web and mark a line along each rib at the edge of the sheeting. Remove the sheeting and lay a bead of medium CA along the TE web and the ribs up to those marks. Reposition the TE sheeting flush with the TE of the TE web and hold in place until dry.

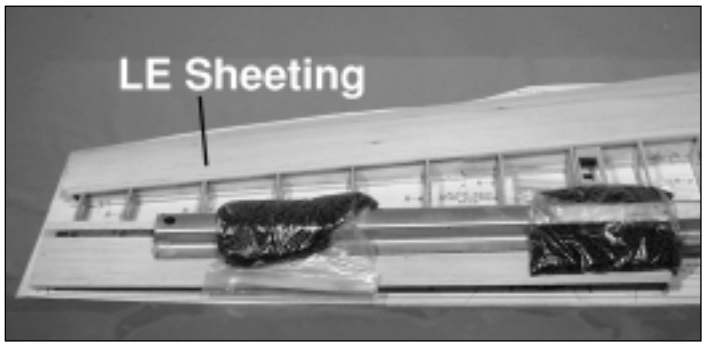
❑ ❑ 15. Select a piece of the 1/16" x 2-3/4" x 24" **aileron sheeting**, and carefully true one edge. Do so by aligning a no-slip straightedge approximately 1/32" down from and parallel with a long edge of the sheet. Trim the sheeting along the straightedge, being careful to keep the knife vertical. Discard the thin piece of sheet you trimmed.

❏ ❏ 16. Measure 2-3/8" in from the cut you just made and cut off the excess sheeting, making a 1/16" x 2-3/8" x 24" trued aileron sheet.

❏ ❏ 17. Place a bead of medium CA along the aileron portion of each rib, the aileron end cap and the aileron web. Align the aileron sheeting you just made with the leading edge of the aileron web and the aileron end cap.



❏ ❏ 18. Use a bar sander to shape the LE web so it aligns with the tops of the ribs and the shape of the airfoil as shown in the sketch. Be careful not to gouge the ribs or LE web.



Note: Use this photo for the next three steps.

❏ ❏ 19. Weight the wing down directly in front of the aileron web to keep it flat on the support jig. **Hint:** An Easy Touch Bar Sander with a weight on top, or bags filled with lead shot and sealed shut, makes an excellent wing weight.

❏ ❏ 20. Using medium CA, glue a LE sheet to the front half of the spar. **Note:** Make sure the sheeting overhangs R-11 and the center of the wing slightly.

❏ ❏ 21. Carefully lift the sheeting away from the ribs, then apply a bead of medium or thick CA to the top of each rib and the LE web. Working quickly, pull the sheeting forward as you press it down to the ribs and the LE web. Use weights to hold the sheeting to the ribs and LE web until the CA cures.

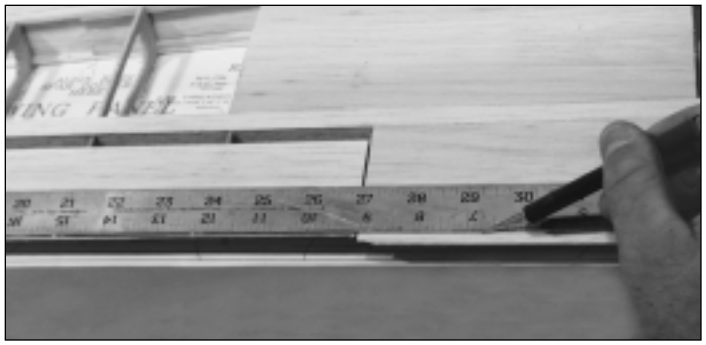
❏ ❏ 22. Once the glue is dry, lift off the weights and remove the T-pins from the spars.

Sheet the Wing Panel Center Section

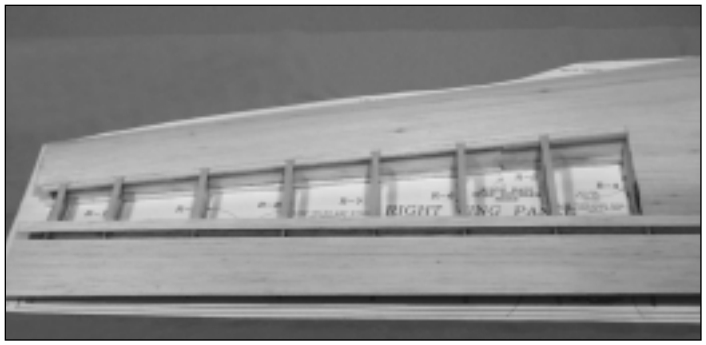
❏ ❏ 1. From a 1/16" x 3" x 30" balsa sheet, cut two 9-1/2" long sheets and one 6-1/4" long sheet. These will become the **center sheeting**.

❏ ❏ 2. Position the first 9-1/2" long sheet over the ribs, flush with the TE sheeting and overhanging R-4 by 1/4". Glue in place.

❏ ❏ 3. Place the second 9-1/2" long sheet flush against the first sheet and overhanging R-4 by 1/4". Don't worry about it overhanging R-1, we'll get to that later. Be sure it is pressed firmly against the first sheet. Lay the straightedge on the spar, pressed firmly against the trailing edge of the LE sheeting. Use a hobby knife to carefully cut the second piece of sheeting along the spar. Remove both pieces of sheeting and the straightedge from the wing. Glue the second piece of sheeting in place. **Note:** You will cut the opening for the servo after the wing is unpinned from the building board.

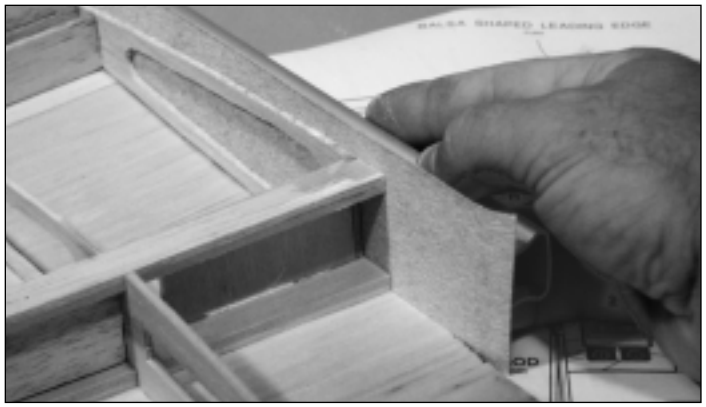


❏ ❏ 4. Position the 6-1/4" long sheet flush with the outboard edge of R-3 (next to, but not touching the aileron end cap), and pressed against the trailing edge of the TE sheeting. Lift it off the ribs, lay glue on the ribs and the face of the TE sheeting. Reposition the sheet and hold in place while the CA cures. Lay a straightedge on the aileron flush with the trailing edge of the aileron as shown in the photo. Carefully trim this sheet along the straightedge.

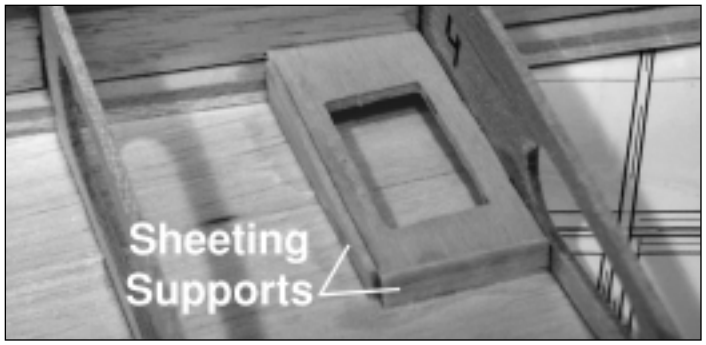


❏ ❏ 5. From 1/16" x 1/4" x 24" balsa sticks, cut and glue **caps strips** to the exposed ribs between the LE sheeting and TE sheeting only**. Hint:** For easier positioning of the cap strips, first mark the location of each rib on the LE and TE sheeting.

❏ ❏ 6. Remove the remaining pins and lift the wing from the building board. Trim everything flush with R-11. Trim the LE sheeting flush with the front of the LE web.

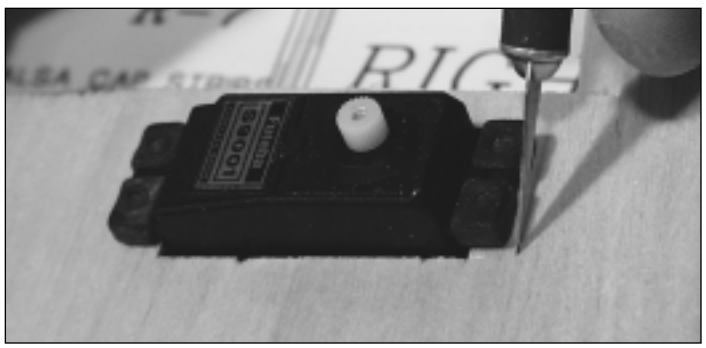


❏ ❏ 7. Trim all of the sheeting flush with R-1. Use a bar sander to sand the spars flush with R-1. **Note:** Be careful not to gouge R-1 and to keep the spar ends square to R-1.

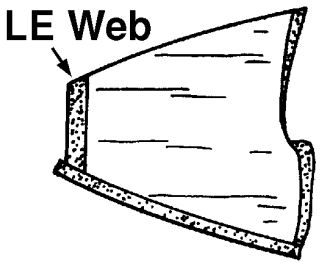


❏ ❏ 8. Set the wing right-side up on the building board. From a piece of leftover sheeting, make a **sheeting support** for the inboard side of the aileron servo tray as shown. Carefully sand the airfoil shape onto the bottom of the support. Glue with thin CA. Make and glue a second sheeting support for the trailing edge of the aileron servo tray. **Note:** Be careful not to change the shape of the sheeting when installing these supports.

❏ ❏ 9. Use a hobby knife to cut the opening for the servo in the sheeting, using the servo tray as a guide. **Hint:** While the wing is right-side up, use a hobby knife to cut just the corners of the servo opening. Turn the wing upside-down again, and use a straightedge to cut straight lines between the four corners you marked. Remove the piece of sheeting.



❏ ❏ 10. With the wing upside-down, fit the aileron servo in place and trim the sheeting around the rubber grommets on the servo. **Note:** Provide approximately 1/16" of clearance between the servo and the sheeting.

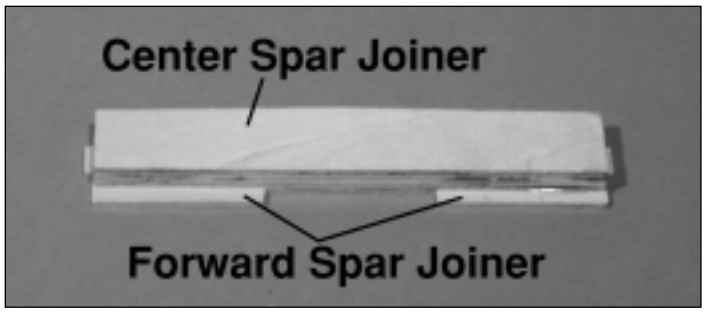


❏ ❏ 11. Turn the wing right-side up again, and use a sanding block to shape the LE web so it aligns with the tops of the ribs and the shape of the airfoil.

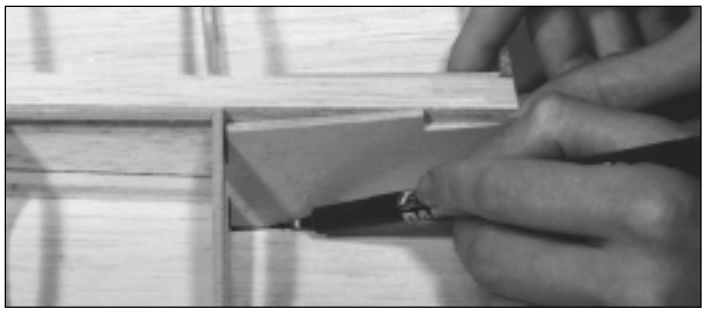
Sit back and relax! Take a look at your great work! Enjoy for just a minute how light and strong this structure is. Okay, ready to get back to work?

If this is the first time through, go back to the start of **Build the Wing Panels** and build the left wing half.

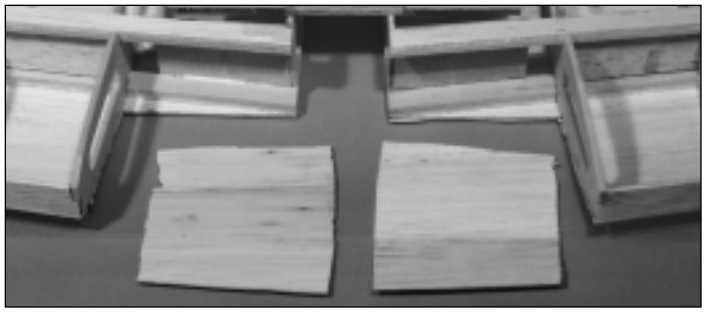
Join the Wing Panels



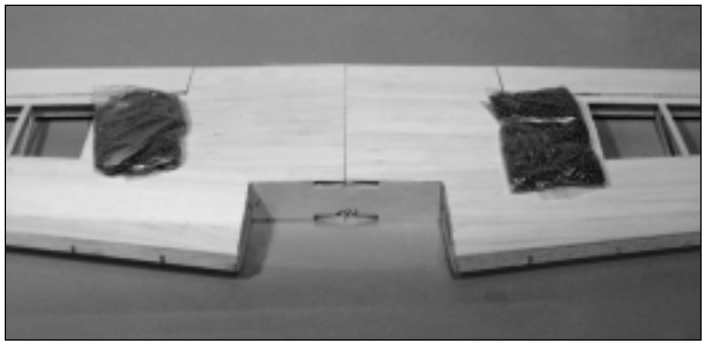
❏ 1. Using medium CA, glue the three die-cut 1/8" ply **center spar joiners** together. Center these three layers on top of the die-cut 1/8" ply **forward spar joiner** so that the high point of the center joiners is aligned with the peak on the center section of the forward joiner. The bottom edge of the center joiners will also be aligned with the flat edge of the center section of the forward joiner. Glue them in place. This complete assembly is now called the wing joiner.



❏ ❏ 2. Lay the right wing panel right-side up on the building board. Hold the wing joiner so the forward spar joiner is facing you and the flat side of the center section is up. Write “top” on the front of the forward spar joiner at the flat edge. **Without using any glue**, test fit the wing joiner into its position against the spars. Mark a straight line on the sheeting where the wing joiner meets the sheeting.



❏ ❏ 3. Cut the sheeting along the line drawn in step 2 and along R-2A, and remove the leftover piece of sheeting. Repeat steps 2 and 3 for the left wing panel.



Be sure the building board is free of debris and items which will be in your way, because you’re ready to join the wings!

❏ 4. Lay both panels upside-down as shown in the photo. **Without using glue**, test fit the wing halves with the wing joiner. Some fitting of the wing joiner may be required. Take your time and be extremely careful that you have a perfect fit, with no gaps between the spars, and the tabs on the forward spar joiner locking completely into both R-2A ribs. A few extra minutes here will help ensure that you have a strong, true wing that will perform at its optimum. **Note:** Be SURE that you have the wing joiner upside-down, just like the wings are, so that the “top” label is inverted and is just above the building board as shown in the photo.

❏ 5. When you are confident with the fit and that you can comfortably position the wing joiner, remove it and lift the wing halves from the building board. Place a Plan Protector under the center of the wing to catch excess epoxy. Coat both R-1s, all four spars, and the wing joiner with 30-minute epoxy, and install the wing joiner. Place weights on top of the wing to hold it in place. **Do not** disturb the wing until the epoxy is completely cured.

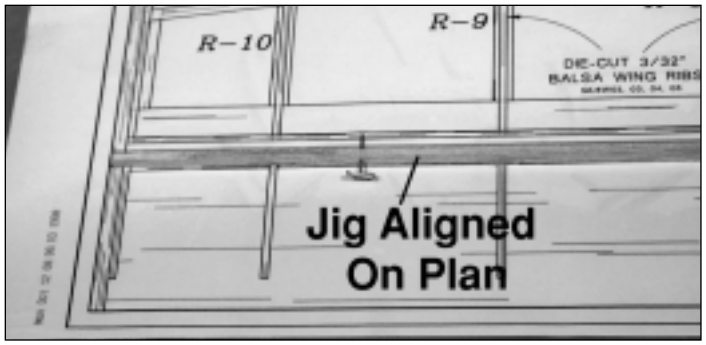
It’s time to take a long, relaxing break and let the epoxy do its job.

Finish the Top of the Wing

❏ 1. Turn the wing right-side up on the building board. (Notice the dihedral built into the wing, which is flat on top.) Using a hobby knife, carefully cut the support jigs away from each wing half. Be careful and take your time, trying not to break the jig and keeping the cuts straight, even if you have to cut through some small drops of dried glue along the way. You will use these jigs for sheeting the top of the wing, so do not break or discard them.

❏ 2. Cut the 5/8" x 5/8" x 6" balsa stick in half, making two **filler blocks**. Position each filler block against R-2 and the aileron web as shown in the photo. Carve and sand each block to the shape of the rib airfoil. Glue them in place with medium CA.

❏ 3. From a 1/4" x 1/4" x 12" balsa stick, cut eight 1-1/2" long pieces. Center and glue them to the front of the TE web at the eight hinge locations.

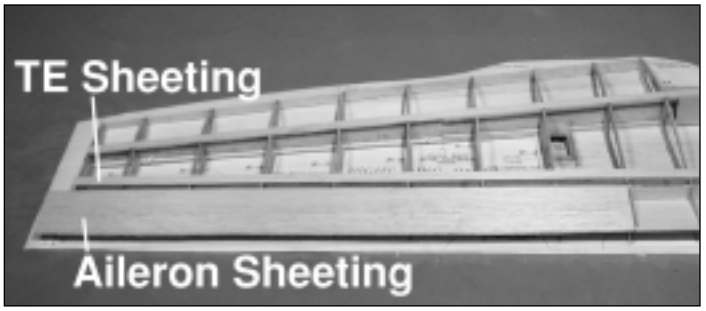


❏ ❏ 4. Remove the wing from the building board. Lay out the right wing panel plan. Pin the jig (cut from the wing in step 1) on the plans over the aileron web, being sure the T-pins are at a shallow enough angle so that the pins will not touch the sheeting when you lay the wing on the jig. **Note:** Place the jig so that the **narrow end of the jig is at the tip of the wing plan.**

❏ ❏ 5. Place the wing with the left wing panel right-side up on top of the wing jig which is pinned to the right wing plan. Pin the left bottom spar to the plans. You are now ready to sheet the top of the wing as you did the bottom.

❏ ❏ 6. Align the 1/16" x 1/2" x 30" **TE sheeting** with the back of the TE web, and the centerline of the wing. Glue it in place.

❏ ❏ 7. Select a piece of 1/16" x 2-3/4" x 24" balsa **aileron sheeting**, and carefully true one edge of the sheeting. Measure 2-3/8" in from the cut you just made and cut off the excess sheeting, making a trued 1/16" x 2-3/8" x 24" aileron sheet.



❏ ❏ 8. Position the aileron sheeting (which you just made) flush with the leading edge of the aileron web and the aileron end cap. Glue the sheeting to the aileron end cap, the aileron web, the aileron ribs, and the trailing edge of the bottom sheeting.

❏ ❏ 9. Use a sanding block to shape the LE web so it aligns with the tops of the ribs and the shape of the airfoil. Be careful not to gouge the ribs or LE web.

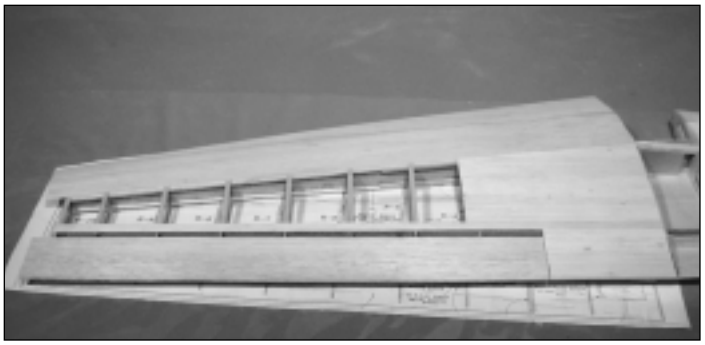
❏ ❏ 10. Weight the wing down directly in front of the aileron LE web to keep it flat on the support jig.

❏ ❏ 11. Using medium CA, glue a LE sheet to the front half of the spar. **Note:** Make sure the sheeting overhangs

the tip rib and is aligned with the centerline of the wing. Glue the sheeting to the top of each rib and the LE web as you did with the bottom sheeting. Use weights to hold the sheeting to the ribs and LE web until the CA cures.

❏ ❏ 12. Once the glue has dried, lift off the weights and remove the T-pin from the spar.

❏ ❏ 13. From a 1/16" x 3" x 30" balsa sheet, cut two 9-1/2" long sheets and one 6-3/16" long sheet.



❏ ❏ 14. Position the first 9-1/2" long sheet over the ribs, flush with the LE of the TE sheeting and the centerline of the wing. Glue it in place.

