PIPER J-3 CUB

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

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

GREAT PLANES® MODEL MANUFACTURING COMPANY

PO Box 788 Urbana, IL61801 (217)398-8970

CUB2P02 05/95 V 1

TABLE OF CONTENTS

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

Your Great Planes Piper J-3 Cub 20 is not a toy, but rather a sophisticated, working model that functions very much like an actual airplane.

Because of its realistic performance, the Cub 20, 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 experienced, knowledgeable help with assembly and during 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 47302-9252
Toll Free (800) 435-9262
Fax# (317)741-0057

AMA
SINCE 1936

INTRODUCTION

Thank you for purchasing the Great Planes **Piper J-3 Cub 20** for your next project We are sure that you will find a great deal of modeling satisfaction while building and flying this 1930's classic

You will find the **J-3 Cub** easy to build and fly, very predictable and fairly acrobatic, yet it has no bad habits Traditional Great Planes interlocking construction makes it simple to build a great looking and straight airplane that is sturdy enough to take along every time you go to the flying field

If you have chosen this kit as your first R/C model, it is important that you find an experienced modeler to help you throughout the building and flying of this plane He should thoroughly check the plane over before flying it and help you with the first flights The J-3 Cub lacks the self-recovery characteristics of a **good basic trainer** such as the Great Planes **PT Series** airplanes On the other hand, if you have already learned the basics of R/C flying and you are able to safely handle a "trainer" airplane, the **J-3 Cub** is an excellent choice to sharpen your skills and learn the art of flying a taildragger So, dust off your work bench, put a new blade in your hobby knife, load some fresh sandpaper and let's build a 'J-3 Cub'

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.

PRECAUTIONS

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

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

3 You must use a proper R/C **radio** that is in first class condition, the correct sized **engine** and **correct components** (fuel tank, wheels, etc) throughout your building process

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

5. You must **test** the operation of the model before the first and each successive flight to insure that all equipment is operating, and you must make certain that the model has remained structurally sound Be sure to check the nylon clevises often and replace if they show signs of wear

6 You must fly the model only with the help of a competent, experienced R/C pilot if you are not already an experienced and knowledgeable R/C pilot at this time

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

Remember: Take your time and follow directions to end up with a well-built model that is straight and true.

ENGINE SELECTION

There are several engines that will work well in the Cub 20 For a relaxed flying experience, an 0 S 15FP is a good choice For a more spirited model an 0 S 20- 25FP or 26 Surpass (4-stroke) will work very well Your choice of 2-stroke or 4-stroke engine will determine the location of the throttle pushrod exit, so you must acquire the engine early in the building process, and plan ahead.

OTHER ITEMS REQUIRED

Note Items in parentheses (GPMQ4130) are suggested part numbers recognized by distributors and hobby shops and are listed for your convenience GPM is the Great Planes brand, HCA is the Hobbico® brand and TOP is the Top Flite® brand

- D 4 Channel radio with 4 servos
- D Engine 15-25 2-stroke
  20- 26 4-stroke
- D Propeller (A Top Flite Power Point® is recommended, see the engine instructions for size)
- D 6oz Fuel Tank - (GPMQ4102)
- D 12" Medium Fuel Tubing - (GPMQ4131)
- D (2) 2-1/2" Main Wheels - (GPMQ4223)
- D (1) 1" Tail Wheel - (GPMQ4241)
- D (4) 5/32" Wheel Collars - (GPMQ4306)
- D (2) 3/32" Wheel Collars - (GPMQ4302)
- D (2) Rolls MonoKote® Cub Yellow Covering - (TOPQ0220)
- D 1/2" Latex Foam Rubber Padding - (HCAQ1050)
- D Cub Yellow LustreKote® - (TOPR7220)
- D 1/16" Black Striping Tape - (GPMQ1460)
- D Fueling Valve - (optional GPMQ4150)
- D Switch and Charge Jack Mount - (GPMM1000)
- D Screw-Lock Pushrod Connectors - (GPMQ3870)
- D Flexible Cable Pushrod for Throttle - (GPMQ3700)
- D 2" Pilot Figure - (optional - Williams Bros #184)

SUGGESTED SUPPLIES AND TOOLS

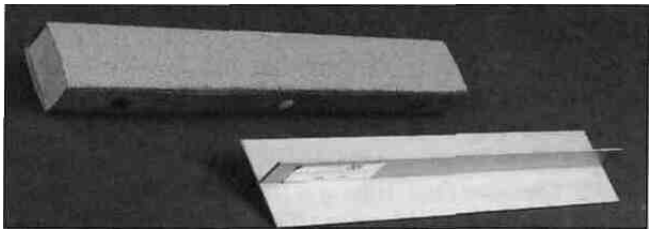
We recommend Great Planes Pro™ CA and Epoxy

- D 2 oz Thin CA Adhesive - (GPMR6003)
- D 2 oz Medium CA+ Adhesive - (GPMR6009)
- D 1 oz. Thick CA- Adhesive - (GPMR6014)
- D 6-Minute Epoxy - (GPMR6045)
- D 30-Minute Epoxy - (GPMR6047)
- D Pacer Formula 560 Canopy Glue
- D Hand or Electric Drill
- D Sealing Iron - (TOPR2100)
- D Heat Gun - (TOPR2000)
- D Hobby Saw - (X-acto® Razor Saw)
- D Hobby Knife with #11 Blades
- D Razor Plane - (Master Airscrew®)
- D Screw Drivers - (Phillips and Slot tip)
- D Flat File
- D T-Pins Medium - (HCAR5150)
- D String
- D Straightedge with Scale
- D Masking Tape - (required for construction)
- D Sandpaper- (coarse, medium, fine grit)*
- D T-Bar Sanding Block - (or similar)
- D Lightweight Balsa Filler- (HCAR3401)
- D #10-24 Tap and Tap Wrench
- D Isopropyl Rubbing Alcohol - (70%)
- D Dremel® Moto-Tool® or Similar - (optional)
- D Kyosho® Curved Scissors (optional) **- (KYOR1010)**

Drill Bits: ❑ 1/16" ❑ 5/32" ❑ 5/64" ❑ 3/16" ❑ 3/32" ❑ 13/64" ❑ 1/8" ❑ 1/4"

EXPERT TIP

*0n our workbench, we have four 11" T-Bar sanders, equipped with #50, #80, #150 and #220-gnt sandpaper This setup is all that is required for almost any sanding task Custom sanding blocks can be made from balsa for sanding hard to reach spots We also keep some #320-grit wet-or-dry sandpaper handy for finish sanding before covering.

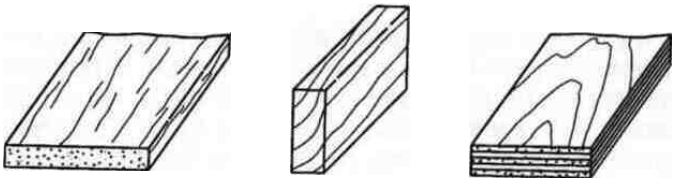


T-Bar sanding tools are made from lightweight extruded aluminum and can be found at most hobby shops A 2" x 11" strip of sandpaper is attached to the T-Bar by gluing it on with rubber cement. Apply the rubber cement to both the bottom of the T-Bar and the back of the sandpaper When both surfaces are dry, press the sandpaper firmly onto the T-Bar Spray adhesive can be used for this purpose but it's harder to remove the sandpaper when you need to replace it Wooden sanding blocks can be made from straight 11" lengths of 1" x 2" scrap lumber Start on one side, then wrap a sheet of sandpaper completely around the wood, ending on the same side as the one you started on. Push 3 or 4 thumbtacks into this side, then trim off the excess material.

COMMON ABBREVIATIONS

Elev = Elevator	Fuse = Fuselage
LE = Leading Edge (front)	LG = Landing Gear
Ply = Plywood	Stab = Stabilizer
TE = Trailing Edge (rear)	" = 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 fit well.

Thin CA is also known simply as **CA** This is the adhesive that has revolutionized model building because it allows you to assemble the parts first, then apply the adhesive The thin formulation flows or "wicks" into the joints and sets almost instantly, eliminating the need to use pins to hold things together while the glue dries. You will often use thin CA for the initial bond, but then follow with medium or thick CA for extra strength, especially when gluing plywood or hardwood.

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 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 in conjunction with accelerator to make fillets when a little extra strength is required Curing time is about 1-2 minutes.

Accelerator is a liquid chemical that comes in a spray bottle for use in speeding up the cure time of all CA types It should be misted on, not sprayed heavily on the joint Accelerator may cause exposed CA to bubble and sometimes change color If accelerator is sprayed on heavily it may weaken the glue joint, so use it sparingly

A WORD ABOUT **CA** SAFETY

After applying CA, don't stand directly over 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, never** point the CA applicator tip toward your face' Be especially careful when opening a clogged tip In case of eye contact, flush thoroughly with water and then seek medical attention, **but don't panic. Please, keep CA (and all other modeling chemicals) out of the reach of children!**

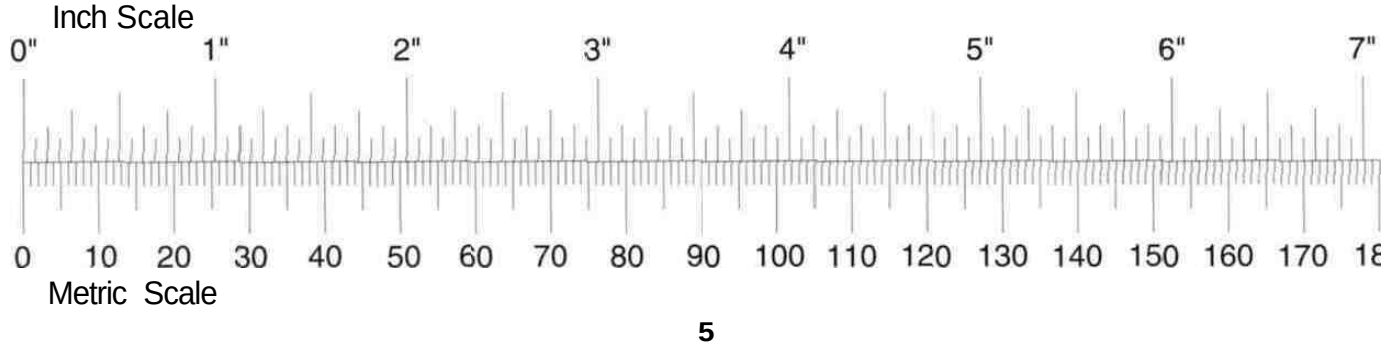
Epoxy:

Great Planes has two Epoxy formulations available for the modeler Both offer exceptional strength and convenient working times 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 mix 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.

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

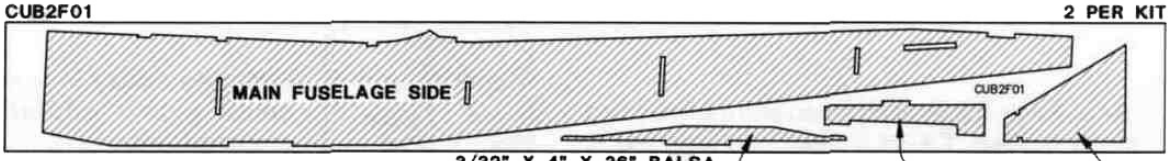
30-minute epoxy is used for extra strength (because it can penetrate longer) and where several parts must be aligned and checked before it cures Working time is about 25 minutes, handling time 2 hours, and it's fully cured in 8 hours.

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 CA and epoxy fumes, 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



DIE-CUT PATTERNS

CUB2F01 — 2 PER KIT



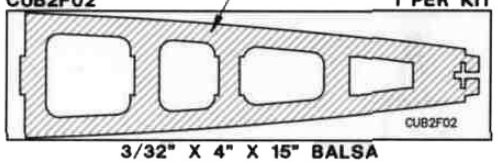
3/32" X 4" X 36" BALSA

LOWER FRONT FUSELAGE SIDE

AFT UPPER FUSELAGE SIDE

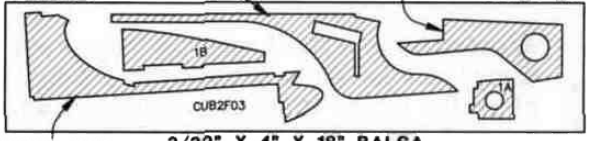
LANDING GEAR FAIRING

CUB2F02 — AFT FUSELAGE TOP — 1 PER KIT



3/32" X 4" X 15" BALSA

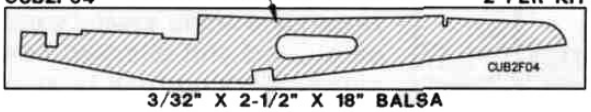
CUB2F03 — CABIN DOUBLER — AFT FUSELAGE DOUBLER — 2 PER KIT



CABIN TOP

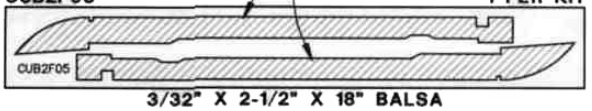
3/32" X 4" X 18" BALSA

CUB2F04 — LOWER FUSELAGE DOUBLER — 2 PER KIT



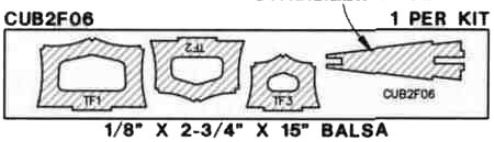
3/32" X 2-1/2" X 18" BALSA

CUB2F05 — UPPER FUSELAGE DOUBLER — 1 PER KIT



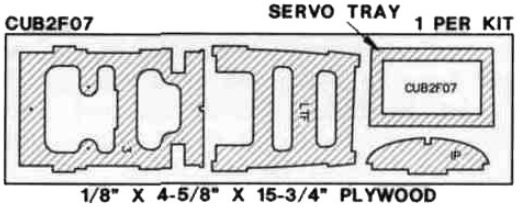
3/32" X 2-1/2" X 18" BALSA

CUB2F06 — STABILIZER BASE — 1 PER KIT



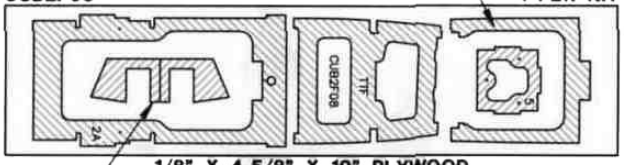
1/8" X 2-3/4" X 15" BALSA

CUB2F07 — SERVO TRAY — 1 PER KIT



1/8" X 4-5/8" X 15-3/4" PLYWOOD

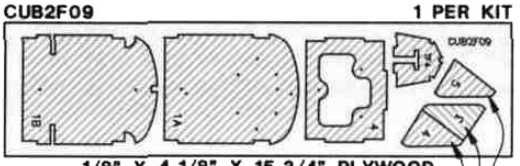
CUB2F08 — CABIN BRACE — 1 PER KIT



1/8" X 4-5/8" X 19" PLYWOOD

LANDING GEAR DOUBLER

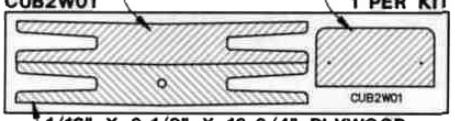
CUB2F09 — 1 PER KIT



1/8" X 4-1/8" X 15-3/4" PLYWOOD

ANGLE GAUGES

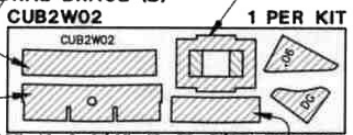
CUB2W01 — AFT SPAR JOINER — WING PLATE — 1 PER KIT



1/16" X 3-1/8" X 13-3/4" PLYWOOD

FORWARD SPAR JOINER

CUB2W02 — DIHEDRAL BRACE (B) — AILERON SERVO TRAY — 1 PER KIT

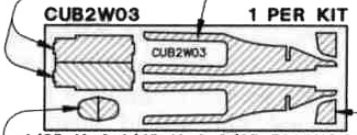


1/8" X 3-1/4" X 10-1/2" PLYWOOD

LEADING EDGE JOINER

DIHEDRAL BRACE (A)

CUB2W03 — STRUT MOUNTING PLATE BRACE — WING TIP BRACE — 1 PER KIT



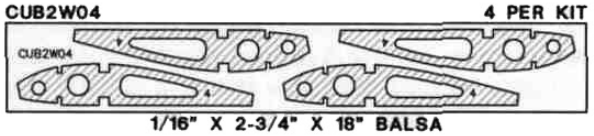
1/8" X 3-1/4" X 9-3/8" PLYWOOD

AFT

FWD

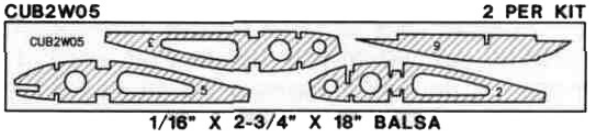
STRUT MOUNTING PLATE

CUB2W04 — 4 PER KIT



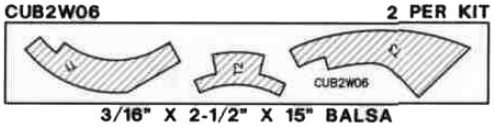
1/16" X 2-3/4" X 18" BALSA

CUB2W05 — 2 PER KIT



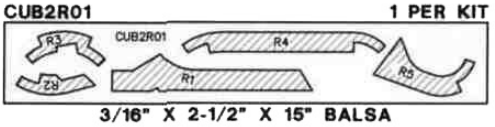
1/16" X 2-3/4" X 18" BALSA

CUB2W06 — 2 PER KIT



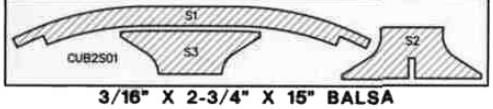
3/16" X 2-1/2" X 15" BALSA

CUB2R01 — 1 PER KIT



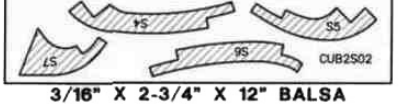
3/16" X 2-1/2" X 15" BALSA

CUB2S01 — 1 PER KIT



3/16" X 2-3/4" X 15" BALSA

CUB2S02 — 2 PER KIT



3/16" X 2-3/4" X 12" BALSA

METRIC CONVERSIONS

Inches x 25.4 = mm (conversion factor)

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

GET READY TO BUILD

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

D 2. Remove all parts from the box. As you do, determine the name of each part by comparing it with the plans and the parts list included in this kit. Using a felt tip pen or ball point pen, write the part name or size on each piece to avoid confusion later. Use the die-cut patterns shown on page 6 to identify the die-cut parts and mark them before removing them from the sheet. Save all 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 T-Bar or sanding block to lightly sand the edges to remove any die-cutting irregularities.

