# PT-20™ MKII the perfect trainer

# PT-40™ MKII the perfect trainer

MADE IN USA

## *Instruction Manual*

**WARRANTY**

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

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

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

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

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

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

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

GREAT PLANES® MODEL MANUFACTURING COMPANY
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PT24P03 V1.2 Printed in USA

# Table of Contents



***IF YOU DON'T READ ANYTHING ELSE...BEFORE YOU BEGIN CONSTRUCTION, PLEASE READ THIS:***

We realize there is a lot to read between the cover and step one where you finally start gluing parts together (we wrote it all). Please do not be tempted to just "skim over" this preliminary reading material – it contains very important information. Other manufacturers' instructions may be shorter, but in the end you'll be glad we gave you the extra information. It is important to get started on the right foot if you are to build and fly your PT successfully – the rest of your modeling "career" depends on it! Our suggestion is to forget about building until you have **carefully studied** this preliminary information and skimmed through the construction portion of the manual. The PT is not at all a difficult model to build but a methodical, patient outlook is the correct approach to take – and following this advice is a good place to begin.

## *Protect Your Model, Yourself & Others...Follow This Important Safety Precaution*

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

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

***To make your R/C modeling experience totally enjoyable, we recommend that you get help from an experienced, knowledgeable modeler with assembly and 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 can also contact the national Academy of Model Aeronautics (AMA), which has more than 2,300 chartered clubs across the country. Through any one of them, instructor training programs and insured newcomer training are available.

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

***Academy of Model Aeronautics***
5151 East Memorial Drive
Muncie, IN 47302
Office: (317) 287-1256
Toll Free: (800) 435-9262
Fax: (317) 741-0057

## *INTRODUCTION*

Thank you for purchasing the Great Planes PT, the Perfect Trainer, for possibly your first step into the exciting world of R/C flying. If you aspire to progress in the hobby and are using the PT as a "stepping stone" to more advanced models, then you've made the right decision in not only choosing an all wood kit, but choosing the PT – a kit that will teach you many of the building skills required for your next model. With its **"Expert Tips"** and thorough, detailed instructions, this manual encourages you to "exercise and develop" your building skills which will be of great value in the future. Although your PT is intended as a trainer, you'll probably find that long after you've completed it and "moved on" to other models, you'll dust the PT off and take it out for a few flights every now and then. A good high wing trainer such as the PT is always a joy to fly no matter what your skill level. After all, an airplane so easy to takeoff, fly and land is a real confidence booster!

The PT family of trainers has been around for more than a decade. As just about any old pro will tell you, no other trainer model offers so many important features most needed by a novice. While R/C flying can be learned by practically anyone, it does require a fair amount of hand-eye coordination – a skill that can only be learned by quality "stick time." This is where the PTs shine. They are all designed to be rugged, stable and self-recovering and to fly slowly enough to allow you time to think about your next maneuver.

Once your PT has been trimmed for straight and level flight (by an experienced pilot) you will be able to get out of most situations by simply letting go of the sticks on your transmitter. The PT will normally level its own wings and resume stable flight within 50 - 100 feet. This feature alone has helped many student pilots master the basics in the shortest possible time.

The PT is designed for either 3 or 4-channel operation with two different wing setups (see Wing Configuration on page 4 for further details). You can start with just rudder, elevator and throttle control, then add a fourth servo for the ailerons when you want to refine your skills. The ailerons may be locked in a neutral position after the wing is assembled, but can be hooked up in just a few minutes with an additional servo. We recommend the 3-channel setup for beginners. Due to the dihedral (upward angle of the wing) built into the wing and generous rudder size, the turn and bank response is almost identical to using ailerons. When you are ready to move up to advanced maneuvers such as crosswind landings and basic aerobatics, all you have to do is hook up the ailerons.

If you are already an experienced pilot who is just looking for a sport model for those lazy summer afternoons, we provide the necessary information to build the wing with less dihedral and washout to allow more responsive flight characteristics. Our goal is for you to experience the fun and satisfaction that thousands of modelers the world over enjoy, without the mistakes that have spoiled the hobby for some.

## *Important Note About this Manual*

***Both the PT-20 and 40 are built from this manual.*** Nearly all the parts in the PT series are identical so most of the differences are only in the sizes and thicknesses of the pieces – you can't even tell from most of the photos. When important differences do arise between the 20 and 40, they are clearly indicated so you'll have all the information you need to build your model.

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

## DECISIONS YOU MUST MAKE

**Engine Selection**
There are many engines that will work well in your PT. For the PT-20 we recommend a 2-stroke sport engine such as the O.S.® .20 or .25 FP, or the .25 FX (high performance). Generally, most beginners start out with a 2-stroke engine but for some of those who are a little more ambitious and "must have" the sound of a 4-stroke, the O.S. .26 FS is a good choice.

For the PT-40 we recommend a 2-stroke sport engine such as the O.S. .35 or .40 FP, or the .40 or .46 FX (high performance). If you choose the 4-stroke option, the O.S. .40 or .48 FS is a good choice. Super Tigre™ also offers the G-40 and G-45 sport engines.

Your dealer will be able to help decide which engine is the best choice but basically, the O.S. FP series has proven to be the highest quality yet most economical choice. The O.S. FX series and the Super Tigre G series are higher performance engines and might be a little overkill for a trainer but would be good powerplants for sport models you may build in the future.

4-Stroke engines are neat because they provide a realistic sound (realism is generally not a requirement for a trainer, mind you), are generally quieter than a 2-stroke and appeal to those who are a little more technically or mechanically minded. 4-Stroke engines do cost more and require a little more care than a 2-stroke. If you use a 4-stroke in your PT you will have to relocate the throttle pushrod exit location on your firewall **so plan ahead.**

**Wing Configuration**
You have a choice in the type of wing to build – the trainer **("A-wing")** or the sport **("B-wing")**. The A-wing has more dihedral than the B-wing and will allow your PT to fly just great as a 3-channel model without functioning ailerons. We show you how to build the ailerons but "lock" them down. You can always hook them up later. Building the A-wing without functioning ailerons saves you a little money (most four channel systems are sold with three servos) and building time. If the PT is your first R/C model we strongly **(that's strongly)** recommend that you build the A-wing with more dihedral. If you build the sport wing you will lose the full benefit of the self-recovery features of the PT – features that will help you solo faster and safer.

With the lower dihedral angle of the B-wing you may still fly your PT without functioning ailerons, but it performs best with ailerons – this configuration will suit intermediate and sport flyers.

You also have the option of securing the wing to the fuselage either with **nylon bolts or rubber bands.** The hardware is furnished in the kit for both options. If this is your first kit we recommend that you go with the rubber band method. **Rubber bands offer two advantages over bolts:** First, the model is easier to build. Second (this is the important one), rubber bands allow the wing to shift if your wing tip contacts the ground (or an obstacle) upon takeoff or landing. Bolts are less forgiving in this respect, and even a minor whack can cause enough damage to send your PT back to the shop for repairs.

## PREPARATIONS

### Accessories Required to Complete Your PT-20

- ❑ 4-Channel radio with 3 or 4 servos; ***see Wing Configuration Section***.
- ❑ Engine; ***see Engine Selection***
- ❑ Spare Glow Plugs (O.S. #8 for 2-stroke engines, OSMG2691), (O.S. #F for 4-stroke engines, OSMG2692)
- ❑ Propeller (Top Flite® Power Point®); Refer to your engine's instructions for proper size
- ❑ Top Flite Super MonoKote® Covering (Approximately 2 rolls); ***see Covering***
- ❑ Medium Fuel Tubing (GPMQ4131, 3')
- ❑ 1/4" Latex Foam Rubber Padding (HCAQ1000)
- ❑ 1/16" Foam Wing Seating Tape (GPMQ4422)
- ❑ 4 or 6 oz. Fuel Tank (4 oz. GPMQ4101), (6 oz. GPMQ4102)
- ❑ (1) 2" Nose Wheel (GPMQ4221)
- ❑ (2) 2-1/4" Main Wheels (GPMQ4222)
- ❑ (6) 5/32" Wheel Collars (GPMQ4306, pkg. of 4)
- ❑ Fuelproof Paint; ***see Finishing***
- ❑ 2" Spinner (GPMQ4510 - white)
- ❑ #64 Rubber Bands - optional (HCAQ2020); ***see Wing Configuration***

## Accessories Required to Complete Your PT-40

- ❑ 4-Channel Radio with 3 or 4 Servos; ***see the Wing Configuration section***
- ❑ Engine; ***see Engine Selection***
- ❑ Spare Glow Plugs (O.S. #8 for most 2-stroke engines, OSMG2691), (O.S. #F for 4-stroke engines, OSMG2692)
- ❑ Propeller (Top Flite Power Point); Refer to your engine's instructions for proper size
- ❑ Top Flite Super MonoKote covering (Approximately 2 rolls); ***see Covering***
- ❑ Medium Fuel Tubing (GPMQ4131, 3')
- ❑ 1/4" Latex Foam Rubber Padding (HCAQ1000)
- ❑ 1/16" Foam Wing Seating Tape (GPMQ4422)
- ❑ 6 or 8 oz. Fuel Tank (6 oz. GPMQ4102), (8 oz. GPMQ4103)
- ❑ (1) 2-1/4" Nose Wheel (GPMQ4222)
- ❑ (2) 2-1/2" Main Wheels (GPMQ4223)
- ❑ (4) 3/16" Wheel Collars (GPMQ4308)
- ❑ (2) 5/32" Wheel Collars (GPMQ4306)
- ❑ 2-1/4" Spinner (GPMQ4515 - white)
- ❑ #64 Rubber bands - optional (HCAQ2020); ***see Wing Configuration***

## Suggested Supplies and Tools

These are the building tools, glues, etc. that you will need to complete your PT-20 or PT-40.

We recommend Great Planes Pro™ CA and Epoxy

- ❑ 2 oz. Thin CA (GPMR6003)
- ❑ 2 oz. Medium CA+ (GPMR6009)
- ❑ CA Applicator Tips (HCAR3780)
- ❑ Accelerator (GPMR6035)
- ❑ 30-Minute Epoxy (GPMR6047)
- ❑ #1 Hobby Knife Handle (XACR4305)
- ❑ #11 Blades (HCAR0311, 100 qty.)
- ❑ Razor Saw
- ❑ X-Acto® (or similar) Building Square (XACR7726) or Building Triangle (XACR7725)
- ❑ Medium T-Pins (HCAR5150)
- ❑ Waxed Paper
- ❑ Masking Tape
- ❑ Electric Power Drill
- ❑ Drill Bits: 1/16", 5/64" (or #47), 3/32", 1/8", 5/32", 3/16", #10 (or 13/64"), 15/64" (or 7/32"), 1/4", 17/64"
- ❑ Pliers
- ❑ Scissors
- ❑ Straightedge
- ❑ String
- ❑ Masking tape
- ❑ Screwdrivers (Phillips and Flat Blade)
- ❑ Bar Sander or Sanding Block and Sandpaper (coarse, medium, fine grit); ****see the following Expert Tip***
- ❑ HobbyLite™ Balsa Filler (HCAR3401)
- ❑ Sealing Iron (TOPR2100)

### 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 lightweight, rigid, extruded aluminum and can be found at most hobby shops. They are available in three sizes – 5-1/2" (GPMR6169), 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 of 5-1/2" long strips (GPMR6189) for the short bar sander. The adhesive-backed sandpaper is easy to apply and remove from your sanding bar 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.

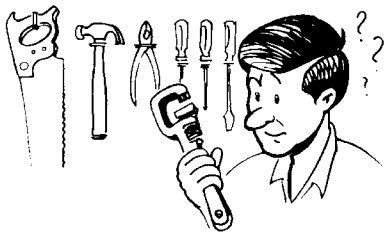
## Optional (but highly recommended) supplies and tools

We've listed the following items separately as they are not absolutely required for you to complete your PT, but these items will facilitate some of the building procedures or provide better results. These are items that you will surely acquire as you progress in the hobby anyway. Don't worry, even veteran modelers take time to accumulate all the tools

they'll need to do the best job possible. In some instances it may not be clear exactly what the optional item is used for so, where appropriate, we've listed the page number and/or the step where that item is used. While you're shopping, you can reference the manual and decide ahead of time whether not to make the additional purchase.

- ❑ 6-Minute Epoxy (GPMR6045) see page 7
- ❑ 1 oz. Thick CA- (GPMR6014) see page 7
- ❑ Epoxy Brushes (GPMR8060)
- ❑ Epoxy Mixing Sticks (GPMR8055, qty. 50)
- ❑ CA Debonder (GPMR6039)
- ❑ T-Pins (HCAR5100 - small, HCAR5200 - large)
- ❑ Hot Sock™ (TOPR2175) ***see page 41, Cover the Structure***
- ❑ Trim Seal Tool (TOPR2200) ***see page 41, step B, Expert Tip – Covering Technique***
- ❑ Heat Gun (TOPR2000)
- ❑ Single Edge Razor Blades (HCAR0312, 100 qty.)
- ❑ Razor Plane (MASR1510) ***see page 14, step B, Expert Tip***
- ❑ Z-Bend Pliers (HCAR2000) ***see page 23, step 3***
- ❑ Straightedge (Fourmost Non Slip FORR2149)
- ❑ 3/16" dia. Antenna Tube (GPMQ3710 - or similar) ***see page 18, step 9***
- ❑ 1/8" Brass Tube, ***see page 38, step 17***
- ❑ Denatured or Isopropyl Alcohol (for epoxy clean-up)
- ❑ Dremel® MultiPro™ Tool or similar w/Sanding Drum, Cutting Burr and Cut-off Wheel

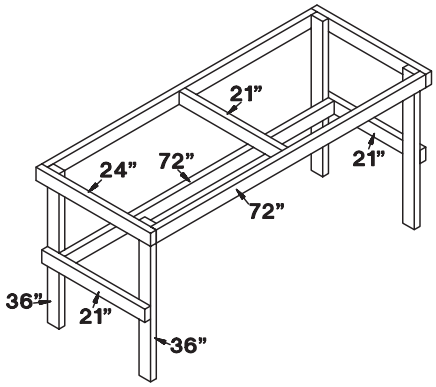
## *Setting Up Shop*



If this is your first model there are a few necessary supplies and tools that you should gather before going any further. The single most important item that is required for any modeling project is a **flat** work surface. The kitchen table is generally not a good idea. A space where you can work, leave stuff out, make a mess, spill glue and paint without worry, and has adequate ventilation is ideal. Hey, the garage sounds like a good place!

A workbench can be as simple as a solid flat table or made from some two-by-fours and a solid core door. Hollow core interior doors work fine, but the cheaper ones are prone to warping.

Here is a suggested approach for building an inexpensive workbench. You will need (7) 6' - two-by-fours of good quality pine or fir, a 30" x 82" door, some 16d (penny) common nails, a handsaw and a hammer.




**WORKBENCH FRAME**

**Assemble the workbench as follows:**

1) Cut one two-by-four into three sections, two 24" long and one 21" long.

2) Nail the 24" pieces to the two ends of two straight 6' pieces to make the frame for the top. Nail the 21" piece in between the two 6' pieces across the center of the frame.

3) Cut two two-by-fours in half to make four 36" legs. Nail (or bolt) the four legs to the frame with the 2" side facing the long sides of the frame.

4) Cut two 21" side rails from one of the remaining boards. Nail the two boards to the sides of each pair of legs.

5) Nail the last 6' board to the front side of the back legs, level with the two side pieces. One-by-three cross braces may be nailed to the back legs for more rigidity.

6) Center the door on the frame and either glue or use double sided foam back sticky tape to hold it in position.

You will need to cover your work surface with something you can push pins into. The back side of a 2' x 4' sheet of ceiling tile makes a great building surface, or if you want to cover a larger area you can buy a 4' x 8' sheet of Celotex insulation board from your local building supply store.

Most of the tools listed previously can probably be found around the house. A few items like a razor saw, hobby knife, sealing iron, heat gun and glues can be purchased at your hobby dealer. As you get more involved with the hobby you will probably want to add a few power tools such as a Dremel tool, belt sander and a scroll saw, but in the case of the PTs, everything you need has already been covered.

## Building Notes

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

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


#4 x 5/8" Sheet Metal Screw

For example #4 x 5/8".

**Machine screws** are designated by a number **(threads per inch)** and a length.


4-40 x 3/4" Socket Head Cap Screw

For example 4-40 x 3/4".

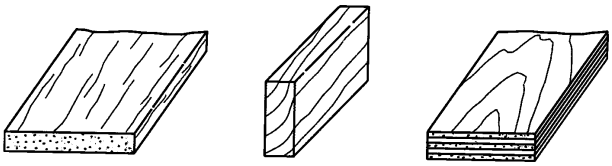
• When you see the term **"test fit"** in the instructions, it means you should first position the part on the assembly **without using any glue,** then slightly modify or "custom fit" the part as necessary for the best fit.

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

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

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

## Types of Wood



**Balsa** **Basswood** **Plywood**

## The What and How of Adhesives

**Cyanoacrylate** or CA glue has changed the way models are built more than any other advance in modeling technology. In the good ol' days, model cement like Ambroid, Duco, Comet and Sigment were the glues of choice. They all had a strong odor that could cause dizziness, dried slowly (compared to CA) and became brittle with age. CA, on the other hand, is stronger, works almost instantly and is bottled in three different viscosities (thicknesses). CA is used for most glue joints, except where epoxy is specified. CA does emit rather strong fumes (some say it's like tear gas) as it cures, so rule number one is to **work in a well ventilated area.**

**All CA glues work best if the joints are smooth and the parts fit well.**


**Thin CA** is also known as plain **CA.** This is the instant variety, used for most initial assembly and tack gluing. Thin CA is usually "wicked" into a tightly fitting joint by putting a few drops on the seam, then holding the parts together while the CA penetrates and bonds the parts. When gluing plywood or hardwood, a mist of accelerator (see page 8) will help the CA work a little better.


**CA+** is also known as **medium** or **gap filling** CA. **CA+** is used for surface gluing, filling small gaps between poorly matched parts and for general purpose applications. It cures slower than thin CA, allowing you to apply a bead to two or three parts before assembly. Also, because it cures slower than thin CA, it penetrates the wood for a stronger bond. Curing time without accelerator is 20 - 30 seconds.


**CA-** or **thick** CA is used when extra positioning time is needed. CA- is a great gap filler and is also used to make fillets when a little extra strength is required. Curing time is about 1 - 2 minutes.


**Accelerator** is a liquid chemical for use in speeding up the cure time of all CA types. It should be **misted** on, not sprayed heavily on the joint. A typical use of accelerator is to spray a light mist on a fillet of thick or medium CA to prevent it from running or dripping. Another use of accelerator is to "prime" **one** of the parts you are joining before you apply the CA, then add thick or medium CA to the part that has not been primed. The CA will cure immediately when the parts contact each other, so be careful as **this leaves no time for positioning.**

There are special instances where this method comes in handy but we do not suggest you build your entire model in this manner. Sometimes, when you glue a joint with thin CA, the CA is so thin that it is drawn deep into the wood and away from the glue joint. This can be prevented by first priming the joint with accelerator, then adding thin CA. The CA will cure "on the spot" before it has a chance to be drawn away from the joint.

During the later stages of construction be aware of areas that you may have sprayed with accelerator. Often times, residual accelerator, even if sprayed on hours before, may cause the CA on a nearby joint to cure prematurely and unexpectedly – it's pretty potent stuff!

Overuse of accelerator may cause CA to bubble and sometimes change color. A drawback to accelerator can be that the CA cures before it has time to fully penetrate the wood, so it should only be used sparingly – only when necessary. For future reference, keep accelerator away from clear canopies and other plastic parts such as cowls and wheel pants. Accelerator will "fog" the butyrate plastic that most canopies are made from and can cause the ABS plastic that many cowls are made from to soften.

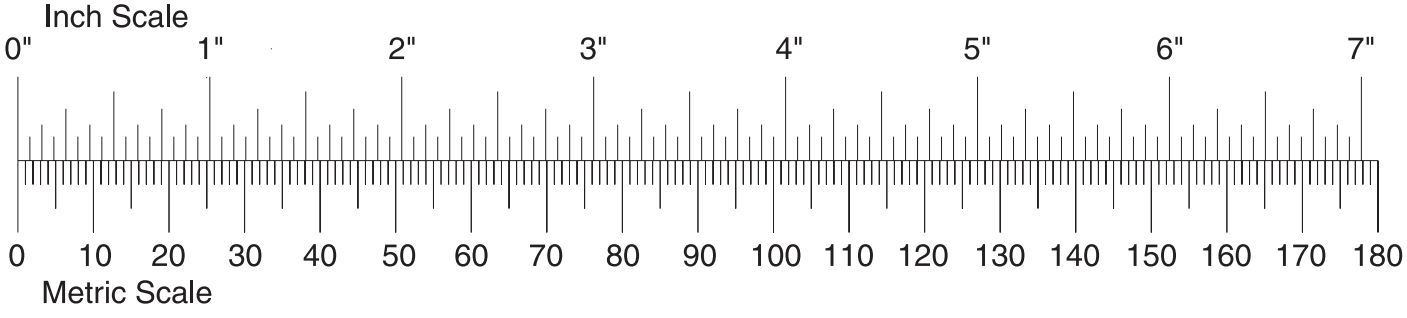
***A word about safety!***

After applying CA, step back or look away from the work to avoid the puff of vapors. All CA glues will bond skin almost immediately. If this should happen, CA Debonder (available from your hobby dealer) or acetone fingernail polish remover will dissolve the CA if allowed to soak into the bond for a few minutes. Don't use vigorous means to separate a skin bond. **Never** point the CA applicator tip toward your face and be especially careful when opening a clogged tip. In case of eye contact, flush thoroughly with water, then seek medical attention, **but don't panic. Please, keep CA (and all other modeling chemicals) out of the reach of children.**

**Epoxy**

Great Planes has several Epoxy formulations available for the modeler. The two most often used epoxies are 6-minute and 30-minute. Both offer exceptional strength and good working times. We recommend that you use epoxy when the joint requires exceptional strength, such as when installing the firewall, when joining the wing panels and when installing wing hold-down blocks. As with most epoxies, you mix equal parts of resin and hardener, stir well, then apply a thin film to each part. Parts should be clamped, pinned, taped or weighted in place until fully cured. Before the epoxy cures, clean off any excess with a paper towel. A word of caution about mixing epoxy – don't use extra hardener in the hopes of making the mixture harder or work faster. Just about all epoxies work best with exactly a 50/50 mixture. When you increase the amount of hardener you run the risk of causing the cured epoxy to become either brittle or rubbery – neither being as strong as a properly mixed batch.

## *Metric Conversion*




**6-Minute epoxy** is used for simple, small gluing operations where elaborate alignment is **not** required. Working time (before it's too gooey to use) is about 5 minutes, handling time 15 minutes and it's fully cured in about 1 hour.


**30-Minute epoxy** is used for extra strength (because it can penetrate longer) and where several parts must be aligned and checked before it cures. Working time is about 25 minutes, handling time 2 hours and it's fully cured in 8 hours.


**45-Minute epoxy** offers plenty of responding time plus incredible strength. It is ideal for sheeting balsa wood to foam core wings and other high stress areas. Working time is about 45-50 minutes, handling time 2 hours and it's fully cured overnight.


Great Planes Pro Wood Glue is an Aliphatic resin glue that works well on all types of wood. It is non-toxic, virtually odorless and dries clear. Some people are sensitive to the fumes and sanding dust derived from CA, so this is a good alternative for general modeling use. Its only drawback is that it is slow to cure, requiring the parts to be securely clamped, pinned or taped while the glue dries. In some cases this is an advantage as it allows plenty of time for accurate positioning of parts. For future reference, aliphatic resin also sands easier than CA and is ideal for joining wing sheeting planks.

*Okay, you've got your work space ready, your tools are at hand and you know how to choose and use the right glue for the job. Let's get started!*

## Get Ready to Build

❑ 1. Unroll the plan sheets. Reroll the plans inside out to make them lie flat.

❑ 2. Remove all parts from the box. As you do, figure out the name of each part by comparing it with the plans and the parts list included with this kit. Using a felt-tip or ballpoint pen, lightly write the part name or size on each piece to avoid confusion later. Use the die-cut patterns shown on pages 10 and 11 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.

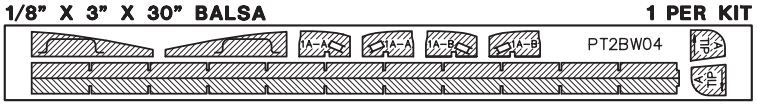
❑ 3. As you identify and mark the parts, separate them into groups, such as fuse (fuselage), wing, fin, stab (stabilizer) and hardware.

### EXPERT TIP

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

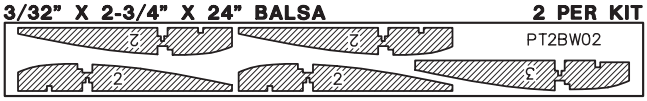
# DIE-CUT PATTERNS FOR PT-20

1/8" X 3" X 30" BALSA — 1 PER KIT




PT2BW04

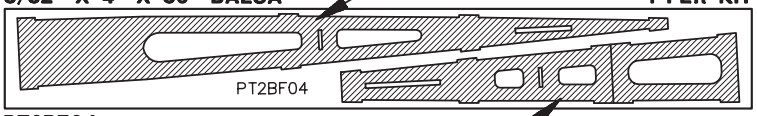
3/32" X 2-3/4" X 24" BALSA — 2 PER KIT




PT2BW02

AFT FUSE BOTTOM

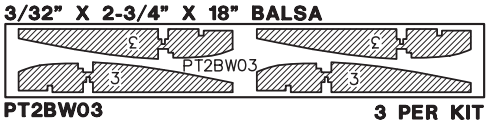
3/32" X 4" X 30" BALSA — 1 PER KIT




PT2BF04

AFT FUSE TOP

3/32" X 2-3/4" X 18" BALSA




PT2BW03 — 3 PER KIT

AFT DOUBLER

3/32" X 4" X 30" BALSA — 2 PER KIT

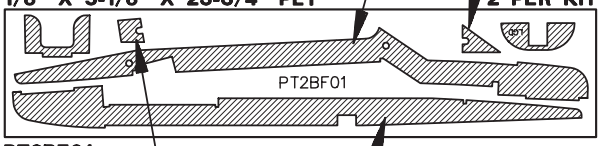

PT2BF05

CABIN FILLER

FRONT TRIPLER

UPPER FUSE DOUBLER

1/8" X 5-1/8" X 23-3/4" PLY — 2 PER KIT




PT2BF01

REAR TRIPLER

LOWER FUSE DOUBLER

3/32" X 3-1/2" X 12" BALSA

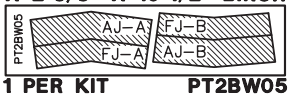

PT2BF08 — 1 PER KIT

1/8" X 2-3/4" X 9" BALSA


PT2BF09 — 1 PER KIT

WINDSHIELD

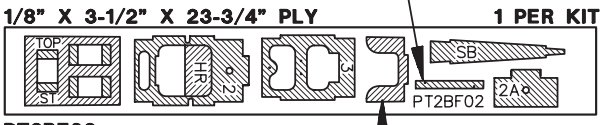
1/8" X 2-5/8" X 10-1/2" BIRCH PLY




1 PER KIT — PT2BW05

DRILL JIG

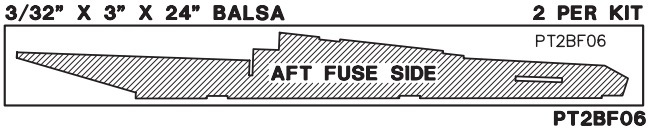
1/8" X 3-1/2" X 23-3/4" PLY — 1 PER KIT




PT2BF02

WING BOLT PLATE

3/32" X 3" X 24" BALSA — 2 PER KIT

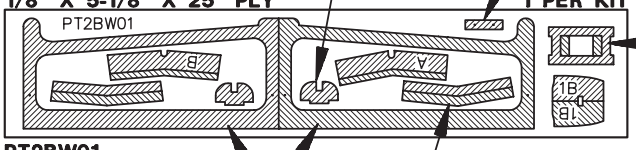



PT2BF06

AILERON SERVO TRAY SUPPORT

AILERON LOCK

1/8" X 5-1/8" X 25" PLY — 1 PER KIT




AILERON SERVO TRAY

PT2BW01

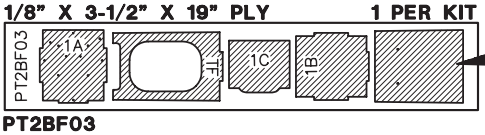
WING TIP JIGS

CENTER JOINERS

3/32" X 2-3/4" X 24" BALSA — 2 PER KIT


PT2BF07

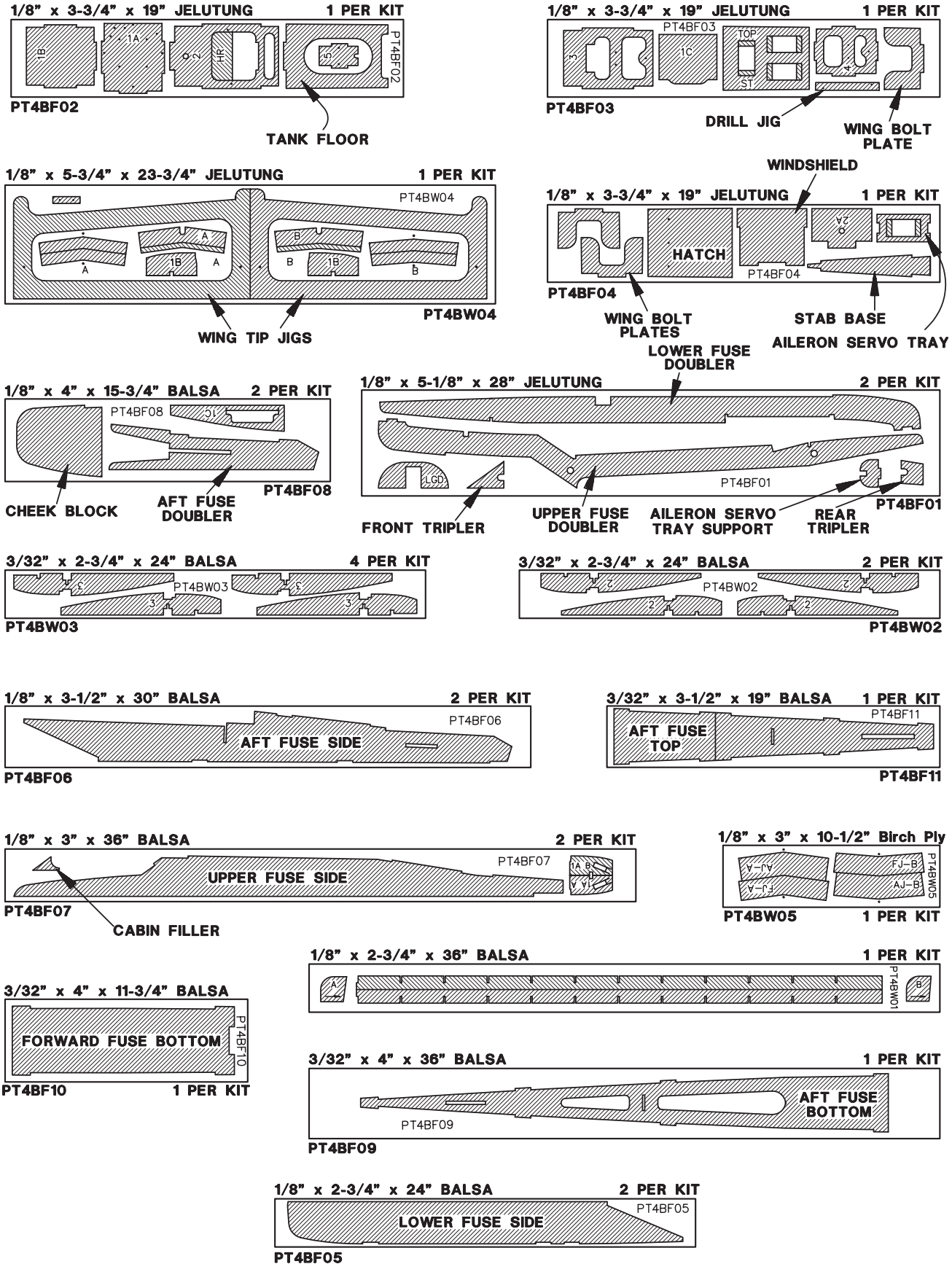
1/8" X 3-1/2" X 19" PLY — 1 PER KIT




HATCH

PT2BF03

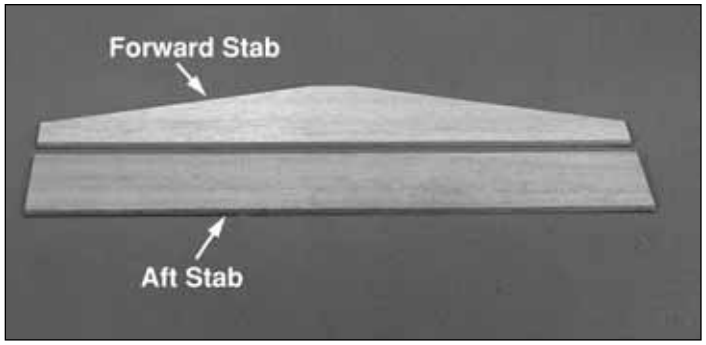
# DIE-CUT PATTERNS FOR PT-40



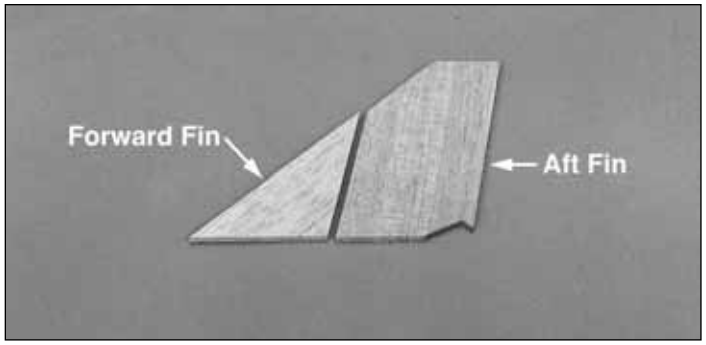
# BUILD THE TAIL SURFACES

## Build The Stabilizer and Fin

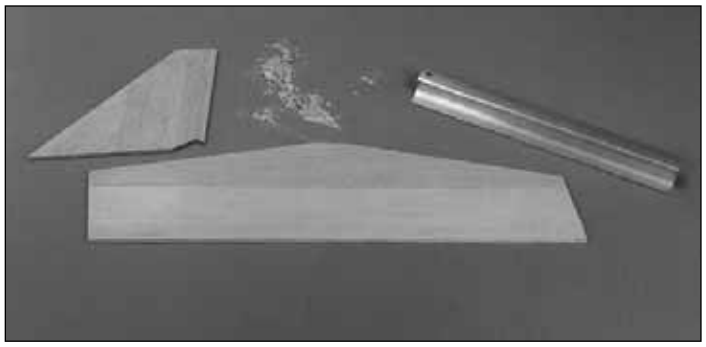
Work on a **flat** surface over the plans **covered with waxed paper.** Frequently refer to the plans to identify the parts and their locations.




