Butterfly

INSTRUCTION MANUAL

MADE IN USA

- ***2-piece Wing for Easy Transportation***
- ***Slow and Forgiving Flight Characteristics***
- ***Simple and Fast Assembly***

WARRANTY

Great Planes® 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, return this kit immediately in new and unused condition to the place of purchase.

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

Dynaflite™ Series by Great Planes®

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Introduction

Congratulations and thank you for purchasing the Dynaflite Butterfly. The Butterfly is a “powered sailplane” or “motor glider” and is an ideal model for learning to fly radio controlled models – especially if you are not able to locate an experienced flight instructor and must try it on your own. Because of its large wingspan and light wing loading, the Butterfly is a gentle model that will give you plenty of time to think and react. Because of its size and light weight however, you must reserve first flight attempts for a calm day – more on that in the “Flying” section at the end of the manual. The Butterfly does not require a powerful engine. Any .10 to .15 cu. in. 2-stroke will do the job – all the engine has to do is provide a little thrust and the large wing will do the rest!

The way you fly the Butterfly is to let it climb (it will do that almost by itself with just a little guidance from you), then throttle back and fly it around rather like a sailplane. When you need more altitude just apply throttle. This doesn’t sound like much action but don’t worry, if you’re a beginner you’ll be busy. Most important, you’ll develop the hand-eye coordination required to fly traditional “40-size” sport/trainers. Enough said. Please thoroughly read the rest of the preliminary information, then let’s get started!

Protect Your Model, Yourself and Others... Follow This Important Safety Precaution

Your Butterfly is not a toy, but a sophisticated working model that functions like a full-size airplane. Because of its performance, if you do not assemble and operate the Butterfly correctly, you could possibly injure yourself or spectators and damage property.

To make your R/C modeling experience totally enjoyable, we recommend that you get assistance with assembly and your first flights from an experienced, knowledgeable modeler. You'll learn faster and avoid risk to 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 can also contact the national Academy of Model Aeronautics (AMA), which has more than 2,500 chartered clubs across the country. We recommend you join the AMA which will provide you with insurance coverage at AMA club sites and events. AMA Membership is required at chartered club fields where qualified flight instructors are available.

Contact the AMA at the address or toll-free phone number below.

Academy of Model Aeronautics
5151 East Memorial Drive
Muncie, IN 47302-9252

(800) 435-9262
Fax (765) 741-0057

or via the internet at: www.modelaircraft.org

Precautions

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

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

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

4. You must test the operation of the model before the first and each successive flight to insure that all equipment operates correctly. You must also make certain that the model has remained structurally sound.

NOTE: We, as the kit manufacturer, can provide you with a quality kit and great instructions, but ultimately the quality and flyability of your finished model depends on how you assemble 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.

Please inventory and 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 and we'll be glad to help. If you are calling for replacement parts, please look up the part numbers and have them ready when calling. Visit our web site at:

www.dynaflite.com

Preparations

Required Accessories

These are the items "not included" with your kit, that you will need to purchase separately. Items in parentheses (OSMG2691) 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.

- ❍ 4-Channel Aircraft Radio with three standard servos

- ❍ O.S.® 10LA (OSMG0011) or O.S. 15LA (OSMG0016)
- ❍ Engine Mount (Hayes 006-AS15 short mount for O.S. LA engines) HAYG0006
- ❍ Propellers; Refer to your engine's instructions for proper size
- ❍ Approximately 2 rolls Top Flite MonoKote® covering; See Covering Tips (page 31)
- ❍ Medium Fuel Tubing (3', GPMQ4131)
- ❍ 1/4" Latex Rubber Padding (HCAQ1000)
- ❍ 1/16" Foam Wing Seating Tape (GPMQ4422)
- ❍ 4 oz. Fuel Tank
- ❍ (2) 2-1/4" Wheels (GPMQ4222)
- ❍ (4) 4-40 x 1/2" screws to secure engine mount (GPMQ3012)
- ❍ (4) 4-40 blind nuts for engine mount screws (GPMQ3324)
- ❍ #64 Rubber Bands (1/4 lb box – HCAQ2020)
- ❍ (4) 5/32" Wheel Collars (GPMQ4306)
- ❍ #4 x 1/2" Screw for mounting engine to engine mount

Setting Up Shop

If this is your first model there are a few supplies and tools that you should gather before you begin. The most important item is a **flat** table that you can build your models on. You can turn a solid core door into a building table, but avoid hollow core doors because they warp easily. If possible, locate your building table in an area that is not in the way of other projects or household activities. Cover your building table with a board that you can stick pins into. The back of a 2' x 4' ceiling tile works well or you can cut a piece to fit your table from a 4' x 8' sheet of Celotex insulation board available from a home improvement store.

Required Supplies and Tools

These are the building tools and adhesives that you will need to build your Butterfly.

We recommend Great Planes Pro™ CA and Epoxy

- ❍ 2 oz. Thin CA Adhesive - (GPMR6003)
- ❍ 2 oz. Medium CA+ (GPMR6009)
- ❍ CA Activator - (GPMR6035)
- ❍ 30-Minute Epoxy - (GPMR6047)
- ❍ #1 Hobby Knife Handle (XACR4305)
- ❍ #11 Blades (Qty. 100 – HCAR0311) or (Qty. 5 – XACR2911)
- ❍ X-Acto® (or similar) Building Square (XACR7726) or Building Triangle (XACR7725)
- ❍ Medium T-pins (HCAR5150)
- ❍ Wax Paper
- ❍ Electric Drill
- ❍ Drill Bits: 1/16", 5/64", 3/32", 3/16", 11/64" or 5/32", 15/64" or 1/4"
- ❍ String for aligning the stabilizer
- ❍ Screwdrivers (Phillips and Flat Blade)
- ❍ Top Flite Covering Iron (TOPR2100)
- ❍ A building board that you can stick pins into (see "Setting Up Shop")

Optional Accessories

You can build your Butterfly without these items but they will make the job much easier and provide you with better results. These are things you will accumulate as your building "career" progresses anyway.

- ❍ Razor Plane (MASR1510)
- ❍ Single-Edge Razor Blades (100, HCAR0312)
- ❍ CA Applicator Tips (HCAR3780)
- ❍ Hot Sock™ (for your covering iron, TOPR2175)

- ❍ 6-Minute Pro™ Epoxy (GPMR6045)
- ❍ Trim Seal Tool™ (TOPR2200)
- ❍ Heat Gun (TOPR2000)
- ❍ Straightedge (Fourmost Non-Slip, FORR2149)
- ❍ Denatured or Isopropyl Alcohol (for epoxy clean-up)
- ❍ Spare Glow Plugs (O.S. #8 for most 2-stroke engines, OSMG2691)
- ❍ HobbyLite™ Balsa Filler (HCAR3401)
- ❍ Epoxy Brushes (GPMR8060)
- ❍ CA Debonder (GPMR6039)
- ❍ Powered hand tool with Sanding Drum and Cut-off Wheel
- ❍ Bar Sander or Sanding Block and Sandpaper (coarse, medium, fine grit)*

*A flat, durable, easy-to-handle sanding tool is a necessity for building model airplanes. Great Planes makes a complete range of Easy-Touch™ Bar Sanders and replaceable Easy-Touch adhesive-backed sandpaper. For the Butterfly all that is required is the short 5-1/2" Bar Sander (GPMR6169) and two assortment packages of adhesive-backed sandpaper (GPMR6189).

For future reference, here's a list of Easy-Touch Bar Sanders and adhesive-backed sandpaper:

5-1/2" Bar Sander (GPMR6169)
11" Bar Sander (GPMR6170)
22" Bar Sander (GPMR6172)

12' Roll of adhesive-backed sandpaper,

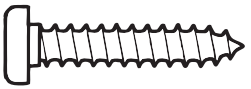
80-grit (GPMR6180)
150-grit (GPMR6183)
220-grit (GPMR6185)

Assortment pack of 5-1/2" strips (GPMR6189)

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 6-32 x 3/4"

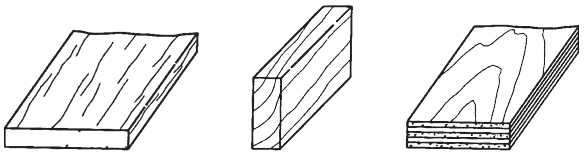
- When you see the term "test fit" in the instructions, it means you should first position the part on the assembly **without** using any glue, then slightly modify or "custom fit" the part as necessary for the best fit.

- 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 either the working time and/or the additional strength.

Common Abbreviations

Fuse = Fuselage
Stab = Horizontal Stabilizer
LE = Leading edge (front)
TE = Trailing edge (rear)
Ply = Plywood
" = Inches

Types Of Wood



Balsa Basswood Plywood

Cyanoacrylate Glue

The most popular type of glue modelers use for general construction of R/C models is Cyanoacrylate or CA glues. Modelers build with CA because it cures fast (immediately in some cases) and the pieces do not have to be clamped or pinned together as they do with traditional adhesives. CA's do, however have their own set of special procedures and precautions that you should follow. Always use CA in a well ventilated area. Open some windows or place a fan in the room to circulate the air. Do not lean directly over your work when you use CA and look away while it cures or "sets off." CA can cure immediately upon contact with skin so if you accidentally bond your fingers, do not use vigorous motion to separate them. Use CA Debonder (GPMR6039) or acetone (nail polish remover) or soak your fingers in warm water for a few minutes. **Never** point the tip of a CA bottle toward your face and be especially careful when you unclog a CA tip. Hobbico CA Applicator Tips (HCAR3780) are highly recommended and will help keep the bottle from clogging. Keep paper towels or tissues close by to immediately absorb excess CA dropped on your model or work area. **Read all the warning labels on your CA bottle.**

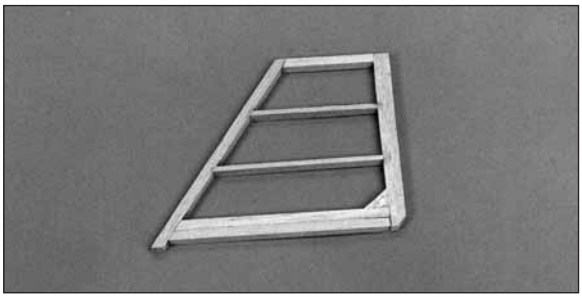
There are different viscosities of CA's intended for different conditions you will encounter when you build. Thin CA is great for "tack-gluing," for glue joints that fit well and for parts that are already joined but need to be permanently bonded. Medium CA is used for general construction where you apply glue to one part, then join it to another part. Thick CA is great for glue joints that don't fit perfectly or parts that require a little time for positioning before the glue cures. You will encounter many other conditions that require one or the other types of CA. For the Butterfly all you really need is thin and medium CA.

CA Accelerator is a chemical that you can spray over uncured CA to make it cure immediately. A mist spray of accelerator will do the job. **Do not** inhale the vapors! Some modelers "preprime" the parts to be glued with accelerator, join them, then add the CA. This way the CA is guaranteed to cure immediately. This prepriming is especially handy when you use thin CA because it will cure before all of the glue soaks into the wood away from the glue joint. We do not recommend you build your entire model with this method and use accelerator only when necessary. Often, overspray from accelerator used hours or even days earlier on nearby glue joints will cause the CA you use on the next step to cure prematurely and unexpectedly – so be careful!

Build the Tail Surfaces

Build the Fin

Place your building board on top of your flat building table. Position the plan sheet so the rudder and fin drawing is over your flat building board. (Reroll the plan sheet inside out to make it lie flat or use weights or tape to hold it down.) You may separate the wing portion from the plan or fold the plan in half to make it easier to work with. Cover the fin drawing with wax paper so the glue will not stick.



Refer to this photo while you build the fin.

❑ **1.** Cut the **fin trailing edge** from a 1/4" x 3/8" x 36" balsa stick, then pin it over its location on the plan. Many modelers find that they can more

accurately cut small balsa sticks (such as the ones used in the tail surfaces) with a single-edge razor blade rather than a hobby knife.

❑ **2.** Cut the **fin leading edge** from a 1/4" x 1/4" x 24" balsa stick, then pin it over its location on the plan.

❑ **3.** Cut the two **base pieces** and the **tip** of the fin from the same 1/4" x 1/4" balsa stick, then glue them to the LE (leading edge) and TE (trailing edge) with medium CA and pin them in position.

❑ **4.** Cut the two fin "**ribs**" from one of the 1/8" x 1/4" x 24" balsa sticks, then glue them in position over their location on the plan.

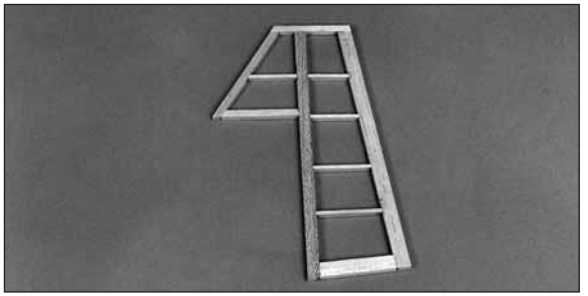
❑ **5.** Make the **gusset** for the corner of the fin TE and the **base** of the fin from the 1/4" x 3/8" balsa stick you used in step 1.

❑ **6.** Remove the T-pins, then lift the fin from your building board. We will instruct you to build the dorsal part of the fin **after** you position the fin on the fuselage. Reinforce glue joints that don't look strong with medium CA.

Build the Rudder, Stabilizer and Elevator

Use the following building **sequence** for the rudder, stabilizer and elevator as a guide to cut the balsa sticks and pin them to the plan, then glue them together the same as you did for the fin. Don't forget to cover the plan with wax paper.

Rudder Building Sequence



Refer to this photo while you build the rudder.

❑ **1.** The **LE** from the remainder of the 1/4" x 3/8" stick used in step 1 of the fin.

❑ **2.** The **TE**, then the **bottom** from a 1/4" x 1/2" x 12" balsa stick.

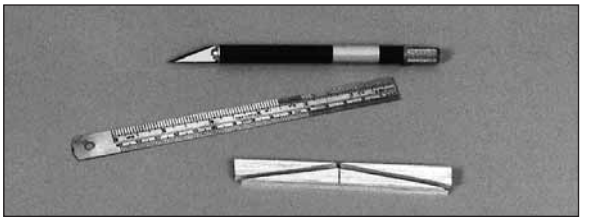
❑ **3.** The "**balance tab**" part of the rudder and the tip from the remainder of the 1/4" x 1/4" balsa stick you used for the fin and another 1/4" x 1/4" x 24" balsa stick if needed.

❑ **4.** The "**ribs**" from the remainder of the 1/8" x 1/4" stick you used for the fin.

❑ **5.** Remove the T-pins and lift the rudder from the building board. Reinforce glue joints that don't look strong with medium CA.

Stabilizer Building Sequence

Refer to this photo while you build the stabilizer.



❑ **1.** The **TE**, **LEs**, **tips**, then **LE** "**brace**" from two 1/4" x 3/8" x 36" balsa sticks. To make the brace for the LE, first cut the 1/4" x 3/8" piece to a length of 4-1/4", then mark a centerline. Use a straightedge and a hobby knife with a #11 blade to cut the angle on the brace that extends from the centerline to both corners.

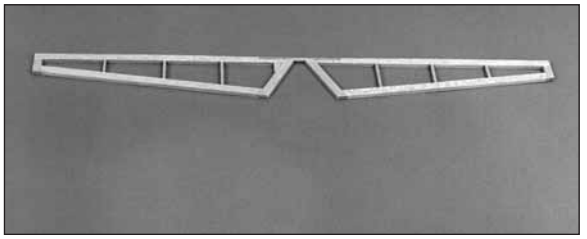
❑ **2.** 1/8" x 1/4" x 24" basswood **stab spar**.

❑ **3.** The **stab center** (in front of and behind the basswood spar) from the 1/4" x 1-1/2" x 3- 7/8" balsa sheet.

❑ **4.** The **stab ribs** from 1/8" x 1/4" x 24" balsa sticks.

❑ **5.** Remove the T-pins and lift the stab from your building board. Reinforce glue joints that don't look strong with medium CA.

Elevator Building Sequence



Refer to this photo while you build the elevator.

❑ **1.** The **LEs** as shown on the plan, cut from a 1/4" x 3/8" x 36" balsa stick. Use a hobby knife to cut the "notches" for the 3/16" elevator joiner dowel. Pin the LEs to the plan.

❑ **2.** The **TEs** and **tip ends** from the remaining 1/4" x 3/8" balsa sticks from previous steps. Do not make the elevator root ends until instructed to do so (the roots are the ends of the elevators nearest the fuselage).

❑ **3.** Test fit the 3/16" x 3-3/4" **elevator joiner dowel** in the notches in the LEs of the elevators, then if necessary adjust the notches so the dowel is parallel to the TE of the stab on the plan.

❑ **4.** Glue the dowel in position with epoxy. Stick T-pins into your building board in front of the dowel to hold it against the elevators. Slightly raise the dowel so it is centered in the LEs, then wipe away excess epoxy before it cures.

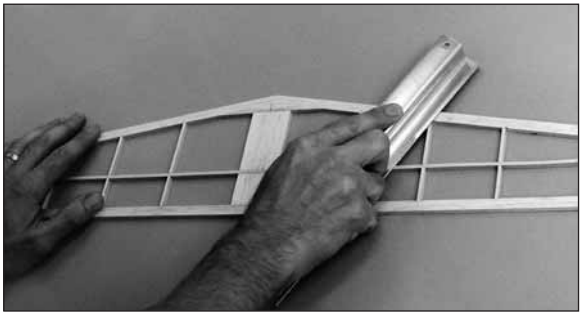
❑ **5.** After the epoxy fully cures cut, then glue the **elevator root ends** to the assembly.

❑ **6.** The **elevator ribs** from remaining 1/8" x 1/4" balsa sticks, then the control horn base for the right elevator from leftover 1/4" x 3/8" balsa.

❑ **7.** Remove the elevator from the plan, then add CA to glue joints that don't look strong.