D 3. As you identify and mark the parts, separate them into groups, such as fuse (fuselage), wing, fin and 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 sub-assemblies.

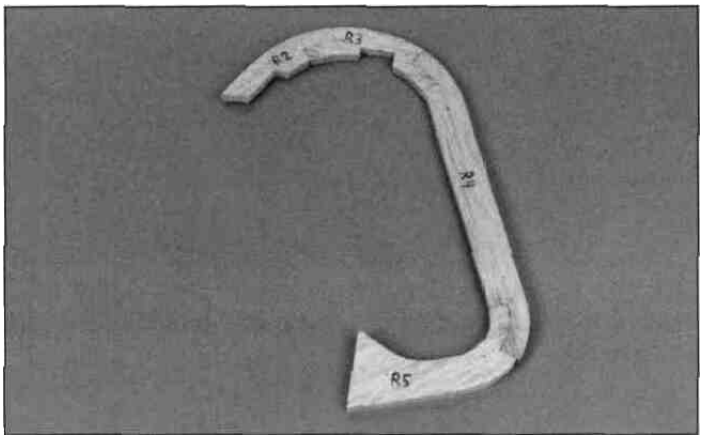
IMPORTANT: For a model that flies well with no unexpected tendencies, all good modelers understand that each assembly, especially the wing, must be built on a **flat** surface. Also, a relatively soft, **flat** building board that you can stick "T" pins into is required. This is for pinning down individual parts during construction. A suitable building board is a sheet of "Celotex" used in home construction. This material may be found at hardware or home improvement stores. If the building board is not flat, it must be clamped to your flat building table. Now we're ready to begin!

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!

BUILD THE TAIL SURFACES

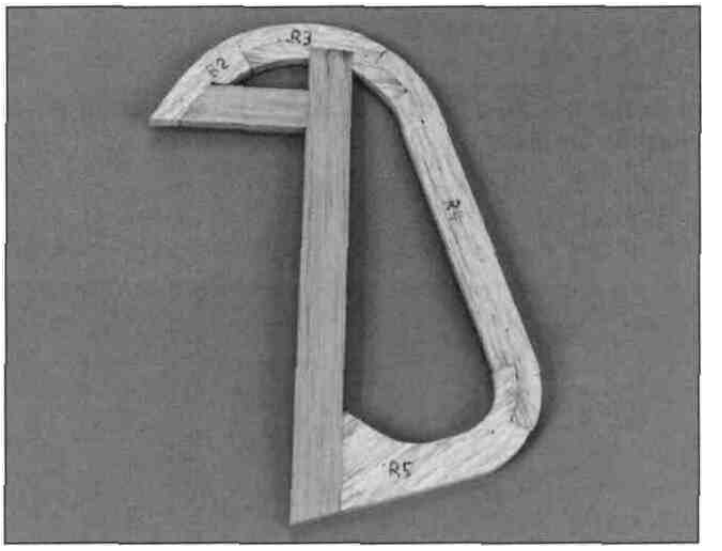
BUILD THE RUDDER

Tape the plan to a flat building surface, then cover the fin and rudder section with waxed paper. Refer to the plan **to** identify the parts and their locations.

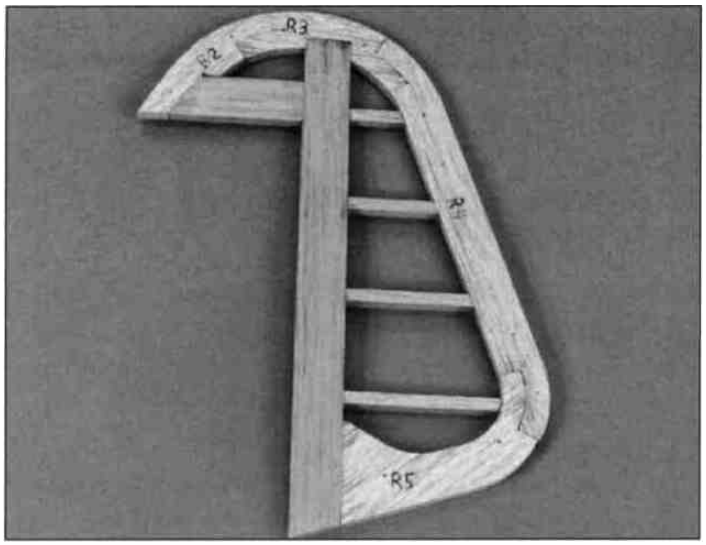


D 1. Place the die-cut 3/16" balsa rudder parts **R2, R3, R4** and **R5** over the plan in their locations. Check their fit and sand the mating edges as needed. Use a T-bar or other flat sanding block to make any necessary adjustments. Pin the parts to the building board after proper alignment and fitting has been done. Do not glue the parts together at this time.

D 2. Select the straightest piece from the four 3/16" x 5/8" x 18" balsa sticks. Set this piece aside for use later on the stabilizer trailing edge.



D 3. Cut the **rudder LE** from another 3/16" x 5/8" x 18" balsa stick. Fit the LE into the notch in **R3** and against the edge of **R5.** Cut the **horizontal frame** section from the 3/16" x 5/8" x 18" left over from the rudder leading edge, and fit it in position. Pin the LE and horizontal frame section in place and glue all the parts together with thin CA. Wipe off any excess glue from the surface before it cures. **NOTE:** Leave all the parts pinned to the building board.

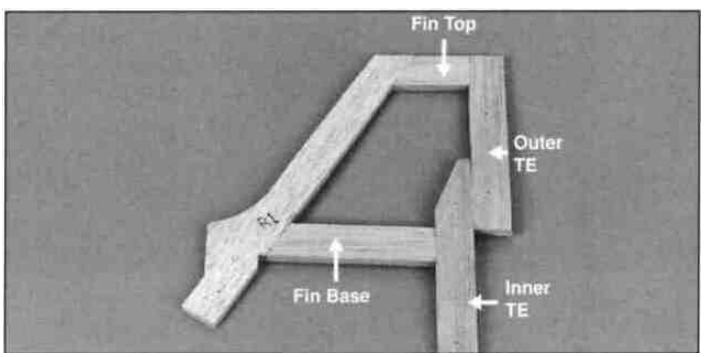


D 4. Cut the **ribs** from the 3/16" x 3/16" x 24" balsa stick. Position the ribs in the rudder frame and glue them in place with thin CA.

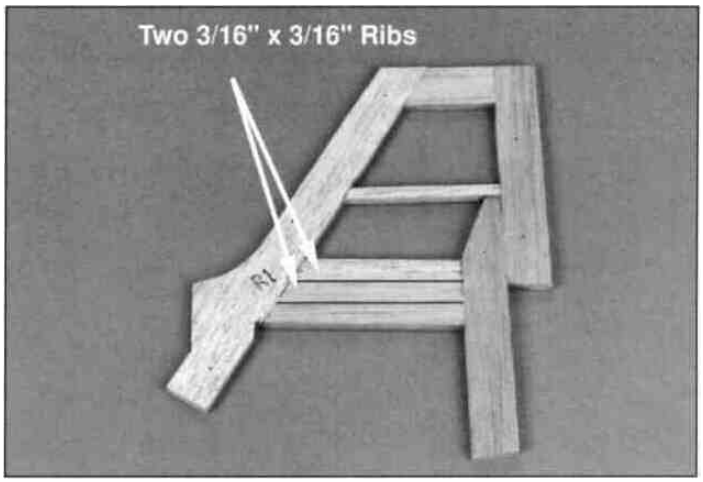
D 5. Remove the rudder from the building board and inspect all the glue joints. Add thick CA to any open joints.

BUILD THE FIN

D 1. Pin the die-cut 3/16" balsa **fin leading edge R1** in place on the plan.



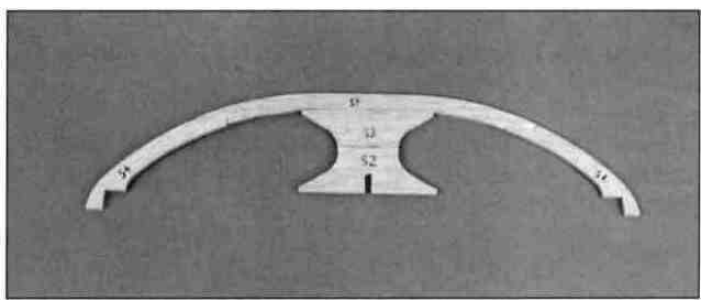
D 2. Cut the **fin top, fin base** and the **inner and outer fin** TE from the remaining 3/16" x 5/8" x 18" balsa sticks. Check the fit and sand their mating edges as needed. Pin the parts in place, then glue them together with thin CA. **NOTE:** Leave all the parts pinned to the building board.



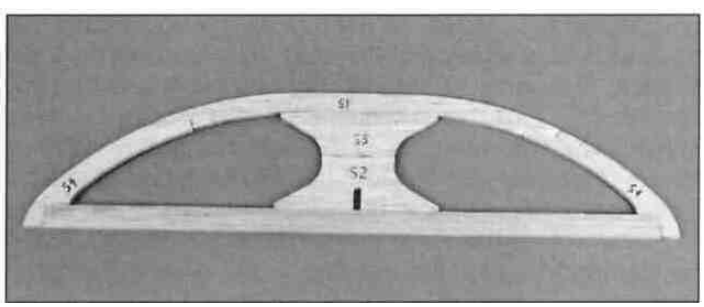
D 3. Cut the three ribs from the 3/16" x 3/16" x 24" balsa stick to fit between the forward and aft frames. Position two ribs above the lower frame for additional bracing and the third rib at the location shown on the plan. Glue the ribs to the frame with thin CA.

D 4. Remove the fin from the building board and inspect all the glue joints. Apply thick CA where necessary.

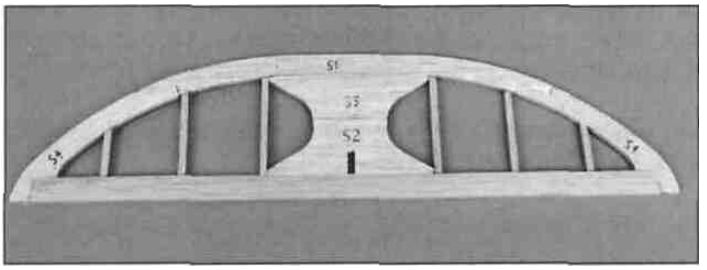
BUILD THE STABILIZER



D 1. Work over waxed paper covered plans. Place the die-cut **S1, S2, S3** and **S4** balsa parts over the plan to check their fit. Sand their mating edges as needed and pin the parts in place.



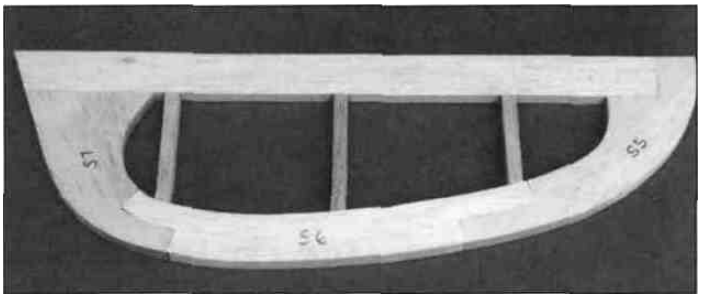
D 2. Cut the **Stabilizer TE** from the 3/16" X 5/8" X 18" balsa stick you set aside earlier. Fit the TE between the S4 parts on the plans. Glue all the parts together with thin CA. **NOTE:** Leave the parts pinned to the building board.



D 3. Refer to the plan, then cut six **ribs** from the 3/16" x 3/16" x 24" balsa stick. Position the ribs in the stabilizer frame and glue in place with thin CA.

D 4. Remove the stabilizer from the building board and inspect all of the glue joints. Apply thick CA to any open joints.

BUILD THE ELEVATORS



D D 1. Position the **S5, S6** and **S7** from the die-cut 3/16" balsa parts over the plan and check the fit of the mating edges and sand them as needed. Cut the **elevator LE** from a 3/16" x 5/8" x 24" balsa stick. Pin the parts in place over the plans and glue them together with thin CA.

D D 2. Refer to the plan, then cut three elevator **ribs** from the 3/16" x 3/16" x 24" balsa stick. Position and glue the ribs in the elevator frame with thin CA.

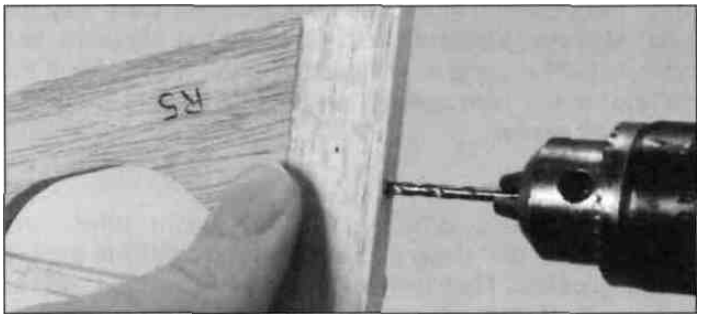
D D 3. Remove the elevator from the building board and inspect all the glue joints. Apply thick CA to any open joints.

D 4. Repeat this process to build the other elevator.

