SPITFIRE 40

INSTRUCTION MANUAL

Wing Span - 54.75 in
Wing Area - 526 sq in
Weight - 5 - 6 lbs
Wing Loading - 22 - 26 oz/sq ft
Fuse Length - 48 in

WARRANTY

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

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

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

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

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

GREAT PLANES® MODEL MANUFACTURING COMPANY

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SAFETY PRECAUTIONS: PROTECT YOUR MODEL, YOURSELF & OTHERS

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

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

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

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

Academy of Model Aeronautics
5151 East Memorial Drive
Muncie, IN 47302-9252
Tele. (800) 435-9262
Fax (765) 741-0057
Or via the Internet at:
http://www.modelaircraft.org

PRECAUTIONS

1. Build the plane according to the plans and instructions. Do not alter or modify the model, as doing so may result in an unsafe or unflyable model. In a few cases the plans and instructions may differ slightly from the photos. In those instances the written instructions are correct.

2. Take the time to build straight, true and strong.

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

4. Properly install all components so that the model operates correctly on the ground and in the air.

5. Check the operation of the model before every flight to ensure that all equipment is operating, and that the model has remained structurally sound. Be sure to check nylon clevises or other connectors often and replace them if they show signs of wear or fatigue.

6. If you are not already an experienced R/C pilot, you must fly the model only with the help of a competent, well experienced R/C pilot.

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

Before starting to build, compare the parts in this kit with the Parts List, and note any missing parts. Also inspect all parts to make sure they are of acceptable quality. If any parts are missing, broken or defective, or if you have any questions about building or flying this airplane, please call us at (217) 398-8970 or e-mail us at:

productsupport@greatplanes.com.

If you are contacting us for replacement parts, please be sure to provide the full kit name GP Spitfire .40 and the part numbers as listed in the Parts List.

You can also check our web site at *www.greatplanes.com* for the latest GP Spitfire .40 updates.

INTRODUCTION

Congratulations and thank you for purchasing the Great Planes Spitfire.

The best known of all British fighters was the Supermarine Spitfire. The brainchild of R. J. Mitchell, the Spitfire prototype flew for the first time in March 1936 and two years later the first operational squadron became active at Duxford airfield, near London. During the Battle of Britain, Spitfires were used in multiple roles, from day fighter to night interceptor to ground support action, and were pitted against the best aircraft the Germans could deliver. Over 20,000 were produced and evolved through 24 marks, seeing service at every front during and after the war. The last Spitfires were retired from front line service in 1954. Today only 200 remain in museums and private collections around the world. Of these, less than 50 remain in flying condition.

The best known Spitfires were the Mk V and the Mk IX. We chose to kit the Mk IX with the traditional small fin and rounded rudder as it is by far the most recognized model. The Great Planes Spitfire was designed to reflect the nimble handling and light wing loading of the original. The airframe is very light without sacrificing strength to offer optimum performance with most sport engines. The Great Planes Spitfire has enlarged tail surfaces and flat sides for better sport performance and easy assembly, as well as fully interlocking ribs/webs to make wing construction a breeze.

DECISIONS YOU MUST MAKE

Engine Selection
There are several engines that will work well in the Spitfire, but for unlimited performance we recommend a hot 2-stroke such as an **O.S.® 46FX or SuperTigre® GS45.** If you prefer a 4-stroke, an **O.S. .52 Surpass™** works well and the **O.S. .70** makes exceptional performance a part of every flight experience.

Exhaust System
If you choose to use a 2-stroke engine you will need an in-cowl muffler for the best appearance. On our prototype Spitfire with the **O.S. .46FX,** we used the **Slimline #3208 Sport Muffler (SLIG3208).** With the **O.S. Surpass .52 and Surpass .70,** we used the stock exhaust included with the engines, and a Hobbico® Exhaust Deflector (HCAP2175).

Optional Retracts
For optimum flight performance and scale looks, consider installing optional mechanical retracts. We provide detailed instructions for their installation. Note that a 5-channel radio is required for retracts ***plus*** the following additional items:

- ❑ (1) Retract servo (FUTM0670)
- ❑ (1) Pair of .40-size mechanical main retracts (HCAP4010)
- ❑ (1) Pair .40 size axles, 1-1/4" x 5/32" (GPMQ4279)
- ❑ (2) Screw-Lock™ pushrod connectors (GPMQ3870)
- ❑ (2) 2-56 x 12" Pushrods with 2-56 clevises (GPMQ3772)
- ❑ (8) #4 x 5/8" Sheet metal screws (for mounting retracts)

PREPARATIONS

Accessories Required to Complete Your Spitfire

*Items in parentheses such as (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.*

- ❑ CA applicator tips (HCAR3780)
- ❑ 4-Channel Radio with 5 Standard Servos (twin aileron servos required) **and**
- ❑ (2) 12" servo extensions (HCAM2100 for Futaba)
- ❑ (1) Y-Harness (HCAM2500 for Futaba) **or** computerized radio
- ❑ Optional Retract Equipment – *See **Optional Retracts** (page 3)*
- ❑ Engine – *See **Engine Selection** (page 3)*
- ❑ Muffler – *See **Exhaust System** (page 3)*
- ❑ Spare glow plugs [O.S. #8 for most 2-stroke engines, (OSMG2691), O.S. Type-F for most 4-stroke engines, (OSMG2629)]
- ❑ Propeller (Top Flite Power Point®); Refer to your engine's instructions for proper size
- ❑ Top Flite Super MonoKote® covering (approximately 2 rolls) – *See **Covering** (page 30)*

- ❏ Fuelproof paint – *See **Painting** (page 31)*
- ❏ Medium fuel tubing (GPMQ4131, 3')
- ❏ 1/4" Latex foam rubber padding (HCAQ1000)
- ❏ 10 oz. Fuel tank (GPMQ4104)
- ❏ (2) 2-1/2" Wheels (GPMQ4223)
- ❏ (1) 3/4" Tailwheel (GPMQ4240)
- ❏ 3" Spinner (GPMQ4530 – white)
- ❏ Pilot (DGA 1/6 scale sportsman pilot used in prototype, DGAQ2010) (Optional)
- ❏ Fueling system (Great Planes Easy Fueler™, GPMQ4160)
- ❏ 1-ft section of Velcro® or other non-adhesive backed hook and loop material

Suggested Building Supplies

These are the building tools, glue, etc. that we recommend and mention in the manual. *We recommended Great Planes **Pro™** CA and Epoxy.*

- ❏ CA applicator tips (HCAR3780)
- ❏ 1 oz. Thick CA- (GPMR6014)
- ❏ 2 oz. Thin CA (GPMR6003)
- ❏ 2 oz. Medium CA+ (GPMR6009)
- ❏ CA Accelerator (GPMR6035)
- ❏ 6-Minute Pro epoxy (GPMR6045)
- ❏ 30-Minute Pro epoxy (GPMR6047)
- ❏ Pacer Formula 560 canopy glue (PAAR3300)
- ❏ #1 Hobby knife handle (HCAR0105)
- ❏ #11 Blades (HCAR0311, 100 Qty.)
- ❏ X-ACTO® razor saw (XACR2531)
- ❏ Builder's triangle set (HCAR0480)
- ❏ Small T-pins (HCAR5100)
- ❏ Medium T-pins (HCAR5150)
- ❏ Plan Protector (GPMR6167)
- ❏ Masking tape (TOPR8018)
- ❏ 1/4-20 (GPMR8105), and 6-32 (GPMR8102) Drill and tap sets
- ❏ Dead Center™ engine mount hole locator (GPMP8130)
- ❏ Groove Tube™ (GPMR8140)
- ❏ Electric power drill
- ❏ Drill Bits: 1/16", 5/64", 3/32", 7/64", 1/8", 5/32", #18 or 11/64", 3/16", #10 or 13/64" (unless purchased with 1/4-20 tap listed above), 7/32", 1/4", 17/64"
- ❏ Specialty drill bit or brass tube – 1/4" drill bit (6" long) or brass tube
- ❏ Monofilament string for aligning wing and stabilizer
- ❏ Screwdrivers (phillips and flat blade)
- ❏ HobbyLite™ balsa filler (HCAR3401)
- ❏ Sealing iron (TOPR2100)
- ❏ C.G. Machine™ (GPMR2400)
- ❏ AccuThrow™ deflection meter (GPMR2405)
- ❏ Bar sander or sanding block and sandpaper (coarse, medium, fine grit)

EXPERT TIP

*In our busy workshop we use the Great Planes **Easy-Touch Bar Sanders** equipped with Great Planes #80, #150 and #220-grit **Easy-Touch Adhesive-Backed Sandpaper.** Great Planes **Easy-Touch Bar Sanders** are made from light weight, rigid, extruded aluminum and can be found at most hobby shops. They are available in three sizes...5-1/2" (GPMR6169) and 11" (GPMR6170) for most general purpose sanding and 22" (GPMR6172) for long surfaces such as wing leading edges. The **Easy-Touch Adhesive-Backed Sandpaper** comes in 2" x 12' rolls of 80-grit (GPMR6180), 150-grit (GPMR6183), and 220-grit (GPMR6185) and an assortment pack of 5-1/2" long strips (GPMR6189) for the short Bar Sander. The adhesive backed sandpaper is easy to apply and remove from your Easy Touch Bar Sander when it's time for replacement.*

This setup is all that is required for almost any sanding task. Custom sanding blocks can be made from balsa or hardwood blocks and sticks for sanding difficult-to-reach spots. We also keep some #320-grit wet-or-dry sandpaper for finish sanding just before covering.

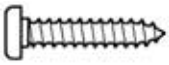
Part Numbers for Other Tools or Accessories You May Require

- ❏ Epoxy brushes (GPMR8060)
- ❏ Epoxy mixing sticks (GPMR8055, Qty. 50)
- ❏ CA debonder (GPMR6039)
- ❏ Clevis installation tool (GPMR8030)
- ❏ Hot Sock™ (TOPR2175)
- ❏ Trim Seal Tool™ (TOPR2200)
- ❏ Heat gun (TOPR2000)
- ❏ Single-edge razor blades (HCAR0312, 100 Qty.)
- ❏ Razor plane (MASR1510)
- ❏ 36" Non-slip straightedge (HCAR0475)
- ❏ Denatured or isopropyl alcohol (for epoxy clean-up)
- ❏ Dremel® Moto-Tool® or similar w/sanding drum, cutting burr, cut-off wheel
- ❏ Curved-tip canopy scissors (HCAR0667)
- ❏ Servo horn drill (HCAR0698)

Building Notes

• There are two types of screws used in this kit:

Sheet metal screws are designated by a number and a length.



For example #4 x 3/4"

Machine screws are designated by a number, threads per inch, and a length.

For example 4-40 x 3/4"

• When you see the term **"test fit"** in the instructions, it means you should first position the part on the assembly **without using any glue,** then slightly modify or "custom fit" the part as necessary for the best fit. **Do not** glue until told to do so.

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

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

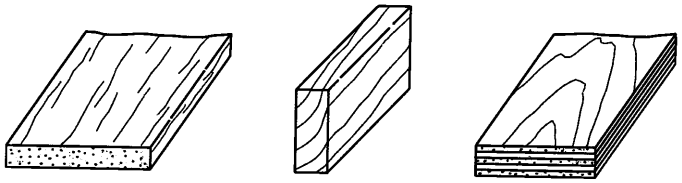
• Several times during construction we refer to the **"top"** or **"bottom"** of the model or a part of the model. For example, during wing construction we tell you to "glue the top main spar" or "trim the bottom of the former." It is understood that the "top" or "bottom" of the model is as it would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

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

Common Abbreviations

Fuse = Fuselage
Stab = Horizontal Stabilizer
Fin = Vertical Fin
LE = Leading Edge (front)
TE = Trailing Edge (rear)
LG = Landing Gear
Ply = Plywood
" = Inches

Types of Wood



Balsa **Basswood** **Plywood**

Get Ready to Build

1. Unroll the plan sheet. Re-roll it inside out to make it lie flat. **Note: Do NOT cut the vertical fin plan from the fuselage plan for assembly of the vertical tail.**

2. Remove all parts from the box. As you do, figure out the name of each part by comparing it with the plans and the parts list included with this kit. Using a felt-tip or ballpoint pen, lightly write the part **name** or **size** on each piece to avoid confusion later. Use the die-cut patterns shown on back side of the center pull-out section, to identify the die-cut parts and mark them **before** removing them from the sheet. **Save all scraps.** If any of the die-cut parts are difficult to punch out, do not force them! Instead, cut around the parts with a hobby knife. After punching out the die-cut parts, use your Bar Sander or sanding block to **lightly** sand the edges to remove any die-cutting irregularities or slivers.

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

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

Metric Conversions

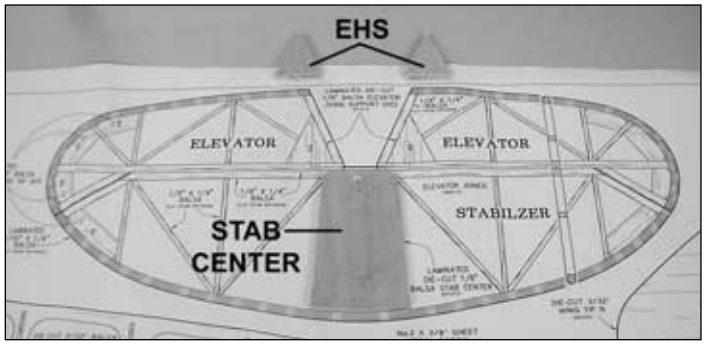
1/64" = .4mm	3/16" = 4.8mm	1" = 25.4mm	18" = 457.2mm
1/32" = .8mm	1/4" = 6.4mm	2" = 50.8mm	21" = 533.4mm
1/16" = 1.6mm	3/8" = 9.5mm	3" = 76.2mm	24" = 609.6mm
3/32" = 2.4mm	1/2" = 12.7mm	6" = 152.4mm	30" = 762mm
1/8" = 3.2mm	5/8" = 15.9mm	12" = 304.8mm	36" = 914.4mm
5/32" = 4mm	3/4" = 19mm	15" = 381mm	

BUILD THE TAIL SURFACES

Don't forget to cover the plan with Great Planes Plan Protector so the glue won't stick to the plan.

Build the Stab/Elevators

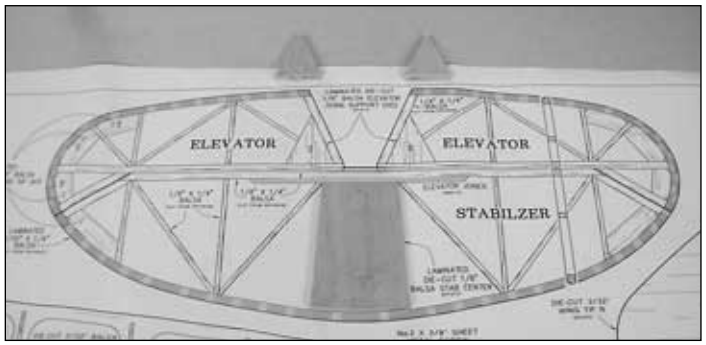
Note: Be sure to save all of the leftover pieces from building the stabilizer. These pieces will be utilized in constructing the fin.



❏ 1. Laminate the two die-cut 1/8" balsa **stab centers** with medium CA, creating the stab center. Laminate the four die-cut 1/8" balsa **elevator horn supports EHS,** creating two horn supports.

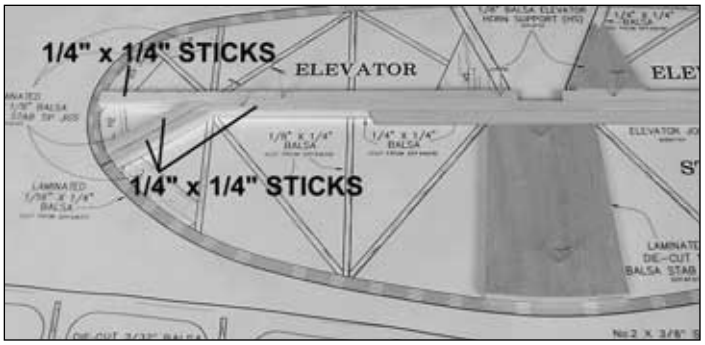
❏ 2. Pin the stab center in position over the plan.

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



❏ 3. Select the 3/16" x 1/4" x 6" basswood **stab spar.** Sand a bevel on both ends as shown on the plans. Glue the stab spar to the stab center.

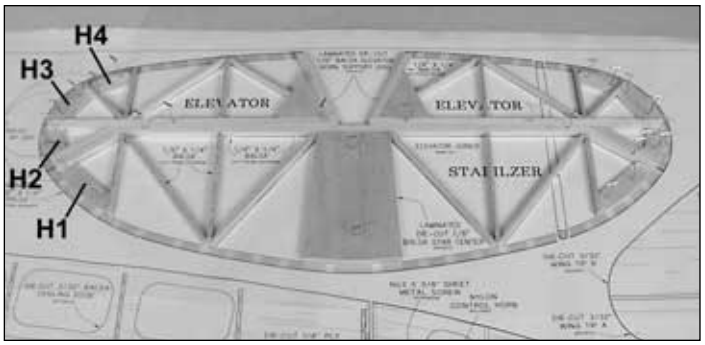
Note: Some stab photos do not show the stab spar in place. Follow the text and plans.



❏ 4. From the 1/4" x 1/4" x 18" sticks, cut and glue the **stab trailing edge** to the stab spar. Cut the stab trailing edge angles, elevator leading edge, and elevator leading edge angles. **Note:** Be sure to leave long enough segments of 1/4" x 1/4" stick for the fin.

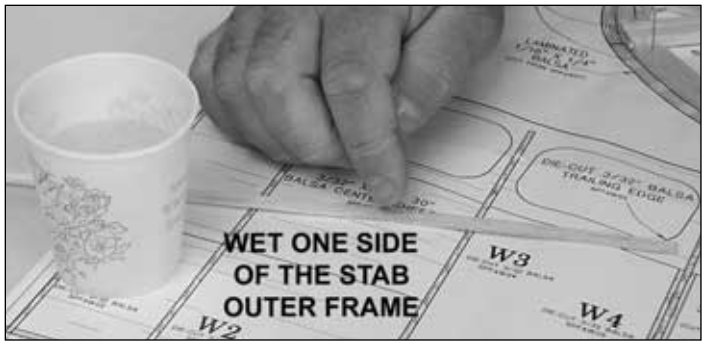
Hint: Single-edge razor blades work well for making clean vertical cuts in sticks such as those used for the tail framework on this model.

❏ 5. Glue the angled portion of the stab trailing edge to the straight section of the stab trailing edge, and the angled portion of the elevator leading edge to the straight section of the elevator leading edge. **Note:** Do not glue the angled pieces to each other.



❏ 6. Position the horn supports you made in step 1 and the die-cut 1/8" balsa **elevator jigs H1-H4** over the plans. From the leftover 1/4" stick, cut, fit and glue the elevator roots to the elevator leading edges and horn supports. Glue the horn supports to the elevator leading edges. **Note:** The jigs are **for alignment only** and **DO NOT** remain in the elevators.

❏ 7. Using 1/8" x 1/4" x 18" sticks, fit and glue the remaining stab and elevator framework.

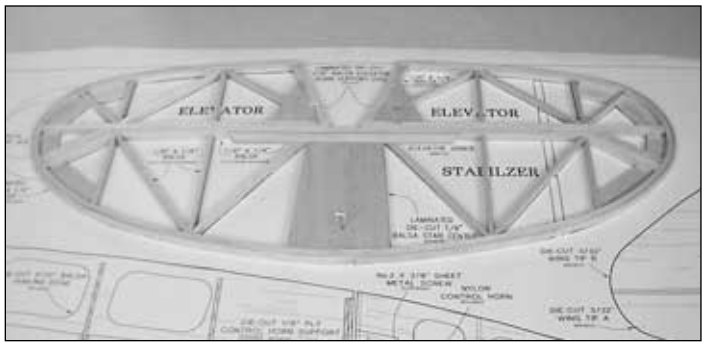


❏ ❏ 8. Select two 1/16" x 1/4" x 24" strips for the **stab outer frame.** Wet one side of the first strip by dipping your finger in water, then running it along the one side of the strip. Take care not to wet both sides. Using medium CA, secure the dry side of the strip to the middle of the stab center working toward the tip. **Note:** Water accelerates CA much like commercial accelerators, so be careful not to get anything wet that should not be.

Hint: Another way to wet the strips is by holding them in the air and spraying with a spray bottle. Do not spray the strips while sitting on a flat surface, or both sides will get wet.

❏ ❏ 9. Slowly wrap the strip from the stab center all the way around to the inboard elevator roots, securing it with thin CA as you go. Take care to stay tight against the ribs, leading and trailing edges, and jigs. Remember not to glue to the jigs.

❏ 10. Repeat steps 8 and 9 for the left side of the stab.



❏ 11. Wet one side of the next strip. Turn it over and lay a bead of medium CA down the other side. Staggering the joint 1/2" from all previous joints, but being sure to keep the joints supported by the stab center, glue the next strip onto the previous one. Trim the strip flush with the elevator inboard root. **Note:** If you can work fairly quickly, the last applied strip will still be wet on the outside. This will accelerate the CA, securing the strips to one another immediately. If you crack the strip, don't worry. Just hold it in place until the medium CA cures and then, seal it with thin CA if necessary.

❏ 12. Apply the remaining 5 strips. Remember to stagger the joints.

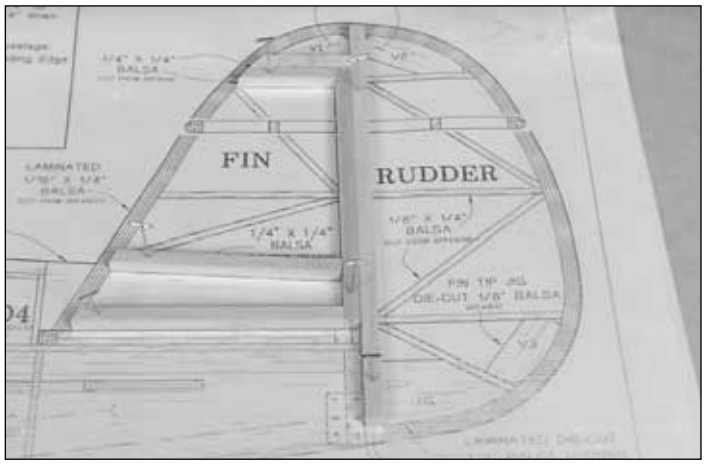
❏ 13. Unpin the stab from the plans and remove the jigs. Inspect all glue joints and re-glue with CA as necessary. Use a bar sander or a large sanding block and 220-grit sandpaper to sand the entire top and bottom surface of the stab framework until it is flat and even. Be careful while sanding so that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

❏ 14. Round all edges of the stab and elevators to the shape shown on the cross-section on the plans. **Hint:** Labeling the elevators "left" and "right," and labeling the bottom of the stab, will ensure proper assembly later.

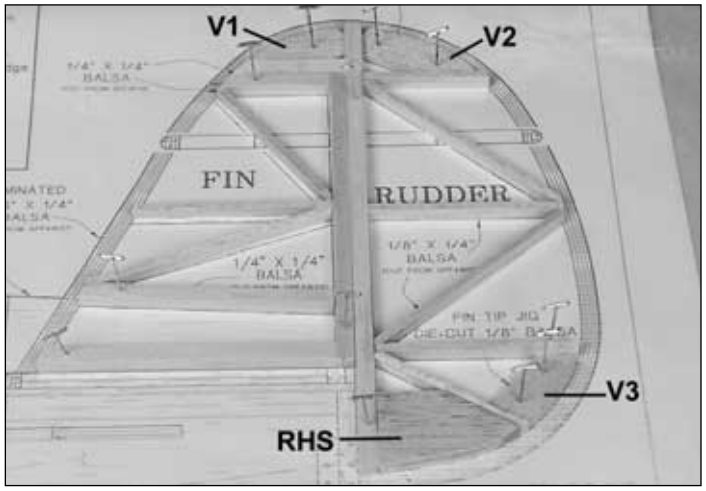
❏ 15. Cut the stab outer frame between the elevator angled leading edges and stab angled trailing edges, separating the elevators from the stab. Sand the outer frame smooth.

Build the Fin/Rudder

Don't forget to cover the fin area of the plan with Great Planes Plan Protector so the glue won't stick to the plan. **DO NOT** cut the vertical fin plan from the fuselage plan.