❑ 1. Locate the shaped balsa **forward** and **aft stab.** Check their fit and sand the mating edges if needed. Apply a light bead of medium CA to the mating edges and glue them together. Immediately wipe away any excess CA before it cures.




❑ 2. Locate the shaped balsa **forward** and **aft fin.** Check their fit and sand the mating edges if needed. Work over the plans (don't forget the waxed paper), then glue the two parts together as you did the stab parts. Immediately wipe away any excess CA from the surface before it cures.



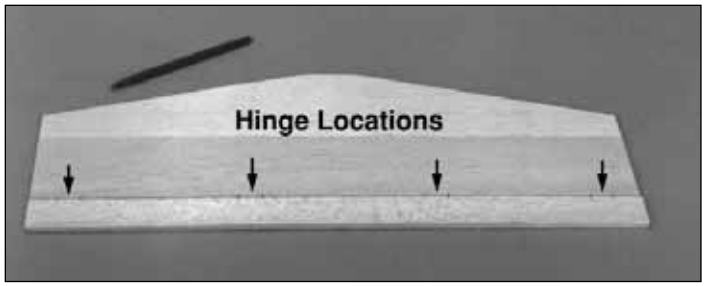
❑ 3. See the **Expert Tip** that follows, then sand the stab and fin flat and smooth with sharp 220-grit sandpaper and your bar sander or a sanding block.

**EXPERT TIP**

It is more important to keep the thickness of the entire stab and fin **constant** than it is to completely eliminate the glue joint. Don't spend too much time sanding **in one particular** spot where the seam might not be perfect – otherwise that area of the stab or fin will become thinner than the rest. This is a little more important on the PT-20.

## Hinge The Elevator and Rudder

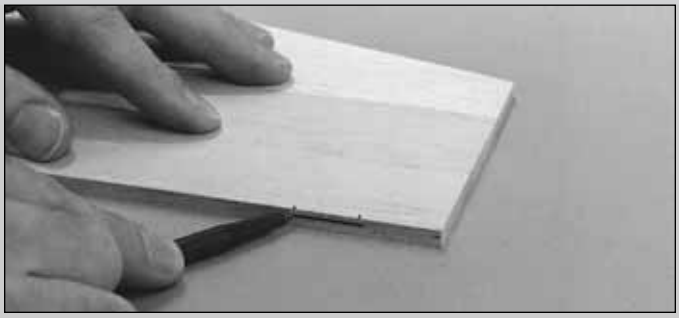
**Note:** One of the best ways to enhance the finish and appearance of your model is to do a good hinging job. Properly aligned hinge slots and secure hinges will eliminate problems at the flying field. Follow these instructions and take your time in order to avoid crooked or misaligned hinge slots that can lead to tight control surfaces or loose hinges.




❑ 1. Locate the balsa **elevator** (refer to the plan for size and shape). Use a ballpoint pen to lightly mark the location of the hinges on the stab and the elevator where they are shown on the plan.

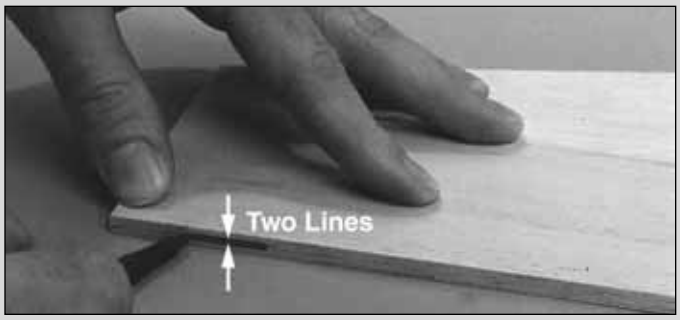
❑ 2. Refer to the **Expert Tip** below and mark the location of **each hinge** slot on the trailing edge of the stab.

**EXPERT TIP**

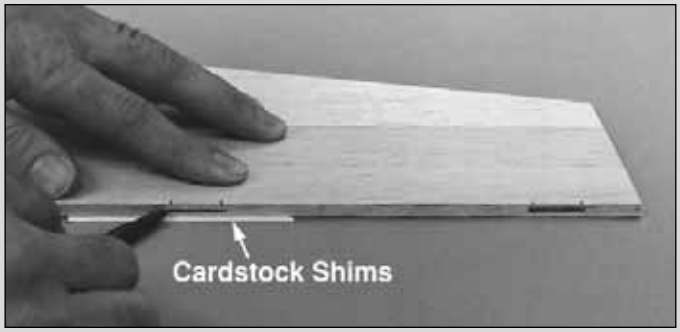


**HOW TO DRAW A CENTERLINE**

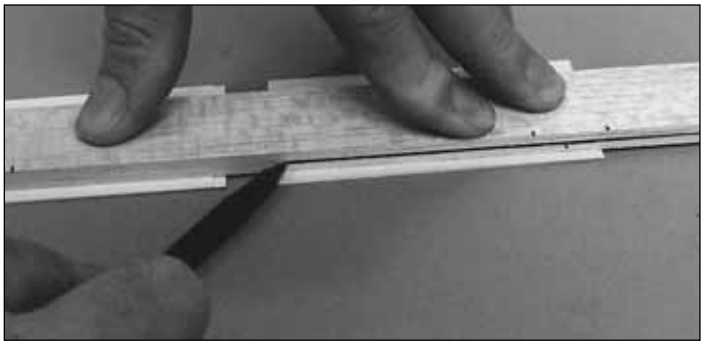
A. Place the part on a flat surface and draw a line approximately 1" long with a ballpoint pen (a Bic Stik works well).




B. Confirm that the line you have drawn is **on center** by flipping the part over and drawing a second line over the first. If the line is on center, you will see only one line. Draw a centerline at each hinge location. If you see two lines (as in the photo) go to step C.

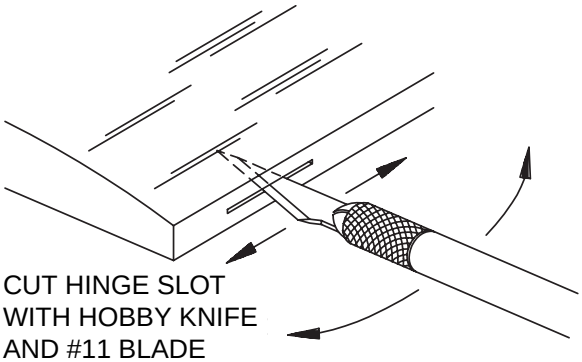



C. Place shims such as business cards or playing cards under the stab until you can mark the centerline.



❑ 3. Use the same procedure to mark the centerline on the **entire length** of the leading edge of the elevator.


❑ 4. 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. This first cut will establish the **location** of the hinge slot, so concentrate on staying on the centerline and **don't cut too deep!**


❑ 5. Make three or four more cuts on the same line, **going slightly deeper each time.** As you make these additional cuts, go straight into the wood. Continue this process while **"wiggling"** the knife handle from side to side until the blade has reached the proper depth for the hinge.

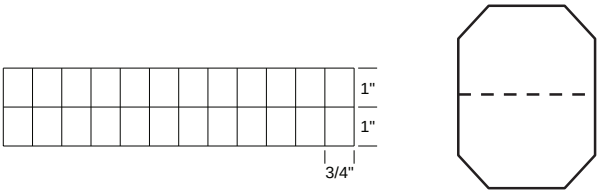
❑ 6. Refer to the **Expert Tip** below and sand the LE of the **elevator** and **rudder** to a "V" as shown on the plans. Leave the TE of the stab and fin squared off.

**EXPERT TIP**


**HOW TO BEVEL THE LEADING EDGES**

A. Place the leading edge of the elevator on your work surface and use your ballpoint pen to mark a "bevel to" line on both sides about 3/32" high. **Note:** You will probably have to shim the elevator (similar to the way you did for drawing the hinging centerlines) so your bevel to line is not too far away from the leading edge.

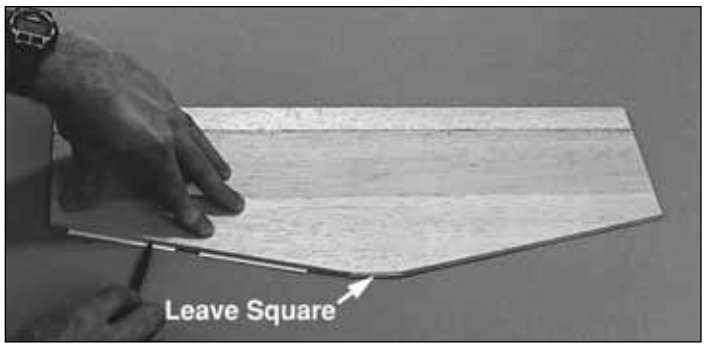

B. Use a razor plane or your bar sander with 150-grit sandpaper to make the “V” on the rudder and elevator. Use the “bevel to” lines and the previously drawn centerline as a guide to keep the angle of the “V” constant and centered.




❑ 7. Cut the **hinges** for the elevator and the rudder from the supplied 2" x 9" **hinge material,** then snip off the corners so they go into the slot easier. **Note:** If you are building the PT-20, make the hinge for the bottom of the rudder 3/8" wide.

❑ 8. **Temporarily** join the elevator to the stab with the hinges and widen any slots if required so they all match up.

❑ 9.Return to step 1 and use the same procedures to hinge the rudder and fin. **Note:** If you are building the PT-20, make the **bottom** hinge slot in the rudder 3/8" wide.

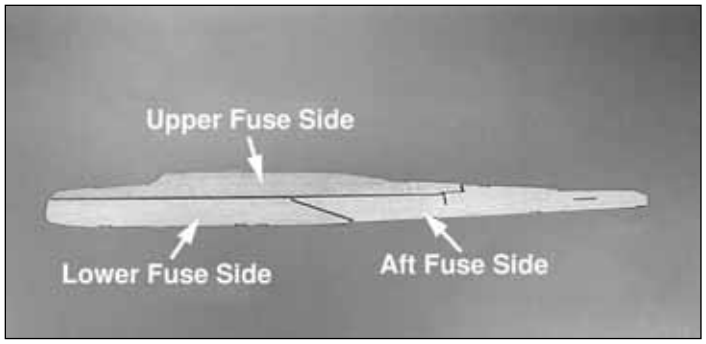


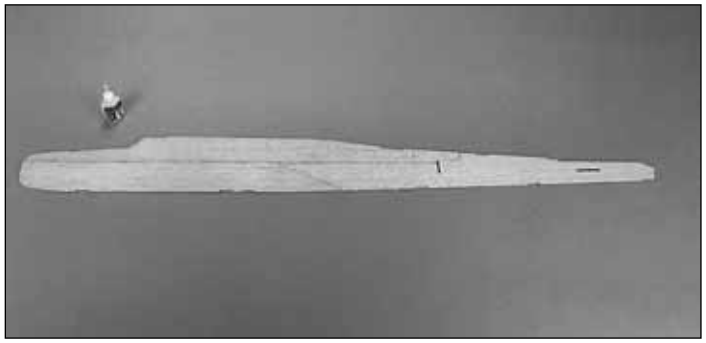

❑ 10. Use the same “centerline technique” you used when you made the hinge slots to mark the perimeter of the stabilizer and elevator. Round the perimeter of the stab and elevator with your bar sander and 220-grit sandpaper using the centerline as a guide. On the stab, keep the trailing edge and the “flattened-off” center portion of the leading edge square. Finish-sand the stab and elevator with 320-grit sandpaper. **Hint:** Leave the elevator attached to the stab during sanding so the ends will be rounded off the same.

***Congratulations!*** *You’ve made it through the first stage and if this is your first model you should be proud of yourself. You should also have learned a few “tricks of the trade” used by the guys that designed this kit. Remember, all of these helpful tips are the same methods that we use to build our award winning models and are tips that you can use and refine for future, more ambitious building projects!*

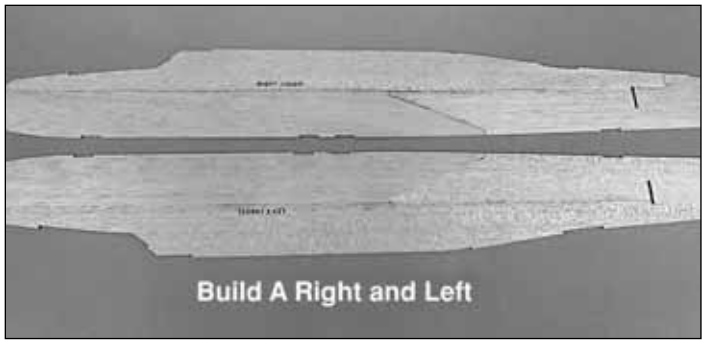
## BUILD THE FUSELAGE

### Preparation



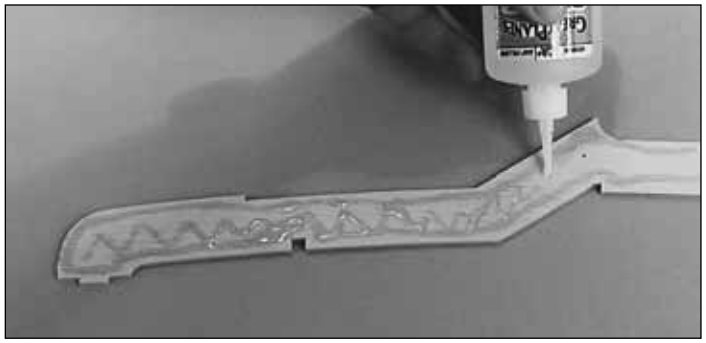
❑ 1. Test fit the die-cut balsa **fuse side** pieces as shown in the photo. Sand the edges as necessary for a good fit. When satisfied with the fit, make a fuse side using thin CA to glue the parts together over waxed paper. Make a **second** fuse side in the same manner. **Note:** It is easiest to first glue the **aft fuse side** to the **upper fuse side,** then glue the **lower fuse side.**




❑ 2. Examine the two fuse sides for blemishes, then position them on your workbench **exactly** as shown in the photo with the best-looking sides facing down. You must **build a right and a left side** so be sure that the sides are mirrored as you look at them. Mark the inside surfaces as "right" and "left."

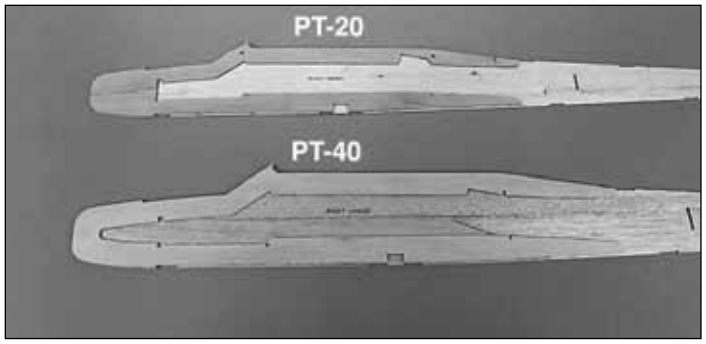
❑ 3. Lightly sand the edges of the die-cut 1/8" plywood upper and lower fuse doublers to remove any slivers or die-cutting irregularities.

**Work especially carefully during the following two steps.** You must **accurately** position the fuse doublers on the fuselage sides as this is the most critical step in building a straight fuselage.

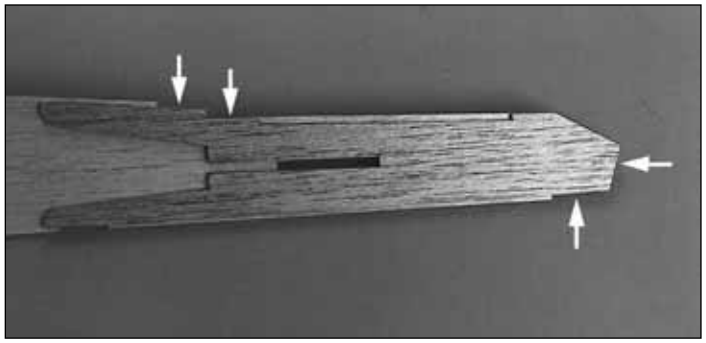


❑ ❑ 4. Still working over waxed paper, test fit, then glue a die-cut 1/8" plywood **upper fuse doubler** to the **inside** of the right fuselage side with medium CA. See the photo at step 6. The **top edge** of the doubler should align with the **top of the fuse side** at the wing saddle. The balsa side **behind the wing saddle** protrudes above the doubler by 3/32".

❑ ❑ 5. Test fit the **lower fuse doubler** in the notch of the top doubler with 3/32" of the balsa fuselage side showing below the doubler when it's properly aligned. Glue the lower doubler in position with medium CA the same way as you did the upper doubler. See the photo at step 6.

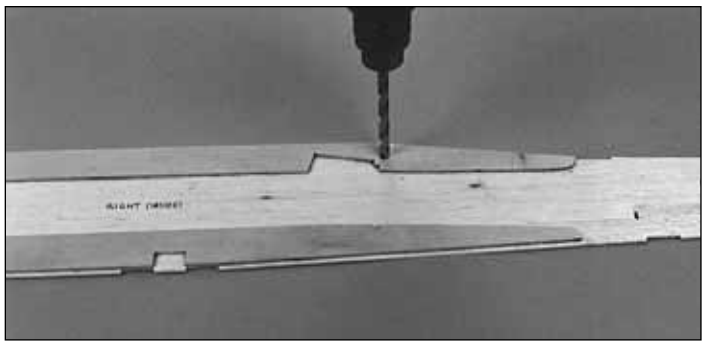



❑ 6. Repeat steps 4 and 5 to glue the doublers to the **inside** of left fuse side. **Be sure you are building a right and a left.**



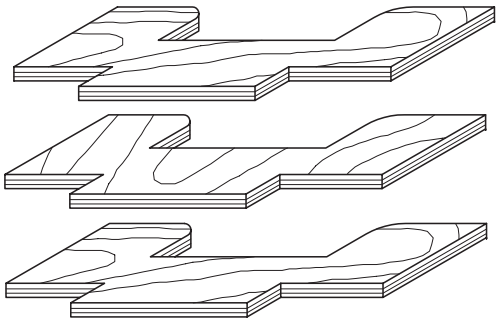
❑ ❑ 7. Test fit the die-cut balsa **aft fuse doubler** on the inside of the right fuselage side. The "steps" in the front and rear of the doubler should align with the fuselage side and the aft end of the doubler and the fuselage side should also align. Apply medium CA to the doubler, then glue it in position. Repeat for the other fuselage side.

**Skip step #8 if you will be using bolts to mount your wing.**

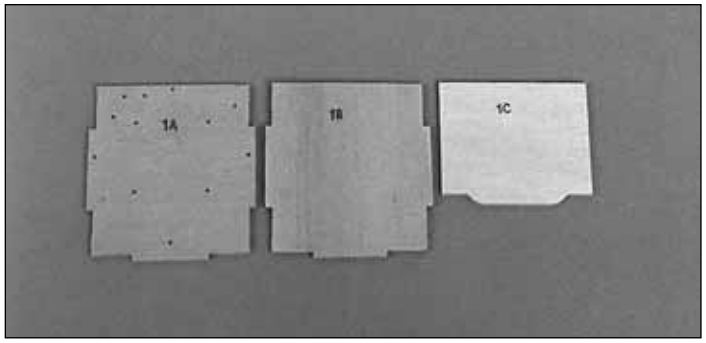


❑ 8. If you will be installing the dowels for rubber band wing attachment, drill 1/4" holes through the fuse sides at each punch mark in the upper doublers. Use a backup block of scrap wood under the fuse side to prevent splitting the balsa as the drill bit goes through (and to keep from drilling into your table).

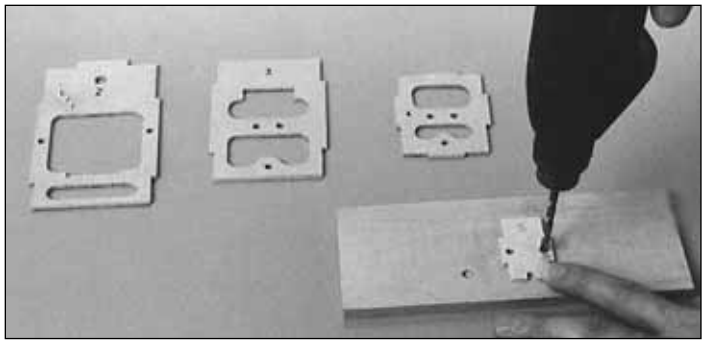
❑ 9. Locate the three die-cut 1/8" plywood firewall formers **F-1A, F-1B** and **F-1C** and the three die-cut 1/8" plywood **wing bolt plates. Note:** You need the wing bolt plates for strength even if you will be using rubber bands to attach the wing.



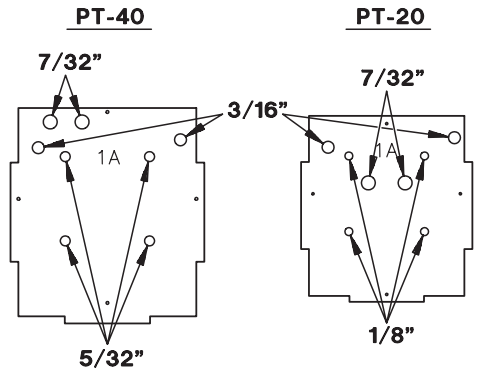
❑ 10. Notice that two pieces of the wing bolt plate assembly have grain running in one direction while the third piece has grain running opposite to the first two. The odd one goes in the center of the "sandwich." Mix about 1/4 oz. of 30-minute epoxy and glue the bolt plates together as shown (the extra epoxy will be used in the next step). This assembly must be clamped together with C-clamps or weighted down while the epoxy cures. If you use weights, be sure the pieces do not slide and shift when you add the weights.




❑ 11. Use the remaining **30-minute epoxy** to glue F-1A, F-1B and F-1C together. Be sure that F-1A (the one with the punch marks) is on top of the stack with the punch marks **facing outward,** the locking tabs are aligned, and that F-1C is flush with the top edge of the assembly (see the fuse plan). This assembly must be held together with clamps, or weighted down while the epoxy cures. **Note:** If the three formers are wrapped, simply clamping them together may not necessarily "cancel out" the warps. It is best to clamp the assembly over waxed paper to a **flat** board or table. Allow the epoxy to fully cure before removing the clamps.

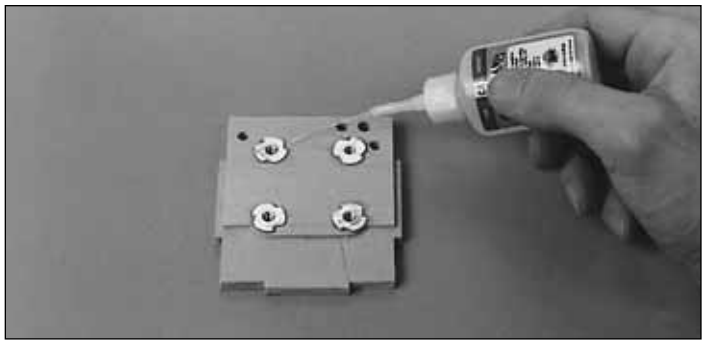


❑ 12. Position the die-cut 1/8" plywood formers **F-2 through F-5** over a piece of scrap wood, then drill a 3/16" hole through each of the punch marks (former F-4 on the PT-20 is balsa). **Do not drill** the F-1 assembly during this step. **Note:** When punching out former F-2 from the die sheet, don't accidentally throw away the plywood **hatch retainer** as it may be easily mistaken for scrap. Refer to the die drawings.




❑ 13. Refer to the sketch, then drill two 3/16" pushrod tube holes through the firewall where indicated. Change your bit size to 7/32" (or 15/64" for perfection) and drill the two fuel tube holes where indicated. Finally, drill four 5/32" holes (1/8" if you're building the PT-20) for the engine mount blind nuts. **Note:** The remaining four punch marks around the perimeter of the firewall could be used for locating the center of the firewall should you choose to use a different engine mount.

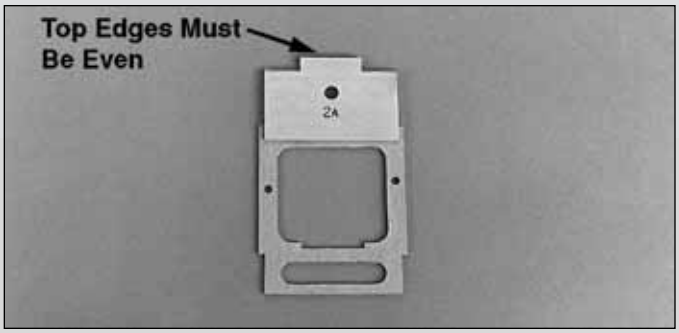
❑ 14. Clean up any slivers from around the holes you drilled and also the edges of the formers with a bar sander and 220-grit sandpaper.



❑ 15. Press a **6-32 blind nut** (**4-40** if you're building the PT-20) into one of the holes in the back of the firewall (F-1C), then tap it gently with a hammer until it is fully seated. Put a few drops of thin CA on the outer edge of the flange to secure the blind nut. Install the remaining three blind nuts the same way.

## CONSTRUCTION NOTE:

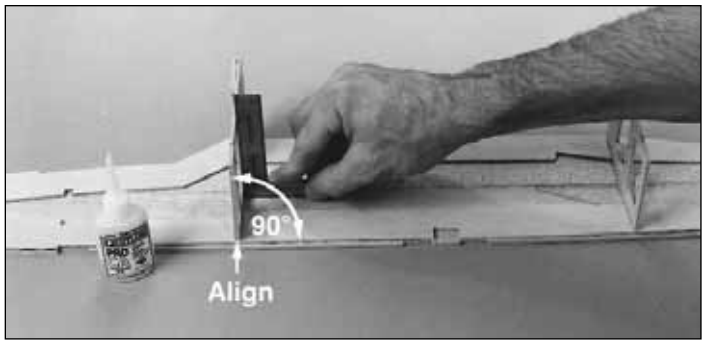
**Perform this step ONLY if you are building the bolt-on wing version.**



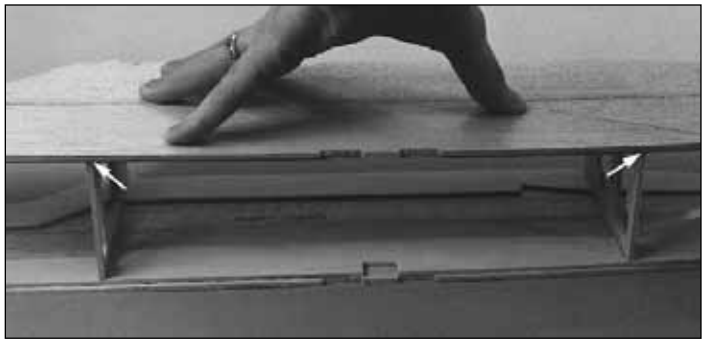

❑ 16. Glue the die-cut 1/8" plywood **former doubler F-2A** to the **front** of **former F-2** (that's the side with the punched number) so the **top edges** are even.

## *Join the Fuselage Sides*

**IMPORTANT:** Position all of the formers with the embossed numbers facing **the front of the model.**

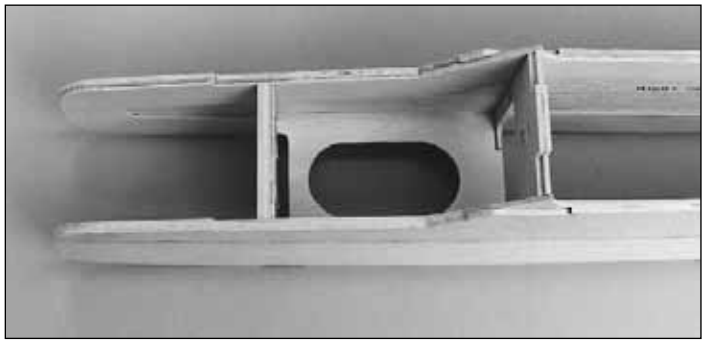



❑ 1. Test fit the die-cut 1/8" plywood formers **F-2** and **F-3** in position on the right and left fuse sides. Be sure the bottoms of the formers line up with the bottom of the doublers on **both fuselage sides.** *For the bolt-on wing version, the **F-2A** former must face toward the front of the model.* Glue F-2 and F-3 to the **right** fuse side as shown with medium CA. Hold F-2 and F-3 vertical with a triangle or building square while the CA cures.

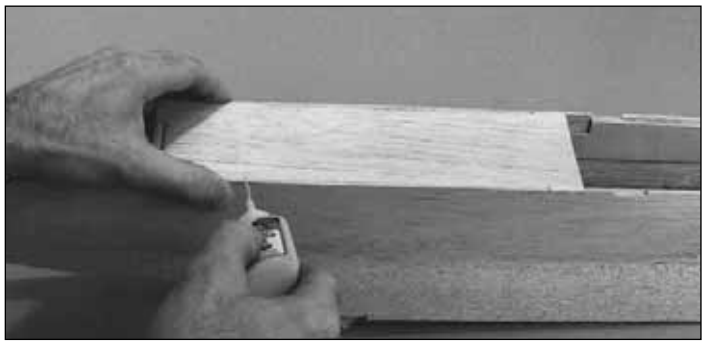


❑ 2. Glue the **left fuse side** to formers F-2 and F-3, making sure the fuse sides are aligned and the bottoms of the formers are flush with the bottom of the doublers.

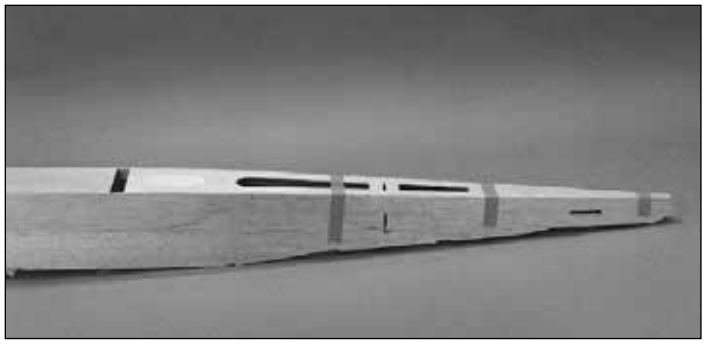
❑ 3. Test fit, but **do not glue,** the die-cut 1/8" plywood **tank floor** and the firewall assembly between the fuse sides. The tab at the rear end of the tank floor should fit into the notch at the bottom of F-2 and the front of the tank floor should fit under F-1C on the back of the firewall assembly. Make any adjustments if required to the firewall sides or the tank floor.



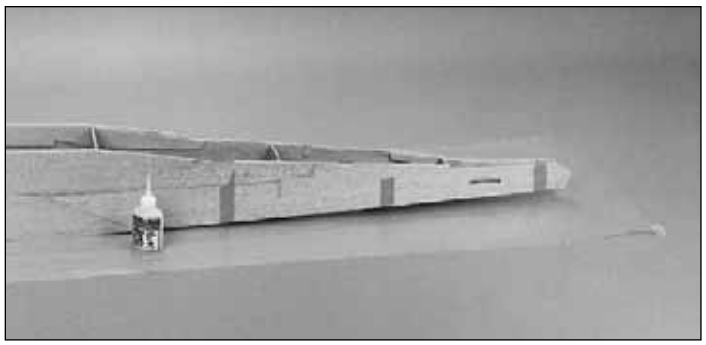

❑ 4. With the tank floor installed (but not yet glued), glue the firewall assembly in position with **30-minute epoxy.** Use rubber bands and/or masking tape to clamp the fuselage sides together while the epoxy cures. After the epoxy has cured, glue the tank floor in position with medium CA.



❑ 5. Test fit the die-cut 3/32" balsa **front fuse bottom** into the notches and recess on the bottom of the fuse. If you have your battery pack handy, simulate installing it under the tank floor as you would if the model was completed. A 500 mAh flat pack wrapped in foam will fit but if you have a larger battery pack you may wish to enlarge the opening in the tank floor. Make modifications before you glue the front fuse bottom in position. When satisfied with the fit, glue the front fuse bottom in position with thin CA along both outside edges. Turn the fuse over, then wick thin CA into the inside joints between the bottom and the formers. Follow with medium or thick CA in any open joints.



❏ 6. Test fit the die-cut 3/32" balsa **rear fuse bottom** between the fuse sides. Temporarily hold the bottom in position with a few strips of masking tape.

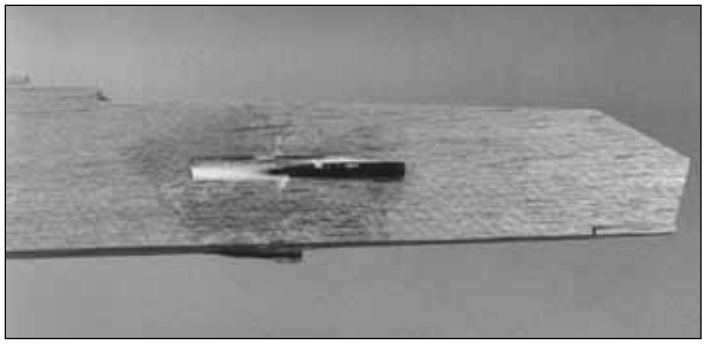


❏ 7. Install the die-cut 1/8" formers **F-4** and **F-5** in the notches of the fuse sides and bottom. Be sure that the **antenna tube hole** is toward the bottom of the fuse. Use more masking tape to hold the formers **tightly** in position. When you are satisfied that everything is **square and true,** place the fuse on waxed paper, then wick thin CA into the joints (from the inside) between the fuse sides, bottom and the formers. As you apply glue, press down on the fuselage to hold it square.

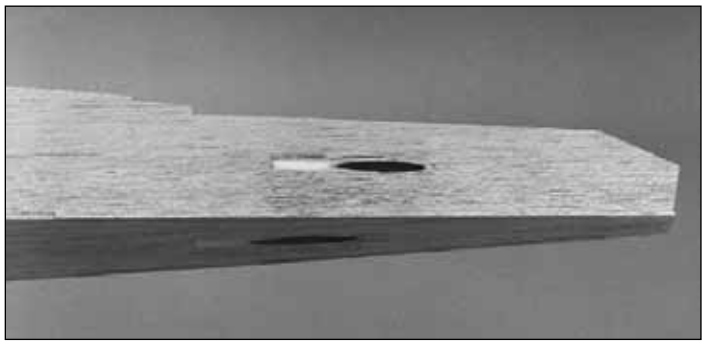
❏ 8. Apply **medium** CA along **all** of the inside joints to permanently secure the framework. Remove the masking tape.