❏ ❏ 15. Place the second 9-1/2" long sheet flush against the first sheet and flush with the centerline of the wing. Use a straightedge to trim the second sheet flush with the LE sheet as you did on the bottom wing sheeting. Glue it in place.

❏ ❏ 16. Position the 6-3/16" long sheet flush with the outboard edge of R-3 and the centerline of the wing, and pressed against the trailing edge of the TE sheeting. Glue the sheet to the ribs, the TE sheeting, and the bottom sheeting below it. Trim even with the aileron as you did on the bottom wing sheeting.

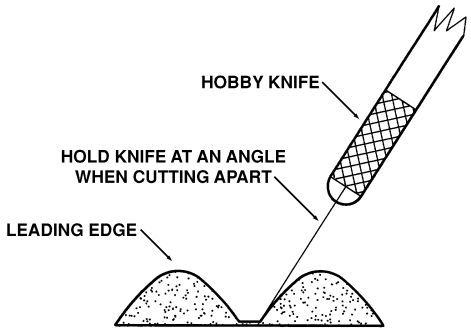
❏ ❏ 17. From 1/16" x 1/4" x 24" balsa sticks, cut and glue **cap strips** to the exposed ribs between the LE sheeting and TE sheeting only.

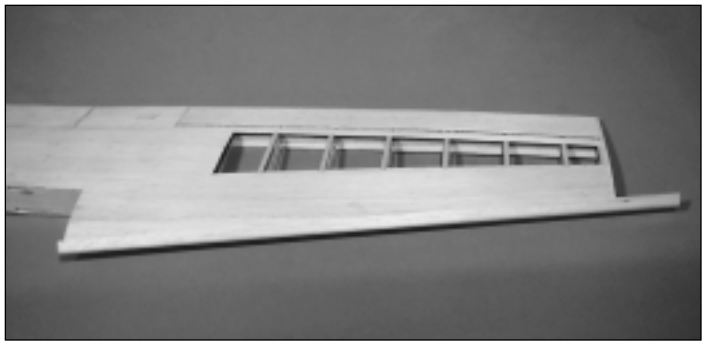
❏ ❏ 18. Lift the wing from the building board. Trim everything flush with R-11.

❏ ❏ 19. Trim the LE sheeting flush with R-2A, the wing joiner and the front of the LE web.

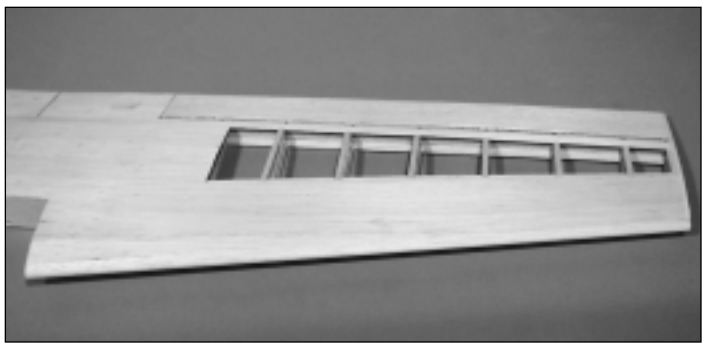
❏ 20. Repeat steps 4-19 with the right wing panel right-side up over the left wing plan.

❏ 21. Glue the die-cut 3/16" balsa **wing tips** to each R-11 and sand them to match the airfoil shape of R-11.

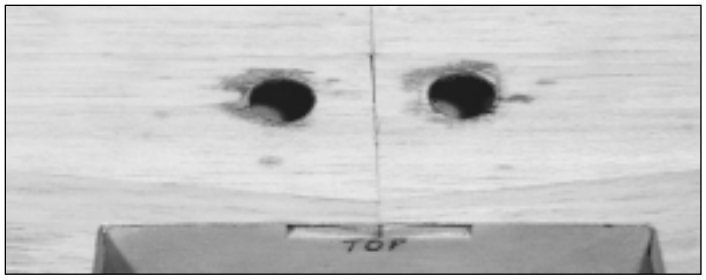




❏ 22. Separate the **shaped leading edges** as shown in the sketch. Leaving 1/4" of shaped LE stock extending beyond the inboard edge of the left wing's R-2A and keeping the shaped LE centered vertically on the LE web, glue the shaped LE to the front of the left wing with medium CA. Repeat for the right wing panel.

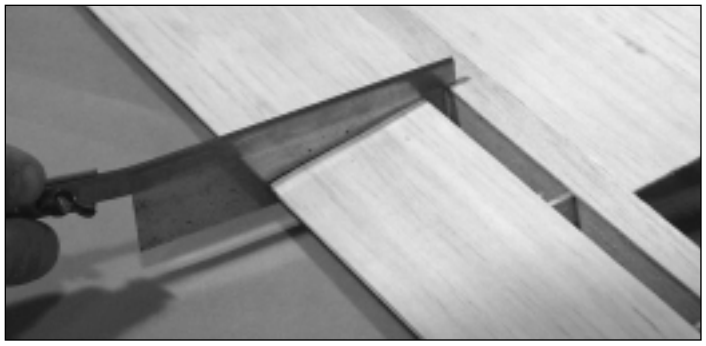


❏ 23. Trim each LE flush with R-2A and with the wing tips. Sand both LE's to blend with the wing, forming a smooth airfoil shape.



❏ 24. Using the plans as a reference, cut the servo wire holes in the top of the wing. **Note:** Use a nickel as the template to draw the circles.

Finish the Ailerons

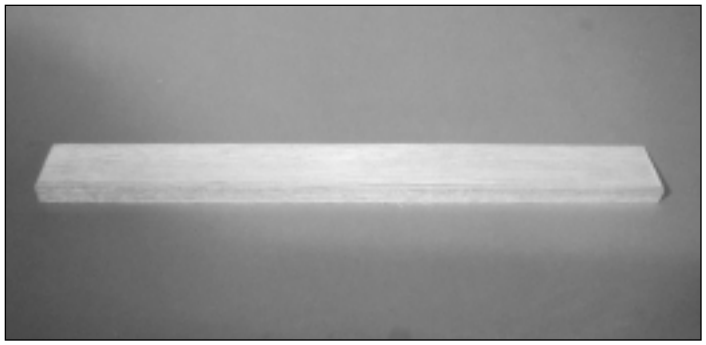


❏ ❏ 1. Place the wing right-side up on the building board. Using a razor saw, cut through the aileron web at the root of the right aileron.

❏ ❏ 2. Using a razor saw, cut the ribs and wing tip between the aileron web and the TE web. **Hint:** To avoid confusion later, label the inboard end of the ailerons “right” and “left” respectively as you remove them.

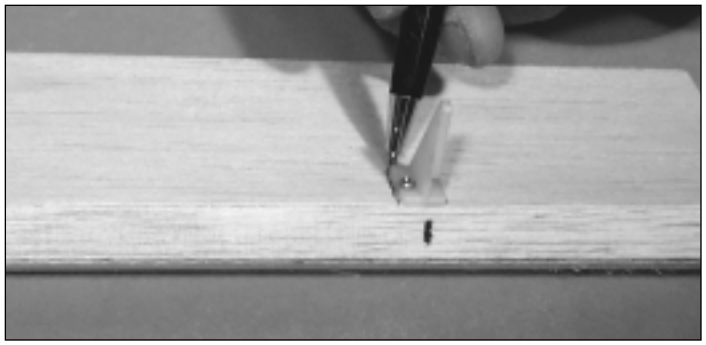
❏ ❏ 3. Carefully trim and sand the aileron ribs and the wing tip flush with the aileron web. Carefully trim and sand the ribs and the wing tip flush with the TE web.

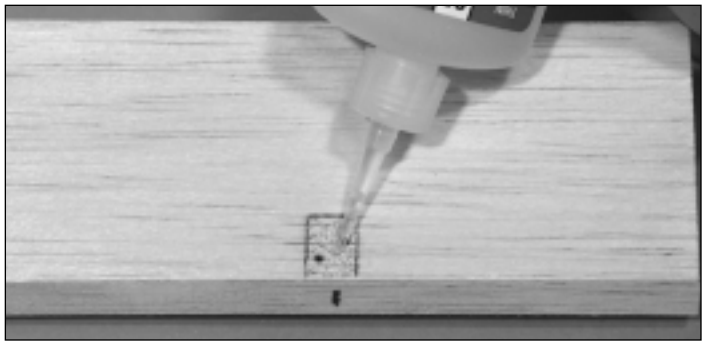
❏ ❏ 4. Glue the 1/8" x 1" x 24" balsa **wing trailing edge** onto the TE of the right wing panel, leaving excess extending both top and bottom. Sand it flush with the wing tip and the sheeting, top and bottom.



❏ ❏ 5. Glue the 1/4" x 1" x 24" balsa **aileron leading edge** onto the front of the right aileron, leaving excess extending both top and bottom. Sand it flush with the aileron end cap, and the sheeting, top and bottom.

❏ ❏ 6. Bevel and hinge the aileron the same as the elevator and rudder. Cut the hinge slots in the wing TE and aileron per the hinge locations shown on the plan.





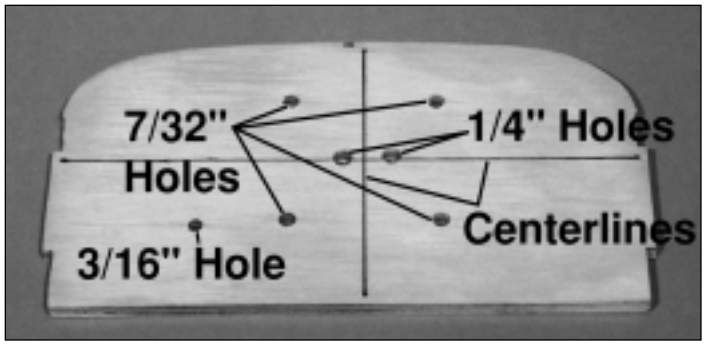
❏ ❏ 7. Position and mount the **aileron control horn** on the right aileron using #2 x 3/8" sheet metal screws. Draw a

line around the control horn. Remove the screws and the control horn. Using a hobby knife, poke 12 pin holes in the top sheeting within the rectangle you drew, then apply a generous amount of thin CA. Allow the CA to cure, hardening the balsa, then sand the sheeting smooth. **Note:** Use enough CA to have some enter the screw holes; however, do not use so much that you fill the holes with CA.

❑ 8. Complete steps 1-7 for the left wing panel.

BUILD THE FUSELAGE

Assemble the Fuselage Formers & Sides

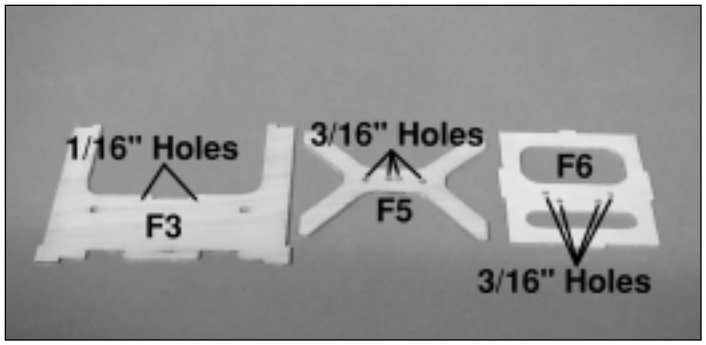


❑ 1. Place one die-cut 1/8" ply **former F-1** on the building board, punch marks facing up. Glue the second F-1 to the first with 30-minute epoxy, again with the punch marks facing up. Make sure the edges all the way around are aligned. Wipe away excess epoxy before it cures. From now on this assembly will be referred to as the **firewall**. **Note:** If the 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. Using a ruler or other straightedge and a pen, draw a line horizontally across the firewall from the left edge punch mark to the right edge 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.

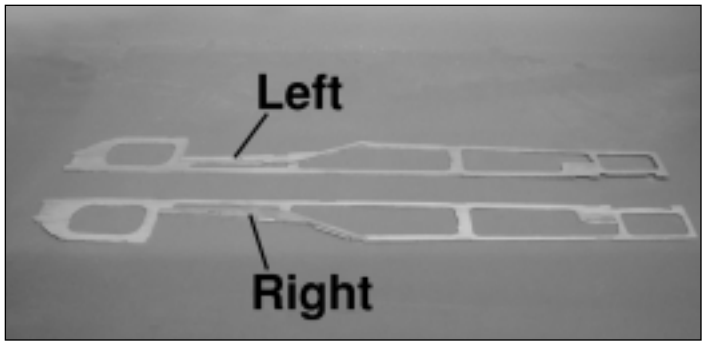
Note: This location is offset for the right thrust built into the model so that the spinner will still align with the center of the cowl.

❑ 3. Assuming you are using the included Great Planes adjustable .60 - 1.20 engine mount, drill the four 7/32" engine mount holes at the punch marks as shown in the photo. Drill the two 1/4" fuel line holes and the 3/16" throttle exit 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°. If you are using a different mount, install it per its instructions, centered on the centerlines you drew in step 1.

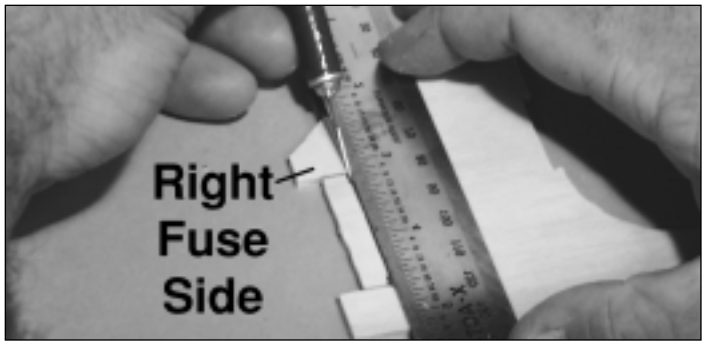


❑ 4. Drill two 1/16" holes through the punch marks in **former F-3**. Drill four 3/16" holes through the punch marks in **formers F-5** and **F-6. Hint:** Place the formers on a scrap piece of wood and press down as you drill the hole so the former does not split when drilled.

❑ 5. Press four supplied **8-32 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. Add a few drops of thin CA around the blind nuts to secure them.

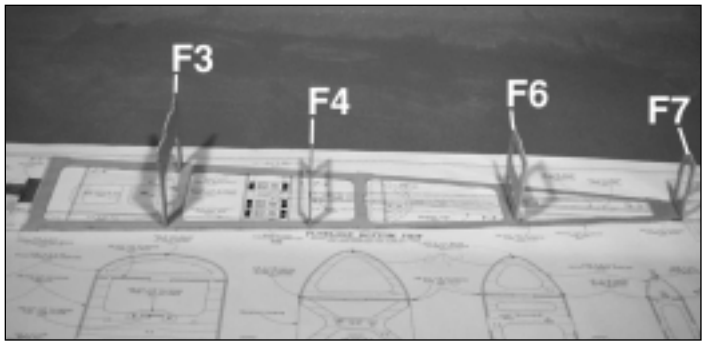


❑ 6. Lay the two **fuselage sides** next to each other as shown in the photo. Glue one die-cut 1/8" ply **fuse doubler** to each fuse side, aligned with the wing saddle and the tab. Label the insides as **LEFT** and **RIGHT**. It is important that you have the fuselage sides in a mirrored position to insure that you build a left and a right side. **Hint:** To help you recognize left from right fuse sides, set the sides upright and pretend you are in the cockpit.



❑ 7. Referring to the photo, confirm that you have properly labeled the fuse sides. Select the right fuse side, and cut off the tab as shown. **Note:** The removal of this tab provides you the appropriate right thrust pre-engineered into the firewall placement.

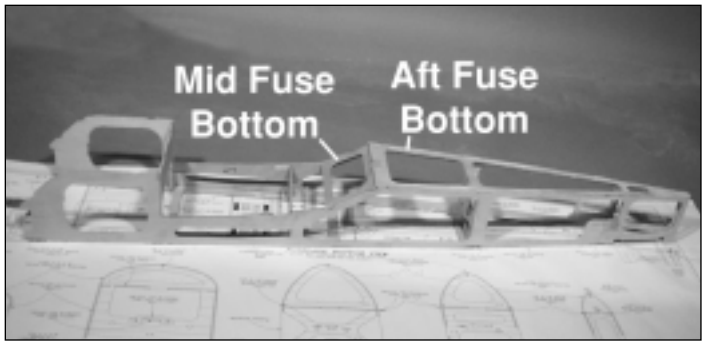
Assemble the Fuselage



❑ 1. Cover the plans with Plan Protector and then pin the fuse top in position, being sure that the fuse top aligns with the firewall. **Hint:** Keeping in mind that the fuse is being built upside-down, notice the right thrust pre-engineered into the fuse top and fuse sides.

❑ 2. Position the die-cut 1/8" ply **formers F-3, F-4, F-6** and **F-7** vertically in their slots in the fuse top. **Do not use glue until told to do so.**

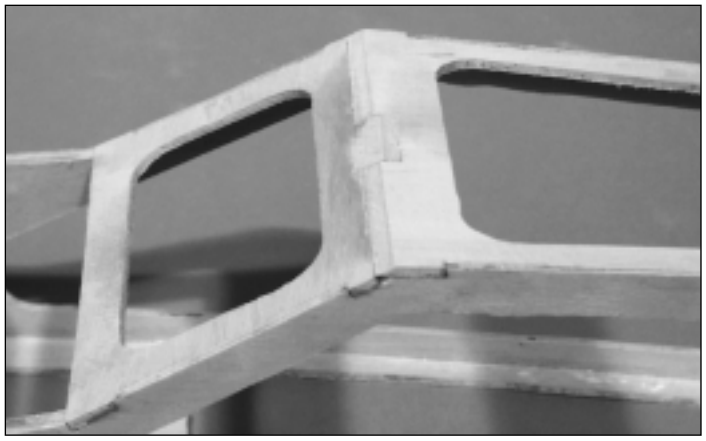
❑ 3. Fit the left and right fuse sides to the formers and fuse top. Do not glue.



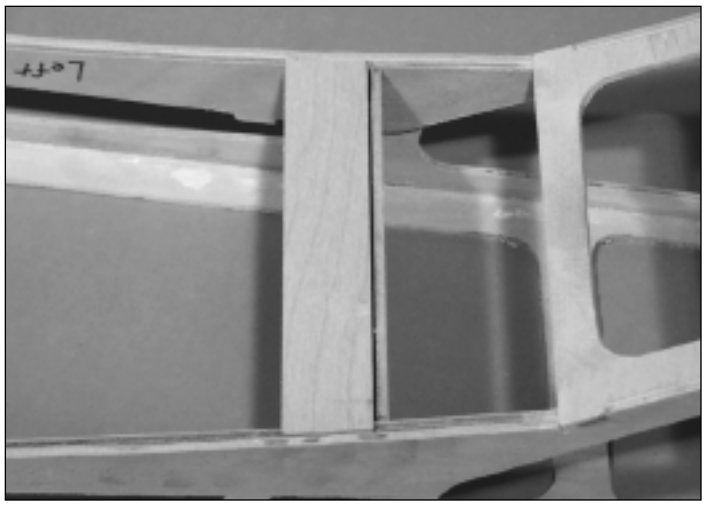
❑ 4. Fit the die-cut 1/8" ply **aft fuse bottom** and **mid fuse bottom** in position on the fuse sides and formers.

❑ 5. Use a square to check that the fuse sides are perpendicular to the building board. Double-check to make sure each former is square. Using thin CA, glue each former to the fuse top, bottom and sides. **Note:** We selected thin CA due to its excellent penetration and rapid cure time. After further assembly you will double-check all the joints and use medium CA as necessary.

❑ 6. Glue the fuse sides to the fuse top and bottom with thin CA. Leave the fuse assembly pinned to the building board until the CA has cured, then unpin it from the plans.



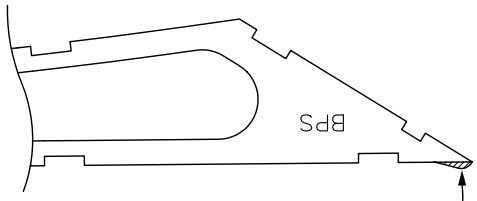
❑ 7. Carefully sand the aft fuse bottom and the mid fuse bottom flush with each other.



❑ 8. Cut one 5-5/8" long **wing bolt block** from the 1/4" x 1" x 18" birch ply stick. Sand a taper on each end until the wing bolt block fits precisely in the slots in the fuse doublers. **Note:** It is very important that the fit of the wing bolt block be perfect.

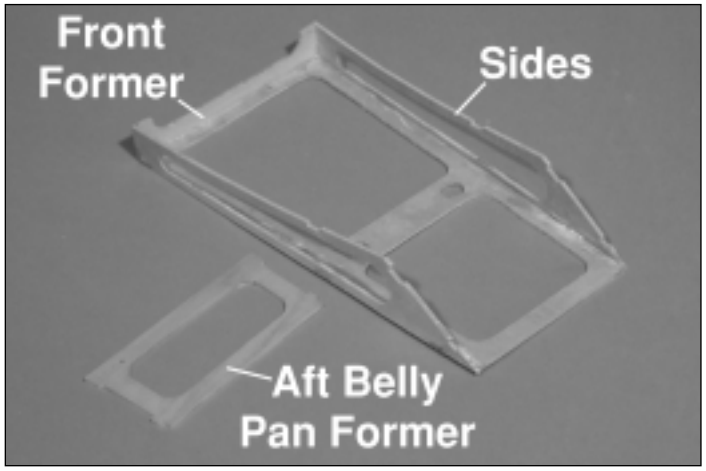
❑ 9. When you are satisfied with the fit, use 30-minute epoxy to secure the wing bolt block in place in the fuse doublers and F-4.