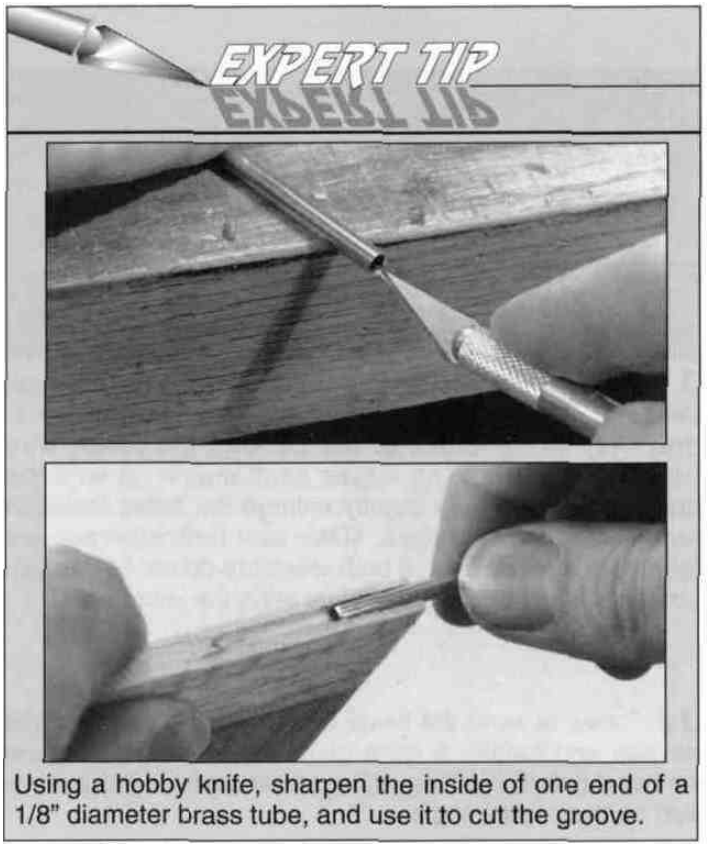
FINISH THE TAIL SURFACES

D 1. Carefully sand all the tail surfaces flat with 150-grit sandpaper and a large sanding block or T-bar. **Remove as little material as possible and don't get carried away - inspect your work as you proceed. It's easy to sand a low spot into the ribs or trailing edge, so be careful to avoid doing this.**

D 2. Draw centerlines around the **outside edges** of the fin, rudder, stabilizer and elevator to assist in sanding and hinge installation.

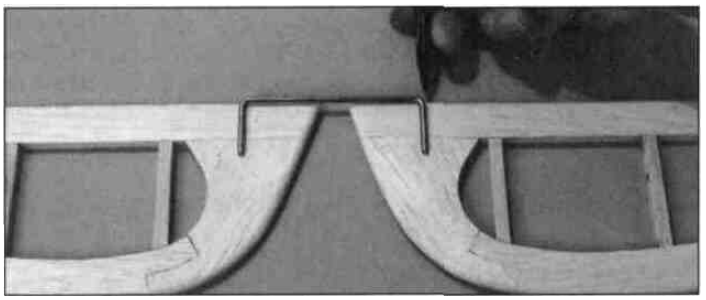


D 3. Position the rudder over the plan and align the **bent wire tail gear** over the bottom end of the rudder as shown. Mark the tail gear "arm" location on the centerline of the rudder LE. Drill a 7/64" hole, 3/4" deep at this spot (the hole is drilled slightly oversize to create a hard epoxy "sleeve" around the wire). Cut a **groove** from the tail gear hole to the bottom of the rudder that will allow the **nylon tail gear bearing** to fit flush with the LE of the rudder. **Do not glue the tail gear in at this time.**



Using a hobby knife, sharpen the inside of one end of a 1/8" diameter brass tube, and use it to cut the groove.

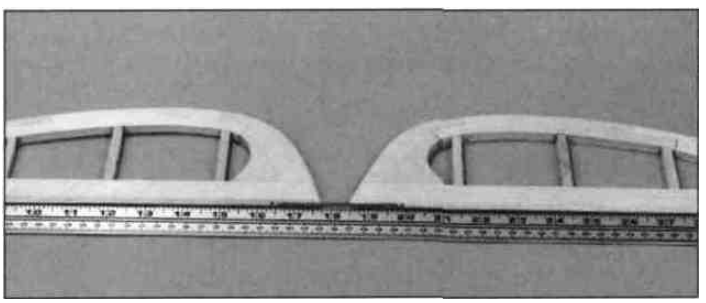
D 4 Trial fit but do not glue the tail gear wire in the rudder. Make adjustments if necessary.



D 5 Temporarily pin the **elevators** on the plan Lay the 3/32" **elevator joiner wire** in place on the elevators and mark its outline using a soft leaded pencil **NOTE:** Mark the elevator joiner wire outline very lightly so that it can be sanded off easily

D 6 Accurately drill a 1/16" diameter pilot hole approximately 3/4" deep and perpendicular (90°) to the LE, at each location Then drill the final hole with a 7/64" drill bit to a depth of 7/8" (The hole is drilled slightly oversize to allow for positioning, and to allow room to create a hard epoxy "sleeve" around the wire).

D 7 Use your sharpened 1/8" diameter brass tube to cut a groove in the leading edge of both elevators to accept the elevator joiner wire Slightly round the inside corner where the groove meets the hole to allow for the bend in the elevator joiner wire.



D 8. Test fit (do not glue yet) the joiner wire into both elevators Position the elevators against a straightedge to check for straightness of the LE with the joiner wire installed If the leading edges don't match up with the straightedge, you may slightly enlarge the holes drilled in the elevator leading edges Make sure both elevators are flat on the work surface If both elevators do not lie flat, you can make slight adjustments by twisting the joiner wire.

D 9. Carve or sand the bevel on the leading edges of the elevator and rudder A razor plane allows you to rough-in the bevel before finishing with a sanding block Refer to the plan for the correct angle

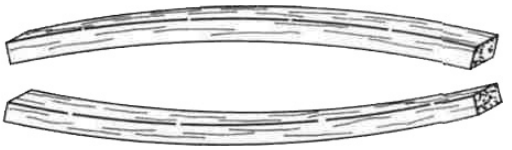
D 10 Sand the leading edges of the stabilizer and fin and the trailing edges of the elevator and rudder to a rounded shape, as shown in the cross-section on the plan.

We have found that it's much simpler to do all hinging after the model is covered.

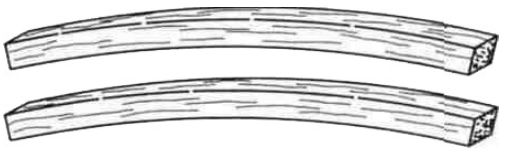
BUILD THE WING

D 1 Build one wing "half" or panel at a time You may want to cut out each wing panel from the plan sheet to place on your building board Tape the plan to your flat building board and cover it with waxed paper Begin with the **right** wing panel.

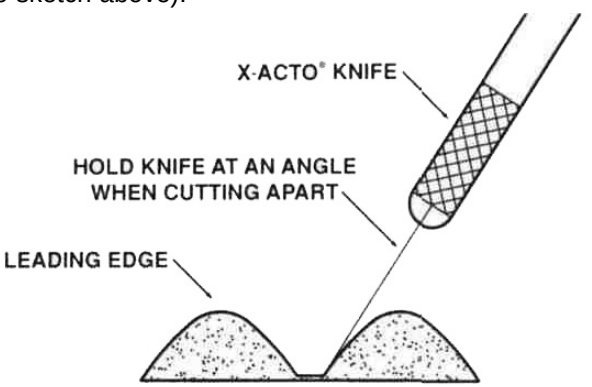
TWO WARPED SPARS INSTALLED THIS WAY WILL RESULT IN A STRAIGHT WING



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



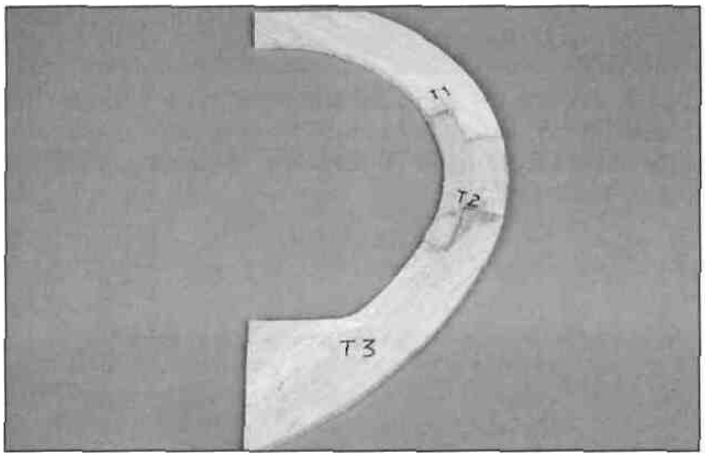
D 2. Locate all four 1/4" x 5/16" x 27" **balsa spars** and examine them carefully for possible imperfections Look for knots, soft spots, diagonal grain and any other imperfections If possible, position each spar so the imperfections are on the **outer** half of the wing panel (toward the tip), where they will be least affected by high stress If the spars are warped slightly try to "balance them out" by installing the warped spars in opposite directions (see sketch above).



D 3. The shaped and notched wing **leading edges (LE)** and **trailing edges (TE)** are fastened together by thin strips of balsa Separate them by cutting with a hobby knife, as shown in the sketch above

D 4. Carefully remove **all** the die-cut 1/16" balsa **R1** through **R6 wing ribs** from the die-cut sheets. Sand the edges **slightly** to remove any die-cutting irregularities.

ASSEMBLE THE WING TIPS



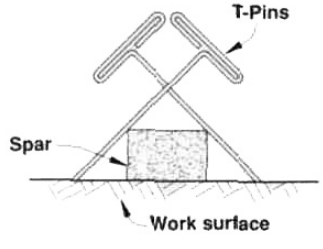
D D 1. Place the die-cut 3/16" balsa wing tip parts T1,T2 and **T3** over the plan and check all joints for proper fit. Make adjustments if necessary. Pin the parts over the plan and glue them together with thin CA.

D D 2. Remove the wing tip from the building board and inspect all glue joints. Apply thick CA to any open joints.

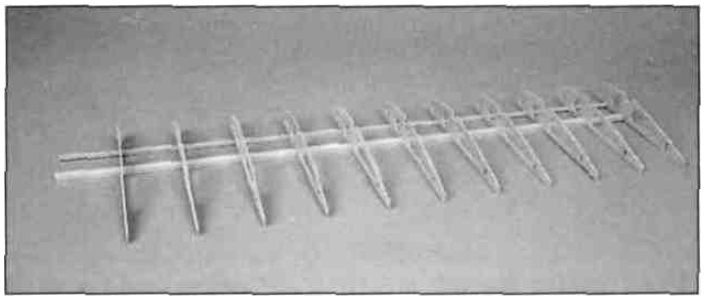
D D 3. Place the wing tip on your work surface and lightly sand both sides smooth with 80-grit sandpaper. Set the wing tip aside for now.

D Repeat steps 1 -3 for the other tip.

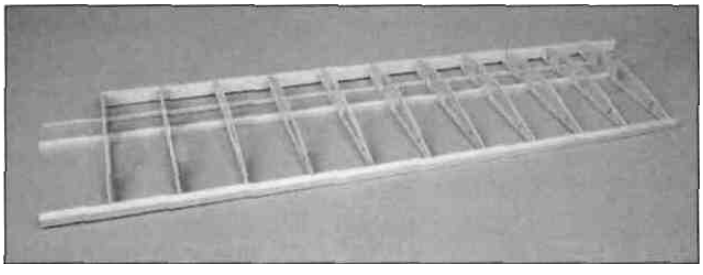
BUILD THE WING PANEL

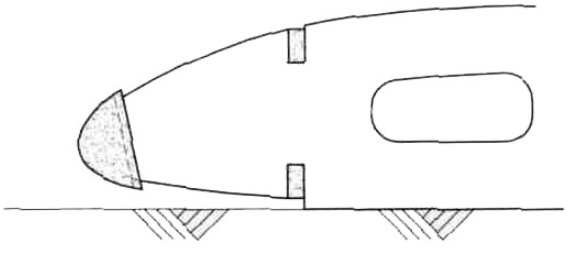


D D 1. Do not use any glue until step five. For now, we're just making preparations and familiarizing ourselves with the layout. Place one of the 1/4" x 5/16" x 27" **balsa lower main spars** and one of the 1/8" x 3/16" x 27" **balsa lower forward spars** on the wing plan. Pin only the main spar down with crossed T-pins as shown in the sketch. We recommend crossed T-pins at every rib bay (the space between the ribs). The lower forward spar is for alignment at this point and will be glued to the ribs later. **NOTE:** Align the end of the spars with the outboard edge of the **wing rib R5.** Leave the spars' "overhang" at the root (inboard end) of the wing. We'll trim it off later before joining the wing halves,



D D 2. Without gluing, place ribs **R2** through **R5** on the spars in their locations as shown on the plans.





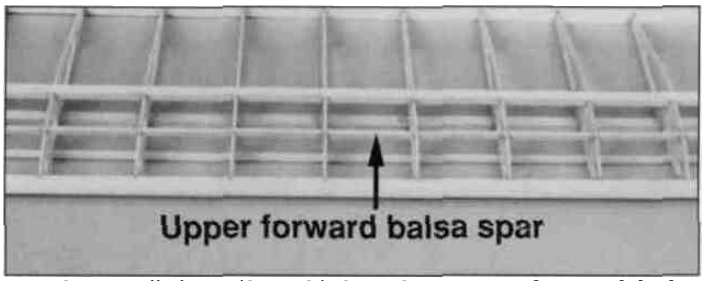
D D 3. Match the notches in the shaped balsa LE and TE with the plan. Add the LE and TE to the ribs making sure each rib is fitted into its respective notch. Center the LE vertically so there is an equal amount of space above and below each rib.

D D 4. Pin the TE to the building board. Place a piece of scrap 1/16" balsa sheet under ribs **R2** and **R3** at the TE to **center** them in the TE. Check that ribs, **R4** and **R5** are **against** the building board.

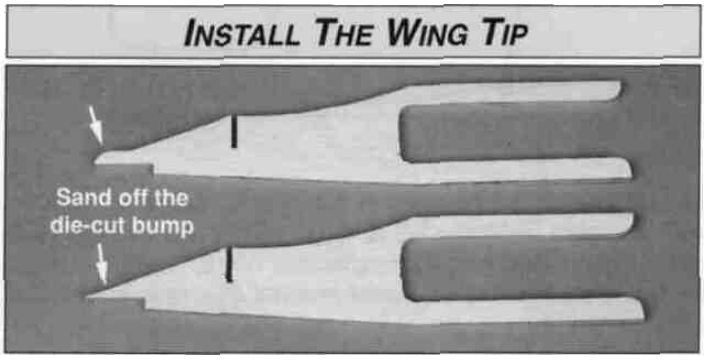
D D 5. Use a small building square or draftsman's triangle to make sure each rib is **vertical** to the main spar. **Glue the ribs to the main spar with thin CA.**

D D 6. Adjust the LE up or down until all the ribs are **centered** in the notches in the LE. Note that the LE is **angled down** slightly as shown in the cross section on the plan. **Apply thin CA to each joint between the ribs and the LE and TE.**

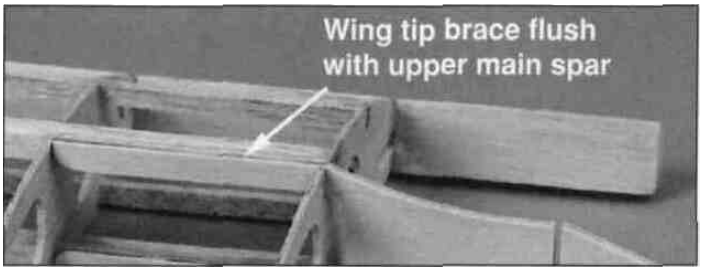
D D 7. Install the 1/4" x 5/16" x 27" **upper main spar** in the wing ribs. Check that the top of the main spar is flush with the top of the ribs. Make sure the end of the upper main spar is flush with the **outboard** edge of rib R5. Glue the main spar to the ribs with thin CA.



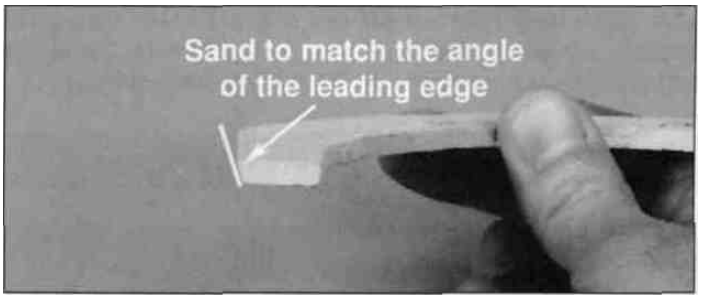
D D 8. Install the 1/8" x 3/16" x 27" **upper forward balsa spar** in the wing ribs with one end of the spar flush with the **outboard** edge of rib R5. Glue the forward balsa spar to the ribs with thin CA.