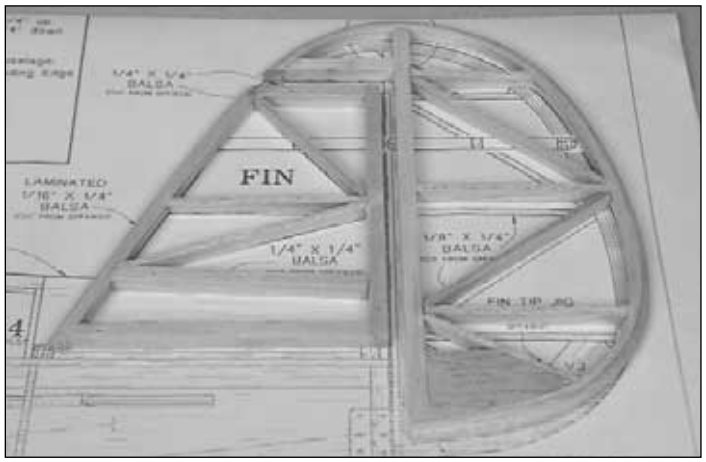
❏ 1. Using the leftover 1/4" x 1/4" balsa stick from the stab, cut, fit, pin and glue all 1/4" sticks into the fin and rudder, being careful not to glue any fin pieces to any rudder pieces.



❏ 2. **Note: Refer to this photo for the following four steps.** Laminate the two die-cut 1/8" balsa **rudder horn supports RHS** making the rudder horn support**.**

❑ 3. From a 1/8" x 1/4" x 18" balsa stick, cut, fit and glue the fin and rudder inner framework in place. Position and glue the rudder horn support to the framework.

❑ 4. Position and pin the die-cut 1/8" balsa **rudder jigs V1 – V3** over the plan. **Note:** Remember that the jigs are ***only*** ***temporary*** and should not be glued to any parts at any time.



❑ 5. Wet one side of one 1/16" x 1/4" x 24" balsa **fin outer frame strip.** Use medium CA to glue the strip to the rudder, then fin framework, wrapping from the bottom of the rudder counterclockwise to the bottom of the fin as you did for the elevator. **Note:** There are no joints on the vertical tail. All strips wrap from the bottom of the rudder to bottom of the fin.

❑ 6. Wetting the outside and laying a bead of medium CA on the inside face, apply the remaining three outer frame strips in succession. **Note:** Remember that the outer strips will secure more easily to the inner layers if you work fairly quickly because the water on the outside of the inner strips will accelerate the CA.

❑ 7. Unpin the fin/rudder, remove the jigs, and sand both sides smooth. Round both the fin and the rudder as shown on the cross-section on the plans.

❑ 8. Cut the outer frame between the fin and rudder and sand the strips smooth.

Join, Bevel & Hinge the Tail Surfaces

Note: We do not recommend using any pin style hinges on this model.

❑ 1. Lay the stab and elevators inverted on your work surface. Align the elevators properly against the stab, taking care to match the angled leading edges to the angled trailing edge of the stab.

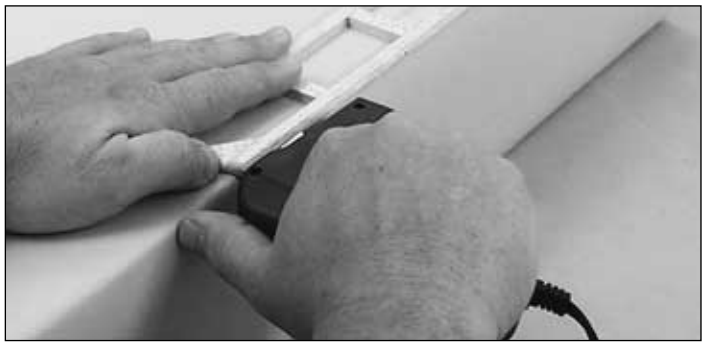
❑ 2. Position the wire **elevator joiner** over the elevators, centered on and aligned with the trailing edge of the stab. Trace the joiner onto the elevators.

❑ 3. Drill 1/8" holes through the elevators' leading edges at the position you marked to the depth you marked to properly fit the joiner.

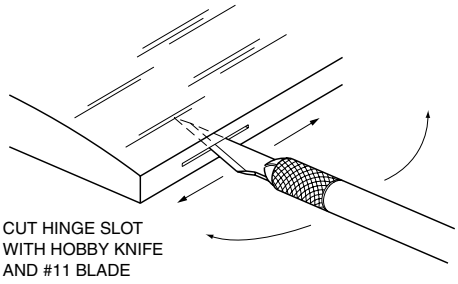
❑ 4. Using a Great Planes Groove Tube™ (GPMR8140), or a sharpened brass tube, cut a groove in the elevator leading edges from the hole to the root so that the elevator joiner fits flush into the elevators.

❑ ❑ 5. Place the stab over its location on the plan. Lightly mark the hinge locations on the trailing edge with a ballpoint pen. Mark the hinge locations on the elevators in the same manner.

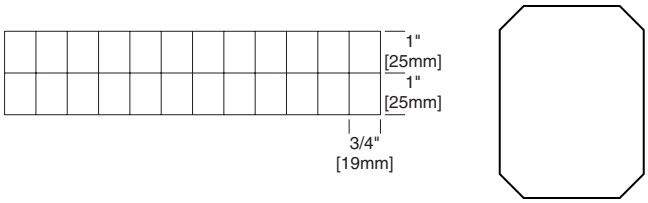
We have simplified the task of cutting hinge slots with the introduction of the Great Planes Slot Machine™. This simple electric tool cuts a perfect width slot for use with CA hinges.



To cut the hinge slot, place the blades onto the wood where you want the slot. Lightly press the teeth into the wood. When you are satisfied with the location, press the button on the handle and the blades will cut easily into the balsa wood.



❑ ❑ 6. (***Complete step 6 only if you will not be using the Great Planes Slot Machine to cut the hinge slots.)*** Cut the hinge slots in the elevator and stabilizer using a #11 blade. Begin by **carefully** cutting a very shallow slit at the hinge location to accurately establish the hinge slot. Make three or four more cuts, going a little deeper each time. As you cut, slide the knife from side to side until the slot has reached the proper depth and width for the hinge.



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

❑ 8. Return to steps 5 and 6 and complete the same procedure, using 3 hinges to hinge the rudder to the fin.

❑ 9. Shape the leading edge of the elevators and rudder to a "V" as shown in the cross-section on the plans.

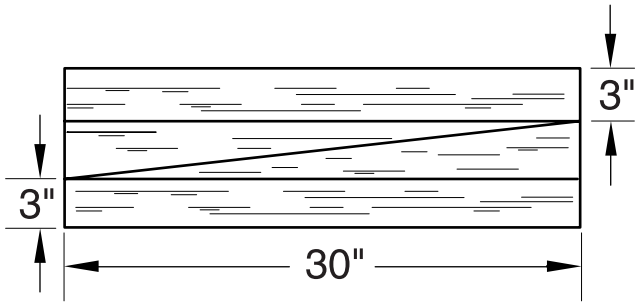
❑ 10. Test fit the joiner wire into your elevator halves. Confirm that the elevators lay flat on your work surface. Bend the joiner slightly as needed to achieve perfect alignment. Epoxy the elevator joiner into both elevator halves.

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

BUILD THE WING

Assemble the Wing Sheeting

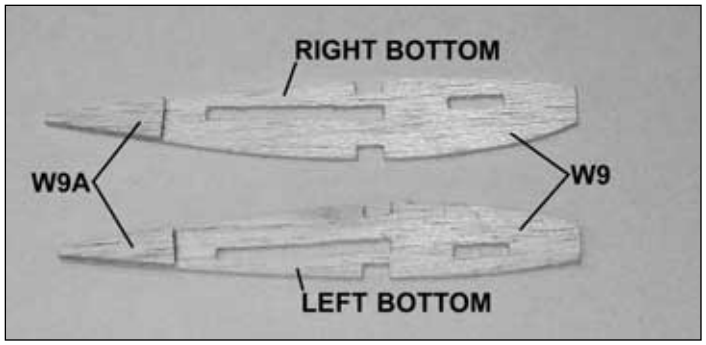
Right now, while the building board is clear, is a great time to assemble the wing sheeting.

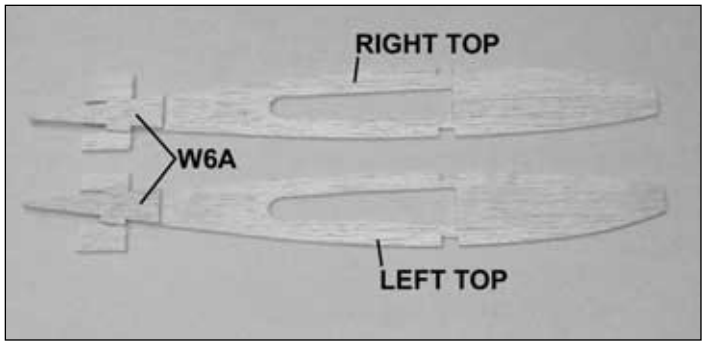


❑ ❑ 1. Edge glue three 3/32" x 3" x 30" balsa sheets together. Make a diagonal cut from 3" down one short side to 3" up the other short side of the sheet, starting and finishing the cuts at the joints, creating two **LE sheets.**

❑ 2. Repeat the step to build the LE sheets for the second wing.

Prepare the Doubled Ribs

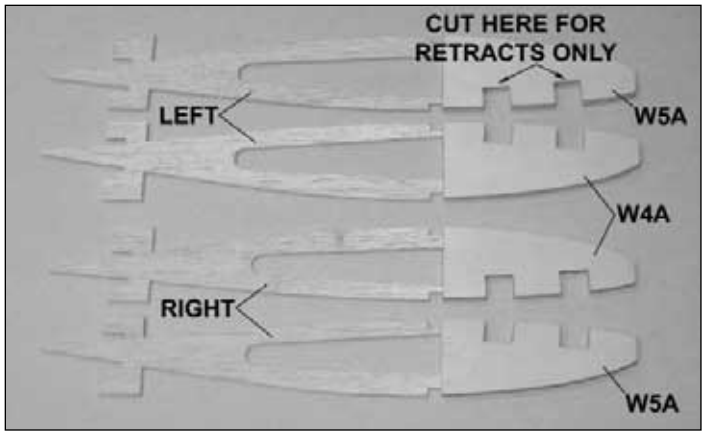




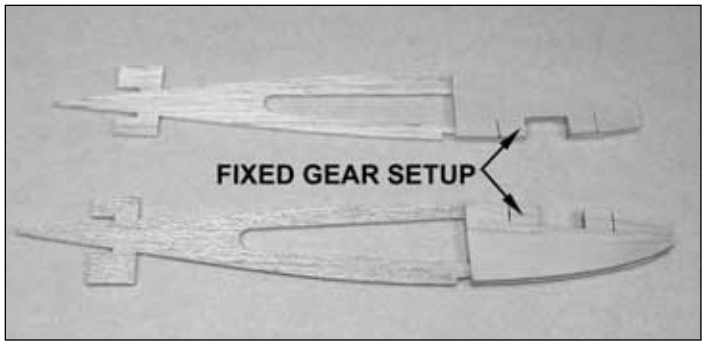
❑ 1. Select both of the die-cut 1/8" balsa **wing ribs W6 and W9** and **wing rib doublers W6A and W9A.** Position the two W9 ribs mirrored to one another as shown in the photo. Glue the two W9A doublers onto the **outboard** sides of W9 ribs. Position the two W6 ribs mirrored, and glue the two W6A doublers onto the **inboard** sides of the W6 ribs. Label the ribs right and left.

At this time, you must decide if your model will have fixed or retractable landing gear. The parts used are identical, but the cut outs made will vary based upon which type of landing gear will be installed. Carefully read and follow the instructions which match your landing gear type.

❏ 2. Select the two die-cut 1/8" ply **wing rib doublers W4A and W5A.**



If you are using retracts, cut out the 2 individual notches in the ply doublers as shown in the photo.



If you are using fixed gear, cut out the single notch in all four ply doublers, two of which are shown in the photo.

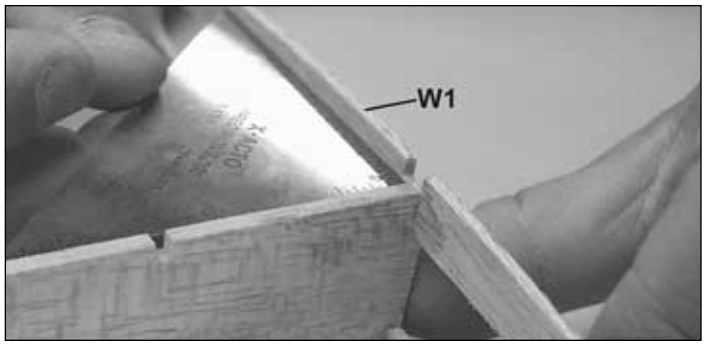
❏ 3. Select the two die-cut 3/32" balsa **wing ribs W4 and W5.** Position the W4 ribs mirrored to one another and glue the W4A doublers onto the outboard sides of W4. Position the W5 ribs mirrored to one another and glue the W5A doublers onto the inboard sides of W5. Label the ribs left and right. Cut the notches from the W4 and W5 ribs, using the notches in W4A and W5A as guides.

Assemble the Wing

We'll begin by building the left wing upside-down over the left wing bottom view plan. Remember that the wing is being built upside-down as you work. Also keep in mind that we will refer to the "bottom" or "top" as being the aircraft's actual bottom or top at all times.

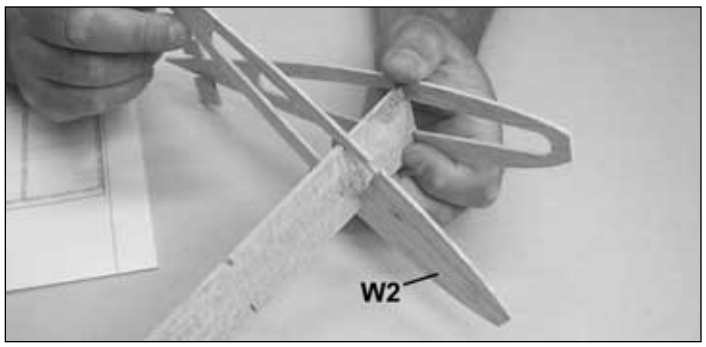
Note that one wing panel on the plan demonstrates fixed gear mounting and the other demonstrates retractable gear mounting. If you are using retracts, you will still build your left wing over the left wing view, but refer to the right wing view for retract equipment mounting. If you are using fixed gear, you will still build your right wing over the right wing view, but refer to the left wing view for fixed gear mounting.

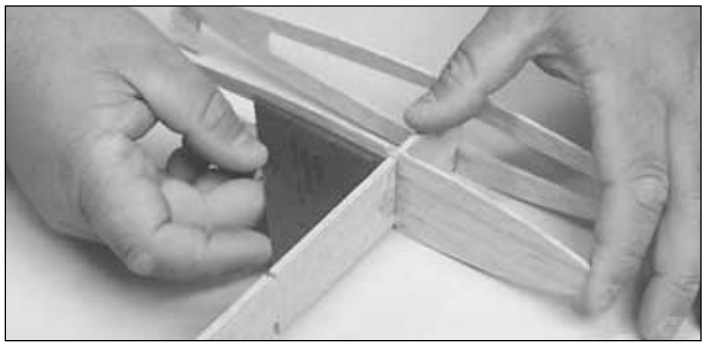
❏ ❏ 1. Cover the left wing panel plan with Great Planes Plan Protector.



❏ ❏ 2. Select the die-cut 3/32" balsa **wing ribs W1 through W9** and the die-cut 1/8" **main web.** Position and glue W1 onto the web, making sure that the web aligns with the bottom of the spar notch and is square to the rib, as shown in the photo.

Note: It is possible to put the ribs onto the web upside-down, but the spar notches will not align if you do so. Be sure to double-check every rib's direction as you build. Also, it is **CRITICAL** that the ribs be locked tight against the web and square to the web.



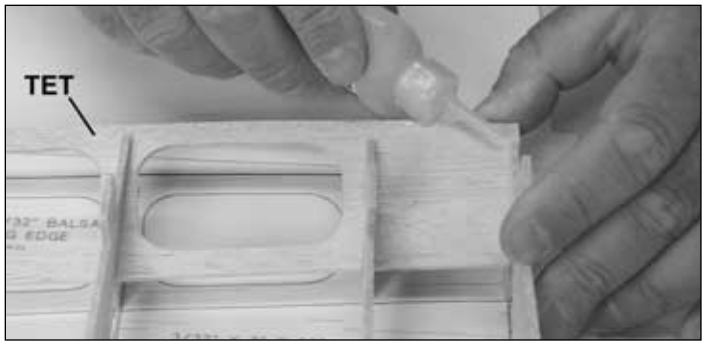


❏ ❏ 3. Slide ribs W2 and W3 onto the web and lock in place as shown in the photos. Confirm they are square, fully locked against the web and right-side-up, and glue in place. Confirm the W4, W5, W6 and W9 ribs you have are for your left wing (doublers W4A and W6A are on the outboard side and W5A and W9A are on the inboard side of the ribs). Position and glue ribs W4 through W9 onto the web.

❏ ❏ 4. Position one 1/8" x 1/4" x 30" basswood **top spar** over the plans, aligning the outboard end with the outboard edge of W9.

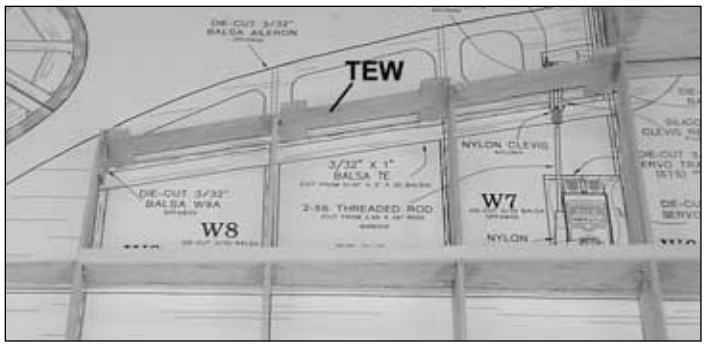
❏ 5. Position the ribs/web assembly you began in step 3 upside-down on the plans, locking the spar into the ribs. Glue the spar to the web and ribs with thin CA. Pin along both sides of the spar in at least 2 locations to make sure the spar stays straight. **Note:**The top half of the rib is distinctly more curved and should be toward the work surface, and the gear support cut outs are away from the work surface.

❏ ❏ 6. Test fit one 1/8" x 1/4" x 30" basswood **bottom spar** into the ribs, again aligning the outboard end with the outboard edge of W9. Lay a bead of medium CA along the spar, then glue it into the ribs and onto the web.

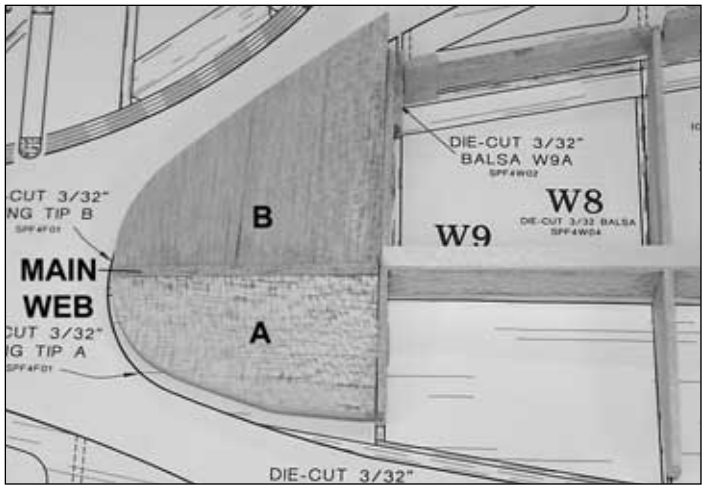


❏ ❏ 7. Select one die-cut 1/8" balsa **trailing edge top TET.** Test fit TET into the top slot of the ribs (remembering the wing is upside-down). Slide TET out of the ribs, and sand a taper on the trailing edge, using the cross-section on the plan as a guideline. **Note:** TET and TEB are very similar, but TET has 3 holes; TEB has 4.

❏ ❏ 8. Slide TET back into the top notches in the ribs with the beveled edge toward the bottom of the wing (remembering that the wing is upside-down). Lock it tight against the ribs, then pull it flush against the top of the wing ribs and glue to each rib.



❏ ❏ 9. Position and glue one die-cut 1/8" balsa **trailing edge web TEW** to W6, W7, W8 and W9 over the plans, keeping it straight and tight against the trailing edge of W7 and W8.



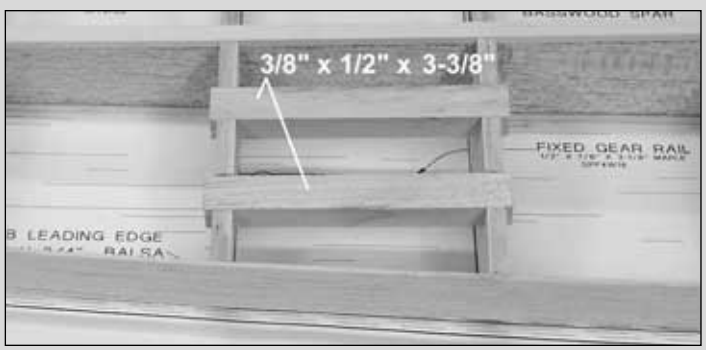
❏ ❏ 10. Select one each die-cut 3/32" balsa **wing tip A and B.** Lock the tabs into W9 and align the outboard ends with the main web. Glue the wing tips to the web and W9.

❏ ❏ 11. Select one 1/16" x 3/4" x 30" balsa **sub LE.** Position one end centered on wing tip A with excess extending past the flat area on the wing tip. Position the other end centered vertically on W1, allowing the excess to overhang W1. Working slowly, glue the sub LE to the wing tip, then to ribs W9 through W2. **Note:** Do not glue to W1 at this time.

❏ ❏ 12. Note that the main web may have twisted W1. Using a ruler or straight edge, be sure W1 is straight from trailing to leading edge, then glue to the sub LE.

If you are using retracts, complete Steps 13R – 17R.
If you are using fixed gear, complete Steps 13F – 15F.

RETRACTS



❏ ❏ 13R. Select two 3/8" x 1/2" x 3-3/8" maple **retract gear rail.** Position them in ribs W4 and W5 and glue in place.

❑ ❑ 14R. Position the retract body over the gear rails and against W4. Using a rotary tool or other cutting tool, cut a groove through W4 for the gear's actuator so that the retract body sits flush on the retract rails tight against W4.

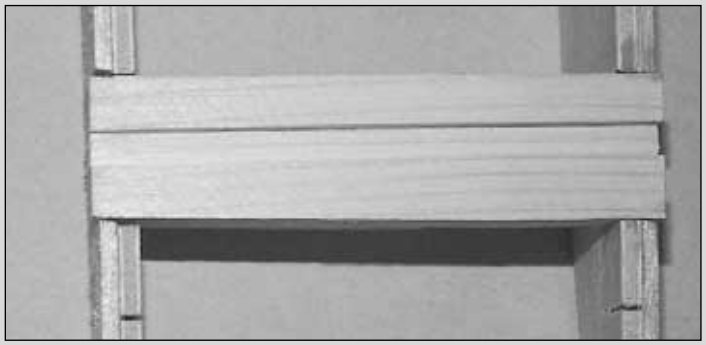
❑ ❑ 15R. With the retract body in position, trace around the retract coil on the mounting rails. Using your rotary tool, cut away where the coil makes contact so the retract strut can completely retract at W4.

❑ ❑ 16R. Cut the retract strut to the length shown on the plan. **Note:** The strut extends past the center of the wheel well to support the axle.

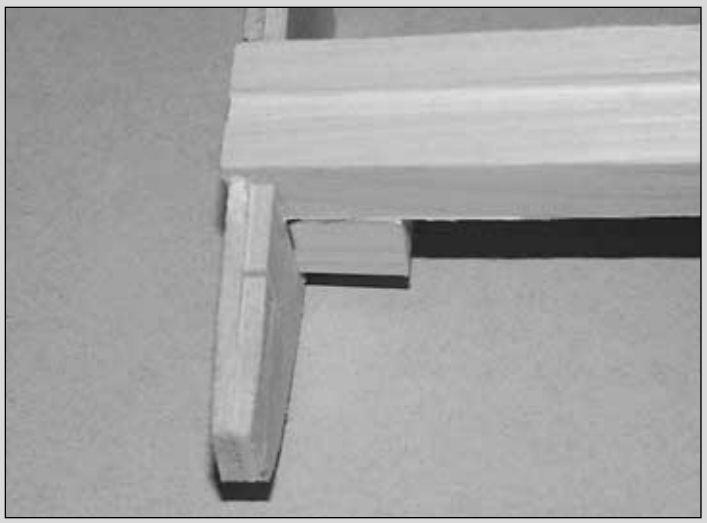
❑ ❑ 17R. Use a 3/32" drill to drill pilot holes through the retract body's mounting holes into the retract rails. Using four #4 x 5/8" sheet metal screws (not included), temporarily screw the retract body to the retract rails. Trim W3 until the retract strut can lock into its retracted position. Remove the retract from the wing and use a small amount of thin CA in each of the 4 retract screw holes to harden the threads.