Assemble the Belly Pan



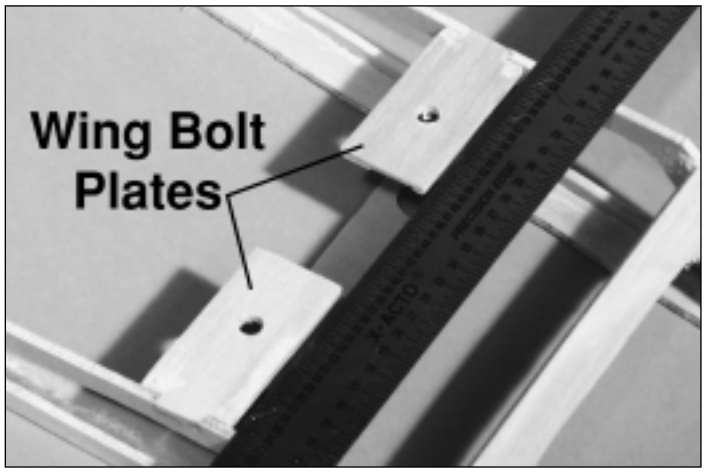
Sand off the small die-cut bump so the BPS will lie flat on the building surface

❑ 1. Sand the bump off of the die-cut 1/8" ply **belly pan sides** as shown in the sketch**.**

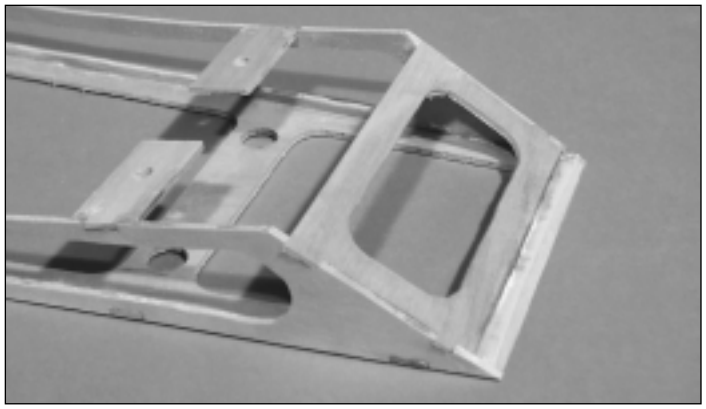


❑ 2. Glue the die-cut 1/8" ply **belly pan sides** and **belly pan front former** perpendicular to the **belly pan bottom.**

❑ 3. Drill a 13/64" hole through each of the die-cut 1/8" ply **wing bolt plates** at the punch marks.



❑ 4. Test fit and then glue the die-cut 1/8" ply **aft belly pan former** and the wing bolt plates in position. **Note:** The wing bolt plates must be mounted right-side up. If the wing bolt plates are inserted right-side up, the aft edges of the two bolt plates will be in line with one another as shown in the photo. If they are angled forward, they are installed upside-down.

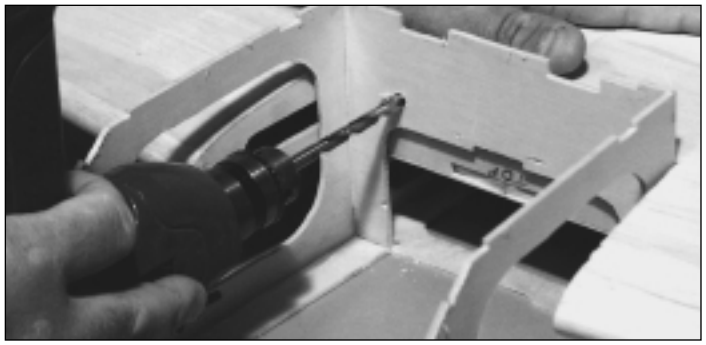


❑ 5. Using the aft belly pan former and belly pan sides as a guide, sand the trailing edge of the belly pan bottom flush as shown in the photo. Sand the trailing edge of the belly pan sides flush with the belly pan bottom.

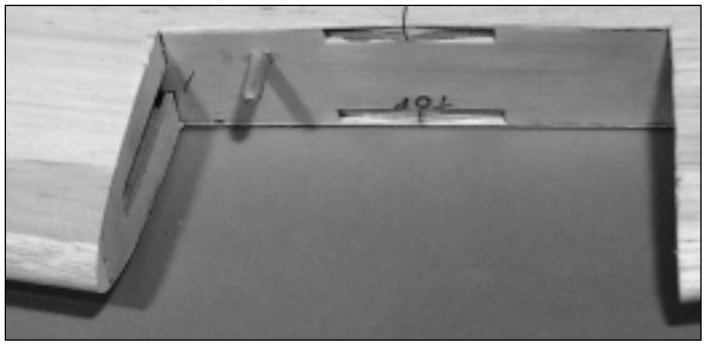
Mount the Wing to the Fuselage

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

❑ 2. Test fit the wing on the fuse. Center the wing side-to-side, leaving equal space between the fuse sides and the wing at the leading edge.

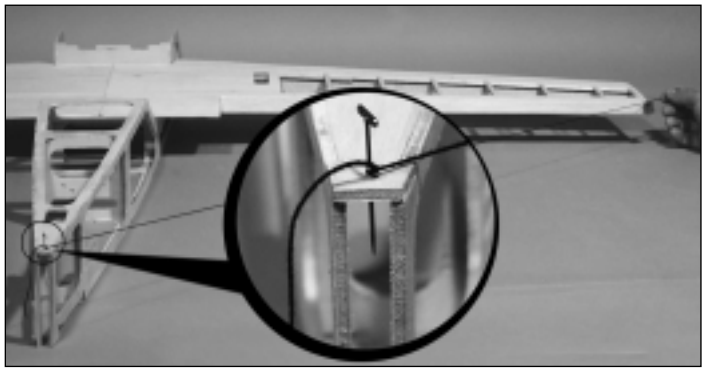


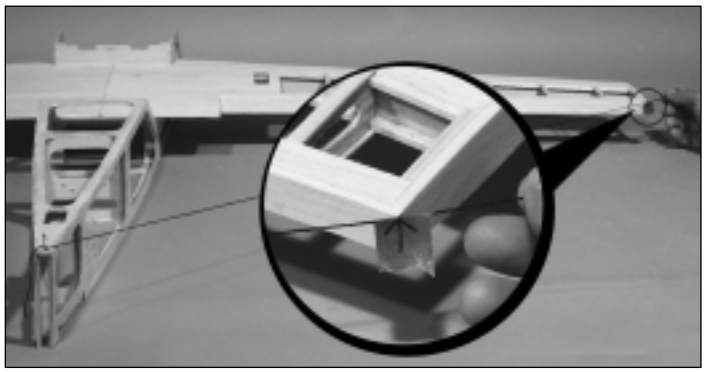
❑ 3. While holding the wing firmly in place and using the pre-drilled holes in F-3 as guides, drill one 1/4" hole through the wing joiner. Remove the wing from the fuse.



❑ 4. Cut the 1/4" x 3" long dowel into two 1/4" x 1-1/2" long **wing dowels**. Slightly round both ends of each wing dowel. Using 6-minute epoxy, glue one dowel in place in the wing, leaving approximately 7/8" protruding from the front of the wing joiner. Allow ample time for the epoxy to cure completely.

❏ 5. Fit the wing back onto the fuse, drill the second dowel hole, remove the wing and epoxy the second dowel in place. Allow ample time for the epoxy to cure.





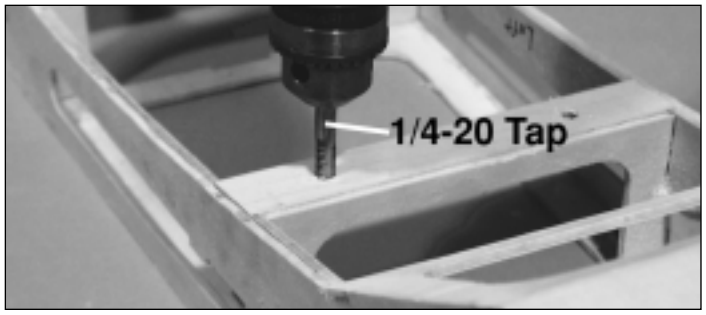
❏ 6. Stick a T-pin through the center of the aft end of the fuselage bottom. Tie a piece of monofilament line to the T-pin. Pull the string to the TE of the wing tip and put a piece of masking tape on the string at the wing tip. Mark an arrow on the tape, then slide the tape on the string so the arrow 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.

❏ 7. Now that the wing is accurately positioned, align the belly pan with the fuselage, tight against the wing. When it is positioned 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.

❏ 8. Remove the wing from the fuselage. Use thin CA to glue the rest of the belly pan to the wing at all contact points. **Hint:** Applying the thin CA from the inside of the belly pan as shown in the photo helps minimize excess CA outside of the belly pan which would have to be sanded.

❏ 9. Holding the wing firmly in place on the fuse, and using the holes in the wing bolt plates as a guide, drill one 13/64" hole through each wing filler block (inside the wing) and the wing bolt block (inside the fuse), keeping the drill perpendicular to the wing bolt plates and centered in the holes.

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



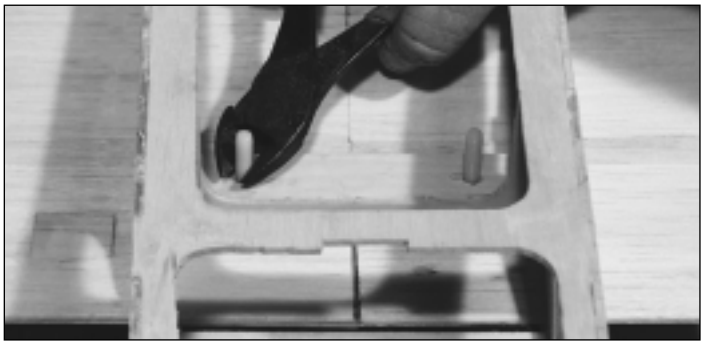
❏ 11. Use a 1/4-20 tap to cut threads in the bolt block in the fuselage. **Hint:** A cordless drill triggered at a slow speed makes a great tap driver.

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

❏ ❏ 13. 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 left 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.

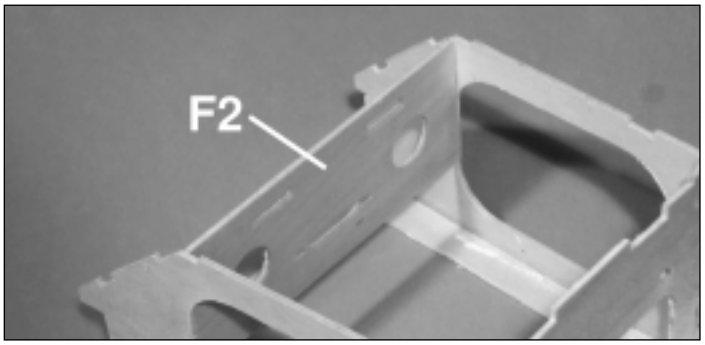
❏ ❏ 14. Using a razor saw, cut off the paper tube flush with the belly pan bottom.

❏ 15. Repeat steps 13 and 14 to mount the paper tube over the other wing bolt. Sand the paper tubes flush with the belly pan bottom.

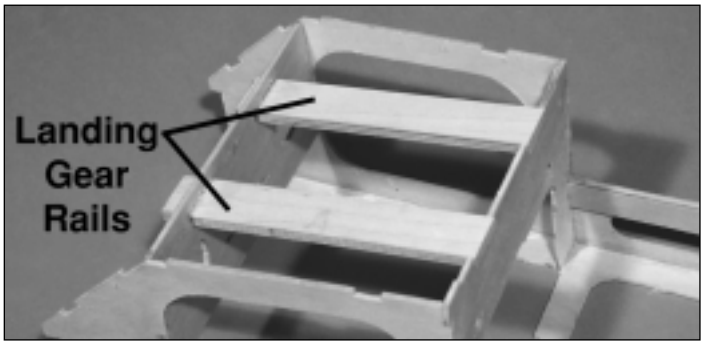


❏ 16. Turn the airplane right-side up. Cut both wing bolts off, leaving 1/4" protruding above the wing bolt block. Turn the airplane upside-down and remove the wing from the fuse.

Finish the Bottom of the Fuselage

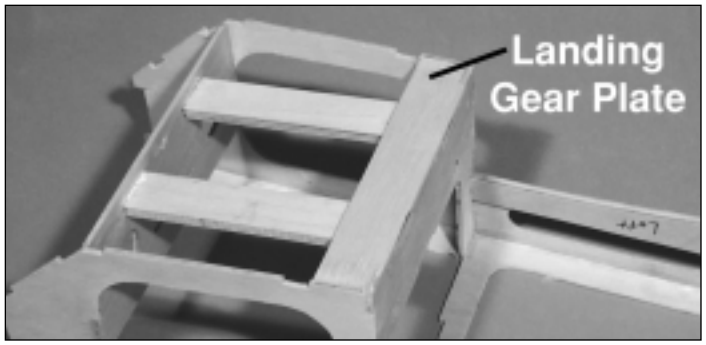


❏ 1. Position and glue F-2 to the fuse sides with thin CA.

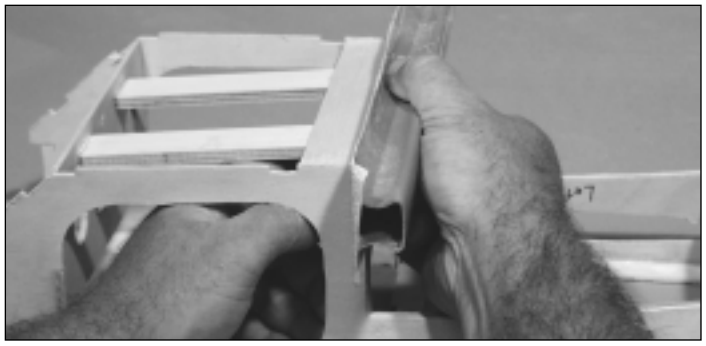


❏ 2. From the 1/4" x 1" x 12-3/8" birch ply stick (leftover from the wing bolt block), cut two 5-3/4" **landing gear rails**. Insert the landing gear rails through F-2 and into the notches in F-3 until they are flush with the **bottom of the aft side of F-3**. (A small amount of the landing gear rails will angle past F-3 into the wing saddle.) **Note:** Pay special attention not to warp F-3 when you are inserting the landing gear rails. F-3 **must** stay straight**.**

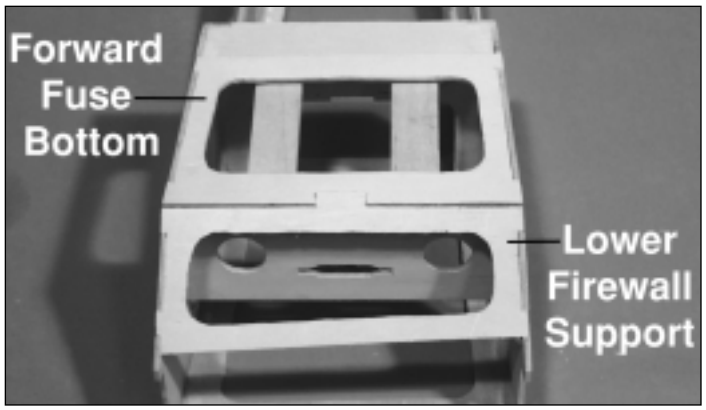
❏ 3. Use 6-minute epoxy to secure the landing gear rails into F-2 and F-3.



❏ 4. Position and glue the die-cut 1/8" ply **landing gear plate** in place. **Note:** The landing gear plate glues flat to the landing gear rails.

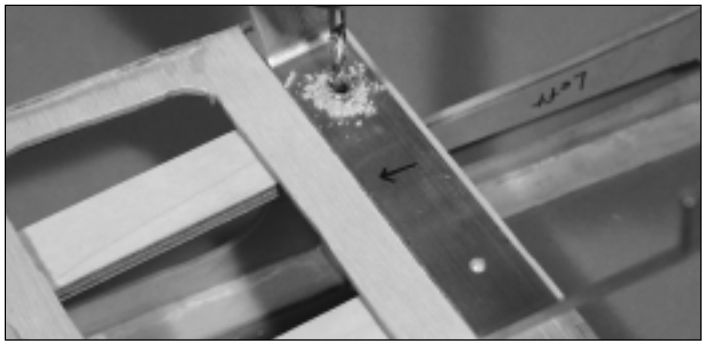


❏ 5. After the epoxy has cured completely, carefully sand the aft end of the gear rails flush with the aft side of F-3 (in the wing saddle).



❏ 6. Position and glue the die-cut 1/8" ply **lower firewall support** and **forward fuse bottom** with thin CA. **Note:** The lower firewall support is installed so that the shorter side glues to the right fuse side (as shown, on the photo's right).

❏ 7. Sand the lower firewall support and the forward fuse bottom flush with each other.



❑ 8. Notice that the leading edge of the landing gear legs are straight, and the trailing edge is tapered. Mark an arrow on the center of the gear pointing toward the straight side (leading edge).

❑ 9. Center the landing gear on the fuse and press it tight against the forward fuse bottom. Using the holes in the gear as a guide, drill two 3/16" holes through the landing gear plate and landing gear rails.

❑ 10. Remove the gear and redrill the holes in the landing gear plate and rails to 7/32". Using the included 8-32 x 3/4" socket head bolts and a 5/32" hex wrench, mount the gear and pull the included 8-32 blind nuts into place.

❑ 11. Turn the fuselage right-side up and glue around the blind nuts with thin CA as you did on the firewall.

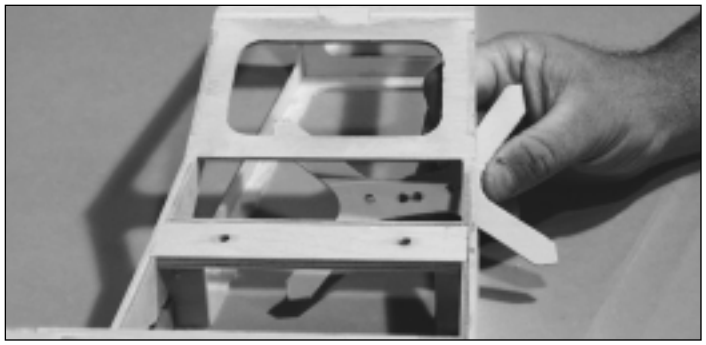
❑ 12. Remove the landing gear.

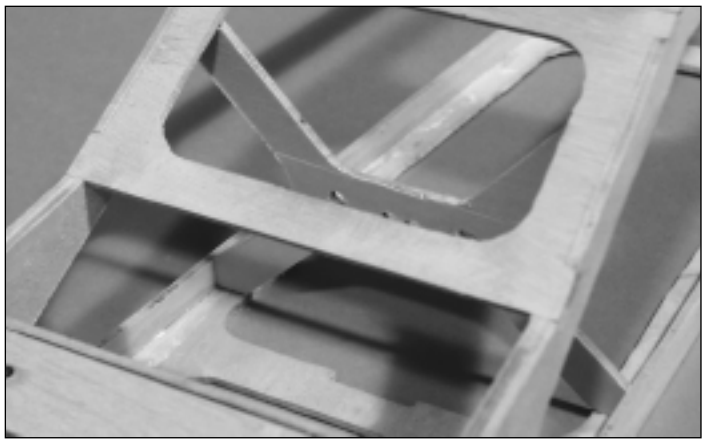
❑ 13. Double-check all of the glue joints of the entire fuselage. Reinforce with medium CA as needed.

Install the Pushrod & Antenna Tubes

Before mounting the pushrod tubes and preparing for the servos for the control surfaces, it's time to make your decision about which rudder servo location you are going to use. If you have selected an engine in the upper power range of this model, such as a .61 FX or .91 Surpass, we recommend the rear servo mounting configuration for light weight, ease of balancing, and also the short, direct control. However, this decision is entirely up to you. The model will perform exceptionally well with either rudder servo location.

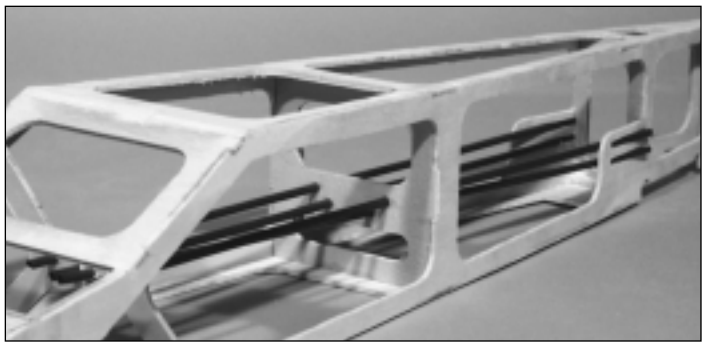
If you have chosen the tail mounted rudder servo location, you may opt to leave out the rudder pushrod tube. We recommend leaving the pushrod tube in the model in case you change engines and wish to relocate the servo at a later time.