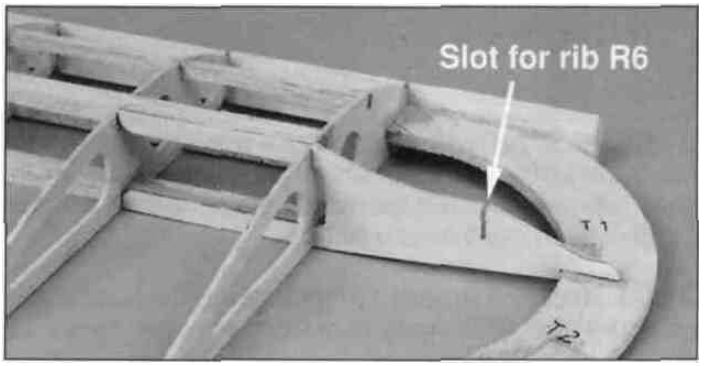
D D 1. Locate the die-cut 1/8" plywood **wing tip brace,** the die-cut 1/16" balsa wing tip rib **R6,** and your previously assembled wing tip. Notice the plywood wing tip brace has a small **"die-cut bump"** at the tip. This is to allow you to finish the piece to a perfect point where the die-cutter may have difficulty in this area. Take a minute to sand off the bump so the profile continues along the intended outline.



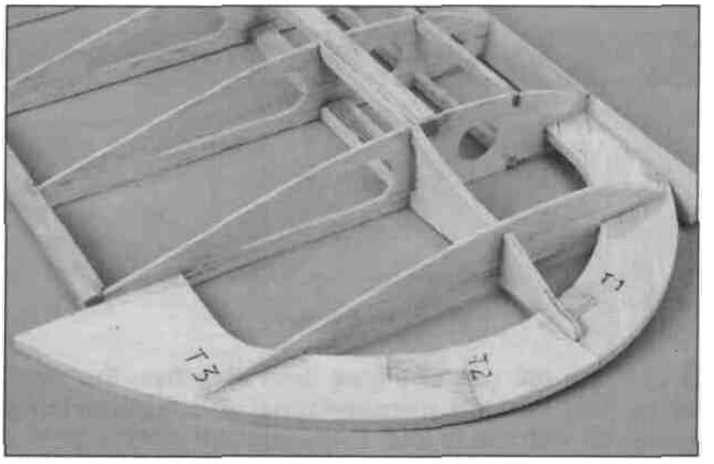
D D 2. Fit the 1/8" plywood **wing tip brace** into rib R5. The top "arm" on the wing tip brace should be flush with the top of the upper main spar and the slot for rib R6 should be over the rib location on the plans.



D D 3. So that the **wing tip** can fit properly between the LE and rib R5, sand the front of the wing tip to match the angle of the LE. Trim the TE flush with R5 so you can fit the tip properly in place.



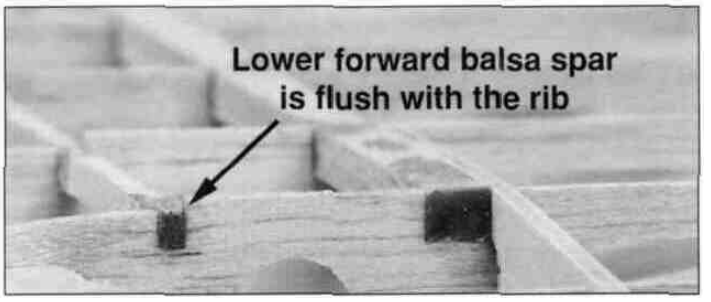
D D 4. Insert the front of the **wing tip** into the slot in rib R5. The aft end of the wing tip is attached to the TE of the wing and the side of rib R5, while lying flush on the building board.



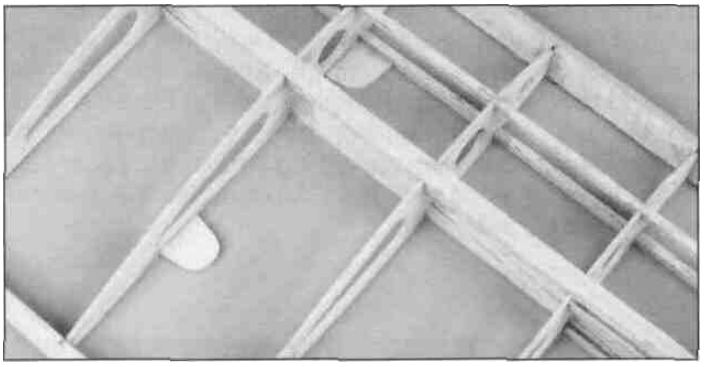
D D 5. Insert rib R6 in the slot in the plywood **wing tip brace.**

D D 6. Check the fit of all the wing tip parts and sand any mating edges as needed. Glue the wing tip parts together and to the wing panel with thin **CA.**

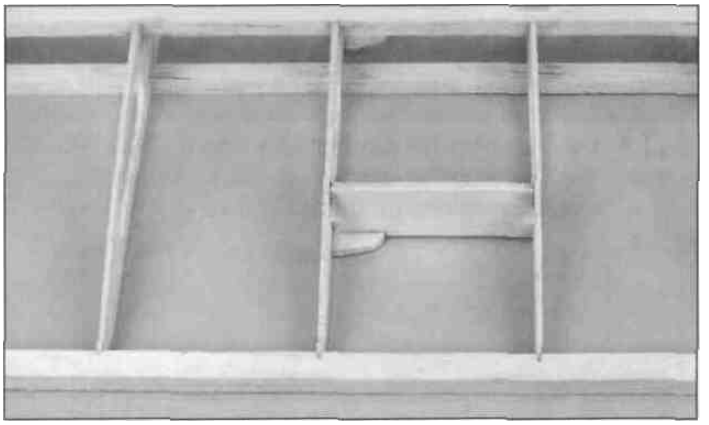
FINISH INSTALLING THE SPARS



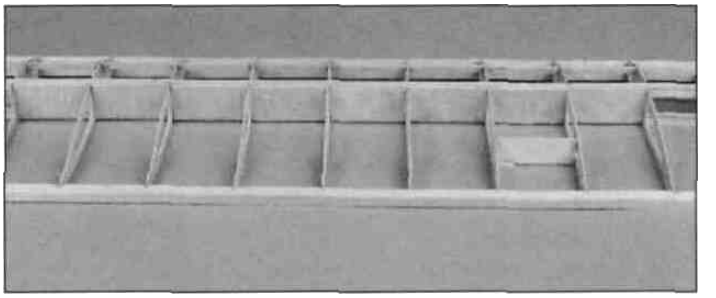
D D 1. Carefully remove the wing from the building board. Turn the wing upside down. Press the **balsa lower forward spar** into the notches in the ribs. Note that the front edge of the notches in ribs R4 and R5 is 1/16" below the aft edge of the notch. The lower forward spar should be flush with the **front** edge of the notch and **flush** with the edge of ribs R2 and R3. Glue in place with thin CA.



D D 2. Carefully remove the wing from the building board and turn it right side up. Align the spars and ribs with the plans and pin it back on the building board. Test fit the **die-cut 1/8" ply forward** and **aft strut mounting plates** to the wing at the locations shown on the plans. Glue them to the wing with thin CA. Then use thick CA to form a reinforcing fillet at the glue joint.

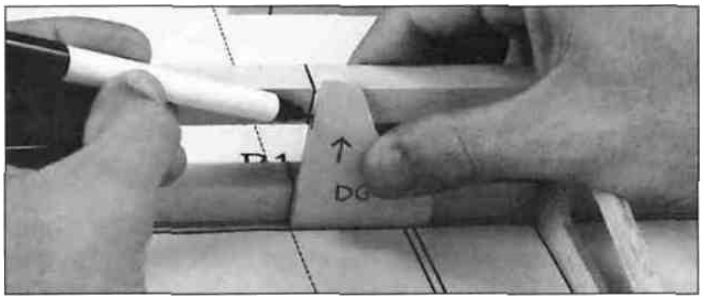


D D 3. Test fit the **die-cut 1/8" ply strut mounting plate brace** over the **aft strut mounting plate.** Make sure the brace contacts the wing ribs and the strut mounting plate. Glue the brace with thin CA, followed by a fillet of thick CA on all three pieces.

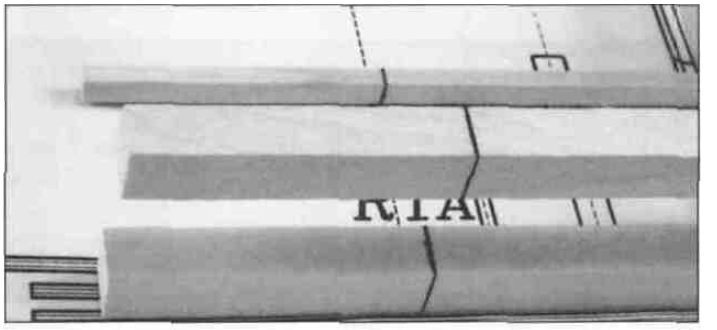


D D 4. Glue eight 1/16" x 2-3/8" x 1-3/16" balsa vertical grain **shear webs** to the rear of the balsa main spars starting between ribs R3 and R4 and ending between the last two R4 ribs. Shear webs will be installed between ribs R2 and R3 after the wing halves are joined. The shear webs are provided slightly thinner than the wing so they may be positioned without protruding above or below the top and bottom spars. It is not necessary to glue the shear webs to the ribs **- but, it is important to glue the shear webs securely to the spars.**

Note: At this point the wing should still be pinned to the work surface. Of course, we cannot add shear webs if the crossed T-pins are in position so remove the T-pins as you go. Then replace the T-pins through the sheer webs in order to keep the wing flat on your building board - or, use weights on top of the wing instead of the T-pins to hold the wing flat as you glue the shear webs in position. You only need to replace T-pins at every other rib bay.



D D 5. Locate the 1/8" die-cut plywood **dihedral gauge** (DG). Hold the gauge next to the **main spar** with the corner of the gauge at the wing centerline on the plan. Mark both sides of the main spars using the (DG) as shown in the photo.

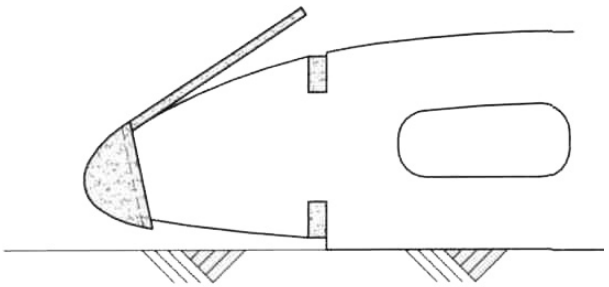


D D 6. Connect both lines by drawing a line across the top of each spar.

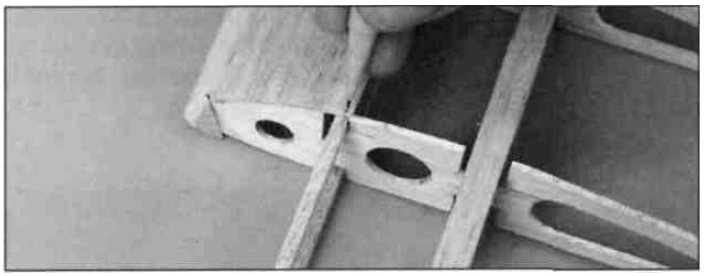
D D 7. Follow the same procedure for the **forward spars** and **TE.**

SHEET THE TOP LEADING EDGE

D D 1. Use a T-bar or flat sanding block with 150-grit sandpaper to lightly sand the top edges of the ribs to smoothly blend the ribs to the main spar and remove any bumps.

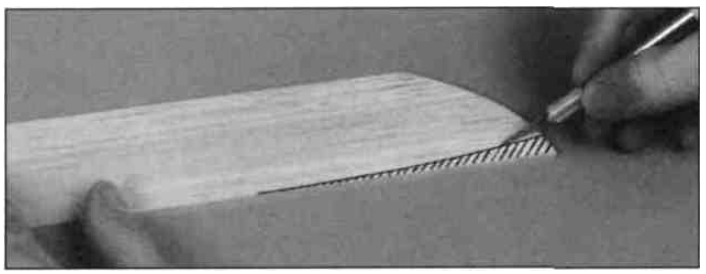


D D 2. Butt one of the 1/16" x 1-1/2" x 30" balsa **wing LE sheets** against the leading edge. For the strongest glue joint, sand or cut a bevel at the front edge of the sheet to match the angle between the leading edge and the ribs.

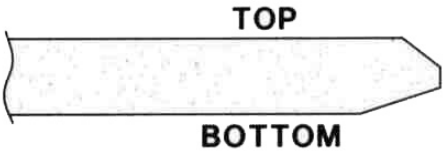


D D 3. Mark the sheet so that its aft edge is 1/16" ahead of the aft edge of the top **forward** balsa spar. The exposed spar will provide a "step" for the cap strips to glue to later.

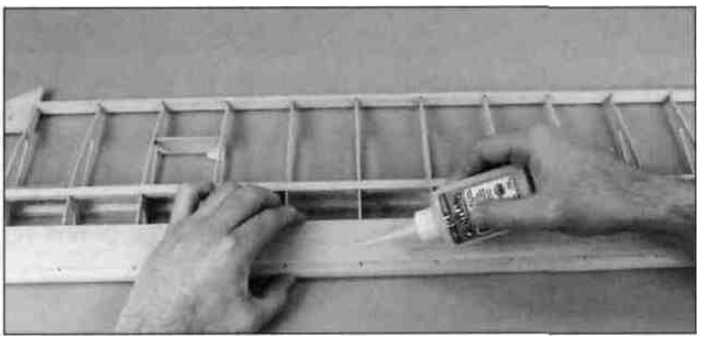
D D 4. Before attempting to bend the sheet so it may reach the outer wing tip, the sheet must be thoroughly wetted from R5 outward. Use a spray bottle or a sponge to liberally apply water to the tip area of the sheet outboard of rib R5. Carefully "work" the sheet with your fingers by bending and twisting it in the direction required to meet the wing tip. Replace the sheet on the wing and test bending the sheet into position. **Don't force the sheet - add more water if necessary.**



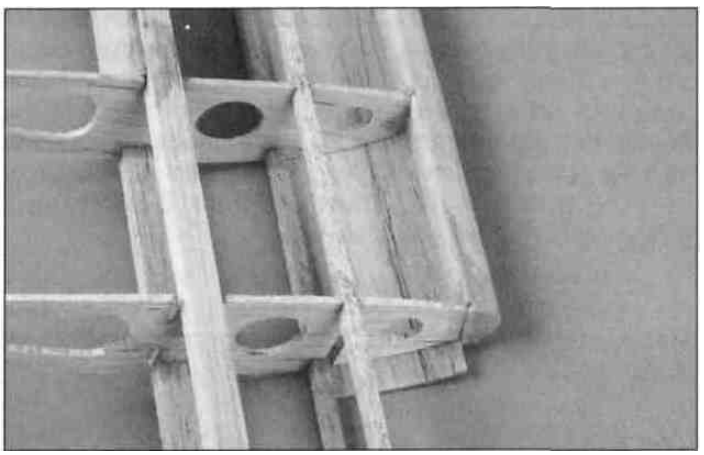
D D 5. Starting at rib **R5** the **aft** edge of the sheeting will have to be trimmed to keep it parallel with the front spar (notice that the sheeting bends backward as it is curved to meet the tip). Trim and test fit the sheet until it conforms to the desired straight line.



D D 6. To provide a gluing surface for the sheeting, carve a slight **bevel** on the **wing tip** where the sheet will meet the tip.

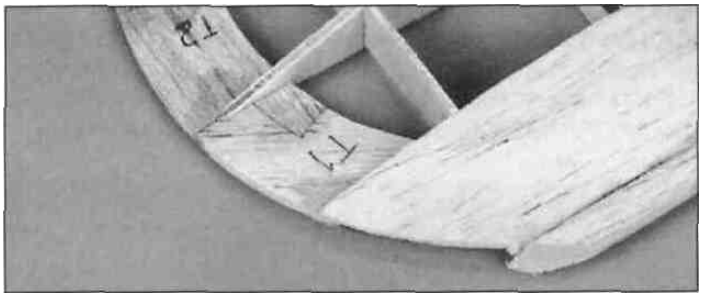


D D 7. Position the leading edge sheeting against the rear edge of the LE and covering rib R2. Using thin CA, glue the front edge of the sheet to the LE. Slightly wet the entire sheet to bend it to the spar. Apply a bead of thick CA to the forward spar. Working quickly, bend the sheeting to the spar holding it down with something flat like a T-bar sander or flat block of wood until the CA cures. **Do not** glue the sheet to the LE past rib R5.



D D 8. Lift the wing off the building board. Wick thin CA between the ribs and the sheet from the inside of the wing. Add a fillet of medium or thick CA along the inside of the LE.