❑ Proceed to Step 18.

FIXED GEAR



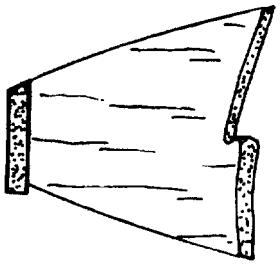
❑ ❑ 13F. Select one of the 1/2" x 7/8" x 3-3/8" maple **fixed gear rail.** Position it in ribs W4 and W5 and glue in place.



❑ ❑ 14F. Epoxy one of the 1/2" x 1/2" x 7/8" maple **torque block** to the top of the fixed gear rail and flush against W5. **Note:** The leading edge is removed from this photo for clarity.

❑ ❑ 15F. Drill a 5/32" hole through the fixed gear rail and the torque block with the outboard edge of the hole flush with the W5A doubler.

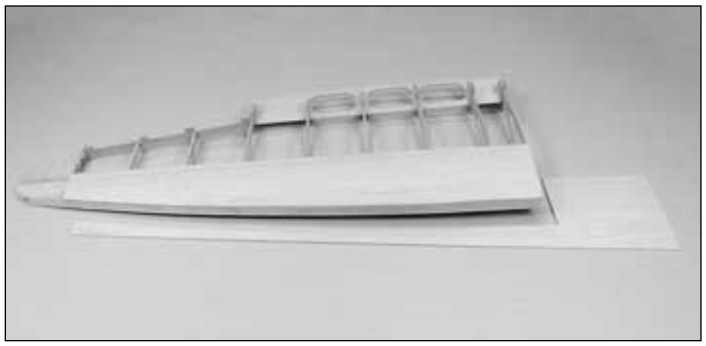
❑ 16. Proceed to step 18.



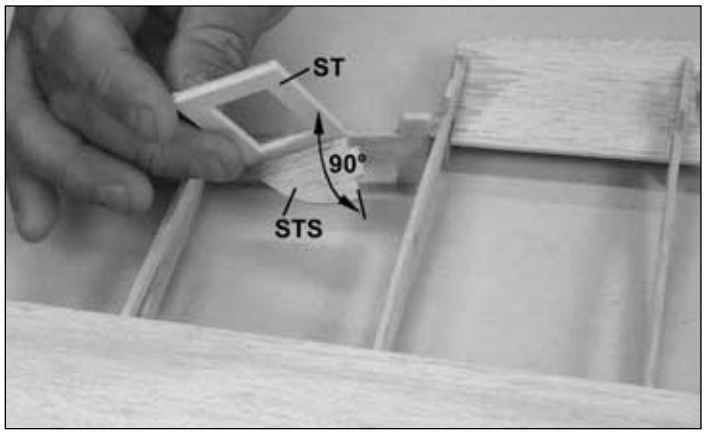
❑ ❑ 18. Using a razor plane, shape the sub LE to match the airfoil shape of the ribs as shown in the sketch.

❑ ❑ 19. Unpin the wing from the work surface. Select one LE sheet you made earlier. Practice positioning the LE sheet with the outboard edge flush with the outboard edge of W9 and the

trailing edge on the center of the main spar. Coat the forward half of the main spar with medium CA and press the LE sheet down firmly in place, holding in position until the CA cures. Carefully roll the sheeting back from the ribs and lay a bead of medium CA along the ribs and the sub LE. Weight the sheeting onto the ribs and sub LE and allow the CA to cure. **Note:** If using retracts, **do not** glue the sheeting to the retract rails. If using fixed gear, **DO** glue the sheeting to the fixed gear rails.

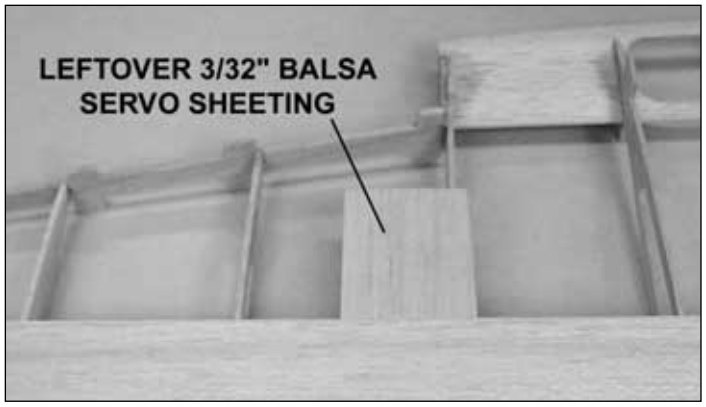


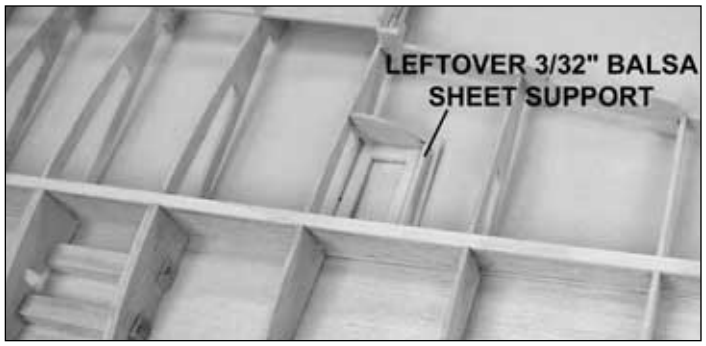
❑ ❑ 20. Lift the wing off the work surface. Trim and sand the LE sheet flush with the sub LE and everything flush with W1.



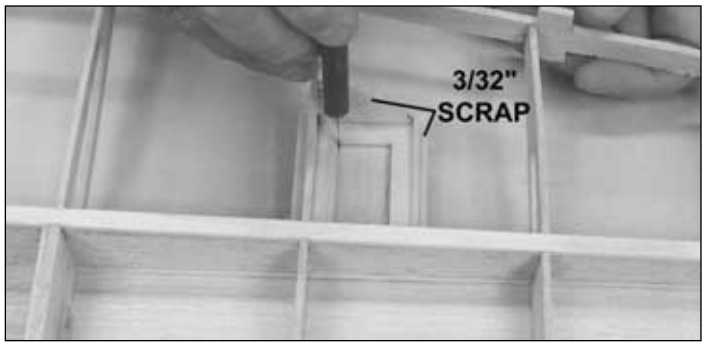
❑ ❑ 21. Glue the die-cut 3/32" balsa **servo tray support STS** perpendicular to the die-cut 1/8" ply **servo tray ST** as shown in the photo.

❑ ❑ 22. Position ST flush against the top of the bottom spar and W6, locking STS into the lightening hole in W6. Glue ST and STS to the spar and W6.

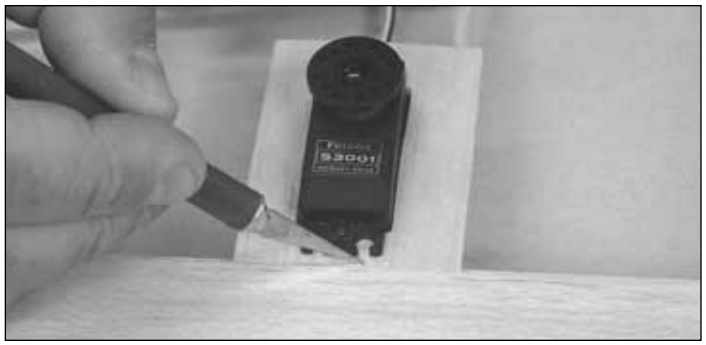




❑ ❑ 23. Using a piece of leftover 3/32" balsa, make servo sheeting over the servo tray. Glue the servo sheeting to the spar, W6 and ST. Turn the wing right-side-up. Using another piece of leftover balsa, cut and glue a sheeting support from ST to the servo sheeting.

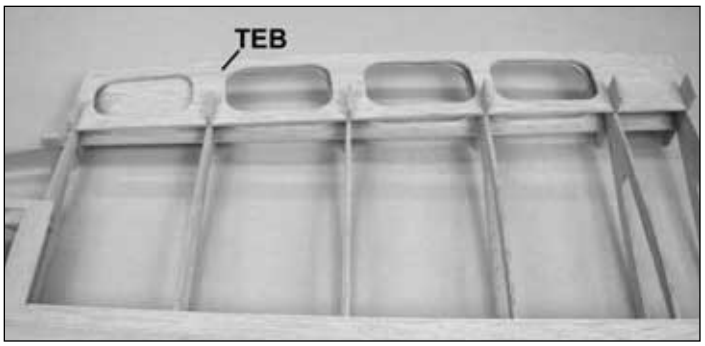


❑ ❑ 24. Cut the opening for the servo in the sheeting, using the servo tray as a guide. **Hint:** While the wing is right-side-up, use a hobby knife to cut just the corners of the servo opening. Turn the wing upside-down again, and use a straightedge to cut straight lines between the 4 corners you marked. Remove the piece of sheeting.



❑ ❑ 25. With the wing upside-down, fit the aileron servo in place and trim the sheeting around the servo, leaving room for the

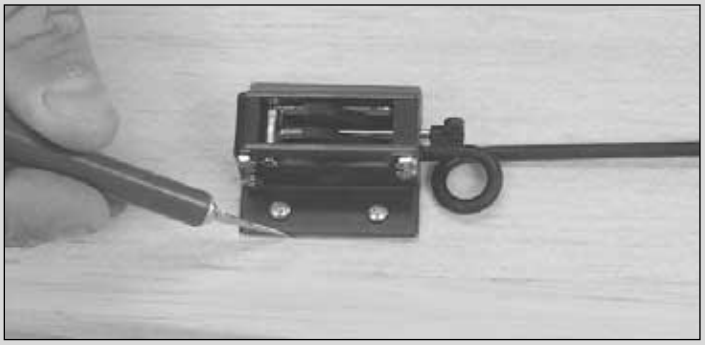
rubber grommets. **Note:** Provide approximately 1/16" of clearance between the servo and the sheeting.



❏ ❏ 26. Select one die-cut 1/8" balsa **trailing edge bottom TEB** (TEB has 4 holes). Test fit TEB into the bottom notches in the ribs. Sand the trailing edge slightly, if needed, to mate flush with TET and against the ribs. Using medium CA, coat all areas where TEB makes contact with the ribs and TET. Hold TEB in place until the CA is fully cured.

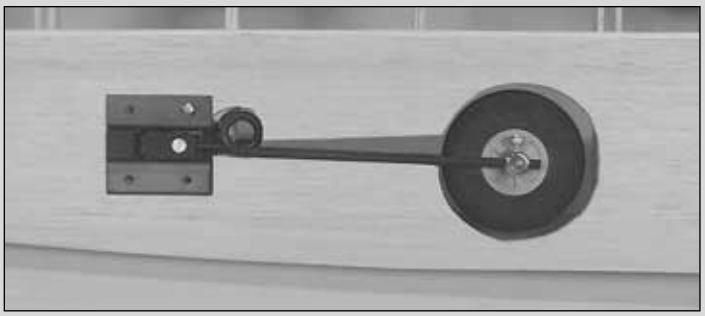
If you are using retracts, complete steps 27R – 29R.
If you are using fixed gear, complete steps 27F – 29F.

RETRACTS



❏ ❏ 27R. Turn the wing right-side-up. Using the holes in the retract rails as a guide, drill 3/32" holes through the bottom LE sheeting. Turn the wing upside-down. Temporarily screw the retract body to the wing as a template for where to cut for the bottom sheeting. Trim the sheeting around the retract body only. **Note: DO NOT** cut around the gear leg with the gear mounted upside-down.

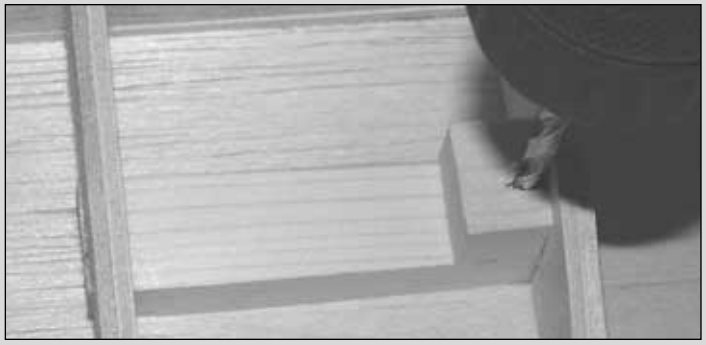
❏ ❏ 28R. Remove the retract body from the wing and remove the cut out sheeting. Remount the retracts upright in the wing and cut out around the retract strut.



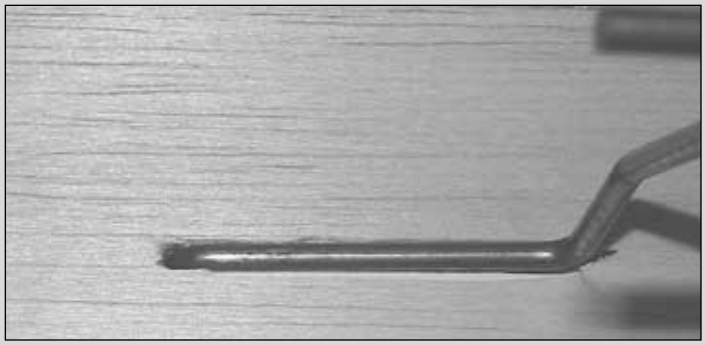
❏ ❏ 29R. Mount your axle and wheel (not supplied) to the retract strut with the wheel centered between ribs W2 and W3. Cut out the sheeting around the wheel, allowing 1/8" clearance all the way around the wheel.

❏ Proceed to step 30.

FIXED GEAR

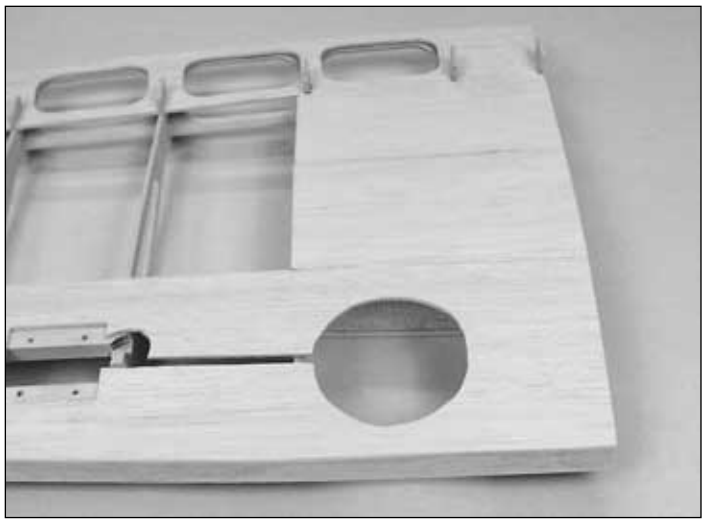


❏ ❏ 27F. Turn the wing right side up. Using the torque block's hole as a guide, drill a 5/32" hole through the bottom leading edge sheet.



❏ ❏ 28F. Turn the wing over. Cut a slot out of the bottom leading edge sheeting over the groove in the fixed gear rail. Fit the 5/32" wire **main landing gear** into the rail.

❏ ❏ 29F. Secure the gear to the gear rail with four #2 x 1/2" sheet metal screws and the two nylon **landing gear straps** as shown on the plan. Remove the gear and straps and set aside.



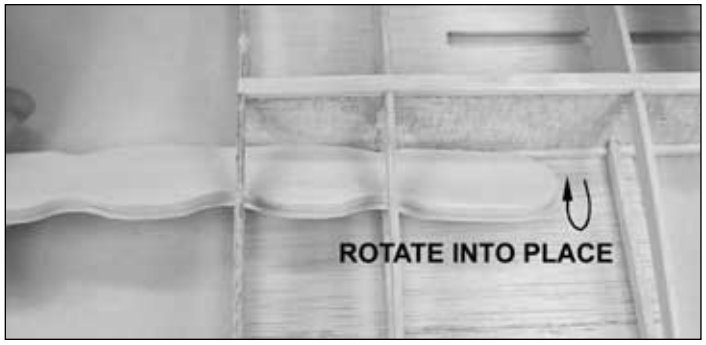
❏ ❏ 30. From one 3/32" x 3" x 30" balsa sheet, cut two 5-1/2" long pieces. Edge glue the two sheets, making one 3/32" x 5-1/2" x 6" **center sheet.** Cut, fit and glue the center sheet to W1, W2, W3, the spar, and butted against TEB. Sand the center sheet flush with W1.

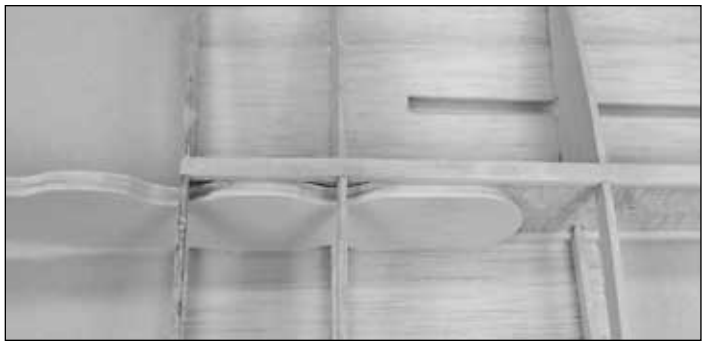
❏ 31. If this is your first time through, return to step 1 of "Assemble the Wing" on page 10, being sure to build a right wing.

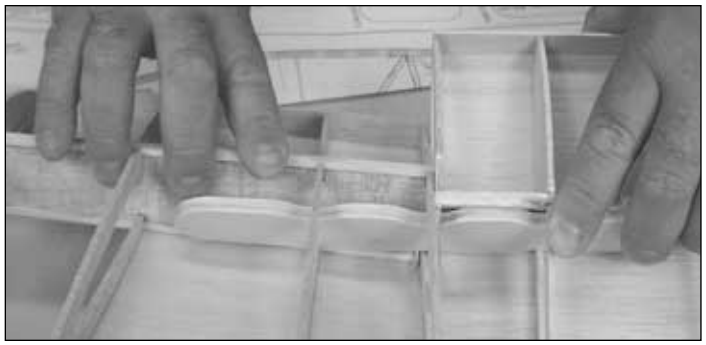
Join the Wing Panels

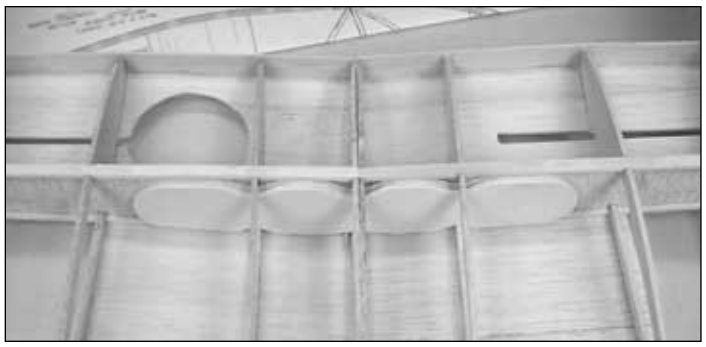
❏ 1. Use epoxy to laminate the two die-cut 1/8" ply **wing joiners WJ** together.

DESIGNER'S NOTE: We know what you're thinking. "This is the craziest joiner I have ever seen! WHAT were you thinking?" Bear with us. You'll soon see how this unusual shape helps to pull the two wing halves together.







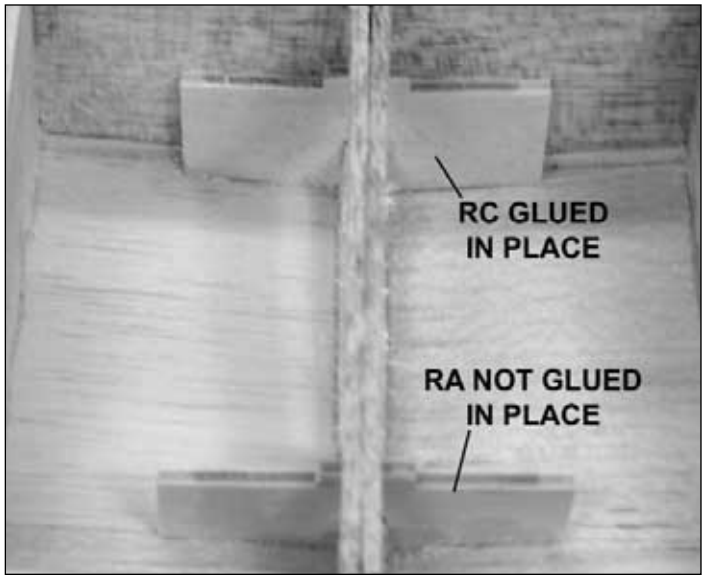


❏ 2. Test fit the joiner to the wings as follows: slide the joiner horizontally through the right wing panel's ribs 1 and 2. Rotate the wing joiner vertically so it locks flush against the web. Slide the left wing panel over the joiner and rotate the left wing panel into place. The roots of the spars should be flush against one another. Sand the joiner slightly as needed to gain a perfect fit. **Note:** Be sure the joiner is right-side-up so your wing has dihedral, not anhedral.

Note: In case you should ever have to repair your wing, the ideal dihedral angle is 13-1/2 degrees. This is easily measured by placing one wing panel flat on the workbench (right-side-up). The tip of the second wing panel should be 5-1/2" off the work surface. Please note that 5-1/2" is ideal with a perfect fit. Your wing's dihedral may vary by as much as 1/4" on each side (1/2" total) without it negatively affecting the aircraft. A tight, proper fit is more important than an exact tip measurement.

❏ 3. Remove the joiner from the wings. Working over the Plan Protector, coat the right face of the joiner and spar web with epoxy and rotate the joiner into the right wing. Be sure the epoxy secures the joiner flush to the web and spars. Allow the epoxy to cure completely.

❏ 4. Coat the left face of the joiner and the root ribs with 6-minute epoxy. Rotate the left wing onto the joiner, ensuring a tight fit to the joiner and aligning the leading and trailing edges of the root ribs to one another. Allow the epoxy to cure completely.

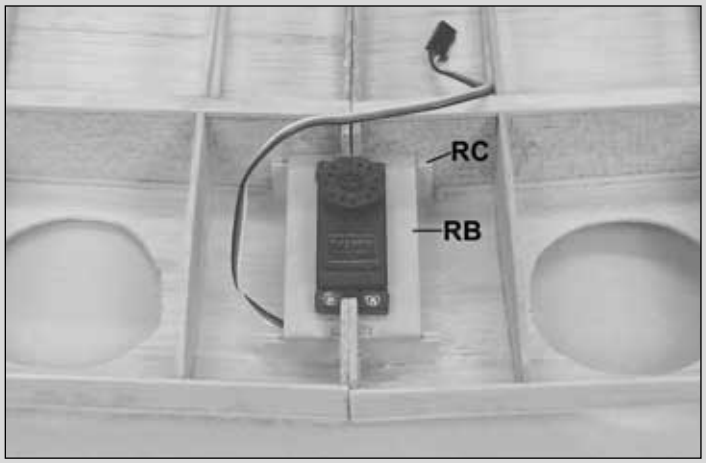


❏ 5. Select the die-cut 1/8" ply **retract servo tray parts RA, RB, and RC.** Stand RC vertical against the web, spars, and bottom sheeting, with the tab for RB pointing up. Glue RC in place.

❏ 6. Temporarily position RA as far forward as possible over ribs W1. Position the tray, RB, onto the ribs and into the notch in RC. Slide RA under the leading edge of RB to support it, keeping RA vertical. Glue RA to ribs W1. Glue RB to RA and RC. **Note:** Steps 5 and 6 must be completed even if you are using fixed gear because RA also supports the wing dowels.

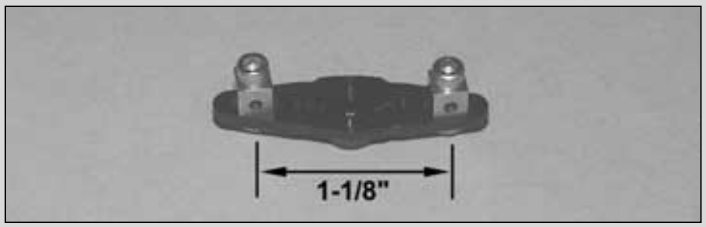
I***f you are using retracts, complete steps 7R – 17R.***
If you are using fixed gear, skip to "Complete the Wing Panels" on page 17."