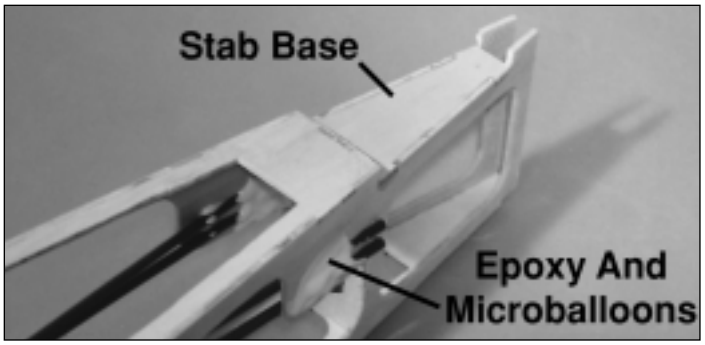
❑ 1. Locate the die-cut 1/8" ply **Former F-5**. Holding F-5 so that the pushrod tube holes are horizontal and the narrower side is toward the mid fuse bottom, position F-5 as shown in the first photo. Slide into position in the fuselage as shown in the second photo. Be careful not to slide it so far back that you are forcing the fuse sides apart. F-5 should fit snugly but not bow the fuse sides. When you are satisfied with the fit, glue in place. **Hint:** Remember the fuse is inverted when positioning this former.

❑ 2. Cut the two 36" dark grey plastic **pushrod tubes** in half so you have four 18" lengths. Sand the outside of the tubes with coarse sandpaper so glue will stick.



❑ 3. Install the four tubes through the guide holes in the formers. Approximately 1/8" of the tubes should protrude past the rear edge of the exit slots in the fuselage sides.

❑ 4. Glue the pushrod tubes to F-5 and F-6 with medium CA.

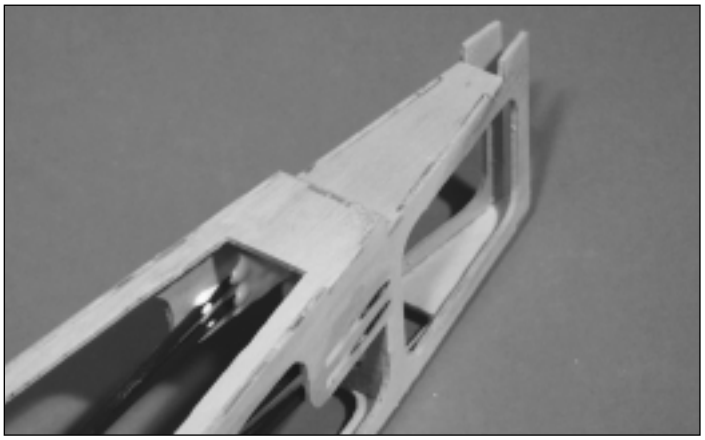


❏ 5. You're about to mix epoxy to work on the aft end of the fuselage. Before you do so, test fit the die-cut 1/8" ply **stab base**. Lightly sand as needed for a perfect fit. Temporarily remove the stab base.

❏ 6. Mix 30-minute epoxy, and use some of it to install the stab base.

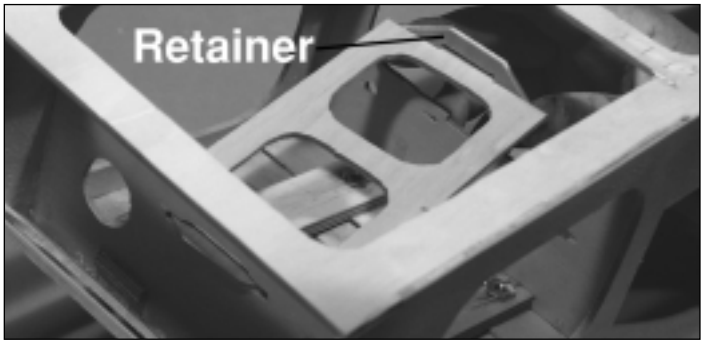
❏ 7. Mix the remainder with microballoons to create a thick, strong, easy-to-sand filler. Epoxy the tubes to the slots at the aft end of the fuselage. Completely fill the slots with the microballoons and epoxy. **Note:** Talcum powder may be substituted for the microballoons.

❏ 8. Allow the epoxy in both areas to cure completely.



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

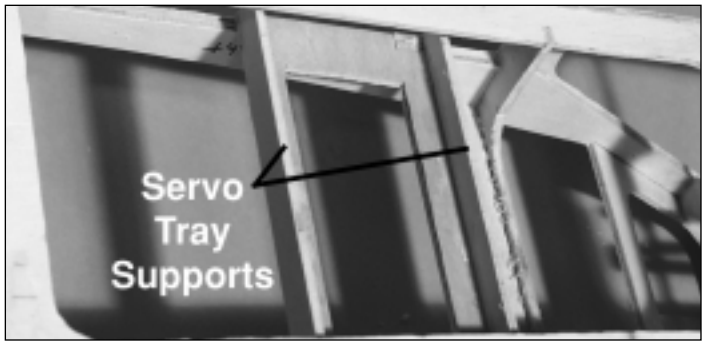
Installing the Tank Tray & Servo Tray



❏ 1. Test fit the die-cut 1/8" ply **tank tray** and the die-cut 1/8" ply **tank tray retainer**. Small adjustments may be required for a perfect fit. Sand lightly as needed until the tank tray fits snugly in place with the tank tray retainer, without bowing formers F-2 and F-3.

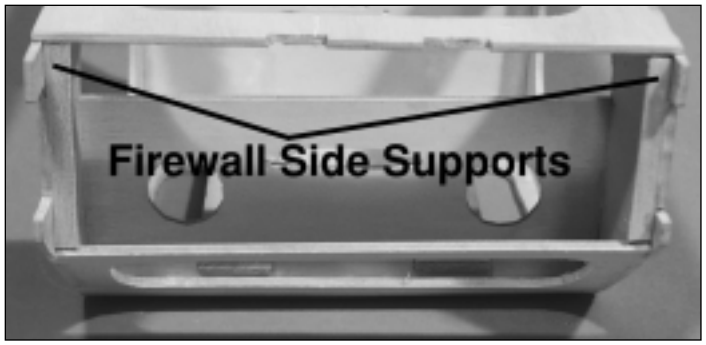
❏ 2. When you are satisfied with the fit, install the tank tray and retainer. Using the holes in F3 as guides, drill two 1/16" holes through the tank tray retainer. Insert the #2 x 3/8" flat head screws through the 1/16" holes in F-3 into the tank tray retainer. Remove the screws, the tank tray retainer and the tank tray. Harden the threads in the tank tray retainer by inserting a drop of thin CA in each hole. Set the tank tray and retainer aside until you are ready to install the tank. **Note:** This will allow the threads to dry completely so the tank tray retainer can be removed. With the removal of the two screws, the tank and tank tray will be easily removable for service, repair or replacement.

❏ 3. Fit and glue the die-cut 1/8" ply **servo tray** tightly against the tabs in the fuse sides.

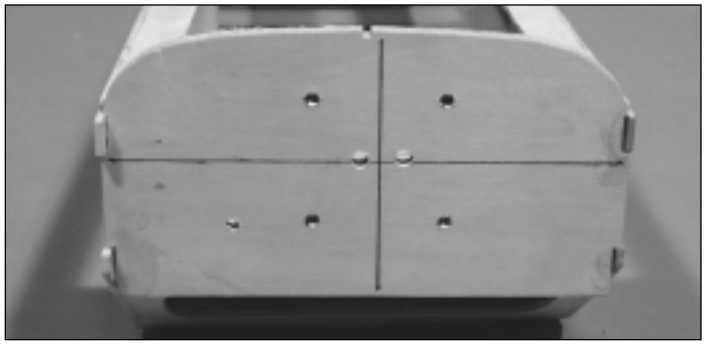


❏ 4. Fit and glue the two die-cut 1/8" ply **servo tray supports** to the servo tray and fuse sides.

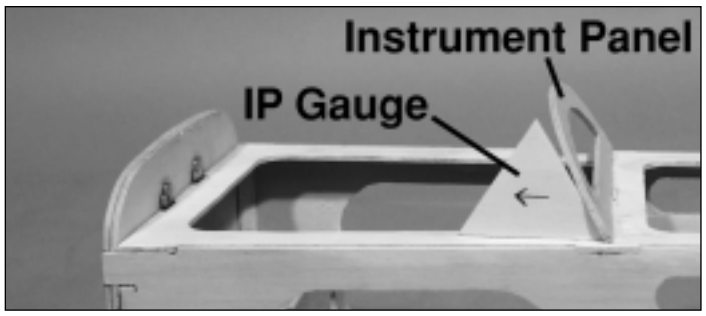
Build the Front Fuselage Deck



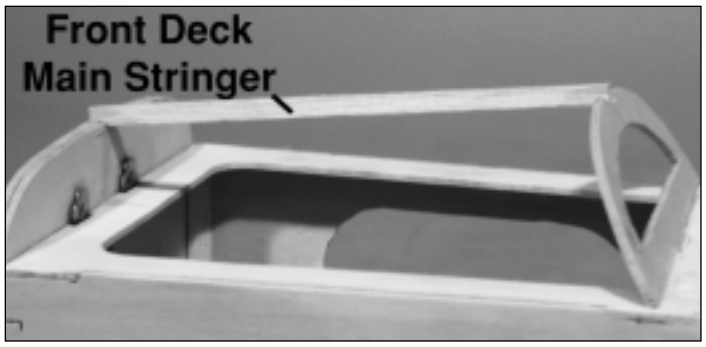
❑ 1. From the 3/8" x 6" balsa triangle stock, fit and glue the two firewall side supports to the fuse sides with medium CA.



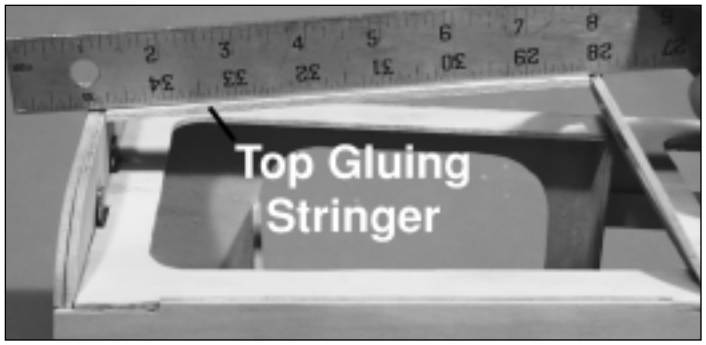
❑ 2. Fit and glue the firewall in place with 6-minute epoxy.



❑ 3. Position the die-cut 1/8" ply **instrument panel** in place, using the **IP gauge** to set its angle. Glue the instrument panel in place with medium CA. Remember that the gauge is for alignment only, and is not to be glued in place.



❑ 4. From a 1/8" x 1/4" balsa stick, cut a 7-1/8" piece for the **front deck main stringer**. Glue this stringer into the notches in the firewall and the instrument panel. Save the leftover piece for the turtle deck main stringer.

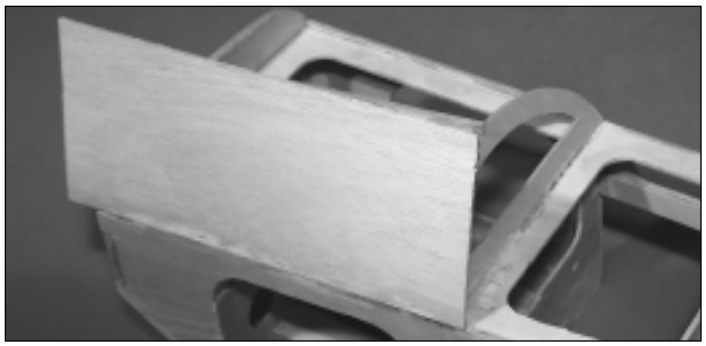


❑ 5. From a 1/8" x 1/8" x 24" balsa stick, cut two 6-5/8" long **top gluing stringers**. Use a straightedge held on top of both the firewall and the instrument panel to position the left top gluing stringer. With medium CA, attach the left top gluing stringer to the left side of the main stringer.

❑ 6. Glue the right top gluing stringer in place on the right side of the main stringer.

❑ 7. From a 1/8" x 1/8" x 24" balsa stick, cut two **side gluing stringers** to fit between the firewall and the instrument panel on the fuse top. Glue these to the fuse top between the firewall and the instrument panel approximately 1/16" in from the outside edge of the fuse.

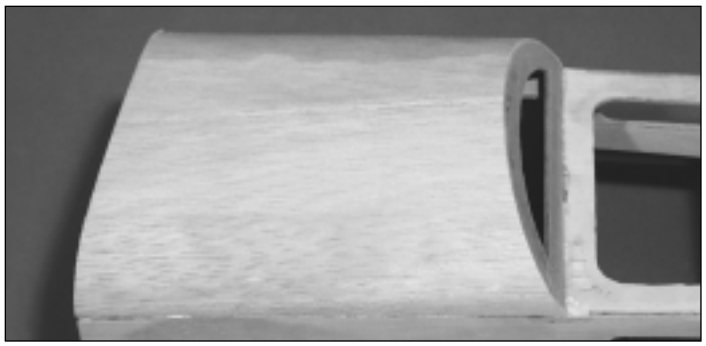
❑ 8. Select the 3/32" x 4" x 18" balsa sheet and cut into two 9" sheets, creating the **left** and **right front deck sheeting.**



❑ ❑ 9. Lay a bead of medium CA along the joint between the left side gluing stringer and the fuse top. Tightly press the left front deck sheeting to the left side gluing stringer and fuse top. Hold firmly until the CA has cured. **Note:** Allow the sheeting to overhang both the firewall and the instrument panel. You will trim off this excess later.

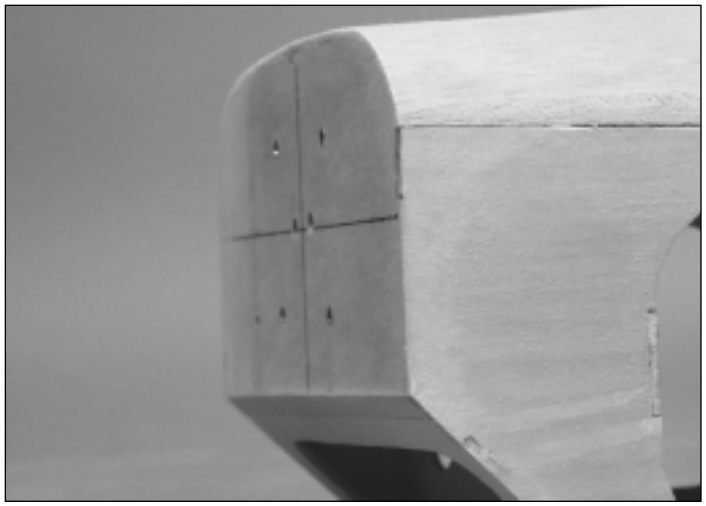
❏ ❏ 10. Liberally wet the left front deck sheeting with an ammonia/water mix to help it bend. Gradually wrap the sheeting over the fuse top. Holding it in place, use a hobby knife to carefully trim the sheeting so that it fits against but does not bow the main stringer. Apply a bead of medium CA along the left half of the instrument panel and firewall and along the joint of the main stringer and the left top gluing stringer. Press the sheeting firmly in place, ensuring a tight joint with the firewall and instrument panel. Hold it in place until the CA cures.

❏ 11. Repeat steps 9 and 10 for the right front deck sheeting.



❏ 12. Use a hobby knife to trim the front deck sheeting flush with the instrument panel and the firewall. Sand the front deck sheeting flush with the instrument panel, the fuse sides, and the firewall.

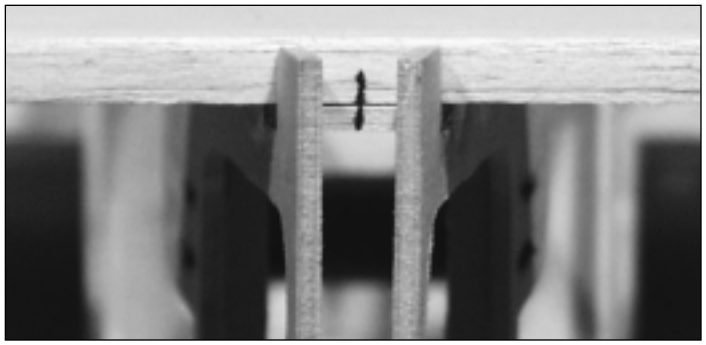
❏ 13. Sand the main gluing stringer flush with the front deck sheeting. **Note:** Be careful not to sand through the sheeting.



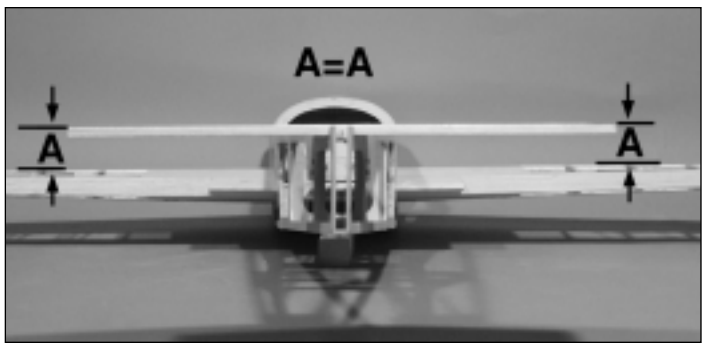
❏ 14. Sand the fuse sides flush with the firewall. Sand the firewall flush with the lower firewall support.

Mount the Stabilizer to the Fuselage

❏ 1. If you have not already done so, make sure the stab and fin are final sanded to a smooth finish. It will be a little more difficult to do so after they are glued to the fuselage. Mount the wing on to the fuselage.



❏ 2. Accurately measure the trailing edge of the stab base and use a ballpoint pen to lightly mark the center. Use the same procedure to mark the rear center of the stabilizer. Mount the wing to the fuselage. Position the stab centered on the stab base on the fuselage, using the marks you just made for alignment.



❏ 3. Stand about six to ten feet behind the model and see if the stab is parallel with the wing. If necessary, use a bar sander to make slight adjustments by sanding the stab base until the stab is in alignment with the wing.

❏ 4. Place the stab on the stab base with the center marks aligned, then use a large T-pin to attach **only the trailing edge** of the stab to the stab base.

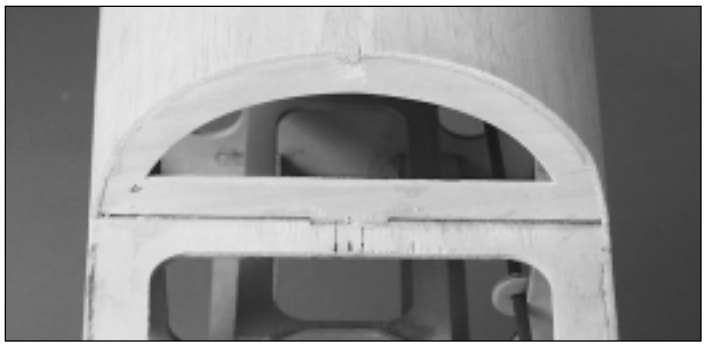
❏ 5. Stick a T-pin through the front deck main stringer above the instrument panel, then use the “pin and string technique” used on page 23 for aligning the wing, to accurately align the stab with the fuselage. Once the stab is accurately aligned, pin the LE of the stab to the stab base.

❏ 6. Carefully turn the fuselage over and use a ballpoint pen to **lightly** mark where both fuselage sides contact the bottom of the stab.

❏ 7. Remove the stab from the stab base but leave the T-pins in the stab. Apply a film of 30-minute epoxy to the stab base and to the stab between the lines you marked indicating the fuselage sides.

❏ 8. Reposition the stab on the stab base and reinsert the T-pins into the same holes. Use the pin and string to confirm the stab alignment, then use weights, more T-pins or clamps to hold the stab in position. Wipe away excess epoxy before it cures. Recheck alignment, then do not disturb the model until the epoxy cures.

Mount the Fin to the Fuselage



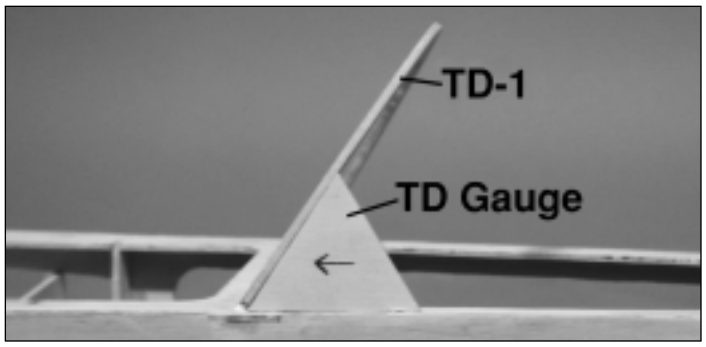
❏ 1. Measure the center point of the instrument panel where it meets the fuse top, and make a short line from this point aft on the fuse top. Measure 5/32" to the right, and draw a parallel line. Measure 5/32" to the left and draw a parallel line.