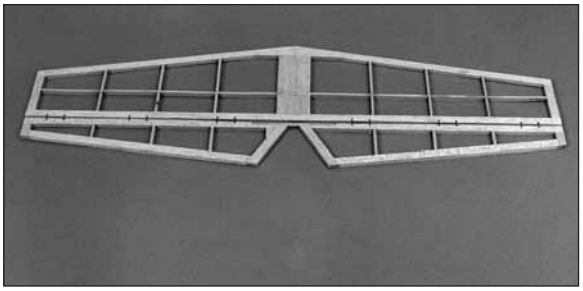
Finish The Tail Surfaces

❑ **1.** See the note below, then use your bar sander or a sanding block and 220-grit sandpaper to even the edges and blend the ribs, LEs and TEs of all the tail surfaces so they are flat and smooth.



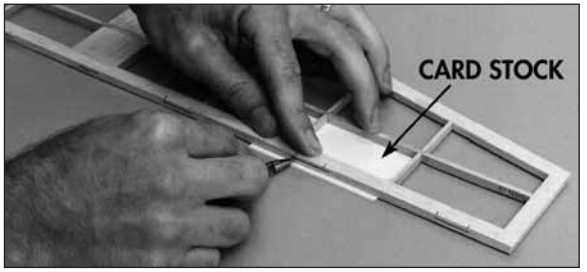
A note about sanding "built-up" tail surfaces

Be careful when you sand a balsa structure made up of "sticks." The part flexes and moves while you sand and it can be difficult to keep your sanding block flat so you do not snag any of the small ribs or over-sand one area and thin it more than another area. Due to the design and slow flying speed of the Butterfly, **a perfectly smooth finish is not necessary**. For this model, the purpose of sanding is just to remove any glue bumps or uneven edges. Stop sanding when you have reduced most of the high spots. Use a large sanding block or a flat bar sander and do not apply much pressure while you sand. Enjoy – it's not a racing plane – it's a floater.



❑ **2.** Use a ballpoint pen to mark the location of the hinges on the control surfaces as shown in the photo.

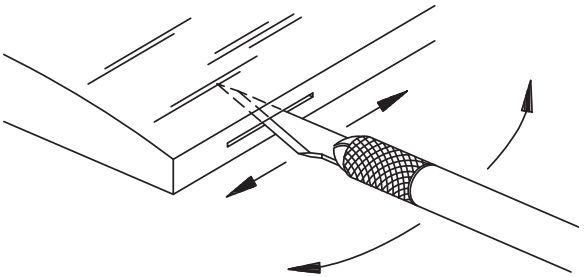
Note: The plan shows two hinges in each elevator but use **three** as indicated in the photo.



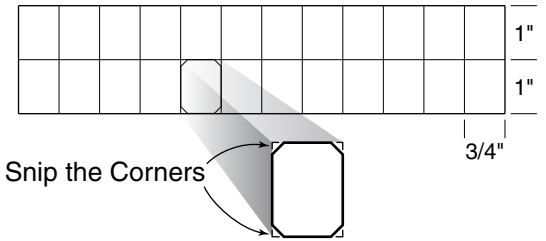
❏ **3.** Lay the stabilizer on your building table. Use thin card stock or business cards to raise the stab so you can mark the hinge slots in the **center** of the TE at the hinge locations. Mark the hinge slots in the TE of the fin the same way.

❏ **4.** Use the same procedure to mark the centerline the **entire length** of the LE of the rudder and the elevator.

Cut the Hinge Slot with a
Hobby Knife and a No. 11 Blade

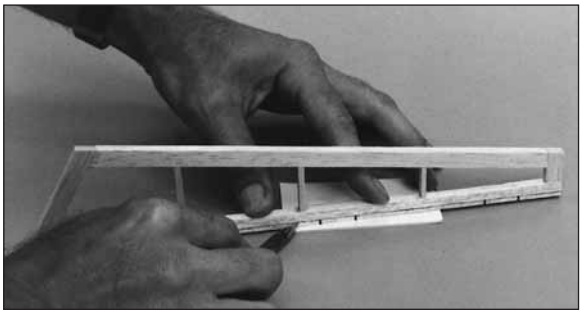


❏ **5.** Use a hobby knife with a #11 blade to make the hinge slots. The first cut should be a **shallow** slit to establish the hinge slot location. After the first cut, make several more cuts going slightly deeper each time. Move the knife from side to side and widen the slot as you cut.



Cut eight hinges from the hinge material supplied as shown in the sketch. Snip the corners off so they go into the slots easier.

❏ **6.** Test join (remember, this means no glue) the elevator to the stab and the rudder to the fin with the hinges. Adjust the width of the hinge slots if necessary.



❏ **7.** Separate the elevator from the stab and the rudder from the fin. Use the "pen-and-card stock" technique to mark a **guideline** 3/32" to 1/8" from the LE on both sides of the elevator and rudder. The guidelines indicate where to round the LE for control movement.

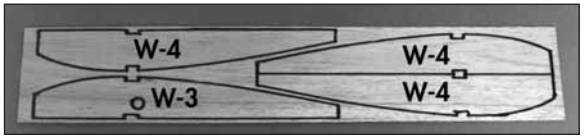
❏ **8.** Use the guidelines and a sanding block or razor plane to round the leading edges of the rudder and elevator equally.

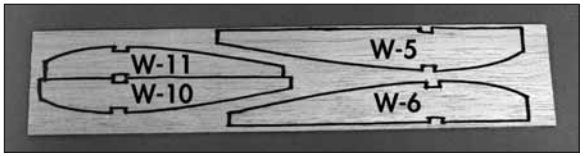
❏ **9.** Mark a **centerline** on the trailing edge of the rudder and elevator with a ballpoint pen. Use your bar sander or sanding block and 150-grit sandpaper to taper the rudder and elevator as shown on the cross-section of the plan or simply round the trailing edges the same as the leading edges.

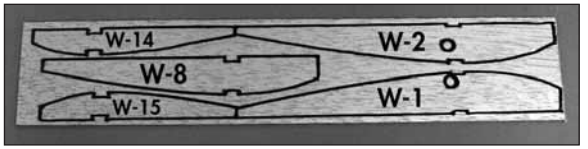
Build the Wing

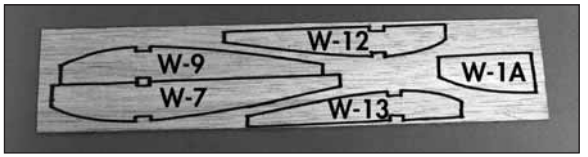
Build the Inner Wing Panels

Build the **right** wing half first so your progress matches the photos in the manual. Lay the right wing plan over your building board, then cover the plan with wax paper.





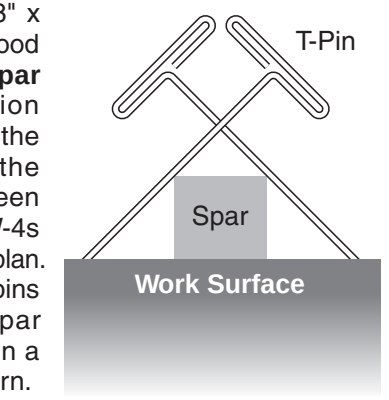


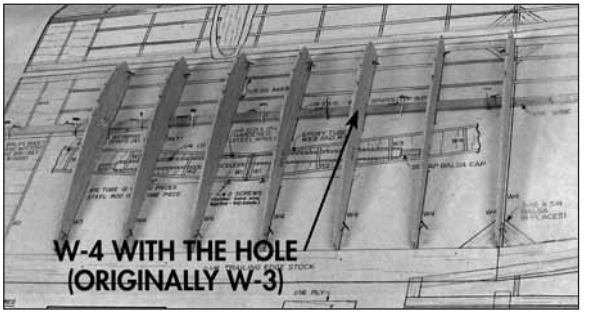


❏ **1.** Before you remove the balsa ribs from their die sheets, use the photos to identify the ribs and mark them with a ballpoint pen as shown. If you plan to cover the wing with transparent MonoKote film, mark the ribs neatly all in the same location or mark them in an inconspicuous location so the marks will not be seen through the covering.

❏ **2.** Remove all the ribs from their die sheets, then use a bar sander and 220-grit sandpaper to remove any slivers or die-cutting irregularities. Save the leftover 1/16" plywood from the W-1s to be used later during final landing gear installation.

❏ ❏ **3.** Pin a 1/8" x 3/8" x 24" basswood bottom **inner spar** over its location on the plan so the tip "ends" at the centerline between the laminated W-4s as shown on the plan. Do not insert T-pins through the spar but install them in a criss-cross pattern.

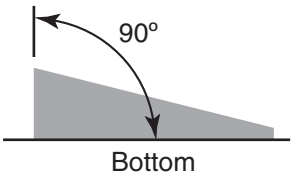


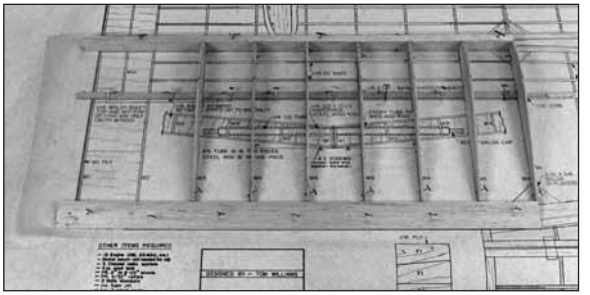


❏ ❏ **4.** Position rib **W-3** on the bottom spar and pin it to the building board over its location on the plan. Position the six **W-4s** of the inner wing panel on the spar and pin them to the building board as well.

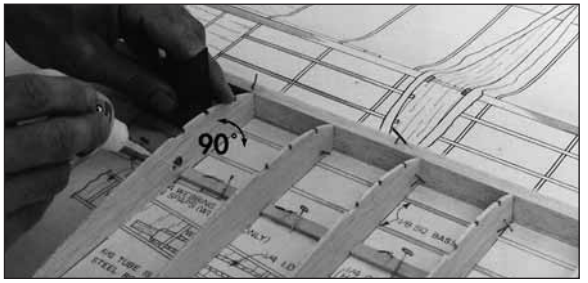
Note: Substitute the **third** W-4 rib in from the tip with a W-3.

❏ ❏ **5.** Position a 3/8" x 1-1/4" x 21" tapered balsa **inner TE** over its location on the plan so the tip aligns with the centerline at the laminated W-4s on the plan. Securely pin the TE to the building board so it tightly contacts the wing ribs.

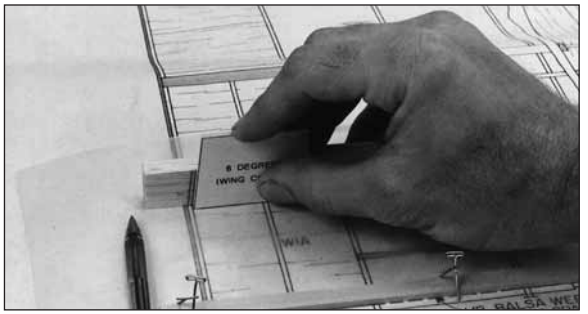




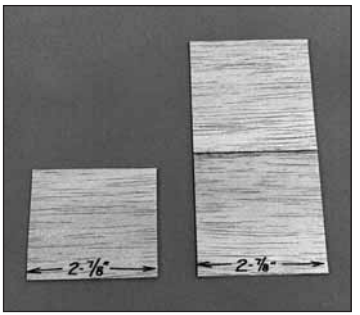
❏ ❏ **6.** Position a 3/8" x 3/4" x 21" balsa **inner LE** over its location on the plan so the tip aligns with the centerline at the laminated W-4s on the plan. Securely pin the LE to the building board so it tightly contacts the wing ribs.



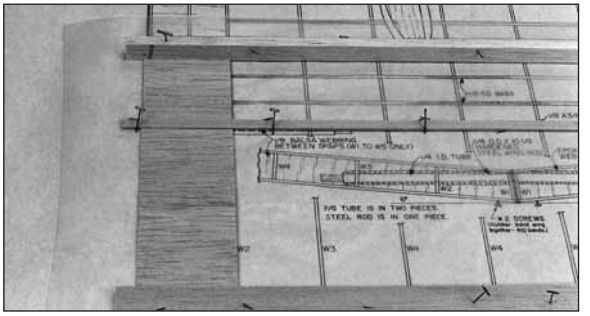
❑ ❑ **7.** Remove the T-pins in rib W-3. Use a 90-degree triangle to hold W-3 perpendicular to the building board, then glue it to the spar, LE and TE with medium or thin CA. Glue the W-4s to the spar, LE and TE the same way.



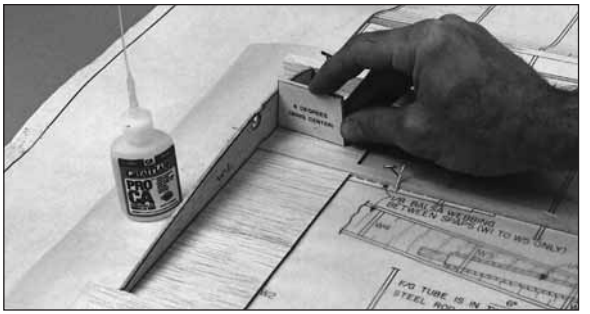
❑ ❑ **8.** Use the die-cut 1/8" plywood **wing center gauge** to accurately mark where the balsa W-1 contacts the LE so you know where to position W-1 after the bottom sheeting is glued in place. Mark the TE the same way.



❑ ❑ **9.** Cut three 2-7/8" wide strips from the 1/16" x 3" x 36" balsa sheet. Glue two of the strips together to make the **aft bottom sheeting** behind the bottom spar. The other strip is to be used for the **forward bottom sheeting** ahead of the spar. Use a straightedge and a sharp #11 blade to trim the sheets so they fit between the LE and bottom spar and the TE and bottom spar, but leave the sheets 2-7/8" wide.



❑ ❑ **10.** Use medium or thin CA to glue the sheets in position so the outer edges align with the **outer edge** of rib W-2. The sheeting will be sanded flush with the balsa W-1 after the wing is removed from the plan.

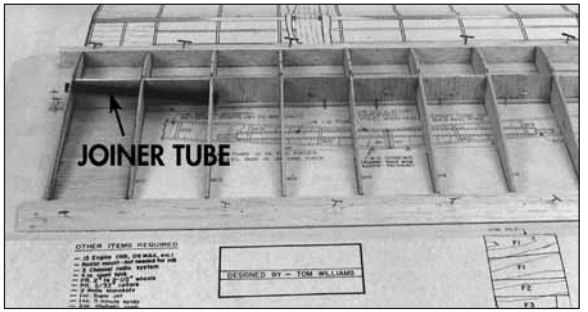


❑ ❑ **11.** Align **W-1** with the marks on the LE and TE, then glue it in position using the wing center gauge to set the correct angle.

❑ ❑ **12.** Glue **W-2** in position with thin or medium CA. While gluing, hold W-2 perpendicular to your building board as you did with the W-4s.

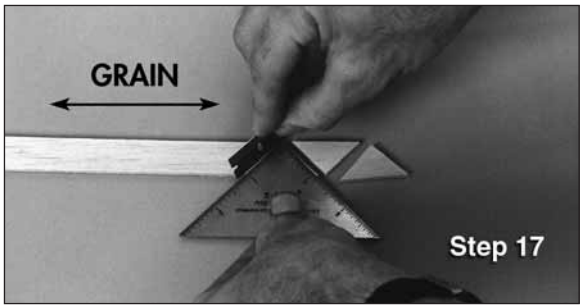
❑ ❑ **13.** Trim, test fit, then glue the 1/8" balsa vertical grain **shear webs** between only the W-4 ribs (that's five shear webs). Note that the shear webs between the W-4s are centered on the bottom spar. You will have to temporarily remove the T-pins that interfere with the shear webs, then replace the T-pins through the shear web after you glue each web into position. See the following photo.

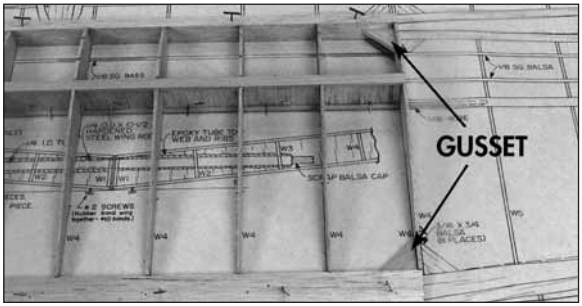
❑ ❑ **14.** Trim and test fit, but **do not glue** the remaining shear webs. Use the wing center gauge to cut the angle for the shear web that fits between W-1 and W-2.



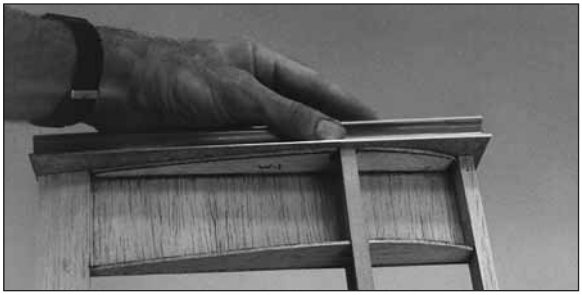
❑ ❑ **15.** Slide the composite **wing joiner tube** into the holes of W-1, W-2 and W-3. The holes in the ribs are slightly oversize so you can accurately position the tube when you permanently glue it into the wing. Position the joiner tube so it rests against the forward edge of the holes in the ribs, then position the shear webs so they contact the tube yet remain vertical. Glue the shear webs to the wing (not the joiner tube) in this position.

❑ ❑ **16.** Remove the joiner tube, then test fit the 1/8" x 3/8" x 21" basswood **inner upper spar** in the notches of the ribs. Make sure none of the crossed T-pins interfere with the top spar and you will be able to remove them after you permanently glue the spar into position. If necessary, trim the shear webs that do not allow the spar to rest fully into the notches of the ribs. Use medium or thick CA to glue the upper spar to the assembly so the end is even with the outer rib W-4.