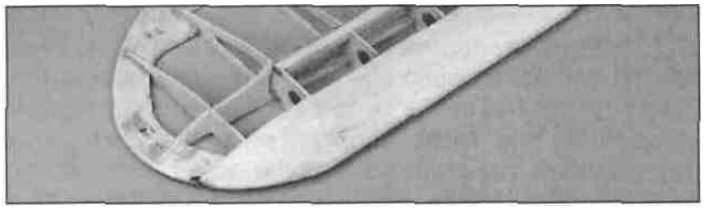
D D 9. Wet the sheet one more time in the tip area - the water may have evaporated from the balsa. Test bend the sheet to the tip. Apply thick CA where the sheet will contact the outer tip. Add ***thin*** CA to the joint between the **sheet** and rib R6. Fill the small seam between the LE and the front of the sheet between ribs R5 and R6 with a scrap piece of balsa.



D D 9. Trim off some of the excess sheet past the wing tip to allow the bottom sheet to make contact with the wing tip.

SHEET THE BOTTOM LEADING EDGE

D D 1. Turn the wing over and install another 1/16" x 1-1/2" x 30" balsa **wing LE sheet** almost the same way you installed the top except cut the sheet so it goes to the aft edge of the forward spar. This time apply thick CA to the ribs before you add the sheet.



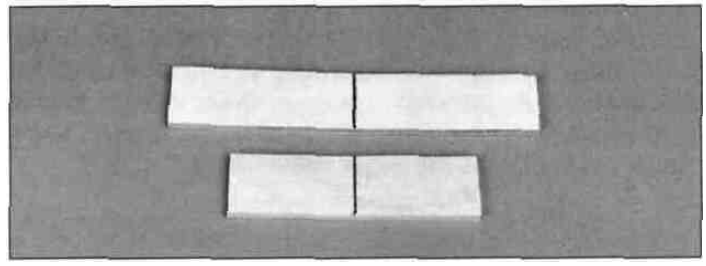
D D 2. Notice on the plan that the LE does not begin to curve back until **outboard** of rib R5. Refer to the plan for the correct shape. A razor plane works well to cleanly remove material until you get close enough to use sandpaper. Be **careful** with the razor plane - take a **little** off at a time. Then use 150-grit sandpaper to rough sand the wing tip to shape.

D D 3. Use a razor saw to cut both **forward spars,** both **main spars,** and the **TE** on the lines previously drawn. (See steps 5-7 on page 13).

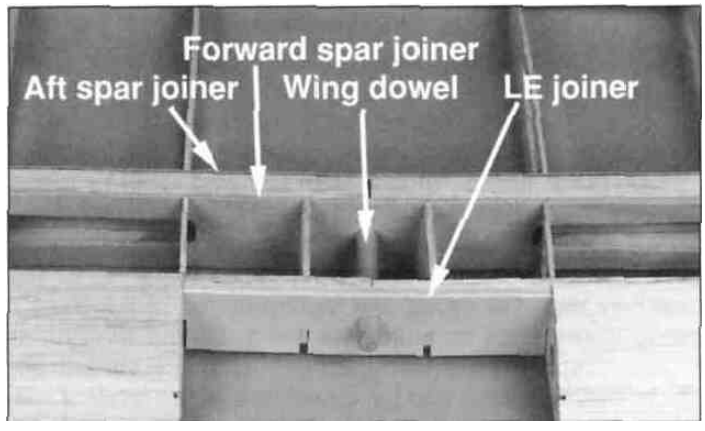
D D 4. Sand the end of the spars and the trailing edge up **to** the lines. Remove only a small amount of material at a time. It's easier to remove material than it is to add it.

Now that the right wing panel is completed, dust off your building board and build the left wing panel.

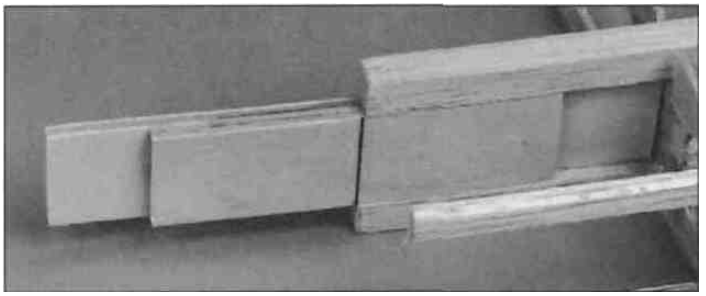
JOINING THE WING PANEL



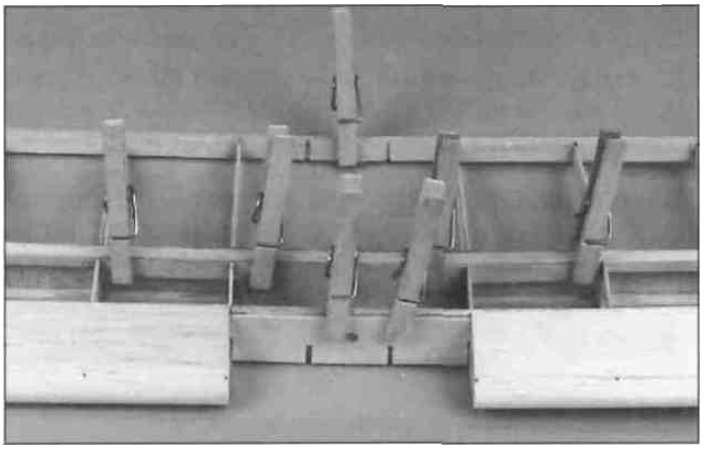
D 1. Locate the die-cut 1/8" birch plywood **dihedral brace (A)** and the die-cut 1/8" birch plywood **dihedral brace (B).** Measure and draw a vertical centerline on both dihedral braces. Glue the two dihedral braces together with 30-minute epoxy, lining up the centerlines. Clamp the braces together and remove any excess epoxy with a paper towel moistened with rubbing alcohol. While the epoxy is curing, move onto the next step.



D 2. Without using glue, temporarily join the **wing halves** using the die-cut 1/16" birch ply **forward** and **aft spar joiners** and the die-cut 1/8" **LE joiner.** Also test fit the die-cut 3/32" balsa **sub ribs** 1A in front of the forward spar joiner. You may trim the ends of the forward and aft spar joiners, but the LE joiner determines the width of the center section and this should not be changed. With one of the wing panels lying flat on your work table, prop up rib **R5** of the other panel 15/16" to account for the dihedral. Check the fit of the spars, joiners and TE. At this time test fit the 1/4" x 1-3/4" **wing dowel** to check that it is perpendicular to the leading edge joiner when fully seated into the forward spar joiner. If you have to make adjustments here, **do not** modify the LE joiner but adjust the position of the wing dowel hole in the front spar joiner instead. Make sure you have not built any "sweep" into the wing by making the spars or TE too long or too short. Be sure to maintain the correct spacing between ribs R2 per the plan so the wing will fit on the fuselage.



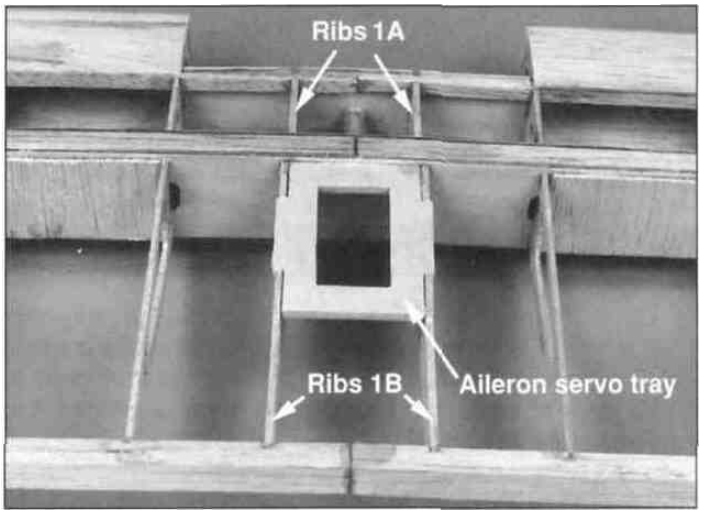
D 3. After the epoxy on the **dihedral brace** has cured, trial fit the brace between the **main spars.** The dihedral brace should fit snugly between the main spars without forcing them apart. Sand the dihedral brace as necessary, being careful not to change the angle of the brace.



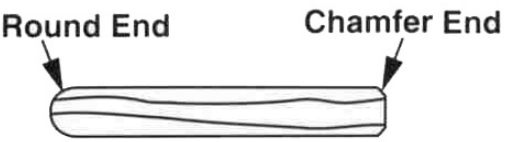
D 4. 30-minute epoxy must be used for this step. Place waxed paper on your work surface and mix up at least 1/2oz. of 30-minute epoxy. Apply the epoxy to all mating surfaces of the **forward** and **aft spar joiner, leading edge joiner, main spars, dihedral brace** and **trailing edge.** Slide all the parts together and wipe off any excess epoxy with a paper towel. Lay one wing panel flat on the work table and block up the other wing panel 15/16" at rib **R5.** Carefully align the spars and trailing edges of the panels, being careful not to build in a twist. Clamp everything together and wipe off any excess epoxy. Remove any epoxy that squeezes into the dowel hole of the forward spar joiner. **Allow the epoxy to fully cure before removing the clamps and disturbing the wing.**

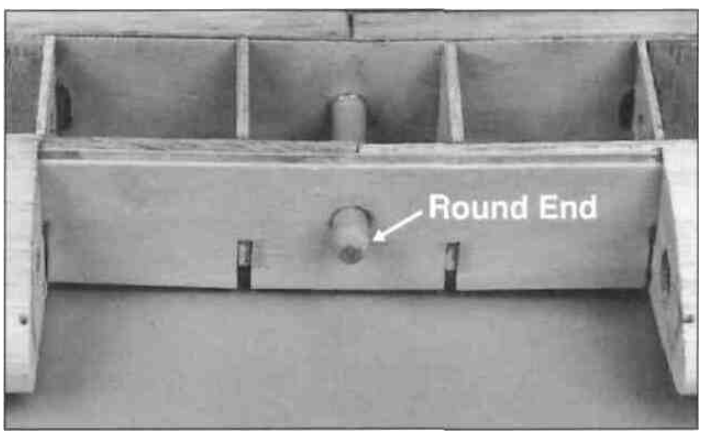
D 5. Remove the wing from the building board and take off all of the clamps. Sand off any excess epoxy that may interfere with final assembly (wing sheeting, shear webs).

D 6. Add the four remaining 1/16" balsa vertical grain **shear webs** - one in **front** and one **behind** the **joiners** between ribs **R2** and **R3. Important:** the bottom center sheeting does not **cover** the main spar but butts up against the **spar joiners** in front of, and behind the spar. Therefore, the 1/16" shear webs must be positioned so that they are about **1/16" lower than the edge of the spar joiners.**



D 7. Without gluing, install both 3/32" die-cut balsa **sub ribs 1A and 1B** between ribs **R2.** Place the **aileron servo tray** in the notches in ribs 1B to produce the proper spacing between the ribs. **Note:** Keep the plywood aileron **servo tray doublers** you removed from the center of the aileron servo tray. They will be used during radio installation. Also, check that the 1B ribs are centered vertically in the slots in the TE and 1/16" **below the main spar and spar joiners.** Glue ribs 1A, 1B and the aileron servo tray in position with thin CA. Turn the wing over a apply a fillet with thick CA at the joints of the 1B ribs, the aft spar joiner and the aileron servo tray.



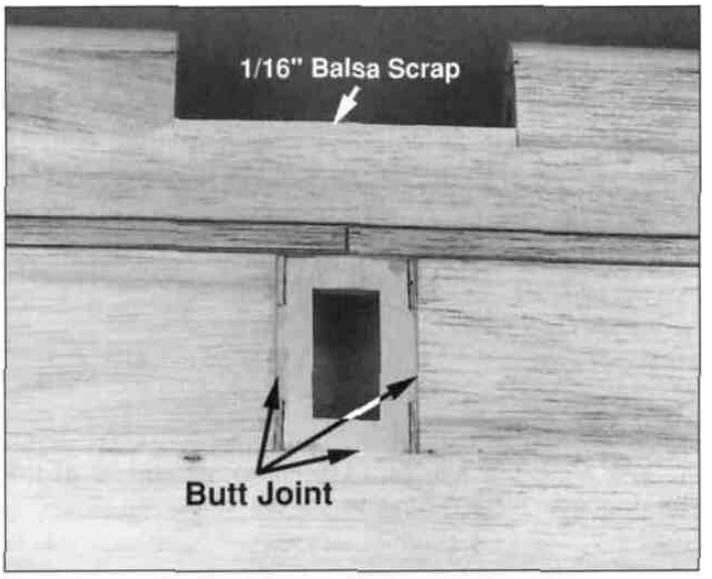


D 8. Round off one end of the 1/4" hardwood wing dowel and slightly chamfer the other end of the dowel. Remove any hardened epoxy that may be remaining in the hole in the **forward spar joiner** with a round file. Install the dowel with 6-minute epoxy. Wipe off any excess epoxy around the front of the dowel with alcohol and a paper towel.

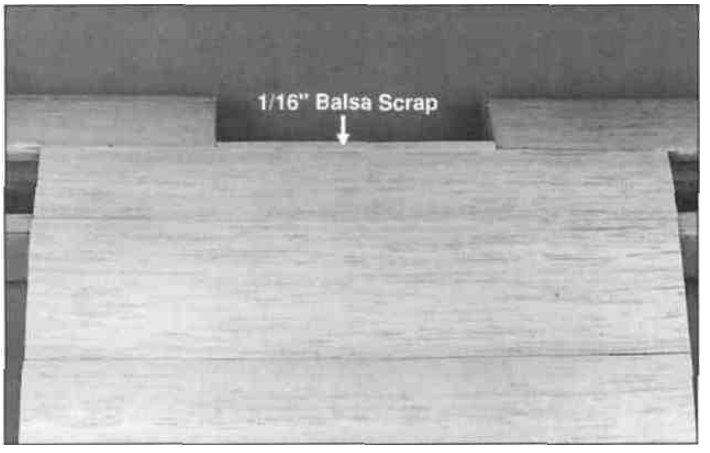
SHEET THE CENTER OF THE WING

D 1. Once more, look for any excess epoxy that will interfere with the center section wing sheeting. Sand or cut any excess epoxy off.

D 2. Locate the three pieces of 1/16" x 2-1/2" x 24" balsa **center section wing sheeting.** Cut them into six 9-1/2" lengths.

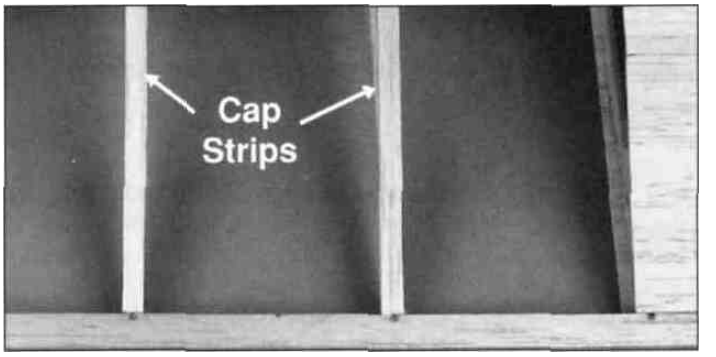


D 3. Sheet the **bottom** of the wing first. Begin with the **rear sheet,** then add the **middle section,** then the **front.** Also, the bottom sheeting does not cover the main spar, but is flush with it. Mark the location of the aileron servo tray on the rear and middle sheets. Trim the sheets to blend into the **aileron servo tray.** Add a strip of 1/16" balsa scrap over the **forward spars** and the plywood **LE joiner.**



D 4. Sheet the **top center section.** Again, sheet the **rear** section first, then the **middle,** then the **front.** The seam between the front and middle section sheeting should be made over the main spar. Like the bottom, add a strip of 1/16" balsa scrap over the forward spars and plywood leading edge joiner.

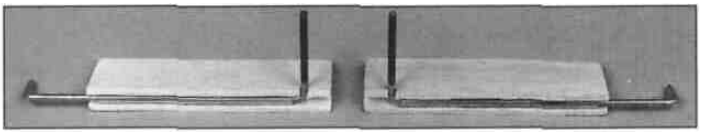
D 5. After both the **top** and **bottom sheeting** is installed, use a T-bar or sanding block to even the edges of the sheeting 1/8" past the R3 ribs.