❏ 2. Position the fin as shown on the plans, using a long straightedge lined up with the marks you made in step 1 to ensure the fin is precisely aligned at the fuse centerline. Use a builder’s triangle to check that the fin is perpendicular to the stab when the lower portion of the fin TE is clamped between the fuse sides. Mark the stab on both sides of the fin.

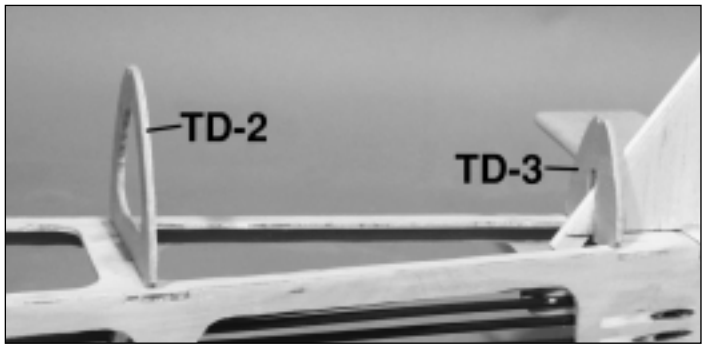
❏ 3. Using 30-minute epoxy, glue the fin in place, double-checking that it’s perpendicular and aligned with the centerline of the fuse. Clamp the fin in place within the fuse sides and allow the epoxy to dry completely. **Note**: Be sure no epoxy ran onto the clamps, attaching them to the airplane.

Enjoy a good cup of coffee, and relax a while! Look at your awesome workmanship.

Build the Turtle Deck



❏ 1. Remove the wing from the fuselage and set the fuse right-side up on the building board. Position the die-cut 1/8" ply **former TD-1** in its notch in the fuse top, using the die-cut 1/8" ply **TD gauge** to set TD-1 at the correct angle. Glue TD-1 in place. **Note**: The gauge is used only for setting the angle (do not glue the gauge in place).



❏ 2. Use a square to position the die-cut 1/8" ply **formers TD-2** and **TD-3** vertically, at 90° to the fuse top.

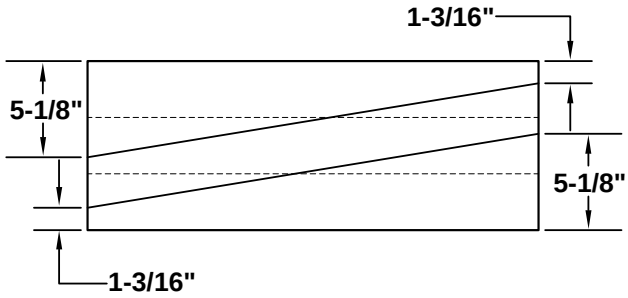
❏ 3. Locate the 1/8" x 1/4" balsa stick leftover from the front deck main stringer. Cut an angle on one end so that when it is placed into former TD-3, the end is flush with the front of the fin as shown in the photo. Glue this **turtle deck main stringer** to formers TD-1, TD-2, TD-3 and the fin.

❑ ❑ 4. Just as you did for the front deck, select a 1/8" x 1/8" x 24" balsa stick. Cut a left **top gluing stringer** to fit from TD-1 to TD-2 against the turtle deck main stringer. Use a straightedge held on top of both TD-1 and TD-2 to position the left top gluing stringer. With medium CA, attach the left top gluing stringer to the left side of the turtle deck main stringer.

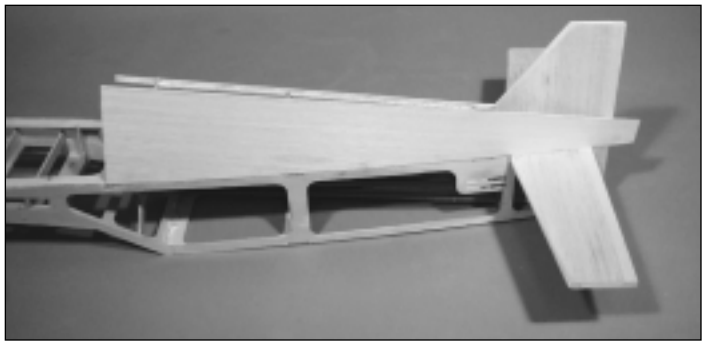
❑ 5. Repeat step 4 for the right top gluing stringer between TD-1 and TD-2 and for the left and right top gluing stringers between TD-2 and TD-3.

❑ ❑ 6. Position a 1/8" x 1/8" x 24" balsa stick, the left **side gluing stringer,** into the notch in the TD formers and beginning 1/8" past the trailing edge of the stab. The stringer should be approximately 1/16" recessed from the fuse sides. Cut the left side gluing stringer flush with the leading edge of TD-1. Glue it in place with thin CA. **Note:** Use thin CA sparingly on the stab, as thin CA wicks through balsa easily, and saturated sheeting is difficult to sand.

❑ 7. Repeat step 6 for the right side gluing stringer.



❑ 8. Edge glue three 3/32" x 3" x 24" balsa sheets together, making a 9" x 24" main sheet. Lay the sheet on the building board and cut the two **turtle deck sheets** as shown on the sketch.

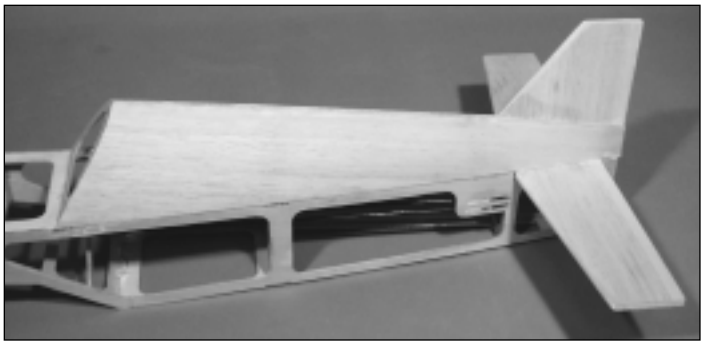


❑ ❑ 9. Position one of the turtle deck sheets on the left side of the fuselage as shown. **Note**: The grain is running parallel to the turtle deck main stringer (not the fuse side). The front is aligned with the bottom leading edge of TD-1, and the bottom edge is butted against the fuse top and along the gluing stringer.

❑ ❑ 10. Using a hobby knife, carefully trim the inner edge of the sheeting where it contacts the fin so that when the sheeting is pressed firmly against the fin the angle makes a good gluing seam.

❑ ❑ 11. Wet the outside of the sheeting with a water/ammonia mix. Gradually bend the sheeting over the formers and check the fit of the top seam along the gluing stringer and flush against the main stringer. Trim as needed for a tight, clean fit.

❑ ❑ 12. Using medium CA, glue the turtle deck sheeting to the vertical fin, TD-1, TD-2, TD-3, the main and gluing stringers. **Hint:** This is easiest to do in sections. Glue the sheeting to TD-3 and the fin. Then glue to the main and gluing stringers from TD-3 to TD-2 and also to TD-2. Then glue to the main and gluing stringers from TD-2 to TD-1 and also to TD-1.

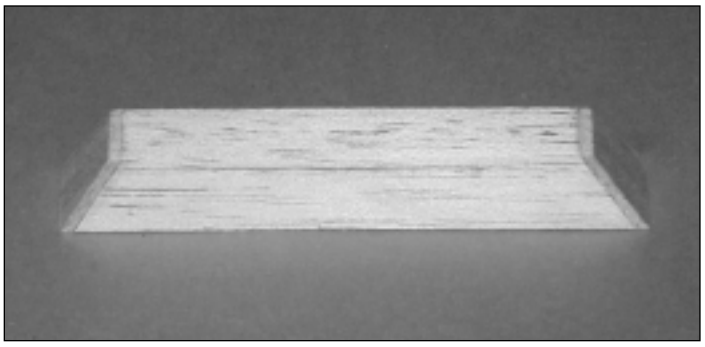


❏ ❏ 13. Trim the sheeting, the main and gluing stringers flush with TD-1. Trim the sheeting flush with the trailing edge of the fin.

❏ 14. Repeat steps 9-13 for the right side.

❏ 15. Sand the turtle deck smooth to the shape shown on the cross-section. Sand the leading edge flush with TD-1 and the trailing edge flush with the fin. **Note:** Don't worry if you have any small gaps along the main stringer. Now is a good time to fix these little blemishes with some hobby filler.

Finish the Cockpit



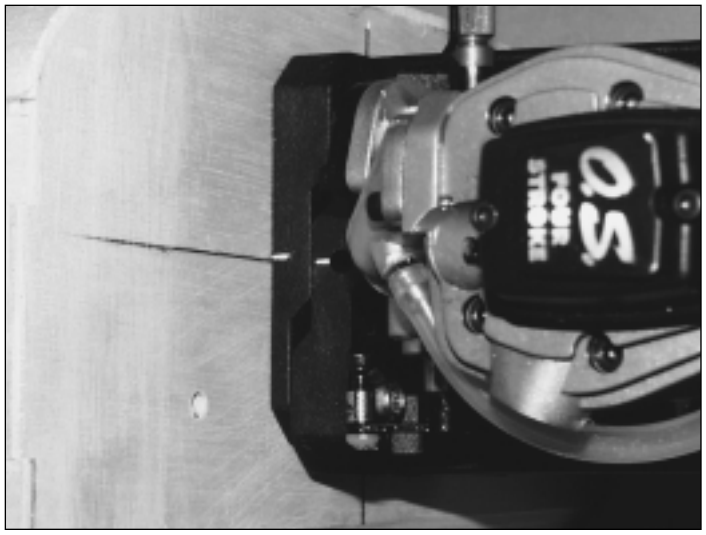
❏ 1. Select the two die-cut 3/32" balsa **IP-2** instrument panels. Holding them vertical to the building board positioned 1/2" apart, use leftover sheeting to sheet between the two IP-2s, creating the pilot's instrument panel. To make covering the cockpit floor easier, installation of this panel will be completed after covering, as shown in the second photo above. **Fact:** In an aerobatic plane such as the G-202, as with many light planes, the rear seat is for the pilot and the forward seat is for the passenger. This second seat is carefully positioned very close to the CG of the aircraft, so that the additional weight of the passenger does not alter the aircraft's CG.

Wow! Step back and take a good look. Pat yourself on the back! You are completely finished framing your Giles G-202! Nice work.

Mount the Engine

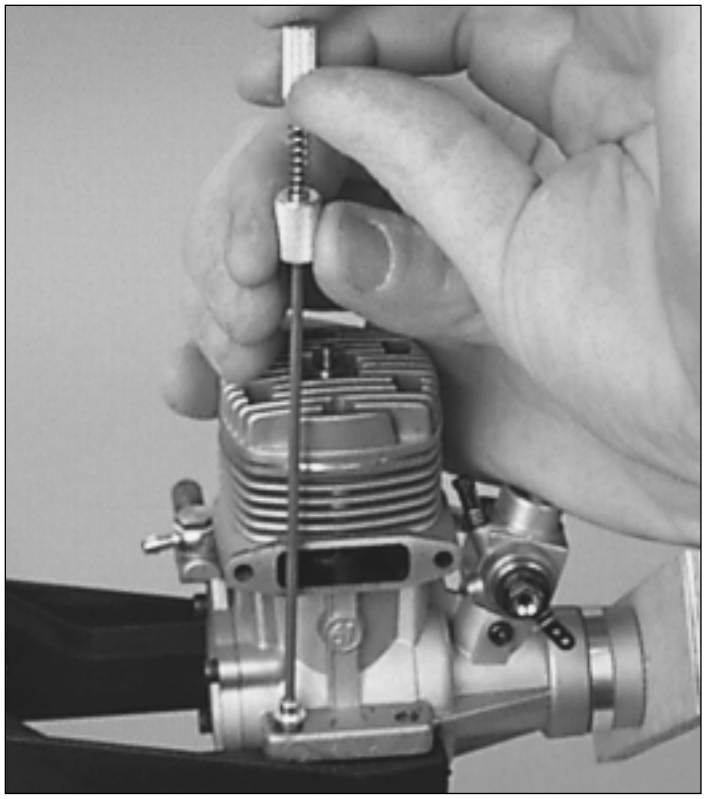
❏ 1. Cut the "spreader bars" from the supplied Great Planes engine mount, then use a hobby knife to remove any flashing leftover from the molding process so that the halves fit together well.

❏ 2. Temporarily attach the engine mount to the firewall with four 8-32 x 1-1/4" socket head bolts and #8 flat washers. Do not tighten the screws all the way, because you still need to adjust the mount.



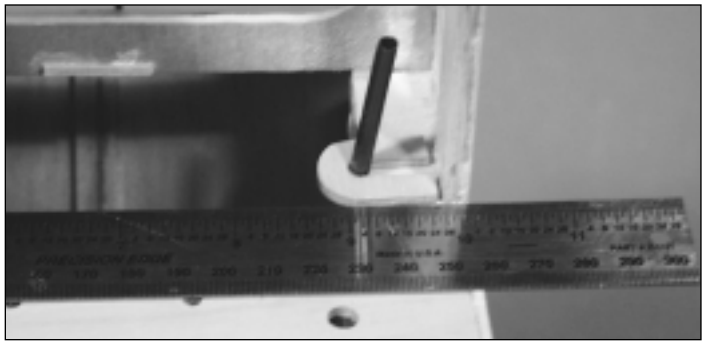
❏ 3. Place the engine on the mount and slide the halves in or out until the engine fits properly. Position the mount so the molded-in "tick marks" are equally spaced on the horizontal centerline you drew on the firewall. When the engine mount is adjusted and positioned, tighten the mounting screws.

❏ 4. Position the engine on the mount so the drive washer (or the back of the spinner) is 5-1/4" away from the firewall and clamp it in place.

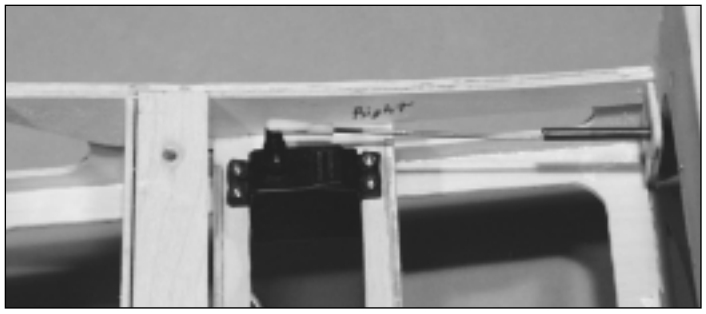


❑ 5. Use the Great Planes Dead Center™ Engine Mount Hole Locator to mark the locations of the bolt holes. Remove the engine from the mount and drill four 7/64" holes. Tap the engine mount with a 6-32 tap for the 6/32 x 3/4" socket head engine mounting bolts.

Install the Servos & Make the Pushrods



❑ 1. Select the 11-3/4" grey outer pushrod guide tube for the throttle. Use coarse sandpaper to roughen the outside of the tube so glue will stick. Slide it through its hole in the firewall and use medium CA to glue it into the firewall. Cut the pushrod outer tube flush with the outside of the firewall. Position the die-cut 1/8" ply **throttle pushrod retainer** in place against F-3, using a ruler to ensure that it does not protrude into the wing saddle. Glue in place with thin CA.



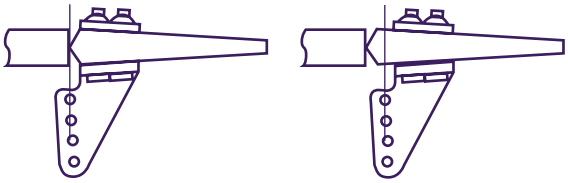
❑ 2. Mount the throttle servo as shown on the plans in the right side of the servo tray.

❑ 3. Install a nylon clevis to the 17-1/2" throttle pushrod wire. Slide the throttle pushrod through the pushrod tube with the clevis on the servo end. Without attaching the clevis to the servo, bend the pushrod as needed to make the pushrod move smoothly and the clevis properly reach the servo arm.

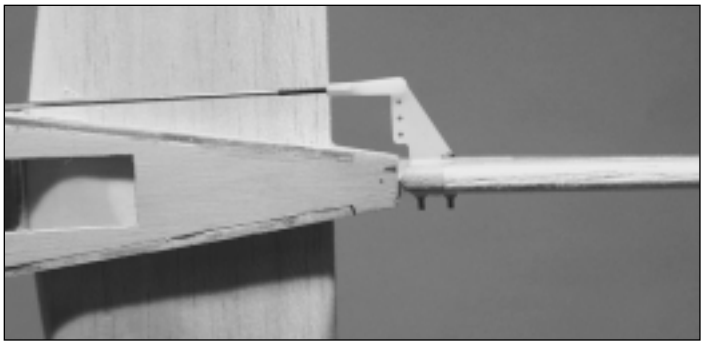
❑ 4. Bend and/or cut the engine end of the throttle pushrod as needed to fit the engine installation, using the drawing on the fuselage plan as a guide. Make adjustments to the bends in the wire so the pushrod aligns with the carburetor arm on the engine, then temporarily connect the pushrod to the carb arm with whatever connection type you have selected for the throttle. (We recommend a Great Planes Screw-Lock Pushrod Connector, not included, for the throttle connection for ease of use and adjustment.) Temporarily mount the muffler and make sure the throttle pushrod will not interfere with the muffler. Make adjustments to the bends in the wire if necessary**. Note:** Because of the close tolerances between the servos and the wing, **do not** use Screw-Lock Pushrod Connectors on the pushrods at the servo.

At this point, you MUST choose your rudder servo location. If you are installing anything but the lightest of engines in the recommended range, we recommend the aft rudder location to assist in balancing the model, as well as providing very short, tight rudder linkages for optimal performance. If you are using the forward rudder servo location, complete steps 5 through 8. If you are using the optional rear-mounted servo location, mount and hook up your rudder servo, using the plans as a guideline, and remembering that you will need to move the control horn and cut the pushrod to the appropriate length.

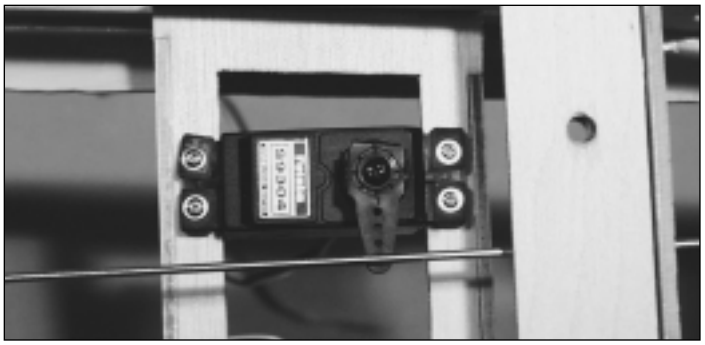
❑ 5. Thread a nylon clevis onto the 36" pushrod wire (threaded on one end) for the rudder pushrod. Slide the pushrod wire through the rudder pushrod guide tube, which is the lower guide tube on the left side of the fuselage. Remove the **backing plate** from a nylon **control horn** and connect the horn to the clevis in the outer hole. Fit the rudder to the fin, using the hinges to hold them in place. DO NOT GLUE THE HINGES IN PLACE.



Correct Incorrect



❑ 6. Position the control horn on the rudder 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 horn to the rudder with the backing plate and 2-56 x 5/8" screws.

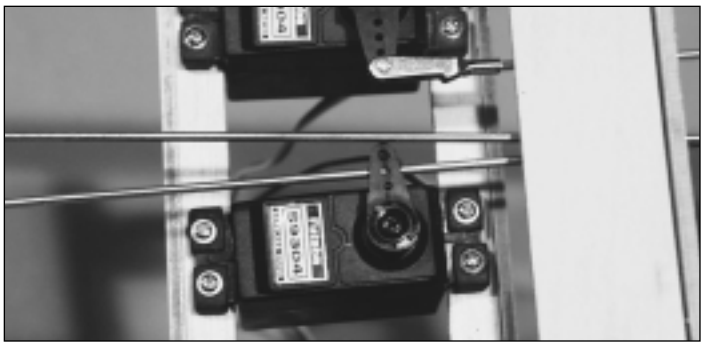


❑ 7. Position the rudder servo in the left side of the servo tray as shown on the plans, using a long servo arm included with your radio to position the servo so that the end of the servo arm lines up with the pushrod. Mount the servo. **Note:** Be sure the servo is positioned as shown with the servo shaft toward the aft end of the fuselage to allow clearance when the wing is attached.

❑ 8. Neutralize the rudder (clamping the counterbalancer to the fin, using balsa pads to keep from damaging the rudder, works well) and be sure the servo arm is perpendicular to the servo case. Cut the pushrod off 1/2" behind the servo arm. Slide a solder clevis onto the pushrod at the rudder servo. Attach the clevis to the outer hole on the servo arm and mark the pushrod with a marker at the aft edge of the clevis. **Note:** Leave the clevis and pushrod installed until after you mount the elevator servos to ensure proper clearance.