❏ 9. Cut the two 36" plastic **outer pushrod tubes** to 26" for the PT 40 (24-1/4" for the PT 20). One tube will be used as the **elevator pushrod guide tube** and the other will be used as the **rudder pushrod guide tube.** Make the **antenna tube** (optional) from any type of 3/16" pushrod tube (not included). We recommend purchasing a Great Planes 36" flexible pushrod set (GPMQ3710) and using one of the outer tubes from the set. **Save the scrap pieces from the elevator and rudder tubes for use later.**

❏ 10. Sand the outside of each tube with 150-grit sandpaper so glue will stick to them. Slide the **antenna tube** (if used) through the **bottom hole** in formers F-3, F-4 and F-5 and through the exit slot in the bottom of the fuse. Slide the pushrod tubes through the **upper holes** in the formers and out through the exit slots at the rear of the fuse. All of the tubes should **protrude about 1/2"** past the rear end of the slots. Use medium CA to glue the pushrod tubes to each former and the exit slots.

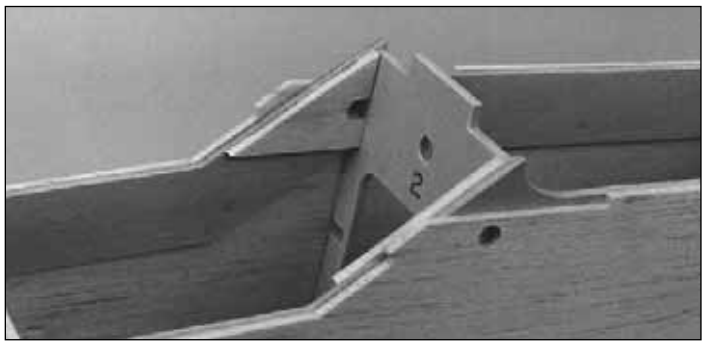


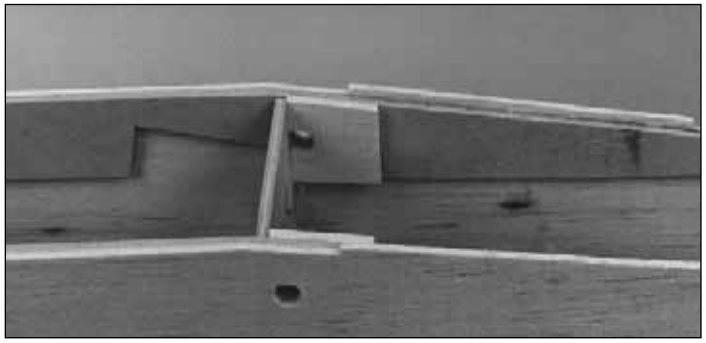
❏ 11. Use HobbyLite filler to fill the gap around the pushrod tubes on the outside of the fuselage.



❏ 12. After the filler has fully cured, sand the protruding pushrod tubes and the filler so it is flush with the fuselage.

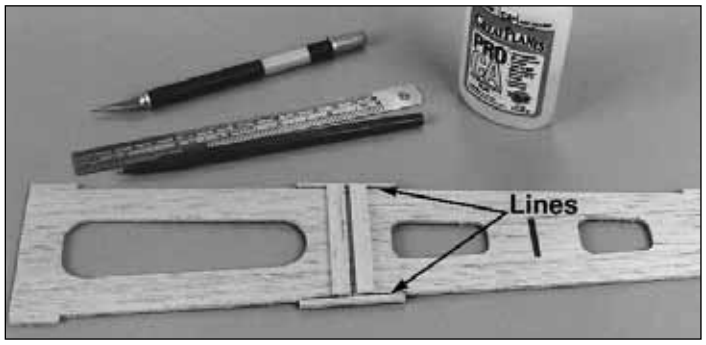
**Skip step #13 if you will be using bolts to mount your wing.**



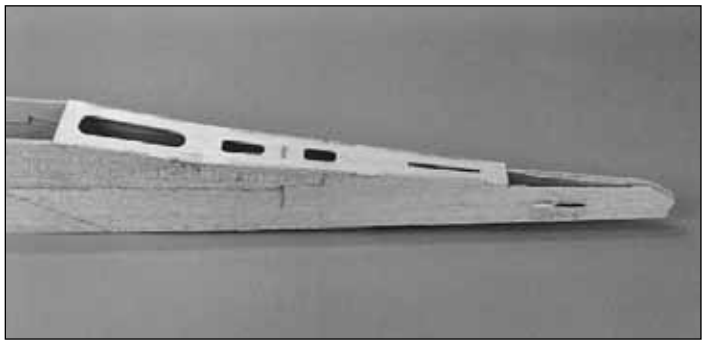


❏ 13. Glue the die-cut 1/8" plywood **front** and **rear dowel triplers** in position with medium CA.

❏ 14. Hold the die-cut 3/32" balsa **fuse top** at the edge of your work table, then **gently** "crack" the wood along the die-cut score line. **Do not break the part in two. Hint:** Bend the fuse top **away** from the side that has the score on it.




❏ 15. Use a straightedge and a ballpoint pen to draw a line across the notches on the fuse top at the score line. Cut two 1/4" wide strips from 3/32" scrap balsa and glue them to the inside of the fuse top on either side of the score line between the lines you marked. **Note:** If building the PT-20, the 3/32" balsa strips must be shorter than the ones shown in the photo to fit between the fuselage doublers.



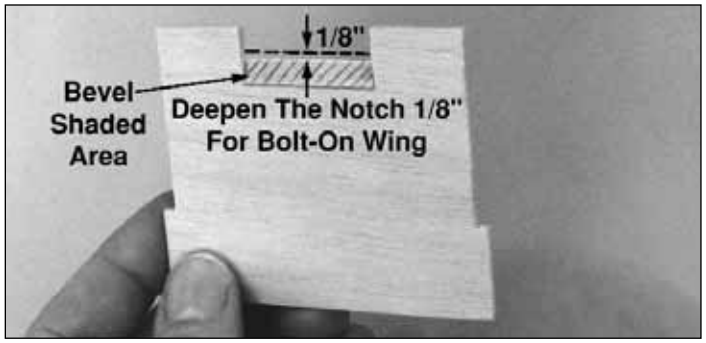
❏ 16. Test fit the fuse top to the fuselage. Glue it in position by wicking thin CA into the joint between the top, former tabs, and the sides. Follow with medium CA to fill in any gaps.

❏ 17. Use epoxy to glue the wing bolt plate assembly into the notches of the plywood doublers and F-3. *We recommend that you perform this step even if you are not going to use the bolt-on wing option.*

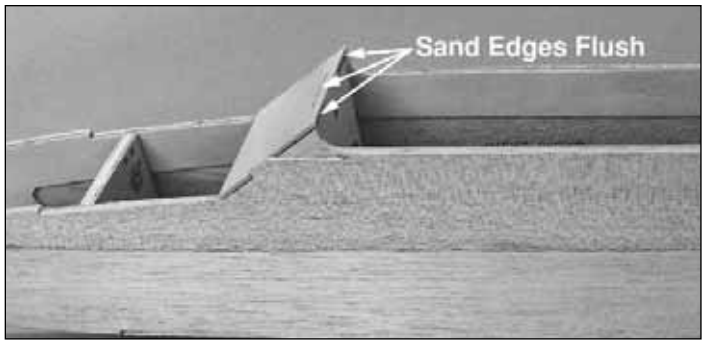
## CONSTRUCTION NOTE:

**Perform this step ONLY if you are building the bolt-on wing version.**

❏ 18. Increase the depth of the notch in the die-cut 1/8" **windshield** by 1/8" to allow for F-2A (the windshield for the PT-20 is balsa). See the following photo.

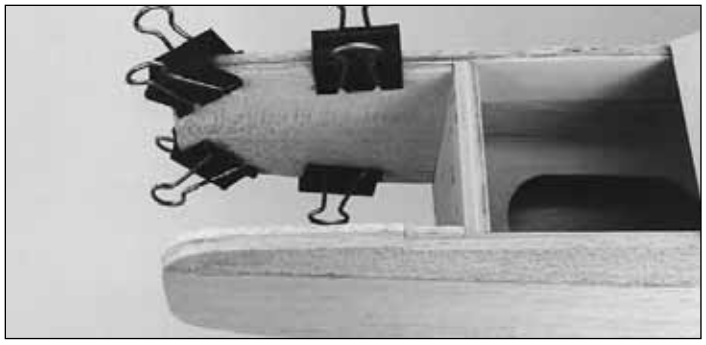



❏ 19. Carefully sand or cut a bevel along the bottom of the notch in the windshield. This bevel will allow the windshield to fit flush against F-2.

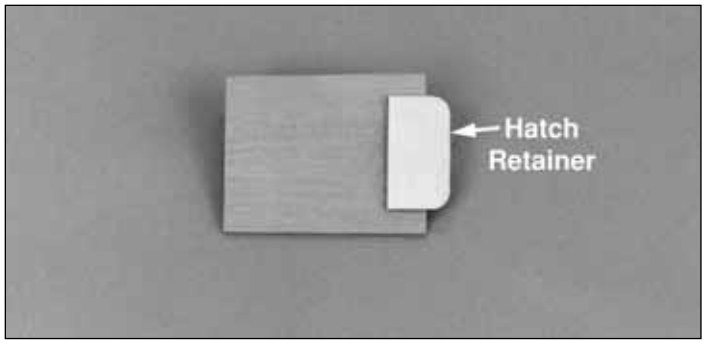



❏ 20. When the windshield fits properly, glue it in position with medium CA. Sand the top of former F-2 (A) flush with the front surface of the windshield. Sand the rear of the windshield overhang flush with the back of F-2.

**Skip step #21 if you are building the PT-20.**

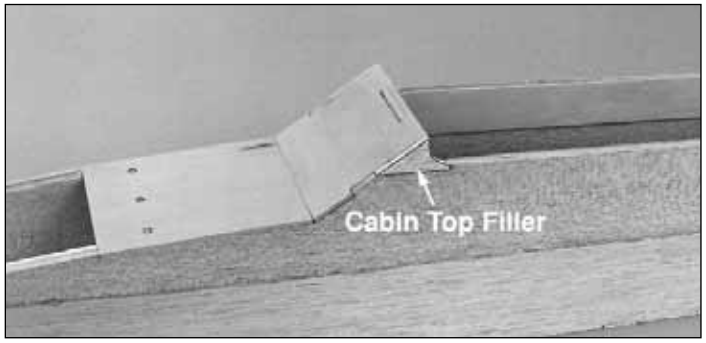


❏ 21. Test fit the die-cut 1/8" balsa **nose blocks** in the engine compartment, then glue them in position with epoxy. After the epoxy has cured, sand the outside edges flush with the fuse.

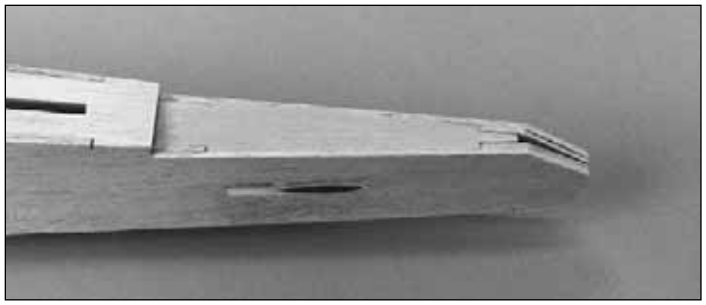


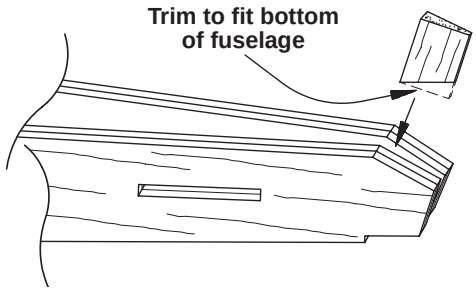

❑ 22. Locate the die-cut 1/8" plywood **hatch retainer (HR)**. Center the hatch retainer on the **bottom** (unpunched surface) of the die-cut 1/8" plywood **tank compartment hatch** with approximately 3/8" protruding from the rear, then glue it in position.

❑ 23. Position the hatch on the fuselage and drill 1/16" holes through the punch marks in the hatch into the firewall. Remove the hatch, then enlarge the holes in **the hatch only** with a 3/32" drill bit. Temporarily mount the hatch to the fuselage with **#2 x 3/8"** screws.




❑ 24. Glue the two die-cut balsa **cabin top fillers** in the notches on both sides of the windshield.



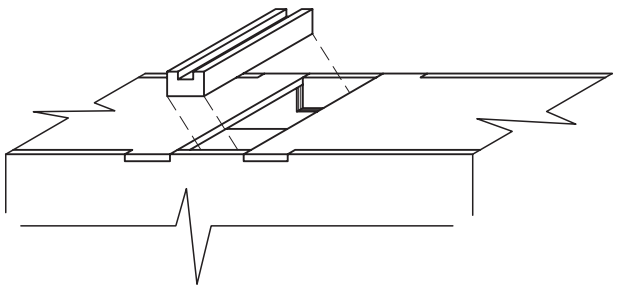



❑ 25. Test fit, then glue the die-cut **stab base** and the tapered balsa tail wedge into the aft end of the fuselage. Trim the tail wedge as necessary for a good fit.

**Skip step #26 if you are building the bolt-on wing version.**

❑ 26. Slightly chamfer the ends of the two **wing dowels,** then test fit them through the holes in the fuse. **Hint:** Run a 1/4" drill through the fuse sides to make sure the holes are all lined up. **Remove the dowels until the model is covered.** You will be instructed when to glue the dowels in.

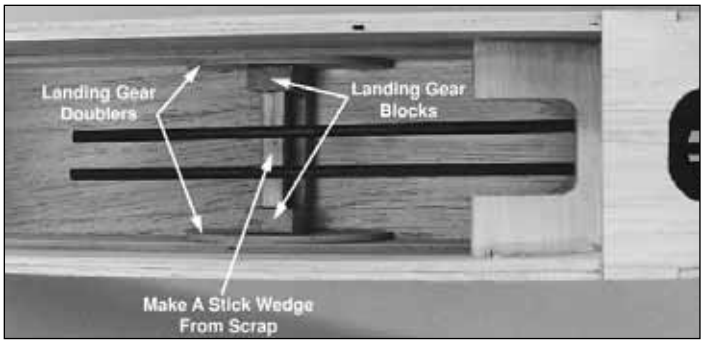
## *Install the Main Landing Gear*



❑ 1. Test fit, but **do not glue,** the grooved hardwood **landing gear (LG) rail** in the slot on the bottom of the fuse. It should fit snugly in the space between the ends of the bottom sheeting and the notches in the fuse sides.

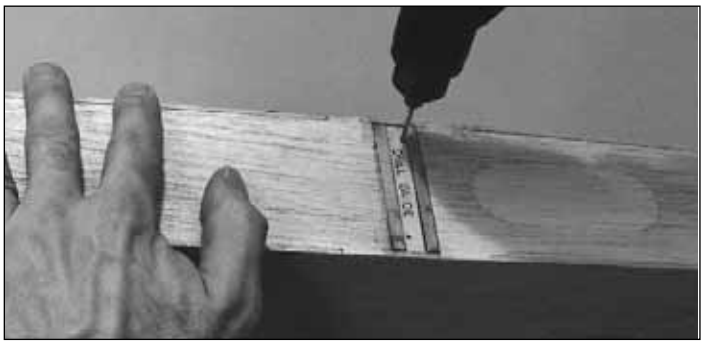
❑ 2. See the following photo at step 4. While the rail is in position (but not yet glued) test fit the two die-cut 1/8" plywood **landing gear doublers (LGD)** and the hardwood **landing gear blocks. Note:** The grain direction of the LG blocks is vertical (as shown on the plan).

❑ 3. Remove all the landing gear parts, then mix enough 30-minute epoxy to glue the LG rail and the LG blocks. Glue the LG rail to the fuse sides and fuse doublers with epoxy, then glue the LG doublers in position with medium CA. Immediately proceed to the next step.



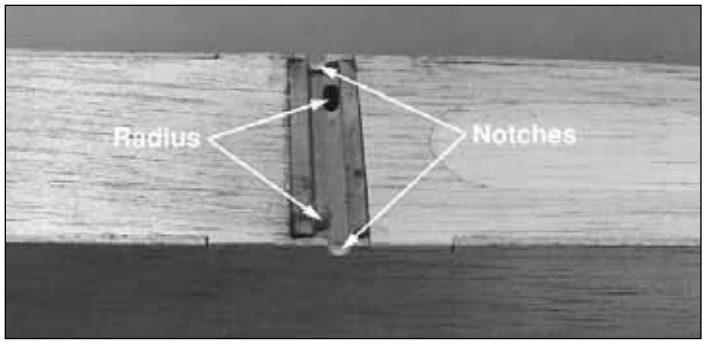

❑ 4. Glue in the LG blocks with 30-minute epoxy. Wedge a scrap balsa stick between the blocks to hold them in position while the epoxy cures. For added clamping power, turn the fuselage over and place weights on top of the LG rail to hold it down.

❑ 5. After the epoxy has cured, glue the front and aft fuse bottoms to the LG rail with medium CA.



❑ 6. For this step, the epoxy must be **fully** cured. Fit the die-cut 1/8" plywood **landing gear drill guide** into the groove in the rail (it doesn't matter which way it goes in). Drill a 3/32" pilot hole through the rails and landing gear blocks at each of the punch marks on the guide. Use care to drill the holes perpendicular to the fuse bottom. Look inside the fuse to make sure you drilled the holes straight into the hardwood blocks.

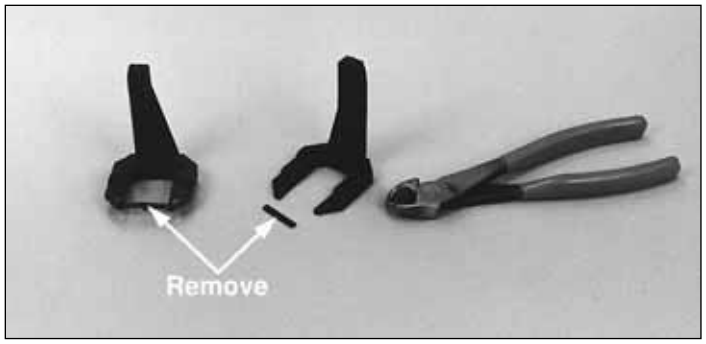
❑ 7. Remove the drill guide, then redrill the holes with a **3/16" bit (5/32"** if you are building the PT-20) making angular adjustments if necessary. **Hint:** If you have a numbered drill set, you may drill the holes with a #12 drill bit (#22 for the PT-20) for easier installation of the landing gear.




❑ 8. Carve a **radius** in each LG rail hole toward the center of the fuse to allow the LG wire to fully seat in the holes. Cut a round notch in each fuse side to clear the LG. Test fit the **main landing gear.** It's helpful if you use a file to remove any burrs or sharp edges from the ends of the wire. After fitting the LG in position, you may remove it and set it aside until final assembly.

**Note:** If you will be installing a 4-stroke engine you need to plan ahead for servo location and pushrod routing. Refer to the sketch on page 46 and the fuselage plans for the 2-stroke/4-stroke servo and pushrod setup.

## *Install the Engine*



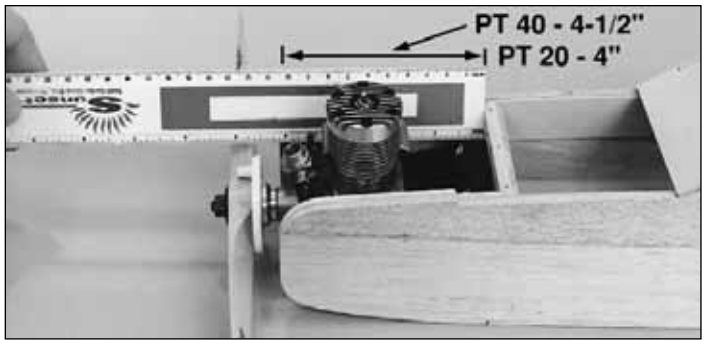

❑ 1. Remove the "spreader bar" from each mount half. Carefully trim any extra material left by the spreader bar or flashing from any other rough edges so the mount halves will fit together. Fit the mount halves together.

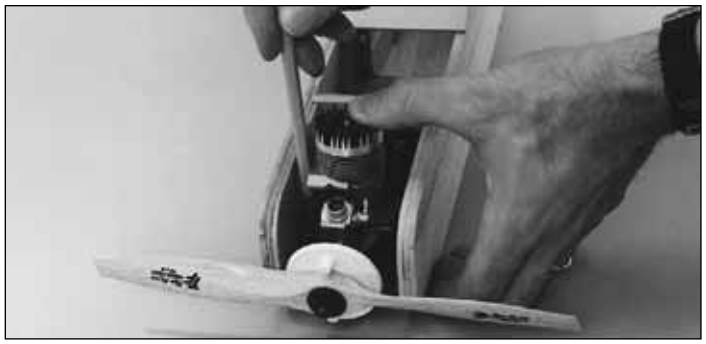
❑ 2. Remove the fuel compartment hatch. Use a pen and a straightedge to mark the vertical centerline on the firewall by drawing a line connecting the punch marks on the top and bottom of the firewall.

❑ 3. Temporarily bolt the engine mount to the firewall using four **6-32 x 1"** screws with **#6 flat washers** (use 4-40 x 1" screws with #4 washers if you are building the PT-20). Don't tighten the screws completely until after the engine has been positioned.

**Note:** You will need your engine for the following steps. From here on it is a good idea to plug the holes in your engine so balsa dust cannot get in. Stuff a piece of paper towel into the exhaust and carburetor venturi to seal them off.

❑ 4. Remove the needle valve from your engine. Position the engine on the engine mount and adjust the engine mount halves until the **engine mounting lugs** will sit flat on the rails. Position the mount so the firewall centerline is centered **between** the "tick" marks on the mount. Tighten the screws to hold the mount firmly in position against the firewall.



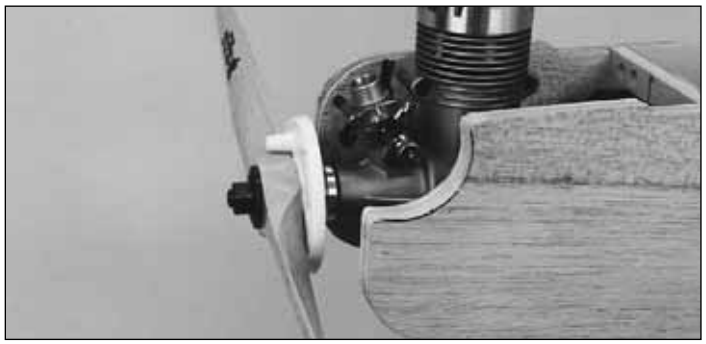
❑ 5. Mount the spinner back plate on your engine. If you're building the PT-40 position the engine so that the spinner backplate is 4-1/2" (115mm) from the firewall. If you're building the PT-20, position the engine so that the spinner pack plate is 4" (102mm) from the firewall. **Carefully mark the engine mounting holes** on the rails with a sharpened piece of wire or a pencil. **Note:** If installing a 4-stroke engine, the engine may be forward of the recommended position to allow for the choke mechanism. This is acceptable and will **not** cause a balance problem.

❑ 6. Remove the engine and engine mount from the fuse. Use a center punch or sharpened nail to "dimple" the marks on the rails, then drill a 3/32" hole through the rails at each punch mark. If you have access to a drill press, this is the best tool for the job. However, if you are using a hand-held electric drill, try to keep the bit perpendicular to the rails.

**EXPERT TIP**

Some modelers prefer to secure the engine to the mount with machine screws (not supplied) because they are easier to screw in. For both the PT-20 and 40, 4-40 x 3/4" screws are recommended. Use a #48 drill bit to drill the holes, then tap the threads with a 4-40 tap.

❑ 7. Install a **threaded ball stud** in the bottom hole of the carburetor arm of your engine and secure it with a **0-80 nut** and a drop of epoxy or thread locking compound. Fasten the engine to the mount with four **#4 x 5/8" screws** included in this kit (or your 4-40 screws). **Hint:** Add a drop of household oil to the #4 sheet metal screws to make them easier to screw into the mount.



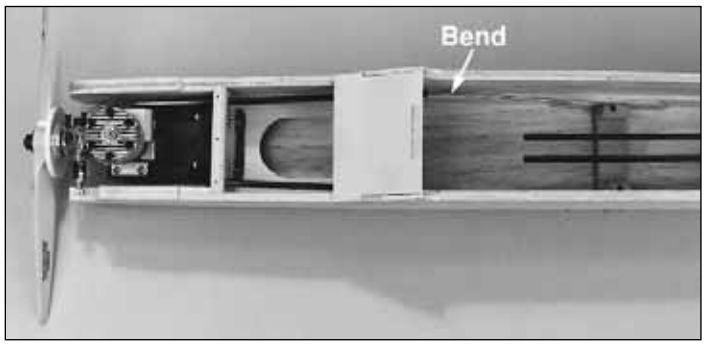
❑ 8. Carefully and neatly cut away some of the fuselage side so you can reach the needle valve. A Dremel tool with a sanding drum works well for this.

❑ 9. Remove some of the fuselage side to clear the muffler. There should be approximately 1/8" clearance between the muffler and the fuselage.

❑ 10. From one of the leftover pieces of **outer pushrod tube** (you saved from the elevator and rudder guide tubes) cut a piece for the **throttle guide tube.** It should extend 1/2" past the firewall and 1/2" aft of F-2. Temporarily install the throttle guide tube through the holes in the firewall and F-2.

❑ 11. From the other piece of outer pushrod tube, cut the **nose steering guide tube.** It should be flush with the front of the firewall and extend 1/2" aft of F-2. Temporarily install the nose steering guide tube in the firewall and F-2.

❑ 12. Cut 14" from the **threaded** end of a **36" threaded wire pushrod** (after cutting you should have a 14" long piece of wire threaded at one end and a non-threaded piece 22" long). The threaded end wire is the **throttle pushrod** and the non-threaded piece is the **nose gear pushrod.** Screw a **ball link** about 14 full turns onto the threaded pushrod wire. Save the nose gear pushrod for later.




❑ 13. Insert the throttle pushrod through the pushrod tube. Make one downward bend in the pushrod so that the ball link will meet the ball stud on the engine without binding. Don't snap the ball link onto the ball until later. Bend the wire away from the fuselage side about 1" aft of F-2. The final adjustments will be done during the radio installation.

## *Install the Nose Gear*

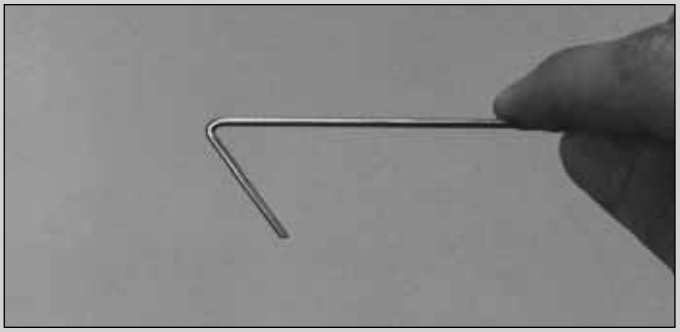
❑ 1. Remove the engine from the engine mount. Slide a **5/32" wheel collar** (included with this kit) with a **set screw** installed on the **nose gear,** then install the nose gear into the engine mount so 1/4" protrudes above the engine mount.

❑ 2. Position the wheel collar so it is snug against the bottom of the engine mount, then temporarily tighten the set screw to lock the wheel collar in position. *Look ahead to the photo at step 5 for more information.*

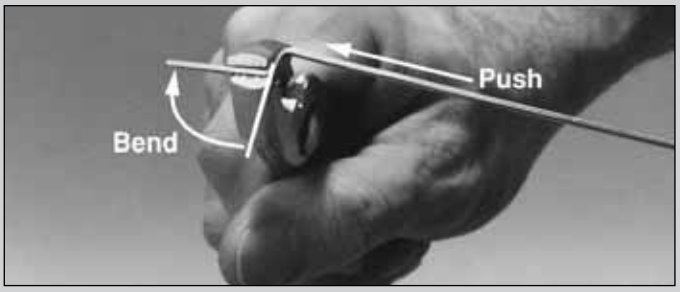
❑ 3. Use your "Z-bend" pliers or follow the **Expert Tip** that follows to make a "Z-bend" near the end of the non-threaded wire left over from step 12.

### EXPERT TIP

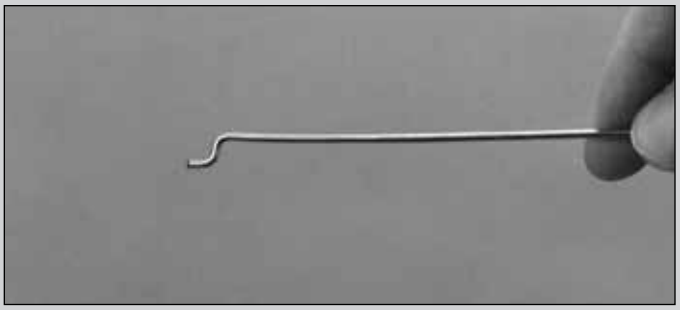
**HOW TO MAKE A Z-BEND WITH REGULAR PLIERS.**



A. Bend the wire. This bend should be about the same angle as the one shown in the photo.

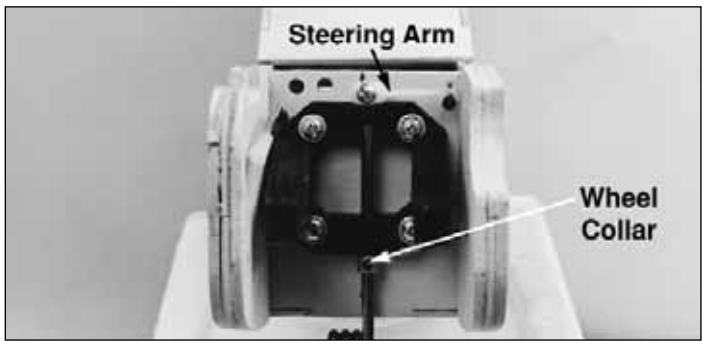

B. Make the second bend about 1/8" ahead of the first to form the "Z."

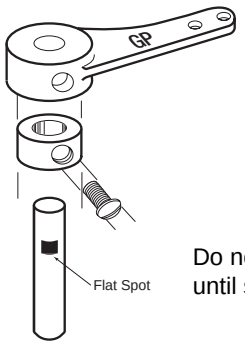


C. If there is any extra wire, cut it off so there is only 3/16" past the bend. File the burrs off. **Always wear safety glasses when cutting wire.** While bending, push the wire toward the pliers.

D. If you didn't like the way that the Z-bend came out and you have enough wire, cut it off and try another.


❑ 4. Place a 5/32" wheel collar inside the **nylon steering arm** and start a **6-32 x 1/4" screw** into the arm and the wheel collar (see the following sketch). Carefully cut the end off the steering arm so there are only two holes left. Enlarge the outside hole in the steering arm with a 5/64" drill bit (#47 for perfection), then insert the nose gear pushrod wire with the Z-bend into the hole.



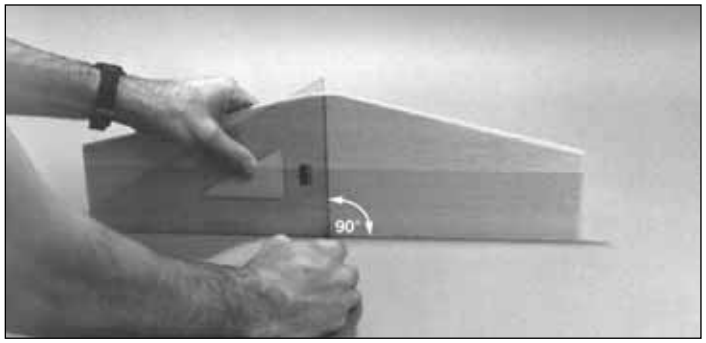

Do not file the “flat spot” until step 2 on page 53.

❑ 5. Slide the nose gear pushrod wire through the guide tube and place the arm on the nose gear sticking out of the engine mount. Position the steering arm as shown on the plan, then temporarily tighten the set screw.

❑ 6. Bend the nose steering pushrod away from the fuselage side about 1" aft of F-2. Test the actuation of the nose steering by moving the pushrod back and forth from inside the fuselage. Position the hatch on the fuselage and confirm that it does not interfere with the Z-bend. If necessary, make adjustments to the Z-bend or carve a little material from the hatch to clear the Z-bend.

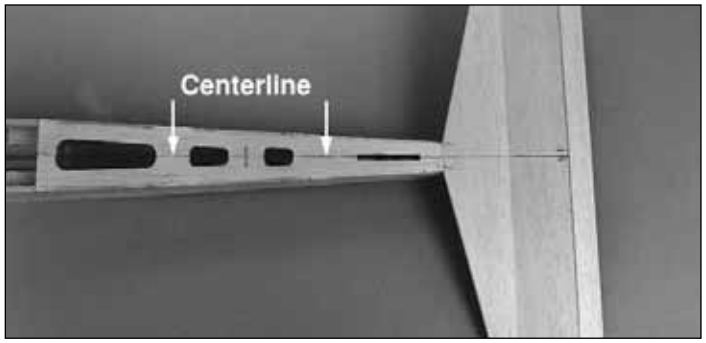
*There, we slipped in a little bit of the control hookups so that'll make the finishing procedure move a little faster. Put all your tools away, dust off your workbench, vacuum the floor and get ready to glue the tail surfaces to the fuselage. After you build the wing, all of the wood working will be complete!*

## *Attach the Stab and Fin to the Fuse*



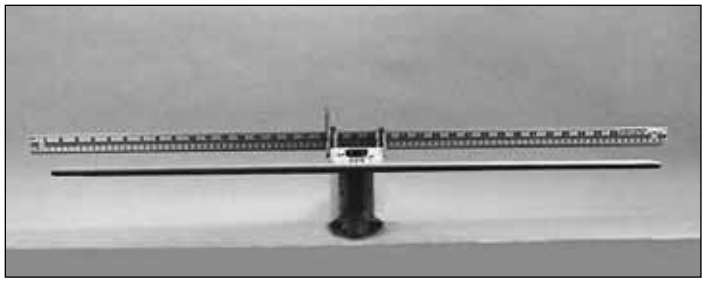

❑ 1. Remove the elevator from the stab and measure the total width of the stab at the TE. Make a mark at the midpoint of the TE. Use a drafting triangle or a carpenter's square to draw an accurate **centerline** on the **top** of the stab at the mark.

❑ 2. Accurately measure the width of the fuse at the top of F-3, and just in front of the stab base, then mark the center of the fuse top at **both** of those locations. Lightly draw a **centerline** between these two marks (the centerline should perfectly bisect the slot for the dorsal fin tab). Stick a pin into the fuse top at the F-3 centerline mark.