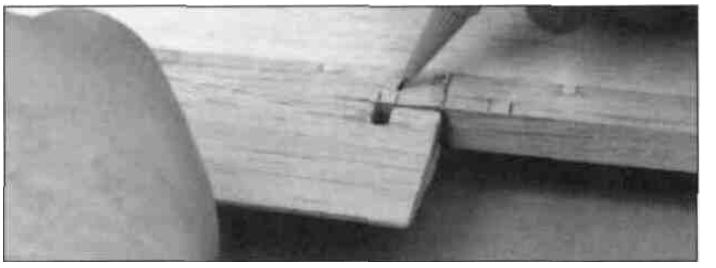
D 6. From the 1/16" x 3/16" x 24" balsa sticks, cut, then glue the **cap strips** to the top of all **R4** and **R5** ribs with medium CA. These cap strips run from the leading edge sheeting to the TE.

D 7. Lightly mark a centerline from the TE toward the LE on the top sheeting of the wing.

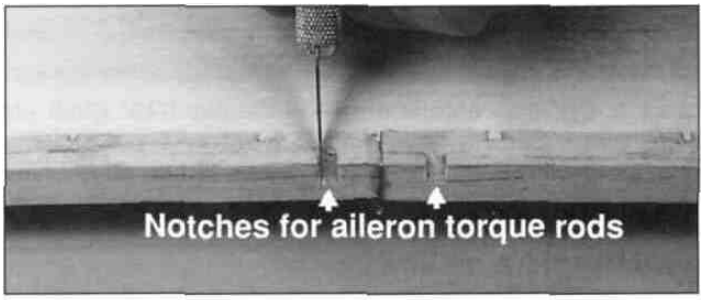
WING COMPLETION



D D 1. Position the tapered and grooved 1-1/8" x 3-3/8" hardwood **wing center TE** pieces over the plans and mark the location of the aileron torque rod exits. Cut a notch in the **bottom forward** edge of both pieces as shown in the photo.



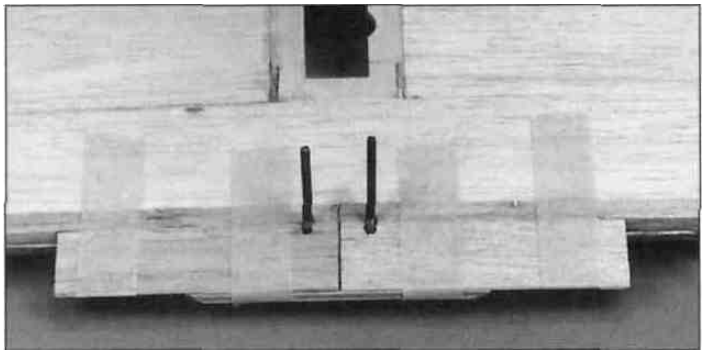
D D 2. Sand a slight angle on the inboard edge of the wing center TE to match the dihedral angle to permit the two pieces to butt together without a gap. While holding the wing center TE against the aft edge of the wing, aligned with the wing centerline, mark the torque rod notches on the **bottom** of the wing.



D D 3. Cut shallow notches at both torque rod locations on the **bottom** aft edge of the wing to allow the torque rods to swing forward.

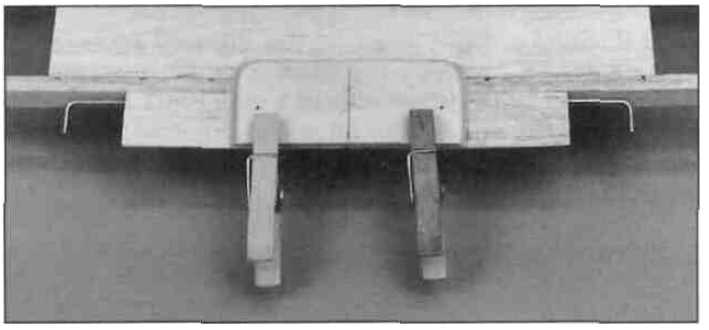
D D 4. To provide better glue adhesion, roughen the nylon surface of both torque rod tubes with coarse sandpaper. Clean the nylon tubes with alcohol and a paper towel.

D D 5. Lightly coat the torque rods with petroleum jelly, then slide the nylon tube back and forth a few times to lubricate the inside of the tube. This procedure will prevent the torque rods from being glued to the tube during the next step.

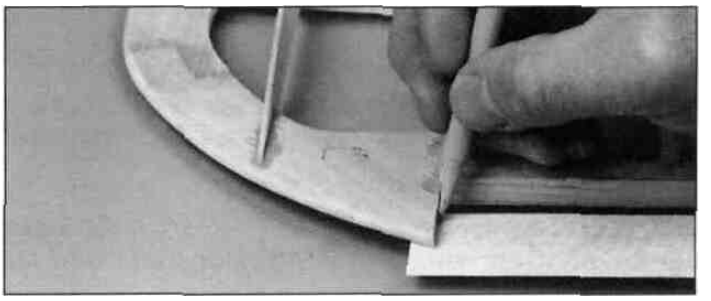


D D 6. Coat the center section of the **nylon bearings** with 30-minute epoxy. Then insert the tubes into the grooves of the wing center TE. Wipe off any epoxy that may squeeze out with a paper towel. Apply epoxy to the forward edges of the wing center TE (keep it out of the notches) then glue them in position as shown on the plans. Use masking tape to hold the wing center TE in position while the epoxy cures.

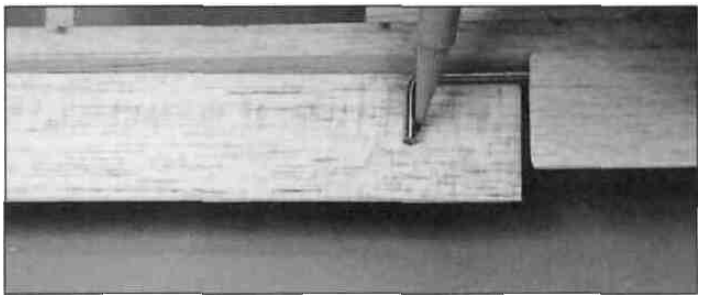
Note: Allow the epoxy to harden completely before proceeding with step 7.



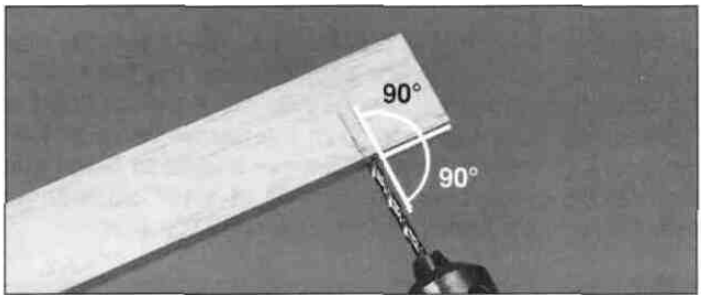
D D 7. Draw a centerline on the die-cut 1/16" birch ply **wing plate.** Sand a bevel on the **front** and **sides** of the wing plate with 80-grit sandpaper. Leave the aft edge of the wing plate square. Use 6-minute epoxy to glue the wing plate in position on the top of the wing. Use the centerline you drew to align the wing plate with the centerline of the wing. The aft edge of the wing plate must be flush with the aft edge of the wing center TE. Clamp the wing plate in position while the epoxy cures.



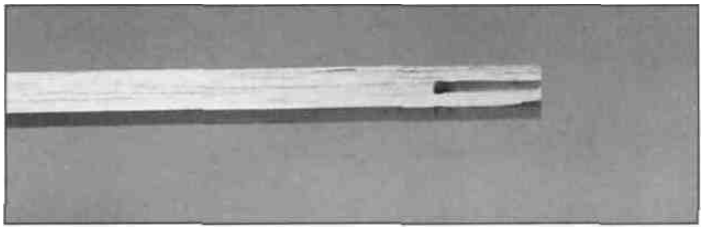
D D 8. While holding a 1-1/8" x 27" **balsa aileron** against the inside edge of the wing center TE, draw a line on it that matches the inside edge of the wing tip TE. Cut the aileron 1/8" shorter than the TE opening to allow for covering material.



D D 9. Hold the aileron in position, **centered in the opening,** then mark the location of the torque rod arms.



D D 10. Draw a centerline on the forward edge of the aileron. Drill a 7/64" hole, 3/4" deep, perpendicular to the forward edge of the aileron to accept the torque rod arm.



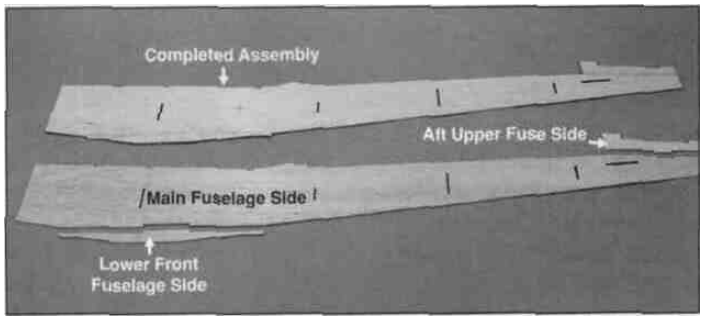
D D 11. Cut a groove from the inboard edge of the aileron to the *hole* to accept the torque rod. **Hint:** Use your sharpened piece of 1/8" brass tubing for this task.

D D 12. Sand the forward edge of the aileron to a "V." Refer to the cross-section of the wing on the plans for the desired angle

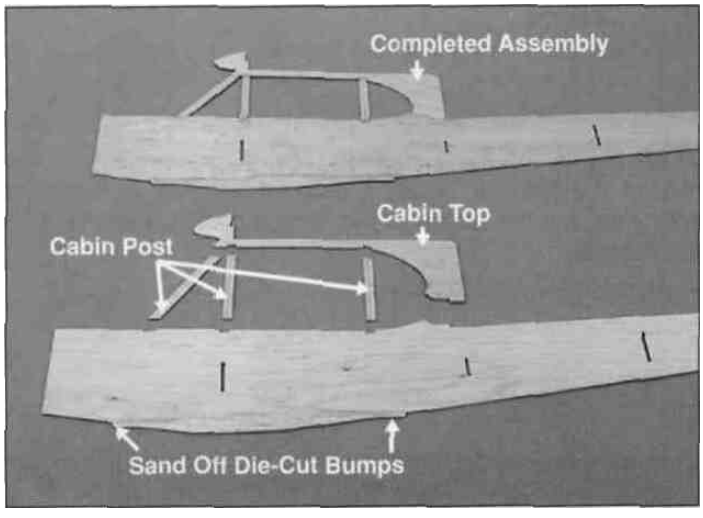
Well, you are about halfway through the framing stage, so clean up your workbench, have a soda and let's build the fuse.

BUILD THE FUSELAGE

BUILD THE FUSELAGE SIDES



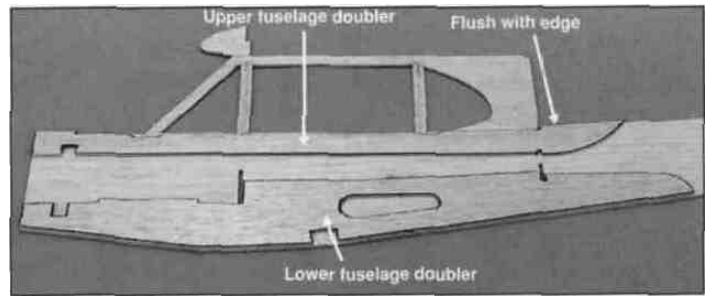
D D 1 Pin or tape the fuselage plan to a flat work surface and cover it with waxed paper Trial fit the die-cut 3/32" balsa **main fuselage side, lower front fuselage side** and **aft upper fuselage side** together as shown in the plans Sand as necessary to achieve a good fit then pin the sides over the plans Glue the side pieces together with thin CA Wipe off any excess CA with a paper towel before it cures



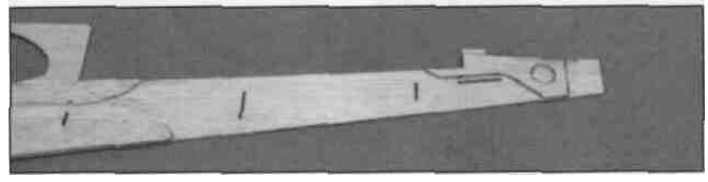
D D 2 Pin the die-cut 3/32" balsa **cabin** top to the plan Cut three **cabin posts** from the 3/32" x 5/16" x 24" balsa stick and pin them into position Glue the cabin posts and cabin top to the fuselage side with thin CA Also sand off the die-cut bumps on the lower front fuselage side so that the edges are flush with each other.

D D 3 Remove the fuselage side from the plans and inspect the glue joints for gaps, filling where necessary with thick CA.

D 4 Repeat steps 1-3 for the other fuselage side When completed, place both sides together and sand the edges where necessary to make the pieces identical Designate a **right** and a left side at this time Mark the sides **to avoid building two "rights" or two "lefts"** in the following steps Sand the **inside** and **outside** of both fuselage sides with 150-grit sandpaper

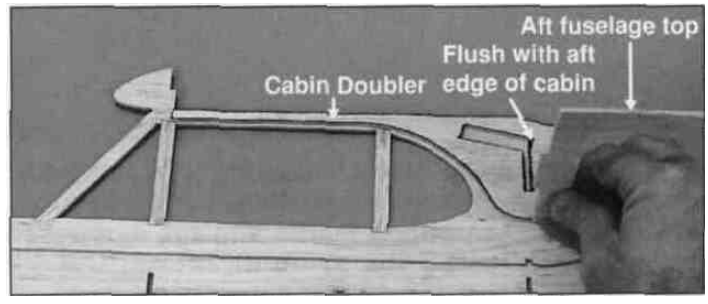


D D 5 Glue the die-cut 3/32" balsa **lower fuselage doubler** and **upper fuselage doubler** to the **inside** of one **of** the fuselage sides The lower fuselage doubler must align at the front and bottom edges The upper fuselage doubler must align with the fuselage side at the front and at the aft top edge.

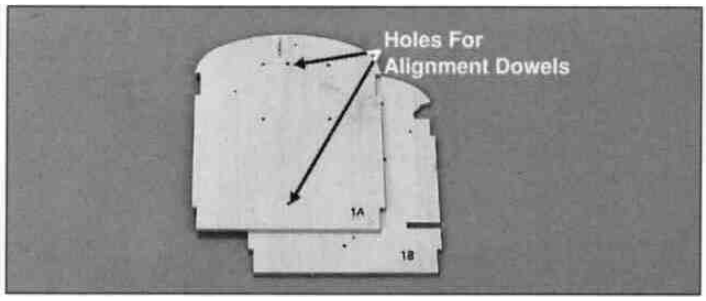


D D 6 Glue the die-cut 3/32" balsa aft fuselage doubler in place The doubler should match up with the front corner made by the main fuselage side and the aft upper fuselage side and line up with the top edge of the aft upper fuselage side

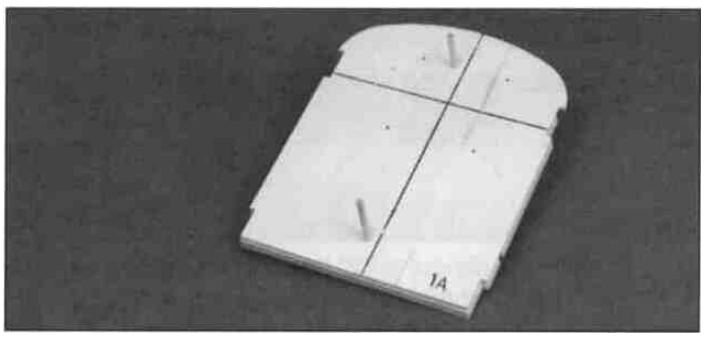
D 7 Repeat steps 5 and 6 adding the doublers to the **inside** of the other fuselage side **Be sure to make a right and a left side.**



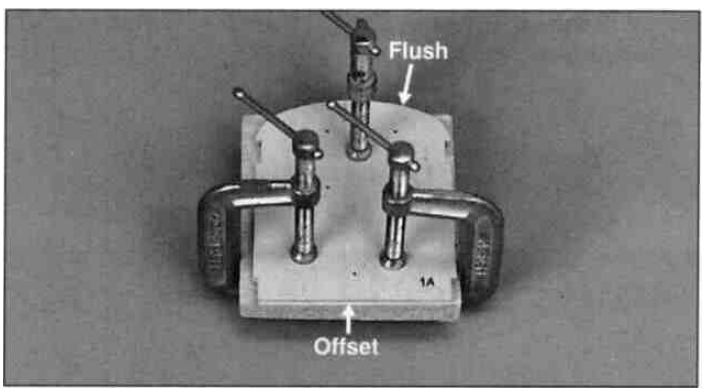
D 8 Use the die-cut 3/32" balsa **aft fuselage top** as a gauge to position the die-cut 3/32" **balsa cabin doubler.** The bottom of the cabin doubler should be above the fuselage side by the thickness of the aft fuselage top The **aft edge** of the vertical slot in the cabin doubler should be **flush with the aft edge** of the cabin and the top edge must be flush with the top of the cabin side Once you have determined its exact location, glue it to the cabin with thin CA Glue a doubler to both the right and left fuselage sides.