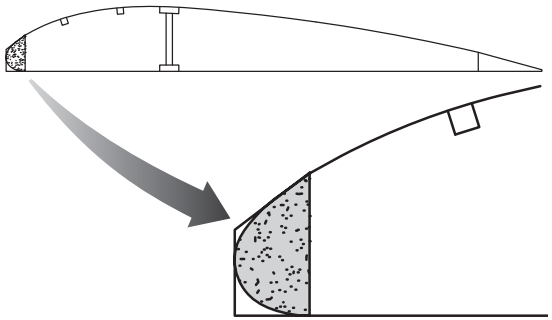


❑ ❑ **17.** Make two **gussets** from the 3/16" x 3/4" x 12" balsa sheet, then glue them in position. If you have one, use a small building triangle to accurately cut the gussets. Note the grain direction as shown in the photo.



❑ ❑ **18.** Remove the T-pins and lift the wing panel from your building board. Trim the ends of the spars, LE and TE, then use your bar sander and 150-grit sandpaper to make the spars, LE, TE and bottom sheeting fit perfectly flush with W-1.

❑ ❑ **19.** Glue **W-1A** into position with medium CA.



❑ ❑ **20.** See the Tip that follows, then use a razor plane, a hobby knife with a carving blade or a #11 blade to **roughly** carve the leading edge according to the sketch.

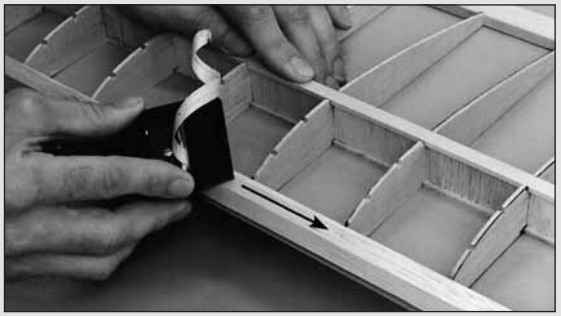
Note: Leave the leading edge at least 1/16" high in front of ribs W-1, 2 and 3 to accommodate the top sheeting. You will final sand the LE after you join the inner panels to the outer panels and glue the top sheeting in position.

TIP: How To Use A Razor Plane

We highly recommend a razor plane to shape the LEs because it is the safest, fastest and most accurate method to remove large quantities of balsa.

A. Adjust your razor plane so it removes about 1/64" or less balsa at a time.

B. Position the LE of the wing panel at the edge of your work bench so it is supported and the bench does not interfere with the razor plane.



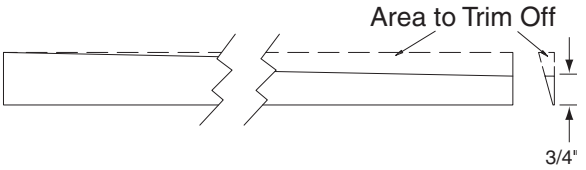
C. Hold the razor plane at an angle to the grain direction as shown in the photo.

D. Work slowly and inspect your work frequently. Before you know it you will shave the LE down quite far.

❏ **21.** Arrange the plan so the **left** inner wing panel is over your building board, then cover it with wax paper. Return to step 3 and build the left inner wing panel the same way as the right. **Don't forget to switch to the left wing panel plan so you do not build two right panels.**

Build the Outer Wing Panels

Start with the **right** outer wing panel so your progress matches the photos in the manual.

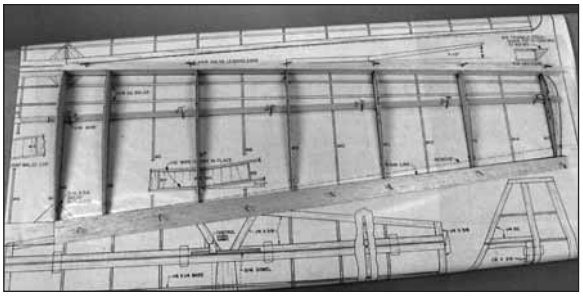


❏ ❏ **1.** Trim the end of a 3/8" x 1-1/4" x 30" tapered balsa **outer trailing edge** so it matches the angle at W-4 shown on the plan. Mark the tip end of the TE 3/4" away from the aft edge. Use a straightedge and a ballpoint pen to mark a line on the TE connecting the mark you made at the tip with the forward edge of the other end (the root) of the TE.

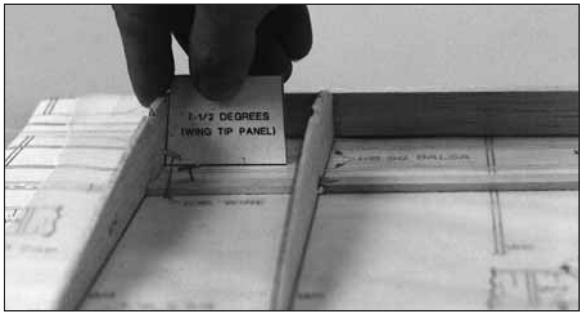
❏ ❏ **2.** Use the line you marked (or a straightedge) as a guide to trim the TE with a sharp #11 hobby knife as shown on the wing plan.

❏ ❏ **3.** Cover the outer panel of the **right** wing plan with wax paper, then use the "crossed T-pin" method to pin the 1/8" x 3/8" x 30" basswood bottom **outer main spar** in position so the root end aligns with the plan at W-4.

❏ ❏ **4.** Position the **odd numbered ribs** and W-4 on the bottom spar, then pin them to your building board.



❏ ❏ **5.** Pin the outer TE and the 3/8" x 3/4" x 30" balsa **outer LE** to the building board so they tightly contact the ribs and the ends align where indicated on the plan at W-4.



❑ ❑ **6.** Remove the T-pins from rib W-4. Use the **wing tip panel gauge** to set W-4 at the correct angle and glue it to the TE, bottom spar and LE.

❑ ❑ **7.** One rib at a time, remove the T-pins and use a building triangle to hold the rib vertical, then use medium or thin CA to glue the ribs you installed to the bottom spar, LE and TE.

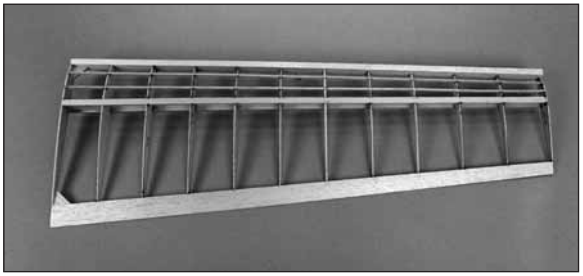
❑ ❑ **8.** Install, then glue the remaining ribs to the assembly using a building triangle to make sure they are vertical.

❑ ❑ **9.** Cut, then install the gussets at W-4 from the 3/16" x 3/4" balsa stick. Due to the taper of the LE and TE these gussets are not exactly a 90-degree angle.

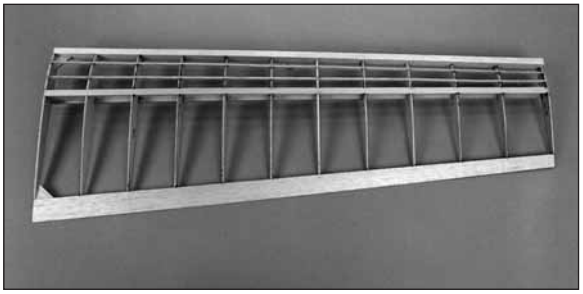
❑ ❑ **10.** Add the 1/8" balsa cross-grain shear web between W-4 and W-5. Use the die-cut 1/8 plywood **wing tip panel gauge** to cut the end of the web that contacts W-4.

❑ ❑ **11.** Test fit, then use medium or thick CA to glue the 1/8" x 3/8" x 30" basswood top **outer spar** to the ribs and shear web. Don't forget to make sure the crossed T-pins are not in the way and you can remove them after you permanently glue the spar into position.

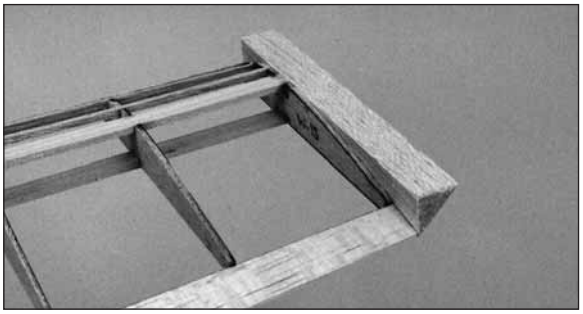
❑ ❑ **12.** Test fit, then use medium CA to glue both 1/8" x 1/8" x 30" balsa **outer turbulator spars** in the notches of the ribs so the ends extend past W-4 by approximately 1/16" (you can sand them flush later).



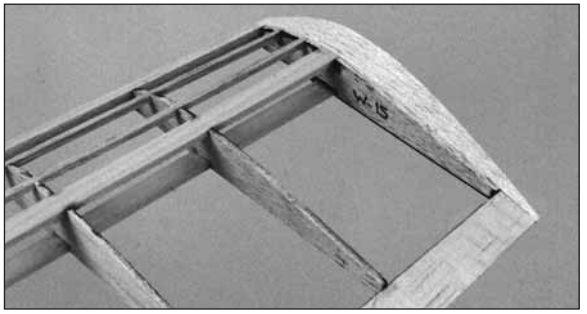
❑ ❑ **13.** Remove the T-pins, then lift the panel from the plan. Use a razor saw to cut the ends of the spars, LE and TE so they extend past W-15 by approximately 1/32" to 1/16". Use your bar sander to sand the ends flush with W-15 and W-4.



❑ ❑ **14.** Use a razor plane, a hobby carving blade or a #11 blade to **roughly** carve the leading edge the same way as you carved the inner wing panels.



❑ ❑ **15.** Glue the 3/4" x 6-1/4" triangle balsa **wing tip** to W-15. The **aft edge** of the wing tip should align with the **aft edge** of the TE. It may appear that the triangle wing tip is too short because it does not align with the LE, but as indicated on the plan you will shape the LE to align with the wing tip.



❏ ❏ **16.** Roughly carve the wing tip with a razor plane or a hobby knife. Final shape the tip and blend it to W-15 with a bar sander and 150-grit sandpaper.

❏ ❏ **17.** Carefully remove any glue blobs and blend all the ribs to the spars, TE and LE with a bar sander and 220-grit sandpaper.

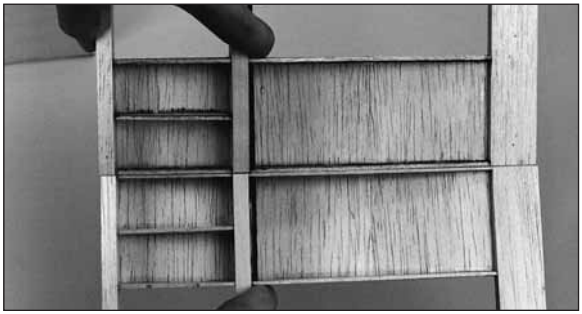
❏ **18.** Arrange the plan so the **left** outer wing panel is on your building board, then cover it with wax paper. Return to step 1 and build the left wing panel the same way you built the right. **Don't forget to switch to the left wing panel plan so you do not build two right panels.**

Join the Inner Panels

Do not permanently join the inner wing panels, but permanently install the joiner tubes so you can temporarily join the panels for a days flying session. Take the panels apart when it is time to go home.

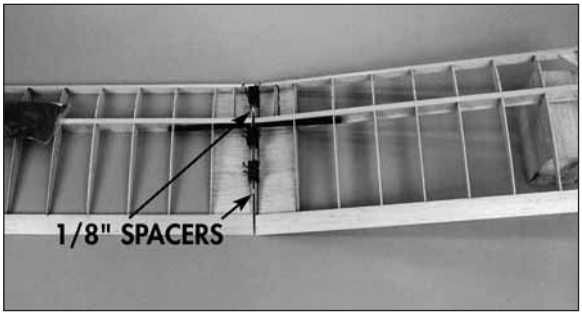
❏ **1.** Thoroughly roughen the outside of the wing joiner tubes with 150-grit sandpaper so the glue will stick. Use a metal file or a powered hand tool with a cut-off wheel to remove the burrs and chamfer the ends of the 1/4" x 10-1/2" steel **wing joiner rod**. Remove any dirt or manufacturing oil from the rod with a cloth dampened with alcohol or other solvent.

❏ **2.** Plug one end of both **wing joiner tubes** with a piece of 3/32" or 1/8" leftover balsa, then carefully glue the plug in position with a few drops of thin CA. Do not allow CA to flow into the tube because it may interfere with the joiner rod.



❏ **3.** Without any glue, temporarily join both inner wing panels with the joiner tubes and the joiner rod. Hold the wing halves together and inspect the fit between the W-1 ribs of the joining panels. If necessary, separate the panels and use your bar sander to adjust to the ends of the spars, LEs or TEs so the W-1s fit together well.

❏ **4.** With the joiner tubes and the joiner rod in position, temporarily clamp the wing halves together, then place a weight on one of the wing panels to hold it down. Measure the height of the outer W-4 from the building table. It should be approximately 4-1/2".

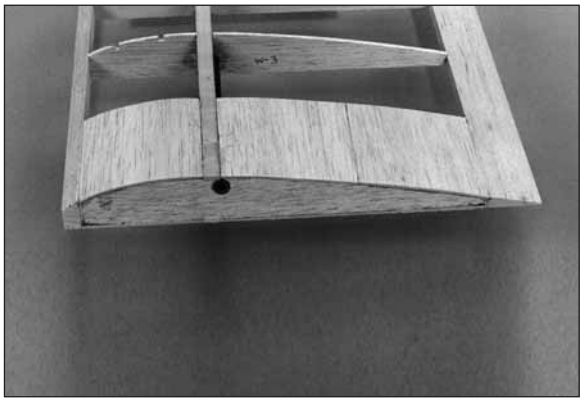


❏ **5.** Remove your clamps, then position 1/8" leftover balsa "spacers" between the W-1s and clamp them together. The spacers will allow both joiner tubes to protrude 1/16" from the inner panels.

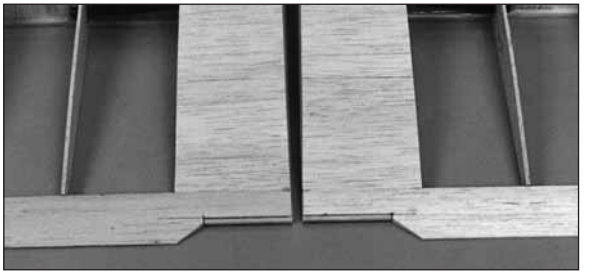
❏ **6.** Use a stack of books, blocks of balsa or similar to support the raised wing panel at W-4. Align the joiner tubes so the ends meet in the center of the wing and clamp the tubes to the shear webs. "Spot-glue" the ends of the joiner tubes in each wing panel with medium CA or epoxy.

❏ **7.** Carefully lift the wing from your building board so you do not break the spot-glued joints, then place it on the leading edges. Mix a batch of 30-minute epoxy, then thoroughly glue the joiner tubes to the shear webs, spars and ribs. **Do not disturb the wing until the epoxy cures.**

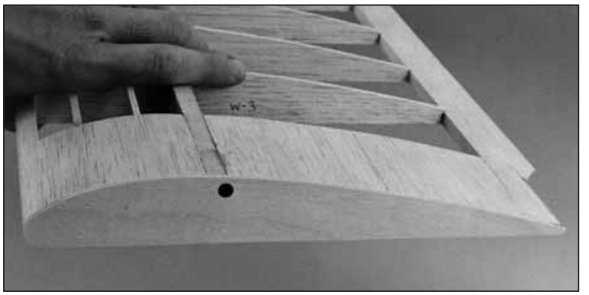
❏ **8.** Remove the clamps and separate the wing panels. Make the top center section sheeting for both wing panels from the remainder of the 1/16" x 3" balsa sheet. Test fit the sheets and confirm that the front and rear edges are flush with the TE, upper spar and LE. If needed, trim the tops of the ribs. Bevel the front edge of the front sheet so it matches the LE, then glue the sheets in position.



❏ **9.** Use a hobby knife and your bar sander with 150-grit sandpaper to trim the edge of the sheet so it is even with W-1. **Do not** trim the ends of the joiner tubes so they are flush with W-1.

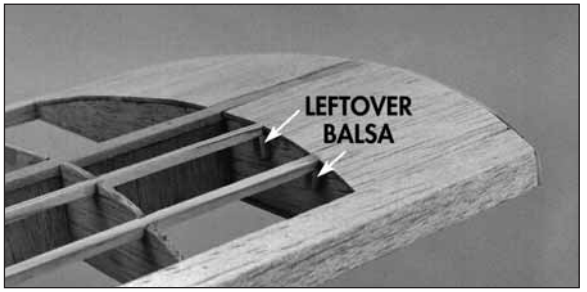


❏ **10.** Cut both of the TEs as shown on the plan. Cut the 1/8" x 4" hardwood **dowel** into two pieces, then test fit and glue the dowels to the TEs of both wing panels with medium CA. Use your bar sander to true the end of the dowels so they are flush with the ends of the wing.



❏ **11.** Test fit the die-cut 1/16" plywood **W-1 root ribs** on the ends of the wing panels and the joiner tubes. Then, glue them in position with medium or thick CA. If you've just removed the W-1's from their die sheet, remember to save the leftover 1/16" plywood to be used later during final landing gear installation.

❏ ❏ **12.** Test fit the 1/8" x 1/8" x 18" basswood **turbulator spars** in the notches of the right wing panel. The ends of the spars contact the center sheeting and the tops of the spars are even with the sheeting as shown in the following photo. If necessary, adjust the notches so the spars fit flush with the tops of the ribs, then glue the spars in position with thin or medium CA.



❑ ❑ **13.** Glue a piece of 1/8" leftover balsa to rib W-2 to support the turbulator spars. Trim the ends of the spars so they are even with the end of the panel at rib W-4.

❑ **14.** Glue the turbulator spars in the left wing panel the same way.