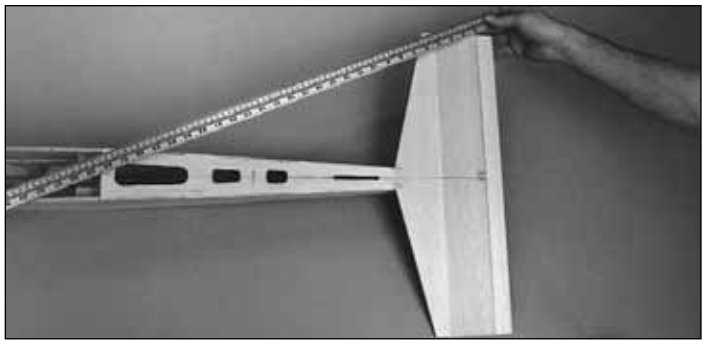


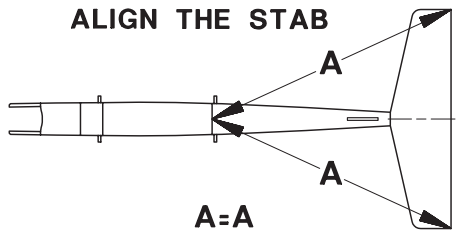

❑ 3. Temporarily join the elevator to the stab with hinges. Position the stab and elevator on the stab base with the centerline of the stab aligned with the centerline of the fuse. Pin the stab to the fuselage.

❑ 4. Lay a 36" straightedge (yardstick) on edge, across the front of the wing saddle on top of the fuse. Hold the straightedge in place by clipping a couple of clothespins to the fuse sides on both sides of the straightedge.

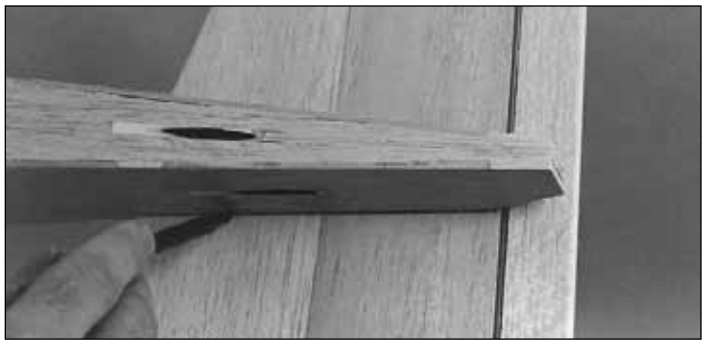


❑ 5. Check the alignment of the stab by standing 6 to 10 feet behind the airplane. Crouch down until the stab TE and the bottom of the straightedge are close together. If the stab TE is not exactly parallel with the straightedge, remove the stab and carefully sand the high side of the stab base with a sanding block. Then replace the stab and recheck its alignment. You do not have to sand much to make a big change in the stab angle. Keep making adjustments until the stab lines up with the straightedge.



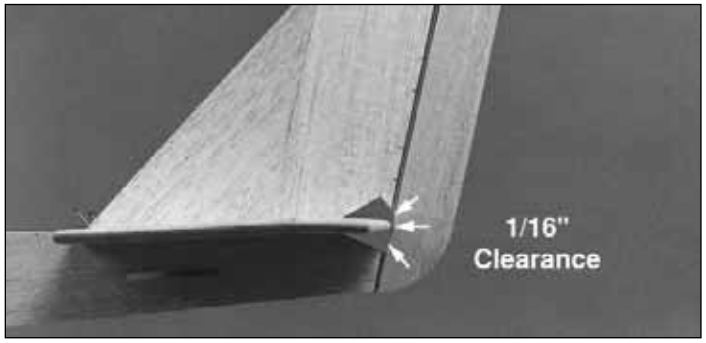



❑ 6. Double check the stab alignment by measuring from the pin at F-3 to the stab TE at both tips. Adjust the alignment of the stab (while keeping the stab centered on the fuse) until these measurements are **equal.**

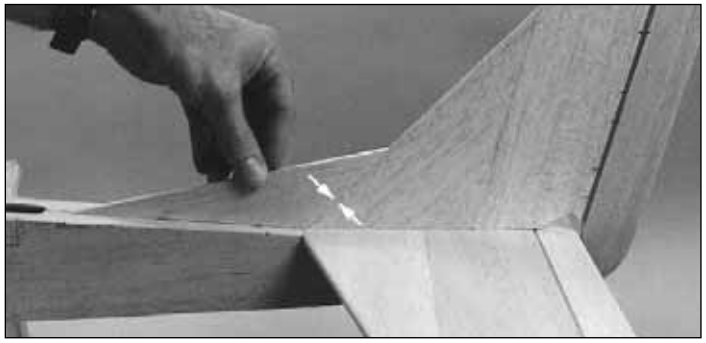


❑ 7. Once you have the stab pinned in correct alignment, use a ballpoint pen to make **reference marks** on the bottom of the stab.

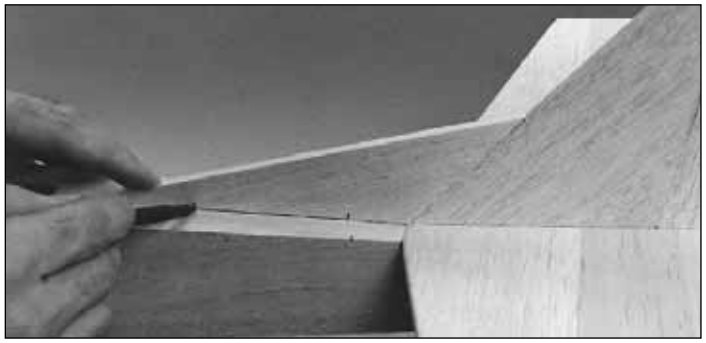
❑ 8. Remove the stab from the fuse. Mix up a batch of 30-minute epoxy and apply it to both the stab base and the stab between the reference marks. Reposition the stab on the fuse using the reference marks. Use T-pins to clamp the stab in position and recheck the stab alignment. Wipe away any excess epoxy before it cures. Allow the epoxy to **fully cure** before proceeding.




❑ 9. Place the fin and rudder on the stab. Slide the fin forward until the leading edge of the rudder contacts the end of the fuselage. Make sure the rudder does not interfere with the up and down movement of the elevator. There should be 1/16" clearance throughout the entire movement of the elevator. Enlarge the partially round cutout in the rudder if necessary.



❑ 10. Position the shaped balsa **dorsal fin** on the fuselage and test fit it to the front of the fin. If necessary, adjust the angle of the aft edge of the dorsal fin until it perfectly matches the fin.

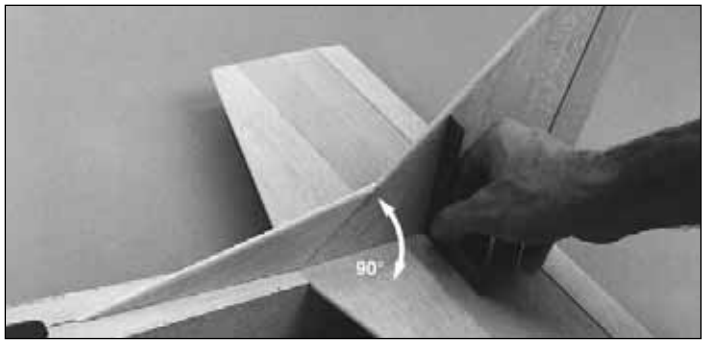


❑ 11. Glue the dorsal fin to the stab on your **flat** building board. Reposition the fin (now with the dorsal fin) on the

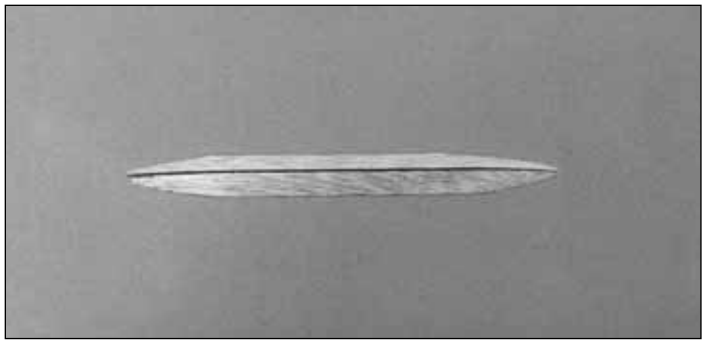
fuselage and stab and mark the location of the slot in the fuselage for the balsa **dorsal fin tab.** Remove the fin from the stab and glue the dorsal fin tab to the dorsal fin. Sand the fin, dorsal fin and the dorsal fin tab flat and smooth with your bar sander and 150-grit sandpaper.

❑ 12. Use the same centerline technique you did for the stab to mark the centerline around the perimeter of the fin and rudder. Use your bar sander to round the edges. The "corner" where the dorsal fin meets the fin is a little tricky so just work slowly and do not over-sand in that area. Finish-sand the entire fin and rudder with 320-grit sandpaper.

❑ 13. Reposition the fin on the stab with the dorsal fin tab keyed into the fuse top. Confirm that the fin is parallel to the centerline of the fuselage. Place a straightedge along the side of the fin. The straightedge should be parallel to the centerline you drew on the fuse. When the fin is aligned, mark the position of the fin on the aft edge on the stab as a reference for the next step.




❑ 14. Use medium CA to glue the fin in position (with the aft edge aligned with the marks you made on the stab) while holding a triangle against it and the stab to maintain vertical alignment.



❑ 15. Locate the 12" balsa triangle stock and cut two pieces to the length shown on the plan. These will be used to reinforce the fin. Hold the pieces together (back-to-back), then simultaneously shape them as shown in the photo and on the plans.

❑ 16. Refer to the **Covering** section on page 42 to see how to glue the shaped **fin reinforcements** in position ***after*** covering or, use medium CA to glue the fin reinforcements to the stab and fin at this time.

❑ 17. Mark the rudder's bottom hinge location on the fuse. Carefully cut the slot for the hinge in the tail end of the fuse. Reattach the rudder to check the hinge alignment. Remember, the bottom hinge for the rudder on the PT-20 is 3/8".

*Hang in there. You only have to build the wing before you start covering.*

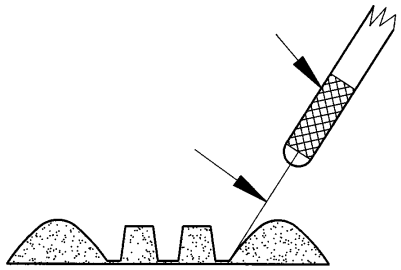
## BUILD THE WING

### Preparation

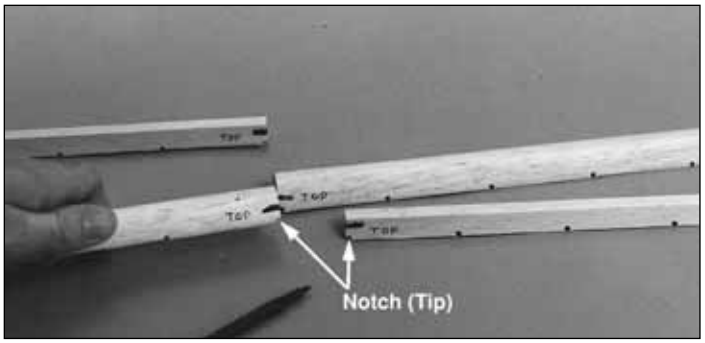
Building the wing for the PT is fun. Even if this is your first kit you won't have any trouble building a beautiful wing that is straight and true. **The secret is not to use any glue until instructed to do so.** You will soon see that the structure just about holds itself together, giving you the opportunity to make sure that everything fits perfectly before you make an "irreversible oops!"

We mentioned at the front of this manual that you have a choice in the type of wing to build – the trainer ("A-wing") or the sport ("B-wing"). As stated earlier, we **strongly** recommend that you build the trainer version if this is your first R/C model.

❑ 1. Carefully remove all die-cut 3/32" balsa **R-2** & **R-3 wing ribs** from their die sheets. Remove any die-cutting "fuzz" by lightly sanding each rib with 220-grit sandpaper.



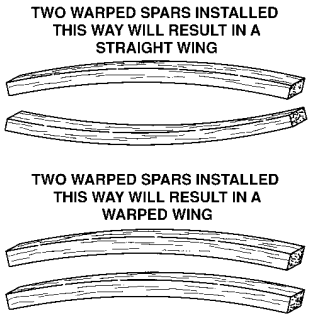
❑ 2. The shaped and notched **leading edges (LE)** and **trailing edges (TE)** are fastened together by a thin layer of balsa. Carefully separate them with your hobby knife as shown in the sketch. Use your bar sander with 220-grit sandpaper to lightly sand the rough edges away.

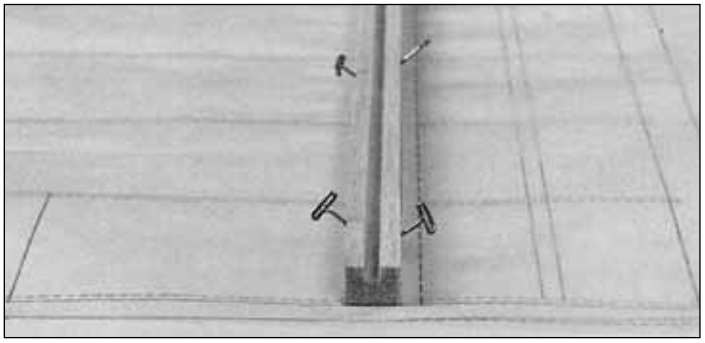



❑ 3. The **TOP** of each LE and TE has a pen mark applied at the factory. For clarity you may mark them yourself as "top." The end **with the notch** is the **TIP.**

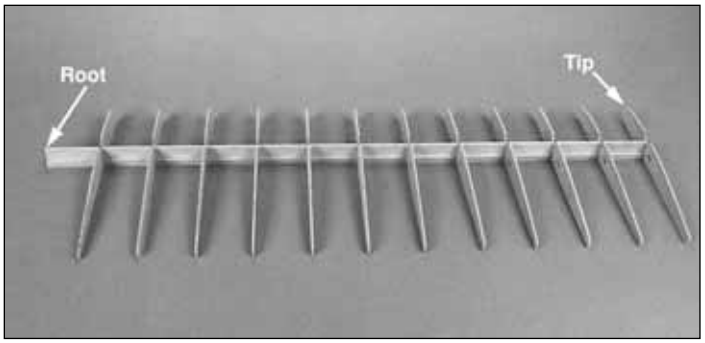
## *Build the Wing Panels*

Both wing panels are built directly over the plans. Don't forget to cover the plans with waxed paper. Build the right wing panel first so that your progress will look the same as our photos. **Note:** For clarity the photos show the framework removed from our building board, even though we too build over the plans.



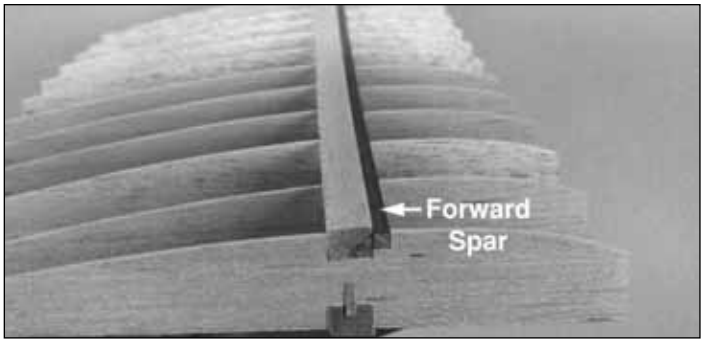



❑ ❑ 1. Examine the four slotted **main spars** for warps. Refer to the sketch above, then divide them into pairs. Pin one of the bottom spars to the plans using the pinning method shown at enough locations to hold the spar straight over the plans. The tip of the spar should align with the tip rib R2 while the excess should be at the root *(the root of the wing panel is the end that joins the other wing panel and ...is not the tip)*.

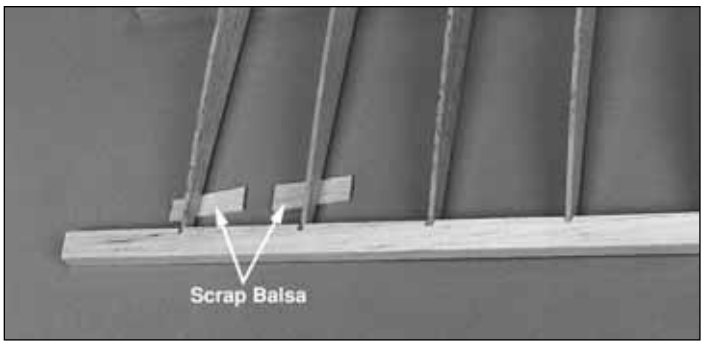



❑ ❑ 2. Insert the die-cut 1/8" balsa **slotted web** into the slot in the main spar. The notched end of the web should be at the **tip** with the notches pointing **upward.** Add (no gluing yet) all the R2 and R3 wing ribs. Make sure each rib is fully seated in the web and the ribs align with the plan.

❑ ❑ 3. Add the matching slotted main spar to the assembly (remember you made matching pairs). The top of the spar should be even with the tops of **all** the **R3** ribs.

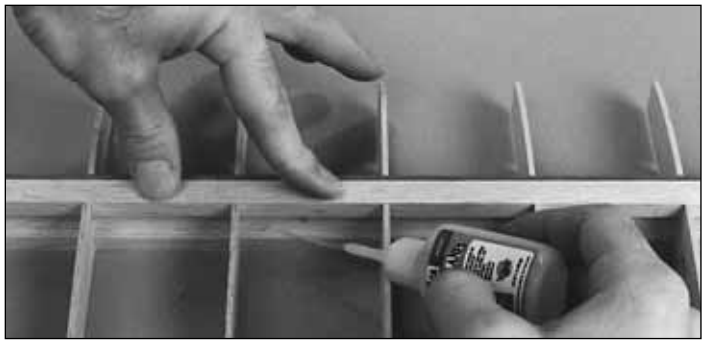



❑ ❑ 4. Add the 3/16" x 3/16" x 30" top **forward spar.**



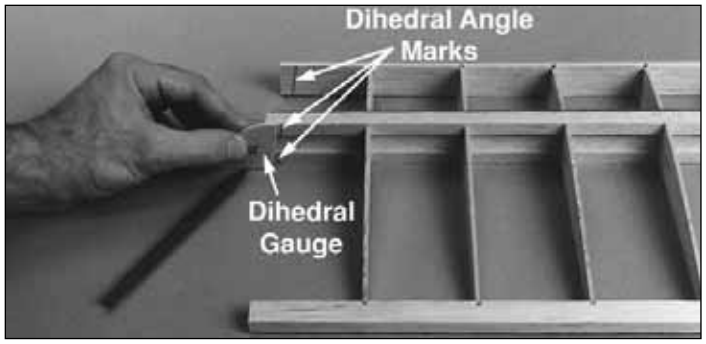

❑ ❑ 5. Slide a scrap piece of 3/32" balsa under each **R2** rib near the trailing edge (use 1/16" balsa for the PT-20). Fit the notched **TE** to the assembly with the ribs fully seated in the notches. Pin the TE in to your building board.

❑ ❑ 6. Examine the frame carefully to be sure everything is **fully pressed into position** and **aligned** with the plans. The bottoms of the R3 ribs must be contacting the plans and the bottoms of the R2 ribs must be contacting the shims you added in the previous step. We are about to start gluing so now is the time to fix any problems.



❑ ❑ 7. Use thin CA for all points of contact starting with the notches along the TE *(the Hobbico applicator tips really help for this step)*. Press or hold all of the parts in position as you apply the CA. Move on to the main spars and slotted web and the rib/spar joints. If you can't reach all the glue joints with your CA bottle, don't worry. Just get the ones you can for now and we'll remind you to get the others after the wing is removed from the building board.


❑ ❑ 8. Carefully fit the notched **LE** in position, making sure all of the ribs are fully seated in the notches. The **bottom edge** of the LE should contact the plan when the TE is securely pinned to the building board. Glue the LE to the ribs with thin CA.




❑ ❑ 9. Position the **dihedral gauge** for the **"A-wing"** or the **"B-wing"** against the aft sides of the main spars with the bottom edge of the gauge over the center line of the wing. Use a ballpoint pen to mark the dihedral angle on the top and bottom spar, then use the same procedure to mark the dihedral angle on the LE and TE.

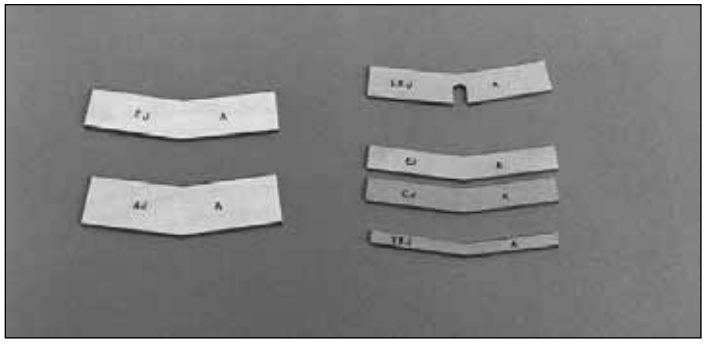
❑ ❑ 10. Remove the wing panel from the building board. Hold it upside down and add thin CA to the underside of the top spar where it contacts the web and the top forward spar. Add thin CA to any joints you couldn't reach before.

❑ ❑11. Use a razor saw to cut the TE, main spar assembly and LE about 1/16" longer than the lines you drew with the dihedral gauge.

❑ ❑ 12. Use a long bar sander and 150-grit sandpaper to "fine tune" the dihedral angle by sanding a little at a time to the dihedral line.

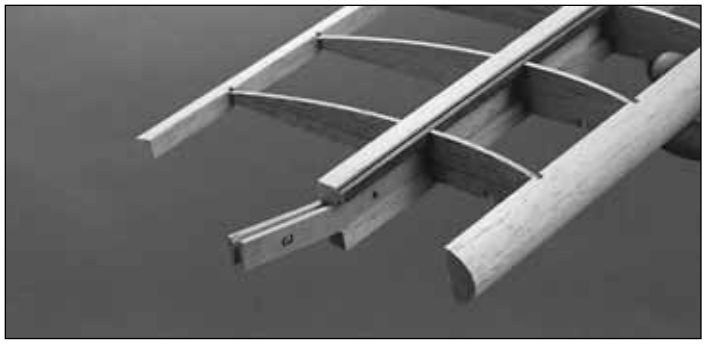
*There you have it! One framed wing panel. Hurry up and build the other one. Then you can join them and set the wing on the fuselage to see what this thing is going to look like and day dream about learning to fly! Return to step 1 and build the **LEFT** wing panel. Don't forget to **use the other drawing on the plan** so you build a **LEFT** side.*

## *Join the Wing Panels*



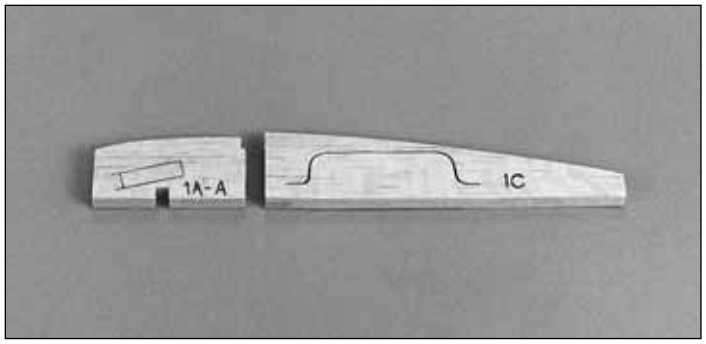
❑ 1. Gather all the die-cut 1/8" plywood wing joiners for the wing you have decided to build. These would be the **leading edge joiner** (**LEJ-A** or **B**), **forward joiner** (**FJ-A** or **B**), two **center joiners** (**CJ-A's** or **B's**), **aft joiner** (**AJ-A** or **B**) and finally the **trailing edge joiner** (**TEJ-A** or **B**).

❑ 2. Use your bar sander and 220-grit sandpaper to remove any die-cutting irregularities or slivers from the joiners.



❑ 3. Without glue, test fit the CJ's between the top and bottom spars of one wing panel. Hold the wing panels together with the CJ's in position. Make sure the CJ's fit between the top and bottom spars and that the LE, TE and the spars meet. Examine all the joints carefully. There should be no gaps between any of the parts, **especially the top and bottom spars.** If necessary, make small corrections with your bar sander, checking progress regularly to avoid "over correcting." You may need to shorten **both ends** of the CJ's slightly to allow the wing halves to meet.

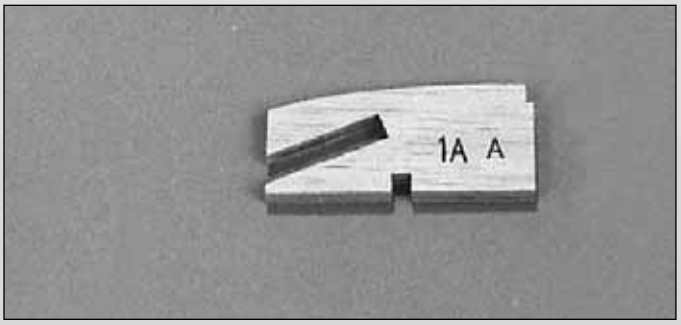
❑ 4. With CJ's temporarily holding the wing halves together, test fit the rest of the joiners.




❑ 5. Use medium CA to glue the die-cut balsa **rear center ribs 1C** to each other and the **front center ribs 1A-A** (or **1A-B**) to each other.

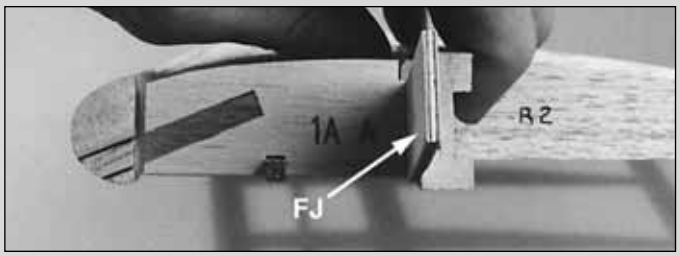
## CONSTRUCTION NOTE:

**Perform this step ONLY if you are building the bolt-on wing version.**




❑ A. Remove the die-cut piece for the wing dowel in the front center ribs 1A-A (or B). Use the die-punched lines as a guide to extend the notch to the front of the center ribs and remove the rest of the wood.

❑ ❑ B. Temporarily install a 3/16" x 3/16" bottom **forward spar** in the right wing panel. Fit the 1A forward center rib assembly on the spar, then fit the FJ between the rib and the main spars. This should temporarily hold the rib in position for the next step.




❑ ❑ C. Draw two lines on the end of the LE to match the spacing and angle of the slot in the rib.

❑ ❑ D. Remove the spar and the center rib. Wrap a piece of 150-grit sandpaper around one of the 1/4" dowels included in this kit or use a round wood rasp to sand **half** the diameter of the dowel hole in the end of the LE.

❑ ❑ E. Do the same procedure for the other wing panel.

❑ F. Temporarily join the wing panels with the forward center rib. Test fit one of the 1/4" wing dowels into the center rib and make sure you have made the grooves deep enough in each leading edge. Cut the dowel off 3/4" in front of the leading edge. Disassemble the wing halves and remove the center rib.

*You will need several small C-clamps (or modeling clamps) and a few clothespins or office spring clips for the next few steps. Clear a space on your work bench long enough to accommodate the soon-to-be-joined wing.*

**IMPORTANT: Perform a "test run" of steps 7 through 16 without any glue so you understand where to position all the joiners, how many clamps you will need and where to place them. Do not attempt to join the wing halves with anything but 30-minute epoxy – you'll need the working time to be sure that all the joiners are accurately positioned and the clamps are properly set.**

❏ 6. You will need something to prop up one of your wing tips to set the correct **dihedral angle** (see the photo at step 16). Use the chart that follows to determine how much to raise one of the wing tips for the model you are building. You can use a stack of books, balsa blocks or something similar for this job:

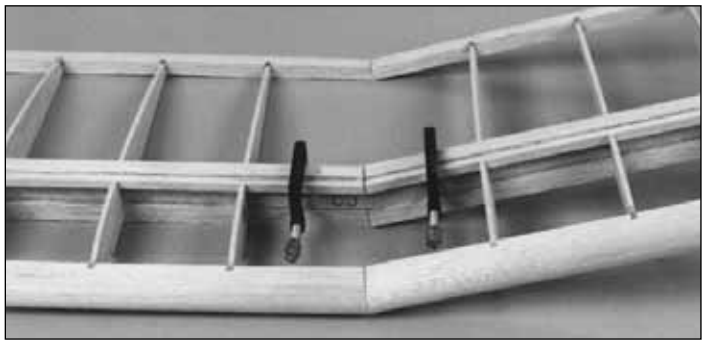
| | **PT-20** | **PT-40** |
|---|---|---|
| A-wing | 7" (178mm) | 8" (204mm) |
| B-wing | 4-3/8" (112mm) | 5" (128mm) |

❏ 7. Lay two 1' sheets of waxed paper on your work table and have a few sheets of paper towel on hand to wipe your hands.

❏ 8. Coat the **ends** of the LE's, main spars and webs, TE's of both wing panels, both center joiners and both sides of the webs in each wing panel with 30-minute epoxy. Lay the CJ's (epoxy side up) on one of the sheets of waxed paper so you don't mess up your work table.

❏ 9. Install the center joiners in one wing panel just as you did when you were test fitting. Join the other wing panel to the assembly with the center joiners.

❏ 10. Lay one wing panel on your flat building table with the other sheet of waxed paper under the panel. Lay the wing tip of the other wing panel on the stack of books or blocks to set the correct dihedral angle (see step 16).

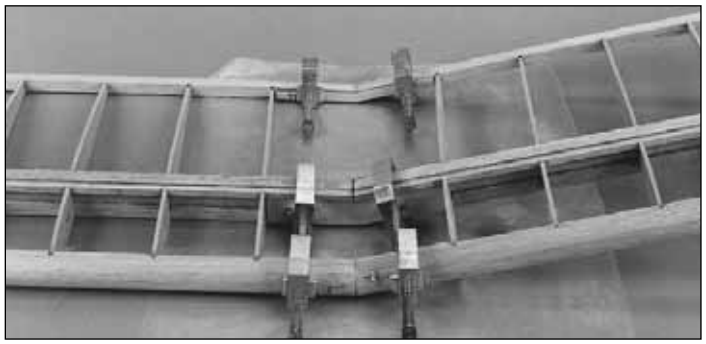


❏ 11. Align the TE and LE. Then pin them together. Clamp the wing halves together by placing small C-clamps on the center joiners of each wing panel.

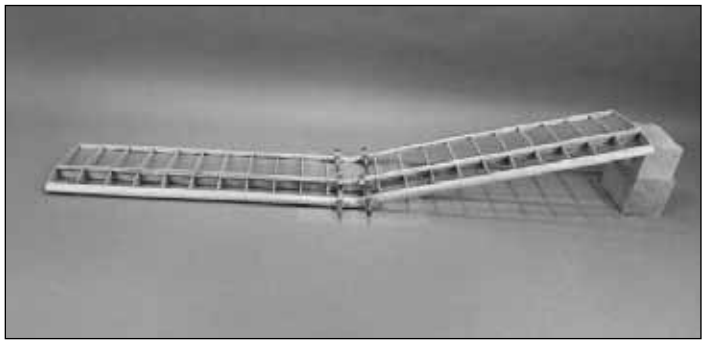
❏ 12. Wipe away excess epoxy with a paper towel, double check all the glue joints, then let the epoxy cure **fully** before proceeding.

❏ 13. After the epoxy from the preceding step has cured, remove the clamps and T-pins. Coat one side of the remaining joiners with 30-minute epoxy. Place the joiners epoxy side up on the sheet of waxed paper so you don't mess up your work table. Immediately proceed to the next step.

❏ 14. Position the forward joiner and the aft joiner on the front and rear of the main spars respectively (on the PT-40 there is a small space between the center joiners and the forward and aft joiner). Make sure the aft joiner is **centered** above and below the main spars for the wing sheeting and the top edge of the forward joiner is fully contacting the bottom of the forward spar. Clamp the joiners in position. Proceed immediately to the next step.



❏ 15. Clamp the leading edge joiner and the trailing edge joiner to the leading and trailing edge. Make sure **both joiners are centered** between the top and bottom of the trailing and leading edges for the wing sheeting.



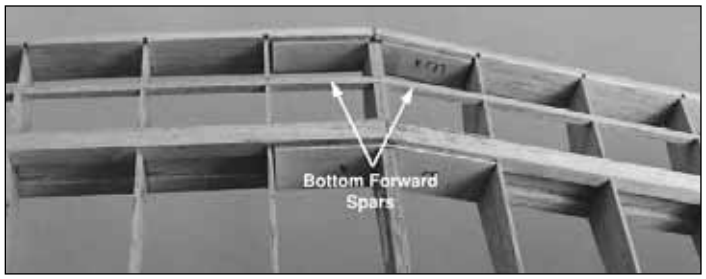
❏ 16. Use a balsa stick to wipe away excess epoxy that was squeezed out from the top and bottom edges of all the joiners. Confirm that the joiners have not shifted and are still centered above and below the LE's, TE's and spars. Place the wing back onto your work table with one of the panels propped up. Do not disturb the wing until the epoxy has fully cured.

*Here's your chance to get some sleep, so rest while you can. There's still lots more to do!*

## Prepare the Wing for Sheeting


❑ 1. Use epoxy to glue the front center rib 1A between the LEJ and FJ. Make sure it is equally centered in each wing half and the front is centered on the leading edge. **Hint:** If you are building the bolt-on wing, insert the 1/4" dowel through the hole in the leading edge and into the center rib. This will help you align the center rib. Remove the dowel before the epoxy cures.

❑ 2. Use medium CA to glue the **rear center rib 1-C** on the centerline of the wing between the AJ and the TEJ.

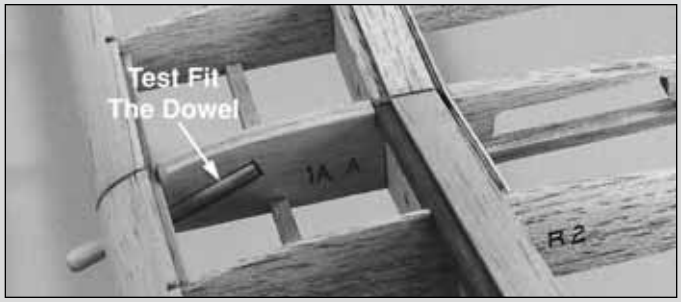



❑ 3. Glue the 3/16" x 3/16" bottom forward spars to the notches in the ribs of both wing halves. Cut the ends so they are flush with the tips.

### CONSTRUCTION NOTE:

**Perform this step ONLY if you are building the bolt-on wing version.**

A. Chamfer one end of the dowel you cut earlier. This end will be the front.




B. Test fit the dowel through the leading edge and fully into the slot in the front center 1A rib assembly. With the dowel in the center rib, test fit the die-cut plywood 1B center rib doublers to the sides of the balsa center ribs.