RETRACTS

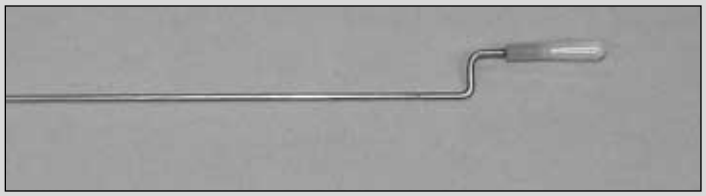


❏ 7R. Cut openings in the top of both ribs W1 to fit the retract servo. If necessary, trim the bottom portion of the ribs as well to fit the servo.

❏ 8R. Mount your retract servo and both retract bodies.

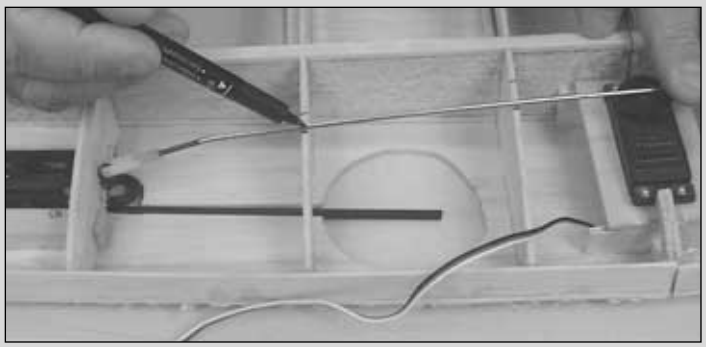


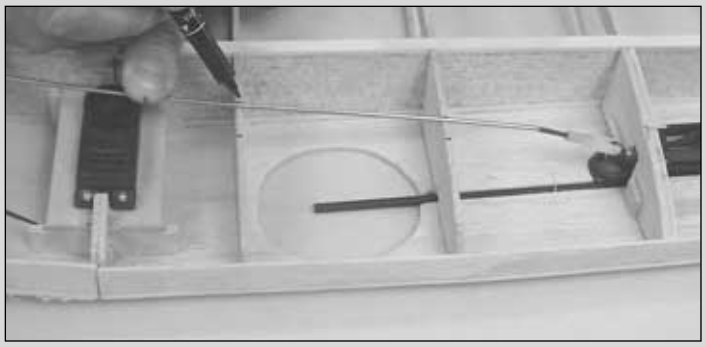
❏ 9R. Find a servo horn with two holes which are 1-1/16" to 1-1/8" from each other. Mount Screw-Lock Pushrod Connectors (GPMQ3870, not included) as shown. **Hint:** The standard 6-arm Futaba servo horn works well – just trim off the four arms that are not needed. **Note:** This horn should be installed for all steps.



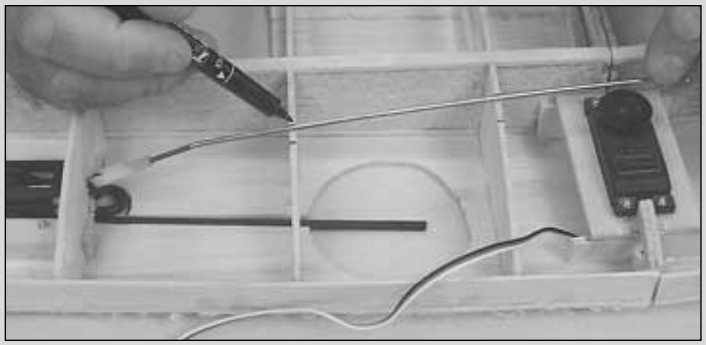
❏ 10R. Cut 5/8" of the threads off the end of two 12" threaded-on-one-end pushrods. Attach clevises (GPMQ3772, not included). Bend to the shape shown in the photo.

Note: The pushrod wire shown in the following four steps is not the same as will be used in the model. It should be bent as shown in the photo above. Follow the instructions and use these photos for reference only.

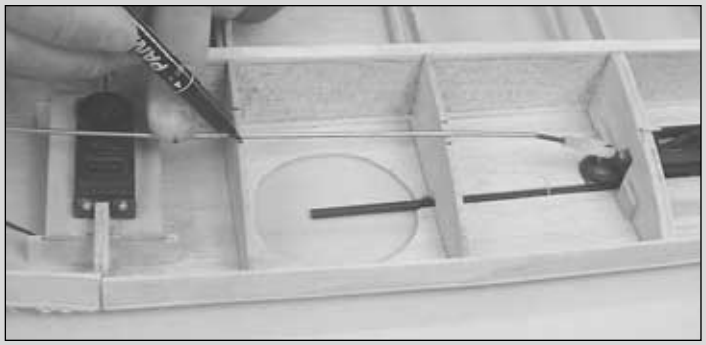




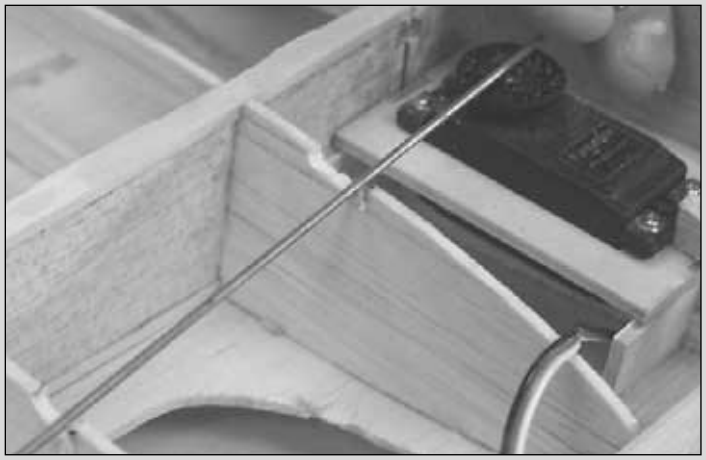
❏ 11R. Use a straightedge to mark a line from the **center of the servo arm** to the **control link** on the right retract on W2. Repeat for the left retract.



❏ 12R. On the right wing half, mark on W2 where a line from the **aft** screw-lock to the control link on the right retract intersects W2.

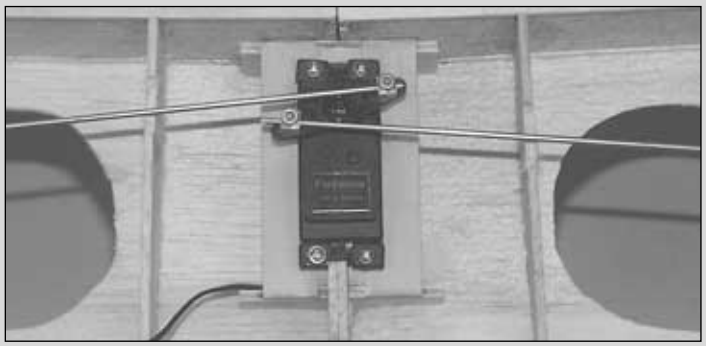


❏ 13R. On the left wing half, mark on W2 where a line from the **forward** screw-lock to the control link on the left retract intersects W2.



❏ 14R. Cut a 1/4" deep slot between the marks on both ribs W2.

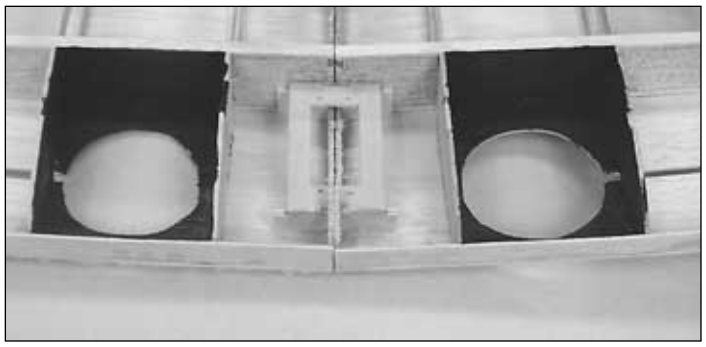
❏ 15R. Plug your retract servo into your receiver. Set it so the servo arm, in the “up” position, is rotated slightly, as shown in the photo. Make sure it rotates clockwise to move the gear down.



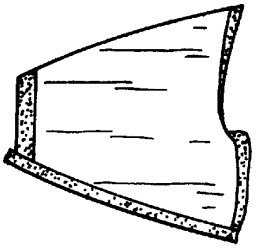
❏ 16R. Hook up the pushrods with the gear in the “down” position and the arm as shown. Pull the pushrods until the gear locks down, then tighten the set screws on the screw-lock connectors.

❏ 17R. Remove the retracts and the servo from the wing. **Note:** Label the retract bodies left and right and leave the pushrods attached to the retracts to make it easier to reinstall them later.

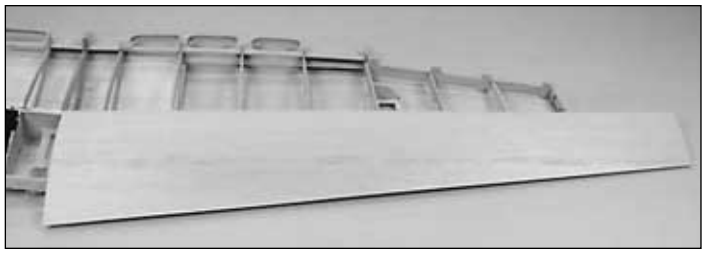
Complete the Wing Panels



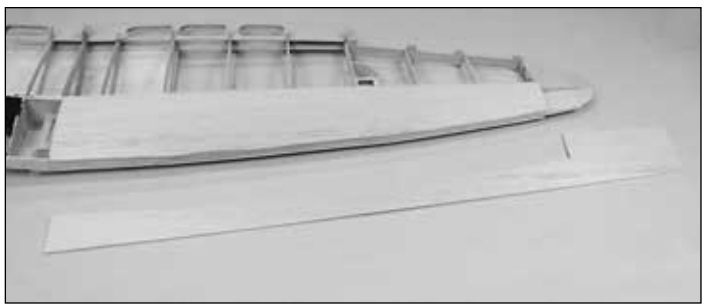
❏ 1. Fuelproof all wood between ribs 2 and 3 from the spars forward. **Hint:** Fuelproof paint or thinned epoxy works well for this task.



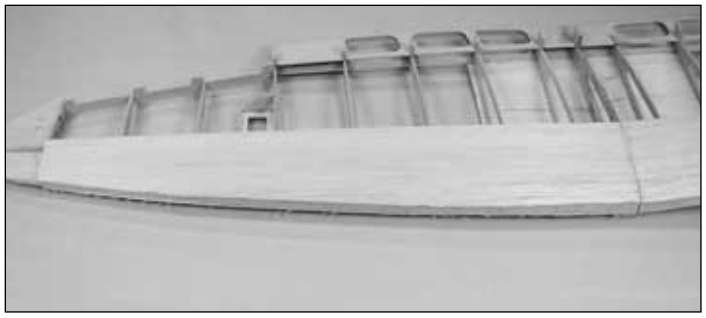
❏ 2. Turn the wing right-side-up. Use a sanding block to shape the sub LE so it aligns with the tops of the ribs and the shape of the airfoil.



❏ ❏ 3. Weight the wing so that the left wing half stays flat on the building board. Select one LE sheet you made earlier. Test fit the LE sheet with the inboard edge aligned with the center of the wing and the trailing edge aligned with the center of the spar. Coat the forward half of the main spar with medium CA and press the LE sheet down firmly in place, holding in position until the CA cures. Carefully roll the sheeting back from the ribs and lay a bead of medium CA along the ribs and the sub LE. Weight the sheeting onto the ribs and sub LE and allow the CA to cure.

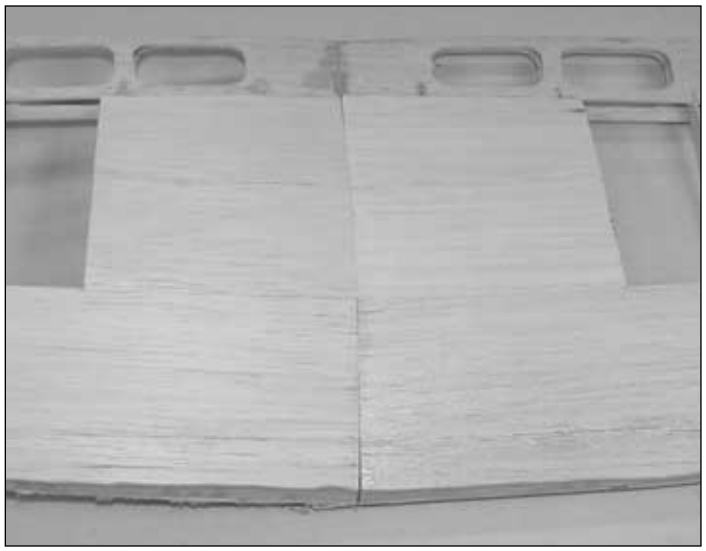


❏ ❏ 4. Trim the sheeting flush with the sub LE and W9.

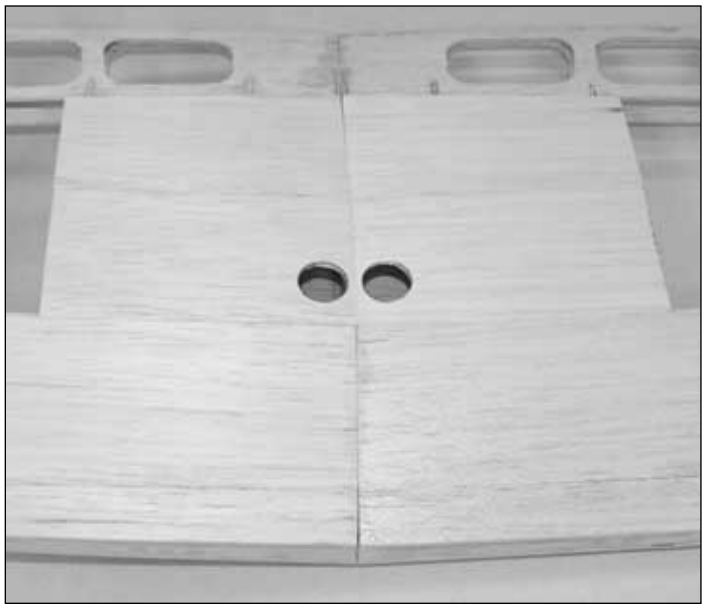


❑ 5. Repeat steps 3 and 4 for the right wing half.

❑ 6. Cut the jig tabs off the top of the wing.

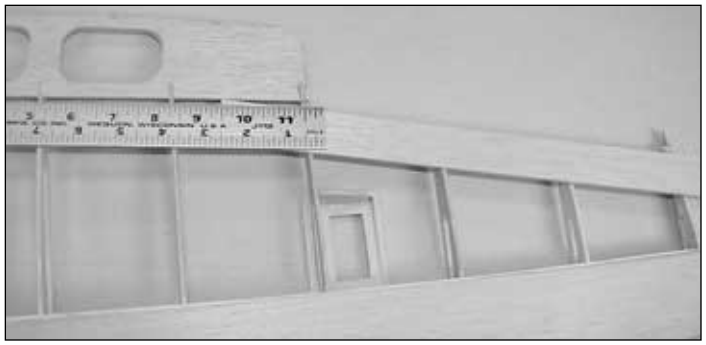


❑ 7. From one 3/32" x 3" x 30" balsa sheet, cut four 5-1/2" long pieces. Edge glue two sets of two sheets together, making two 3/32" x 5-1/2" x 6" **center sheets.** Cut, fit and glue the center sheet to W1, W2, W3, the spar, and butted against TEB.



❑ 8. Use a nickel to draw two circles on the center sheeting roughly where shown on the plans. Use a hobby knife to cut out the two circles.

❑ 9. Sand the top of the TE web to the shape of the ribs.



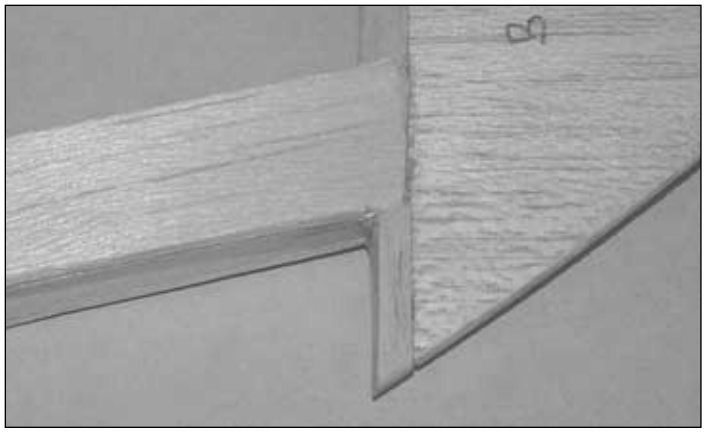
❑ 10. From a 3/32" x 3" x 30" balsa sheet cut four 3/32" x 1" x 11-1/4" **TE sheets.** Align one TE sheet with the TE web. Cut the root end to the angle of the TE and round as shown in the photo.

❑ 11. Use the TE sheet you just made as a template to cut the other three. Glue the top two in place. Trim the outboard ends flush with ribs W9.

❑ 12. Flip the wing over and trim the jig tabs off the bottom of the wing. Trim the top TE sheets flush with the TE web.

❑ 13. Sand the bottom of the TE webs to the shape of the ribs. Glue the remaining two TE sheets in place. Trim the sheets flush with the TE web.

❑ 14. Using 3/32" x 1/4" x 30" balsa sticks, fit and glue **cap strips** to all of the exposed ribs on both wing panels, top and bottom.

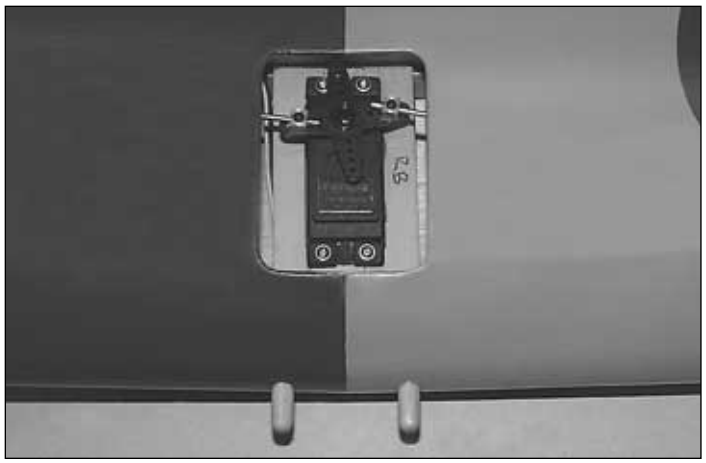


❏ 15. Shape the TE of the cap strips on ribs W9 to match the shape of the wing tips. Sand the inboard edges of the cap strips in the aileron bays flush with ribs W9.

❏ 16. From a 1/4" x 3/8" x 18" balsa stick, cut six 2" hinge blocks. Glue the hinge blocks in place on the front side of the TE webs.

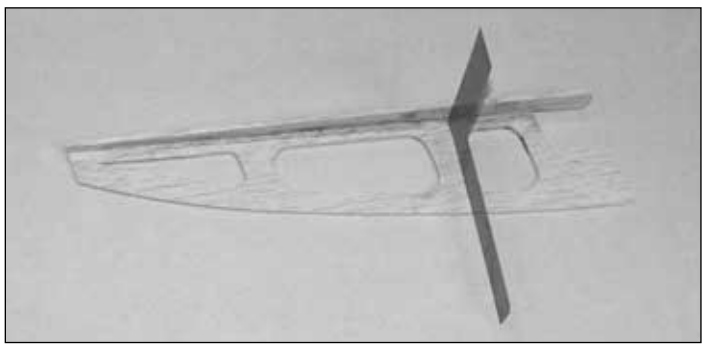
❏ 17. Glue the two 1/4" x 3/4" x 30" balsa **wing LE** to the sub LE and the sheeting.

❏ 18. Shape the LE as shown on the cross-section on the plans.

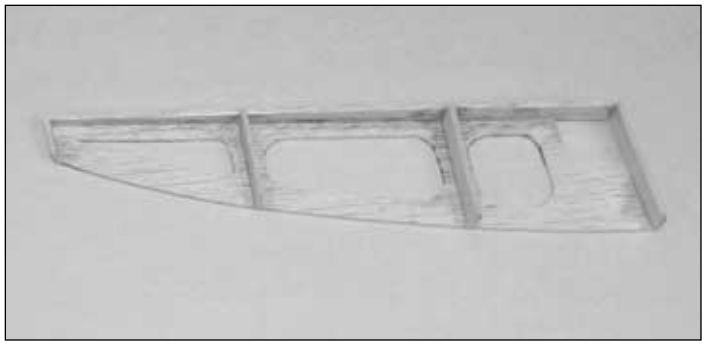


❏ 19R. *If you are using retracts,* cut an opening in the top wing sheeting for the retract servo. **Note:** Your wing should not be covered at this time.

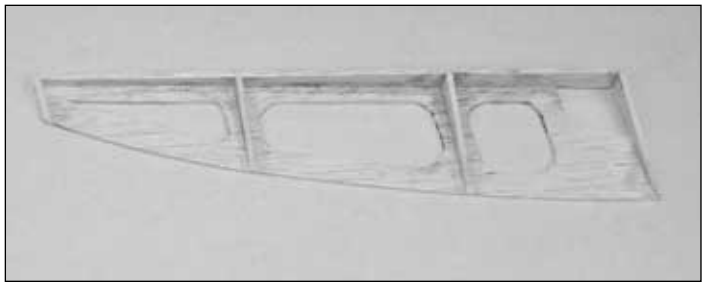
Build the Ailerons



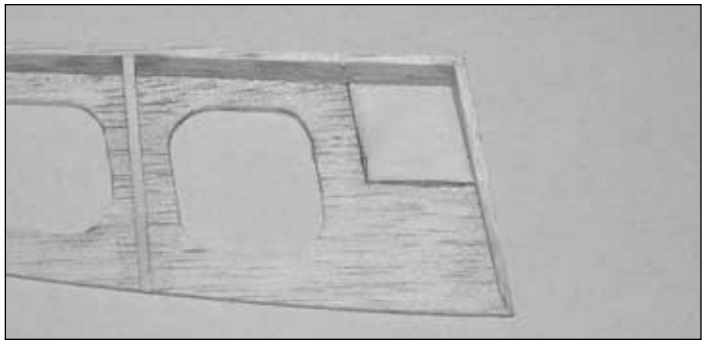
❏ ❏ 1. Glue the die-cut 3/32" balsa **aileron sub LE ALE** to the die-cut 3/32" balsa **aileron core AL** using a square to keep them perpendicular.



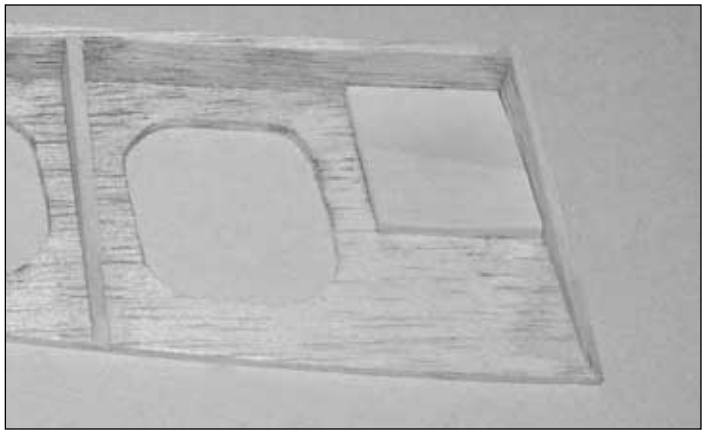
❏ ❏ 2. Using leftover 3/32" balsa, fit and glue four **aileron ribs** in place.



❏ ❏ 3. Trim the ribs from the TE of the aileron core to the top of the aileron sub LE.



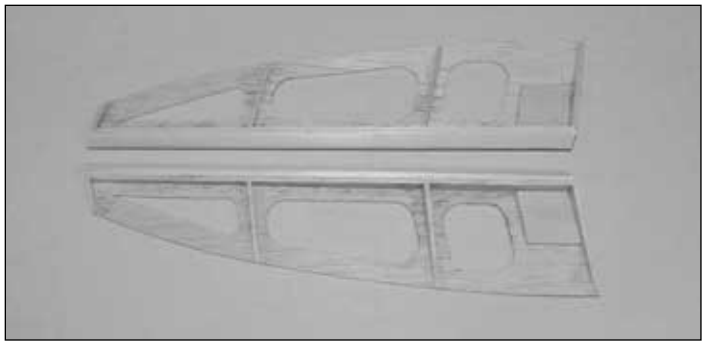
❏ ❏ 4. Trim the aileron sub LE and the aileron root rib so that the 1/8" die-cut ply **control horn support CHS** fits flush in the bottom of the aileron. Glue the control horn support in place.



❏ ❏ 5. Glue a second control horn support in place over the first but tight against the root rib.