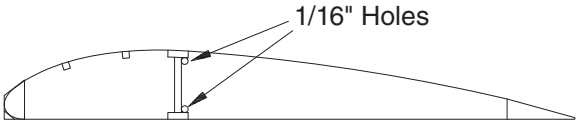
❑ **15.** Use a bar sander and 220-grit sandpaper on both inner wing panels to carefully remove any glue blobs and blend all the ribs to the spars, TE and LE.

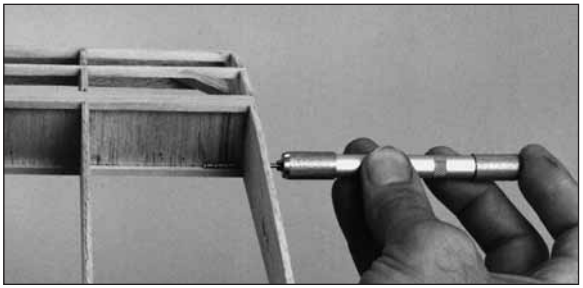
Join the Outer & Inner Wing Panels

❑ **1.** Remove the burrs and chamfer the ends of the four 1/16" x 5" **wing panel joiner wires** with a metal file or a powered hand tool and a cut-off wheel. Remove any oil from the wires left from the manufacturing process with a cloth dampened with alcohol or other solvent. Thoroughly roughen the wires with 150-girt sandpaper so the glue will stick.

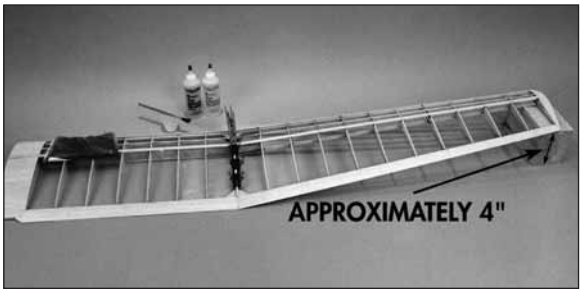
❑ ❑ **2.** Test fit the right inner wing panel to the right outer wing panel. If necessary, use your bar sander to adjust the ends of the spars, LEs or TEs for a good fit.

❑ ❑ **3.** With the mating W-4 ribs contacting each other and the inner wing panel laying flat on your building table, rib W-15 of the outer panel should be approximately 4" off the table. If necessary, adjust the ends of the spars at the W-4s to achieve the **approximate** 4" measurement.

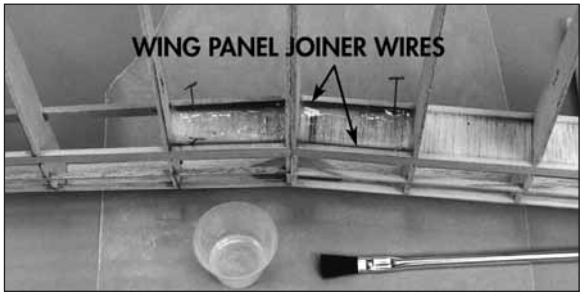




❑ ❑ **4.** Use a hobby knife or a 1/16" drill to make two holes in both W-4 ribs to accept the wire wing panel joiners. Bend, then test fit the joiner wires. Adjust the bends so the wires accurately match the “bend” in the wing and fully contact the spars.



❑ ❑ **5.** Apply a thin film of epoxy to the W-4 ribs, then join the two panels with the joiner wires. Support the tip the same way you did when you joined the inner panels. Place a sheet of wax paper under the wing to protect your building board from excess epoxy, then clamp the W-4 ribs together. Wipe away excess epoxy before it cures. **Do not apply epoxy to the joiner wires until instructed to do so.**



❑ ❑ **6.** After the epoxy has fully cured, carefully prop the wing up on its leading edge, then apply 30-minute epoxy to the wing joiner wires to securely glue them to the shear webs and spars. Use T-pins if necessary to hold the joiner wires against the spars. **Do not disturb the wing until the epoxy cures.**

❑ **7.** Return to step 2 and join the panels of the other wing half the same way.

Finish the Wing

❑ **1.** Drill a 1/16" hole in the bottom spar of both wing halves where shown on the plan for the #2 x 3/8" screws to secure the wing halves with rubber bands. We will instruct you to install the screws after you cover the wings.

❑ **2.** See the Tip that follows, then shape the LEs of both wing panels.

Tip: How To Final Shape The LEs

The Butterfly is a motor glider not a high performance aerobatic model – it's named the "Butterfly" after all! It is not critical that you shape the leading edges with the greatest precision. You probably would not notice any difference in the flight performance of a Butterfly with a leading edge accurately finished by an expert builder and a Butterfly with a leading edge roughly carved to shape with a hobby knife. This isn't to say that you should not always strive for building accuracy and a good finish, but don't worry if your LEs don't look perfect. Building a straight fuselage and flat, warp-free wings are where you should concentrate most your building efforts.

Here are some tips that can make shaping your LEs a little easier and faster:

A. While you shape the LEs, frequently reference the cross-section on the plan and the drawings of the **LE gauges** on the plan. If you are a perfectionist, cut the gauges from the plan, then use rubber cement or spray adhesive to glue them to leftover 1/8" plywood or thin cardboard (such as a cereal box). Cut the gauges from the wood or cardboard you glued them to, then test fit the gauges to the appropriate sections of the wing to arrive at the correct shape.

B. We highly recommend a razor plane to shape the LEs until they are nearly the shape shown on the plan – leave enough material to final shape by sanding.

C. Shape the LEs of the inner panels first since they have a constant shape from W-1 to W-4.

D. After you roughly shape the LE's by carving (or using the razor plane), final shape the LE's with a bar sander and 220-grit sandpaper. Wrap a piece of 220-grit sandpaper around the LE and final sand by hand.

E. Once you shape the inner LE's, use the gauges to final shape the outer LE's and blend the two together where they meet.

❑ **3.** Inspect all glue joints of both wing panels. Add CA to all glue joints that don't look strong.

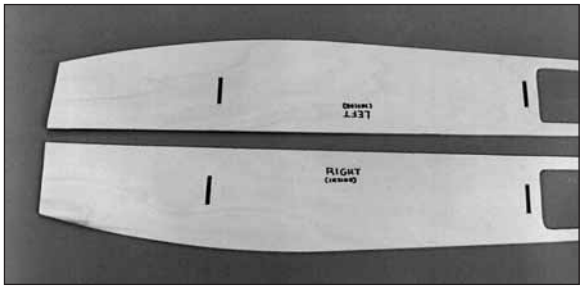
❑ **4.** Final sand the wings with your bar sander and 320-grit sandpaper and blend all the ribs with TE, LE and spars.

Build the Fuselage

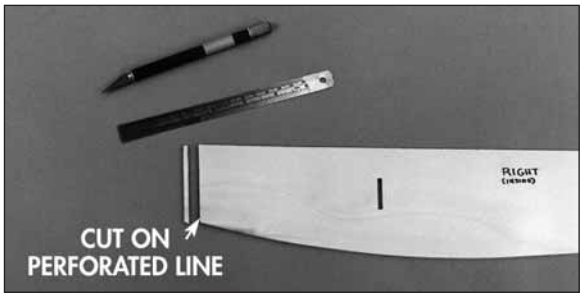
Prepare the Fuse Sides

All the parts used during fuselage construction are die-cut 1/8" plywood unless otherwise specified.

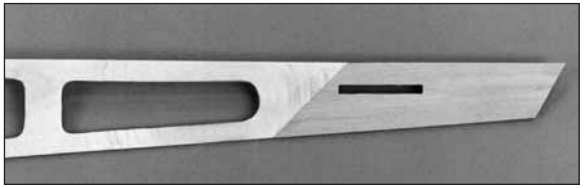
❑ **1.** Carefully remove the **forward** and **aft fuselage sides** from their die sheets, then remove slivers or die-cutting irregularities with a bar sander.



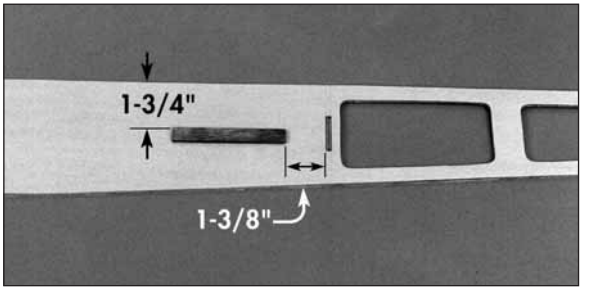
❑ **2.** Lay the forward fuselage sides on your work bench opposite each other in a "mirror image." Mark the inside of the fuselage sides as the "**right inside**" and the "**left inside**" with a ballpoint pen.



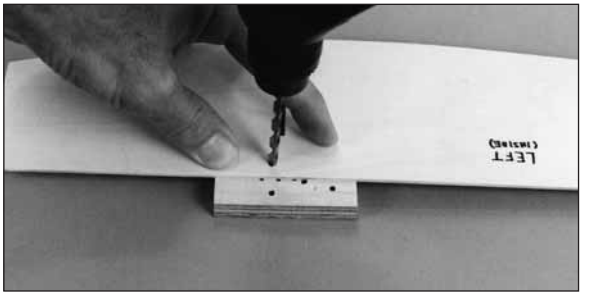
❑ **3.** Remove the portion of **only the right fuselage side** indicated by the perforated line with a hobby knife and a straightedge.



❑ **4.** Glue the aft **fuselage sides** to the forward fuselage sides with medium CA. Work over the plan covered with wax paper to make sure the pieces align. Use a bar sander and 150-grit sandpaper to sand the two sides so they are flat and even.



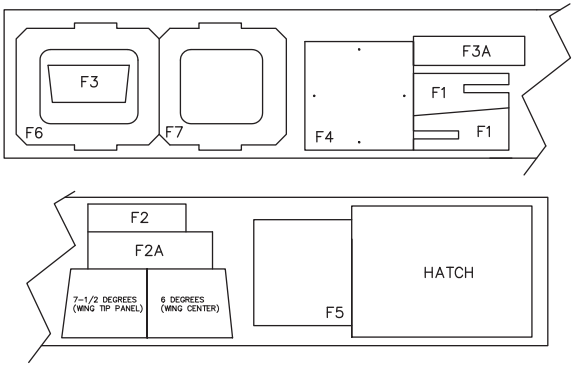
❑ **5.** Glue a **servo rail support** to the inside of both fuselage sides at the location shown in the photo.



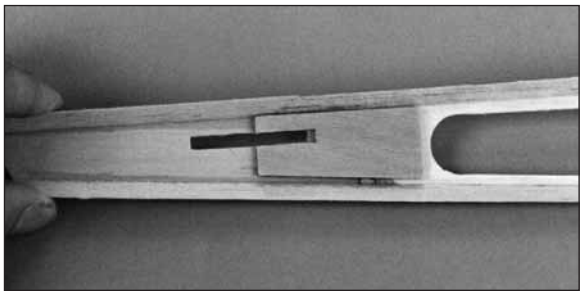
❑ **6.** Place one of the fuselage sides on a piece of scrap wood, then drill a 3/16" hole at both punch marks for the wing dowels. Press down on the fuselage side to keep the drill from splitting the wood as it goes through. Repeat for the other fuselage side.

❑ **7.** While you have your drill and bits out, drill an 11/64" hole at the **forward** landing gear wire punch mark in the **right** fuse side and the **aft** punch mark in the **left** fuselage side. If you do not have an 11/64" drill, you may use a 5/32" drill but you will have to enlarge the hole slightly with a hobby knife.

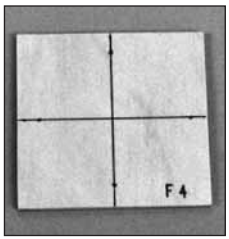
❑ **8.** Use thin CA to glue the 1/4" x 36" balsa triangle **fuselage reinforcement stringers** to the top and bottom of the **inside** of both fuselage sides. **Be certain you glue the stringers to the inside of the fuselage sides.** The front of the stringers should be 1/8" aft of the front edge of the fuselage sides (for F-5). Make the "splice" in the stringers as shown on the plan at the rear of the fuselage.

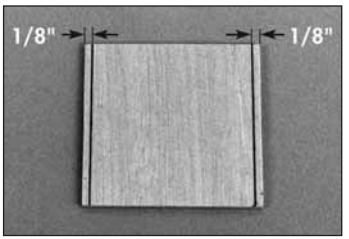


❏ **9.** Use the above die drawing of the fuselage parts to mark each part with a ballpoint pen exactly as they are shown. This will insure proper orientation of the formers during construction.

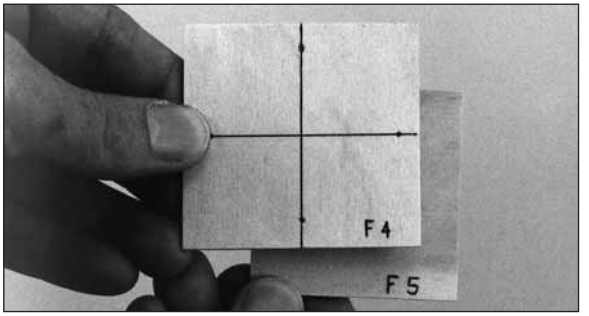


❏ **10.** Use medium CA to glue the notched **aft fuse side joiners** (**F-1**) to both fuselage sides so the front edge of the notches in the joiners are 1/4" **ahead** of the front edge of the notches in the fuse sides as shown in the photo.

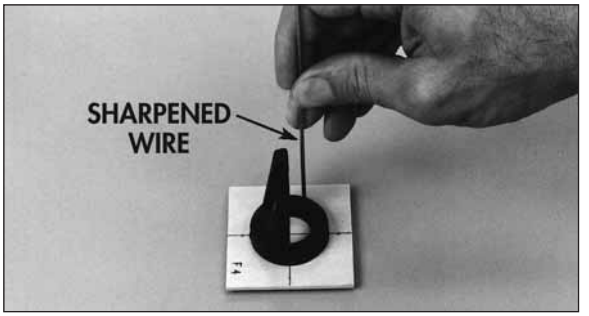




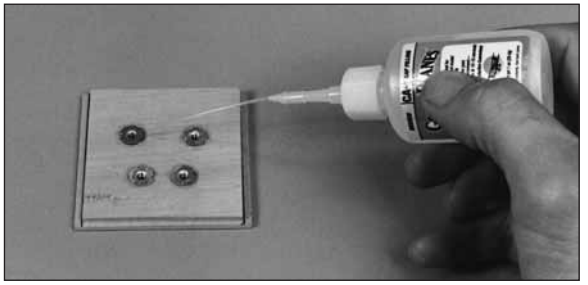
❏ **11.** Use a ballpoint pen and a straightedge to draw a line connecting the punch marks on the front of F-4 to indicate the position of your engine mount. Draw two vertical lines (with the grain of the wood) on the **back** of F-4 1/8" from each side to indicate the position of F-5.



❏ **12.** Glue F-5 to F-4 with epoxy so the edges of F-5 align with the lines on the back of F-4 and the top edges of F-4 and F-5 are even. From now on this assembly will be referred to as the "**firewall**." Make certain that the "F-4" and "F-5" designations you marked are in the same orientation. If the parts are slightly warped, clamp them to a flat table or board with wax paper between the board and the parts. Wipe away excess epoxy before it cures.



❏ **13.** Center the engine mount (not included) on the firewall so the "rails" align with the horizontal line. Use a piece of wire sharpened at one end to mark the location of the engine mount holes on the firewall. Remove the mount and drill 1/8" holes at the marks to fasten mount with 4-40 x 1/2" machine screws and 4-40 blind nuts (not included). We used a Hayes 061 KM-15 engine mount (HAYG1061) on our prototype.



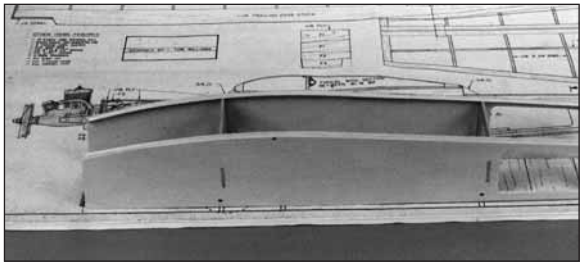
❏ **14.** Insert 4-40 blind nuts into the holes from the back of the firewall, then lightly tap them all the way in with a hammer. Apply medium CA around the edges of the blind nuts to permanently secure them.

❏ **15.** Drill a 3/16" hole through the punch mark in the right side of F-6 for the throttle pushrod guide tube.

Join the Fuselage Sides

❏ **1.** Fit F-6 into the forward notch of the right fuselage side. Use a small square or a 90-degree triangle to hold F-6 perpendicular and use medium CA to securely glue it in position. The "F-6" designation must face forward.

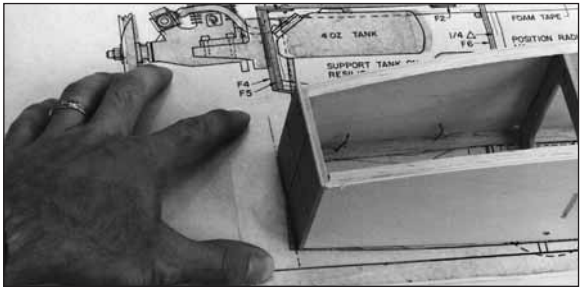
❏ **2.** Glue F-7 to the right fuse side the same way as F-6.



❏ **3.** Test fit the left fuselage side to the assembly. Position the temporarily joined fuse sides upside-down over the top view of the fuselage plan. Make sure the fuselage sides fully contact your flat building table and the formers and sides align with the plan. Adjust the notches in the left fuse side if necessary, then use medium CA to glue the left side to the formers.

❏ **4.** Beginning at former F-6, pin the fuselage in position over the top view of the plan by inserting T-pins through the triangle fuselage reinforcement stringers into your building board. Accurately align the fuselage with the plan as you proceed toward the rear. Insert all the T-pins so they are all at the same angle, slanting forward for example, so you will be able to remove the fuselage from your building board after you glue the sheeting in position. Do not insert any T-pins in front of F-6.