❑ 9. Fit the elevators to the stabilizer, using the hinges to hold in place. **Do not glue. Note:** If you wish to use twin elevator servos, you will need to adjust the next few steps accordingly to make them fit and mount the clevises, etc. If you choose twin elevator servos, a computer radio with appropriate mixing functions is REQUIRED, as the servo arms must be mounted both facing inboard for the pushrods to function properly.

❑ 10. Thread a clevis onto one end of each 35" pushrod wire (threaded on both ends) for the elevator pushrods. Slide each pushrod through the elevator pushrod guide tubes, which are the upper guide tubes on each side of the fuselage. Remove the backing plates from two nylon control horns and connect the horns to the clevises in the outer holes. Position and temporarily mount the elevator control horns as you did the rudder control horn.



❑ 11. Position the elevator servo in the servo tray as shown on the plans, using a medium servo arm included in your radio to position the servo so that the end of the servo arm lines up centered between the two pushrods. Mount the servo. **Note:** Be sure the servo is positioned as shown with the servo arm toward the aft end of the fuselage to allow clearance when the wing is attached.

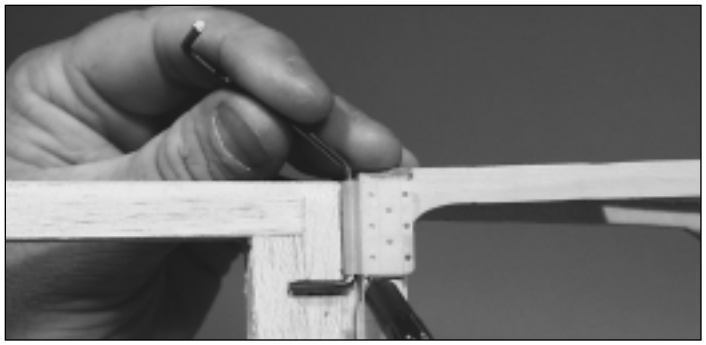
❑ 12. Neutralize both elevators (clamping them to the stab and using balsa pads to keep from damaging them) and be sure the servo arm is perpendicular to the servo case. Cut one pushrod 1/2" behind the servo arm; cut the second pushrod off 1" behind the servo arm. Save the two leftover pieces for the ailerons. **Note:** The two elevator pushrods will not be joined until final assembly, after the model is covered.

❑ 13. Slide the solder clevis onto the longer pushrod, clip the solder clevis onto the servo, and mark as you did the rudder pushrod.

❑ 14. Remove all three pushrods and both solder clevises from the aircraft. Position the nylon bushings, equally spaced, onto the wire pushrods. **Note:** The longest pushrod

is marked and is for the rudder; the second longest is marked and is the elevator pushrod with the solder clevis; the shortest is the second elevator pushrod.

❑ 15. Remove the solder clevises from the servo arms. The pushrods must be cleaned prior to soldering. Rubbing alcohol works well for this, but don't wipe off the marks. Silver solder the clevises to the pushrods, using the marks you made for reference.



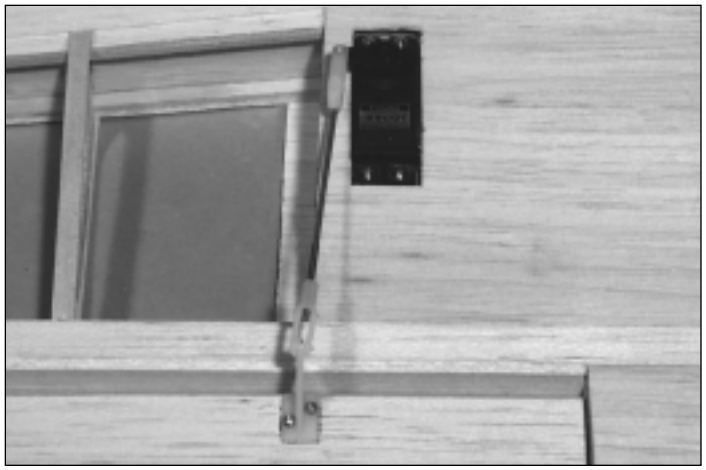
❑ 16. Mark the location of the **tail gear wire** on the rudder and the nylon tail gear bearing on the fuselage, aligning the bottom edge of the nylon tail gear bearing and the aft fuse bottom.

❑ 17. Remove the rudder and elevators from the model. Using a pen, draw lines around the control horns after which the horns may be removed. Poke approximately a dozen holes at each surface's control horn location with the tip of a hobby knife. Remove the hinges from each surface, then use thin CA to harden the wood inside the lines you drew where the control horns attach.

❑ 18. Drill a 7/64" hole 5/8" deep in the leading edge of the rudder at the mark you made for the tail gear wire. Cut a groove in the rudder for the nylon tail gear bearing. The Great Planes Groove Tube™ works great for this task. Test fit the tail gear wire in the rudder. Cut a slot in the trailing edge of the fuse at the marks you made for the nylon tail gear bearing. Without using any glue, test fit the rudder to the fin with the tail gear wire. When satisfied with the fit, remove the rudder and set it aside.

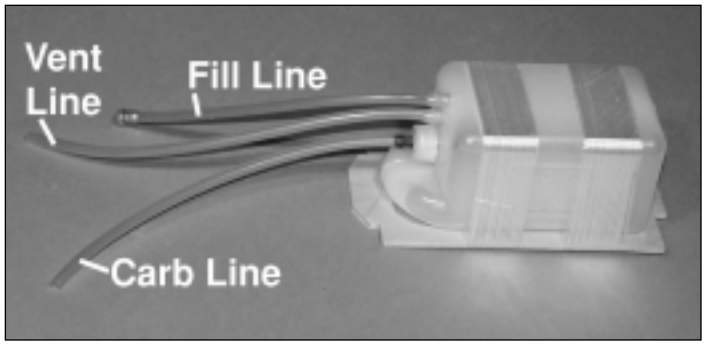
❑ 19. Mount the aileron servos in the wing with the screws provided with your radio. Mount the aileron control horns back on the ailerons.

❑ 20. Thread the clevises onto the pushrod wires leftover from the elevators.



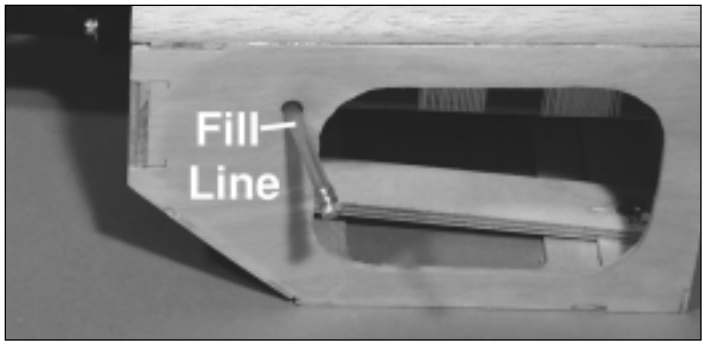
❑ 21. Connect the clevis to the control horn. Center the aileron and position the servo arm perpendicular to the servo case. Mark the pushrod where it crosses the servo arm. Bend the pushrod up 90° at the mark and connect it to the servo arm from the bottom with a nylon Faslink™. Trim the excess wire that protrudes past the nylon Faslink. **Hint:** For a precise pushrod fit, enlarge the selected servo arm hole with a 5/94" drill bit set.

Assemble & Install the Tank



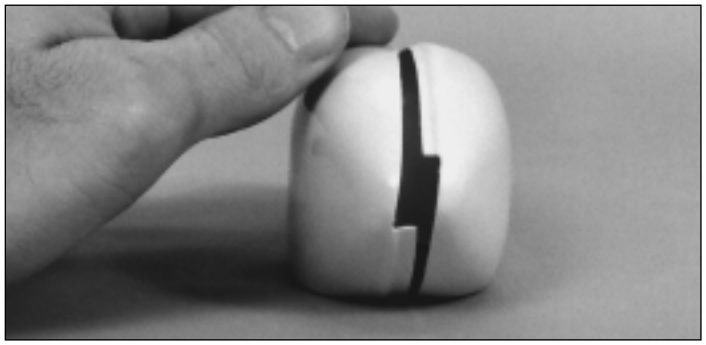
❑ 1. Using nylon reinforced packing tape, secure the tank to the tank tray. Using a 1/16" drill bit, drill out the middle nipple on the Great Planes 10 oz. tank (not included). Attach a 12" piece of fuel tubing to the upper nipple, and cap the line with a Great Planes Aluminum Fuel Line Plug (not included). This will be the line to fill and drain the model. **Note:** This system is extremely simple, lightweight, and inexpensive. It also allows you to completely drain the model by simply using the fill line while the model is inverted in a plane stand.

❑ 2. Attach a 12" piece of fuel tubing to the middle nipple, which will attach to the muffler pressure tap. Assemble and install the tank cap. Attach a third piece of 12" fuel tubing to the main nipple in the center of the tank cap, which will attach to the carburetor.

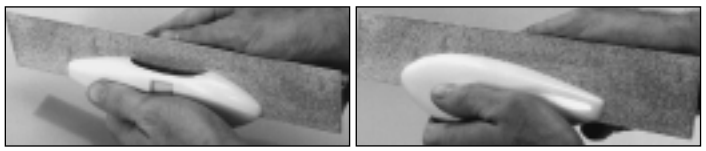


❏ 3. Drill a 1/4" hole in the side of the fuselage as shown in the photo. Harden the wood around the hole with thin CA. This is the exit location for the fill/drain line. **Note:** To fill the model, simply have the model sitting upright on its gear, gently pull the fuel line out of the model a few inches, remove the fuel line plug, and fill through the fuel line. To drain the model, simply leave the model inverted in a plane stand. Pull the fuel line out, remove the fuel line plug and drain the fuel tank.

Assemble the Wheel Pants



❏ ❏ 1. Trim one matching set of wheel pant halves along the molded cut lines. Notice that the **top** of the outer pant goes over the lip of the inner pant and the **bottom** of the inner pant goes over the lip of the outer pant. You can use a hobby knife to **carefully** score along the cut lines and flex the plastic until the excess breaks free, or use small scissors to cut along the lines. Hobbico Curved Tip Canopy Scissors work extremely well for this and make the job a cinch. For now, don't worry about accurately cutting out the opening in each wheel pant half–just cut an approximate opening for the wheels.



❏ ❏ 2. Use your bar sander to carefully true the edges of the overlapping pieces of the wheel pant halves so when you glue them together the seam will be as small and straight as possible. Notice that the front and rear of the pant halves do not overlap and are "butt glued" together. Use 150 or 220-grit sandpaper to remove the flashing and **thoroughly** roughen all areas that are to be glued including the indentation on the inside of both inner pant halves.

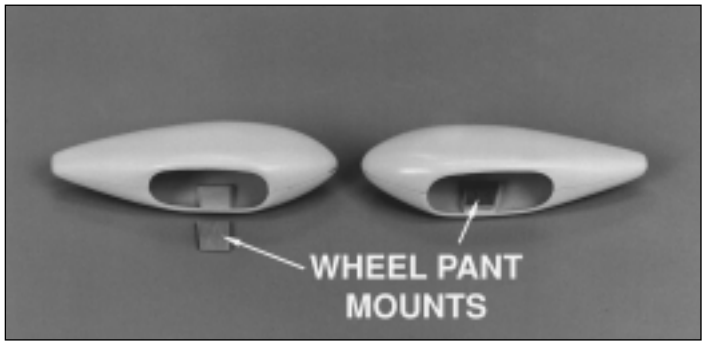
❏ ❏ 3. Test fit the wheel pant halves together and make adjustments where necessary for the best possible fit.

❏ ❏ 4. Join the wheel pant halves and carefully spot glue them together in just a few places with thin CA. Start by spot gluing the top, then the front and rear where the two halves just butt together. After the halves are joined, securely glue them together along all seams with thin CA.

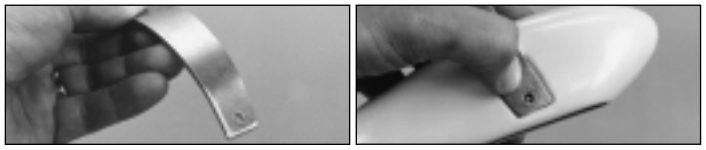
Note: Do not use CA accelerator on the ABS plastic as it may develop cracks and/or keep the paint from adhering.

❏ ❏ 5. Use your hobby knife (or a Moto-Tool with a sanding drum) to finish cutting out the wheel opening.

Hint: Make the wheel opening wide, as this will make installing the wheels and axles easier and cause less interference with the wheels upon landing and takeoff. You can see the size of the wheel openings in the following photo.



❏ ❏ 6. Use medium CA to glue the die-cut 1/8" plywood **wheel pant mounts** to the inside of the wheel pant.

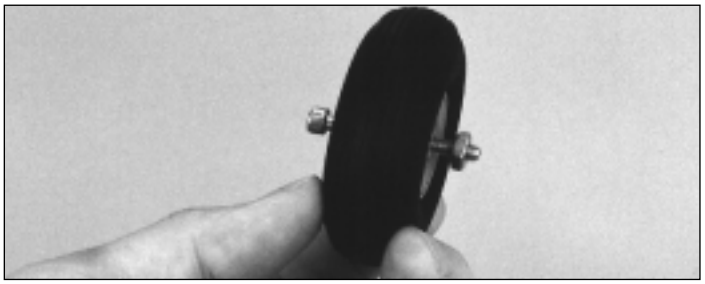


❏ ❏ 7. Use a metal file to chamfer the edges and corners of the aluminum landing gear so it will neatly fit in the recess of the wheel pant. Position the wheel pant on the aluminum landing gear, then use a felt-tip pen to accurately mark the location of the axle mounting hole.

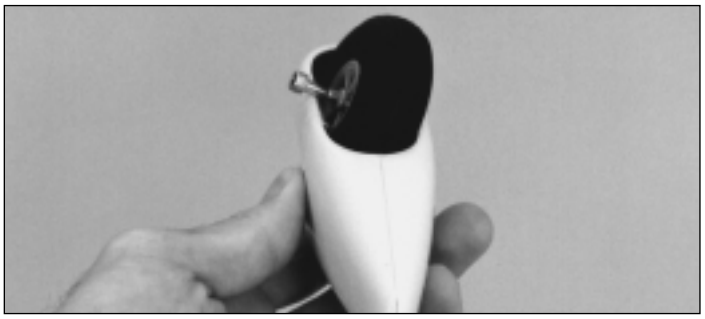
❏ ❏ 8. Drill a 3/16" (11/64" or #18 for precision) hole in the wheel pant at the mark. Back up the wheel pant mount with a piece of scrap wood so you do not split it as the drill goes through.

❏ ❏ 9. Most 2-1/2" wheels (not included) are made to fit 5/32" axles, but the 8-32 screws supplied in this kit for the axles require a larger hole. If the wheel does not roll freely on the 8-32 x 1-1/2" SHCS "axle," enlarge the wheel hub with an 11/64" (#18 for perfection) drill.

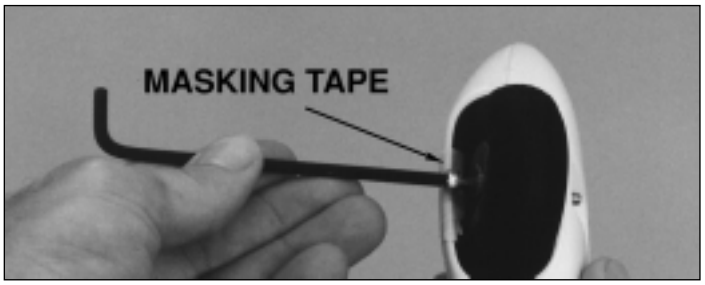
❏ ❏ 10. Test fit the wheel in the wheel pant using the following procedure:



A. Install an axle in a wheel. Thread an 8-32 nut about 1/8" onto the axle.

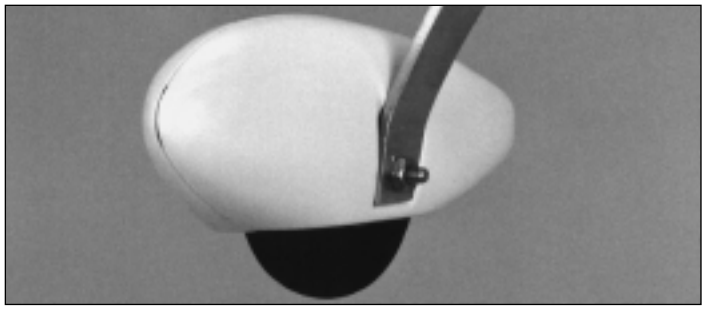


B. Insert the wheel in the pant with the end of the screw inserted in the plywood wheel pant mount and the head of the screw sticking out of the wheel pant. ***Note:*** *When you reinstall the wheel after the wheel pant has been painted, put masking tape on the bottom of the pant so the screw will not scratch it.*



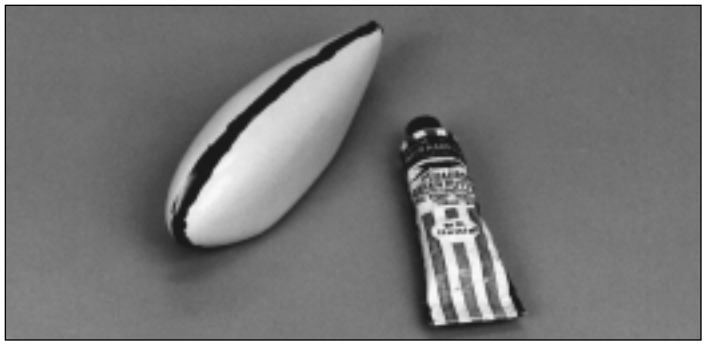
C. Use a 9/64" hex wrench to screw the axle through the wheel and the wheel pant until the wheel goes all the way in and the axle goes through the pant mount.

D. Adjust the tightness of the nut with hemostats or needle nose pliers.

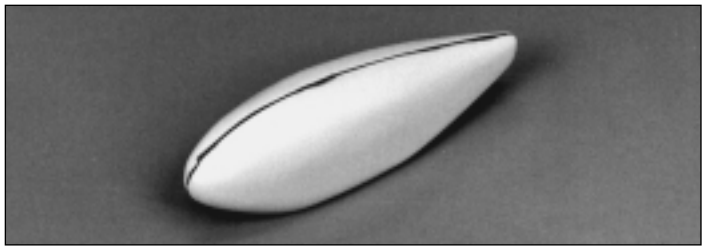


❏ ❏ 11. Temporarily mount the wheel pant to the landing gear with another 8-32 nut on the axle.

❏ 12. Repeat steps 1 to 11 to assemble and temporarily mount the other wheel pant to the landing gear.

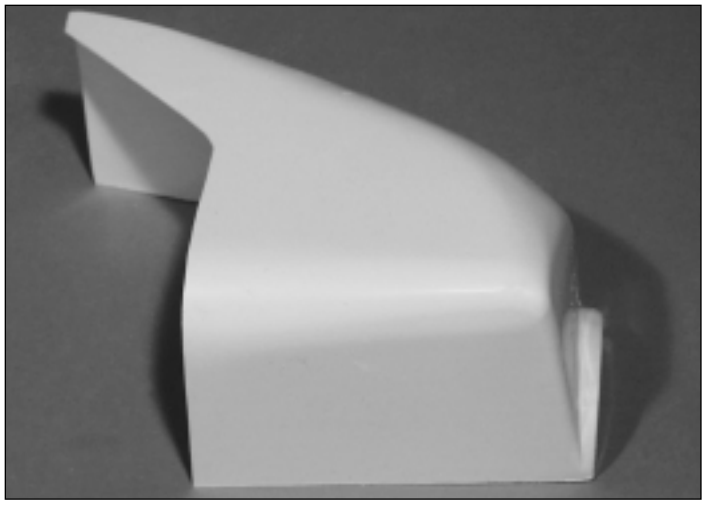


❏ 13. Before painting the wheel pants, fill the seams with putty filler such as Squadron White Putty or resin filler such as Bondo. We use Bondo most of the time as it cures quickly and is easy to sand, but usually it must be purchased in large quantities. Squadron putty works well but it takes overnight to dry and usually requires at least two applications because it shrinks as it dries.



❏ 14. After the filler has cured, wet sand the wheel pants with 400-grit sandpaper to prepare them for primer.

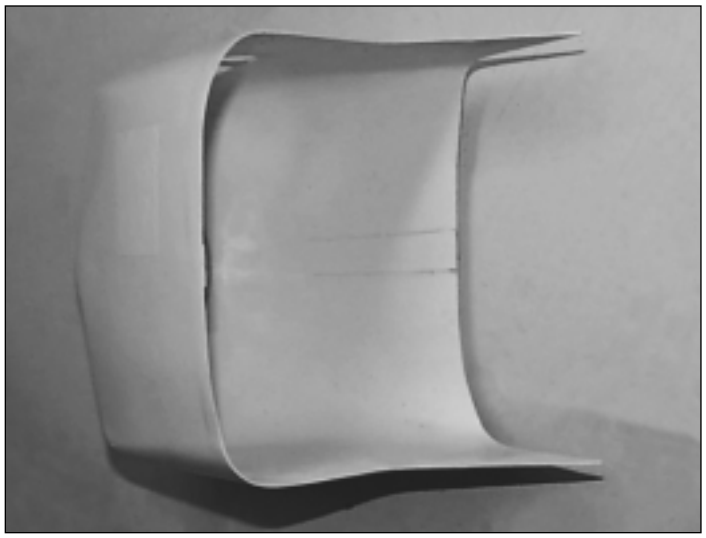
Assemble the Cowl



❏ 1. Cut the cowl halves along the cut lines, then use a bar sander to true all the edges. To check the straightness of the edges, set the cowl half seams on the building board to be sure it is straight and smooth.