C. Remove the dowel and rib doublers. Lightly coat both sides of the center rib and only one side of each rib doubler with epoxy. Reposition the doublers on the center ribs and clamp them until the epoxy cures. You will be instructed to glue the dowel in after the wing is sheeted.

### EXPERT TIP

**HOW TO MAKE "SOFT WEIGHTS"**

Weights are needed for a variety of purposes during the model building process, especially when setting the wing washout in the following steps or if you need an extra pair of hands to hold the wing. We made some 2 and 3 pound "soft weights" as follows:

A. Obtain four small, but sturdy plastic bags (freezer bags work well), four old tube socks (preferably laundered), and 10 pounds of buck shot, available at sporting goods or gun stores. Sand may also be used, but the weights become pretty bulky.

B. Use a scale to measure out two 2 pound bags and two 3 pound bags of shot (or sand). Seal the bags with masking tape, without compressing the contents. Soft weights work best if they are floppy like bean bags.

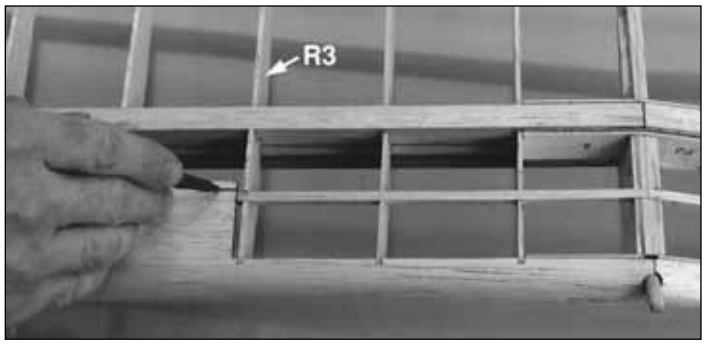
C. Put the sealed bags into the tube socks, then tie a knot in the socks to prevent them from leaking all over your bench.

## Sheet the Wing

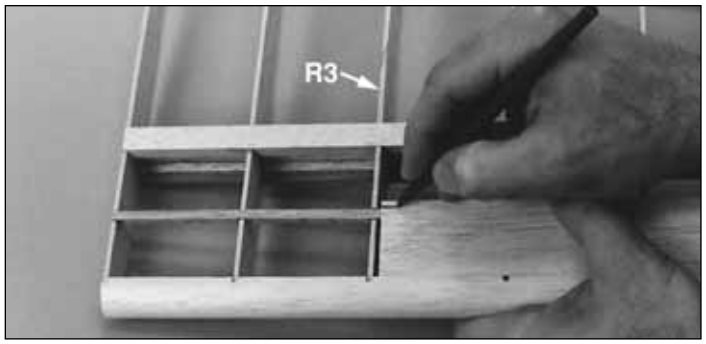
❑ 1. Use a straightedge and a new #11 blade to cut one of the 3" x 30" balsa sheets into two 1-1/2" wide sheets. If needed, true one edge of the sheets you just cut by trimming them with your hobby knife and straightedge.

## EXPERT TIP

Do not attempt to cut the sheet with only one pass of the knife but make several passes, deepening each cut as you go. This will enable you to actually strip the wood by **cutting,** not splitting, the wood. This provides a smooth, straight edge instead of a jagged edge.




❑ 2. Turn the wing upside down. Position the trued edge of one of the 1-1/2" wide sheets you just cut against the leading edge of one of the wing panels at the R3 rib nearest the root. Use a ballpoint pen to mark the “step” in R3 at the aft edge of the bottom forward spar.




❑ 3. Do the same for the other end of the sheet at the R3 rib nearest the tip.

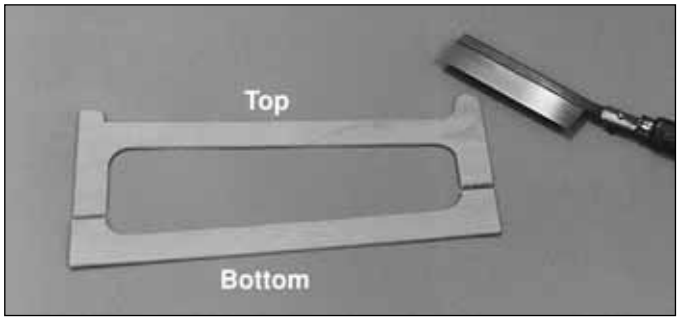
❑ 4. Use a straightedge to cut the skin *slightly wider* than the lines you marked (it’s easier to remove material than it is to add it). Test fit, but do not glue, the forward bottom wing skin between the leading edge of the wing and the notch in the ribs. A little too wide? No problem. Just use your straightedge to strip a little more off and test fit again.

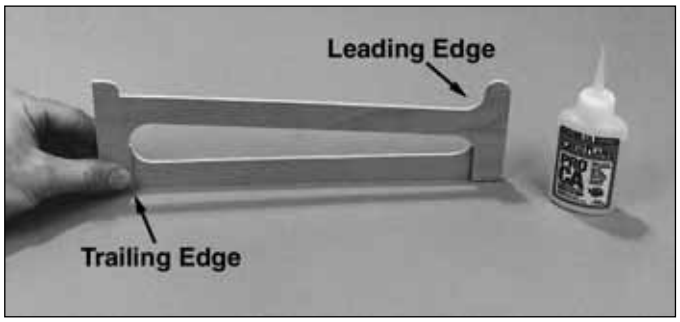
❑ 5. Use the same procedure to fit, but do not glue, the other 1-1/2" wide sheet to the other wing panel.

❑ 6. Test fit the sheets so they join at the center rib, then trim the ends so they are flush with the outside edge of the tip ribs.

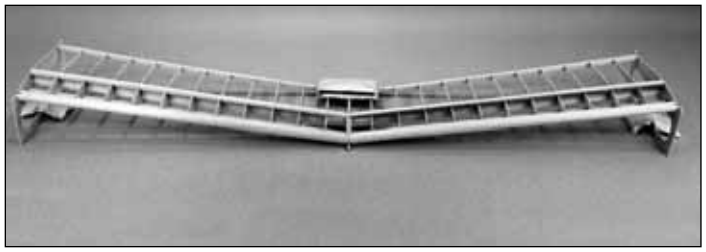
❑ 7. The sheets should temporarily stay in the wing without any glue. If needed, use a few pieces of masking tape to hold the sheets in position while you proceed to the next steps.

## *SKIP STEP #8 IF YOU ARE BUILDING THE TRAINER WING (A-WING)*



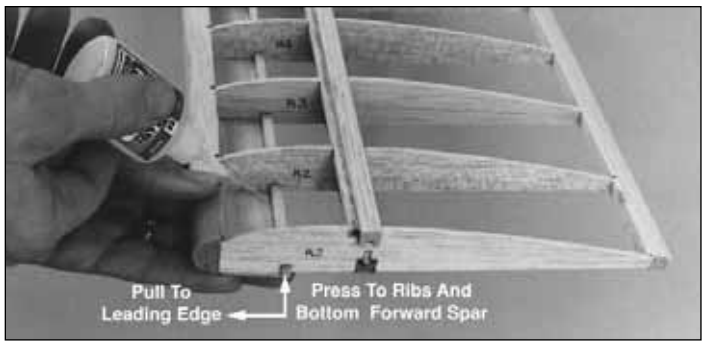

❑ 8. If you are building the **SPORT WING,** modify the **washout jigs** as follows: Use a straightedge to draw a line through the punch marks on both die-cut 1/8" plywood **washout jigs,** then use a razor saw to cut along the lines you drew, separating the tops from the bottoms. Glue two pieces together so the bottoms of both parts are even as shown in the photo. Hold both of the jigs together to make sure they are identical. If they are not **identical,** use a sanding block to even them up.



❑ 9. Turn the wing upright and carefully place weights in the center. Prop up each tip by placing the die-cut 1/8"

plywood **washout jigs** directly under each tip rib – the jigs should stand **vertically.** Be certain the jigs are positioned correctly as noted in the photo at step 8. **Hint:** It helps if you can pin the TE and rear center rib to the work bench. This will keep the wing from sliding from side to side while you position the washout jigs.

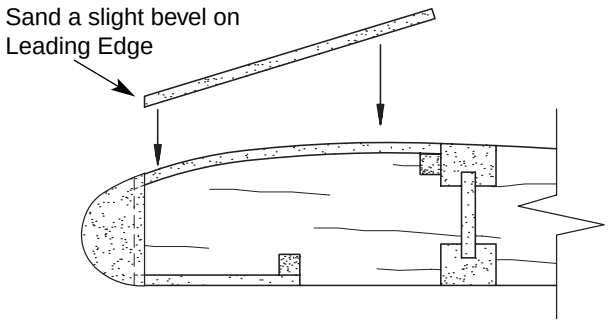
❑ 10. Tack glue the jigs to the LE, bottom main spar and TE of each wing tip with a drop of medium CA.



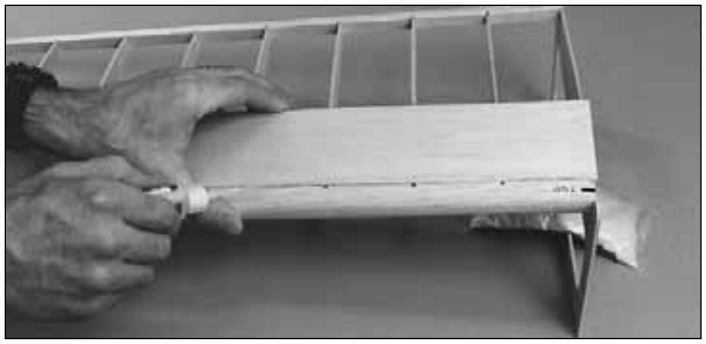

❑ 11. Press the bottom sheeting to the bottom of the ribs and the bottom forward spar, simultaneously pulling it tight to the leading edge. Use **thin** CA to securely glue the sheeting only to the ribs and the bottom forward spar. Do this one section at a time, working from the tip to the root of each wing panel. *Refrain from using any accelerator during this and the next step. Remember, residual accelerator can prematurely activate the CA you will apply during the following steps (Photo is shown with the tip jig removed for clarity).*

❑ 12. Glue the bottom sheeting of both wing panels to the LE with **medium** CA.

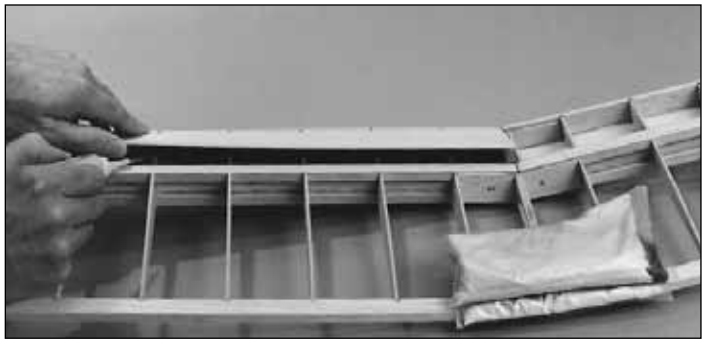
❑ 13. If necessary, lightly sand the tops of the wing ribs to even them up. Make sure there are no glue bumps or imperfections that will prevent the top sheeting from fitting well.




❑ ❑ 14. Use the same "mark and trim" technique we showed you for the bottom sheets to cut another 3" x 30" sheet for the top of one of the wing halves – remember to cut it slightly oversize at first. The top sheet fits between the LE and the main spar. Sand a slight bevel along the leading edge of the sheet, then test fit it between the LE and the top spar. Trim the root end of the sheet to fit evenly on the **centerline** of the 1-A rib.



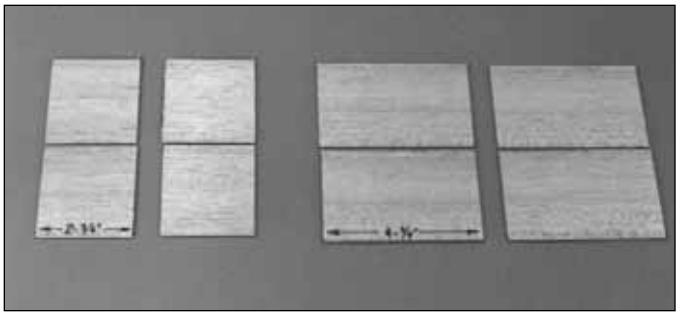
❑ ❑ 15. Hold the sheet tightly against the LE, then wick thin CA into the joint along its full length. Wipe off any excess CA before it cures.



❑ ❑ 16. From the rear of the wing, gently lift up on the sheeting. Then, working quickly, apply a bead of **medium** CA to the top of each rib and the top forward spar. Press the sheet into position and hold it there, applying even pressure or using T-pins to hold the sheeting until the CA cures.

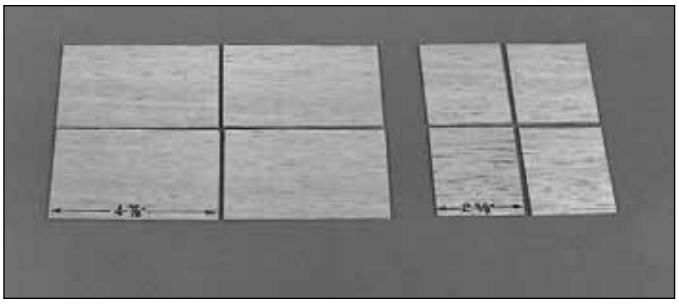
❑ 17. Cut and fit the sheeting for the LE of the other wing panel. Try for a nice joint at the center by careful sanding and test fitting. Fit and glue the second sheet in position the same as the first sheet.

## *THIS STEP FOR PT-40 MK II ONLY*

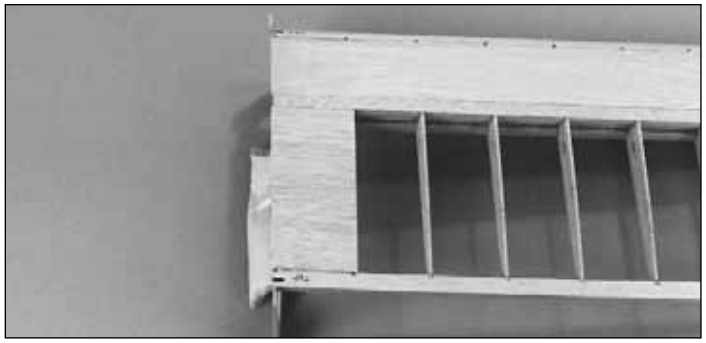


Use a ballpoint pen and a drafting triangle or a building square to ***accurately*** mark one of the remaining 3/32" x 3" x 30" sheets, dividing it into four 2-3/4" wide sheets and four 4-3/4" wide sheets. Use the square to keep the ends of the sheets perpendicular to the edges. Cut the sheets into sections along the lines you marked with a hobby knife and a straightedge. The 2-3/4" sheets are used to sheet the ***top*** of the ***wing tips*** and the 4-3/4" sheets are used to sheet the ***top*** of the ***center section.***

## *THIS STEP FOR PT-20 MK II ONLY*

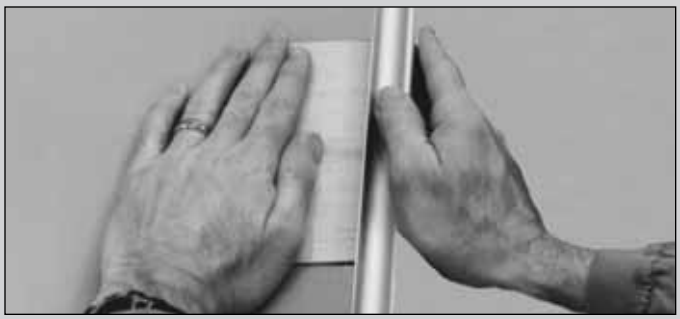


Use a ballpoint pen and a drafting triangle or a building square to ***accurately*** mark one of the remaining 1/16" x 3" x 30" sheets, dividing it into four 2-5/8" wide sheets and four 4-7/8" wide sheets. Use the square to keep the ends of the sheets perpendicular to the edges. Cut the sheets into sections along the lines you marked with a hobby knife and a straightedge. The 2-5/8" sheets are used to sheet the ***top*** of the ***wing tips*** and the 4-7/8" sheets are used to sheet the ***top*** of the ***center section.***



❑ 18. Refer to the **Expert Tip** that follows, then use the narrow sheets you just cut to sheet the wing tips over the R2 tip ribs between the spar and the trailing edge. The sheet should extend past the inboard R2 rib by approximately 1/8".

EXPERT TIP



Instead of individually gluing the two sheets to the wing tip, glue them together on your work table first (over a piece of waxed paper). Sand off the glue seam and true the inboard edge of the sheet with your bar sander. Test fit, trim, then glue the sheet to the tip.

❑ 19. Use the wide pieces you cut to sheet the center section of the wing the same way as the tips. You will have to "custom fit" the edges of the sheeting where they meet because of the curvature and dihedral of the wing. Arrange the weights so you add one side of sheeting at a time.

❑ 20. Finally you can take the weights off the wing and carefully remove those wing jigs. If you are building the wing for bolt-on attachment, use epoxy to glue in the wing dowel you cut earlier.

## *STEP 21 & 22 FOR PT-40 MK II ONLY*

❑ 21. Use your ballpoint pen and a drafting triangle to **accurately** mark and cut the last 3/32" x 3" x 30" balsa sheet into four 2-5/8" wide sheets and four 4-7/8" wide sheets. The 2-5/8" sheets will be used to sheet the ***bottom*** of the **wing tips** and the 4-7/8" sheets will be used to sheet the ***bottom*** of the **center section.**

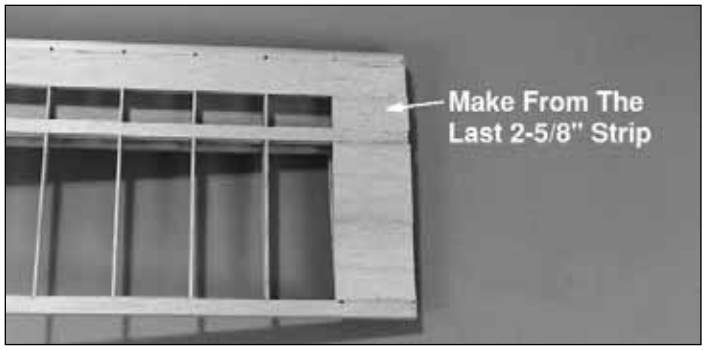
❑ 22. Find the 3/32" x 3" x 15" sheet – it should be the last piece of sheeting in the box – to cut one more 2-5/8" wide strip and one 4-7/8" wide strip.

## *STEP 23 & 24 FOR PT-20 MK II ONLY*

❑ 23. Use your ballpoint pen and a drafting triangle to **accurately** mark and cut the last 1/16" x 3" x 30" balsa sheet into four 2-5/8" wide sheets and four 4-15/16" wide sheets. The 2-5/8" sheets will be used to sheet the ***bottom*** of the **wing tips** and the 4-15/16" sheets will be used to sheet the ***bottom*** of the **center section.**

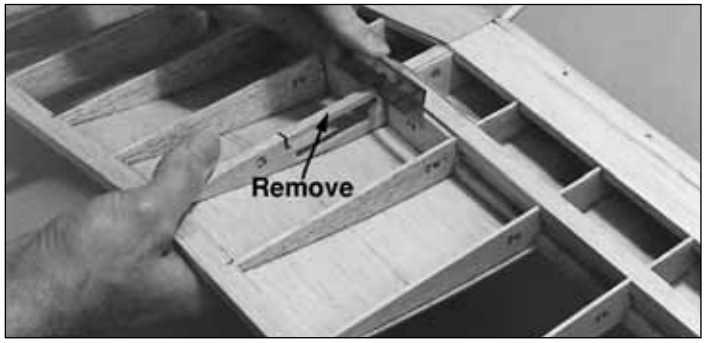
❑ 24. Find the 1/16" x 3" x 15" sheet – it should be the last piece of sheeting in the box – to cut one more 2-5/8" wide strip and one 4-15/16" wide strip.

❑ 25. Use four of the narrow sheets to sheet the bottom of the wing tips as you did the top of the wing tips.




❏ 26. Make two pieces from the last 2-5/8" strip to fill in the space between the main spar and the forward bottom sheeting at each tip. Glue the pieces in position. *You should be pretty good at wing sheeting by now.*

## *Fit the Aileron Servo Tray*

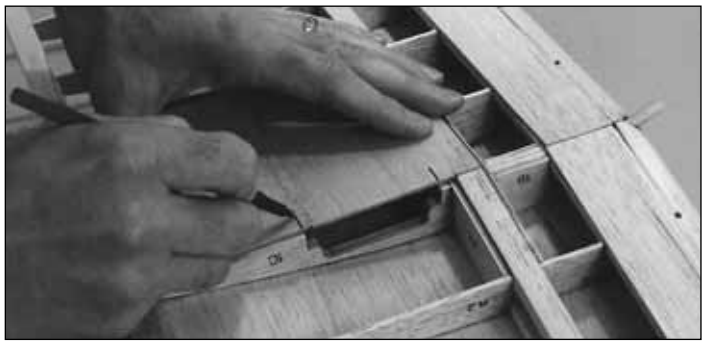



❏ 1. Cut through the thin portion of the bottom aft center rib 1C and remove the piece.

❏ 2. Remove the two die-cut 1/8" plywood **servo tray supports** and the 1/8" plywood **aileron servo tray** from the die sheet. Don't mistake the rectangular cutouts from the middle of the servo tray for scrap because they are the **servo tray doublers** for the servo screws. Put the doublers back in your kit box for safekeeping.

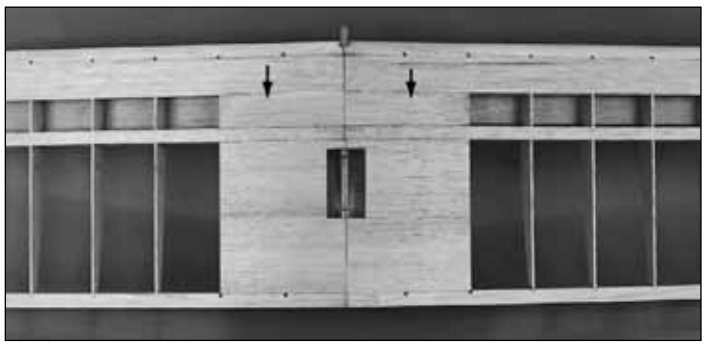
❏ 3. Insert the die-cut servo tray supports into 1C, then test fit the servo tray to the supports. Adjust the notch in 1C if required until the supports fit into the notches of the servo tray. Set these pieces aside for now.

❏ 4. Make a ***left*** and a ***right*** **bottom center section** sheet by gluing two pairs of previously cut sheets together along one edge. Trim and test fit each sheet to the bottom of the wing *(you know the routine)* but **do not glue them in position yet.**



❏ ❏ 5. Position one of the sheets on the wing and mark the location of the servo tray supports. Remove the sheet and cut a section out of it to clear the supports. Repeat the process for the other sheet.

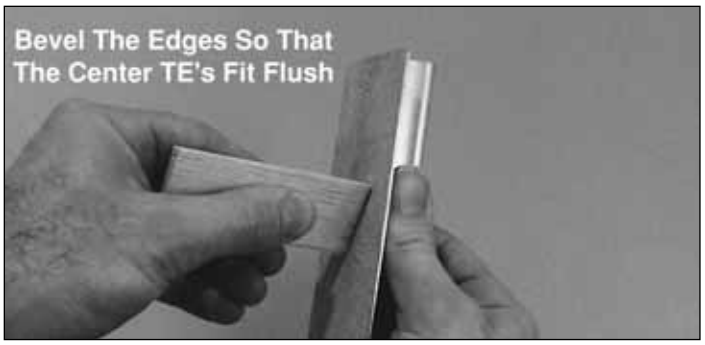
❏ 6. Test fit the sheets with the servo tray supports and the servo tray. After you have confirmed that all the pieces fit, remove the servo tray and supports and glue only the sheets to the wing center section.

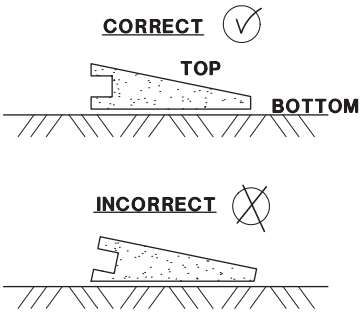


❏ 7. Use the last sheet you cut to cover the center section in front of the main spar.

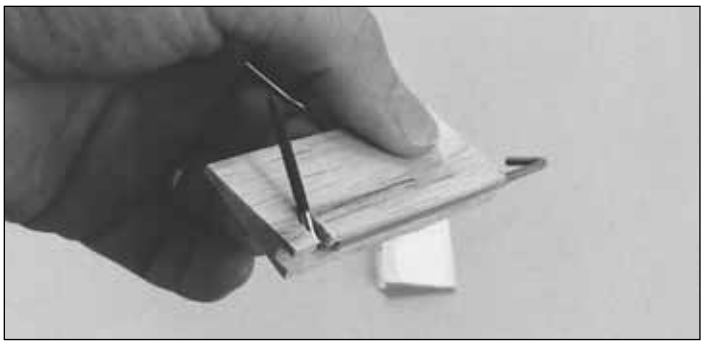
❏ 8. Before you proceed, use your bar sander and 150-grit sandpaper to "rough-sand" the structure. This will smooth out most of the high spots and remove any glue blobs. True the ends of all sheeting and spars at each wing tip.

## *Wing Completion*



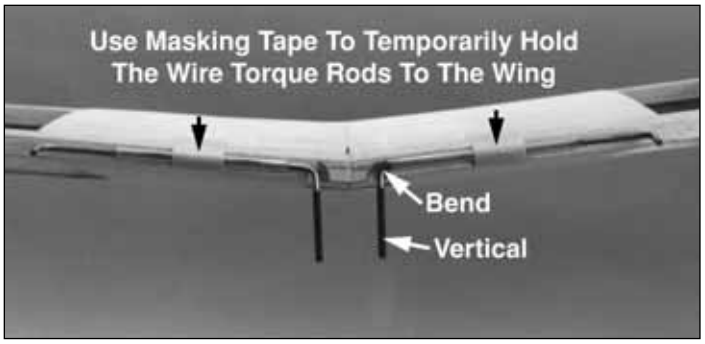




❑ 1. Reference the cross section on the wing plan so you know which sides of the tapered and grooved **wing center trailing edges** are the top and which sides are the bottom. Position the wing center trailing edges on the wing and sand a slight angle on the inboard end of each one so they fit flush when matched to the dihedral angle. Lightly mark the wing center TE's as "R" and "L."



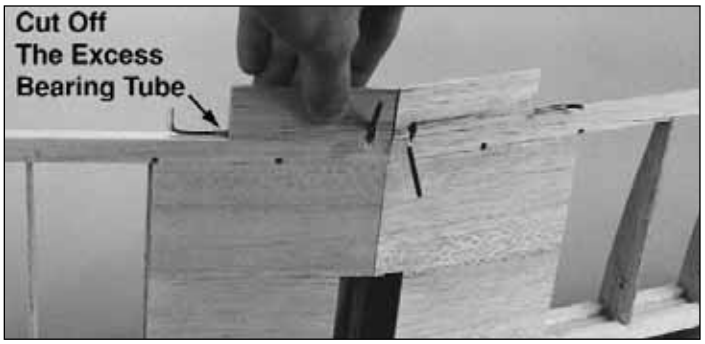
❑ 2. Position the wing center TE's over the top view of the plan with the root end aligned with the drawing. Mark the location of the aileron torque rod exits and the outboard ends of the wing center TE's as shown on the plan. Cut a notch in the **bottom forward** edge of each piece and cut them to the length shown on the plan. Test fit the wire **torque rods.**

❑ 3. Hold the wing center TE's against the aft edge of the wing aligned with the wing's centerline. Mark the torque rod notches on the bottom of the wing, then cut the notches just as you did for the wing center TE's. The notches in the wing TE don't need to be nearly as deep as the notches in the wing center TE's.




❑ 4. Use a pliers to bend the wire torque rods so the threaded "arm" is vertical when the torque rods are positioned on the trailing edge of the wing.

❑ 5. With the torque rods in the wing center TE's, position the nylon bearing tubes so they do not restrict movement of the torque rods. If part of the bearing tube protrudes from the Wing center TE's, trim it off (see the following photo).



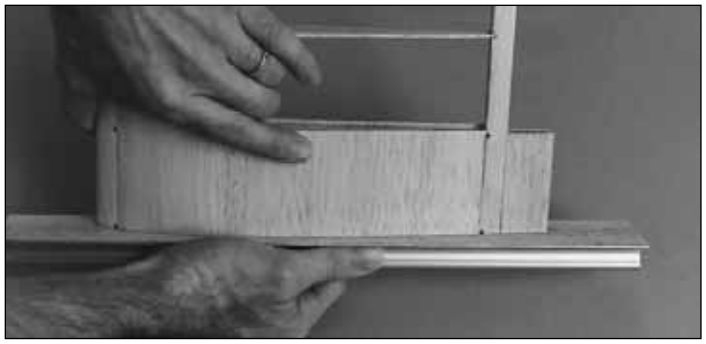

❑ 6. Position the Wing center TE's with the torque rods on the trailing edge of the wing. Make sure the notches align and are deep enough to give the torque rods enough throw.

❑ 7. Use coarse sandpaper to roughen the part of the torque rods that fit into the ailerons and also the nylon bearing tubes.

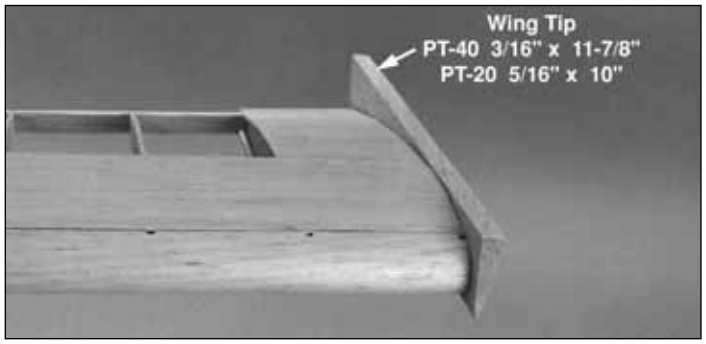
❑ 8. With a toothpick, apply a small amount of petroleum jelly (Vaseline, etc.) around the torque rods at each end of the nylon tubes. This will help prevent glue from entering the nylon tube.

❑ 9. Apply 30-minute epoxy to the nylon tubes, staying clear of the tubes ends. Insert the tubes into the grooves of the Wing center TE's. Use a paper towel to wipe off any epoxy that squeezes out. Apply epoxy to the forward and inboard edges of the Wing center TE's, then glue them in position as shown at step 6. Use masking tape to hold the Wing center TE's in position while the epoxy cures.

❑ 10. Cut a 2-5/8" piece from each 30" **aileron** to make the wing **tip trailing edges.** Glue the tip trailing edges to the wing so that the end of the tip TE protrudes past the wing tip by approximately 1/16". This will assure that the tip TE is flush with the end of the wing after sanding.



❏ 11. Use your bar sander to sand the tip TE's flush with the tip rib.

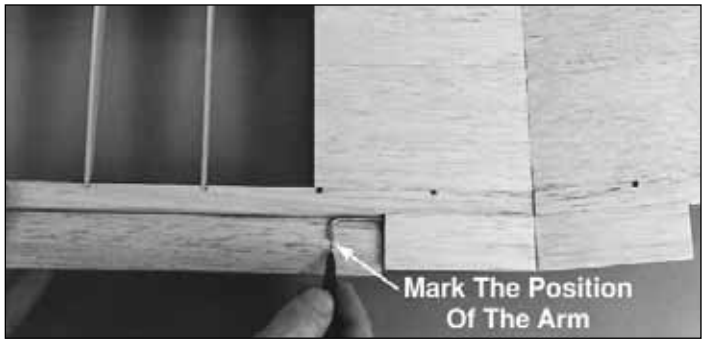


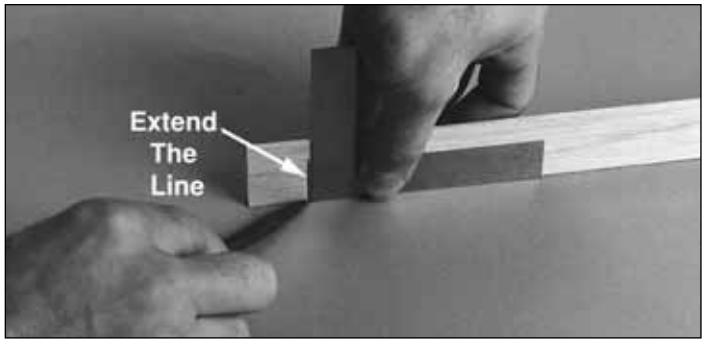

❏ 12. While you're working on the end of the wing, glue the 3/8" x 11-7/8" tapered balsa **wing tips** to each end of the wing with medium CA (the **wing tips** for the PT-20 are 5/16" x 10"). The wide part of the tapered tip goes on top. Be sure the bottom of the tip is flush or approximately 1/16" below the bottom tip sheeting.

❏ 13. Carve or plane the tip so it is nearly flush with the wing, then use your bar sander and 220-grit sandpaper to make it flush.

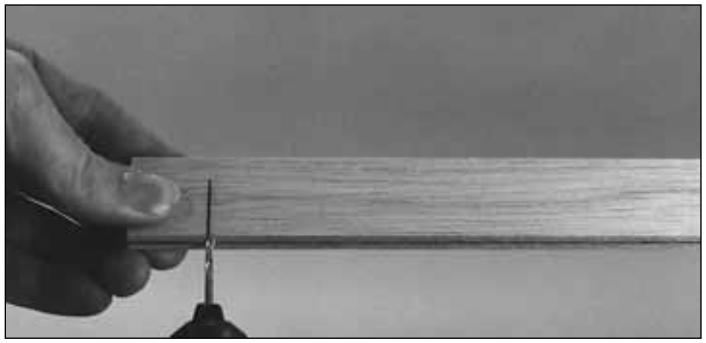
*Enough of the fun stuff. Let's get back to work and finish this wing!*

❏ ❏ 14. After the epoxy on the center trailing edges has fully cured, position an aileron on the left wing panel and mark the distance between the tip trailing edge and the center trailing edge. Don't forget there is a **top** and a **bottom** to the aileron. Reference the sketch at step 1. Cut the aileron 1/8" shorter than the mark. Mark this as the Left aileron.

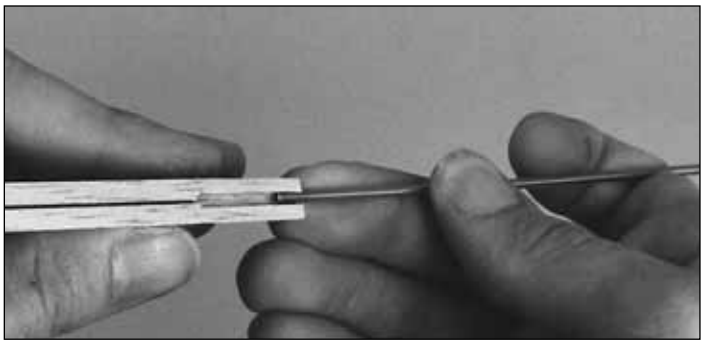



❏ ❏ 15. Hold the left aileron in position, **centered** in the aileron opening, then mark the location of the torque rod arm. Use a square to extend your marks to the front edge of the aileron.