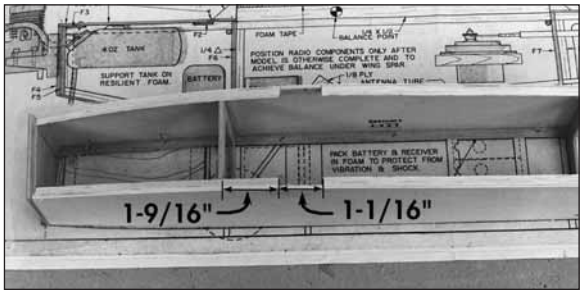
❏ **5.** Place a piece of wax paper under the front of the fuselage at the firewall. Glue the firewall to the fuse sides with 30-minute epoxy. Immediately proceed to the next step.



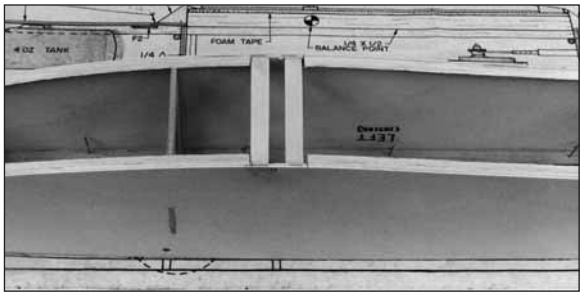
❏ **6.** Before the epoxy cures, pin the front of the fuselage to the plan the same way you did the rear of the fuselage. The firewall should align with the dashed line which represents the position of the firewall on the plan **when the fuselage is upside-down**. Use masking tape to hold the fuse sides together until the epoxy cures.

❏ **7.** Use medium or thick CA to glue a piece of triangle stock to both corners where the firewall meets the fuselage sides.

Sheet the Fuse Bottom



❑ **1.** Mark the location of the **landing gear rails** on the bottom edges of the fuse sides and the triangle fuse side stringers as shown in the photo. Remove the portion of triangle stringers on both fuselage sides between the lines you marked.



❑ **2.** Position the **landing gear rails** between the fuselage sides and align them with the landing gear holes as shown on the plan. Glue the landing gear rails in position with medium CA.

❑ **3.** Sand the bottom of the fuselage with your bar sander and 150-grit sandpaper so the formers, triangle side stringers and the landing gear rails are even.

❑ **4.** Bevel the one end of the 1/16" x 3" x 12" plywood **forward fuselage bottom** so it matches the right thrust angle of the firewall, then glue it to the bottom of the fuselage with medium or thick CA.

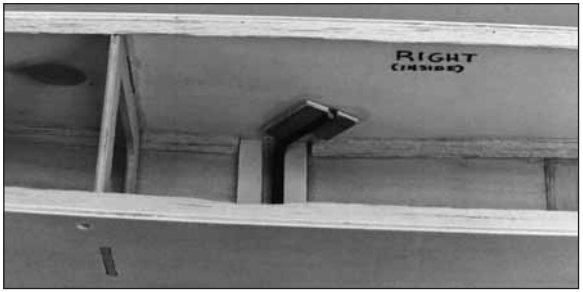
❑ **5.** Cut the cross-grain **bottom fuselage sheeting** from the 1/16" x 2" x 36" balsa sheet, then glue the individual planks in position with medium CA. Use your builders triangle to keep the fuselage sides perpendicular as you proceed.

❑ **6.** Remove as many T-pins as possible, then carefully lift the fuselage off your building board and remove the remaining T-pins.

❑ **7.** Sand the ply and balsa fuselage bottom even with the fuse sides.

❑ **8.** Use a metal file or a powered hand tool with a cut-off wheel to remove any burrs and chamfer the ends of both 5/32" **landing gear wires**.

❑ **9.** Fit one of the landing gear wires through the hole in the right fuselage side and hold it in position as shown on the plan. Position the landing gear wire as accurately as you can so it has the same amount of forward "rake" as shown on the plan. Place the **aft landing gear bearing** inside the right fuselage side next to the wire as shown on the plan. Use thin CA to glue the aft landing gear bearing to the fuselage side.



❑ **10.** Position the **forward landing gear** bearing on the right fuselage side next to the landing gear wire and glue it in position with thin CA.

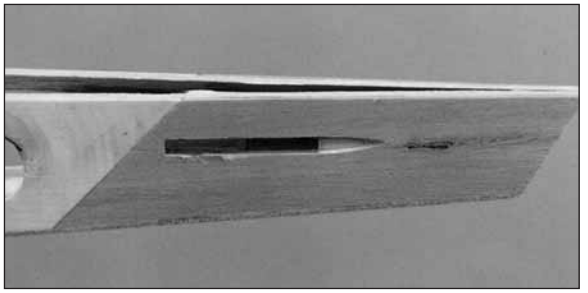
❑ **11.** Insert the other landing gear wire in the fuselage and position it so it matches the angle of the left wire. Glue the forward and aft landing gear bearings to the left fuselage side the same way you did for the right side.

❑ **12.** Remove the landing gear wires. You will permanently install the landing gear after you cover the model.

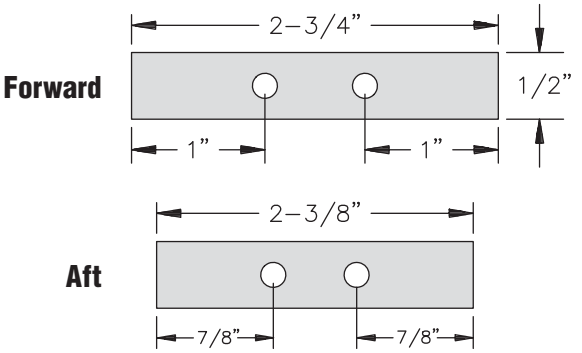
Finish the Fuselage

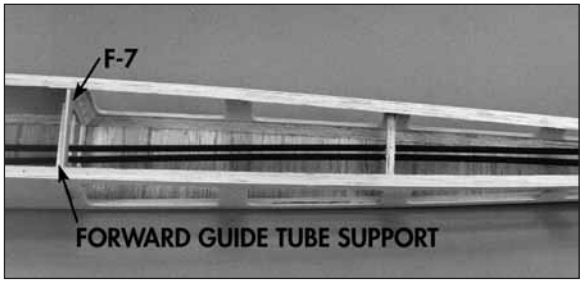
❑ **1.** Use the remaining balsa triangle stock to reinforce formers F-6 and F-7 where shown on the plan.

❑ **2.** Cut two 36" outer pushrod guide tubes to a length of 24". Use 150-grit sandpaper to carefully (so you do not snap them in two) roughen the outside of the tubes so glue will stick to them. Save the remaining 12" from one of the tubes for the throttle pushrod guide tube.



❑ **3.** Use a small, round wood file or a hobby knife to bevel the aft edge of the slot in both fuselage sides for the pushrod guide tubes.

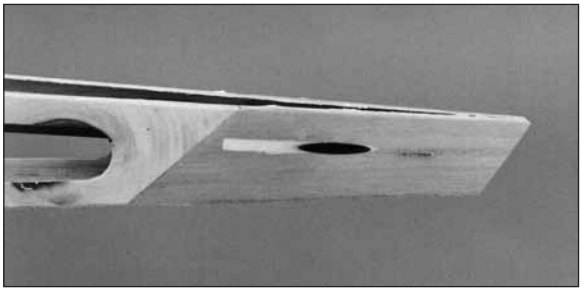




❑ **4.** Make a **forward** and **aft pushrod guide tube** support as shown in the sketch from leftover 1/4" x 3/8" balsa. Position the aft support as shown in the photo and position the forward support in front of F-7. Insert the pushrod guide tubes.

❑ **5.** Position the guide tubes so approximately 1/2" protrudes from the slots at the rear of the fuselage. Use medium CA to glue **only the aft support** in position but do not glue the tubes to the support and do not glue the front support in position until instructed to do so.

❑ **6.** Glue the pushrod guide tubes in the slots in the rear of the fuselage with thin CA, then fill the slots with HobbyLite filler or glue the tubes in the slots with epoxy and microballoons. If you've never heard of microballoons, it's a powder made of microscopic glass "balloons" that you mix with epoxy to use as a filler or adhesive. The microballoons and epoxy mixture is harder to sand than regular filler so it is used only where structural strength is required.

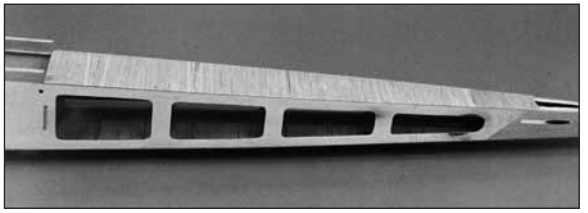


❑ **7.** Sand the filler and pushrod tubes with your bar sander and 150-grit sandpaper so they are flush with the fuselage sides.

❑ **8.** Glue the pushrod tubes to only the aft support.

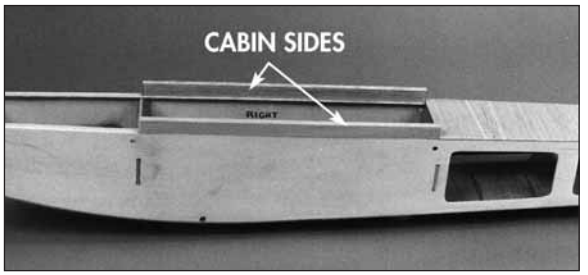
❑ **9.** Use your bar sander to sand the tops of the fuse sides so the formers, the triangle side stringers and the fuse sides are all even.

❑ **10.** Position the stab on the fuselage so the trailing edge is 1" aft of the end of the fuse (as shown on the plan). Use a ballpoint pen to mark the location of the stab leading edge on the top of the fuse sides and triangle stringers.



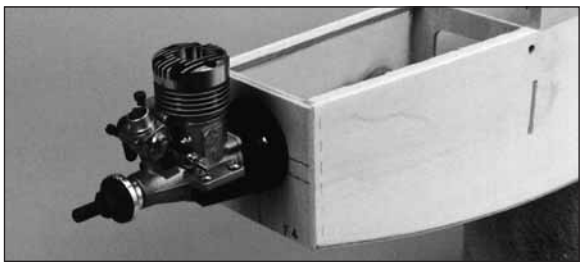
❑ **11.** Cut the cross-grain **aft top fuselage sheeting** from the 1/16" x 2" x 24" balsa sheet and the remainder of the 1/16" balsa sheet you used for the bottom of the fuse. Position and glue (with medium CA) the individual planks between F-7 and the marks you just made.

❑ 12. Trim, then sand the sides of the top sheeting so it is even with the fuse sides. Sand the top sheeting so it is flat, even and smooth.

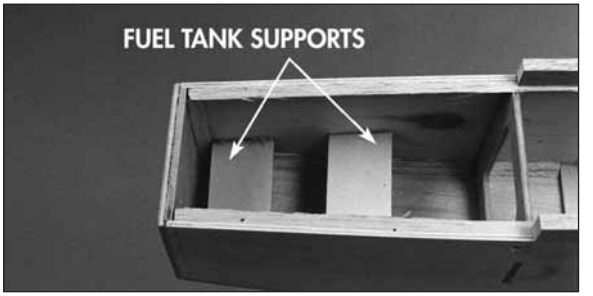


❑ **13.** Make the **cabin sides** from the 1/4" x 1/2" balsa sticks, then glue them to the top of the fuse sides in the location shown on the plan.

❑ **14.** Mount the engine mount to the firewall with 4-40 x 1/2" machine screws and blind nuts (not included).



❑ **15.** Position your engine on the engine mount and mark the location of the engine mounting holes. Drill 3/32" holes in the mount, then secure the engine to the mount with #4 x 1/2" screws (not included).



❑ **16.** See the information about fuel tanks that follows, then test fit a 4 oz. fuel tank in the fuselage. You may support the tank with layers of foam ("R/C foam" used to protect receivers and batteries and cushion fuel tanks) or build **fuel tank supports** from leftover 1/8" plywood. Place one layer of 1/4" foam between the tank and the tank floor.

A Crash Course In Fuel Tanks

A. In order for an engine to draw fuel from the tank, three things are important:

1. The **pick-up** line inside the tank must be cut to a length so it is as long as possible, yet does not allow the "**clunk**" (the weight at the end of the line) to contact the rear of the tank. If the clunk is able to touch the rear of the tank, it may become stuck in a position that is above the fuel level, thus preventing fuel flow to the engine.

2. Position the fuel tank so its **centerline** is as close as possible to the same level as the **carburetor**. This way, fuel flow will be nearly consistent no matter if the tank is full or almost empty.

3. Avoid **kinks** and **sharp bends** in the fuel line. Position the tank inside the tank compartment and drill the fuel line passage holes in the firewall to allow the lines to exit without sharp bends. If necessary, **loop** the fuel tubing inside the tank compartment before it enters the firewall.

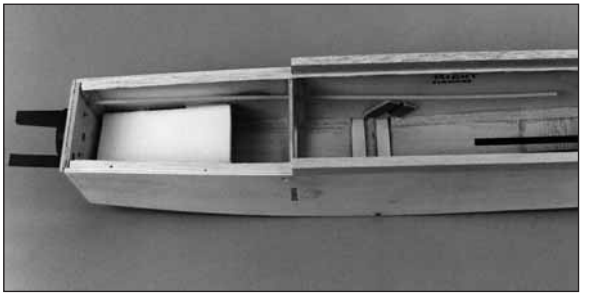
B. Generally, all sport models require only two fuel lines: one that goes to the **top of the tank** for pressure or a vent and another for fuel pick-up. Some models use a third line for a fuel filler valve but this is not required on your Butterfly. To fill the tank, simply disconnect the pick-up line from the carburetor and fill through it. When the tank is full fuel will flow through the vent line that is connected to your muffler (disconnect the line from the muffler while fueling).

C. The line that comes from the top of the tank and is connected to the muffler is the vent or "pressure" line. Exhaust pressure from the muffler pressurizes the fuel tank for reliable fuel flow. Should the pressure line ever become disconnected, You will notice that the engine will run lean due to the decrease in pressure which causes less fuel flow (by the way, "**lean**" means not enough fuel and "**rich**" means too much fuel).

D. Frequently inspect your fuel lines for small holes and replace them annually. Undetected holes in fuel lines cause air or fuel leaks and can cause a variety of engine running or starting problems.

❏ **17.** Position the fuel tank in the fuselage, then drill 1/4" holes (or 15/64" for precision) in the firewall for the fuel lines. Plan carefully where you drill the holes so the engine mount will not interfere with the fuel lines. Temporarily connect the fuel lines to make sure the holes are in the proper location.

❏ **18.** Drill a 3/16" hole in the firewall for the throttle pushrod guide tube.

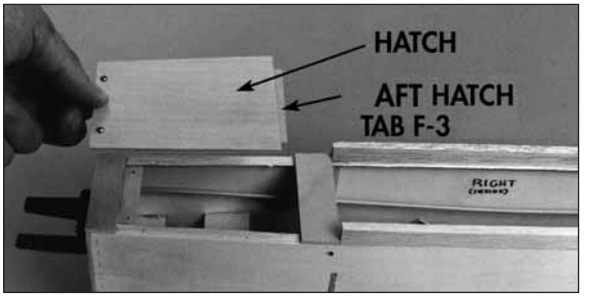


❏ **19.** Temporarily install the 12" pushrod tube (you saved from the remainder of the elevator and rudder guide tubes) in the fuselage through the firewall, past the fuel tank and through the hole you previously drilled in F-6.

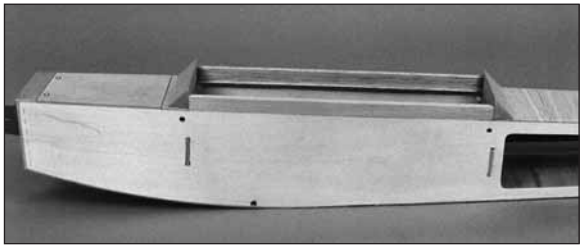
❏ **20.** Remove the fuel tank, engine and fuel lines. Glue the **forward fuselage tops F-3A** and **F-2A** in position with medium CA. Glue the **forward hatch tab F-3** to the bottom of F-3A. (See photo at step 23.)

❏ **21.** Cut or sand a bevel to one end of the **hatch** so it fits between F-3A and F-2A.

❏ **22.** Glue the **aft hatch tab** to the hatch with medium CA, then position the hatch and drill two 1/16" holes through the hatch and the forward hatch tab.



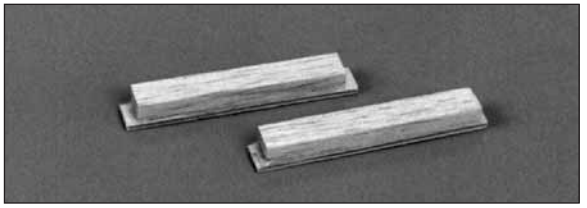
❏ **23.** Remove the hatch, then enlarge the holes **in the hatch only** with a 3/32" drill. Fasten the hatch to the fuselage with two #2 x 3/8" screws, then sand the sides of the hatch so they are even with the fuselage.



❑ **24.** Make the front and rear "**windows**" from the 3/4" x 6-1/4" balsa triangle stock. Glue the windows in the position shown on the plan, then sand the sides of the windows so they are even with the fuse and cabin sides.

❑ **25.** Use leftover 1/16" balsa sheet to cover the back of the fuselage.

Install the Servos



❑ **1.** Cut two 2-1/2" sticks from the remaining 1/4" x 3/8" balsa stick. Glue the sticks (centered) to the ply **servo rails**.

❑ **2.** Test fit the servo rails and your servos on the servo rail supports in the fuselage.

❑ **3.** Position the rails so they support the servos but allow enough space so you can remove the servos when necessary. Glue the rails to the fuse sides and the rail supports with medium CA.