❏ 2. For now, the openings in the front of each cowl half only need to be roughly cut out. Using coarse sandpaper, “roughen” along what will be the seam on the inside edge of each cowl half so the glue will stick.

❏ 3. Join the two pieces together, using several pieces of masking tape to tape across the seams.

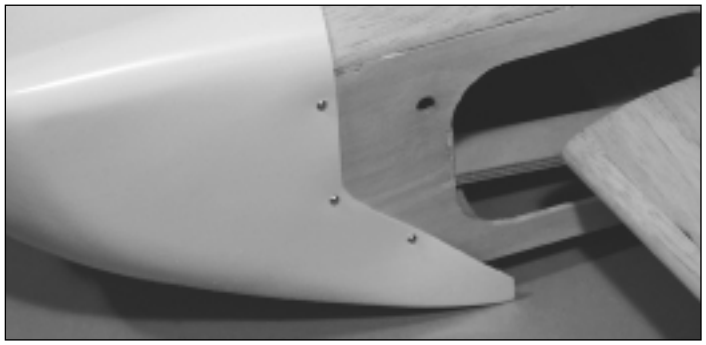


❏ 4. Rough sand the 3/4" x 18" ABS **cowl mating strip** on one side so the glue will stick. Using medium CA, glue the mating strip to the inside of the seam in the bottom of the cowl. Cut off the excess and glue it in place along the inside of the seam in the top of the cowl. Trim off any excess. **Hint:** Be careful not to glue the cowl to the building board.

❏ 5. Use a sharp hobby knife or a Multi-Tool with a sanding drum to accurately cut the engine openings at the front of the cowl.

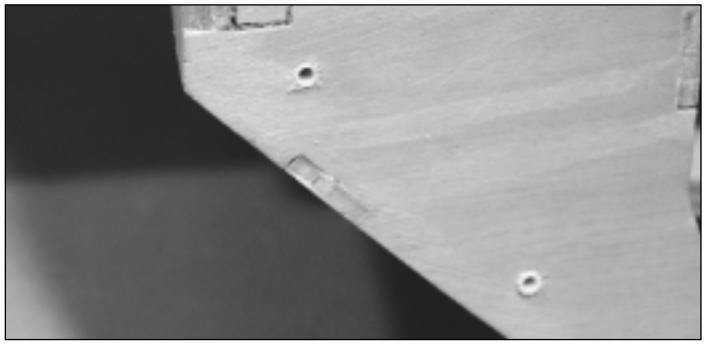
❏ 6. If the mating strips did not go all the way to the spinner ring, reinforce the unmated areas with fiberglass tape and medium CA.

❏ 7. Slide the cowl onto the fuselage. Slide the spinner backplate over the crankshaft and against the drive washer and secure it in place. Move the cowl as necessary to leave a 1/8" gap between spinner and cowl and to align the cowl properly with the spinner. **Note:** If you are utilizing the O.S. .91 four stroke or other engine in the top end of the engine range, you may need to remove the valve cover and/or needle valve to get the cowl to slide on without rubbing on your engine.

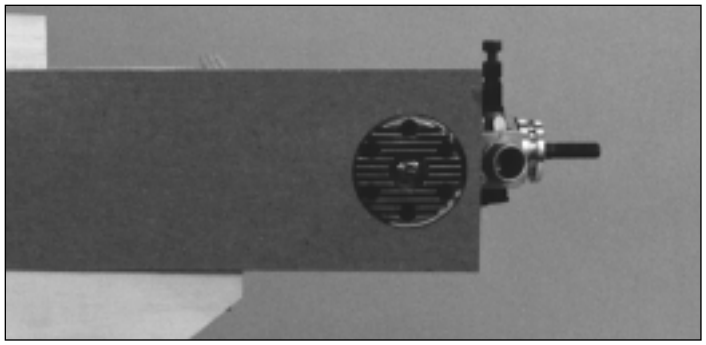


❏ 8. Hold the cowl in position tight against the front deck sheeting and aligned with the spinner. Using the plans and photo as a guide for location, drill the first cowl mounting screw hole with a 1/16" drill bit. Fasten the cowl in place with a #2 x 3/8" sheet metal screw.

❏ 9. Confirming the proper positioning of the cowl for each hole, drill the remaining holes and install the remaining five screws.



❏ 10. Remove the screws and the cowl from the model. Drill out the pilot holes you just made in the fuse with a 1/8" drill bit. From the 6" piece of white inner pushrod, cut six 1/4" lengths, making six **cowl screw retainers**. Push the 1/4" lengths into each hole until flush with the fuselage side. Glue them in place with thin CA from the inside of the fuselage. **Note:** These plastic retainers help keep the cowl screws from vibrating loose.



❏ 11. Use a piece of thin cardboard or plastic to make a template for the cutout in the cowl for the valve cover (if necessary), the engine mixture screw and for the glow plug. Tape the template to the fuselage side, accurately indicating the positions.

❏ 12. Remount the cowl in position with the mounting screws, being careful not to move or damage the template. Use a felt-tip pen to transfer the holes in the template onto the cowl.

❏ 13. Remove the cowl and template, then remount the valve cover and/or needle valve, if necessary. Cut out the holes in the cowl, then test fit it to the fuselage (you may have to temporarily remove the needle valve so it does not interfere with the cowl). Adjust the position and size of the holes as needed. **Hint:** Cut the holes in the cowl undersize at first so you can make adjustments to their position without having to oversize them.

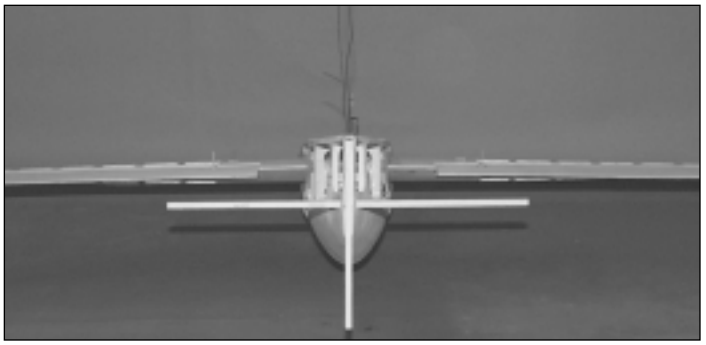
❏ 14. Cut six 1" x 1" pieces of fiberglass cloth. Use medium CA to glue one piece to the inside of the cowl at each cowl mounting hole. After the CA cures, re-drill the holes with a 1/16" drill bit.

❏ 15. Fill the seams and other imperfections in the cowl as described in the preceding wheel pants section. Wet sand the entire cowl with 400-grit sandpaper to prepare it for priming.

BALANCE THE MODEL LATERALLY

Do not confuse this procedure with "checking the C.G.", which will be discussed later in the manual.

A model which is not laterally balanced properly may exhibit a variety of unpleasant traits, ranging from uncharacteristic tip stalls to problems with spin entries. This aircraft, when balanced properly, exhibits none of these tendencies. Be sure to check the lateral balance carefully as described to help ensure that the model exhibits the same exceptional handling qualities of our prototypes.



❏ 1. With the wing level and attached to the model (and the radio system, engine and muffler installed), suspend the model inverted by the propeller shaft and the trailing edge of the fuselage/fin base through the lightening holes under the stab. (Be sure the knot is centered on the fin and the line off the prop shaft is extending off the center of the prop shaft, not to one side or the other.) Be SURE that the model is suspended securely and that you can be hands-free to complete this process. **Hint:** Above our workbench, we have two pieces of cord suspended from the beams in the ceiling to secure around the prop shaft and the tail.

❏ 2. With a hobby ruler, measure how far each tip is off the building board. Rock the plane on the strings gently and let it settle. Measure again. Add stick-on weight to the high tip until the two tips measure exactly the same height off the building board. Secure the weight inside the wing. Take the model off the ropes and set it back on the gear. **Note:** The building board must be both flat and LEVEL for this process to work properly. Shim if needed.

PREPARE THE MODEL FOR COVERING

❏ 1. Remove all the pushrods and remove the hinges and control horns from the ailerons, elevators, and rudder. Remove the aileron servos. 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.

❏ 4. Cut the canopy along the outside cut lines. **Do not** cut along the second set of lines, provided as "paint to here" locator lines to help you paint the canopy. Test fit and trim as necessary.

COVER THE MODEL WITH MONOKOTE® FILM

Covering Technique

Cover the model with **Top Flite MonoKote Film** using the recommended covering sequence that follows. Before you cover the fuselage, first apply 1/4" wide strips of MonoKote film in the corners of the stab and fuse and the fin and the fuse, 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 and at the tips.** Modelers who cut covering on top of the wood structure 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.

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.

The colors given below are suggested to match the scheme on the box.

Cub Yellow (TOPQ0220, 1 roll)
Royal Blue (TOPQ0221, 1 roll)
White (TOPQ0204, 1 roll)
Red (TOPQ0201, 1 roll)

Suggested Covering Sequence

Fuselage:

❏ 1. 1/4" strips at fin and stab as described above (*blue on top, yellow on bottom*)
❏ 2. Fin tip then stab tips (*fin in blue, stab tips in white, other colors will overlap*)
❏ 3. Stab bottom, then top (*white top and bottom, then lay yellow top and bottom, overlap over the tips*)
❏ 4. Fin right side, then left side (*blue)*
❏ 5. Turtle deck *(blue)*
❏ 6. Front deck (*blue)*
❏ 7. Aft fuse bottom (*yellow)*
❏ 8. Forward fuse bottom *(yellow)*
❏ 9. Fuse sides overlapping 1/8" onto deck coverings *(yellow, then lay the white stripe, then the red, using the arrowhead decal as a reference for size and positioning. Later you'll mount the decal on the cowl to save you having to paint those fine, thin lines*)
❏ 10. Elevator counterbalancer roots (*white)*
❏ 11. Elevator bottoms, then tops (*white counterbalancer, then add yellow top and bottom; blue body bottom; white body bottom)*
❏ 12. Rudder tip, then right side, then left side (*blue tip, yellow from bottom of rudder up 2 horizontal ribs, then blue to match the fuse side, then white, then red stripes)*
❏ 13. Cockpit (*white)*
❏ 14. Pilot's Instrument Panel (IP-2) (*white)*

Wing:

❏ 1. R-2A ribs (*yellow*)
❏ 2. Wing tips (*white, other colors will overlap)*
❏ 3. Trailing edges of wing in aileron bays and cap of aileron bay (*white, other colors will overlap)*
❏ 4. Belly pan bottom, then sides, then leading and trailing edges, overlapping the wing leading and trailing edges (*yellow)*
❏ 5. Bottom of right, then left panel (*white straight across from leading edge at wing tip, then lay yellow, then red seam. Allow yellow and red strip to overlap the entire tip. Cut and install stars, outer 1/8" in red, the inner star size in blue)*
❏ 6. Top of right, then left panel (*white to cover entire aileron bay square to belly pan and tip, then blue, then yellow, then red stripes)*
❏ 7. Aileron tips, then bottom, then top of aileron (*tips white, bottom white, top blue)*

PAINT THE MODEL

After the model is covered, you must fuelproof the firewall. You may do so with fuelproof model paint, 30-minute epoxy thinned with alcohol, or finishing resin. If you prefer, you can cover the firewall with MonoKote, cutting out for the fuel lines and the pushrod tube. Then, seal around the holes with thin CA. This will fuelproof the firewall and look sharp to boot!

Top Flite LustreKote fuelproof paint is recommended for painting all the ABS plastic parts and the aluminum landing gear. The wheel pants should be removed from the landing gear for painting. Use a file to round the corners of the aluminum landing gear before you paint it. 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 the filler. Wet sand between coats with 400-grit sandpaper and apply a second coat of primer if necessary. If the parts are primed properly, a few light coats of color will quickly provide you a beautiful match to the MonoKote.

Before painting the canopy, use scissors or a hobby knife to trim it along the molded-in cut lines, then true the edges with a bar sander and 220-grit sandpaper. Use 400-grit sandpaper to scuff the frame portion of the canopy so the paint will stick. We recommend painting the canopy frame with Pactra Formula-U or Chevron Perfect Paint. Use masking tape to cover the portion of the canopy that is not to be painted. If you are not sure that the paint is compatible with the clear canopy, test the paint on a scrap piece of canopy material, allowing at least 24 hours to see if the butyrate will deform.

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.

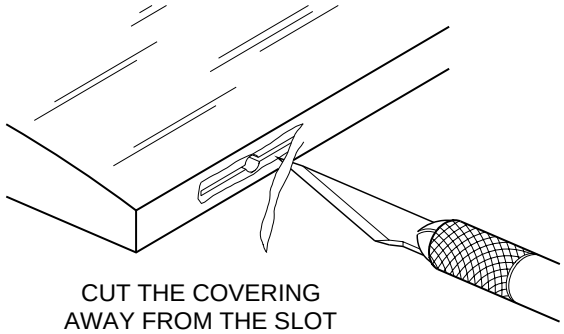
After allowing the propellant to boil off, use an airbrush to spray paint the canopy. If the paint is too thick to spray properly, it can be thinned with a small amount of lacquer thinner. Do not thin with more than 40% thinner. In general about 10% thinner will adequately thin the paint for airbrushing.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

For painting the pilot we have discovered that acrylic water base paints such as the types found at craft stores work great. The acrylic paints look realistic on the pilot because they are not glossy and, best of all, they clean up with water.

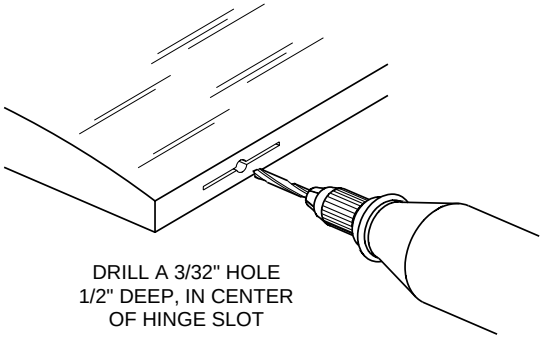
FINAL HOOKUPS & CHECKS

Attach the Control Surfaces



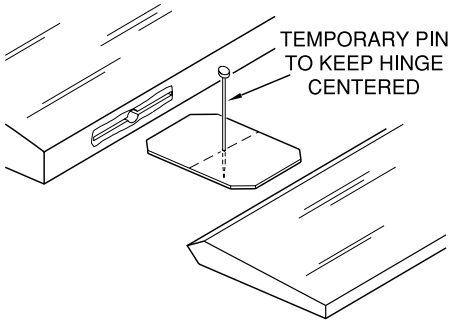
CUT THE COVERING
AWAY FROM THE SLOT

❑ 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.

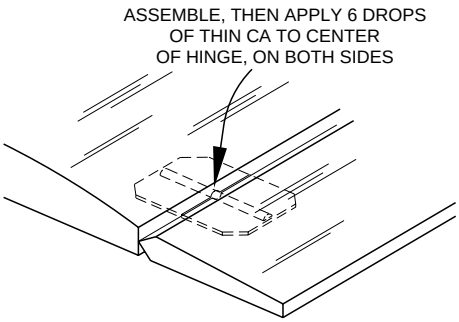


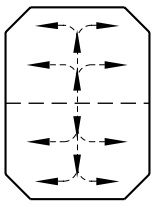
DRILL A 3/32" HOLE
1/2" DEEP, IN CENTER
OF HINGE SLOT

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



❑ 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.





❏ 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. Prepare the hinge slots for the rudder as you did the elevators. 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. **Note:** Vaseline® on the areas where the tail gear bearing contacts the wire will ensure that it does not glue to the tail gear wire or rudder.

❏ 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. Trim the covering at the holes made for the three fuel line exits (2-firewall, 1-fuse side). Reinstall the fuel tank, running the carb and vent lines out the holes in the firewall, and the fill line out the hole in the fuse side. Cap the fill line with the fuel line plug. Mark on the firewall with permanent marker which line is vent and which line is carb (fuel).

❏ 2. Reinstall the engine to the mount and the muffler to the engine. Connect the fuel lines to the carb and exhaust.

❏ 3. Install a 3/4" tail wheel (not included) with a 3/32" wheel collar.

❏ 4. Reinstall the wheels in the wheel pants, then the wheel pants to the landing gear. Secure the 8-32 nuts with a drop of thread lock.

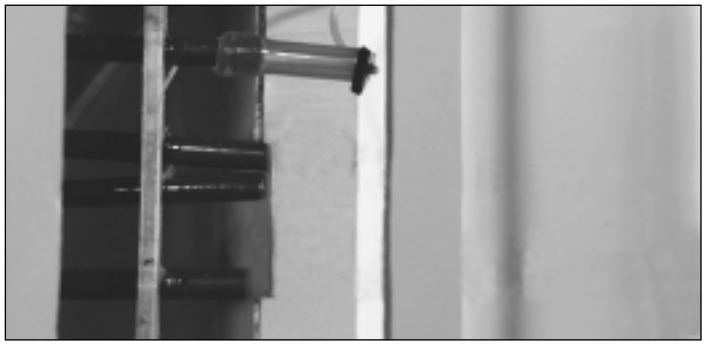
❏ 5. Mount the landing gear to the fuselage with the 8-32 x 3/4" socket head screws and #8 flat washers.

Final Servo & Receiver Installation

❏ 1. Reattach all control horns on the model, using the #2 screws for the aileron control horns, and the elevators and rudder control horns with the 2-56 x 5/8" machine screws.

❏ 2. Reinstall the aileron servos and pushrods. Temporarily plug the aileron servos into the receiver and plug the battery into the receiver. Turn on the transmitter and center the aileron trims. Reposition the servo arms and clevises as needed to make the servo arm perpendicular to the servo case and the surface centered. Check that both servos move the correct direction, remembering that the wing is upside-down. (Reverse the servo direction in the radio if required.) Turn off the transmitter and unplug the battery and receiver. Set the wing aside for now.

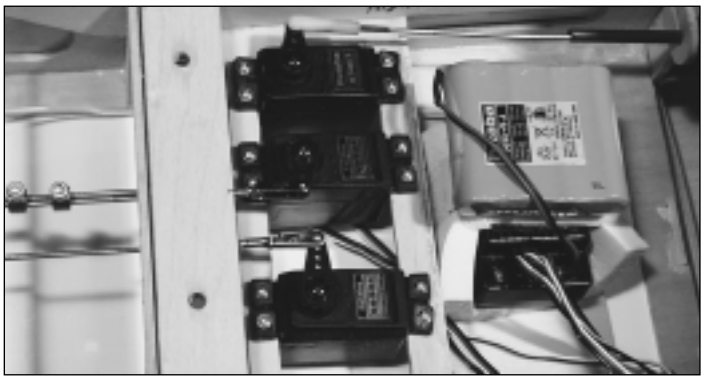
❏ 3. Locate a piece of leftover plywood approximately 2" x 5-1/2" to use as the **receiver plate**. Wrap the receiver in 1/4" foam (or thicker). We recommend securing the receiver (wrapped in foam) to the receiver plate with non-adhesive backed Velcro® (not included) to make maintenance on the model easier. Glue the Velcro strip to the back side of the receiver plate, then attach the receiver to the receiver plate with a Velcro "belt." Glue the receiver plate to the fuse top with medium CA.



❏ 4. With the model inverted in the stand and using the plans as a reference, locate the lower pushrod tube exit on the model's right side under the stab. Slice the covering along this opening. Slip a 1" piece of leftover fuel tubing over the other end of the antenna guide tube to protect the antenna from the sharp edges of the tube.

❑ 5. Thread the antenna under the servo tray, being careful not to entangle it in any of the wiring. Take a cut-off piece of servo arm with at least two holes in it, and feed the antenna through two of the holes, making a **strain relief** which protects the antenna from accidentally being torn out of the receiver. Position this strain relief so that there is a small amount of slack between the receiver and this strain relief when the strain relief is positioned against the opening of the antenna guide tube.

❑ 6. Feed the antenna through the guide tube until the strain relief is resting gently against the antenna guide tube. Using clear tape, tape the section of antenna which extends out the exit to the hinge line of the rudder.



Note: You will use this photo for the next 8 steps.

❑ 7. Temporarily plug the receiver battery directly into the receiver. Turn on the transmitter and be sure the servo arms are all positioned so the servo arms are perpendicular to the cases, including the throttle servo with throttle stick and trim at center. Leave the transmitter on and battery plugged in until told otherwise. **Note:** You will not mount the receiver battery until you have used it to properly set the CG.

❑ 8. Reinstall the throttle pushrod. Check that the servo moves in the correct direction, and reverse if necessary in the radio. Adjust the clevis on the throttle pushrod as needed so that when wide open the throttle barrel just opens completely but does not bind (a buzzing sound of the servo trying to push the arm farther than wide open). Additionally, at low throttle with the throttle trim at center the barrel should be open just “slightly” enough to allow the engine to run, while with the trim pulled all the way back the barrel is completely closed, again without binding.