❏ ❏ 16. Use the techniques we've shown you to draw a centerline along the entire length of the front edge of the aileron (use the piece you cut off in the previous step to "practice on" to find the centerline). Use the centerline and the "torque rod mark" as a guide to drill a 3/32" hole 5/8" deep into the aileron for the torque rod.



❑ ❑ 17. Cut a groove starting from the hole you drilled to the inboard edge of the aileron. **Hint:** Use a hobby knife to sharpen the inside of one end of a 1/8" diameter brass tube, then use the tube to cut the groove.

❑ ❑ 18. Test fit the ailerons to the wing and the torque rods. Make adjustments to the depth of the holes or the grooves you cut so the aileron fits against the trailing edge of the wing. Make sure there is about 1/16" of clearance between the ends of the aileron and the wing center TE's and tip TE's.

❑ 19. Fit the right aileron to the wing in the same manner.

❑ 20. Reference the wing plan and mark the hinge locations on the ailerons and the trailing edge of the wing. Mark the center lines of the hinge slots on the trailing edge of the wing.

❑ 21. Cut the hinge slots in the ailerons and the wing TE.

❑ 22. Refer to the wing cross section on the plan for the desired "V" angle on the ailerons and mark the "bevel to" lines on the top and bottom of the ailerons. Use your razor plane or bar sander to shape the forward edges of the ailerons to a "V."

❑ 23. Test fit the ailerons to the wing and torque rods using hinges. Make adjustments to the hinge slots if needed. For future reference, mark each aileron as "R" and "L" in an inconspicuous location (i.e., on the bottom or an end).

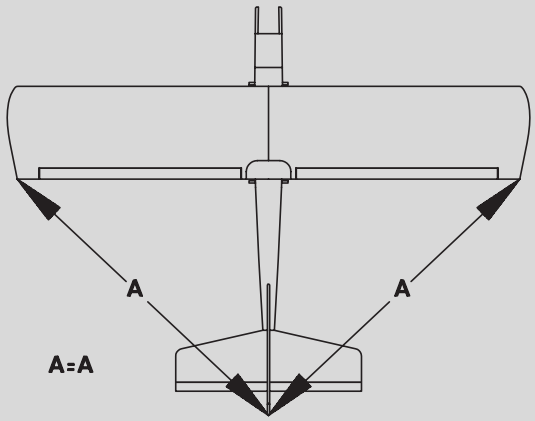
## *SKIP STEP #24 IF YOU ARE BUILDING THE BOLT-ON WING VERSION*

❑ 24. If you are building the PT-40, glue each 1/32" plywood wing protector to the top of the wing 1" from the center. If you are building the PT-20, the wing protectors should each be 7/8" from the center. Align the aft edge of the wing protector with the aft edge of the wing center TE.

## CONSTRUCTION NOTE:

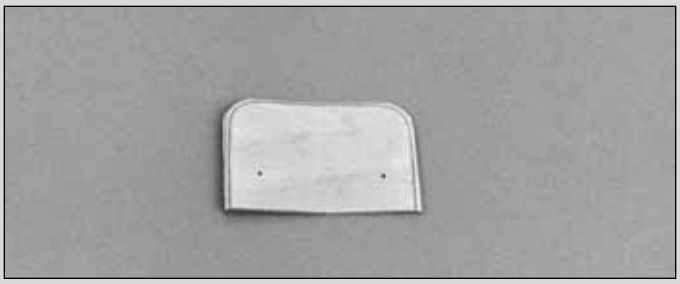
**Perform this step ONLY if you are building the bolt-on wing version.**

❑ 1. Use a 1/4" drill to angle the hole in F-2 downward to match the angle of the wing dowel. Test fit the wing in the wing saddle. It should sit about 1/16" – 3/32" above the wing saddle to account for the wing seating tape which will be applied after you cover the fuselage.




❑ 2. Align the wing with the fuselage by using a string or a tape measure to equalize the distance from each wing tip to the TE of the fin (or the end of the fuselage if you have not glued the fin in place yet). Once aligned, lightly draw matching reference marks on the center TE and the fuse top.

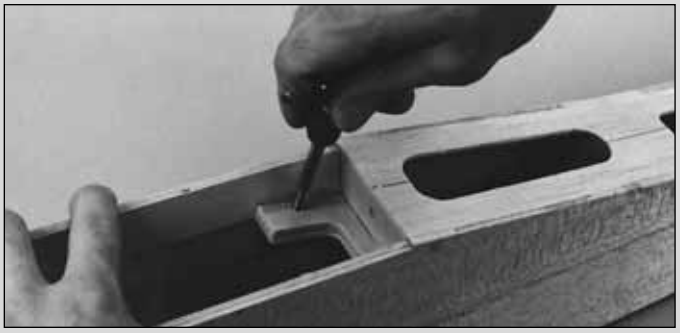
❏ 3. Use your bar sander and 220-grit sandpaper to bevel the sides and front of the top edges of the die-cut 1/16" plywood **wing bolt plate** (see the photo at step 4). The side of the plate with the scored centerline is the **bottom.**



❏ 4. Drill a 1/16" hole through the punch marks in the wing bolt plate. *Carefully* "crack" the plate along its scored centerline – try not to break it in two. The plate should "bend away" from the scored line. **Hint:** Use your #11 knife blade to **lightly** score an additional centerline on the *top* of the plate.

❏ 5. With the wing on the fuselage and in alignment as described in step 2, use medium CA to glue the wing bolt plate to the top of the wing. **Note:** The aft edge of the plate should be even with the trailing edge of the wing and the sides of the plate should align with the sides of the fuselage.

❏ 6. While holding the wing securely in position, use a #10 or a 13/64" drill bit to drill through the wing protector, the wing, and the wing bolt plate in the fuselage. See the **Expert Tip** below and try your best to keep the drill perpendicular to the top surface of each wing half that you drill through so the heads of the bolts will be even with the wing when tightened down. **IMPORTANT: Do not allow the wing to shift during this procedure.**



❏ 7. Tap threads into the wing bolt plate with a 1/4-20 tap.

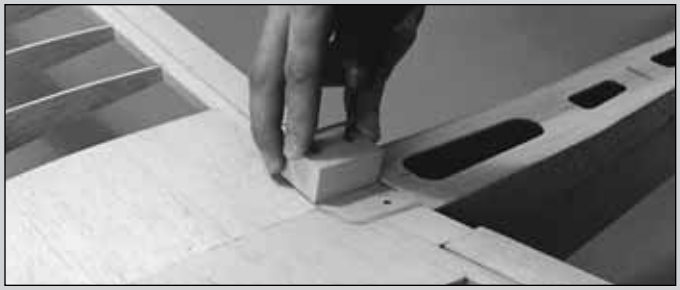
❏ 8. Apply several drops of thin CA to the threads in the wing bolt plate. **Allow the CA to cure thoroughly,** then re-tap the threads**.**

❏ 9. Test fit the wing to the fuselage with two nylon 1/4-20 **wing bolts** supplied in this kit.

## EXPERT TIP

The most accurate way to make sure the holes you drill for the wing bolts are perpendicular to the top surface of the wing bolts are perpendicular to the top surface of the wing is to make a **drill guide.** You'll need a drill press so if you don't have one, beg or borrow (don't steal) a friend's.

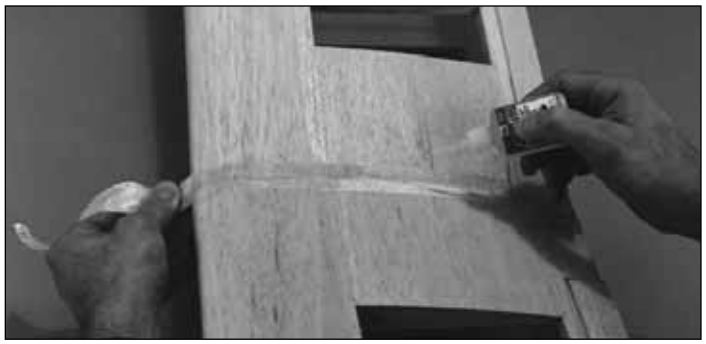

A. Use a drill press to drill a perpendicular #10 (or 13/64") hole and a 17/64" hole in an approximately 1" x 2" x 2" hard wood block.



B. Position the drill guide and drill the #10 hole through the wing and the wing bolt plate in the fuse. The drill guide will accurately "steer" the drill toward the bolt plate. **Remove the wing** and drill the clearance hole in the wing with the 17/64" hole in the drill guide.

*Now the holes on the wing and the bolt plate will be perfectly aligned and the wing bolts will fit squarely on the wing when tightened.*

## *Reinforce the Wing*



❏ 1. Glue the **fiberglass cloth** to the center section of the wing with thin CA. Start by tacking one end of the cloth to

the top of the wing at the front of the wing bolt plate (start at the trailing edge of the wing if you are building the rubber band-on wing). Pull the tape around the leading edge (**CAUTION:** Work in a well ventilated area when applying the CA). Wick thin CA into the cloth and wing sheeting while holding the cloth tightly in position. Turn the wing over, then pull the cloth around the LE toward the TE and glue in position.

❑ 2. Cut off any excess cloth, then lightly sand the surface to smooth off any glue bumps.

*Well, you're through the framing stage and you've given life to a box of balsa. It's really going to fly! Have you decided on your color scheme yet?*

# FINISHING

## Final Sanding

Refer to the **Expert Tips** below, then fill any scuffs, dents or gaps in the balsa with HobbyLite balsa filler. After the filler has fully hardened, sand the entire fuselage with progressively finer grades of sandpaper, ending with 320-grit. Slightly round the corners of the fuselage.


**REPAIRING SURFACE "DINGS"**
Many surface blemishes in the balsa of a framed model are caused by glue bumps or wood chips on your building table. This type of dent in the balsa may be repaired by applying a drop or two of window cleaner or tap water to the dent, then running a hot sealing iron over the spot to expand the wood fibers. After the surface has dried, sand the expanded area smooth.

**FINISH-SANDING**
Many beginners (and some experts) start out with a sound structure and good glue joints but end up with a model that doesn't look its best. One area where some fall short is in the sanding department. It's not necessarily the *technique* of sanding but *how much* sanding that's important. Below are some tips to help your finished model live up to (or compliment) the building job you have done so far:

A. You should wear a particle mask when you are going to do lots of sanding.

B. Keep your sandpaper fresh. When it becomes worn or clogged replace it.

C. You must use a flat sanding block of some type when sanding flat areas such as fuselage sides/top/bottom, tail surfaces, etc. (more details on this subject are located in the front of this manual). If you don't have a bar sander use a flat block of hard wood or something similar.

D. Most important – **don't neglect the sanding job.** While you should inspect your work frequently to make sure you are not over-thinning the wood (more of a concern on 1/16" wing sheeting), you should be able to remove all the uneven glue joints in the structure (such as the fuselage sides) with enough sanding.

E. Sanding *across* the grain removes more wood but leaves sanding marks. Sanding *with* the grain leaves a better finish. You may rough sand across the grain but finish sanding with the grain.

## Fuelproofing

*Fuelproofing may be done either before or after covering.*

❑ 1. Remove the engine mount, fuel tank, landing gear and any other hardware you may have installed in the model.

❑ 2. Fuelproof the engine and fuel tank compartments and any other areas that may be exposed to fuel (such as the landing gear rails, the tops of formers F-2 and F-3, the inside of the fuel compartment hatch). You can use any fuelproof paint such as K&B Superpoxy, model airplane dope or 30-minute epoxy. Pay special attention to the firewall. Refrain from allowing paint or epoxy to clog the blind nuts. Apply petroleum jelly to the threads with a toothpick. If you get some on the wood, be sure to clean it off with rubbing alcohol before fuelproofing.

## Balance the Airplane Laterally

**SPECIAL NOTE: Do not confuse this procedure with "checking the C.G." or "balancing the airplane fore and aft." That very important step will be covered later in the manual.**

Now that you have the basic airframe nearly completed, this is a good time to balance the airplane **laterally** (side-to-side). Here is how to do it:

❑ 1. Temporarily attach the wing, engine (with muffler) and landing gear to the fuselage.

❑ 2. With the wing level, lift the model by the engine propeller shaft and the fin (this may require two people). Do this several times.

❑ 3. If one wing always drops when you lift the model, it means that side is heavy. Balance the airplane by gluing a weight to the **inside** of the other wing tip. **Note: An airplane that has been laterally balanced will track better in loops and other maneuvers.**

## *Cover the Structure*

Several trim options are shown on the box. You may duplicate one of these or use them as a “starting point” to create your own trim scheme.

**Modelers who have not used iron-on coverings should refrain from attempting complicated trim schemes.** You may add stripes, graphics and various designs to your PT. These are cut from different colors of covering, then ironed directly over the base color. If you are new to iron-on coverings, try just a single color base (usually a lighter color such as white or yellow) with perhaps a single stripe, your AMA number, or some stick-on graphics. A simple trim scheme will get you in the air faster and look much better (not to mention give you fewer headaches) than a model that was difficult to cover because of too ambitious a trim scheme.

Make sure the structure is sanded smooth with **320-grit** sandpaper. Remove as much dust as possible from the structure with a vacuum cleaner and a brush or a **Top Flite Tack Cloth** so the covering will stick well.

Cover the aircraft with **Top Flite MonoKote** covering using the sequence that follows. Make sure the MonoKote is thoroughly stuck down and all of the edges are sealed. Use a **Top Flite MonoKote Hot Sock** on your covering iron to avoid scratching the MonoKote film and denting the wood.

### EXPERT TIP

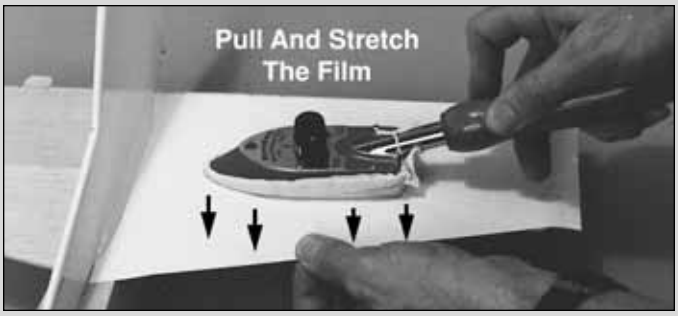
**COVERING TECHNIQUE**

You can practically eliminate wrinkles that sometimes occur in the covering when the model is left out in the sun or in your car by following this technique used in the **Great Planes** model shop:

A. Cover your sealing iron with a **Top Flite Hot Sock** and turn the heat about 3/4 of the way to the high setting.

B. When covering areas that involve sharp junctions, like where the tail meets the fuse, apply narrow strips (3/8" to 1/2") in the corners **before** covering the major surfaces. This is an area where the **Top Flite Trim Seal Tool**™ really comes in handy. The larger pieces of MonoKote film will overlap and capture these smaller pieces. This technique also bypasses the need to cut the MonoKote film in these areas after it has been applied. **DO NOT, under any circumstances, attempt to cut the covering material after it has been applied to the fin and stab, except around the leading and trailing edges and the tip.** Modelers who do this often cut through the covering and part-way into the balsa stab.


C. Cut a piece of MonoKote film for the stab about 2" larger all around. Strip off the backing and position the film flush with the fin, over the MonoKote corner strip. Tack the film down at the center of the stab/fin junction. (For illustration clarity the covering pieces in these photos are not cut 2" over size.)




D. Pull (as in stretch) the film toward edges of the stab, sealing it to the balsa from **the fin outward,** the width of your sealing iron. Work out any **wrinkles and air pockets** as you proceed with a **back and forth motion.**

E. Stretch the MonoKote film **toward the four corners, sealing it down as you proceed.** The trick is to shrink out any wrinkles before you seal the film to the surface.


F. Use a heat gun or your iron with the heat turned all the way up to heat and stretch the film around curved surfaces like the stab and rudder tips. Pull on the excess material while you apply the heat. You may need to pull hard to get out all of the wrinkles, so wear a glove if you

need to. Trim off the excess, then follow-up with your sealing iron to secure the bond.

The idea behind this approach (which can be applied to any part of the model) is to **pre-stretch the MonoKote** film as it's applied, removing the air pockets that can expand later causing sags and wrinkles.

## *Recommended Covering Sequence*

**Tail Surfaces**

❑ 1. Tail Junction Strips as described above
❑ 2. Stab bottoms
❑ 3. Stab tops*
❑ 4. Fin left side, then right side
❑ 5. Elevator bottom, then top
❑ 6. Rudder left side, then right side

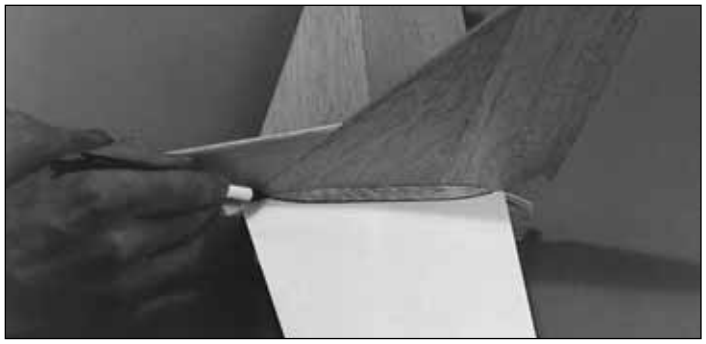
**Wing**

❑ 1. Ends of ailerons
❑ 2. Bottoms, then tops of ailerons
❑ 3. TE of wing (the hinge line)
❑ 4. Wing tips
❑ 5. Bottom of left, then right wing panel (overlap the covering 1/4" at the center)
❑ 6. Top of left, then right wing panel (overlap the covering 1/4" at the center)

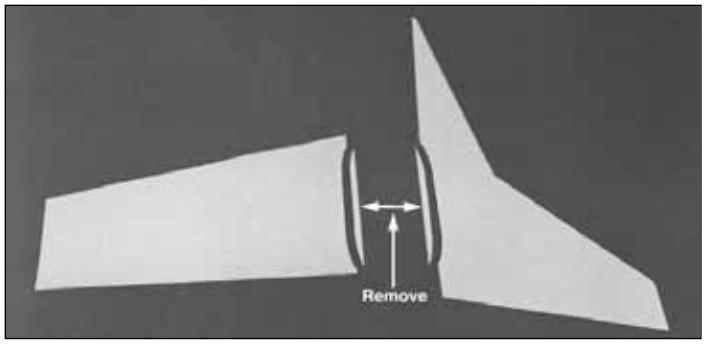
**Fuselage**

❑ 1. Fuse bottom
❑ 2. Fuse sides
❑ 3. Fuse top
❑ 4. Windshield
❑ 5. Fuel tank compartment hatch

* It's easier to cover the triangular **fin reinforcements** before you glue them in place.

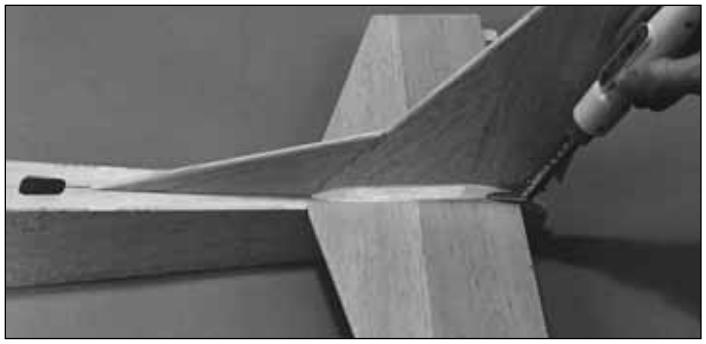


❑❑ A. **Without ironing it down,** place the left side of the stab covering on the stab, then position the fin reinforcement. Use a felt-tip pen to trace the outline of the fin reinforcement onto the stab covering. Do the same thing **for the left side of** the **fin** covering. *The stab and fin MonoKote film pieces shown in these steps are cut only slightly oversize for illustration clarity though as we mentioned, you should cut most of your covering pieces about 2" oversize all the way around.*

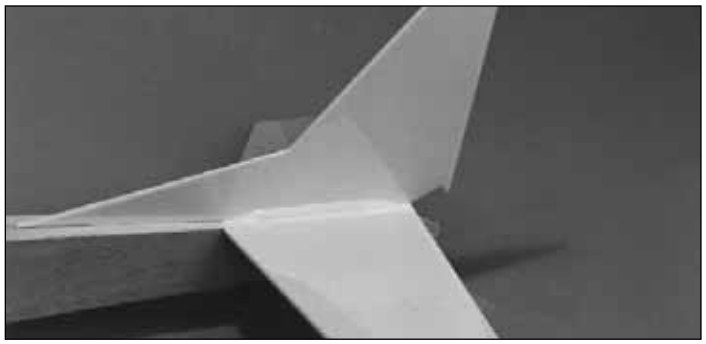



❑❑ B. Remove the stab and fin covering from the model. Place the covering on your workbench (or a cutting mat if you have one), then cut it along the outline you made of the fin reinforcement. After cutting, remove any ink left on the covering with a cloth dampened with alcohol.


❑❑ C. Cover the triangular fin reinforcement but leave about 3/32" of extra covering all the way around.



❑❑ D. Glue the fin reinforcement in position with medium CA. Use a Trim Seal Tool to iron the excess covering to the fin and stab.



❑❑ E. Cover the stab and fin with the pieces you cut earlier.

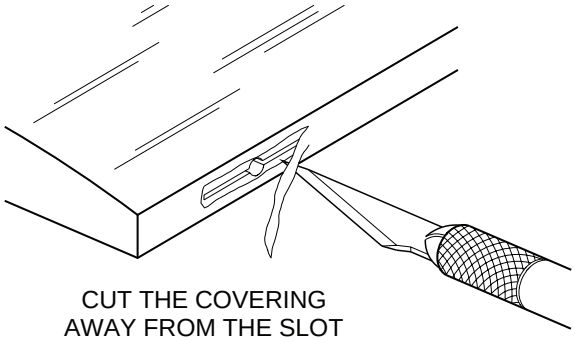
❑ F. Perform the same operation for the other side of the stab and fin.

**Applying windows.**

Use the patterns on the fuse plan (or make your own templates) to cut the window shapes from MonoKote film or self-adhesive MonoKote Trim Sheet. After cutting the pieces to size, wipe the area on the fuselage to be covered with soapy water. A couple of drops of dish detergent to a cup of water is sufficient. Peel the backing from the MonoKote film or MonoKote Trim Sheet, then “float” the covering into position. Use a piece of balsa wood to squeegee the solution from underneath the window. Only work in one direction, blotting moisture after each pass. Iron the film in position if you have used MonoKote film.

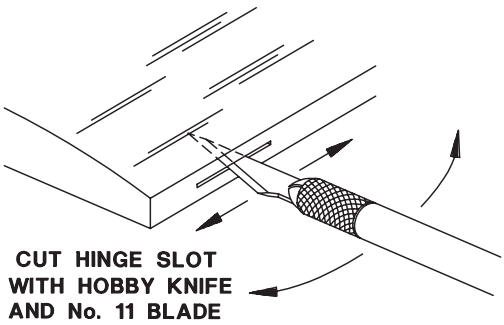
# FINAL HOOKUP AND CHECKS

## Join the Control Surfaces

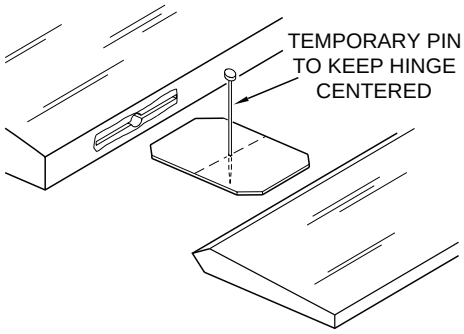


CUT THE COVERING
AWAY FROM THE SLOT

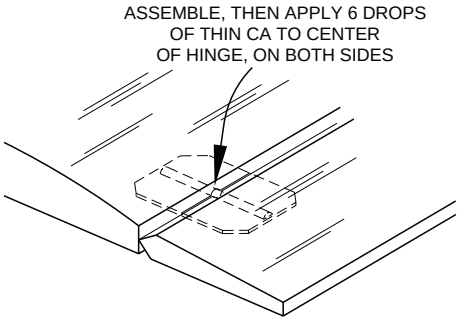
❑ 1. Start with the elevator and the stab. Cut the covering from the hinge slots – don’t just *slit* the covering but actually remove a small strip of covering the size of the hinge slot.



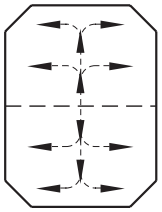

❑ 2. Drill a 3/32" hole 1/2" deep in the center of each hinge slot. A high speed Dremel Tool works best for this. If you have to use a drill, clean out the hinge slots with your #11 blade.




❑ 3. Join the elevator to the stab with the hinges but **don’t glue yet.** Confirm that the hinges are equally positioned in both the elevator and the stab. You may insert a small pin in the center of the hinges to keep them centered. Close the hinge gap to 1/32" or less – it is better to have a *slight* gap to avoid inadvertently gluing the control surfaces together. Remove the pins if you have used any.




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



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

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

❑ 5. Join the rudder to the fin using the same procedures.

❑ 6. Clean the aileron torque rod arms with rubbing alcohol to remove skin oils or smeared petroleum jelly.

❑ 7. Prepare the hinge slots in the ailerons the same way as the tail surfaces.

❑ 8. Use a toothpick to pack the torque rod holes in the ailerons with 30-minute epoxy, then install the ailerons with the hinges and thin CA using the methods we've described. Wipe away the epoxy that is squeezed out of the ailerons with a paper towel and alcohol.

❑ 9. If you're building the rubber band-on wing, reinstall the 1/4" wing dowels and glue them in position with thin CA. Fuelproof the exposed ends of the dowels.

## *Install the Landing Gear*

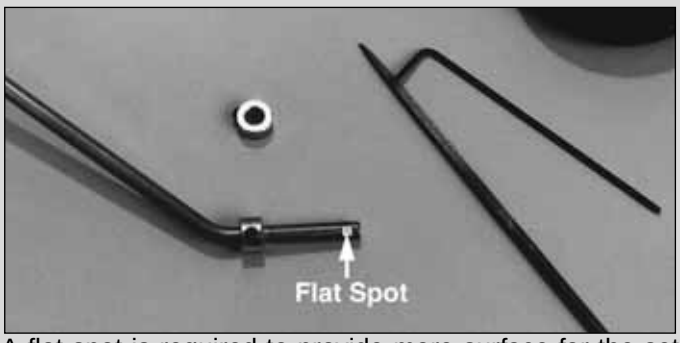
**Skip step #1 if you are building the PT-20**

❑ 1. Enlarge the wheel hub axle holes of the **PT-40 main wheels only** with a #10 (or 13/64") drill bit and an electric drill.

**Wheel Collar**

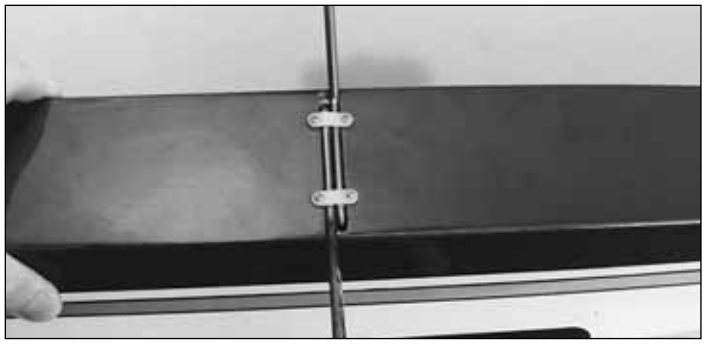
❑ 2. Temporarily install the main wheels on the **main landing gear** using a wheel collar (not included) on each side of the wheel.

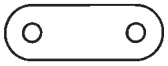
❑ 3. Note where the set screw of the outer wheel collar contacts the landing gear wire (usually there is a mark on the wire where the set screw was tightened). Remove the wheel collar, then file a flat spot where the set screw contacts the gear. This is only required for the outer wheel collars that hold the wheels on.




A flat spot is required to provide more surface for the set screw to hold onto. Locate the mark left by the set screw. Now, with the mark facing up, use a flat file or a Dremel tool with a narrow grinding wheel to make a flat spot at the mark.

❑ 4. Reinstall the wheel and wheel collar. Use liquid thread lock to secure the set screws on all wheel collars.





**Nylon Landing Gear Strap**

❑ 5. Seat the landing gear wire in the landing gear rail on the fuselage. Use a **nylon landing gear strap** as a guide to drill 1/16" pilot holes for the screws. Secure the landing gear with two nylon straps and four **#2 x 3/8" sheet metal screws.**

❑ 6. Install the nose wheel on the **nose gear wire** with two 3/16" wheel collars. Don't forget the flat spot for the outer collar and thread lock on the set screws.

❑ 7. Roughen the outside surface of the throttle and nose steering pushrod guide tubes. Install the tubes in the firewall and F2, then glue them in position with medium CA.

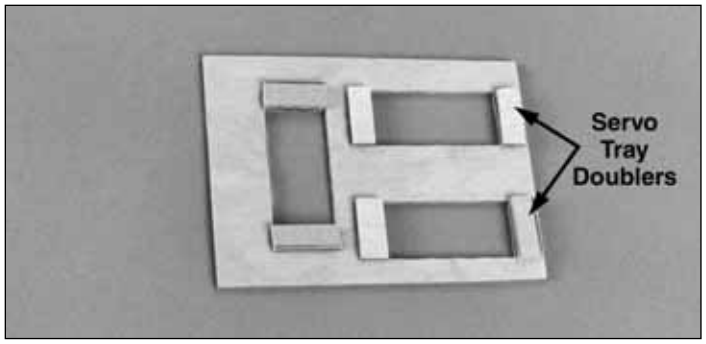
❑ 8. Reinstall the engine mount, the nose landing gear wire, the nose steering pushrod, the steering arm and the throttle pushrod the same way you did during fuselage construction. Check that the nose gear spring **coil** clears the bottom of the fuse, then temporarily tighten the set screw in the wheel collar under the engine mount to set the height of the nose gear wire.

❑ 9. Refer to the top view of the fuse plan for the required angle of the nose wheel and the steering arm, then temporarily tighten the screw in the steering arm. This off-center position will enable you to turn left, as well as right. Test the linkage for free movement. The collar and steering arm will be securely locked in position later when we check the ground stance of the model.

❑ 10. Install the engine, muffler, prop and spinner. Don't worry about putting the prop and spinner on permanently at this stage.

## *Preliminary Radio Installation*

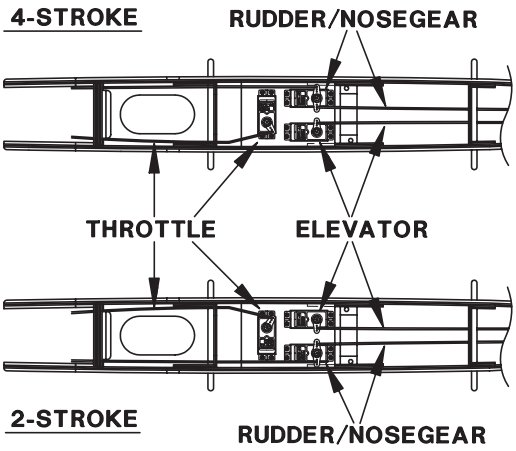
❑ 1. Test fit your servos in the die-cut 1/8" plywood **servo tray** and make adjustments to the size of the openings for the servos if required. The sides of the servos should not contact the edges of the openings in the tray.



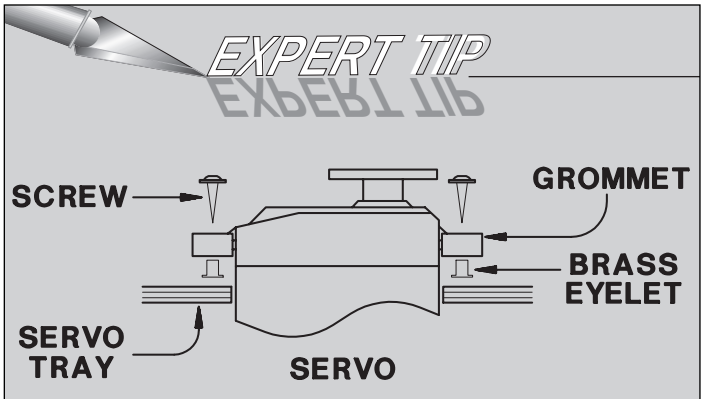

❑ 2. Glue the die-cut 1/8" plywood **servo tray doublers** to the **bottom** of the servo tray with medium CA.

❑ 3. Wrap the battery in one layer of 1/4" foam rubber and secure the foam with tape or rubber bands. Install the battery under the fuel tank floor, then temporarily install the fuel tank compartment hatch with **#2 x 3/8" screws.**

❑ 4. Cut the elevator and rudder pushrod tube guides ahead of F-3 to the approximate length shown on the plan.




❑ 5. See the **Expert Tip** below and mount three servos in the die-cut 1/8" plywood servo tray in the position shown in the sketch for the type of engine you will be using.



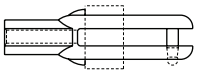

**MOUNTING SERVOS**
The proper way to mount a servo is as follows:
A. Insert a rubber grommet into each of the four servo notches.

B. Insert the metal eyelets up from the **bottom** of the rubber grommets. This way the "lip" of the eyelet will be in contact with the servo tray when mounted. The rubber grommets will isolate the servo from vibration.

C. Position the servo in the servo tray, then mark the location of the mounting holes. Drill pilot holes in the tray with a 1/16" bit at each mark.

D. Use the servo screws supplied with your radio to mount the servos in the servo tray. Tighten the screws until they **just touch** the top of the metal eyelet.

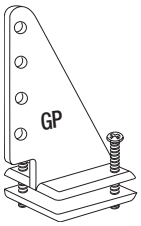
❑ 6. Place the servo tray in the fuselage at the location shown on the plan. Do not glue servo tray in position yet, as you need to be able to shift it forward or aft to help balance the model.