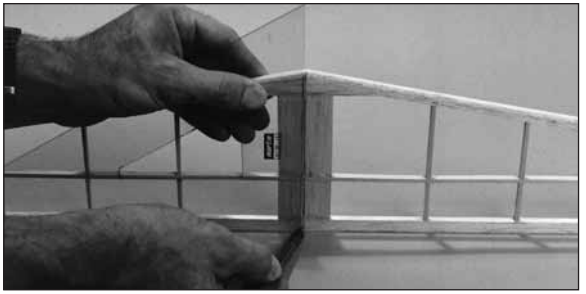
❑ **4.** Install servo arms onto your servos, then position the servos on the rails **as shown in the photo (not on the plan)**. The one-arm servo horns shown in the photo are cut from six-arm servo horns. The throttle servo arm has been shortened by "cutting off the outer hole." Drill 1/16" holes in the servo rails, then mount the servos to the rails with the screws included with your servos.

❑ **5. Optional:** Drill or cut a hole in the back of the fuselage and install a pushrod guide tube (not included) to serve as an antenna guide. The front of the tube should extend approximately 1" in front of the servos. Glue the tube to the formers and the aft 1/16" sheeting, then sand the end of the tube so it is flush with the 1/16" sheeting.

Align the Stab and Fin

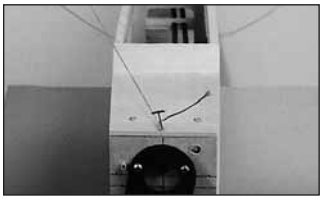
Align the Stab

❑ **1.** Temporarily fasten the stabilizer to the fuselage with T-pins. Use clothespins or clamps to hold a long straightedge on the wing saddle portion of the fuselage (the tops of the cabin sides). Stand behind the airplane and view the stab and the straightedge. If necessary, remove the stab and use your bar sander and 150-grit sandpaper to sand the top edges of the fuse sides so the stab will lie flat and parallel with the straightedge.

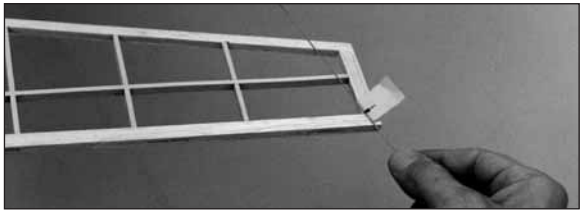


❑ **2.** Accurately mark the center the top of the stab, then use a square or a 90-degree triangle to mark a centerline that extends from the leading edge to the trailing edge.

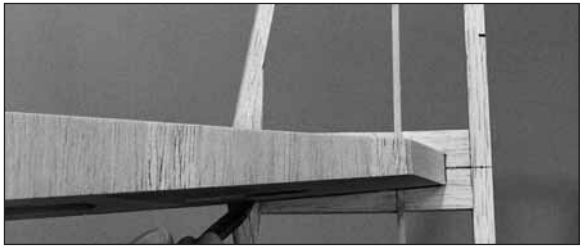
❑ **3.** Accurately mark the center of the fuselage top where the LE of the stab contacts the top sheeting. Position the stab on the fuselage and align the centerline you marked on the stab with the mark on the fuse top. Pin **only the LE** of the stab to the fuse.



❑ **4.** Insert a T-pin into the **center** of the top of the fuselage just behind the firewall (use the vertical line you marked on the center of the firewall as a reference).

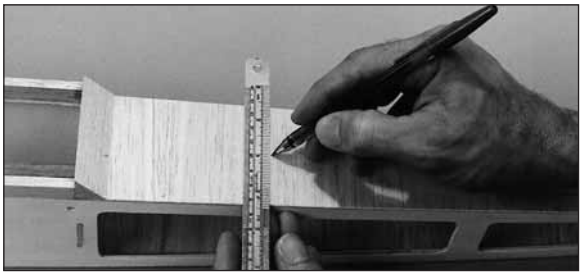


❑ **5.** Fold a piece of masking tape around a 36" long piece of string, then mark an arrow on the tape with a felt-tip pen. Tie the other end of the string around the T-pin you inserted in the front of the fuselage in the previous step. Slide the tape along the string and adjust the stab until the arrow aligns with both stab tips as shown in the bottom photo. Pin the rear of the stab to the fuselage.

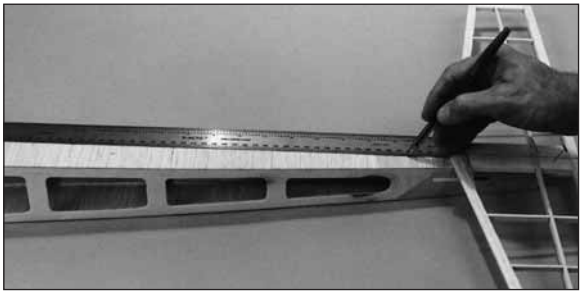


❑ **6.** Carefully turn the fuselage over and mark the outline of the fuselage sides on the bottom of the stab. This line indicates where you should apply the covering "up to" and apply glue when it is time to glue the stab to the fuse.

Align the Fin

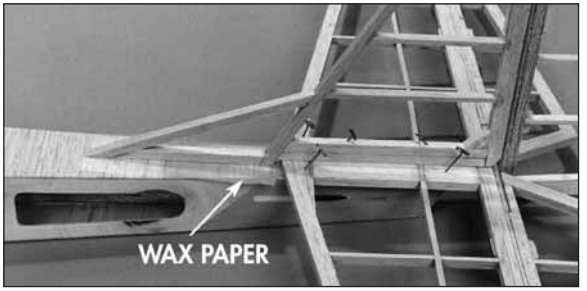


❑ **1.** Accurately mark the center of the fuselage top near the rear "window."

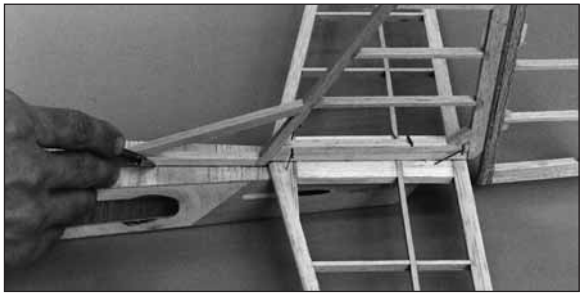


❑ **2.** Use a straightedge to lightly draw a line connecting the centerlines of the fuse top.

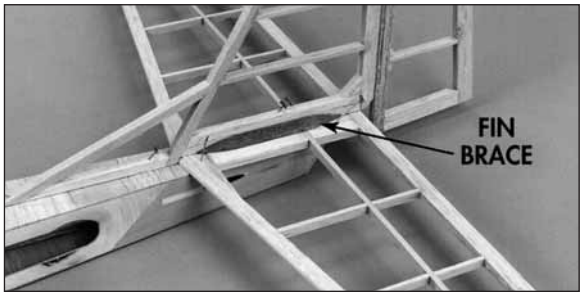
❑ **3.** Position the fin on the centerline of the stab, then pin it in position. Placed wax paper on the aft fuse top in front of the stab where the dorsal fin will be located.



❑ **4.** Make the two pieces of the **dorsal fin** from remaining 1/4" x 1/4" balsa, then glue them **only to the fin** with medium CA.



❏ **5.** Remove the wax paper, then lightly mark the outline of the fin on the fuse top and the stab with a ballpoint pen.



❏ **6.** Make the **fin braces** from the remaining 1/4" balsa triangle stock. Make the braces 4" to 4-1/2" long and bevel the ends. Position the braces on the stab and trace their outlines on the fin and stab with a ballpoint pen.

Covering

Prepare for Covering

❏ **1.** Inspect the entire model for glue joints that don't look strong and reinforce them with medium or thin CA.

❏ **2.** Remove the fin (with the dorsal fin) and stab from the fuse. Final-sand the tail surfaces with 320-grit sandpaper being careful not to break any of the tail ribs or "thin" the balsa too much in any one area.

❏ **3.** Slightly round the top and bottom corners of the fuselage and the triangle stock "windows" with your bar sander and 220-grit sandpaper. Sand the fuselage so it is smooth and even. Fill all dents, scratches and imperfect glue joints that may show through the covering with HobbyLite filler.

❏ **4.** Use medium CA to glue the die-cut 1/8" plywood **tail skid** and balsa triangle reinforcements to the bottom of the fuselage or glue the skid in position after you cover the fuselage.

❏ **5.** Test fit the wing in the fuselage and adjust the front and rear "windows" if necessary so the wing will fit between them.

Covering Sequence

Read the Covering Tips first, then cover your Butterfly in this order:

Tail Surfaces:
1. Stab bottom right, then left
2. Stab top right, then left
3. Elevator ends
4. Elevator bottoms, then tops
5. Fin ends
6. Fin right, then left
7. Rudder right, then left
8. Triangular fin reinforcements

Fuselage:
1. Bottom
2. One side, then the other
3. Top
4. "Windows"
5. Fuel tank hatch
6. Firewall

Wings:
1. Root (center) ends
2. Tips
3. Bottom inner panel
4. Bottom outer panel
5. Top inner panel
6. Top outer panel

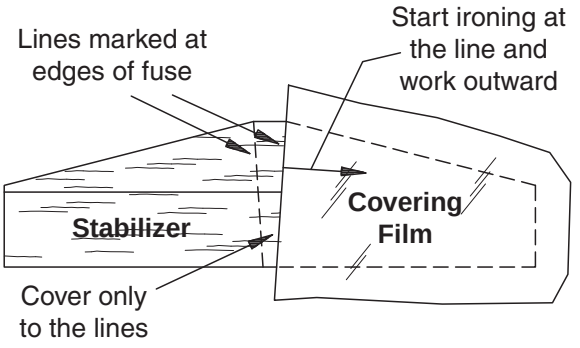
Covering Tips

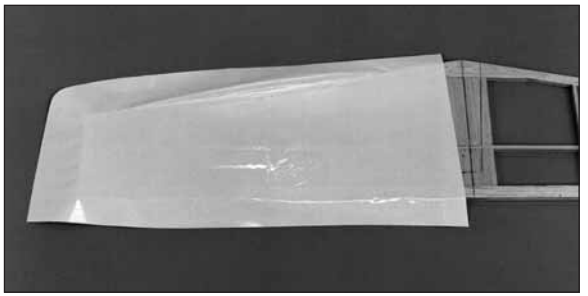
If this is the first time you have covered a model refrain from attempting a complicated trim scheme. Add stripes, graphics and various designs to your Butterfly cut from different colors of MonoKote film, then iron them directly over the

base color. Try just a single color base (usually a lighter color such as white or yellow) with perhaps a single stripe, your AMA number or some stick-on graphics. A simple trim scheme will get you in the air faster and look much better (not to mention give you fewer headaches) than a model that was difficult to cover because of a complicated trim scheme.

We will use the stabilizer as an example because all of the techniques shown apply to the rest of the Butterfly too.

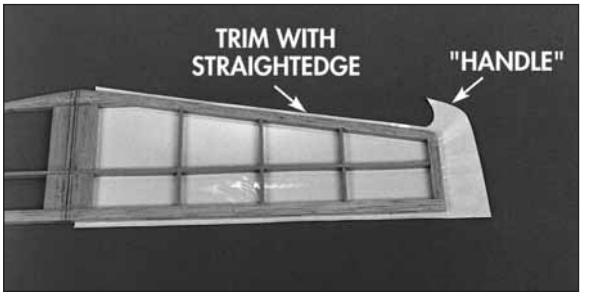
❏ **1.** Here is a "rule of thumb" to keep in mind before you begin: Wherever possible, apply the covering so all seams face downward or rearward. This can be done if you cover the bottom (of the wing, fuse, stab, etc.) first.





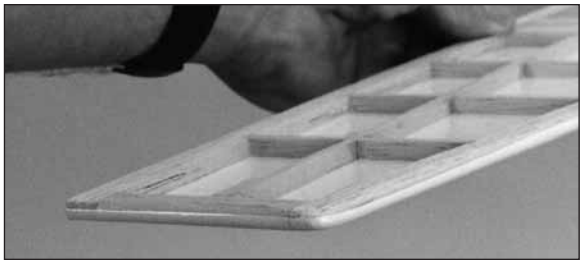
❏ **2.** Cut the covering for one half of the bottom of the stab so it is approximately 1" oversize. Use a straightedge to cut the end that aligns with the lines you drew indicating the fuselage. Use a Top Flite MonoKote Iron with a Hot Sock to securely bond the covering to the perimeter (LE, TE, tip, middle) of the stab but **do not** fully shrink the covering at this time.

Never cut the covering after you iron it to the wood except near the tips. Modelers who do this may weaken the structure which could cause it to fail during flight.



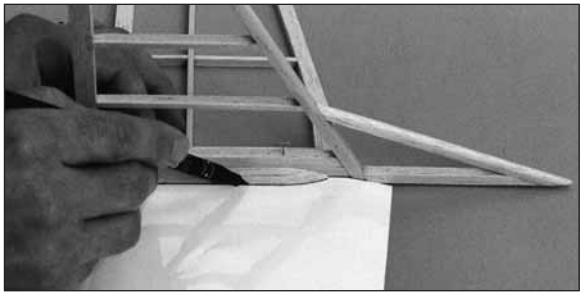
❏ **3.** Use a straightedge to accurately trim the covering near the LE and TE, but leave a little "handle" around the corner and the tip so you can pull the wrinkles out of the covering and stretch it around the tip and corner as you heat it.

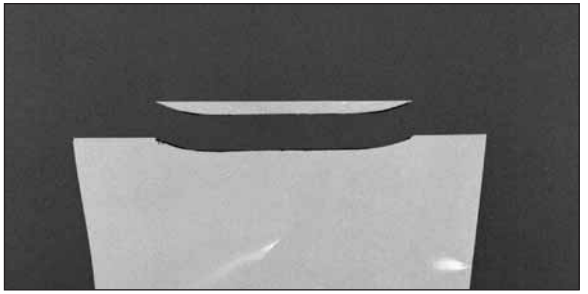
❏ **4.** Seal the front and rear of the covering to the LE and TE, then heat the covering as you pull and stretch it around the tip. It takes a little practice to get all the wrinkles out so don't be discouraged if it doesn't look perfect on your first attempt (or the second or third time). You can reheat and stretch the covering many times. It helps to place the stab on your workbench so the tip is over the edge. Place a weight on top of the stab to hold it down. This will allow you to pull the covering with one hand and hold the iron in your other hand.



❑ **5.** Cut the excess covering from the tip with a single-edge razor blade or a sharp hobby knife.

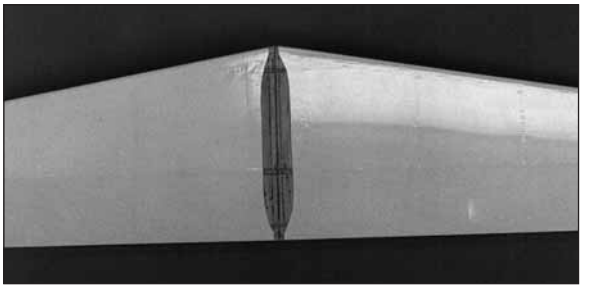
❑ **6.** Cover the other side of the bottom of the stab the same way.

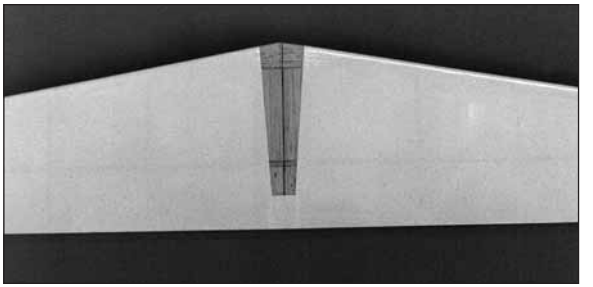




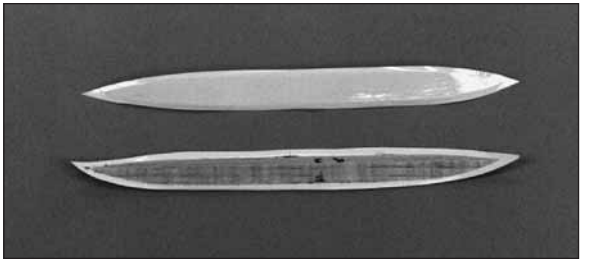
❑ **7.** Temporarily position the top stab covering and the triangle fin reinforcement on the top of the stab. Use a felt-tip pen to trace the outline of the fin reinforcement onto the covering, then take the covering off the stab and cut out that portion of the covering. This will allow you to glue the fin reinforcements directly to the bare wood and **avoid cutting the covering directly on the wood** after you iron it down. You can clean residual ink from the covering with a cloth dampened with rubbing alcohol.

❑ **8.** Iron the piece of covering you just "custom cut" to the top of the stab, then cover the other side the same way.

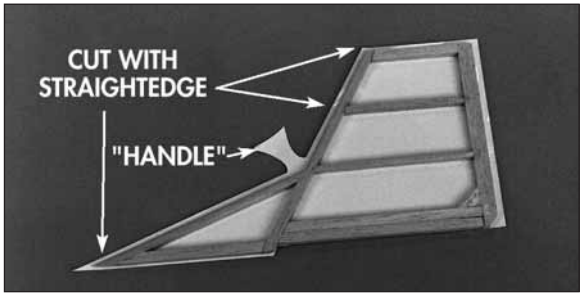


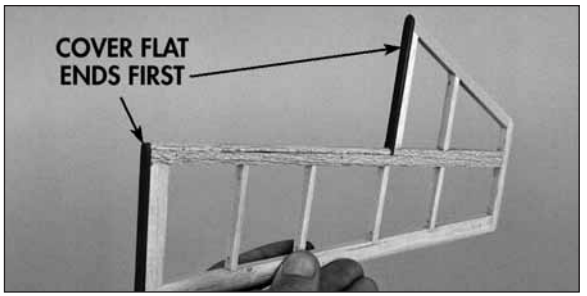


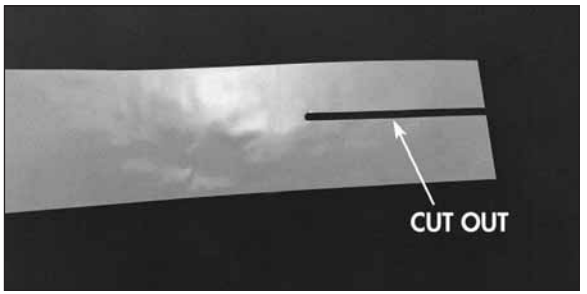
❑ **9.** Completely shrink the covering on the top and bottom and thoroughly bond all the edges to the frame.