D 9 Remove any die-cutting irregularities from the die-cut 1/8" plywood **firewall formers 1A** and **1B** Separately, drill two 1/8" holes through the punch marks in each firewall former

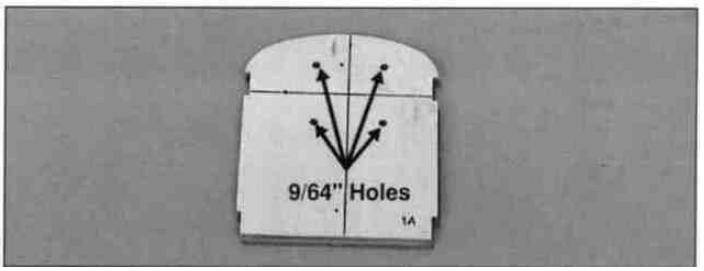


D 10 Cut 1/2" from the end of two 1/8" x 15" **turtle deck dowels.** Trial fit the two firewall formers together with the alignment dowels in the holes **Note:** 1A is slightly shorter than 1 B to allow for the angle of the bottom sheeting.

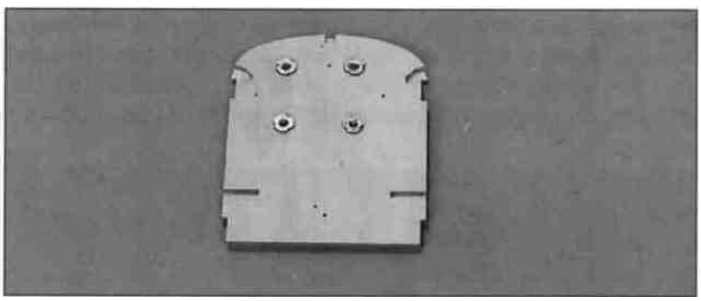


D 11 Use **30-minute epoxy** to glue the formers together with the alignment dowels inserted Refer to the note below. **Make sure all the punch marks and the embossed numbers are facing the same direction.** Cut the alignment dowel flush with 1 A after the epoxy has cured

Note: If the firewall formers are warped, the assembly may not flatten when clamped together To avoid a warped firewall, clamp the two pieces to a flat table or other rigid, flat board before the epoxy cures and remove excess epoxy from the notches where other parts are to fit



D 12 If you are going to use the engine mount supplied with the kit, drill a 9/64" hole through the firewall at each of the **four punched locations** for the 4-40 blind nuts If you are using a different engine mount, draw horizontal and vertical centerlines between the punch marks Center your engine mount over these two lines, then mark and drill the mounting holes for your alternate engine mount Notice that the **vertical "centerline" is offset** to allow for the engine's right thrust

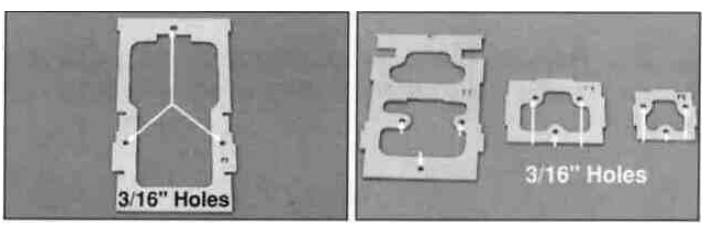


D 13 Lightly tap the 4-40 blind nuts into the holes from the rear of the firewall Apply a drop of thin CA or 6-minute epoxy around the flange of the blind nuts to secure them to the firewall.

JOIN THE FUSELAGE SIDES

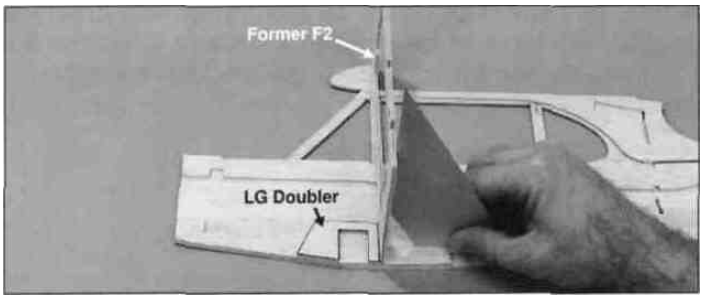
Note: the 1/8" die-cut formers are stamped only with the necessary portion of their name For example, F2A is stamped 2A

IMPORTANT: All formers must be installed with the stamped identification number facing **forward.**

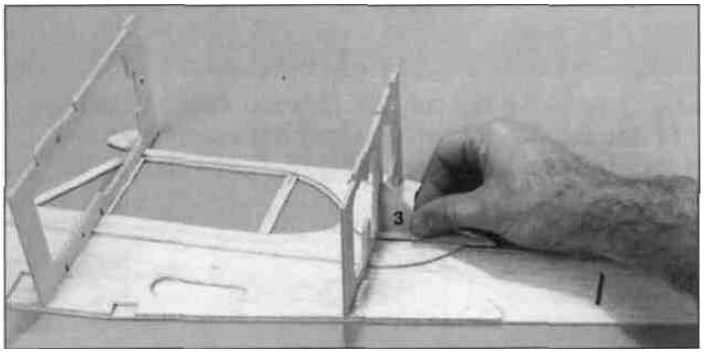


D 1 Drill 3/16" holes at the punch marks in the die-cut 1/8" plywood **fuselage formers F2A, F3, F4** and F5

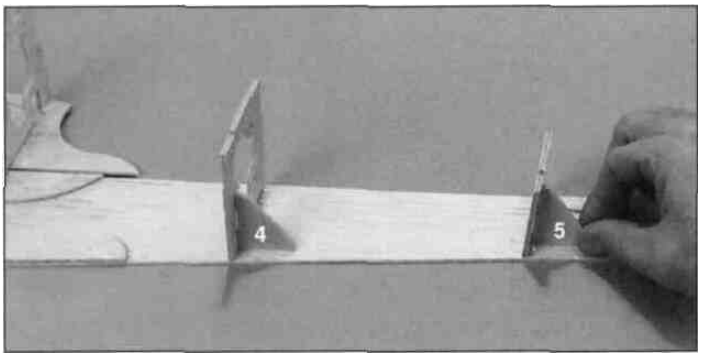
D 2 Test fit formers F2A, F3, F4 and F5 into the right fuselage side Make adjustments if necessary Test fit the same formers in the left fuselage side.



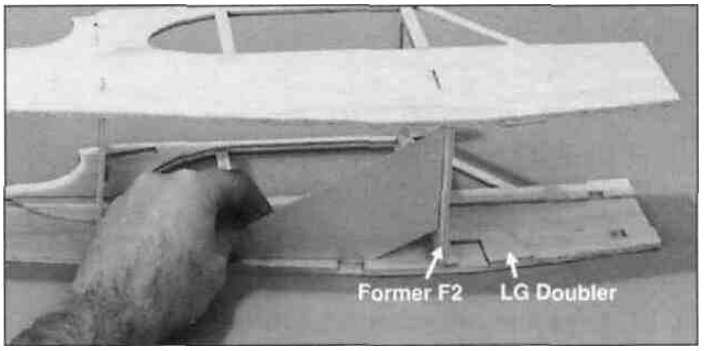
D 3, Install former **F2A** in the **right fuselage side** so that the embossed F2A **faces forward.** Make sure F2A is inserted into the notches completely and flush with the bottom of the fuselage side. Use a carpenter's square or small draftsman's triangle to hold F2A perpendicular to the fuselage side. Apply a few drops of thin CA to hold the former in place, and recheck its alignment as the CA hardens. Place the die-cut 1/8" ply landing gear doubler against the front of F2A and flush with the bottom of the fuselage side. Glue the **landing gear doubler** to the fuselage side with **thick CA.** Apply a small bead of medium CA to the joint between former F2A and the fuselage side, to add strength to the joint.



D 4. Glue former F3 to the right fuselage side using the #3 **angle gauge,** as shown in the photo. The gauge is only used for assembly and is not glued in place.

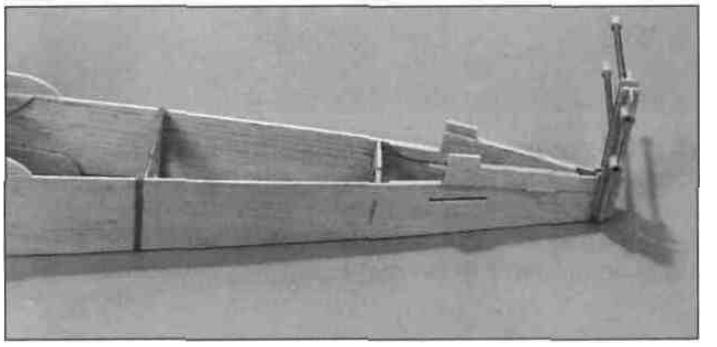


D 5. Glue formers F4 and F5 to the right fuselage side using the corresponding gauges to position each former.



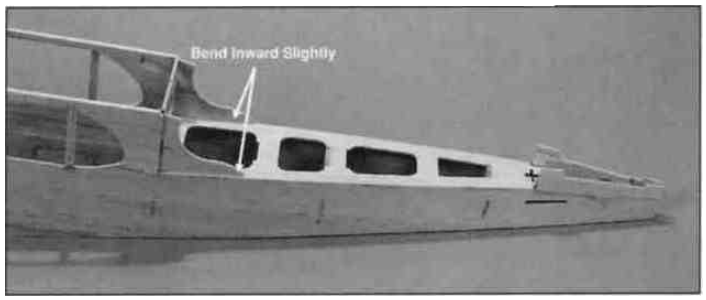
D 6. Join the right fuselage side to the left. Key only former F2A to the left fuselage side. Do not join the other formers to the left fuselage side yet. Lay the fuselage on its **left side** and glue F2A to the left side of the fuselage. Again, F2A must be perpendicular to the fuselage side. It is helpful to prop up the aft end of the right fuselage side while performing this step.

D 7. Glue the other landing gear doubler to the left fuselage side, against the front of F2A and flush with the bottom of the fuselage.



D 8. Key the rest of the formers to the left fuselage side. **Don't use any glue until told to do so.** Place a #64 rubber band around the fuselage at former F4. Clamp the rear of the fuselage together. Lay the fuselage over the top view of the plan. Push the sides down against your building board to make sure they are parallel with each other. Make sure the sides are flush at the aft end, where they are clamped.

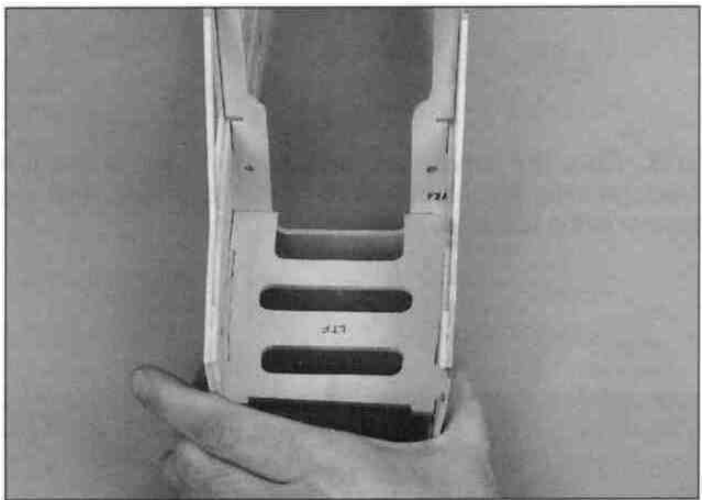
D 9. Using the fuselage top view plan as a reference, **confirm that the fuselage is straight.** Securely glue formers F3, F4 and F5 to the left fuselage side. **Do not glue the fuselage sides together at the aft end.** Remove the clamp and rubber band after the glue has set.



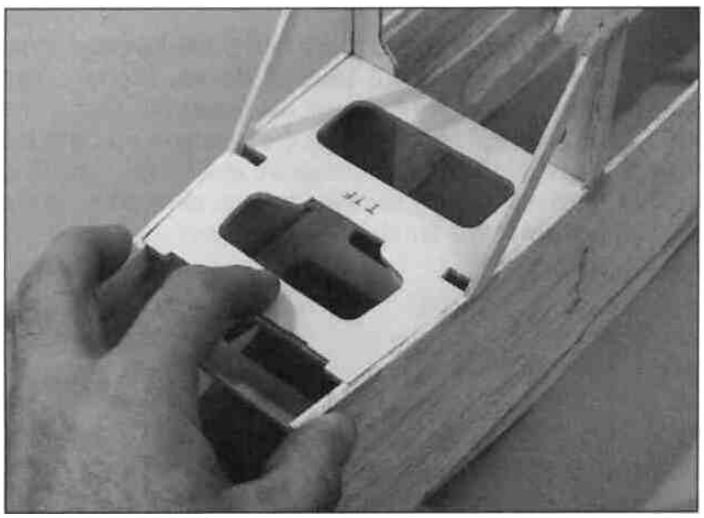
D 10. Slide the **aft fuselage top** into position so the formers key into the slots. Glue the aft fuselage top to the formers and fuselage sides with thin **CA.**

D 11. Glue the **cabin doubler** to the aft fuselage top. The cabin doubler may have to be slightly bent inward to conform to the taper of the fuselage.

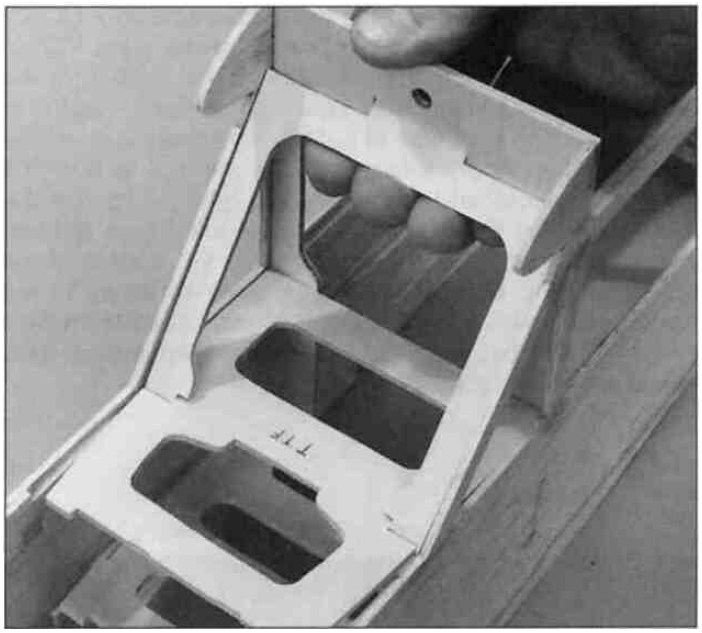
INSTALL THE FIREWALL



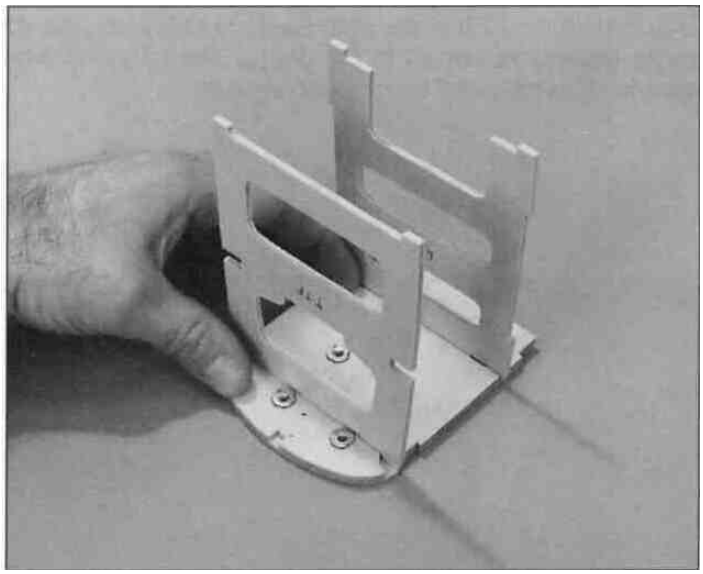
D **1. Do not use any glue until instructed to do so.** Trial fit the die-cut 1/8" plywood **lower tank floor (LTF)** between the fuselage sides, making sure the **embossed "LTF" is facing upward** - this sets the thrust angle for the firewall. Make adjustments to the part or notches if required.