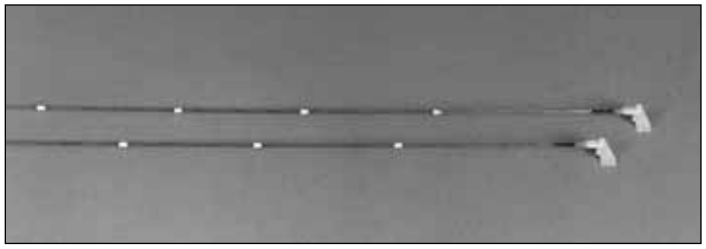

**Nylon Clevis**

❑ 7. Slide a **silicone retainer** over the "hex" end of a **nylon clevis.** Screw the clevis 14 revolutions onto the threaded end of a **36" wire pushrod.**

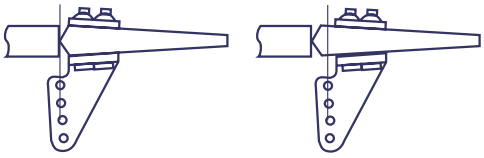
❑ 8. Cut six **1/4" bushings** from the short plastic inner pushrod tube provided in the kit. Slide the bushings on the wire pushrod, spacing them as shown on the plans. **Do not cut the pushrod** wires yet, as you may need to move the servo tray to balance the model. Be sure that the bushings on each end are **"in"** far enough so that they **won't come out of the pushrod tubes** and cause the control to lock. If they are too loose, put a drop of thin CA on the pushrod wire at each bushing to hold them in place. Make sure the **CA is fully cured** before inserting the pushrods into the tubes.




**Nylon Control Horn**

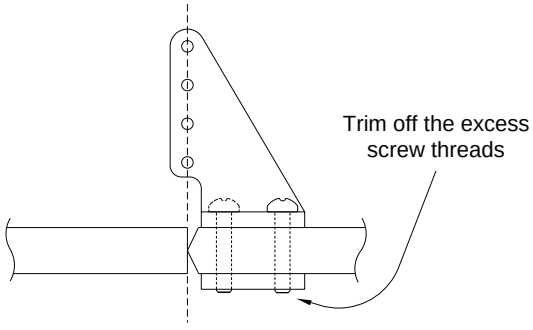


❑ 9. Trim the **backing plate** from a **nylon control horn,** then temporarily fasten the clevis to the second from the outer hole of the horn. Make a second pushrod assembly exactly the same as the first.



Correct Incorrect

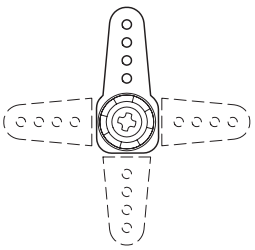
❑ 10. Insert the pushrods into the tubes in the fuse, then hold the horn on the elevator aligned as shown in the sketch. The rudder horn is on the left side of the airplane and the elevator is on the right.




❑ ❑ 11. Mark the location of the holes on the elevator or use the holes themselves in the horn as a guide to drill 3/32" holes through the control surface. Screw the horn in place with two **2-56 screws** and the **backing plate.** Repeat for the rudder.

❑ 12. Prepare **three** "cross" style servo horns as follows but don't install them on the servos until instructed to do so:

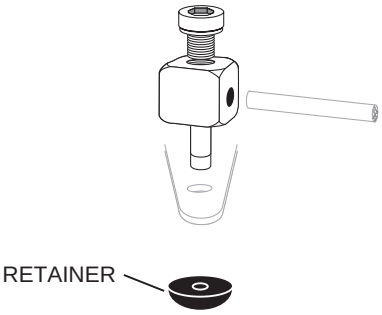
**Note:** *The size and shape of servo horns varies from manufacturer to manufacturer. The sketches and photos show a typical radio installation with standard horns. All standard servo horns should fit in the PT-40. If you are building the PT-20 some servo horns may interfere with each other or the side of the fuselage. To avoid this, shorten the servo horns and move the pushrod one hole in or, if you have a Futaba radio system, you can make the horns out of the "six arm" horns which are shorter.*



**SERVO ARM MODIFICATION**

❑ A. Cut off three arms from **two** servo horns included with your radio control set to make them into "one arm" servo horns. These two single arm horns will be used for the elevator and throttle. Use your bar sander to remove the remaining jagged edges left from the cut-off arms.

❑ B. Enlarge the holes in one of the horns with a 5/64" drill. This will be the **elevator horn.** The other horn is the **throttle horn.**




❑ C. Temporarily install a **Screw-Lock Pushrod Connector**™ in the **throttle horn** where shown on the plan. **Don't install the retainer** until you test the throttle's operation.

❑ D. Cut the **opposite** arms off a third servo horn to make one "long arm" horn. This is the **rudder horn.**

❑ E. Enlarge the holes in **only one side** of the **rudder horn** with a 5/64" drill. Install another Screw-Lock Pushrod Connector without the retainer on the **arm with the small holes** where shown on the plan. This is where your nose wheel steering pushrod will attach.

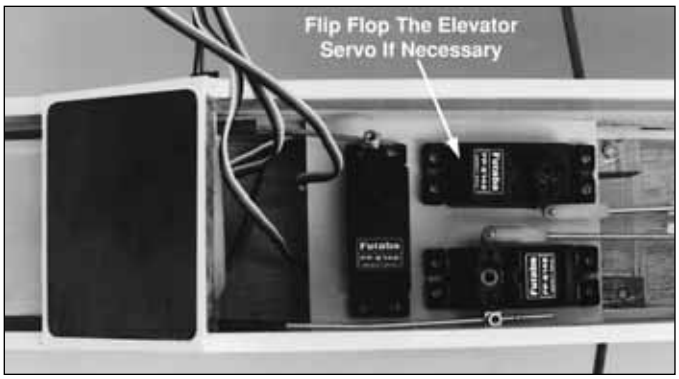
For three channel operation the rudder servo should be plugged into the aileron plug in the receiver (channel #1 on most receivers). *Your "main steering function" in the air is always done on the right stick. Later, when you transition to a four channel model, you will have to "relearn" ground steering your PT on the left stick (where the rudder and nose steering will be moved to when you add ailerons).*

❑ 13. Connect the receiver to the servos, switch and battery. Turn on your transmitter and receiver, then position the elevator, rudder and aileron trim tabs on your transmitter in the center. This is called "centering" the servos and will allow you to place the servo horns on the servos in a neutral position.

❑ 14. Slide the nose steering and throttle pushrods into the respective screw lock connectors on the servo horns. Use a pliers to bend each rod so the horns will fit on the servos with little or no binding.

❑ 15. Fit the elevator, rudder, and throttle horns on the servos and temporarily place the receiver inside the fuselage at the approximate location shown on the plan.

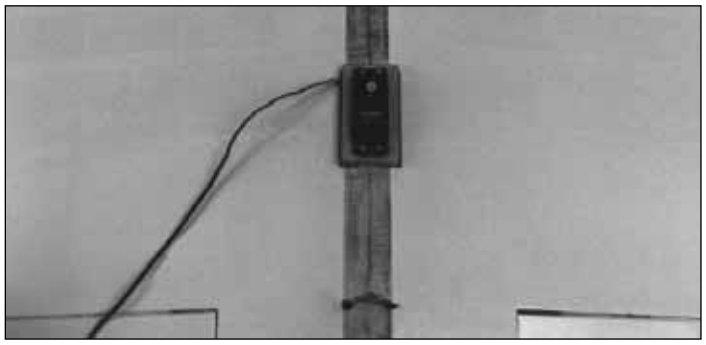
## NOTE TO PT-20 BUILDERS




*If, at any point during the radio installation and hook up that follows, it becomes apparent that the elevator and rudder servo horns or pushrods will interfere, you can "flip flop" the elevator servo to provide a little more clearance between the two servo horns. This will not change any part of your setup except that you will make the elevator pushrod a little shorter.*

❑ 16. Glue the aileron servo tray supports to the aileron servo tray, then glue the doublers to the bottom of the tray. Securely glue the assembly in the wing the way we showed you during final wing construction.

**Skip step #17 if you are building your PT as a 3-channel model.**

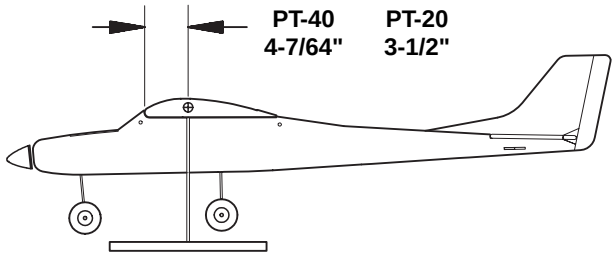


❑ 17. If you are building your PT as a 4-channel model with ailerons, drill the holes for the servo mounting screws, then mount the aileron servo to the servo tray. Place a large servo wheel on the servo.

*We'll stop installation of the radio at this point, then resume after the model is balanced. It's helpful to be able to shift the servo tray when balancing the model.*

## 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. Use a felt-tip pen or a narrow strip of tape to **accurately** mark the balance point on the **bottom** of the wing near both sides of the fuselage. The balance point **(CG)** is shown on the plan and on the PT-40 is located **4-7/64" (104mm) back from the leading edge.** For the PT-20 the balance point is located **3-1/2" (89mm) back from the leading edge.** This is the point at which your model should balance for your first flights. Later, you may experiment by shifting the balance up to **1/4" forward or back** to change the flying characteristics. Moving the balance **forward** may improve the smoothness and arrow-like tracking, but it may require more speed for takeoff and make it more difficult to

slow down for landing. Moving the balance aft makes the model more agile, providing it with a lighter and snappier feel. **Please start at the location we recommend and do not at any time balance your model outside the recommended range.**

❑ 2. Mount the wing to the fuselage with rubber bands or bolts. The engine, muffler and propeller should also be mounted for the C.G. check.

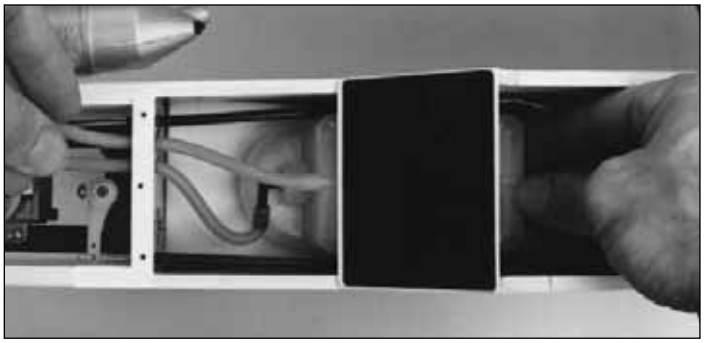
❑ 3. Set the fuel tank (empty) on top of the fuel tank hatch to simulate the actual weight distribution of the finished model with the tank installed. With the wing attached to the fuselage, lift the model with your fingertips at the balance point. If the tail drops when you lift, the model is "tail heavy" and you must move the battery and/or the servo tray toward the nose to achieve balance. If the nose drops, it's "nose heavy" and you must move the battery and/or servo tray toward the tail to achieve balance. The C.G. is always determined with the fuel tank **empty.**

❑ 4. Balance the model by shifting the receiver battery, servo tray and receiver, then retesting. When balance is obtained note the position of the receiver, servo tray and the battery pack.

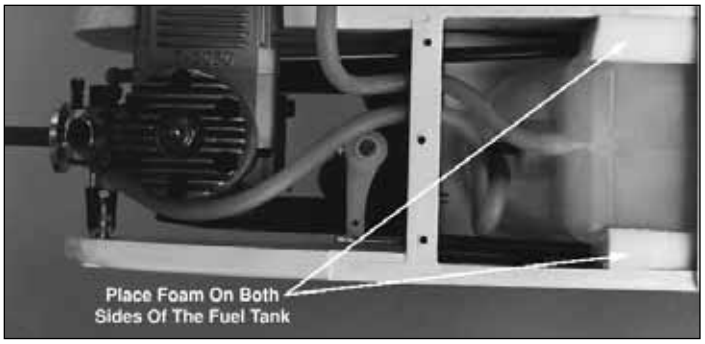
❑ 5. If the balance cannot be achieved by positioning the battery, servo tray and receiver, you may add stick-on lead weight to the tail or nose if required.

❑ 6. Once the position of the battery has been determined confirm that it is securely wrapped in foam and packed in tight enough under the tank floor so that it cannot shift during flight or a rough landing.

❑ 7 If you haven't already done so, assemble the fuel tank according to the manufacturer's instructions. Connect about 6" of medium silicone fuel line to the "vent" and about 10" of fuel line to the "pickup" fittings on the tank (most modelers leave the third "fill" line closed because you can fill the tank through the pickup line).



❑ 8. Cover the tank floor with 1/4" foam rubber. Insert the tank into the tank compartment as you route the fuel lines through the holes you drilled in the firewall (you may temporarily remove the servo tray – or just the throttle servo). Cut the lines to the proper length and connect them to the carburetor and muffler pressure fitting.

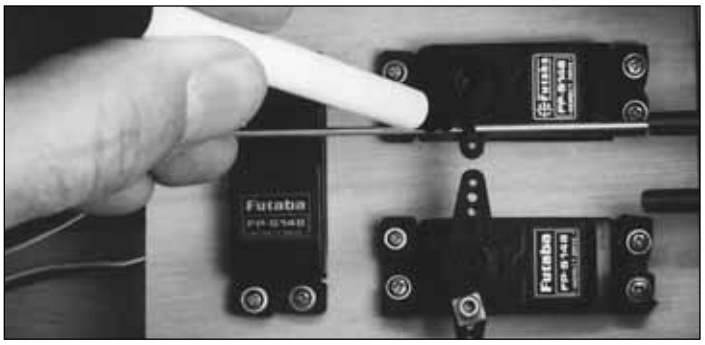



❑ 9. Place more foam on the sides and top of the tank.

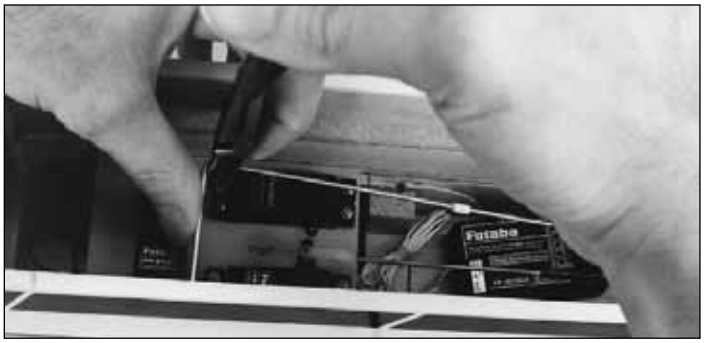
❑ 10. Glue the servo tray securely to the fuse doublers and fuse sides with medium CA at the position required to achieve balance.

**IMPORTANT: After the model is 100% complete, recheck the balance.**

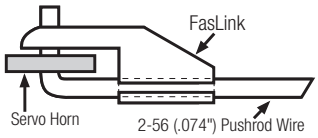
## *Final Radio Hook Up*



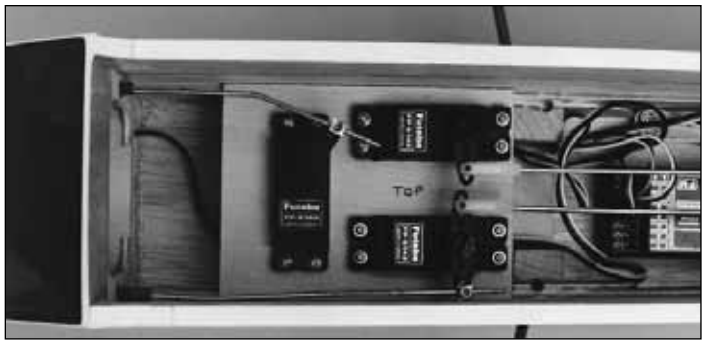

❑ 1. Center the **elevator** and **rudder,** then use a felt-tip pen to mark the pushrods where they cross the holes in the servo horns.




❑ 2. Disconnect the clevises from the horns at the elevator and rudder. Make a 90-degree bend in the pushrods at the marks – hold the pliers firmly and try to make a nice, sharp bend. **Hint**: You may remove the pushrods from the fuselage for this step. Remove the pushrods from the guide tube and bend the wire. Proceed to step 3.




❑ 3. Snap a nylon **Faslink**™ onto both pushrods and cut off the excess wire **1/16" above the Faslink. Caution: Wear safety glasses whenever you cut wire!** If you have removed the pushrods to bend and cut the wire, unscrew the clevis from the threaded end. Slide the pushrods back into the guide tubes from the **front** and screw the clevises back on.



❑ 4. Remove the Faslink and temporarily insert the pushrods through the second from the outside hole in both servo arms (this position may change upon setting the throws). Reinstall the Faslinks to securely connect the pushrods to the servos.

❑ 5. Adjust the clevises so the elevator and rudder are neutral with the radio on, the servos centered and the pushrods connected.

❑ 6. If you haven't already done so, insert the **nose wheel steering pushrod** into the Screw-Lock Pushrod Connector, then center the nose wheel (remember the steering arm should be angled forward). Install a **4-40 x 1/8" socket head screw** in the connector and tighten it down. Test the steering. When the rudder moves to the right, the nose wheel should also move to the right. Make sure the nose gear **steering arm** does not contact the firewall when the rudder stick is pushed fully to the left.

❑ 7. Once you have finished setting up the nose wheel steering, snap the **nylon retainer** on the connector under the servo horn. Remove the 4-40 screw, then reinstall it with thread locking compound and tighten it down. Cut off the excess wire, leaving about 1/2" sticking out of the connector.

❑ 8. Snap the nylon ball link at the front of the **throttle pushrod** onto the metal ball previously installed on the carburetor arm. Pull the throttle control stick **and trim lever** on your transmitter to the fully "back" or closed position.

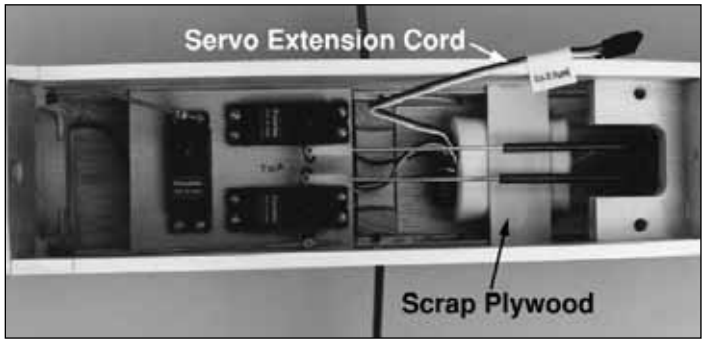
❑ 9. See the photo at step 4, then insert the pushrod through the Screw-Lock Pushrod Connector if you haven't already done so. Install the horn on the servo so it points toward the tail of the model at about a 30-degree angle as shown.

❑ 10. Pull the throttle pushrod toward the tail to fully close the throttle. Install a 4-40 x 1/8" socket head screw in the connector and tighten it. Move the throttle trim lever and watch the carburetor to see if it opens slightly. If the servo does not move (just sits there buzzing), flip the "Servo Reversing Switch" on your transmitter. Open the throttle all the way with the main control stick. If the throttle opens all the way but the pushrod bends (or the servo buzzes), move the connector one hole in toward the center of the servo horn to decrease the amount of throw.

*The goal is to get the engine to idle as slowly (but reliably) as possible with the throttle stick pulled all the way back and the trim switch in the mid to full open position. To shut the engine off, simply pull back the trim switch. This prevents you from inadvertently shutting the engine off during flight.*

❑ 11. When the throttle works properly, install the nylon retainer on the bottom of the screw lock connector to secure it. Tighten the screw (with thread lock) and install the servo horn screw. Cut off the extra wire, leaving about 1/2" behind the connector.

❑ 12. If you have a servo extension cord and are using ailerons, plug it into to the receiver. A servo extension cord will allow you to easily connect the aileron servo to the receiver when you install the wing for each flying session.

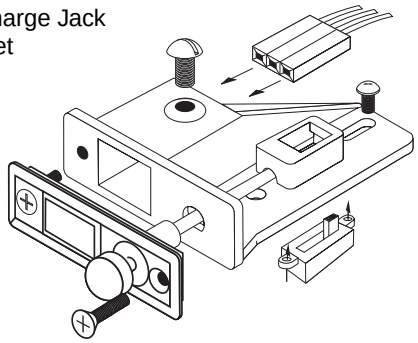


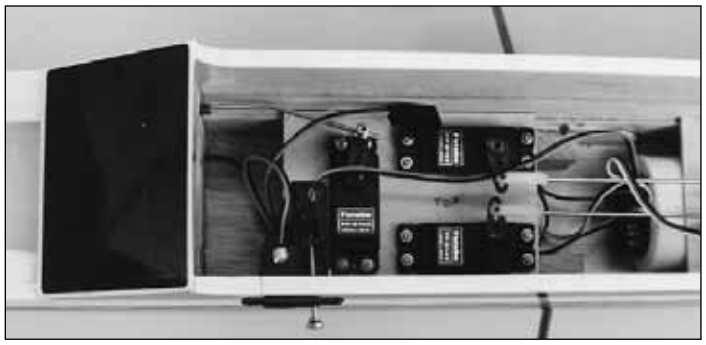

❑ 13. Wrap your receiver with 1/4" thick foam rubber. Secure the foam with a couple of rubber bands or tape.

Position the receiver where it was when you balanced the model, then glue a scrap piece of plywood to the fuselage sides over the receiver to hold it in position.

❏ 14. Route the receiver **antenna** through the optional antenna tube along the bottom of the fuse or to the top of the fin as shown on the plans. Secure the rudder and elevator servo horns with the screws included with the radio control set.

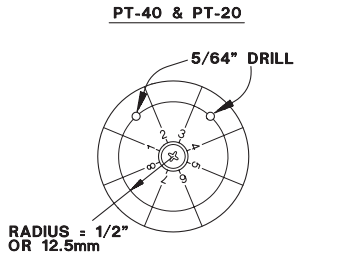
Switch & Charge Jack Mounting Set





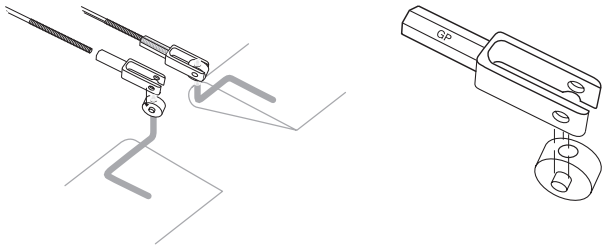
❏ 15. Mount the receiver switch and charging jack through the fuselage on the **opposite** side of the muffler exhaust with a Great Planes **Switch and Charge Jack Mounting Set** (GPMM1000). **Make sure the switch and switch mount will not interfere with the aileron servo and pushrods or any of the other components.**

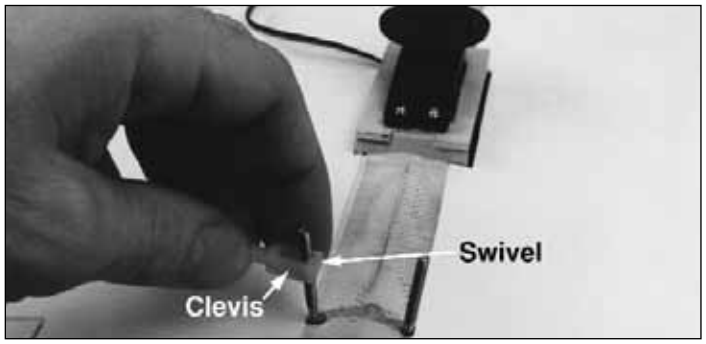
**Note:** *If you will be using only 3 channels without functional ailerons, skip ahead to* ***Aileron Lock for 3-Channel Operation.***



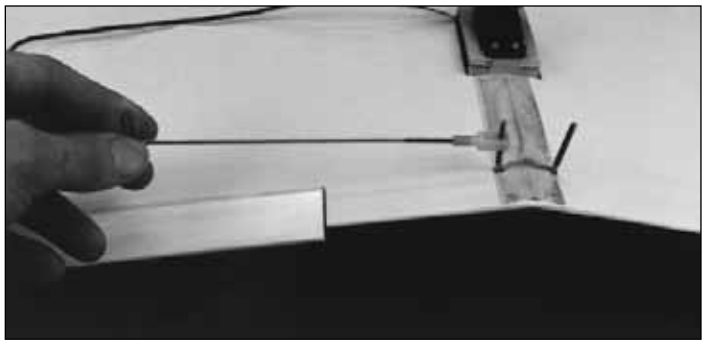

FULL SIZE
DIFFERENTIAL AILERON SERVO WHEEL
DRILL GUIDE

❏ 16. Drill two 5/64" holes in the aileron servo wheel as shown on the plan. The forward placement of the holes will cause the ailerons to have “differential” travel. This means that they won’t move down as much as up – an aid to making smooth turns. See the definition of “Adverse Yaw” and “Differential Throw” under **“Some Modeling Terms and Trivia.”**





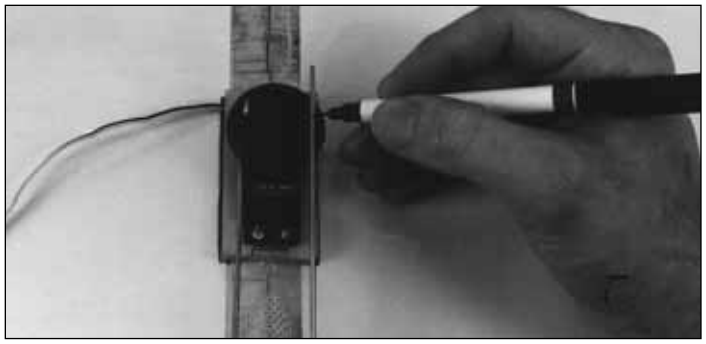

❏ 17. Snap a nylon **Swivel** into a **Nylon Swivel Clevis.** Use the clevis to screw the swivel onto an aileron torque rod to the position shown on the plan.

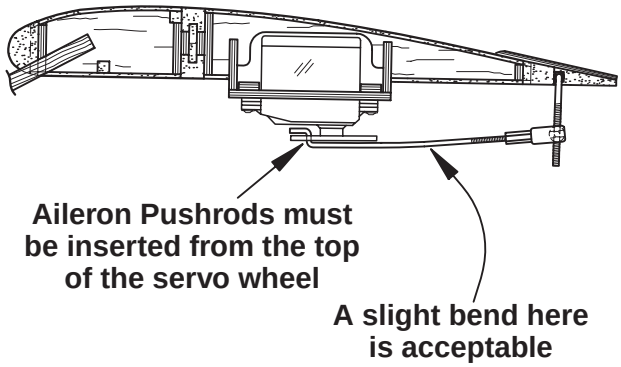


❏ 18. Put an “L” bend in the last 1/4" of the unthreaded end of a **6" threaded rod** and use the “L” as a “handle” to screw the rod about 14 revolutions into the clevis. Cut off the bent portion off the rod. Repeat the same operation to install the other swivel, swivel clevis, and 6" threaded rod onto the other torque rod.

❏ 19. Plug the aileron servo into your receiver, then center it as you have done with the other controls.

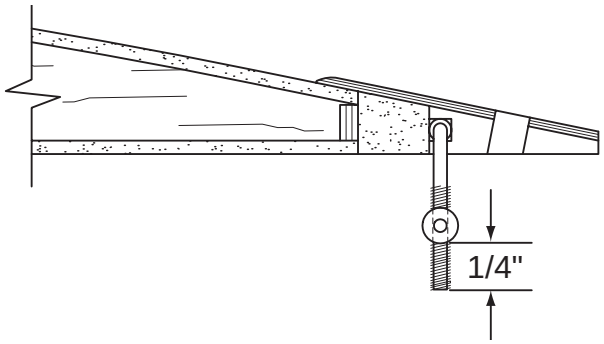
❏ 20. While holding the ailerons so they are neutral, mark both pushrods directly over their respective holes in the servo wheel. Remove the pushrods by unsnapping the clevises.





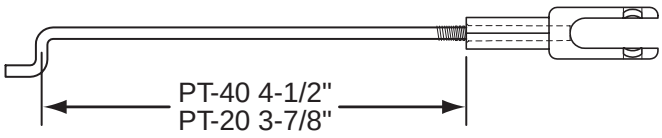

❑ 21. Make Z-bends in the pushrods, then cut off the excess pushrod material. Fit the pushrods through the top of the servo wheel and make a slight bend in the pushrods as shown in the sketch and on the plan. Mount the servo wheel to the servo, then adjust the clevises so the ailerons will be centered when the servo is centered. Connect the clevises to the torque rods.

## *Aileron Lock for 3-Channel Operation*



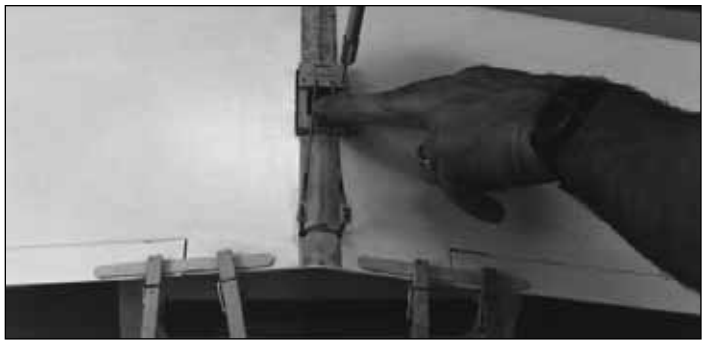

❑ 1. See the photo at step 17, then snap a Nylon Swivel into a Nylon Swivel Clevis. Use the clevis to screw the swivel onto an aileron torque rod so that 1/4" of thread protrudes below the top of the swivel.

❑ 2. See the photo at step 18, then put an “L” bend in the last 1/2" of the non-threaded end of a 6" threaded rod. Use the “L” as a “handle” to screw the rod about 14 revolutions into the clevis. Cut off the bent portion off the rod. Repeat the same operation to install the other Swivel, Swivel Clevis and 6" threaded rod onto the other torque rod.

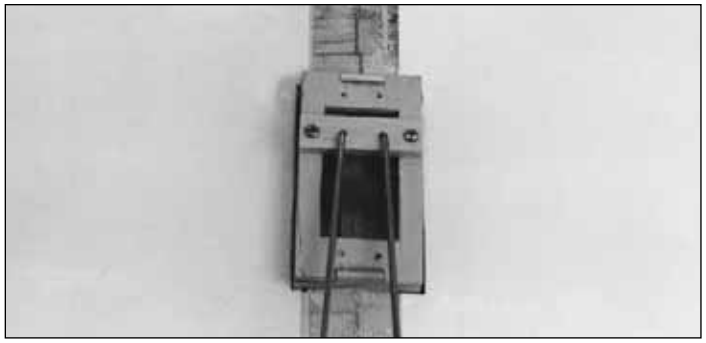



❑ 3. If you are building the PT-40, mark the wire pushrods 4-1/2" from the back end of both clevises (3-7/8" for the PT-20). Make Z-bends at the mark on both pushrods.

❑ 4. Drill two 5/64" holes through the punch marks on the die-cut 1/8" plywood **aileron lock.** Insert the Z-bends into these holes.



❑ 5. Temporarily lock both ailerons in position with popsicle sticks and clothespins as shown. Position the aileron lock on the aileron servo tray. Drill a 1/16" hole through both ends of the aileron lock into the sides of the servo tray. Enlarge the holes in **only** the aileron lock with a 3/32" drill bit.



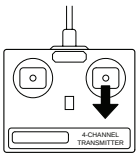
❑ 6. Use two #2 x 3/8" screws to secure the aileron lock to the servo tray. Remove the popsicle sticks and clothespins. If you decide to install a servo at a later date, simply install the servo in place of the aileron lock. The location of the Z-bends should work with most servos to provide the correct setup.

## *Checks and Final Setup*

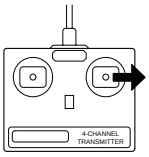
❑ 1. **IMPORTANT:** Go back and check your installation. Be sure that all servo screws, horns and other components are secure. Confirm that you have installed the retainers on the Screw-Lock Pushrod Connectors.

❑ 2. Apply a strip of 1/16" thick foam **wing-seating tape** to the wing saddle. This tape provides a seal against dirt and exhaust oil, and cushions the wing from vibration.

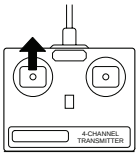
## 3-CHANNEL RADIO SET-UP
(STANDARD MODE 2)




ELEVATOR MOVES UP

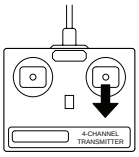



RUDDER MOVES RIGHT
NOSEWHEEL MOVES RIGHT

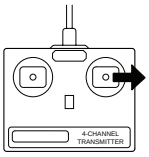



CARBURETOR WIDE OPEN

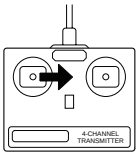
## 4-CHANNEL RADIO SETUP
(STANDARD MODE 2)



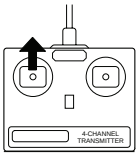

ELEVATOR MOVES UP




RIGHT AILERON MOVES UP
LEFT AILERON MOVES DOWN




RUDDER MOVES RIGHT
NOSE WHEEL TURNS RIGHT

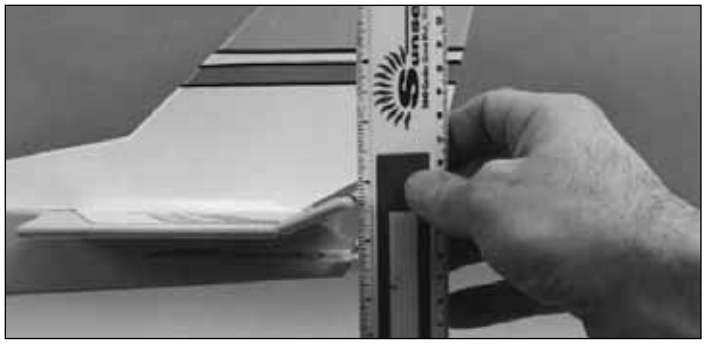



CARBURETOR WIDE OPEN

❑ 3. Check the direction of all control functions. They must all move in the direction shown in the following sketches. If not, change the position of the reversing switches on your transmitter.

## *Control Surface Throws*

**We recommend the following Control Surface Throws:**



**Note:** Control throw (movement) is measured at the **trailing edge** of the elevator, rudder, and ailerons.

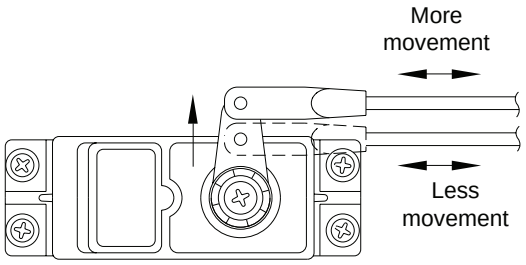
**SINGLE RATE TRANSMITTER**
The following throws are for a transmitter that does **not have Dual Rates.**

| | | |
|---|---|---|
| | **PT-20** | |
| **ELEVATOR** | 1/4" up | 1/4" down |
| **RUDDER** | 1/4" right | 1/4" left |
| **AILERONS** | 1/2"up | 1/4" down |
| | **PT-40** | |
| **ELEVATOR** | 1/4" up | 1/4" down |
| **RUDDER** | 1/4" right | 1/4" left |
| **AILERONS** | 7/16"up | 1/4" down |

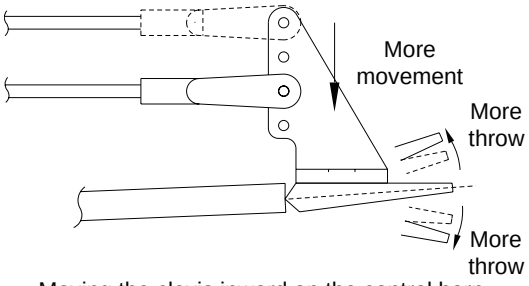
**Note: The balance and control throws for the PT have been thoroughly tested and represent the settings at which the PT flies best. Please set up your PT to the specifications listed. If, after a few flights, you would like to adjust the throws to suit your taste, that's fine. Remember, "*more is not better.*"**

**Note:** *If your radio system does not feature Adjustable Travel Volume (ATV's), you will have to mechanically adjust control surface throw. See the following instructions.*

**Control throw adjustment:** If you move the clevis at the control horn on the control surface **toward the outermost hole,** you will **decrease** the amount of throw. If you move the clevis to a hole **nearer the control surface** you will **increase** the amount of throw. If these adjustments do not provide the desired throws, you may need to work with a combination of adjustments by repositioning the pushrod at the servo. If you move the pushrod **toward** the splined shaft on the servo arm, it will decrease the control surface throw – **outward** will increase it.