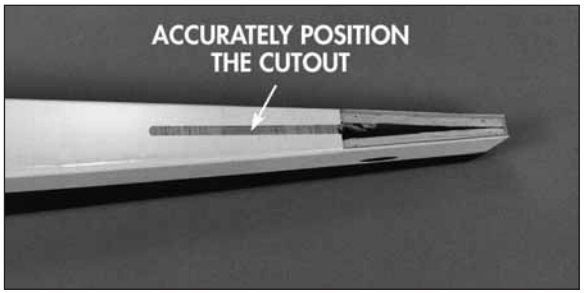


❑ **10.** Cover the triangle fin reinforcements, then trim the excess so it "overhangs" by approximately 3/32". This way all you have to do is glue them to the fin and stab and seal the edges with the iron.







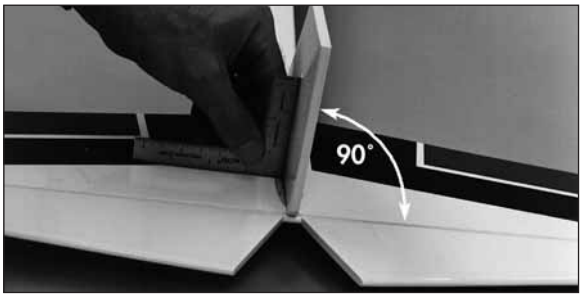


❏ **11.** Use the methods described previously to cover the rest of the model in the correct covering sequence.

Join the Tail Surfaces

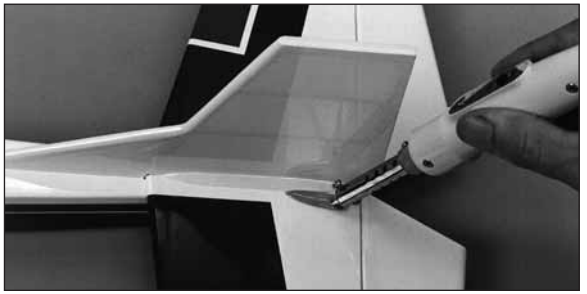
Join the Stab, Fin and Fuse

❏ **1.** Apply a film of 30-minute epoxy to the stab and fuselage where they contact each other, then position the stab on the fuselage. Use the techniques described earlier (in **Align The Stab**) to confirm that the stab is aligned with the fuselage, then use T-pins, weights or clamps to hold the stab to the fuse until the epoxy **fully** cures. Use a cloth dampened with alcohol to wipe away excess epoxy **before** it cures.



❏ **2.** Glue the fin to the stab and fuse. Use a 90-degree triangle or a square to hold the fin perpendicular, then hold it in position with T-pins or masking tape until the glue fully cures. If you require a little working time to align the fin use 30-minute epoxy. Otherwise you may use 6-minute epoxy.

❏ **3.** Test fit the fin reinforcements to the fin and stab. Take the reinforcements off the model, then apply a bead of thick or medium CA to both “sides” of one of the reinforcements. Immediately place the fin reinforcement on the fin and stab and securely hold it in position until the CA cures. Glue the other reinforcement in position the same way.

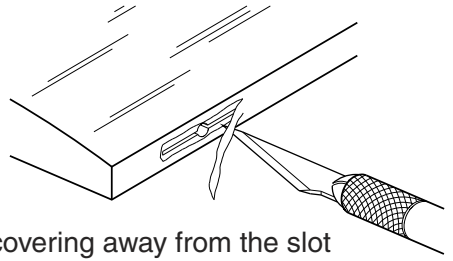


❑ **4.** Use a MonoKote Iron or a Trim Seal Tool to seal the perimeter of the reinforcements onto the fin and stab.

❑ **5.** If necessary, cut 1/4" strips of MonoKote film and use your Trim Seal Tool to iron the strips in the "corners" where the bottom of the stab meets the fuse and the dorsal fin meets the top of the fuse.

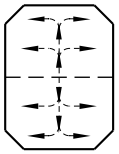
Hinge the Control Surfaces

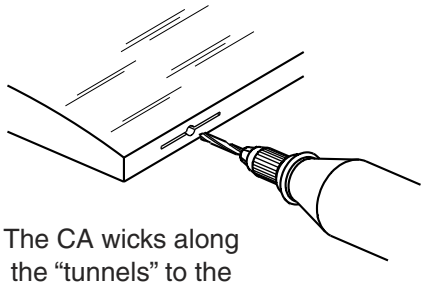
IMPORTANT: Make sure you join the elevator to the stab before you join the rudder to the fin.



Cut the covering away from the slot

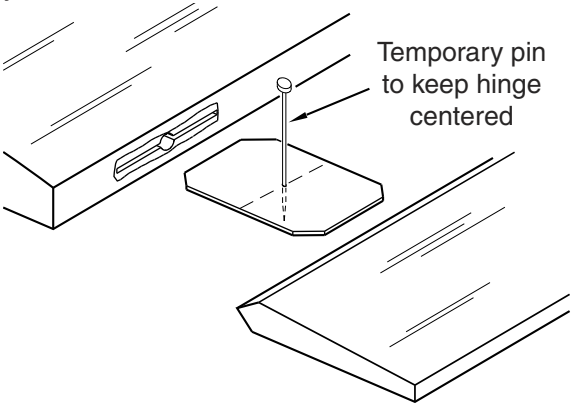
❑ **1.** Use your hobby knife and a sharp #11 blade to remove a small strip of covering from the hinge slots to expose them.





The CA wicks along the "tunnels" to the entire hinge surface.

❑ **2.** Drill a 3/32" hole in the center of all the hinge slots to allow the CA to fully penetrate. This is best done with a high-speed tool such as a powered hand tool. If you use a drill, remove slivers of balsa wood from the hinge slots with a hobby knife after you drill the holes.



❑ **3.** Join the elevator to the stab with the hinges. The **horn plate** of the stab (where the control horn is fastened) should be on the right side. If the hinges will not stay centered, insert a pin through the center of the hinge, then join the surfaces and remove the pins.

❑ 4. Confirm that the ends of the elevator align with the ends of the stab, that the hinges are centered and there is approximately a 1/32" gap between the TE of the stab and the LE of the elevator. A small gap is desirable so you do not inadvertently glue the elevator to the stab with residual CA.

❑ **5.** Carefully apply 6 drops of thin CA to each side of all the hinges. Keep a tissue handy to wipe away excess CA. If you spill a few drops of CA on the MonoKote film you can use CA Debonder (GPMR6039) to remove it. Or, wait until the CA fully cures, then carefully lift it off with a hobby knife blade.

Do not use accelerator on any of the hinges. Do not glue the hinges with anything other than 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 secure and the controls could separate while the model is flying.

❑ **6.** Let the CA fully cure, then flex the elevator several times to check the movement.

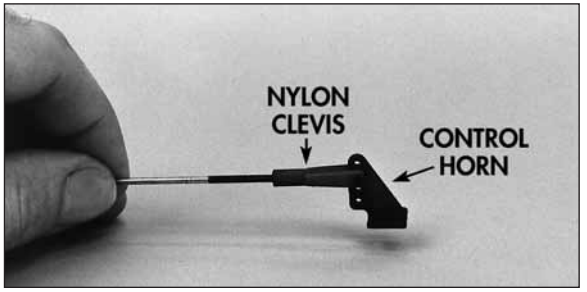
❑ **7.** Hinge the rudder the same way as the elevator.

Fuelproofing

Fuelproof areas that will be exposed to raw fuel or exhaust residue. These include the firewall, the entire fuel tank compartment, the underside of the hatch and inside the fuselage around the wing saddle area (the insides of the “windows” and cabin sides). Use 30-minute epoxy (you may thin the epoxy with alcohol so it is easier to brush on) or fuelproof model airplane paint.

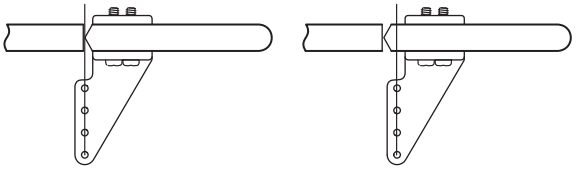
Final Hook-ups & Checks

Connect the Servos



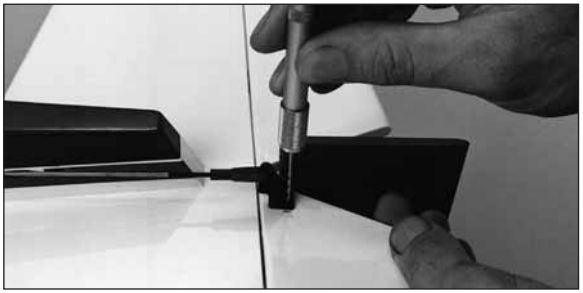
The nylon parts in this photo have been dyed black for illustration clarity.

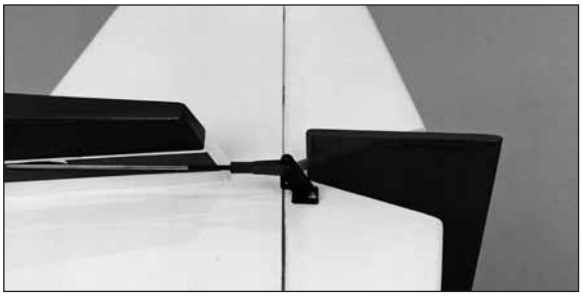
❏ ❏ **1.** Cut a 36" wire rod (included) to a length of 30" (including the threaded end). Connect a nylon clevis to a nylon control horn, then thread the clevis approximately 20 turns onto the rod.



RIGHT **WRONG**

❏ ❏ **2.** Use a new #11 blade to cut the covering from the pushrod guide tube exits in the rear of the fuselage, then insert the pushrod into the elevator guide tube. Position the control horn on the elevator in the location indicated on the plan so that the holes in the control horn align with the hinge gap as shown in the sketch.

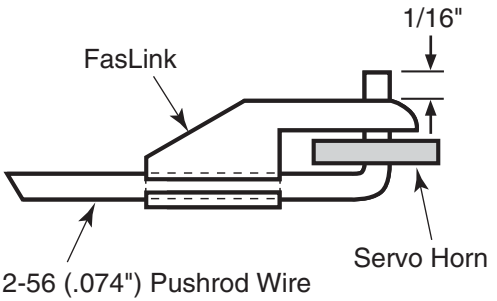


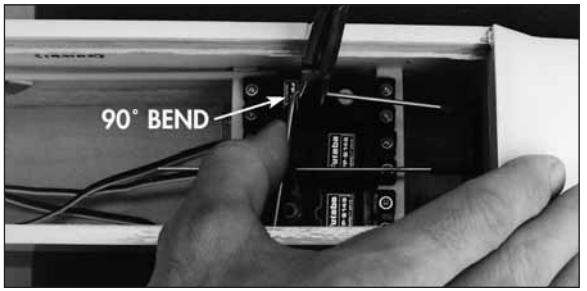


❏ ❏ 3. Use the holes in the base of the control horn as a guide to drill two 1/16" holes through the elevator, then mount the control horn to the elevator with two 2-56 x 1/2" screws and the **control horn plate**.

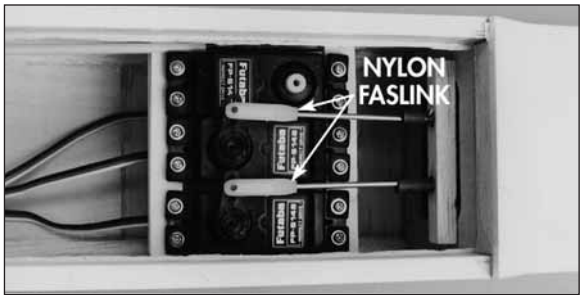
❏ ❏ **4.** Make another pushrod assembly and mount the control horn to the rudder the same way as the elevator.

❏ ❏ **5.** Follow the instructions included with your radio to hook-up and center all servos. Center the elevator servo arm, then use a felt-tip pen to mark the wire pushrod where it crosses the holes in the arm.



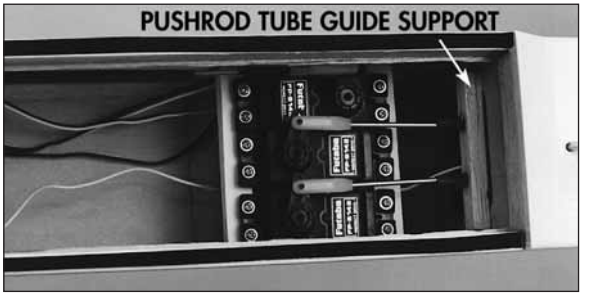


❏ ❏ **6.** Disconnect the clevis from the elevator horn, then make a 90-degree bend in the pushrod at the mark. Snap a FasLink™ Pushrod Keeper (included) onto the pushrod. Cut the wire so it protrudes from the FasLink by 1/16" as shown in the sketch.



❏ ❏ **7.** If necessary, enlarge the holes in the servo arm with a hobby knife or a 5/64" drill bit, then connect the pushrod to the elevator servo arm **from the bottom** and secure it with a FasLink. Adjust the clevis so the elevator is centered, then fit a silicone retainer on the clevis and connect the clevis to the elevator control horn.

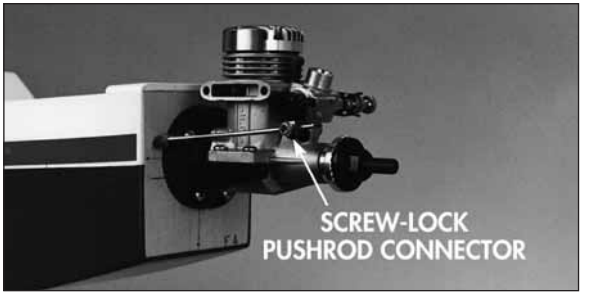
❏ ❏ **8.** Connect the rudder pushrod to the servo and rudder the same way.



❏ ❏ **9.** Glue the forward pushrod guide tube support to F-7, then glue the pushrod guide tubes to the support with medium or thin CA.

❏ **10**. Install the engine mount on the firewall. Attach the engine to the mount.

❏ **11.** Sand the 12" outer throttle guide tube so glue will stick. Insert the tube through the holes in the firewall and F-6. Cut a 36" rod (threaded one-end) to a length of 17" including the threaded end. Thread a nylon clevis onto the wire pushrod, then install the pushrod so the non-threaded end protrudes from the firewall.



❏ **12.** Connect the clevis to the servo arm, then connect the front of the throttle pushrod to the carburetor arm with a Great Planes Screw-Lock™ Pushrod Connector (included). The pushrod may require a couple of small bends to align with the pushrod connector. Cut off the excess wire so approximately 1/4" protrudes from the connector.

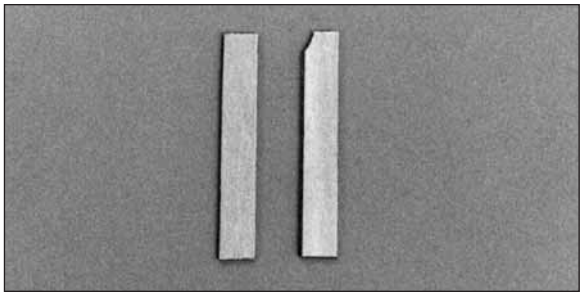
❏ **13.** Glue the outer throttle pushrod guide tube to the firewall and F-6 with thin CA.

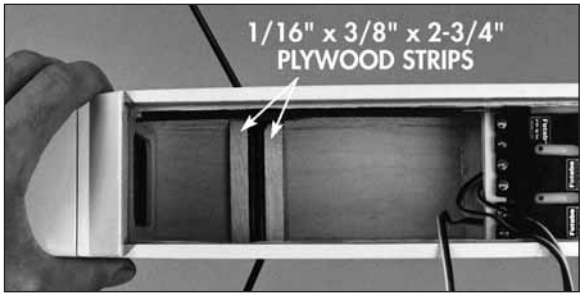
❏ **14.** Install the fuel tank and connect the fuel tubes.

❏ **15.** Install the fuel tank hatch with the #2 x 3/8" screws. The hatch should secure the tank, but if necessary, place extra foam around the fuel tank so it cannot shift during flight.

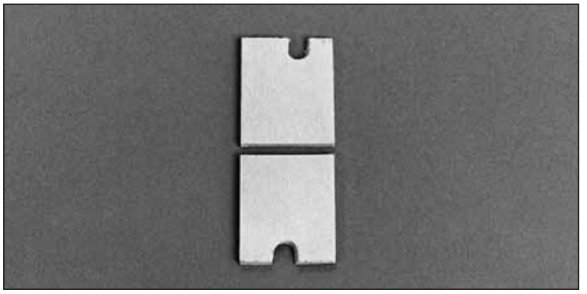
Mount the Landing Gear

❏ **1.** Cut the covering from the landing gear holes on both sides of the fuselage, then fit the landing gear in the rails.

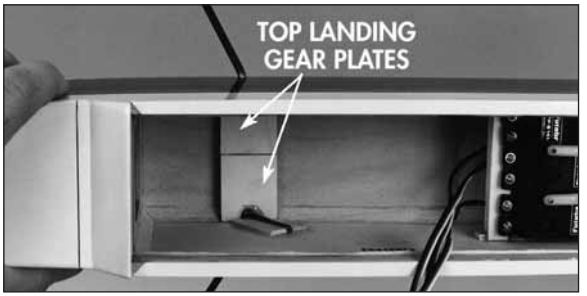




❏ **2.** Use the 1/16" plywood leftover from the W-1 root ribs to make two 1/16" x 3/8" x 2-3/4" strips. Chamfer the corner of one of the strips so it will clear the "upright" part of the left landing gear in the right side of the fuse. Glue the strips to the top of the landing gear rails with 6-minute epoxy.