❏ ❏ 6. From a 1/4" x 3/4" x 24" balsa stick, cut an **aileron LE** the length of the ALE. Position the LE centered on the ALE and glue in place. Trim the sides of the LE flush with the ALE.

❏ ❏ 7. Draw a centerline on the LE. Shape the LE of the aileron to a "V."



❏ 8. Repeat steps 1 through 7 to build the other aileron. **Note:** be sure to build a left and right aileron.

❏ 9. Using the same techniques as the stab, hinge the ailerons.

BUILD THE FUSELAGE

Assemble the Fuselage Sides

❏ 1. Cover the fuselage side view of the plans with Great Planes Plan Protector.

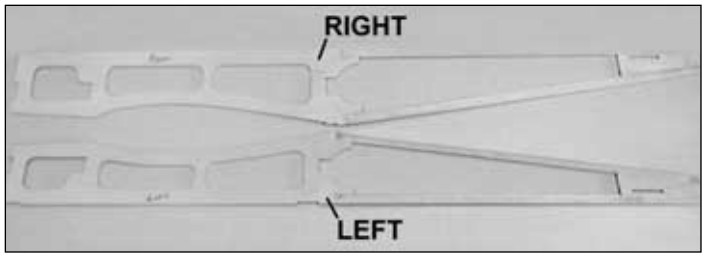
❏ ❏ 2. Pin a die-cut 1/8" ply **forward fuse side FFS** over the plan.

❏ ❏ 3. Pin the die-cut 1/8" balsa **aft fuse side AFS** over the plan.

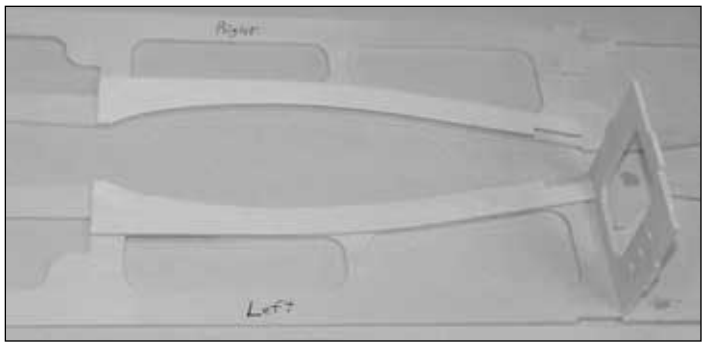
❏ ❏ 4. Using two 1/8" x 1/2" x 24" balsa sticks, cut, fit and glue the **fuselage side sticks** in place, building a **right** fuse side.

❏ 5. Remove the T-pins from the right fuse side. Write "RIGHT" on the forward fuse former. Cover the right fuse side with Great Planes Plan Protector.

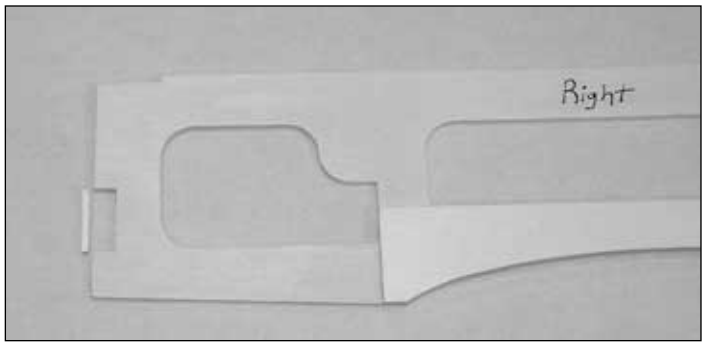
❏ 6. Repeat steps 2 – 4, building the **left** fuse side over top of the first.



❏ 7. Flip the left side over so it is a mirror image of the right, as shown in the photo. Label the inside of the left side "left."



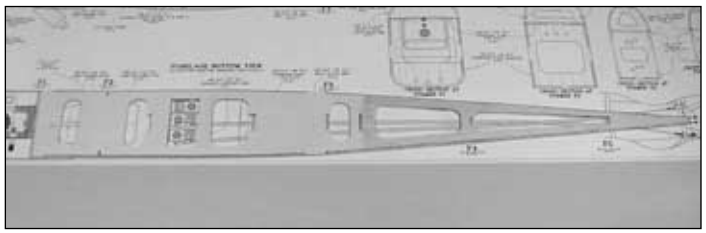
❏ 8. Glue the die-cut 1/8" ply **fuse doublers FS** to the inside of the right fuse side, using the die-cut 1/8" ply **former F3** to properly position FS. Repeat for the left side. **Note:** Do **NOT** glue F3 in place at this time.



❏ 9. Trim the right-thrust notch from the right fuse side as shown in the photo by cutting between the aft edge of the slots.

❏ 10. Lightly sand the outsides of each fuse side.

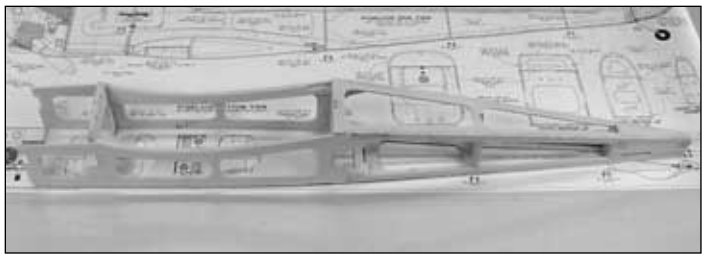
Assemble the Fuselage Box



❏ 1. Position and glue the die-cut 1/8" ply **forward fuse top FFT** and the die-cut 1/8" balsa **aft fuse top AFT** over the plans. **Note:** Remembering that the plans are a bottom view, be sure to position the forward fuse top as demonstrated on the plans to allow for the right thrust built into the aircraft.

DESIGNER'S NOTE: The 2° right thrust built into the firewall helps keep the aircraft tracking straight under acceleration and deceleration, minimizing the need to apply right rudder in coordination with throttle. This design requires no down thrust. The thrust angles built into this aircraft have been extensively tested and we recommend you do not modify them.

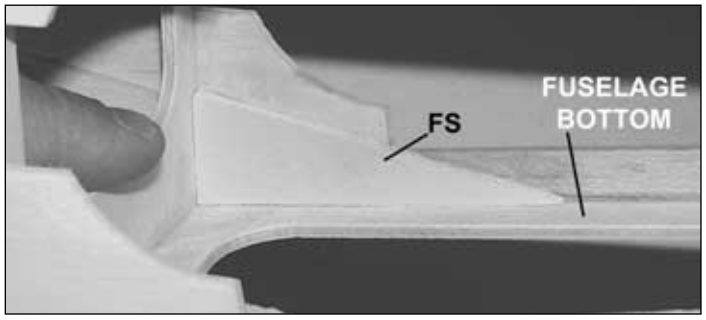
❑ 2. Glue the die-cut 1/8" ply **former F2A** to the front of die-cut 1/8" ply **former F2,** aligning the dowel holes. **Note:** The embossed labels on each former are on the front side.



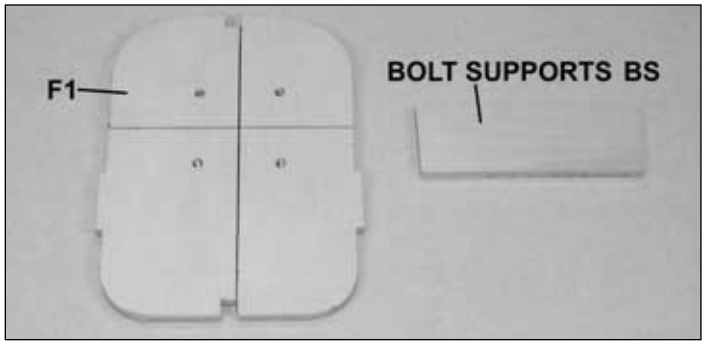
❑ 3. Position the die-cut 3/32" balsa **formers F5, and F4,** then the die-cut 1/8" ply **formers F3 and F2** into their notches in the fuse top. Position the fuse sides inverted over the plan bottom view, locking into the formers and the fuse top.

❑ 4. Position the 1/8" die-cut ply **aft fuse bottom AFB** between the fuse sides and onto the formers. Checking that the fuse sides are perpendicular to the work surface as you go, glue all joints, working from the aft end of the fuse forward.

❑ 5. Lift the fuselage off the plans. Carefully inspect all glue joints, and reinforce any weak joints with medium CA on the inside of the fuselage.



❑ 6. Glue the two die-cut 1/8" ply **fuse supports FS** in place in the bottom corners of the fuse.



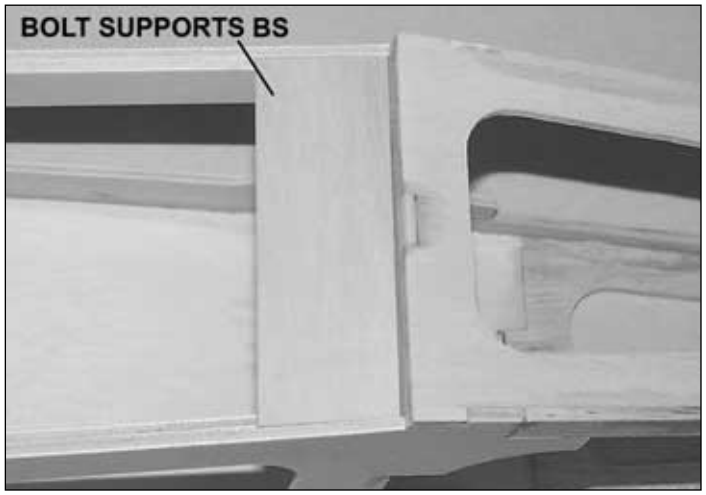
❑ 7. **Note: Refer to this photo for the following four steps.** Glue the two die-cut 1/8" **ply bolt supports BS** together.

❑ 8. Place one die-cut 1/8" ply **former F1** on the building board, punch marks and embossing facing up. Epoxy the second F-1 to the first with 30-minute epoxy, again with the punch marks facing up. Make sure the edges all the way around are aligned. Wipe away excess epoxy before it cures. From now on this assembly will be referred to as the **firewall. Note:** If the formers are warped, simply clamping them together may not "cancel out" the warps. It is best to clamp the formers to a table or a flat board until the epoxy cures.

❑ 9. Using a straightedge, draw lines horizontally and vertically, connecting the punch marks. The intersection of these two lines is the center of the engine mount.

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

❑ 10. Drill the four 11/64" (5/32" is OK) holes at the punch marks as shown in the photo for the included Great Planes Engine Mount. Press the four supplied 6-32 blind nuts into the holes on the back of the firewall. Gently tap the blind nuts with a hammer to fully seat them into the firewall, then add a few drops of thin CA around the blind nuts to secure them. Take care not to get any CA into the threads of the blind nut.

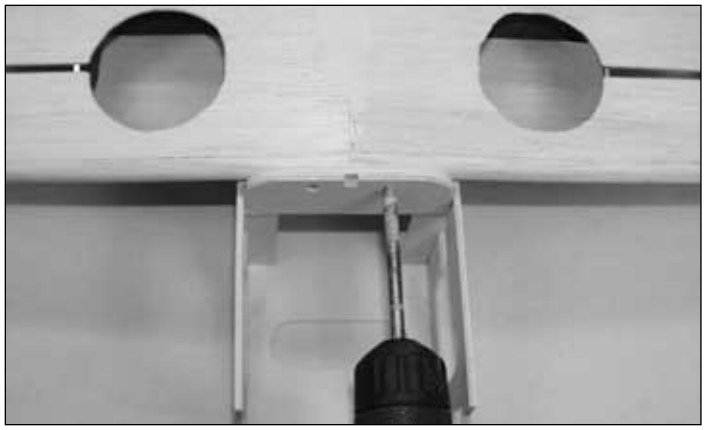


❑ 11. Using 6-minute epoxy, position and glue BS into the wing saddle, notched tight into both fuse doublers and against both fuse sides.

Mount the Wing to the Fuselage

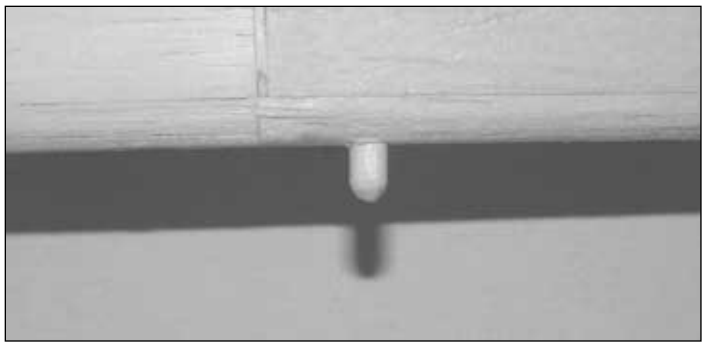
❑ 1. If necessary, sand the entire wing saddle area lightly until the fuse side doublers and fuse sides are flush. **Note:** Be careful not to sand an angle into the wing saddle.

❑ 2. Test fit the wing on the fuse. Center the wing side-to-side, leaving equal space between the fuse sides and the wing at the leading edge. If necessary, sand or trim the wing's trailing edge slightly to properly fit the wing saddle.

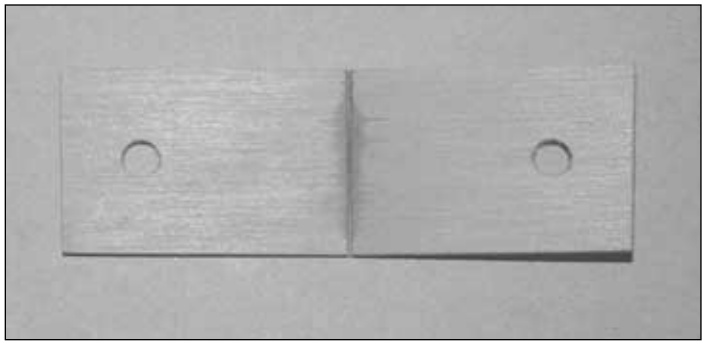


❏ 3. Using the hole in F2 as a guide, drill one 1/4" hole all the way through the leading edge and wing joiners, angling the drill toward the bottom of the wing slightly to clear RB. **Note:** Use a 6" long, 1/4" drill bit or sharpened brass tube.

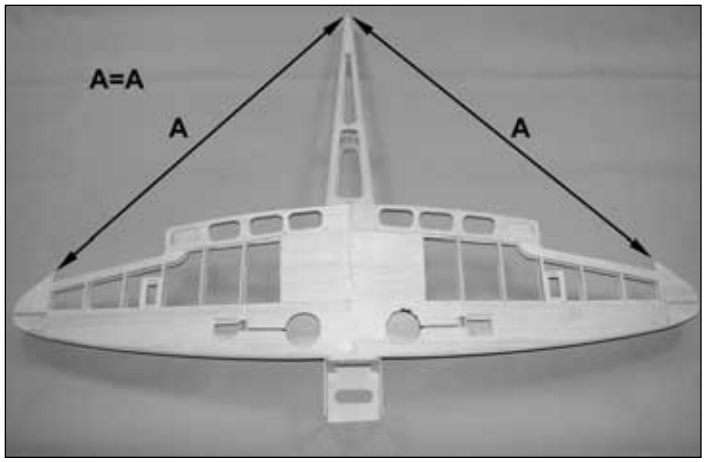
❏ 4. Round one end on each of the 1/4" x 4-1/2" **dowels.**



❏ 5. Glue one 1/4" x 4-1/2" dowel in the wing, leaving 3/8" sticking out of the LE. Repeat for the second dowel.



❏ 6. Mark a centerline on the die-cut 1/8" ply **bolt plate BP** as shown in the photo. Sand a taper on the leading edge and ends of one side of BP. Flip BP over. Using a razor saw, cut 1/2 way through the other side of the bolt plate so it can be bent to match the wing.

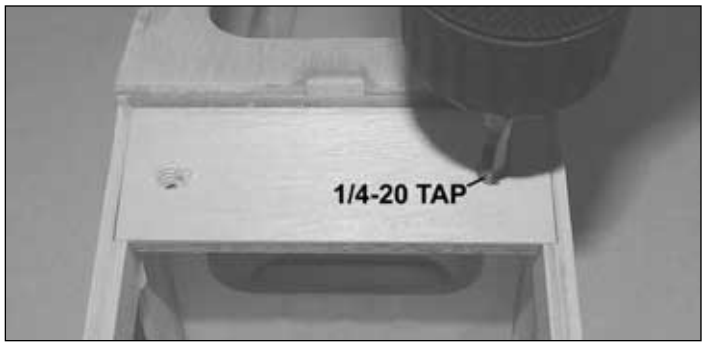


❏ 7. Stick a T-pin through the center of the aft end of the fuselage bottom. Tie a string to the T-pin. Pull the string to the TE of the wing tip and put a piece of masking tape on the string at the wing tip. Mark an arrow on the tape, then slide the tape on the string so the arrow aligns with the wing tip. Swing the string over to the other tip and see if it aligns with the same point. If necessary, shift the wing and mark the location of the tip by adjusting the position of the tape on the string. Do this until the arrow on the string aligns with both tips.

❏ 8. Glue BP onto the wing, aligning the trailing edge with the fuselage.

❏ 9. Holding the wing firmly in place on the fuse, and using the holes in the wing bolt plates as a guide, drill one #7 (or 13/64") hole through each wing filler block (inside the wing) and the wing bolt block, (inside the fuse), keeping the drill perpendicular to the wing bolt plates and centered in the holes.

❏ 10. Remove the wing from the fuselage and enlarge both holes in the **wing only** to 17/64" (or 1/4").



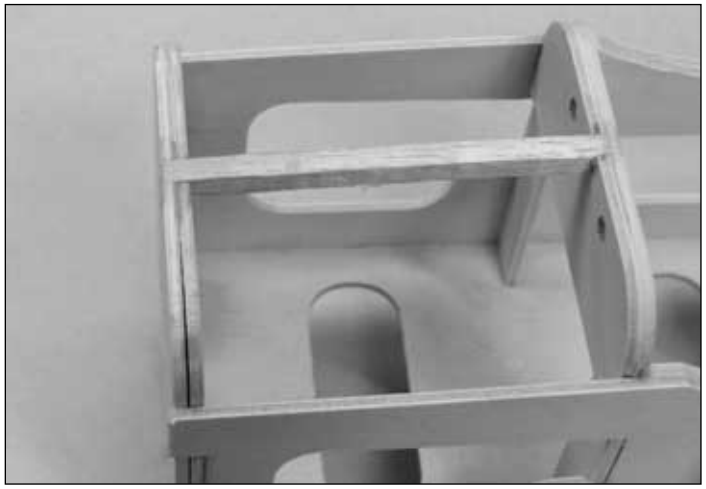
❏ 11. Use a 1/4-20 tap to cut threads in the bolt block in the fuselage. **Hint:** A cordless drill makes a great tap driver.

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

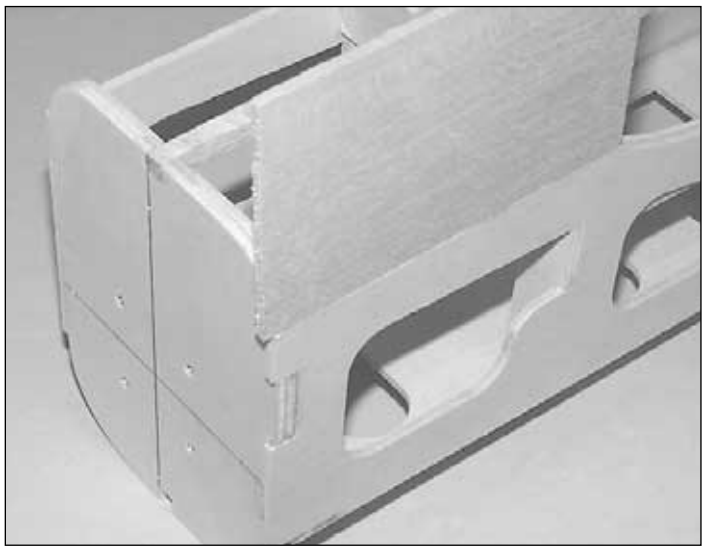
❏ 13. Bolt the wing to the fuse with the 1/4-20 nylon wing bolts. Turn the airplane right-side-up. Cut both wing bolts off, leaving 1/4" protruding above the wing bolt block. Turn the airplane upside-down and remove the wing from the fuse. Set the wing aside.

Finish the Bottom of the Fuselage

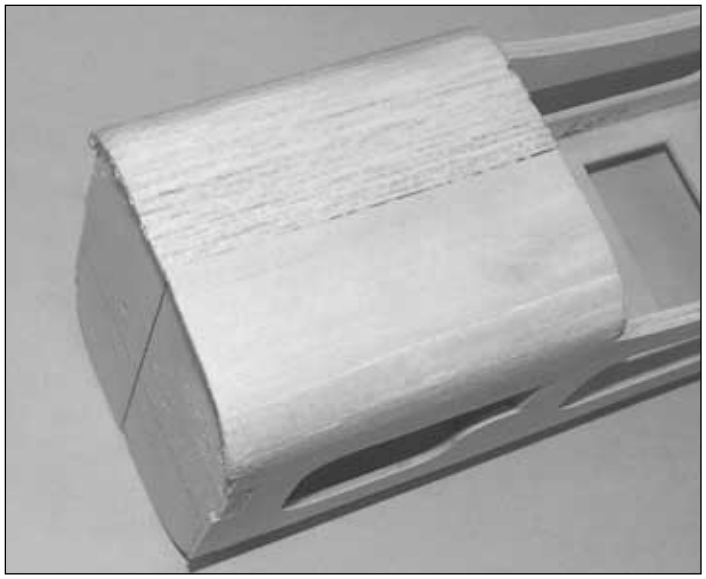
❏ 1. Glue F1 (the firewall) to the fuse sides with epoxy.



❏ 2. Using 1/4" x 1/4" balsa stick leftover from the stab, cut, fit and glue a **lower gluing stringer** from the firewall into F2A and flush against F2.

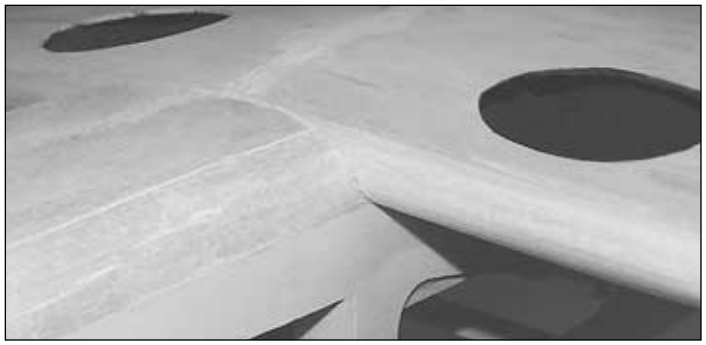


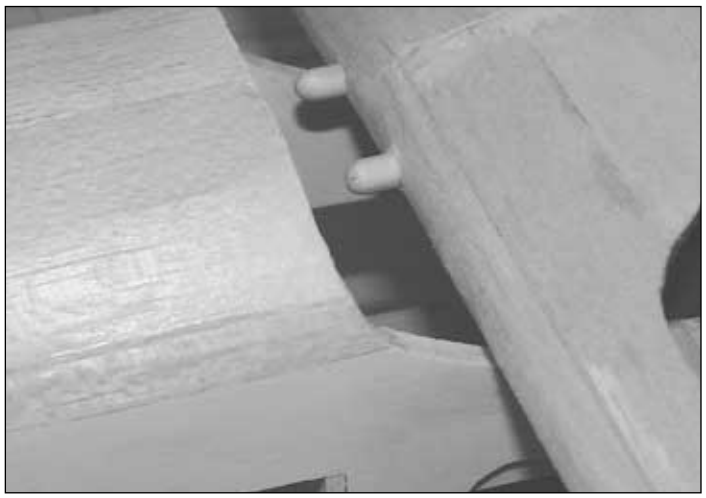
❏ 3. Cut one 4-3/4" long sheet from each of the two 1/8" x 3" x 24" balsa sheets, making two **forward fuse bottom** sheets. Lay a bead of medium CA along the bottom of the right fuse side. Align the trailing edge of the sheet to the leading edge of the wing saddle in the fuse side (which is approximately 1/4" aft of F2). Glue the right forward fuse bottom sheeting to the right fuse side. **Note:** This sheeting will maintain the shape of the wing saddle.



❏ 4. Liberally wet the outside of the right forward fuse bottom sheeting with an ammonia/water mix to help it bend. Gradually wrap the sheeting around the fuse bottom. Holding it in place, use a hobby knife to carefully trim the sheeting so that its edge is centered on the lower gluing stringer. Apply a bead of medium CA along the right half of the firewall bottom, F2, and the gluing stringer. Press the sheeting firmly in place, ensuring a tight joint with the firewall and F2.