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




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

**DUAL RATE TRANSMITTER**

A feature available on some radios which allows you to switch the control surface throws in flight is referred to as "Dual Rates." This lets you change the responsiveness of your model for the type of flying you are doing.

The following throws are for a transmitter equipped for **Dual Rate** servo control.

**PT-20**

| | |
|---|---|
| **ELEVATOR** | |
| (High Rate) | (Low Rate) |
| 3/8"(10mm) up | 1/4"(6mm) up |
| 3/8"(10mm) down | 1/4"(6mm) down |
| **RUDDER** | |
| (High Rate) | (Low Rate) |
| 3/8"(10mm) right | 1/4"(6mm) right |
| 3/8"(10mm) left | 1/4"(6mm) left |
| **AILERONS** | |
| (High Rate) | (Low Rate) |
| 5/8"(16mm) up | 1/2"(13mm) up |
| 3/8"(10mm) down | 1/4"(6mm) down |

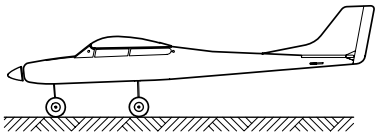
**PT-40**

| | |
|---|---|
| **ELEVATOR** | |
| (High Rate) | (Low Rate) |
| 3/8"(10mm) up | 1/4"(6mm) up |
| 3/8"(10mm) down | 1/4"(6mm) down |
| **RUDDER** | |
| (High Rate) | (Low Rate) |
| 3/8"(10mm) right | 1/4"(6mm) right |
| 3/8"(10mm) left | 1/4"(6mm) left |
| **AILERONS** | |
| (High Rate) | (Low Rate) |
| 9/16"(14mm) up | 7/16"(11mm) up |
| 3/8"(10mm) down | 1/4"(6mm) down |

**Note: The balance and control throws for the PT have been thoroughly tested and represent the settings at which the PT flies best. Please set up your PT to the specifications listed. If after a few flights, you would like to adjust the throws to suit your taste, that's fine. Remember, *"more is not better."***

## *Ground Stance*

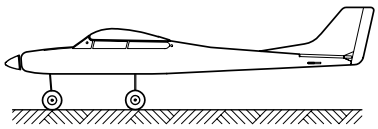
**NOSE TOO LOW**



**May be difficult to rotate on takeoff.**

**Sticks to the runway after landing.**

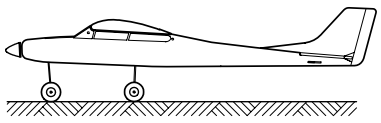
**GOOD STANCE**



**Will lift off easily on takeoff.**

**Lands predictably and stays put on runway.**

**NOSE TOO HIGH**



**Tends to lift-off automatically on takeoff.**
**May bounce and become airborne during landing.**

❏ 1. "Eyeball" the side of the fuselage from 6 - 10 feet away. If necessary adjust the height of the nose by raising or lowering the nose gear wire so that your model will sit pretty much level, as shown in the sketches.

❏ 2. Once the correct ground stance is established, grind the flat spot on the nose gear wire to lock the **bottom** wheel collar in position. Use thread lock on the set screw.

❑ 3. When everything is aligned and the model is sitting correctly, tighten the screw on the steering arm tight enough to leave a mark on the nose gear wire. Remove the nose gear from the engine mount and file the flat spot.

❑ 4. Reassemble the nose gear and install it into the engine mount. Tighten the steering arm screw directly over the flat.

*It is a good practice to periodically check the ground stance of your PT – especially after a hard landing. The wire landing gear is designed to absorb shock from rough landings but occasionally may need to be bent back into position.*

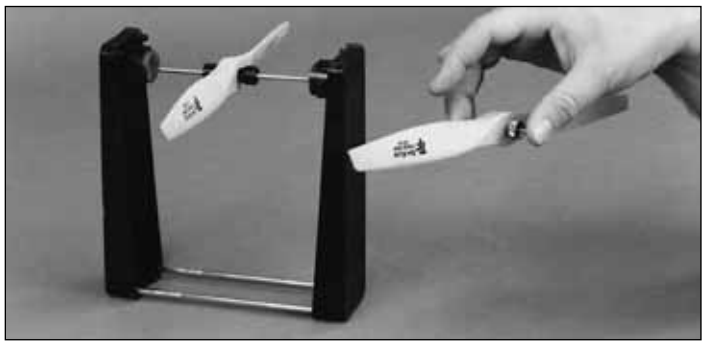
# PREFLIGHT

## Charge the Batteries

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

## Balance the Propeller

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



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

## Find a Safe Place to Fly

The best place to fly your R/C model is an AMA (Academy of Model Aeronautics) chartered club field. Ask your hobby shop dealer if there is such 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 also can tell you the name of a club in your area. We recommend that you join AMA and a local club so you can have a safe place to fly and have insurance to cover you in case of a flying accident (The AMA address is listed on page 3 of this instruction book).

If a club and its flying site are not available, you need to find a large, grassy area at least 6 miles away from any other R/C radio operation like R/C boats and R/C cars and away from houses, buildings and streets. A schoolyard may look inviting but it 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 check that you have installed the radio correctly and all the control surfaces do what they are supposed to. The engine operation also must be checked and the engine "broken-in" on the ground by running the engine for at least two tanks of fuel. **Follow the engine manufacturer's recommendations for break-in.** Check to 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, you need to 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. Have a friend stand by your model and, while you work the controls, tell you what the control surfaces are doing.

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

## Engine Safety Precautions

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

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

Get help from an experienced pilot when learning to operate engines. Use safety glasses when starting or running engines. Do not run the engine in an area of loose gravel or sand; the propeller may throw such material in your face or eyes.

Keep your face and body as well as all spectators away from the plane of rotation of the propeller as you start and run the engine. Keep items such as these away from the prop: loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects such as pencils and screw drivers that may fall out of shirt or jacket pockets into the prop.

Use a "chicken stick" device or electric starter; follow instructions supplied with the starter or stick. Make certain the glow plug clip or connector is secure so that it will not pop off or otherwise get into the spinning propeller. Make all engine adjustments from **behind** the 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 the radio control frequencies currently allowed by the Federal Communications Commission.

## *Flying*

The moment of truth has finally arrived. You've put a lot of effort into building your PT and it looks great! Protect your investment by following a few simple tips:

1. If possible, have an experienced modeler look over your work before you head out to your flying field. It's easier to fix problems in the workshop than on the flight line.

2. Become familiar with starting your engine and break it in before going for your first flight. **Be sure the engine will stop when the trim lever is pulled all the way back.**

3. Assemble a simple flight kit (a shoe box is fine to start with) which should include a starting battery and glo-plug clip (or ni-starter), "chicken stick" for flipping the prop, fuel and a means of filling the tank, a couple of small screwdrivers, #64 rubber bands (or wing bolts), spare prop and glo-plug, 6" adjustable wrench and a pair of needle nose pliers. In addition to tools, you should also take along some paper towels and spray window cleaner to remove residue after each flight.

4. When you load up to go to the flying field be sure that the batteries have charged for at least 14 hours and you have your fuselage, wing, transmitter and flight box. And, most important, you have your AMA license.

5. Range check the radio! See page 54.

## EXPERT TIP

**USING RUBBER BANDS**

If you are using rubber bands to attach your wing, the rule of thumb is to use two #64 rubber bands per pound of model weight. If your model tipped the scales at 7 pounds, you need 14 rubber bands. It doesn't matter too much how many you run straight across the wing or how many are criss-crossed, so long as the last two are criss-crossed. This trick stops the other bands from popping off. Do not use oily rubber bands for more than a few flying sessions. Check each rubber band before using it. Watch out for cracks. Rubber bands can be conditioned by storing the oily ones in a zip-top storage bag partially filled with talcum powder or corn starch. Both products will absorb the oil.

## Taxiing

Start the engine and set the throttle trim for a slow, steady idle. Have your instructor or a helper hold the plane while you work the controls. Upon release, advance the throttle slightly to start rolling, then back-off the power to prevent going too fast and possibly taking off. Stand behind the plane as it taxies away from you and note the direction it turns as you move the rudder control. One thing to keep in mind with R/C models (whether it be cars, boats or planes) is that the steering controls may seem to "reverse" when the model is moving toward you. For example, if you are flying toward yourself and you give a **right** control input (ailerons or rudder), the model will move off to **your left.** The fact of the matter is that the controls are not reversed and the aircraft did actually enter a right turn. The plane does move off to your left from your vantage point, but if you imagined yourself in the cockpit you would realize the plane turned to the right as commanded. All it takes is a little practice to maintain proper orientation of your aircraft, but that's why we recommend finding an instructor.

When you feel comfortable, advance the throttle a little while standing behind the plane to get the feel of a takeoff roll, but pull back on the power before the PT lifts off. Try this several times, adding a little more power each time. If the plane starts to veer off, immediately cut the power to prevent a mishap.

Although many R/C pilots have taught themselves to fly, we strongly recommend that you find an instructor to help get you started. Although the PT series of trainers offer the greatest opportunity of success for the self-taught, there is a high probability that you will crash your airplane on the first flight. Protect your investment of time and money – obtain the assistance of an experienced R/C pilot.

## Takeoff

Your first flights should be made in little or no wind. If you have dual rates on your transmitter, set the switches to "low rate" for takeoff. Taxi into position, pointing directly into the wind. Although this model has good low speed characteristics, you should always build up as much speed as your runway will permit before lifting off, as this will give you a safety margin in case of a "flame-out." Advance the throttle smoothly to the wide open setting. When the plane has sufficient flying speed (you won't know until you try), lift off by smoothly applying a little up elevator (don't "jerk" it off to a steep climb) and climb out gradually, trying to keep it straight and the wings level. The PT will climb at a 20 or 30 degree angle under full throttle. If your PT is set up correctly (throws, ground stance and balance per the instructions), it should lift off with about 1/4 to 1/3 of the elevator travel. If it takes more elevator than this to lift the model into the air you probably have not gained enough ground speed. You could end up stalling *( see **"Stall"** in the **"Some Modeling Terms and Trivia"** section at the end of the manual)* the model if you force it off the ground. Climb to about 100 feet before starting a **VERY** gentle turn by moving the aileron stick. Apply a little more back pressure on the elevator stick as the PT turns. Stop the turn by moving the aileron stick in the opposite direction until the wings are level, then return the stick to the neutral position. Pull the power back to 1/3 throttle.

## Flying

We recommend that you take it easy with your PT for the first several flights and gradually "get acquainted" with this great plane as your engine becomes fully broken-in. The PT is designed to fly level with neutral elevator trim at approximately 1/4 to 1/3 throttle – this is the best speed for learning to fly. On later flights, if you want the PT to maintain level flight at full throttle, you will need to give it a little down trim.

Your first flights should consist of mostly straight and level flight with gentle turns to keep the model over the field. These flights will give you practice at coordinating your control inputs and maintaining the proper orientation of the airplane. As mentioned earlier, turns are accomplished by banking the aircraft with the rudder (ailerons will accomplish this on a 4-channel airplane), then gently adding some back stick (up elevator). Enough back stick should be held in to keep the aircraft at a constant altitude. To stop turning, apply opposite rudder (or aileron) to level the wings, then release the sticks. There is a memory aid that may help keep you out of trouble when the plane is **flying toward you** – "put the stick under the low wing." In other words, move the stick in the direction of the low wing to **raise** that wing. When you are comfortable flying the aircraft, you can practice using the rudder along with the ailerons (if you have ailerons), to "coordinate" the turns – usually, a small amount of rudder applied in the direction of the turn will keep the tail following in the exact same track as the nose.

The most common mistake when learning to fly is "over control." Think of pressure instead of large movements of the control sticks. Remember all PT's will recover from almost any over control situation within 50 - 100 feet if you simply **let go of the sticks.**

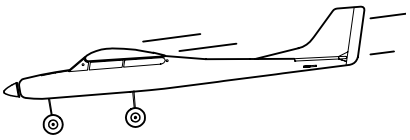
Add and practice one maneuver at a time, learning how your PT behaves in each one. For ultra-smooth flying and normal maneuvers, we recommend using the "low rate" settings as listed on page 53. High rate control throws will give your PT enough control for loops, barrel rolls and many other basic aerobatic maneuvers.

After you have several flights on your PT, it's time to reward yourself with your first aerobatic maneuver – a **loop.** Climb to a safe altitude and turn into the wind. Apply full throttle, level the wings, then slowly pull back on the elevator stick to about 1/2 to 3/4 up elevator (depending on your throws) and hold this control input. After you go over the top and start down the back side of the loop, pull the throttle back to about half. This will keep the stresses on the airplane low and the airspeed relatively constant. Keep holding "up" elevator until the plane is level, then slowly release the sticks. You're done! It's really that easy!

**CAUTION (THIS APPLIES TO ALL R/C AIRPLANES):**
If, while flying, you notice any unusual sounds, such as a low-pitched "buzz", this may indicate control surface "flutter". Because flutter can quickly destroy components of your airplane, any time you detect flutter you must **immediately** cut the throttle and land the airplane! Check all servo grommets for deterioration (this will 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 cause flutter: Excessive hinge gap; Not mounting control horns solidly; Sloppy fit of clevis pin in horn; 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 aileron torque rod; Excessive "play" or "backlash" in servo gears and Insecure servo mounting.

## *Landing*

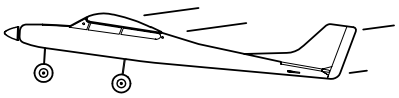
**APPROACH TOO STEEP**



**Apply up elevator.**

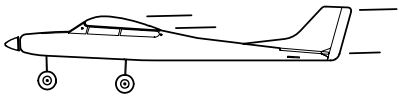
**TOO MUCH FLARE**

**Danger of stalling!**



**Release elevator.**

**GOOD LANDING FLARE**



**Hold this angle until touchdown.**

When it's time to land, fly a normal landing pattern and approach as follows: Reduce the power to about 1/4 and fly a downwind leg far enough out from the runway to allow you to make a gentle 180 degree turn. As you make the turn into the wind for your final approach, pull the throttle back to idle. The PT has a lot of lift so you will need a slow, reliable idle in order to achieve a nice slow landing. Allow the plane to keep descending on a gradual glide slope until you are about 3 feet off the runway. Gradually apply a little up elevator to flare for landing. You should apply just enough up elevator to hold the plane just off the runway while the excess speed bleeds off. The PT should settle onto the runway for a slow, slightly nose-high landing.

**Good luck and have fun flying your PT, but always stay in control and fly in a safe manner.**

## *SOME MODELING TERMS & TRIVIA*

***...so you'll know what they are talking about at the flying field.***

**Ailerons** – Hinged control surfaces located on the trailing edge of the wing, one on each side, which provide control of the airplane about the roll axis. The control direction is often confusing to first time modelers. For a right roll or turn, the right hand aileron is moved upward and the left hand aileron downward, and vice versa for a left roll or turn.

**Angle of attack** – The angle that the wing penetrates the air. As the angle of attack increases so does lift and drag, up to a point.

**ARF** – A prefabricated model - Almost Ready to Fly.

**Buddy Box** – Two similar transmitters that are wired together with a "trainer cord." This is most useful when learning to fly – it's the same as having dual controls. The instructor can take control by using the "trainer switch" on his transmitter.

**Boring holes in the sky** – Having fun flying an R/C airplane, without any pre-determined flight pattern.

**CA** (Abbreviation for "Cyanoacrylate") – An instant type glue that is available in various viscosities (Thin, Medium, Thick and Gel). These glues are ideal for the assembly of wood airplanes and other materials. **Note:** Most CA glues will attack styrofoam.

**Carburetor** – The part of the engine which controls the speed or throttle setting and lean/rich mixture via setting of the needle valve.

**CG** (Center of Gravity) – For modeling purposes, this is usually considered the point at which the airplane balances fore to aft. This point is critical in regards to how the airplane reacts in the air. A tail-heavy plane will be very snappy but generally very unstable and susceptible to more frequent stalls. If the airplane is nose heavy, it will tend to track better and be less sensitive to control inputs, but will generally drop its nose when the throttle is reduced to idle. This makes the plane more difficult to land since it takes more effort to hold the nose up. A nose heavy airplane will have to come in faster to land safely.

**Chamfer** – To slightly round-off or bevel a corner.

**Charge Jack** – The plug receptacle of the switch harness into which the charger is plugged to charge the airborne battery. An expanded scale voltmeter (ESV) can also be plugged into it to check battery voltage between flights. It is advisable to mount the charge jack in an accessible area of the fuselage so an ESV can be used without removing the wing.

**Charger** – Device used to recharge batteries and usually supplied with the radio if NiCd batteries are included.

**Chicken Stick** – A hand-held stick used to flip start a model airplane engine.

**Clunk** – A weighted fuel pick-up used in a fuel tank to assure the intake line is always in fuel.

**Dead Stick** – A term used to describe unpowered flight (glide) when the engine quits running.

**Differential Throw** – Ailerons that are set up to deflect more in the upward direction than downward are said to have "Differential Throw." The purpose is to counteract "Adverse Yaw."

**Dihedral** – The V-shaped bend in the wing. Typically, more dihedral causes more aerodynamic stability in an airplane and causes the rudder to control both roll and yaw axis. This is why some trainers and sailplanes require only 3-channels of radio control—i.e., having no ailerons.

**Ding** – Minor dent or damage to the structure. Also, a nick in a prop. Dinged props must be replaced.

**Down thrust** – Downward angle of the engine relative to the centerline of the airplane. Down thrust helps overcome the normal climbing tendency of flat bottom wings.

**Electric Starter** – A hand-held electric motor used for starting a model airplane engine. Usually powered by a 12-volt battery.

**Elevator** – Hinged control surface located at the trailing edge of the horizontal stabilizer, which provides control of the airplane about the pitch axis and causes the airplane to climb or dive. The correct direction of control is to pull the transmitter elevator control stick back, toward the bottom of the transmitter, to move the elevator upward, which causes the airplane to climb and vice versa to dive.

**Epoxy** – A two-part resin/hardener glue that is extremely strong. It is generally available in 6 and 30-minute formulas. Used for critical points in the aircraft where high strength is necessary.

**Expanded Scale Voltmeter (ESV)** – Device used to read the battery voltage of the on-board battery pack or transmitter battery pack.

**Field charger** – A fast battery charger designed to work from a 12-volt power source, such as a car battery.

**Flaps** – Hinged control surface located at the trailing edge of the wing inboard of the ailerons. The flaps are lowered to produce more aerodynamic lift from the wing, allowing a slower takeoff and landing speed. Flaps are often found on scale models, but usually not on basic trainers.

**Flare** – The point during the landing approach in which the pilot gives an increased amount of up elevator to smooth the touchdown of the airplane.

**Flight Box** – A special box used to hold and transport all equipment used at the flying field.

**Flight Pack** (or Airborne pack) – All of the radio equipment installed in the airplane, i.e., Receiver, Servos, Battery, Switch harness.

**Flutter** – A phenomenon whereby the elevator rudder or aileron control surface begins to oscillate violently in flight. This can sometimes cause the surface to break away from the aircraft and cause a crash. There are many reasons for this, but the most common are excessive hinge gap or excessive "slop" in the pushrod connections and control horns. If you ever hear a low-pitched buzzing sound, reduce throttle and land immediately.

**Frequency Control** – The FCC has allowed the 72MHz band to be used for R/C aircraft operations. This band is divided up into many different channels in which you can choose a radio system. You should be aware that certain areas have frequencies in which there is pager interference. This is why it is always a wise move to check with your local hobby shop to find out any channels that may be troublesome in the area you wish to fly.

**Fuel Overflow Line (Vent)** – The fuel line is either open to atmospheric pressure or attaches to the muffler pressure nipple to pressurize the fuel tank for better fuel flow to the engine. This is the line through which the fuel will overflow when the tank is full.

**Fuel Pick-Up Line** – The fuel line in the fuel tank through which fuel travels to the carburetor. Typically a flexible tube with a weight or "Clunk" on the end which allows it to follow the fuel with changes in aircraft attitude. This is the line through which the tank is filled.

**Fuselage** – The body of an airplane.

**Glitch** – radio problem that never happens unless you are over trees or a swamp.

**Glow Plug** – The heat source for igniting the fuel/air mixture in the engine. When starting the engine a battery is used to heat the filament. After the engine is running, the battery can be removed. The wire filament inside the plug is kept hot by the "explosions" in the engine's cylinder. *See next heading and "idle bar plug."*

**Glow Plug Clip/Battery** – A 1.2-volt battery, which is connected to the glow plug on a model airplane engine for starting. The battery is removed once the engine is running steadily.

**Grease-in** – A very smooth, gentle landing without a hint of a bounce.

**Hit (or to be hit)** – Sudden radio interference which causes your model to fly in an erratic manner. Most often caused by someone turning on a radio that is on your frequency, but can be caused by other radio sources miles away.

**Horizontal Stabilizer** – The horizontal tail surface at the back of the fuselage which provides aerodynamic pitch stability to the airplane.

**Idle Bar Plug** – This type of glow plug has a "bar" across the tip to help prevent raw fuel from being splashed onto the glow element. Too much raw fuel will cool the plug and prevent it from igniting the fuel/air mixture. An idle bar is a help in obtaining a low idle speed.

**Lateral Balance** – The left-right or side-to-side balance of an airplane. An airplane that is laterally balanced will track better through loops and other maneuvers.

**Leading Edge (LE)** – The very front edge of the wing or stabilizer. This is the edge that hits the air first.

**Muffler** – A device attached to the exhaust stack of the engine to reduce noise and increase back-pressure which helps low speed performance. **Note:** Most R/C Clubs require the use of mufflers.

**Muffler Baffle** – A restrictor plate inside the muffler which reduces engine noise. This plate can be removed to increase power, but only if there are no noise restrictions where you fly.

**Needle Valve** – Adjustment on a carburetor used to set proper fuel/air mixture. Some carburetors have separate needle adjustments for low and high throttle. Typically, turning the needle adjustment clockwise (screwing in) leans the mixture (less fuel) and vice versa. However, there are a few exceptions—refer to the engine manufacturer's instructions.

**NiCd** – Nickel Cadmium battery. Rechargeable batteries which are typically used as power for radio transmitters and receivers.

**Nitro** (Nitromethane) – A fuel additive which increases a model engine's ability to idle low and improves high speed performance. Ideal nitro content varies from engine to engine. Refer to the engine manufacturer's instructions for best results. Nitro content in fuel is indicated by the percent of the fuel.

**Ni-starter** – A self-contained battery and glow plug clip, used when starting the engine. *See "glow plug clip."*

**One-point landing (or a figure 9)** – Synonymous with "stuffing it in." Something we hope you never do.

**Pitch Axis** – The airplane axis controlled by the elevator. Pitch is illustrated by holding the airplane at each wing tip. Raising or lowering the nose is the pitch movement. This is how the climb or dive is controlled.

**Power panel** – 12-volt distribution panel that provides correct voltage for accessories like glow-plug clips, fuel pumps and electric starters. Usually mounted on a field box and connected to a 12-volt battery.

**Prop pitch** – Props are designated by two numbers, for instance *10 - 6*. The first number is the prop's length, 10". The second number is the pitch or angle of the blades. The 6 represents the distance the propeller will move forward in one revolution, in this case 6".

**Re-Kitting your airplane** – Changing your finished model back into a kit, as a result of "stuffing it in."

**Receiver (Rx)** – The radio unit in the airplane which receives the transmitter signal and relays the control to the servos. This is somewhat similar to the radio you may have in your family automobile, except the radio in the airplane perceives commands from the transmitter, while the radio in your car perceives music from the radio station.

**Roll Axis** – The airplane axis controlled by the ailerons. Roll is illustrated by holding the airplane by the nose and tail. Dropping either wingtip is the roll movement. This is used to bank or turn the airplane. Many aircraft are not equipped with ailerons and the Roll and Yaw motions are controlled by the rudder. This is one reason why most trainer aircraft have a larger amount of dihedral.

**Root** – *See "Wing Root."*

**Rudder** – Hinged control surface located at the trailing edge of the vertical stabilizer, which provides control of the airplane about the Yaw axis and causes the airplane to Yaw left or right. Left rudder movement causes the airplane to Yaw left and right rudder movement causes it to Yaw right.

**Servo** – The electro-mechanical device which moves the control surfaces or throttle of the airplane according to commands from the receiver. The radio device which does the physical work inside the airplane.

**Servo Output Arm** – The removable arm or wheel which bolts to the output shaft of a servo and connects to the pushrod.

**Shot down** – A "hit" that results in a crash landing. Sometimes caused by radios miles away.

**Slop** – Unwanted, excessive free movement in a control system. Often caused by a hole in a servo arm or control horn that is too big for the pushrod wire or clevis pin. This condition allows the control surface to move without transmitter stick movement. *Also, see "flutter*."

**Solo** – Your first totally unassisted flight that results in a *controlled* landing.

**Spinner** – The nose cone which covers the hub of the propeller.

**Sport Airplane** – A model which possesses some attributes of many of the specialty airplanes and are best for general flying as they are the most versatile and durable.

**Stall** – What happens when the angle of attack is too great for the wing to generate lift regardless of airspeed. When the wing cannot generate lift, the model "falls out of the sky" until sufficient airspeed is gained. Then, you can get control of the model – this takes altitude and should be avoided upon takeoff! (Every airfoil has an angle of attack at which it generates maximum lift – the airfoil will stall beyond this angle).

**Tachometer** – An optical sensor designed specifically to count light impulses through a turning propeller and read out the engine RPM.

**Throw** – The distance a control surface (such as elevator, aileron, rudder) can travel. Throw is measured at the trailing edge of the control surface.

**Tip stall** – The outboard end of one wing (the tip) stops developing lift, causing the plane to roll suddenly in the direction of the stalled wing. This situation is not fun when you are only a few feet off the runway trying to land.

**Track** – The path the model takes through the air or on the ground.

**Trainer Airplane** – A model designed to be inherently stable and fly at low speeds, to give first-time modelers time to think and react as they learn to fly.

**Trailing Edge (TE)** – The rearmost edge of the wing or stabilizer.

**Transmitter (Tx)** – The hand-held radio controller. This is the unit that sends out the commands that you input.

**Touch-and-go** –Landing and taking off without a pause. Often confused with a good bounce.

**Vertical Fin** – The non-moving surface that is perpendicular to the horizontal stabilizer and provides yaw stability. This is the surface to which the rudder attaches.

**Washout** – An intentional twist in the wing, causing the wing tips to have a lower angle of attack than the wing root. In other words, the trailing edge is higher than the leading edge at the wing tips. Washout helps prevent tip stalls and helps the "PT" family of trainers recover, hands-off, from unwanted spiral dives.

**Wheel Collar** – A small, round retaining device used to keep a wheel from sliding off an axle.

**Wing Loading** – This is the amount of weight per square foot that has to be overcome to provide lift. It is normally expressed in ounces per square foot. This specification can be easily calculated as follows: If you know the square inches of the wing, simply divide by 144 to obtain square feet. Divide the total weight (in ounces) of the airplane by the wing area (in square feet). This information is valuable when deciding on which airplane to build next. Planes with high wing loading numbers must fly faster to stay in the air. These are generally "performance" airplanes. Conversely, planes with lower numbers do not need as much air flowing around the wing to keep it flying. Gliders and trainer airplanes fall into this category because slow, efficient flight is desirable.

**Wing Root** – The centerline of the wing, where the left and right wing panels are joined.

**Yaw Axis** – The airplane axis controlled by the rudder. Yaw is illustrated by hanging the airplane level by a wire located at the center of gravity. Left or right movement of the nose is the Yaw movement.

**Z-Bend** – A simple Z-shaped bend in the wire end of a pushrod, which is used to attach the pushrod to a servo output arm.

**Z-Bend Pliers** –A plier type tool used for easily making perfect Z-bends.

# 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 as certain 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-degree 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 lose 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.

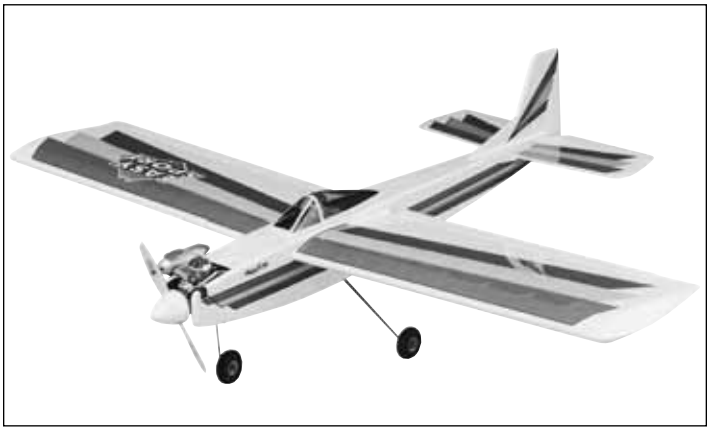
Reprinted in part by Great Planes Model Manufacturing Company, courtesy of Scale R/C Modeler magazine, Pat Potega, Editor, August 1983 issue.

**See the Flight Trimming Chart on Page 62.**

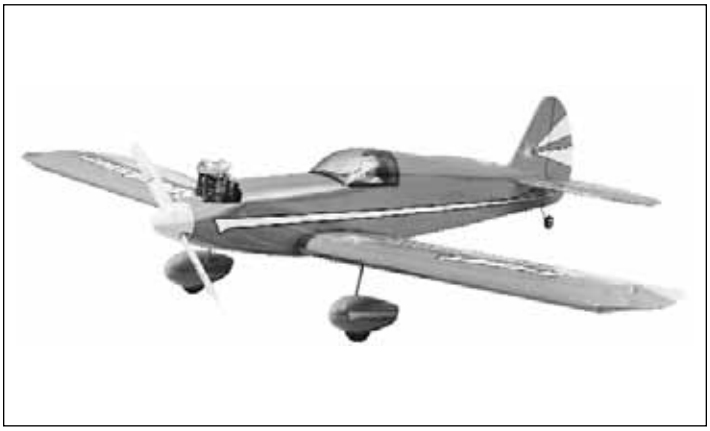
| TRIM FEATURE | MANEUVERS | OBSERVATIONS | CORRECTIONS |
|---|---|---|---|
| CONTROL CENTERING | Fly general circles and random maneuvers. | Try for hands off straight and level flight. | Readjust linkages so that Tx trims are centered. |
| CONTROL THROWS | Random maneuvers | A. Too sensitive, jerky controls.<br>B. Not sufficient control. | If A, change linkages to reduce throws.<br>If B, increase throws. |
| ENGINE THRUST ANGLE[1] | From straight flight, chop throttle quickly. | A. Aircraft continues level path for short distance.<br>B. Plane pitches nose up.<br>C. Plane pitches nose down. | If A, trim is okay.<br>If B, decrease downthrust.<br>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.<br>B. Nose pitches up.<br>C. Nose drops. | If A, trim is good.<br>If B, add nose weight.<br>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.<br>B. Yaws to right in both inside and outside loops.<br>C. Yaws to left in both inside and outside loops.<br>D. Yaws right on insides, and left on outside loops.<br>E. Yaws left in insides, and right on outside loops. | If A, trim is correct.<br>If B, add left rudder trim.<br>If C, add right rudder trim.<br>If D, add left aileron trim.<br>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.<br>B. Falls off to left in loops. Worsens as loops tighten.<br>C. Falls off to right in loops. Worsens as loops tighten. | If A, trim is correct.<br>If B, add weight to right wing tip.<br>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.<br>B. Nose tends to go to inside loop.<br>C. Nose tends to go to outside loop. | If A, trim is correct.<br>If B, raise both ailerons very slightly.<br>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.

# PLANE KITS & ACCESSORIES FROM GREAT PLANES



**Easy Sport™ 40.....GPMA0150**
Move up from trainers with confidence – and the 59.2" span Easy Sport 40. It has trainer-like ease and stability at slow speeds when you need it, plus a symmetrical airfoil and the lightness for aerobatics when you feel like it. Requires a 2-stroke .35-.46 or 4-stroke .48-.60 engine and a 4-channel radio.



**Super Sportster 40 MK II .....GPMA0205**
Reduce throws, and it floats like a trainer. But advance throttle and throws, and this 55" span sport will deliver an avalanche in an instant! A blunt leading edge prevents speed build-up during dives–a symmetrical airfoil leaves the aerobatic envelope wide open. Requires a 2-stroke or 4-stroke .40-.46 engine and a 4-channel radio.

**Express Tote™ Field Box.....GPMP1005**
Solid strength and spacious storage compete for notice in this compact ply carry-all. Offers room for all the essentials--and a 1/2-gallon fuel jug, too!

**Hobbico® TorqMaster™ 90 Starter.....HCAP3200**
With an easy press, you unleash enough torque to start engines up to .90 cu. in. Features aluminum cone, silicone insert, 5', self-coiling cord w/alligator clips and a 2-year warranty

**ProGlo™ NiCd Starter Clip.....GPMP2012**
The chrome-plated socket is a tip-off to the dependability underneath. Knurled, anodized aluminum barrel unscrews so depleted NiCds can be replaced.

**Top Flite® Heat Gun.....TOPR2000**
Dries paints and glues on “Cool”–shrinks tubing and MonoKote® Film drum-tight on “Hot” with 900 watts of power. Adjustable air baffle, wide nozzle and 2-year warranty included.

**Top Flite® SmartStripe™ Stripe Cutting Tool.....TOPR2420**
Turns scrap MonoKote into perfectly proportioned trim stripes. Cuts stripes up to 5-1/4"–or as narrow as 1/64"–with just a quick turn and a simple #11 blade!

**Top Flite® Hot Sock™ Iron Cover.....TOPR2175**
It's a soft, 100% cotton buffer iron that ties on to prevent scratching and hazing–and washes up to be used again. Prevents adhesive build-up on irons, too.

# TWO-VIEW DRAWING

Photocopy this two-view drawing and use the copy to plan your trim scheme