❏ **3.** Cut the die-cut 1/8" plywood **top landing gear plate** in half, then mark the location where the landing gear wire contacts both plates. Use a hobby knife or a powered hand tool to cut a notch in both plates to clear the landing gear.



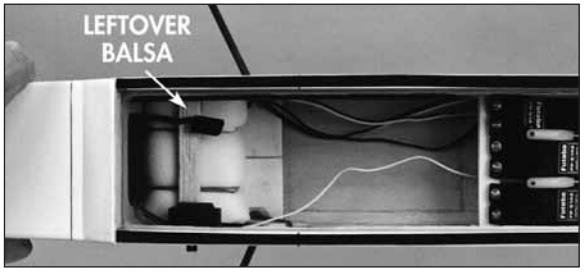
❏ **4.** Thoroughly roughen the portion of both landing gear wires that will be inside the fuselage with coarse sandpaper. Use plenty of 30-minute epoxy to glue the top landing gear plates to the 1/16" strips you positioned in step 2.

❏ **5.** Mount a 2-1/4" wheel on each landing gear wire with 5/32" wheel collars (not included, GPMQ4306) on both sides of the wheels.

❏ **6.** Connect the servo cords and the switch to your receiver, then wrap the receiver and battery pack in foam.

Finish Radio Installation

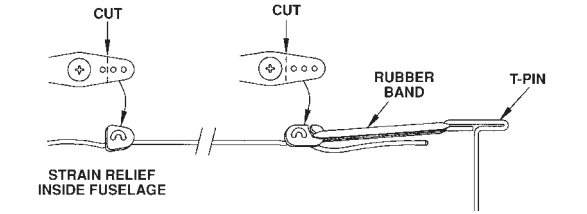
Note: Because the Butterfly is a three channel model (where the steering function is the rudder not ailerons) connect the rudder servo to the "aileron" channel of your receiver.

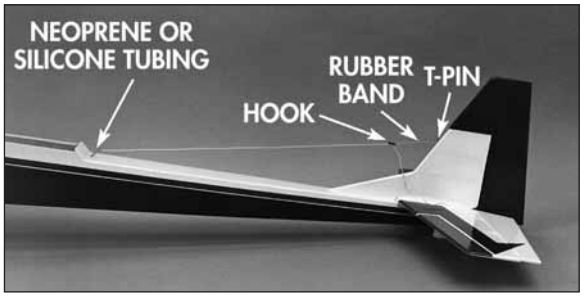


❑ **1.** Temporarily position the battery pack and receiver inside the fuselage in a location that will achieve balance at the Center of Gravity (C.G.) shown on the plan and described in the **Balance Your Model** section that follows. In our prototype a 500mAh flat pack wrapped with 1/4" foam fit "snugly" underneath the fuel tank supports shown in step 16 on page 26.

❑ **2.** Cut the covering from the holes in the fuselage sides for the wing dowels, then glue the dowels in position with medium CA. Fuelproof the ends of the dowels with thin CA, epoxy paint or epoxy.

❑ **3.** Mount the on/off switch on the side of the model that is opposite the engine exhaust in a location that will not interfere with the receiver or pushrods.





❑ **4.** Route the receiver antenna through the antenna tube (if you installed one) or through the top of the fuselage to a T-pin inserted into the leading edge of the fin. Make a strain relief and a hook from an unused servo arm as shown in the sketch. **Never shorten the antenna wire.**

Mount the Wing

❑ **1.** Apply 1/16" thick Great Planes Single-Sided Foam Tape (GPMQ4422) to the wing saddle of the fuselage.

❑ **2.** Poke a hole through the covering where you drilled the 1/16" holes in the bottom spar of both wing halves for the #2 x 3/8" screws. Pack the holes with 6-minute epoxy, then immediately install the screws.

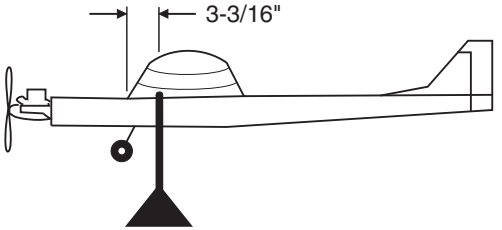
❑ **3.** Join both wing halves with the wing joiner rod, then secure the wing halves together by wrapping a couple of rubber bands around the screws in the bottom spar.

❑ **4.** Place the wing on the fuselage, then hold it in place with two or four #64 rubber bands. When it is time to fly your Butterfly, you should secure the wing with eight rubber bands and cross the last two.

Balance Your Model

This section is **IMPORTANT** and must **NOT** be omitted. A model that is not properly balanced will be **unstable** and **possibly unflyable**.

❑ **1.** Check the balance point with all components installed in the model and the fuel tank **empty**. Attach the wing to the fuselage with a few rubber bands, then accurately mark the balance point on the bottom of both wing halves **next to the fuselage**. The balance point is shown on the plan and is 3-3/16" (81mm) aft of the leading edge.



❑ **2.** Lift the model with your fingers at the balance point or make a simple stand as shown in the sketch. If the tail drops, shift the receiver and/or battery pack forward (if possible) to balance the model. If the nose drops, shift the receiver and/or

battery pack aft. If possible arrange the battery pack and receiver to achieve balance but make sure they remain secure in the fuselage so they cannot shift during flight or a rough landing. If you must add additional weight to the nose or tail of the Butterfly to achieve balance use Great Planes adhesive lead weights (GPMQ4485). An alternative to stick-on nose weight (if your model is tail heavy) is a Great Planes brass spinner nut (GPMQ4640). It has 1/4-28 threads so it will fit most engines.

Set the Control Throws

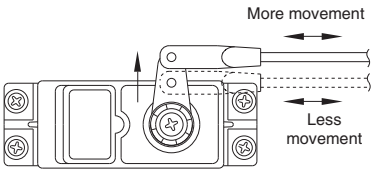
Measure the throws at the widest part of the trailing edge of the rudder and elevator. After a few flights you may change the throws to suit your flight style or the weather conditions.

We recommend the following control surface throws:

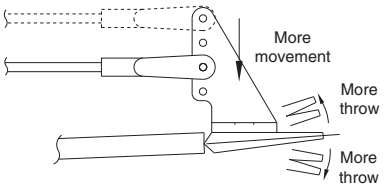
Elevator: 3/4" up and down

Rudder: 1-1/2" left and right

Throttle: Set the throttle so that at "high stick" the carburetor barrel is fully open and at low stick with full to half throttle **trim**, the carburetor barrel is nearly closed. At this position the engine should run reliably at a low RPM (idle). To shut the engine off, decrease the throttle trim tab.



Moving the clevis outward on the servo arm results in more pushrod movement.



Moving the clevis inward on the control horn results in more throw.

The closer the clevis is to the base of the control horn on the control surface and/or the further the pushrod is from the center of the servo arm, the more control throw you will have. To decrease control throw, move the clevis on the control horn outward and/or move the pushrod on the servo arm inward. Combinations of the above arrangements will provide the control throw you require. Of course, if your transmitter has ATV (adjustable travel volume), use them to fine-tune the control throws.

Preflight

At Home

Balance Your Propellers

Balancing the propeller seems like one of those things that you can skip, but many problems are the result of vibration caused by an unbalanced propeller. Nuts and bolts can vibrate loose and vibration can damage delicate radio components inside your receiver and servos. Vibration can even damage the delicate glow plug element which could result in an engine that is difficult or impossible to start. Purchase a Top Flite Precision Magnetic Balancer™ (TOPQ5700) or a Great Planes fingertip prop balancer (GPMQ5000) to accurately balance your propellers.

Charge Your Batteries

Follow the battery charging instructions in the instruction manual that came with your radio control system. You should **always** charge your batteries the night before you fly.

Ground Check Your Model

Inspect all nuts, screws and wheel collars. **Make sure you install the screw that holds the servo arm onto the servos** and the servo cords are securely connected to the receiver.

If you are not thoroughly familiar with R/C models, ask an experienced modeler to inspect your radio installation and make sure the control surfaces respond correctly. The engine must be "broken-in" according to the engine manufacturer's recommendations for break-in. Refer to the **Engine Safety Precautions** on page 42 before you start your engine. After you run the engine on the model make sure all screws remain tight, the hinges are secure and the prop is on tight.

Gather Your Tools

Assemble a simple flight kit (a shoe box is fine to start with) which should include a 1-1/2 volt starting battery and glow plug clip (or ni-starter), a "chicken stick" for flipping the prop, fuel and fuel pump or other means of filling the tank, a couple of small screwdrivers, #64 rubber bands, spare props (balanced) and glow-plugs, a wrench for the propeller nut, a needle-nose plier or hemostats and some CA for field repairs. In addition to tools, you should also take along some paper towels and spray window cleaner to remove exhaust residue from the model (and your hands) after each flight. Store fuel-soaked rubber bands in a container with talcum powder or corn starch to absorb the oil.

At the Flying Site

Range Check Your Radio

Check the operational range of the radio before the first flight. **Before you turn your radio on, the first thing you always must do is make sure no one else is on your frequency (channel).** Most model flying fields utilize frequency control so familiarize yourself with their system. Collapse your transmitter antenna and turn on the transmitter, then the receiver (preferably the receiver should never be on by itself). You should be able to walk at least 100 feet away from the model and still have control. Have an assistant stand by your model and tell you what the control surfaces are doing while you operate them from the transmitter.

Repeat this test with an assistant holding the model and **the engine running at various speeds**. If the control surfaces do not always respond correctly, **don't fly!** Find and correct the problem first. Look for loose servo connections or corrosion, loose fasteners 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 cause severe injury to yourself and others.

Store model fuel in a safe place away from high heat, sparks or flames. Do not smoke near the engine or fuel as it is very flammable. Engine exhaust gives off a great deal of deadly carbon monoxide so **do not run the engine in a closed room or garage**.

Get help from an experienced modeler when you learn to operate engines.

Use safety glasses when you operate model engines.

Do not run the engine near loose gravel or sand; the propeller may throw loose material in your face or eyes.

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

Keep loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects away from the prop. Be conscious of pencils, screwdrivers or other objects that may fall out of your shirt or jacket pockets.

Use a "chicken stick" or electric starter and follow the instructions to start your engine.

Make certain the glow plug clip is secure so that it will not pop off or get into the running propeller.

Ask an assistant to hold the model from the rear while you start the engine and operate the controls.

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

The engine gets hot! Do not touch the engine during or immediately after you operate it. Make sure fuel lines are in good condition so fuel will not leak onto a hot engine and cause a fire.

To stop the engine, close the carburetor barrel (rotor) or pinch the fuel line to discontinue the fuel flow. Do not use your (or any body else's) hands, fingers or any body part to stop the engine (sorry, we had to say that because of liability). Never throw anything into the prop of a running engine.

Flying

Find a Safe Place to Fly

The best place to fly your R/C model is at an AMA (Academy of Model Aeronautics) chartered club

field. Ask your hobby dealer or the AMA if there is a club in your area and join it (the address and telephone number for the AMA is listed on page 3 of this instruction book). Club fields exist to make your R/C flying safe and enjoyable. We recommend that you join the AMA and a local club so you may have a safe place to fly and insurance in case of a flying accident.

If a club flying site is not available, find a large, grassy area at least 6 miles away from houses, buildings, streets and other R/C activity like boats and cars. Avoid flying R/C models near traffic or areas such as parks, school yards, office building lawns, etc. that may attract unrestrained observers (wild kids). If you are a beginner, you are busy enough concentrating on your model without having to answer lots of questions and performing crowd control.

We highly recommend that you get an experienced modeler to assist you with your flight training. An experienced modeler can take your Butterfly up for the first time and make sure it performs correctly, then give you valuable flight instruction. He can hand you the transmitter when the Butterfly has climbed to a safe altitude or connect your transmitter to his if both of your systems have trainer cord or "buddy box" capability. Assistance from an experienced modeler will make your modeling "career" progress faster (and cheaper). We do, however realize that some modelers are determined to learn on their own or are not in a location where an instructor or flying club is available. Therefore, we have provided the following information to give you an idea of what to expect on your first flight with your Butterfly. Both flyers who plan to set out on their own **and** fliers who will have the help of an instructor should carefully read the following information.

Takeoff

First flight attempts should be reserved for calm days when the wind is less than five to seven mph. Although the Butterfly does have landing gear, it is really intended only for landing so you should hand launch the Butterfly. Actually, this makes takeoff a little easier since you do not have to "stay on the runway" or worry if the wind is prevailing down the runway or not. Just hand launch the Butterfly into the wind. If you are at a model flying field check with veteran club members to see if this is an acceptable practice – some clubs specify a flight path no matter the crosswinds.

Always launch (takeoff) and land into the wind. Start the engine and have your assistant hold the model over head. Check the operation of all controls just before takeoff. This will eliminate the possibility of forgetting to turn on the receiver switch (it happens) or overlooking reversed or disconnected controls. Advance the throttle. When you are ready for launch give an affirmative nod to your helper. You should stand behind or to the side and behind the model when your assistant launches it. He should carefully run at a fast pace but only needs to take a few strides, then firmly launch the model in an overhead motion (like a javelin throw). He should throw the model at a level or slightly nose-up attitude so the model can climb gently under its own power. The Butterfly can only fly and climb so fast so if your helper throws the model too hard or at too great of an angle, it may stall (stop flying) requiring time to gain airspeed before it can resume a climb. Just a little help on the hand launch is all your Butterfly needs – just remember it's named the "Butterfly."

There is no exact way to tell you how much "up" elevator to apply when your assistant launches your Butterfly. It's rather a balancing act so be ready to "give it what it needs" to start **a gentle climb**. As long as your Butterfly is gaining altitude you're O.K. (unless you are at a small flying site with obstacles to clear). If the Butterfly appears to climb too steeply and looks as though it is going to stall, momentarily apply a **little** down elevator to point the nose down and **regain air speed**. Once airspeed has returned, resume a gentle climb. The most common mistake of all modelers beginner and expert alike is not controlling the urge to "get away from the ground" and "horsing" the model into the sky. As explained earlier, this only results in a stall, if not a terrible looking (and risky) departure. The idea is not to put the Butterfly into orbit but to reach a safe altitude where you can execute your first turn. All of this is going to happen quickly so try to keep your mind clear and react.

Flight

Allow the Butterfly to climb as gently or steeply as required and you are comfortable with, then execute your first turn. Make a right or a left 180-degree turn (whichever direction will keep you from flying over head or over obstacles). Initiate the 180-degree turn by applying a little rudder in the direction you wish to turn, then apply a little up elevator to keep the nose **level**. You will find that once the turn is initiated, no more rudder is required to hold the turn but **opposite** rudder may be required to stop the turn and return the Butterfly to a straight and level attitude.

At this time the Butterfly is flying "down wind" so it will gain speed and perhaps loose a little altitude. Just apply a little up elevator to maintain altitude or gain altitude if you prefer. Also, be aware that at this point the Butterfly will be "facing you" (not facing **away from you** as it was when you took off) so to make the model move to **your right** (the Butterflies' left) you will have to move the rudder stick to the left. Nothing has changed except your perspective. Some beginners find it helpful to turn slightly away from the model and fly it "over their shoulder" so they are facing almost the same direction as the model. Some instructors tell their students to "put the stick under the low wing when the model is flying toward you." Luckily, the Butterfly will react slowly enough so you should be able to figure it out if you have enough altitude.

Your next turn will be into the wind so it will be a little easier to maintain altitude and complete the turn. Apply rudder in the direction required to initiate the turn. Keep flying a "racetrack pattern" while you maintain altitude and make small corrections (as small as possible) to keep the desired heading.

Due to the nature of the design (a powered sailplane) the Butterfly should gently climb at all times but, if it seems to climb too rapidly, apply a little "down trim" to decrease the rate of climb. If your Butterfly requires you to hold up elevator all the time to get it to climb, apply a little "up trim" to resume a gentle climbing tendency. Once you have become comfortable with the rate of climb and altitude of your Butterfly, throttle back to about 2/3 or 1/2 throttle to keep from climbing out of sight. Actually, the purpose of the engine on your Butterfly is not to get it from "point A to point B" or for "zipping around" (like traditional models), but the engine is for gaining altitude to get your Butterfly high enough to let you fly it, react and learn how to correct mistakes and guide it through the air. Continue flying the "race track pattern" making adjustments to altitude, heading and speed.

Landing

Landing your Butterfly is the easy part because by now you have had a few minutes of flying time under your belt and the "butterflies" (sorry, we couldn't resist) should be all gone. Make a pass over the landing area (remember – always land into the wind) and reduce the throttle to about 1/4. Allow your Butterfly to descend as it approaches the flying field. Hold the throttle at 1/4, then slowly advance the throttle as the Butterfly passes by at an altitude of approximately 10 to 30 feet. Make a few more practice landing approaches adjusting the heading and altitude as you pass by. Finally, decrease the throttle to idle (with the throttle trim adjusted per the control throws) and allow the Butterfly to descend. As the Butterfly reaches an altitude of approximately 10' to 20' gradually apply enough up elevator to maintain a gradual, slow descent (but not enough to climb) until it almost reaches the slowest flying speed possible. At this point the Butterfly should be only about 1 foot off the ground. Allow the Butterfly to continue down the flying field until it looses speed and finally touches the ground.

You should attempt your first landings with just a few "clicks" of extra power on the throttle trim to make sure you do not stall the model too early at too high of an altitude. You do not have to land the Butterfly upon the first attempt. If for some reason (you have not "scrubbed off" enough speed, you are too far away, there is a sudden wind gust) you have trouble with your landing approach, just add power, climb out and try it again.

Remember, your Butterfly is a motor glider so it is going to react slowly (ideal for beginners) and requires lots of space to maneuver.

We hope you have fun with your Butterfly and that your first attempt at R/C airplanes is successful!