❏ 5. Install the left side forward fuse bottom sheet as you did the right.

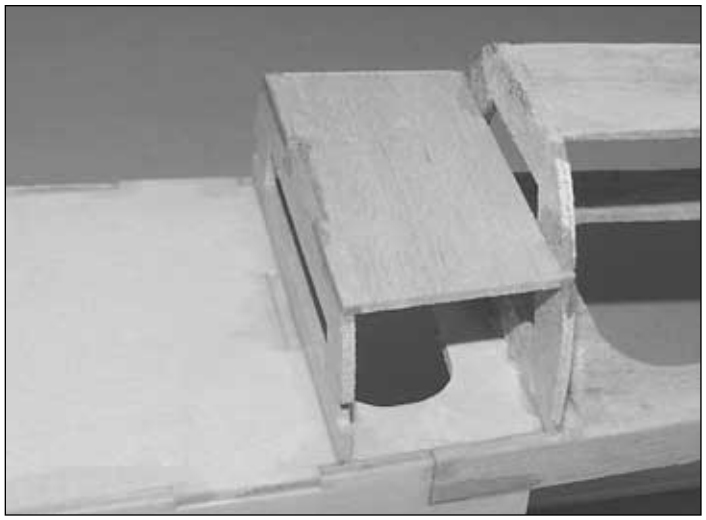




❏ 6. Trim the trailing edge of the forward fuse bottom sheeting to match the LE of the wing.

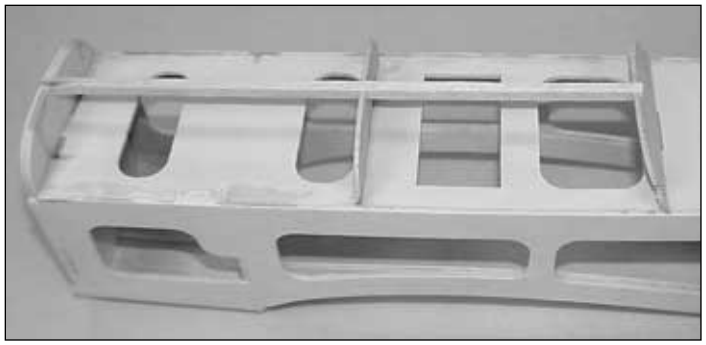
Build the Top of the Fuselage

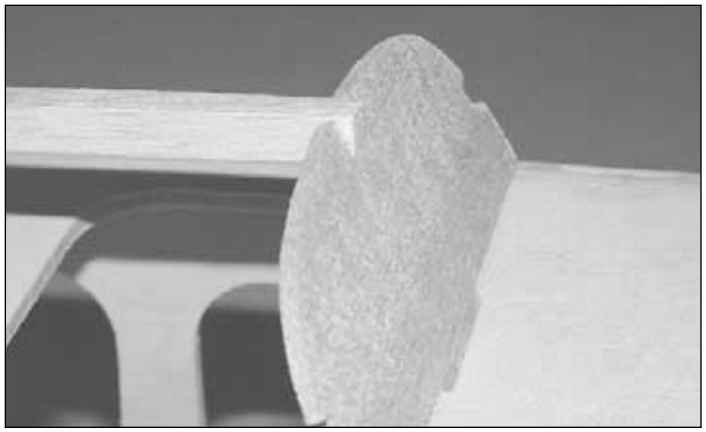
❏ 1. Fit the die-cut 3/32" balsa **turtle deck formers TD2, TD3, and TD4** perpendicular to the fuse top. Fit the die-cut 3/32" balsa **turtle deck top TDT** to the TD formers and glue all joints.



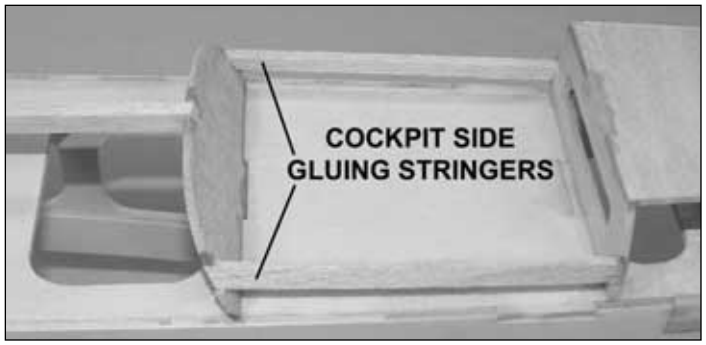
❏ 2. Fit and glue the die-cut 3/32" balsa **turtle deck former TD1** and the die-cut 3/32" balsa **radio gear floor RF** to the fuse top and TD2.

❏ 3. Glue the die-cut 3/32" balsa **front deck former FD1** perpendicular to the fuse top.



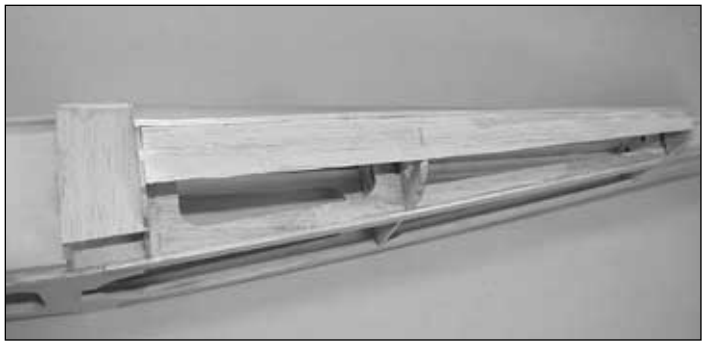


❏ 4. From leftover 1/4" x 1/4" balsa, cut a 12-1/8" long **front deck top gluing stringer.** Position the stick flush with the leading edge of the firewall. Position the die-cut 3/32" balsa **front deck former FD2** in the fuse top, using the front gluing stringer to set its angle as shown in the photo.



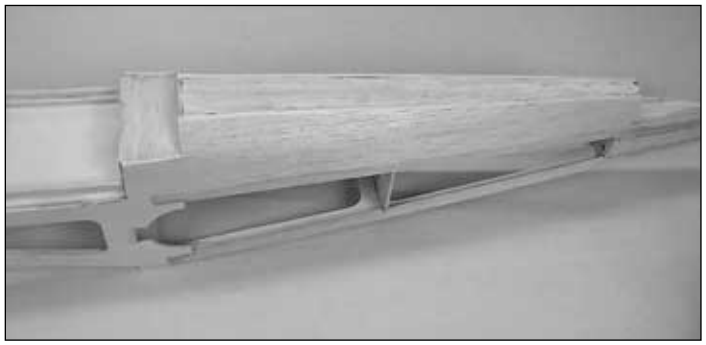
❏ 5. From leftover 1/8" x 1/4" balsa, cut, fit and glue the two **cockpit side gluing stringers** that run from the leading edge of FD2 to the trailing edge of TD1.

❏ ❏ 6. Select one 3/32" x 3" x 24" balsa sheet for the right **turtle deck sheeting.** Align the long edge of the sheeting along the top of the fuse side sticks and the leading edge with the ***center*** of TD1. Glue the turtle deck sheeting to the fuse side sticks from the center of TD1 through the aft edge of TD4.

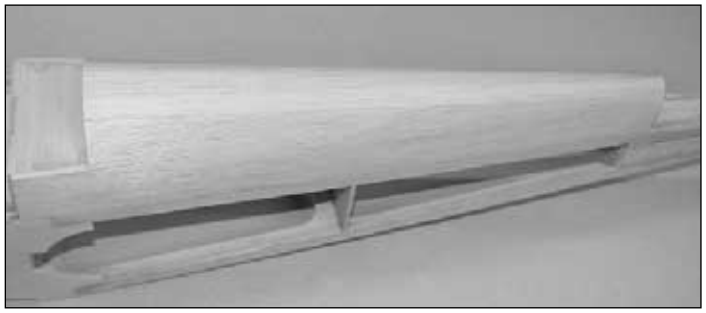


❏ ❏ 7. Wet, wrap and glue the turtle deck sheeting to TD2, TD3, TD4, the cockpit side stringers, and TDT, being careful not to warp TDT.

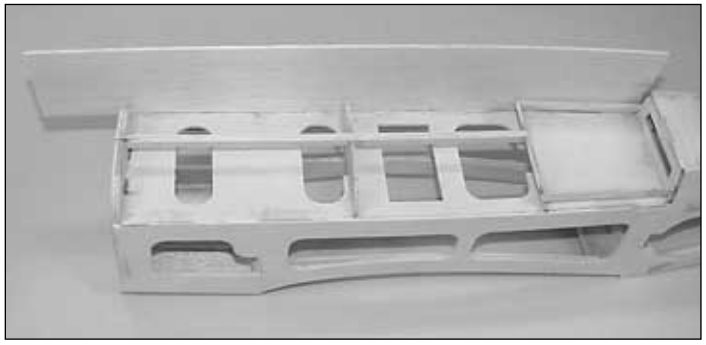
❏ ❏ 8. Trim the sheeting flush with the aft end of TD4 and the top of TDT.



❏ 9. Repeat steps 6 – 8 for the left side turtle deck sheeting.



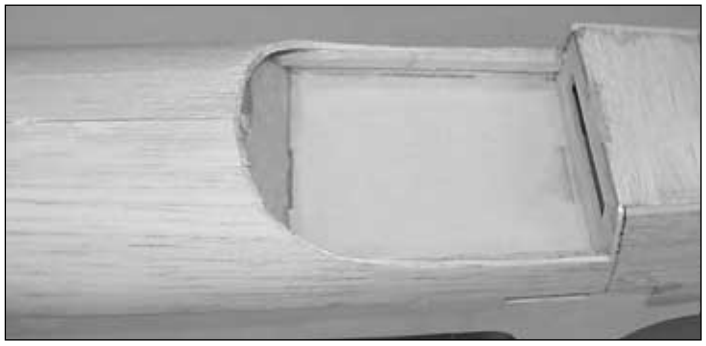
❏ 10. Cut, fit and glue the 1/4" x 1-1/2" x 18" balsa **turtle deck top shaper** from the leading edge of TD2 to the trailing edge of TD4. Using a razor plane then sanding bars, contour the shaper as shown on the cross-sections of formers F4 and F5.



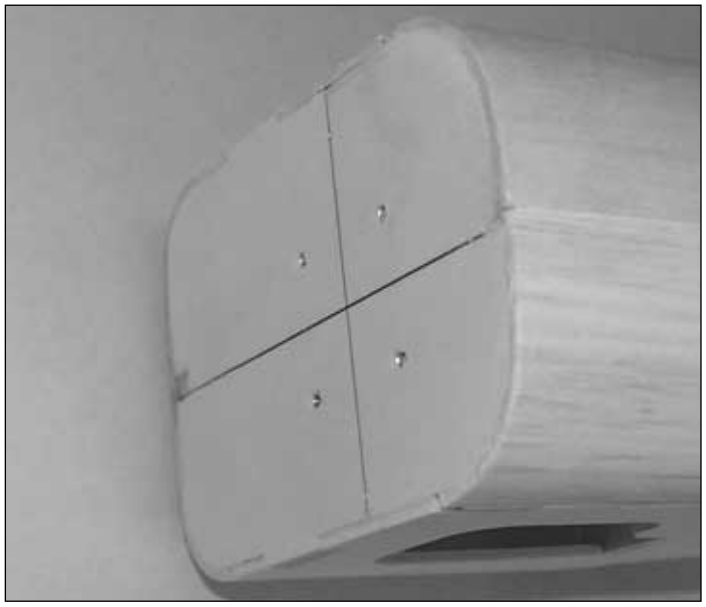
❏ ❏ 11. Select one 1/8" x 3" x 19-3/4" balsa sheet leftover from the forward fuse bottom for the **right front deck sheeting.** Edge glue the front deck sheet to the right forward fuse side, aligned with the leading edge of the turtle deck sheeting.

❏ ❏ 12. Wet the outside of the sheeting liberally with a water/ammonia mix. Test wrap the sheet over the front deck formers until you can comfortably make contact with the center of the front deck center gluing stringer. Glue the sheet to the formers, turtle deck sheet, and cockpit side gluing stringers.

❏ ❏ 13. Trim the front deck sheeting along the center of the center stringer. Look at the photo of the finished model on the box cover, and note how the cockpit arcs from the center of the front deck to the side stringers. This arc must be here to properly support the canopy, so take your time. Using the photo above and below as a guide, draw an arc on the right front deck sheet which begins flush at the center of FD3 and ends flush with the side stringers. When you are satisfied with the positioning, trim the sheet along the arc you made.

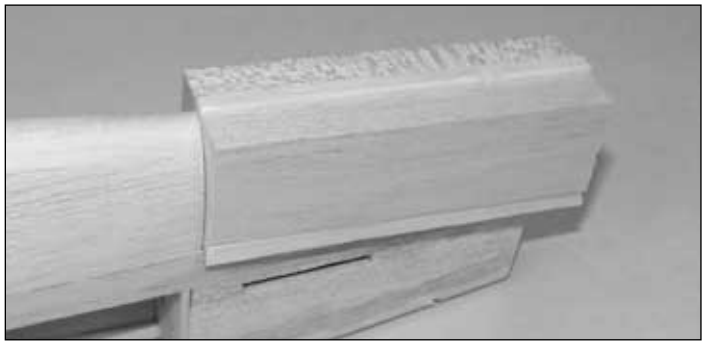


❏ 14. Repeat steps 11 – 13 for the left front deck sheet.



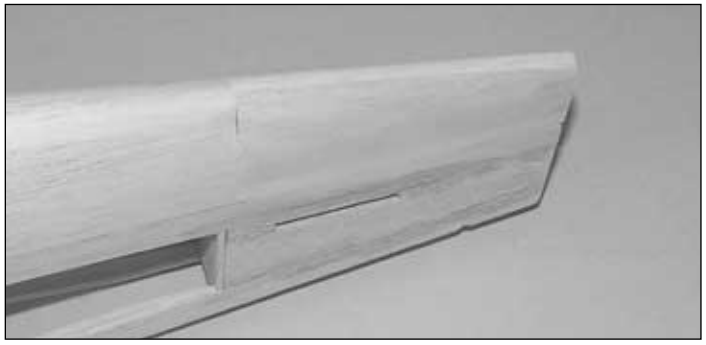
❏ 15. Sand everything flush with the firewall.

❏ 16. Select the two 5/8" x 1-3/8" x 5" balsa **fillet blocks** and the two 1/4" x 1-3/8" x 5" balsa **false stab and fin.**



❏ 17. Tack glue the false stab flat onto the aft fuse top and TD4. Tack glue the false fin vertically onto the false stab, centered on TD4. **Note:** The false stab is 1-3/8" across the fuse, 1/4" tall and 5" long; the false fin is 1/4" across the fuse, 5" long and 1-3/8" tall.

❏ 18. Tack glue the fillet blocks to TD4 and the false stab and fin.



❏ 19. Using a razor plane and progressively finer grades of sandpaper, shape the fillet blocks until they blend into and follow the contour of the fuselage.

❏ 20. Cut the fillet blocks and false stab/fin off the aircraft. Gently remove the false stab and false fin from the fillet blocks. Set the fillet blocks aside.

Install the Pushrod Tubes

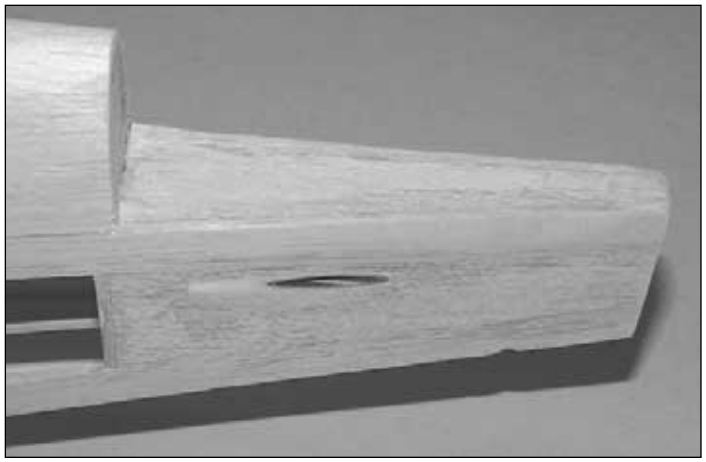
❏ 1. Select the two 36" grey plastic outer pushrod tubes. Sand the outside of the tubes with coarse sandpaper so the glue will stick.

❏ 2. Insert the rudder pushrod tube through the slot in the left aft fuse side, through the center hole in F4, and through the right hole in F3. Approximately 1/8" of the tube should protrude past the rear edge of the slot in the fuselage side.

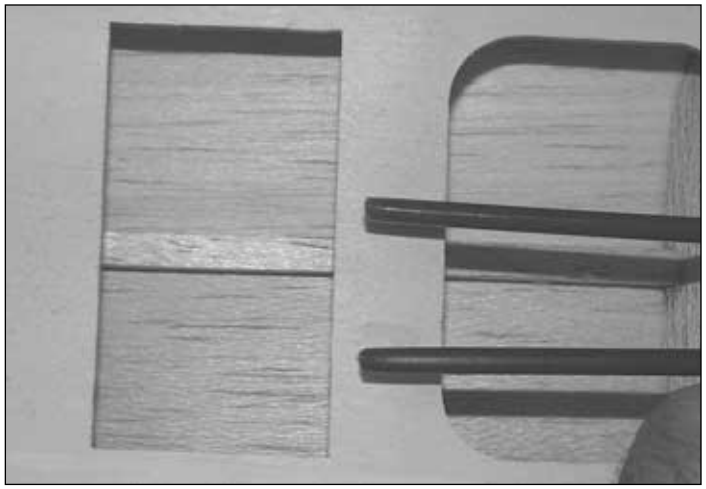
❏ 3. Insert the elevator pushrod tube through the hole in the right aft fuse side, through the right upper hole in F4, and through the center hole in F3. Approximately 1/8" of the tube should protrude past the rear edge of the slot in the fuselage side.

❏ 4. Glue the pushrod tubes to F3 and F4 with medium CA.

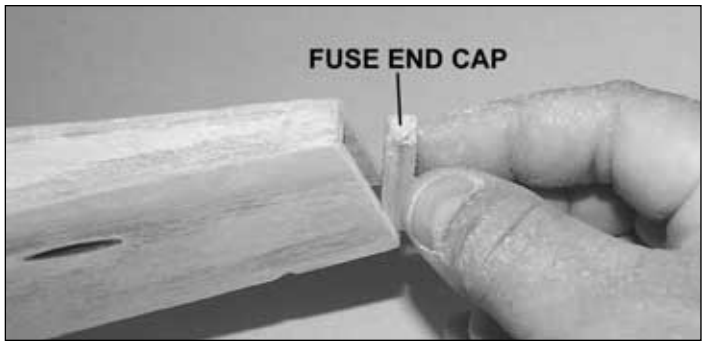
❏ 5. Use a mixture of 30-minute epoxy and microballoons to secure the tubes to the slots at the aft end of the fuselage. Completely fill the slots with the microballoons and epoxy. Allow the epoxy to cure completely.



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



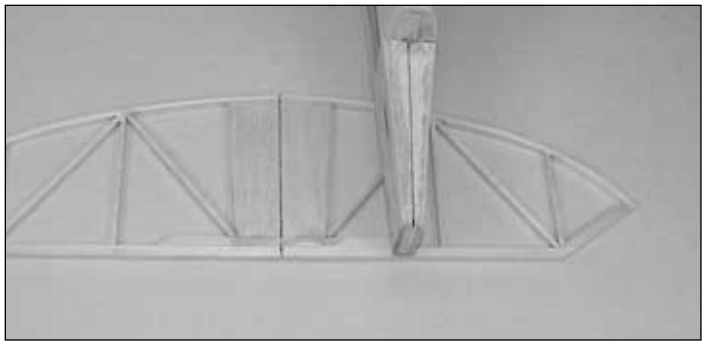
❏ 7. Cut the excess pushrod tube inside the radio compartment 1/4" aft of the servo opening.



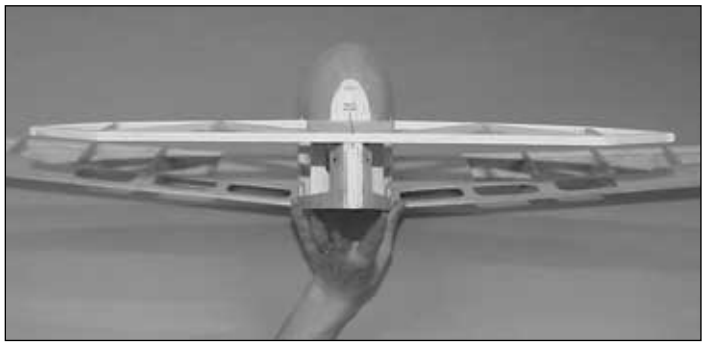
❏ 8. Using leftover 1/4" x 1/4" balsa stick, cut, fit and glue a **fuse end cap** between the fuse top, fuse bottom, and fuse sides at the trailing edge of the fuse.

Mount the Stabilizer to the Fuselage

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



❏ 2. Accurately measure the trailing edge of the aft fuse top and use a ballpoint pen to lightly mark the center. Use the same procedure to mark the center of the stabilizer.



❏ 3. Mount the wing to the fuselage. Position the stab centered on the aft fuse top, using the marks you just made for alignment. Stand about six to ten feet behind the model and see if the stab is parallel with the wing. If necessary, carefully use a bar sander to make minor adjustments by sanding the aft fuse top until the stab is in alignment with the wing.

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

❏ 5. Stick a T-pin through the front deck main stringer above FD2, then use the "pin and string technique" to accurately align the stab with the fuselage. Once the stab is accurately aligned, pin the LE of the stab to the fuse top.

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

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

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

Mount the Fin

❏ 1. Position the fin centered on the stab, using the mark on the trailing edge as a guide. Use a square laid flat on the stab to align the fin lengthwise as shown in the photo. Mark the right side of the fin, then remove the fin from the stab.

❏ 2. Lay a bead of medium CA along the bottom of the fin. Position the fin on the stab, using the line you made as a guide. Hold your square vertically on your stab to confirm the fin is straight vertically and allow the CA to cure.

❏ 3. Glue the fillets to the stab, fin, and TD4.

❏ 4. Using the pieces from the false fin, fill the gap in front of the fin and sand to shape.

Mount the Engine

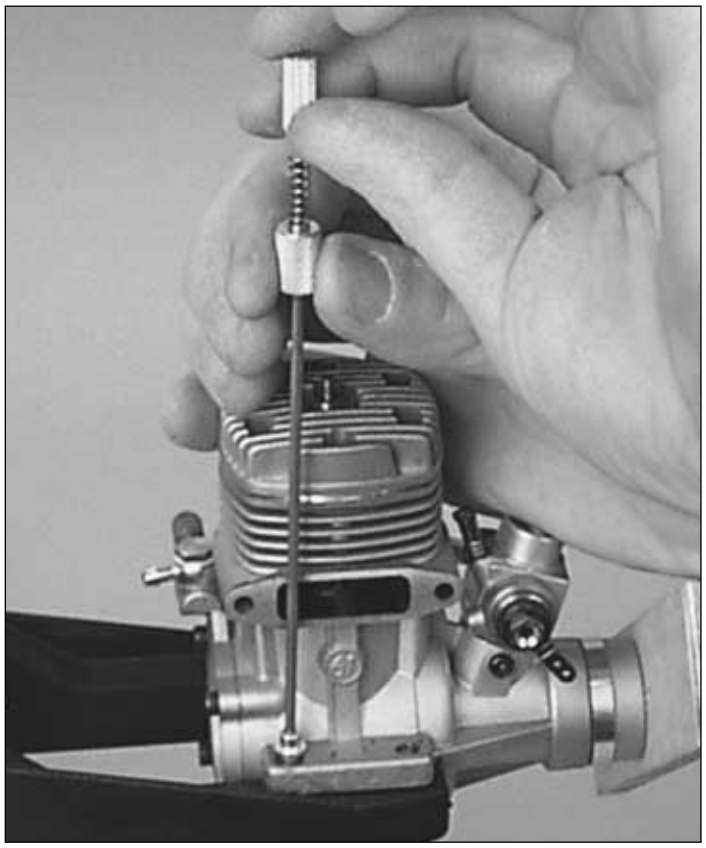
❏ 1. Cut the "spreader bars" from the supplied Great Planes engine mount, then use a hobby knife to remove any flashing

leftover from the molding process so that the halves fit together well.

❏ 2. Temporarily attach the engine mount (inverted) to the firewall with four 6-32 x 3/4" machine screws and #6 flat washers. Do not tighten the screws all the way, because you still need to adjust the mount.