❑ 9. Locate the three tail pushrods. Remove the nylon clevises from the two longer pushrods which have solder-on clevises on the other end.

❑ 10. Remove the covering from the pushrod exits.

❑ 11. Select the longest pushrod, which has a solder-on clevis on one end. This is the rudder pushrod. With the model inverted in the stand, slide the threaded end of the pushrod under the wing bolt plate, and through the rudder pushrod tube (which is on the model’s left) out the slot you made and thread the nylon clevis back in place.

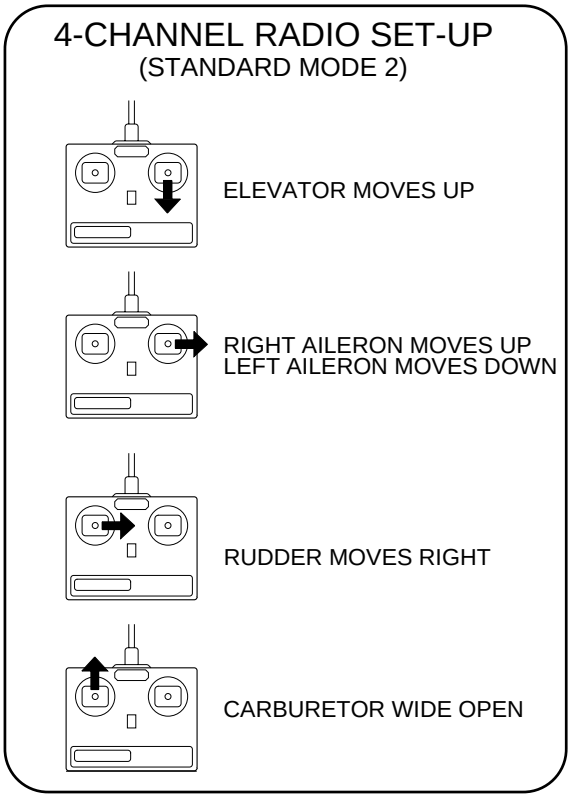
❑ 12. Attach the solder-on clevis to the servo arm. Making sure the rudder is centered, thread the nylon clevis in or out on the pushrod until it can be attached to the control horn with the servo arm still perpendicular and the rudder still centered. Attach the nylon clevis to the control horn. Confirm that the rudder moves the correct direction (remembering that the model is upside-down), and reverse the direction in the radio if required.

❑ 13. Select the longer elevator pushrod, which has a solder-on clevis on the end. Slide two 5/32" wheel collars onto the pushrod all the way up to the solder-on clevis. Slide the threaded end under the wing bolt plate and through the elevator pushrod tube on the model’s left side and thread the nylon clevis back in place. Attach to the servo and control horn as you did for the rudder pushrod.

❑ 14. Using the plans as a reference and feeling the location of the exit of the pushrod tube on the model’s right, cut an exit location for the second elevator pushrod. Holding the nylon clevis end, feed the pushrod up the pushrod tube from the exit location you just created.

❑ 15. Keeping both elevators centered, attach the nylon clevis to the control horns. Keeping both elevators centered and the elevator servo arm centered, slip the second pushrod into the two wheel collars and secure the wheel collars as shown in the photo. Confirm that the elevators move the correct direction, remembering the model is upside-down, and reversing the servo if required.

Set the Control Throws



We recommend the following control surface throws:

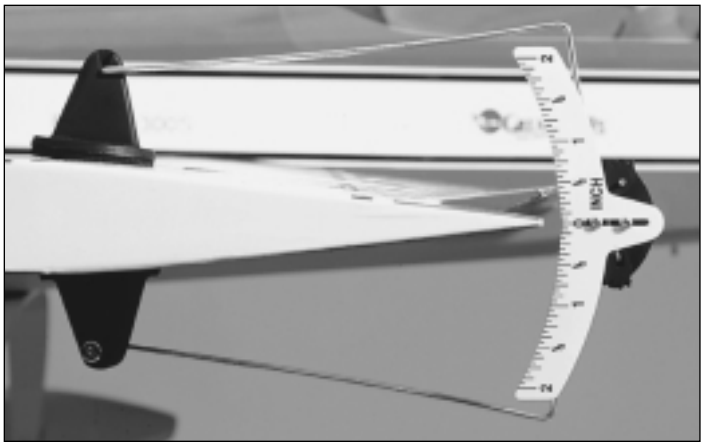
Note: The throws are measured at the **widest part** of the elevators, rudder, and ailerons. Adjust the position of the pushrods at the control/servo horns to control the amount of throw. You may also use the ATVs if the transmitter has them but the mechanical linkages should still be set so the ATVs are near 100% for maximum servo power and the best servo resolution (smoothest, most proportional movement). Please see **Expert Tip: Computer Radios** on page 47.

	High Rate	Low Rate
ELEVATOR:	1/2" up 1/2" down	5/16" up 5/16" down
RUDDER:	2-1/2" right 2-1/2" left	1-1/2" right 1-1/2" left
AILERONS:	5/8" up 5/8" down	3/8" up 3/8" 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.

Unplug your receiver battery and turn off the transmitter when complete.

Note: The balance and control throws for the Giles G-202 have been extensively tested. We are confident that they represent the settings at which the Giles G-202 flies best. Please set up your model to the specifications listed above. If, after you become comfortable with your Giles G-202, you would like to adjust the throws to suit your tastes, that's fine. Too much throw can force the plane into a stall or snap, so remember, "more is not always better."



One leading cause of crashes is flying an airplane with its control throws set differently from those recommended in the instructions. The Great Planes AccuThrow™ lets you quickly and easily measure actual throws first, so you can make necessary corrections before you fly. Large, no-slip rubber feet provide a firm grip on covered surfaces without denting or marring the finish. Spring tension holds AccuThrow's plastic ruler steady by each control surface. Curved to match control motions, the ruler provides exact readings in both standard or metric measurements.

Install the Cowl & Canopy

❏ 1. Install the pilot's instrument panel as shown on the plan. If desired, install the pilot (optional, not included) and instrument gauge decals at this time. **Note:** If you think you might compete in IMAC (scale aerobatics) with this model, you will want to install the gauges and a realistic pilot bust in the model. Failure to have a pilot and instrument panel are each significant downgrades to the total competition score, which is otherwise based solely upon your flights.

❏ 2. Place the canopy on the fuselage in the location shown on the plan, then temporarily hold it in position with tape or rubber bands.

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

❏ 4. Use a sharp #11 blade to ***carefully*** cut the covering about 1/32" inside of the line you marked **without cutting into the balsa**. Cut the covering 1/16" inside of the seam you just made, again without cutting into the balsa. Carefully remove the 1/16" wide strip of covering. Wipe away the ink line with a paper towel lightly dampened with alcohol.

❏ 5. Before you permanently glue the canopy to the fuselage, securely glue the pilot in place.

❏ 6. Reposition the canopy on the fuselage and confirm that it covers the exposed wood. Glue the canopy to the fuselage, using rubber bands or masking tape to hold it in position until the glue dries. We recommend an adhesive 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 it sticks extremely well to butyrate and dries overnight (to allow for accurate positioning).

❏ 7. Install the cowl, then mount the spinner backplate, prop, prop washer, and prop nut. Install the spinner. Reinstall the needle valve and exhaust deflector, if necessary.

❏ 8. 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.

Balance Your Model

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

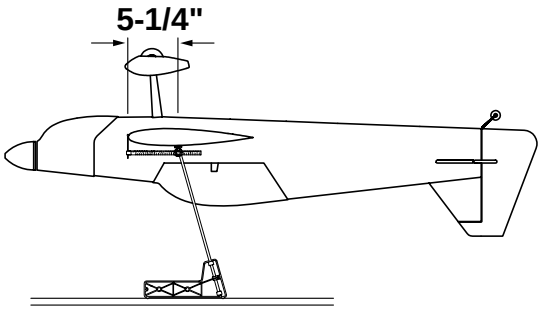
❑ 1. Wrap the battery pack in at least 1/4" of foam rubber and secure it to a piece of leftover plywood. Then, fit it in the location shown on the plan.

EXPERT TIP

SECURING YOUR BATTERY PACK

We like to secure our batteries to the piece of leftover ply by taking two strips of Velcro and making a belt that wraps completely around the pack and the wood and attaches to itself, thus holding the battery securely in place and also making removal quick and easy.

❑ 2. Mount the receiver switch in a convenient location that will not interfere with the servos and pushrods inside 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 (**CG**) is located **5-1/4" back from the leading edge where the wing meets the fuse** as shown in the sketch above and on the fuse plan. **Hint:** Reference the full-size wing plan to help you locate the proper balance point. This is the balance point at which the model should balance for your first flights. After initial trim flights and when you become more acquainted with your Giles G-202, 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 or, preferably, by moving the rudder servo to the aft location. See page 32 for instructions on installing the rudder servo in the aft location. If you chose to use stick-on weights, then later, if the balance is okay, 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, rudder servo 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.*

PREFLIGHT

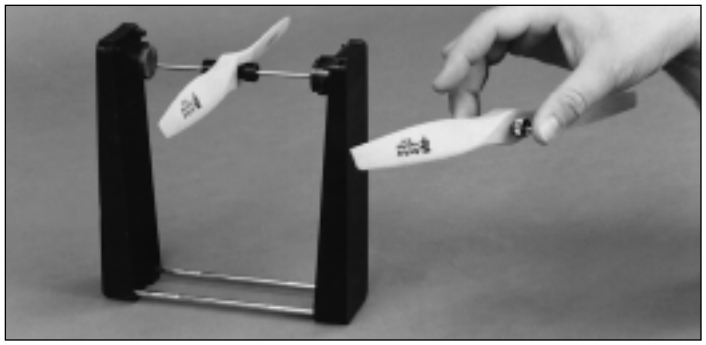
At this time check all connections including servo arm screws, Faslinks™, clevises and servo wires. Make sure you have installed the **silicone retainers** on all the clevises.

Charge the Batteries

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

Balance the Propeller

Balance the 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 the radio receiver and battery. Vibration may cause the 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 Giles G-202 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. 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 ALL items away from the prop, including: radio neck straps, loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects such as pencils, screwdrivers that may fall out of shirt or jacket pockets into the prop.

When using a "chicken stick" or electric starter, follow the 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.

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

9. 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

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 the 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.

SPECIAL NOTE ABOUT FLUTTER AND AEROBATIC AIRCRAFT: Highly specialized aerobatic models such as the Giles G-202 have very large control surfaces designed specifically for performance at low air speeds. Aerobatic models such as this ARE NOT INTENDED for high speed passes and dives. Selection of a prop in the 6 pitch range or lower is strongly recommended for its braking effect, which keeps your aerobatic aircraft from excessive speeds. (An added benefit is that it will provide you increased vertical performance.) Even with excellent control linkages, perfect glue joints, etc, an aerobatic model such as this may well flutter due to excessive airspeed, caused by full throttle application while straight and level or diving, especially while using high speed props such as an 11x9 or 12x8. This is NOT a flaw of the aircraft, but rather a by-product of the desirable high performance aerobatic capabilities of this model. We recommend the use of 6 pitch range or lower pitch props and appropriate throttle modulation, especially while diving, to help you preserve your aerobatic aircraft.

The Great Planes Giles G-202 is a great flying semi-scale sport model that flies smoothly and predictably, yet is highly aerobatic. The Giles 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 rolls to impressive knife-edge loops. The Giles G-202 is limited only by your abilities and imagination. *Have Fun!!*

Takeoff

Take off on "low" rates if you have dual rates on your transmitter–even 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 Giles 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 Giles 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 Giles 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 Giles G-202 for the first several flights, gradually "getting acquainted" with this great sport model 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**

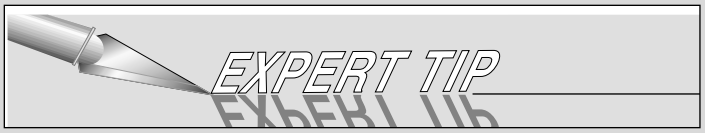
the model down. This will make everything happen a little slower and allow yourself time to think and react. Add and practice one maneuver at a time, learning how the Giles behaves in each. For smooth flying and normal maneuvers, use the low rate settings as listed on page 43. This low rate elevator setting is intentionally very soft and smooth, and was selected specifically to provide clean snaps and loops and a smooth, fluid flight performance overall. High rate elevator was selected specifically for low-speed aerobatic maneuvers such as torque rolls. High rate aileron and/or rudder may be required for crisp snap rolls and spins. For good knife-edge performance, including gorgeous knife-edge loops, high rate rudder and sufficient flight speed are the keys.

Sometime well before it's time to land, you should climb your Giles to a safe altitude, 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. Be sure that you are using low rates. Keep a few clicks of power on until you are over the runway threshold. For the first few landings, plan to land slightly faster than stall speed and on the main wheels, as this is the easiest way to land your Giles. Later, with a little practice you will find you can make slow 3-point landings.

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.



COMPUTER RADIOS

As you prepare to fly the Giles 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, he does not want that same huge volume of throw when he is trying to do 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.

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.

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See the Flight Trimming Chart on Page 49

TRIM FEATURE	MANEUVERS	OBSERVATIONS	CORRECTIONS
CONTROL CENTERING	Fly general circles and random maneuvers.	Try for hands off straight and level flight.	Readjust linkages so that Tx trims are centered.
CONTROL THROWS	Random maneuvers	A. Too sensitive, jerky controls. B. Not sufficient control.	If A, change linkages to reduce throws. If B, increase throws.
ENGINE THRUST ANGLE[1]	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[2]	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.

OTHER KITS AND ACCESSORIES AVAILABLE FROM GREAT PLANES

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The Ultimate Bipe is among the most celebrated stunt planes ever. Great Planes captures the essence of this air show legend in a stylish, .40-size sport-scale kit. The wings feature a fully symmetrical airfoil. With plug-in struts and only four fasteners, you can quickly remove and reattach the wings right at the field. **GPMA0240**

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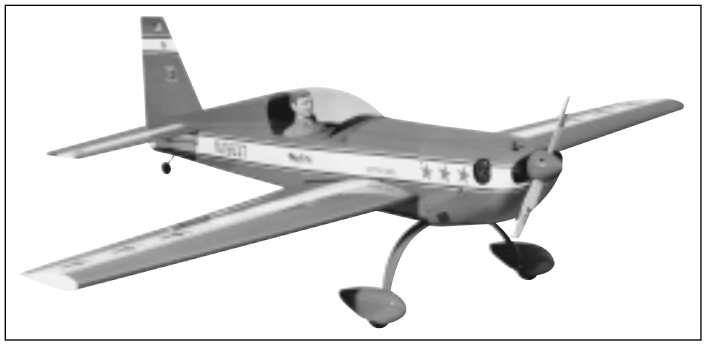
You want a model with enough muscle for any maneuver in the book. You don't want to undertake a massive project. The solution? The .40-size CAP 232! Fly it for spectacular Sunday fun or for glory in IMAC or MINIMAC events. It has unlimited aerobatic potential...and plenty of low-speed stability to keep new sport pilots in control. Interlocking, die-cut, all-wood parts ensure straight, strong assembly. Dual elevator pushrods keep linkages tight and precise and permit infinite adjustability of each elevator half. **GPMA0232**



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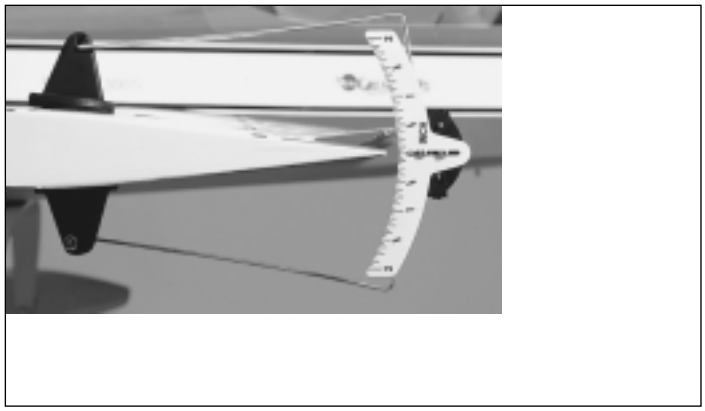
Ideal for MiniMAC, Great Planes' sport-scale Extra 300S kit requires no more experience, expense or assembly work than the average mid-size sport model. It minimizes building challenges with CAD-engineered, perfectly interlocking parts, a photo-illustrated instruction manual and accurate, full-size plans. 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**



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One leading cause of crashes is flying an airplane with its control throws set differently from those recommended in the instructions. The Great Planes AccuThrow lets you quickly and easily measure actual throws first, so you can make necessary corrections before you fly. Large, no-slip rubber feet provide a firm grip on covered surfaces without denting or marring the finish. Spring tension holds AccuThrow's plastic ruler steady by each control surface. Curved to match control motions, the ruler provides exact readings in both standard or metric measurements. **GPMR2405**

Great Planes Groove Tube™ Cutting Tool
Designed to create grooves in balsa for installing aileron torque rods and elevator inter-link wires. Creates a uniformly round groove that increases the rod's performance, without the need for sanding. **GPMR8140**

BUILDING NOTES

Kit Purchased Date:_____

Where Purchased:_____

Date Construction Started: _____

Date Construction Finished: _____

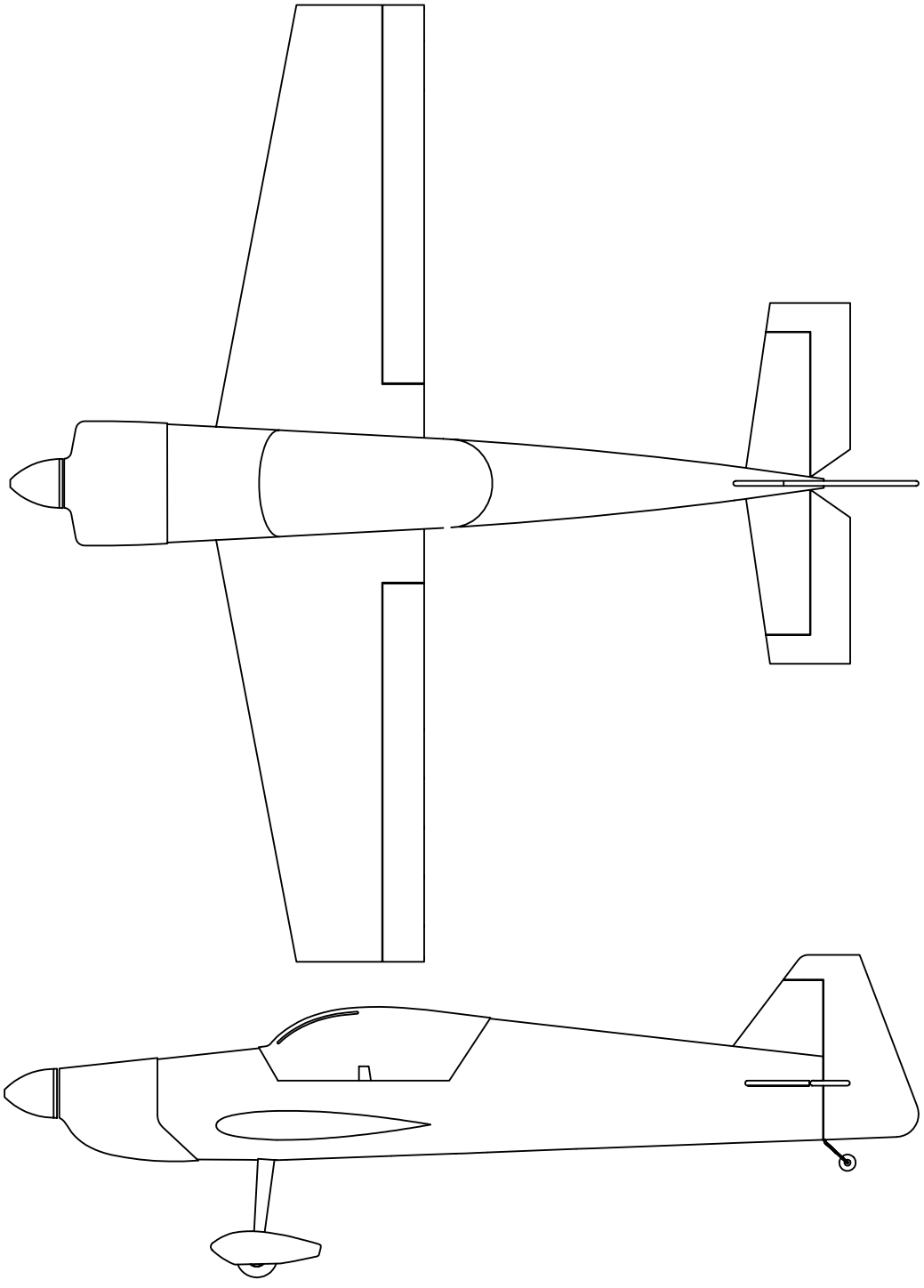
Finished Weight: _____

Date of First Flight: _____

FLIGHT LOG

TWO VIEW DRAWING

Use copies of this page to plan your trim scheme



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