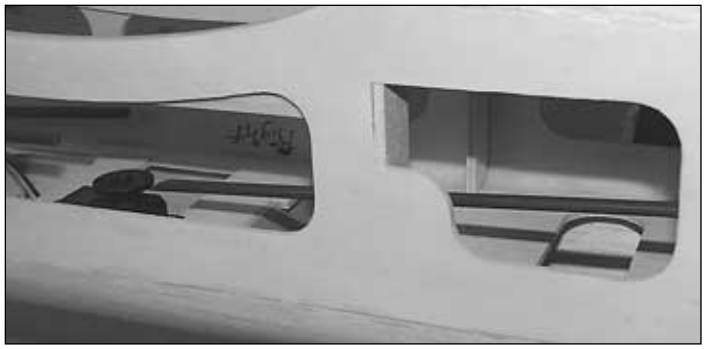
❏ 3. Place the engine on the mount and slide the halves in or out until the engine fits properly. Position the mount so the molded-in "tick marks" are equally spaced on the vertical centerline you drew on the firewall. When the engine mount is adjusted and positioned, tighten the mounting screws.

❏ 4. Position the engine on the mount so the front of the drive washer (or the back of the spinner) is 4-3/4" away from the firewall and clamp in place.



❏ 5. Use the Great Planes Dead Center™ Engine Mount Hole Locator (GPMP8130) to mark the locations of the bolt holes. Remove the engine from the mount and drill four #36 (or 7/64") holes. Tap the engine mount with a 6-32 tap for the 6/32 x 3/4" machine screws.

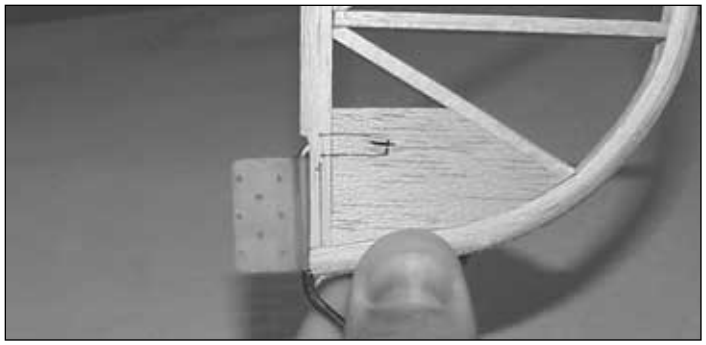
❏ 6. Select the 11-3/4" grey outer pushrod guide tube for the throttle. Use coarse sandpaper to roughen the outside of the tube so the glue will stick. Using the location of your particular engine's throttle arm as a guide, drill a 3/16" hole through the firewall for the throttle pushrod guide tube. Slide the throttle pushrod tube through the firewall.



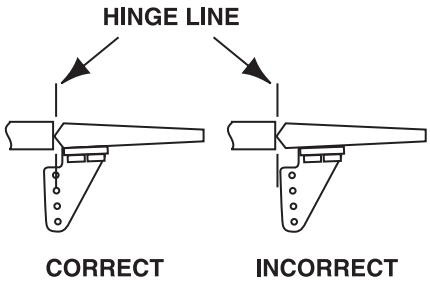
❏ 7. Position your throttle servo in the servo tray. Looking at the left side of the inverted fuse, angle the pushrod tube so it will go directly from the firewall to the servo arm, while keeping the pushrod tube as close to the fuse side as possible. Drill a 3/16" hole through F2 to match the angle and position of the pushrod tube. Position and glue the pushrod tube flush with the front of the firewall. Trim the excess pushrod tube 1/4" in front of the servo tray. **Note:** It is important that the throttle pushrod be close to the fuse side to allow clearance for the tank.

Mount the Tailgear

❏ 1. Temporarily mount the rudder to the fin with the hinges. **DO NOT GLUE.** Mark the location of the **tailgear wire** on the rudder and the nylon tailgear bearing on the fuselage, aligning the nylon tailgear bearing touching the fuse bottom. Remove the rudder.



❏ 2. Drill a 1/8" (or 7/64") hole 5/8" deep in the leading edge of the rudder at the mark you made for the tailgear wire. Cut a groove in the rudder for the nylon tailgear bearing (use a Great Planes Groove Tube tool or a 5/32" brass tube sharpened at one end to cut the groove). Test fit the tailgear wire in the rudder.



❏ 3. Position the control horn on the rudder as shown in the sketch and on the plan. Use a ballpoint pen to mark the location of the control horn mounting holes and drill 3/32" holes at the marks. Temporarily mount the control horn to the rudder with the backing plate and two 2-56 x 5/8" screws, trapping the tailgear wire between the screws. Remove the control horn.

❏ 4. Cut a slot in the trailing edge of the fuse at the marks you made for the nylon tailgear bearing. Without using any glue, test fit the rudder to the fin with the tailgear wire until there is no gap.

Assemble the Cowl

❏ 1. Cut the cowl halves along the cutlines, then use a bar sander with 80-grit sandpaper to true all the edges. To check the straightness of the edges, set the cowl half on its seams on the building board to be sure it is straight and smooth.

❏ 2. For now, just rough cut the openings in the front of each cowl half. Using coarse sandpaper, roughen 1/2" along the overlaps of each cowl half so the glue will stick.

❏ 3. Tape the two pieces together, using several pieces of masking tape and taping across the seams. Note the overlap in the cowl halves.

❏ 4. Test fit the cowl to the fuselage and adjust the taped seams as needed for a proper fit. Carefully remove the cowl from the fuselage. **Note:** You may need to remove your engine's needle valve, exhaust and possibly even the head to test fit the cowl.

❏ 5. Cut four 1" sections off the 1" x 18" fiberglass tape and set aside for the cowl mounting screw locations. Secure the inside of the cowl seams with the remaining fiberglass tape and thin CA.

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

❏ 7. Slide the cowl onto the fuselage. Slide the spinner backplate over the crankshaft, moving the cowl as necessary to leave a 1/8" gap between spinner and cowl, and secure the backplate in place. Position the cowl so that it aligns properly with the spinner.

❏ 8. Hold the cowl in position tight against the front deck sheeting and aligned with the spinner. Drill the first cowl mounting screw hole with a 1/16" drill bit. Screw in place with a #2 x 3/8" screw.

❏ 9. Confirming the proper positioning of the cowl before drilling each hole, drill the remaining holes and install the remaining 3 screws one at a time.

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

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

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

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

❏ 14. Roughen the inside of the cowl at the mounting holes with sandpaper. Use medium CA to glue one of the 1" x 1" fiberglass squares to the inside of the cowl at each cowl mounting hole. After the glue dries, enlarge the holes with a 3/32" drill bit.

❏ 15. Fill the seams and other imperfections in the cowl with putty filler such as Squadron® White Putty™ or automotive filler such as Bondo®. We use Bondo most of the time as it cures quickly and is easy to sand, but usually it must be purchased in large quantities. Squadron putty works well but it takes overnight to dry and usually requires at least two applications because it shrinks as it dries.

❏ 16. When dry, wet sand the entire cowl with 400-grit sandpaper to prepare it for priming.

BALANCE THE MODEL LATERALLY

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

A model which is not laterally balanced properly may exhibit a variety of unpleasant tendencies, ranging from uncharacteristic tip stalls to problems with spin entries. This aircraft, when balanced properly, has **NO** such bad tendencies. Be sure to check the lateral balance carefully to help ensure that the model exhibits the same exceptional handling qualities as our prototypes.

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

❏ 2. If one wing consistently drops, that is a heavy tip. Balance the model laterally by adding weight to the light wing tip.

PREPARE THE MODEL FOR COVERING

❏ 1. Remove all servos, pushrods, hinges and control horns. Remove the engine, mount and any other hardware you may have installed.

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

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

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

COVER THE MODEL WITH MONOKOTE® FILM

Covering Technique

Cover the model with **Top Flite MonoKote Film** using the recommended covering sequence that follows. Before you cover the fuselage, first apply strips of MonoKote film 1/4" larger than the fillets on top and 1/4" overall for the bottom into the corners of the stab and fuse and the fin and the fuse. Then proceed to cover the fin and stab with pre-cut pieces that meet in the corners and overlap the 1/4" strips. **Never cut the covering on the stab and fin after it has been applied except around the leading and trailing edges and at the tips.** Modelers who cut covering on top of the wood structure may cut through the covering and into the stab or fin. This will weaken the structure to a point where it may fail during flight.

Only the prototype's canopy and cowl are painted (see below). All other covering is done with MonoKote Flat Finish Grey and Green and Opaque colors.

The wing, stab and fin coverings are pre-made sections of covering. For one side of the stab's top, begin with a piece of oversized covering of the base grey. Peel off the backing, laying the covering onto a large piece of clean glass. Freehand cut your camouflage shapes from the grey. Peel the backing off an oversized piece of green. Using the cut grey as a guide, cut the camouflage shape into the green, allowing for a 1/4" overlap of the green onto the grey. Lay the green with a 1/4" overlap over the grey. Using a very hot MonoKote iron, secure the green to the grey.

Gently peel the oversized camouflage covering you just assembled, lay it onto the stab, and iron in place as you would a single piece of covering. Doesn't it look great?! No bubbles and no large excesses of covering, either!

Suggested Covering Sequence

Fuselage:

❏ 1. 1/4" strips at fin and stab as described above (camo on top, grey on bottom)
❏ 2. Fin top then stab ends (grey)
❏ 3. Stab/elevators bottom, then top (grey bottom, then camo on top)
❏ 4. Fin/rudder right side, then left side (camo)
❏ 5. Turtle deck (camo)
❏ 6. Front deck (camo)
❏ 7. Aft fuse bottom (camo base)

❑ 8. Forward fuse bottom (camo)
❑ 9. Fuse sides overlapping 1/8" onto deck coverings (camo)
❑ 10. Finishing markings (black/white/decals)

Wing:
❑ 1. Trailing edges of wing in aileron bays and cap of aileron bay (grey, other colors will wrap)
❑ 2. Bottom of right, then left panel (grey)
❑ 3. Top of right, then left panel (camo)
❑ 4. Aileron tips, then bottom, then top of aileron (grey then camo)
❑ 5. Finishing markings (black,white, decals)

PAINT THE MODEL

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

Top Flite LustreKote® fuelproof paint is recommended for painting the ABS plastic cowl. At least one coat of LustreKote primer is highly recommended to fill all the small scratches left from sanding as well as small pin holes in the filler. Wet sand between coats with 400-grit sandpaper and apply a second coat of primer if necessary. If the parts are primed properly, a few light coats of color will quickly provide a beautiful match to the MonoKote.

Before painting the canopy, use 400-grit sandpaper to scuff the frame portion of the canopy so the paint will stick. We recommend painting the canopy frame (and cockpit) with Pactra Formula-U or Chevron Perfect Paint. Use masking tape to cover the portion of the canopy that is not to be painted. If you are not sure that the paint is compatible with the clear canopy, test the paint on a scrap piece of canopy material, allowing at least 24 hours to see if the butyrate will deform.

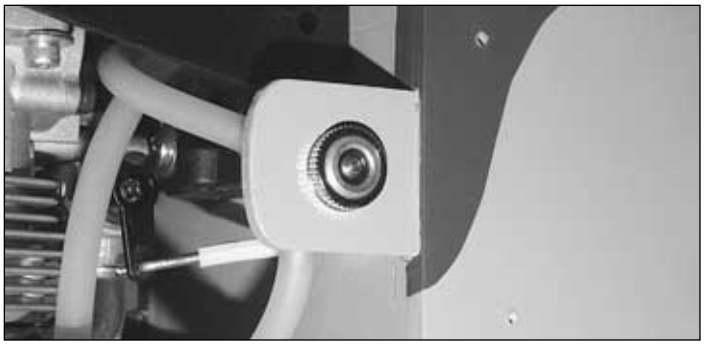
For painting the pilot we have discovered that acrylic water base paints such as the Horizon Paints available through your favorite hobby shop or those found at craft stores work great. The acrylic paints look realistic on the pilot because they are not glossy and, best of all, they clean up with water.

FINAL HOOKUPS & CHECKS

Assemble & Install the Tank & Fuel Filler

❑ 1. Reinstall the engine and mount. Using your engine installation as a guide, drill two 1/4" holes through the firewall for the fuel lines. Fuelproof the openings.

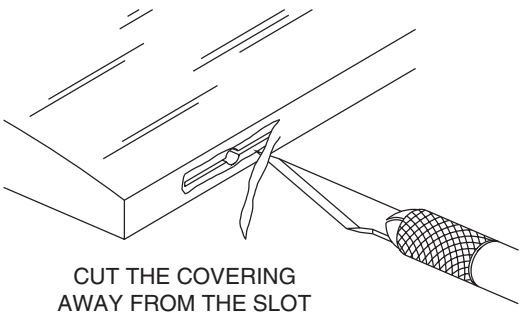
❑ 2. Using the instructions provided, assemble a Great Planes 10 oz. tank (not included). The vent line will attach to the nipple on your muffler for pressure. The main feed line will attach to the fuel filler valve. **Note:** This aircraft is designed around this specific tank. If you choose to use a different tank, you may need to modify the installation accordingly.



❑ 3. Install your fuel filling system. We recommend the Great Planes Easy Fueler (not included). Using leftover 1/8" plywood, create and install a mount for the filler which positions the filler flush with the outside of the cowl. Secure the filler to the mount.

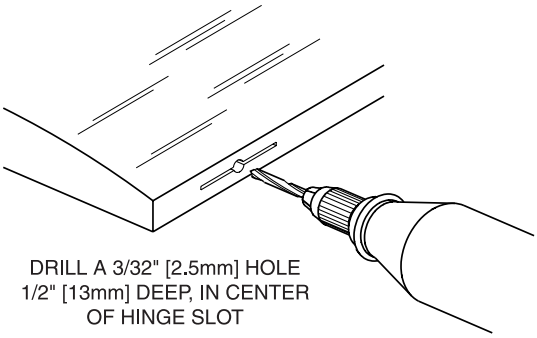
❑ 4. Attach two 12" lengths of nitro-safe fuel line (not included) to the 2 nipples on the tank. Guiding the fuel lines out the opening in the firewall, slide the tank into position through F2. Note that the tank locks into the fuse top. Using two #2 x 1/2" sheet metal screws, attach the 1/8" ply **tank retainer** behind the tank, securing the tank in place.

Attach the Control Surfaces

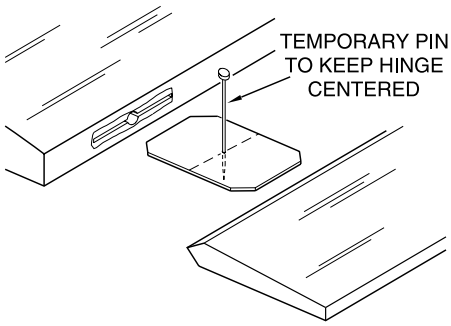


CUT THE COVERING
AWAY FROM THE SLOT

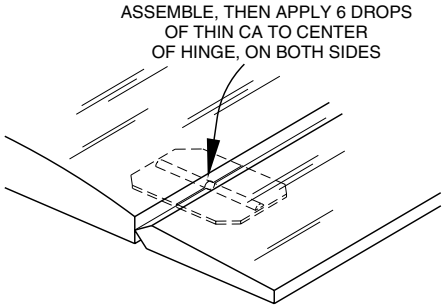
❑ 1. Start with the elevators and stab. Cut the covering from the hinge slots – don't just slit the covering but remove a small strip the size of the hinge slot.

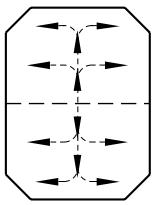


❑ 2. If you did not use a Slot Machine to make your hinge slots, drill a 3/32" hole 1/2" deep in the center of each hinge slot. A high speed Dremel Multi-Tool works best for this. If you use a regular drill, clean out the hinge slots with a #11 blade.



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





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

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

❑ 5. Prepare the hinge slots for the rudder as you did the elevators. Join the rudder to the fin with the hinges and use 30-minute epoxy to simultaneously glue the tailgear wire in the rudder and the tailgear bearing in the fuse. **Do not glue the nylon bearing to the rudder.** Glue the hinges in position with thin CA. **Note:** Petroleum jelly on the areas where the tailgear bearing contacts the wire will ensure that it does not become glued to the tailgear wire or rudder.

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

Install the Servos & Make the Pushrods

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

❑ 2. Bend and/or cut the engine end of the throttle pushrod as needed to fit the engine installation. Make adjustments to the bends in the wire so the pushrod aligns with the carburetor arm on the engine. Slide a 2" piece of white pushrod inner over the pushrod and glue it to the pushrod at the distance where the pushrod exists the firewall. **Note:** This plastic bearing will minimize fuel running back down the pushrod tube.

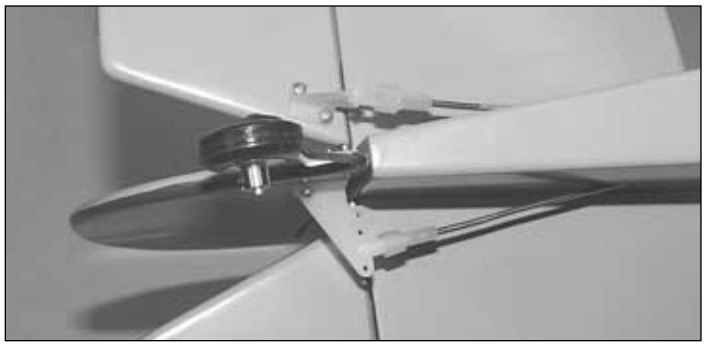
❑ 3. Temporarily connect the pushrod to the carb arm with whatever connection type you have selected for the throttle. (We recommend the simplicity of using a Z-bend.) Temporarily mount the muffler and make sure the throttle pushrod will not interfere with the muffler. Make adjustments to the bends in the wire if necessary.

❑ 4. Trim the covering from the pushrod openings in both sides of the fuse.

❑ 5. Slide the die-cut 1/8" ply **pushrod support** over the servo ends of the elevator and rudder pushrods. Do not glue it at this time.

❑ 6. Screw a clevis onto one 35" pushrod wire (threaded on both ends) for the rudder pushrod. Slide the pushrod wire through the rudder pushrod guide tube, which is the guide tube

exiting the left side of the fuselage. Re-mount the rudder control horn. Attach the clevis to the control horn.



❏ 7. Position the rudder servo in the right side of the servo tray as shown on the plans, using a servo arm included with your radio to position the servo such that the end of the servo arm lines up with the pushrod. Mount the servo.

❏ 8. Center the rudder (clamping the counterbalance to the fin and using balsa pads to keep from damaging the rudder works well) and be sure the servo arm is perpendicular to the servo case. Cut the pushrod 1/2" forward of the servo arm and set aside the excess pushrod for an aileron. Mark the pushrod where it crosses the servo arm. Bend the pushrod and connect it through the outer hole of the servo arm with a Faslink. Trim the excess wire that sticks out past the Faslink.

❏ 9. Screw a clevis onto one end of the 35" pushrod wire (threaded on both ends) for the elevator pushrod. Slide the pushrod through the elevator pushrod guide tube, which is the guide tube on the right side of the fuselage. Remove the backing plate from the nylon control horn and connect the horn to the clevis in the outer hole. Position and temporarily mount the elevator control horn as you did the rudder control horn.

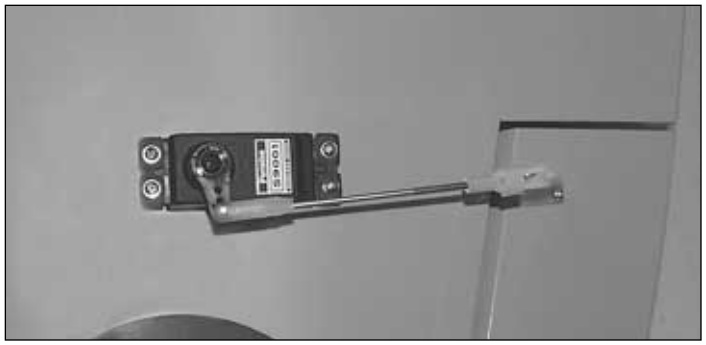
❏ 10. Position the elevator servo centered in the servo tray as shown on the plans, using a medium servo arm included in your radio to position the servo such that the end of the servo arm lines up with the pushrod. Mount the servo.

❏ 11. Center the elevators (clamping them to the stab and using balsa pads to keep from damaging them) and be sure the servo arm is perpendicular to the servo case. Trim and set aside the excess pushrod as you did for the rudder. Mark the pushrod where it crosses the servo arm. Bend the pushrod and connect it to the center hole of the servo arm with a Faslink. Trim the excess wire that sticks out past the Faslink.

❏ 12. Select the two servos you are using for the ailerons and attach a 12" servo extension to each. Guide the extensions through the wings and out the holes in the top of the wing. **Hint:** A wheel collar tied to a string, with the string slip-knotted over the control horn, will help guide it through the wing.

❏ 13. Mount the aileron servos in the wing with the screws provided with your radio. Mount the aileron control horns to the ailerons with #2 x 1/2" screws without the backplate.

❏ 14. Screw the clevises onto the pushrod wires leftover from the elevator and rudder.



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

Install the Landing Gear

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

❏ 2. Reinstall the landing gear, fixed or retractable.

Final Servo & Receiver Installation

❏ 1. Temporarily position the receiver and battery on the servo tray. Connect all servos to your receiver.

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

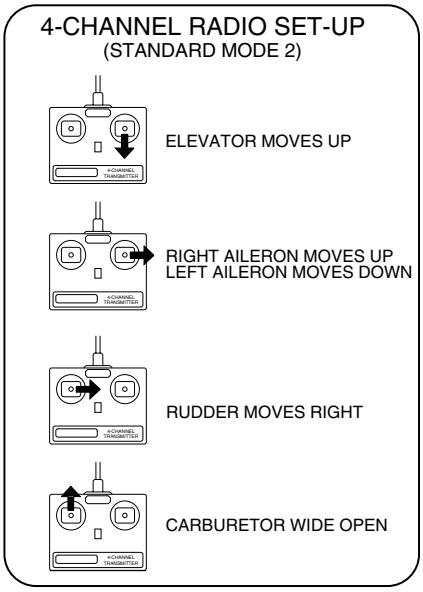
❏ 3. Confirm all servo arms are all positioned so the servo arms are perpendicular to the cases, including the throttle servo with the throttle stick and trim at center. Check servo direction and center the rudder and elevator as you did the ailerons.

❏ 4. Check that the throttle servo moves in the correct direction, and reverse if necessary. Adjust the clevis on the throttle pushrod as needed so that when wide open, the throttle barrel

just opens completely, but does not bind (a buzzing sound of the servo trying to push the arm farther than wide open). Additionally, at low throttle with the throttle trim at center the barrel should be open just slightly – enough to allow the engine to run, while with the trim pulled all the way back the barrel is completely closed, again without binding.

❏ 5. After setting the control throws (see following box), turn off the receiver and transmitter.

Set the Control Throws



We recommend the following control surface throws:

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

	High Rate	Low Rate
ELEVATOR:	9/16" up	5/16" up
	9/16" down	5/16" down
RUDDER:	1" left	5/8" left
	1" right	5/8" right
AILERONS:	7/16" up	1/4" up
	7/16" down	1/4" down

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

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

Mount the Canopy & Cowl

❏ 1. Rough-cut the canopy from the flashing, leaving 1/4" of excess below the cut lines. Test fit the canopy to your model and trim as required.

❏ 2. Install the instrument panel decal. If desired, install a pilot (optional, not included).

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

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

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

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

❏ 7. Reposition the canopy on the fuselage and confirm that it covers the exposed wood. Glue the canopy to the fuselage using rubber bands or masking tape to hold it in position until the glue dries. We recommend a glue specifically formulated for gluing on canopies such as Pacer "Formula 560" canopy glue. Formula 560 is like regular white glue (aliphatic resin) in that it dries clear and cleans up with water but sticks extremely well to butyrate and dries overnight (to allow for accurate positioning).

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

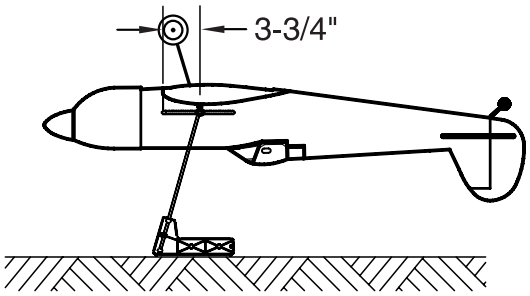
❏ 9. Some modelers prefer to cushion the wing with wing seating foam tape on the wing saddle of the fuselage. Apply 1/16" seating tape on the wing saddle of the fuselage if you choose.

Balance Your Model

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

❏ 1. Wrap the battery pack in at least 1/4" of foam rubber, secure to a piece of leftover ply (we prefer Velcro® for this task for easy removal), then temporarily position it on the aft fuse top.

❏ 2. Mount the receiver switch in a convenient location that will not interfere with the servos and pushrods inside the fuselage and opposite of the engine exhaust.



❑ 3. Accurately mark the balance point on the top of the wing on both sides of the fuselage. Use thin strips of tape or a felt-tip pen to make the marks. The balance point **(C.G.)** is located **3-3/4" back from the leading edge where the wing meets the fuse** as shown in the sketch and on the wing plan. This is the point at which the model should balance for your first flights. After initial trim flights and when you become more acquainted with your Spitfire, you may wish to experiment by shifting the balance up to **1/2" forward or 3/8" back** to change the flying characteristics. Moving the balance **forward** may improve the smoothness and stability but the model may then require more speed for takeoff and make it more difficult to slow for landing. Moving the balance **aft** makes the model **more agile** with a lighter, snappier "feel" and often improves knife-edge capabilities. In any case, **please start at the location we recommend and do not at any time balance your model outside the recommended range.**

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

❑ 5. Position the model on a Great Planes C.G. Machine™, or manually lift the model at the balance point. If the **tail** drops when you lift, the model is "tail heavy" and you must add weight* to the nose to balance the model. If the **nose** drops, it is "nose heavy" and you must add weight* to the tail to balance the model. **Note:** Nose weight may be easily installed by using a "spinner weight" or gluing lead weights to the firewall. Tail weight may be added by using Great Planes "stick-on" weights (GPMQ4485, not included).

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

PREFLIGHT

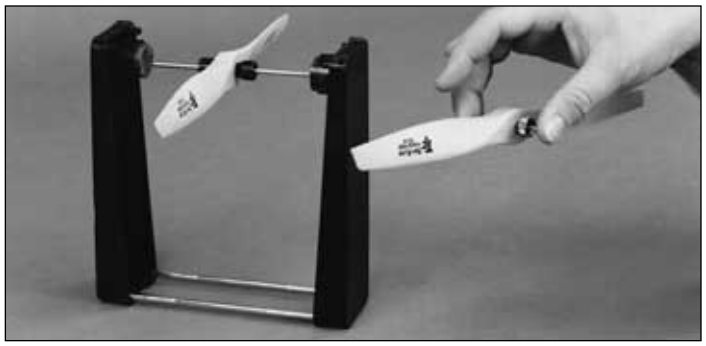
Check all connections including servo arm screws, Faslinks, clevises and servo wires. Make sure you have installed the **silicone retainers** on all the clevises.

Charge the Batteries

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

Balance the Propeller

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



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

Find a Safe Place to Fly

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

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

Ground Check the Model

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

Range Check Your Radio

Whenever you go to the flying field, check the operational range of the radio before the first flight of the day. First, make sure no one else is on your frequency (channel). With your transmitter antenna collapsed and the receiver and transmitter on, you should be able to walk at least 100 feet away from the model and still have control. While you work the controls have a helper stand by your model and tell you what the control surfaces are doing.

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

Engine Safety Precautions

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

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

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

Use safety glasses when starting or running engines.

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

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

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

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

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

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

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

AMA SAFETY CODE (excerpt)

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

General

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

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

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

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

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

Radio Control

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

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

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

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

FLYING

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

The Great Planes Spitfire is a great flying semi-scale sport model that flies smoothly and predictably, yet is mildly aerobatic. The Spitfire does not, however, possess the self-recovery characteristics of a primary R/C trainer and should only be flown by experienced RC pilots. The Spitfire is limited only by your abilities and imagination. *Have Fun!*

Takeoff

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

Flying

We recommend that you take it easy with your Spitfire for the first several flights, gradually "getting acquainted" with this great sport model as your engine gets fully broken-in. If you feel as though you have your hands full, keep this one thing in mind: **pull back on the throttle stick to slow the model down.** This will make everything happen a little slower and allow yourself time to think and react. Add and practice one maneuver at a time, learning how the Spitfire behaves in each. For smooth flying and normal maneuvers, use the low rate settings as listed on page 34. This low rate elevator setting is intentionally very soft and smooth, and was selected specifically to provide a smooth, fluid flight performance overall.

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

Landing

When it's time to land, fly a normal landing pattern and approach. Keep a few clicks of power on until you are over the runway threshold. For the first few landings, plan to land slightly faster than stall speed and on the main wheels, as this is the easiest way to land your Spitfire. Later, with a little practice you will find you can make slow 3-point landings.

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

APPENDIX

FLIGHT TRIMMING

Note: *The following article has been reprinted in part for future reference and also as a guide for your flight instructor or experienced flying partner to help you with trimming your model. If further information is required, please contact your local hobby dealer, local flying club or call Great Planes at (217) 398-8970.*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

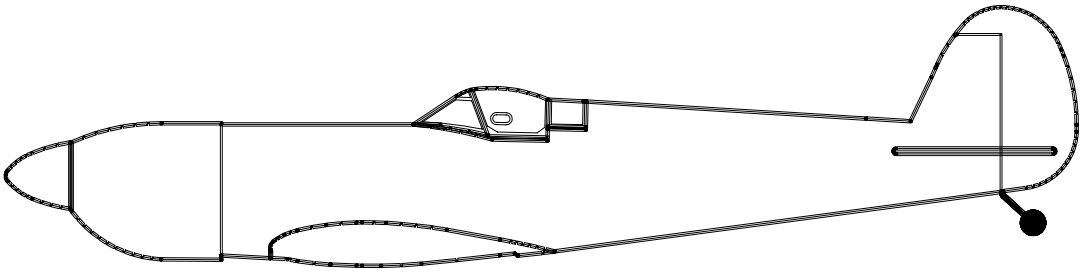
See the Flight Trimming Chart on Page 39

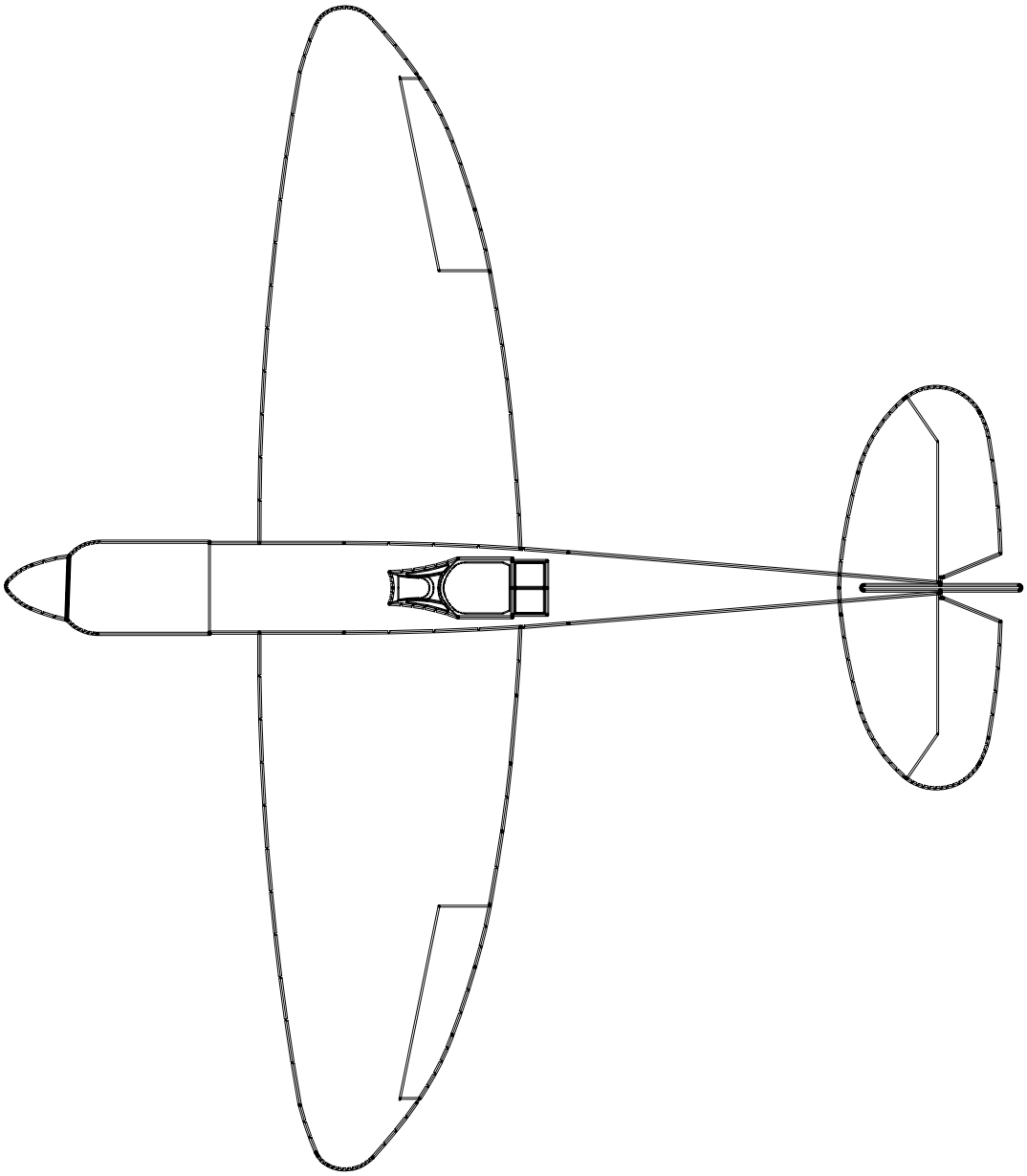
TRIM FEATURE	MANEUVERS	OBSERVATIONS	CORRECTIONS
CONTROL CENTERING	Fly general circles and random maneuvers.	Try for hands off straight and level flight.	Readjust linkages so that Tx trims are centered.
CONTROL THROWS	Random maneuvers	A. Too sensitive, jerky controls. B. Not sufficient control.	If A,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

1. Engine thrust angle and C.G. interact. Check both.
2. Yaw and lateral balance produce similar symptoms. Note that fin may be crooked. Right and left references are from the plane's vantage point.

TWO VIEW DRAWING

Use copies of this page to plan your trim scheme





SPITFIRE 40

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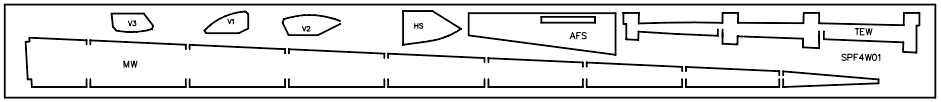

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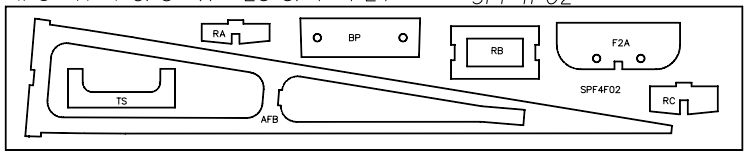

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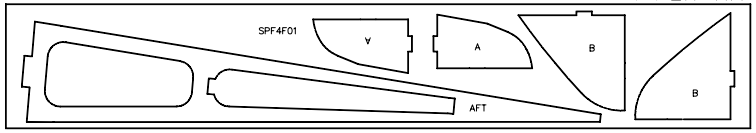

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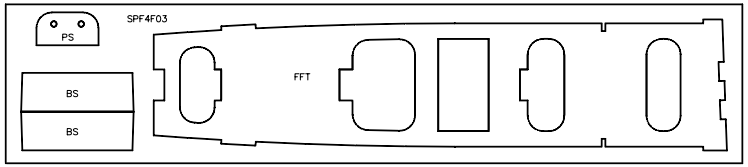

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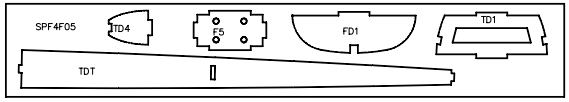

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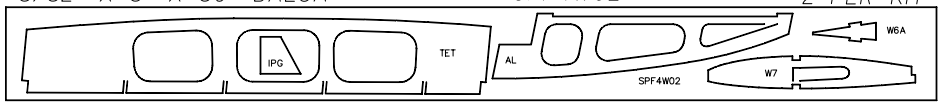

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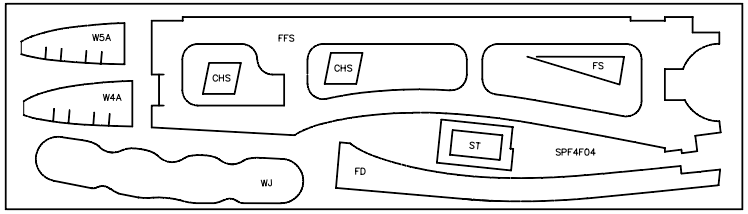

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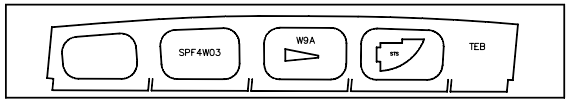

SPF4W03

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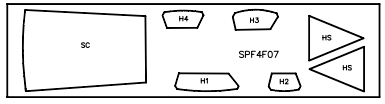

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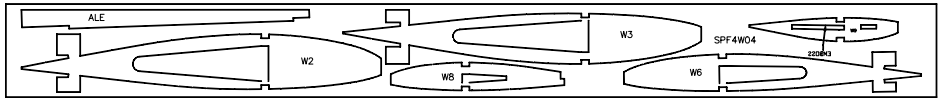

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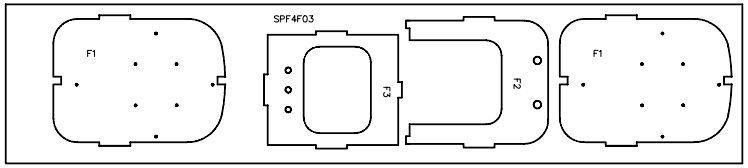
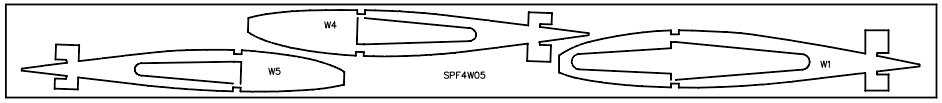
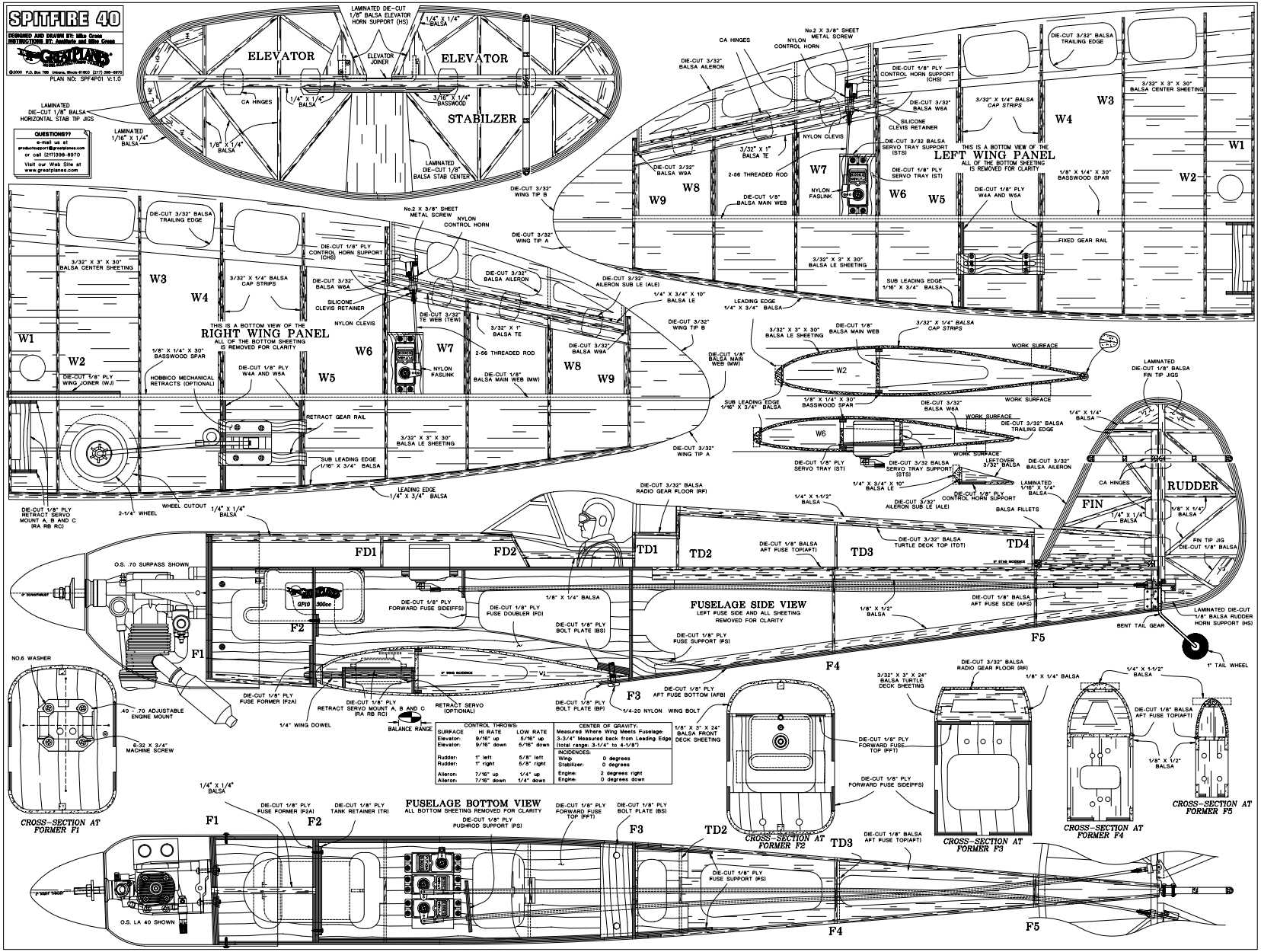


3/32" X 3" X 30" BALSA SPF4W05 2 PER KIT




SPITFIRE 40
DESIGNED AND DRAWN BY: Mike Cross
INSTRUCTIONS BY: Aesthetic and Mike Cross
PLAN NO: SPF4P01 V:1.0
ELEVATOR
ELEVATOR JOINER
ELEVATOR
STABILZER
LAMINATED DIE-CUT 1/8" BALSA ELEVATOR HORN SUPPORT (HS)
LAMINATED DIE-CUT 1/8" BALSA HORIZONTAL STAB TIP JIGS
LAMINATED DIE-CUT 1/8" BALSA STAB CENTER
CA HINGES
1/4" X 1/4" BALSA
3/16" X 1/4" BASSWOOD
1/8" X 1/4" BALSA
LAMINATED 1/16" X 1/4" BALSA
QUESTIONS??
e-mail us at productsupport@greatplanes.com
or call (217)398-8970
Visit our Web Site at www.greatplanes.com
LEFT WING PANEL
ALL OF THE BOTTOM SHEETING IS REMOVED FOR CLARITY
THIS IS A BOTTOM VIEW OF THE
RIGHT WING PANEL
ALL OF THE BOTTOM SHEETING IS REMOVED FOR CLARITY
W1
W2
W3
W4
W5
W6
W7
W8
W9
DIE-CUT 3/32" BALSA AILERON
DIE-CUT 3/32" BALSA TRAILING EDGE
3/32" X 3" X 30" BALSA CENTER SHEETING
3/32" X 1/4" BALSA CAP STRIPS
No.2 X 3/8" SHEET METAL SCREW
NYLON CONTROL HORN
DIE-CUT 1/8" PLY CONTROL HORN SUPPORT (CHS)
DIE-CUT 3/32" BALSA W6A
DIE-CUT 3/32" BALSA W8A
SILICONE CLEVIS RETAINER
NYLON CLEVIS
3/32" X 1" BALSA TE
2-56 THREADED ROD
NYLON FASLINK
DIE-CUT 1/8" BALSA MAIN WEB
DIE-CUT 1/8" PLY SERVO TRAY (ST)
DIE-CUT 3/32 BALSA SERVO TRAY SUPPORT (STS)
DIE-CUT 1/8" PLY W4A AND W5A
1/8" X 1/4" X 30" BASSWOOD SPAR
FIXED GEAR RAIL
3/32" X 3" X 30" BALSA LE SHEETING
SUB LEADING EDGE 1/16" X 3/4" BALSA
LEADING EDGE 1/4" X 3/4" BALSA
DIE-CUT 3/32" WING TIP B
DIE-CUT 3/32" WING TIP A
DIE-CUT 3/32" AILERON SUB LE (ALE)
1/4" X 3/4" X 10" BALSA LE
DIE-CUT 3/32" TE WEB (TEW)
DIE-CUT 1/8" BALSA MAIN WEB (MW)
HOBBICO MECHANICAL RETRACTS (OPTIONAL)
RETRACT GEAR RAIL
DIE-CUT 1/8" PLY WING JOINER (WJ)
WHEEL CUTOUT
2-1/4" WHEEL
DIE-CUT 1/8" PLY RETRACT SERVO MOUNT A, B AND C (RA RB RC)
WORK SURFACE
LAMINATED DIE-CUT 1/8" BALSA FIN TIP JIGS
RUDDER
FIN
CA HINGES
1/4" X 1/4" BALSA
1/8" X 1/4" BALSA
FIN TIP JIG DIE-CUT 1/8" BALSA
LAMINATED DIE-CUT 1/8" BALSA RUDDER HORN SUPPORT (HS)
BENT TAIL GEAR
1" TAIL WHEEL
LEFTOVER 3/32" BALSA
DIE-CUT 3/32" BALSA RADIO GEAR FLOOR (RF)
DIE-CUT 1/8" BALSA AFT FUSE TOP(AFT)
DIE-CUT 3/32" BALSA TURTLE DECK TOP (TDT)
1/4" X 1-1/2" BALSA
BALSA FILLETS
DIE-CUT 1/8" PLY CONTROL HORN SUPPORT
LAMINATED 1/16" X 1/4" BALSA
1/4" X 3/4" X 10" BALSA LE
FD1
FD2
TD1
TD2
TD3
TD4
F1
F2
F3
F4
F5
O.S. .70 SURPASS SHOWN
GP10 300cc
DIE-CUT 1/8" PLY FORWARD FUSE SIDE(FFS)
DIE-CUT 1/8" PLY FUSE DOUBLER (FD)
1/8" X 1/4" BALSA
DIE-CUT 1/8" PLY BOLT PLATE (BS)
DIE-CUT 1/8" PLY FUSE SUPPORT (FS)
FUSELAGE SIDE VIEW
LEFT FUSE SIDE AND ALL SHEETING REMOVED FOR CLARITY
DIE-CUT 1/8" BALSA AFT FUSE SIDE (AFS)
1/8" X 1/2" BALSA
DIE-CUT 1/8" PLY FUSE FORMER (F2A)
DIE-CUT 1/8" PLY RETRACT SERVO MOUNT A, B AND C (RA RB RC)
RETRACT SERVO (OPTIONAL)
DIE-CUT 1/8" PLY BOLT PLATE (BP)
DIE-CUT 1/8" PLY AFT FUSE BOTTOM (AFB)
1/4-20 NYLON WING BOLT
1/4" WING DOWEL
BALANCE RANGE
NO.6 WASHER
.40 - .70 ADJUSTABLE ENGINE MOUNT
6-32 X 3/4" MACHINE SCREW
CONTROL THROWS:
SURFACE HI RATE LOW RATE
Elevator: 9/16" up 5/16" up
Elevator: 9/16" down 5/16" down
Rudder: 1" left 5/8" left
Rudder: 1" right 5/8" right
Aileron: 7/16" up 1/4" up
Aileron: 7/16" down 1/4" down
CENTER OF GRAVITY:
Measured Where Wing Meets Fuselage:
3-3/4" Measured back from Leading Edge
(total range: 3-1/4" to 4-1/8")
INCIDENCES:
Wing: 0 degrees
Stabilizer: 0 degrees
Engine: 2 degrees right
Engine: 0 degrees down
FUSELAGE BOTTOM VIEW
ALL BOTTOM SHEETING REMOVED FOR CLARITY
DIE-CUT 1/8" PLY TANK RETAINER (TR)
DIE-CUT 1/8" PLY PUSHROD SUPPORT (PS)
DIE-CUT 1/8" PLY FORWARD FUSE TOP (FFT)
O.S. LA 40 SHOWN
3/32" X 3" X 24" BALSA TURTLE DECK SHEETING
1/8" X 3" X 24" BALSA FRONT DECK SHEETING
DIE-CUT 1/8" PLY FORWARD FUSE TOP (FFT)
CROSS-SECTION AT FORMER F1
CROSS-SECTION AT FORMER F2
CROSS-SECTION AT FORMER F3
CROSS-SECTION AT FORMER F4
CROSS-SECTION AT FORMER F5

B