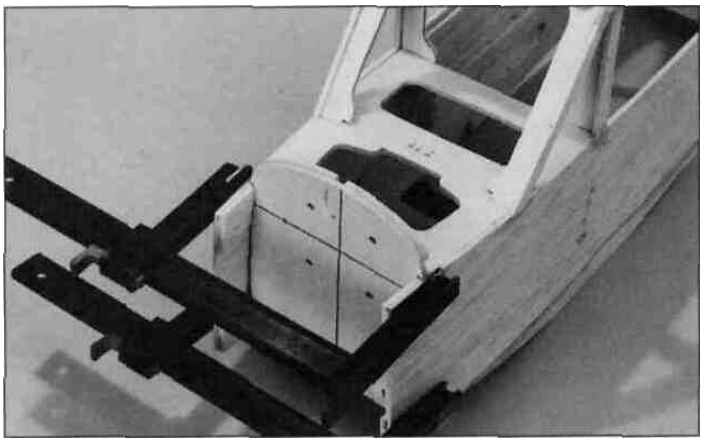
D 2. While the **LTF** is in position, trial fit the die-cut 1/8" plywood **top tank floor (TTF)** with the **embossed "TTF" facing upward.** The **notch in the upper left fuselage doubler** will have to be **enlarged slightly** to accept the TTF because the fuselage doublers are identical although right thrust must be built in.



D 3. Trial fit the die-cut 1/8" plywood **cabin brace** in the TTF and the F2A former. You may have to remove the TTF, insert the cabin brace in the TTF, then reinstall the two pieces simultaneously.



D 4. Remove all three pieces and trial fit the LTF and TTF in the back of the firewall. It is important that the front edge of the LTF and TTF **fully contact** the back of the firewall. Make adjustments to the notches if necessary.



D 5 Reinstall the LTF, TTF, cabin brace and the firewall into the fuselage Practice clamping the fuselage sides together around the firewall and tank floors, making sure the firewall fits into its respective notches It may be necessary to use hardwood sticks to evenly distribute the force of the clamps on the fuselage sides Clamp the sticks together with masking tape, lots of rubber bands or clamps Once satisfied with the fit of all parts, glue them together with **30-minute epoxy.**

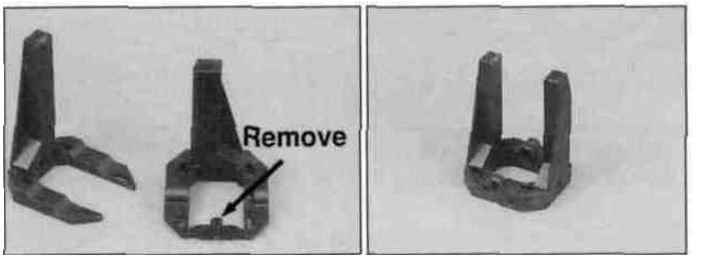
D 6 While you still have an open, accessible structure, inspect all glue Joints, making sure all formers, doublers, tank floors and cabin brace are securely bonded Apply fillets of medium or thick CA where required.

D 7. Sand the tab on the **cabin brace** flush with the aft side of **former F2A.**

INSTALL THE ENGINE

Before we continue, now is the best time to fuelproof the fuel tank compartment We recommend brushing on one of the following 30-minute epoxy thinned with a little alcohol, polyester resin, or fuelproof paint or dope We'll fuelproof the exterior of the firewall/engine compartment later.

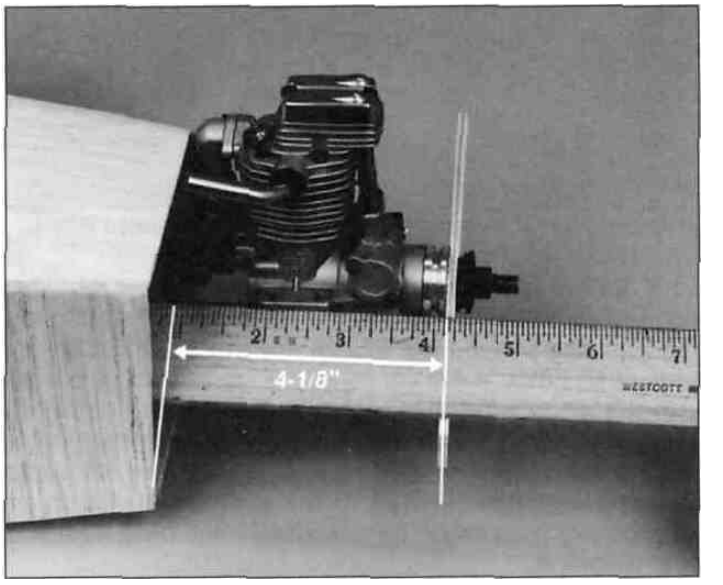
Also, you need to decide if you want your engine side mounted or inverted Side mounting is recommended for the 20- 26 4-stroke, but an inverted engine will allow you to use two dummy engines on the cowl Mounting the 15-25 2-stroke inverted is recommended If you have elected to use the Great Planes adjustable engine mount included in the kit, you may easily mount the engine on its side or inverted as the mounting holes are symmetrical This allows repositioning the engine without drilling new engine mounting holes in the firewall.



If you are using the included Great Planes adjustable engine mount, cut or break the "spreader bar" from each mount half Carefully trim any extra material left by the spreader bar from each mount half The surfaces where the spreader bars were attached must be smooth to allow the mount halves to fit together Trim the flashing off any rough edges if necessary Assemble the mount halves as shown.

Note: The procedures for mounting the 2-stroke and 4-stroke are the same.

D 1. Attach the engine mount to the firewall using the **4 - 40 x 1" phillips head machine screws, # 4 washers and lock washers provided.**



(Top and bottom sheeting shown in photo will be added later)

D 2 Install a straight piece of scrap plywood **against** the **drive washer** on the engine Locate the engine on the engine mount so the distance between the firewall and the aft edge of the piece of scrap plywood is **4-1/8" (105mm).** Mark the mounting screw locations on the engine mount (see the expert tip)

EXPERT TIP

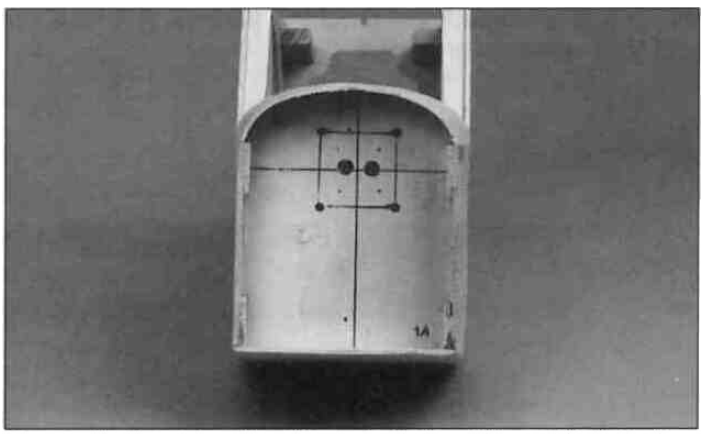
How to accurately pinpoint the location of the engine mounting bolt holes on a plastic engine mount.

A. Before positioning the engine on the engine mount, apply a light coat of petroleum jelly on the mounting lugs of the engine mount.

B. After the engine is in position, sprinkle talcum powder or micro balloons down the mounting holes in the flanges of the engine.

C. Carefully remove the engine. The hole locations should have powder on them. Heat the point of a small nail with a match or lighter. Quickly press the point into the center of the hole locations marked with powder. Mark all four holes with the hot point of the nail.

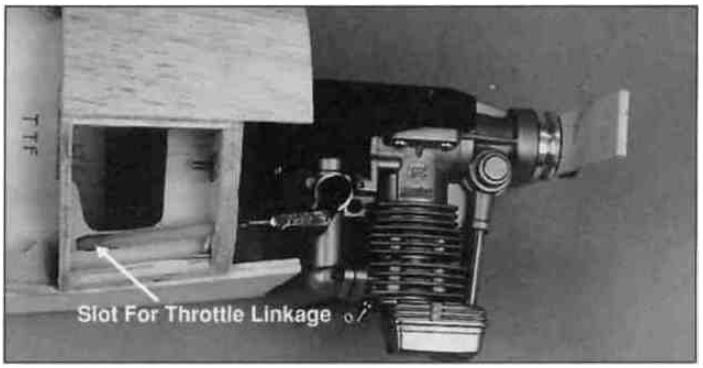
D 3. After marking the location of the holes, remove the engine mount from the firewall and drill four 5/64" holes for the #4 x 5/8" sheet metal screws.



(Top and bottom sheeting shown in photo will be added later.)

D 4. Before reinstalling the engine mount, draw four lines connecting the center of the four blind nuts. For standard medium size silicone fuel tubing, drill two 1/4" (15/64" for a perfect fit) holes in the center of the square you just drew. Set the engine on the engine mount and reinstall the engine mount on the firewall, lining up the embossed marks on the edges of the engine mount with the horizontal centerline on the firewall. If the embossed marks are separated, position them **equally** on both sides of the centerline.

D 5. Set the engine on the engine mount and determine the location of the throttle linkage. The throttle linkage is **not** provided in this kit. We recommend using the Great Planes Flexible Cable Pushrod (GPMQ3700).

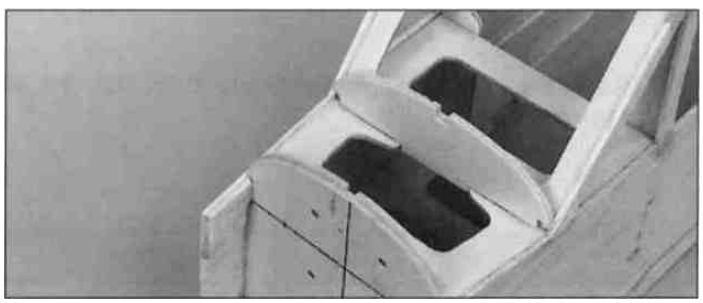


(Top and bottom sheeting shown in photo will be added later.)

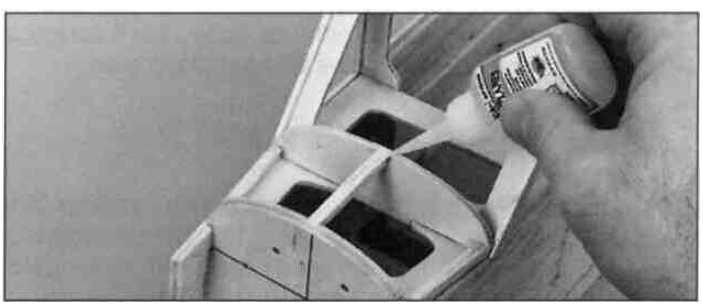
D 6. Remove the engine and drill the hole for the throttle linkage. Temporarily install the fuel tank in the fuel tank compartment. Be sure the throttle linkage will clear the side of the fuel tank in the fuel tank compartment. If the O.S. .26 Surpass engine is used, a slot in the plywood TTF will need to be drilled to allow the throttle linkage to pass through.

D 7. Roughen the outside surface of the Plastic guide tubing for the throttle linkage with 150-grit sandpaper, then insert it through the firewall, the TTF and former F2A. The tube should extend into the radio compartment 2" behind former F2A. Glue the tube into the fuselage with thick CA and trim the tube flush with the firewall.

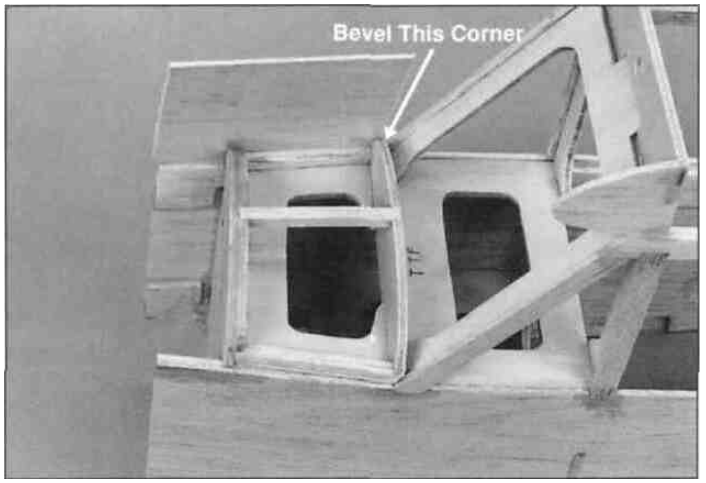
SHEET THE NOSE AND FUSELAGE



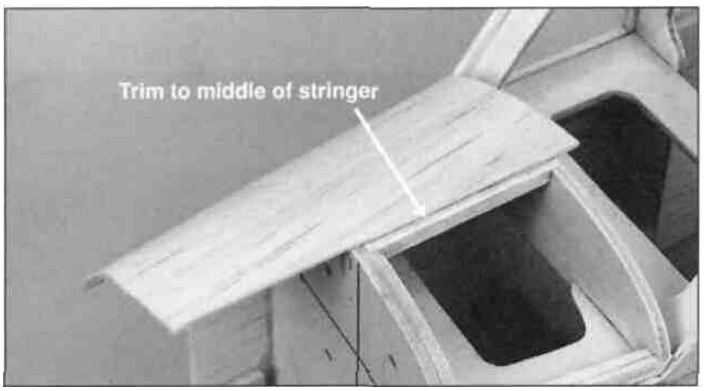
D 1. Glue the die-cut 1/8" plywood **instrument panel** perpendicular to **TTF** with thick CA.



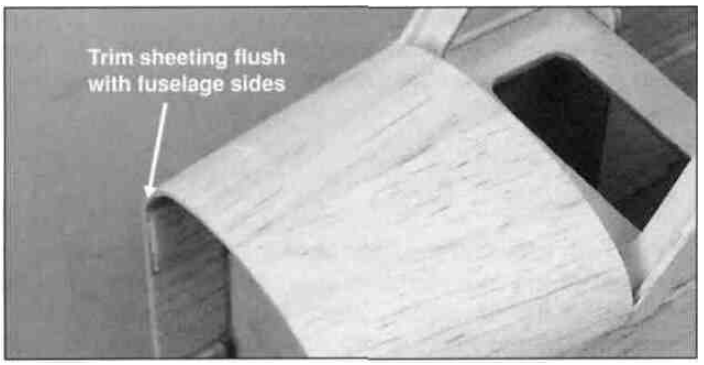
D 2. Cut three stringers from one of the 3/16" x 3/16" x 30" balsa sticks, to fit between the firewall and the instrument panel. Refer to the cross-section on the fuselage plan for the exact positioning of the two bottom stringers. Notice they are slightly angled inward. Glue all three stringers in position with medium CA.



D 3. Cut two 4-3/8" lengths from the 1/16" x 2-1/2" x 8-7/8" balsa **nose sheet.** Align the aft corner of one piece of sheeting so that it's even with the aft edge of the instrument panel. The rear corner of the sheet will have to be slightly beveled to fit against the bottom of the cabin. Glue the sheet to the **top edge of the fuselage side and the stringer** with medium CA.

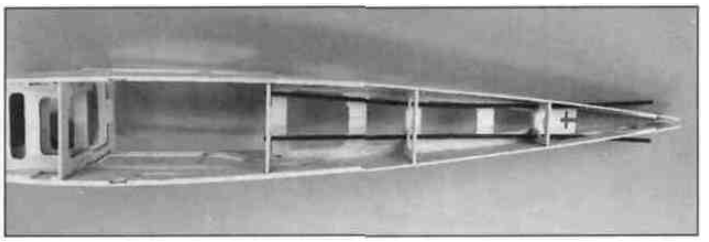


D 4. Wet the outside of the sheet with water, letting it soak in a few minutes. Firmly yet carefully pull the sheet around the firewall and instrument panel and mark where the sheet crosses the **centerline** of the 3/16" middle stringer. Cut the sheet at the lines you marked. Pull the sheet back into position and glue it to the firewall, instrument panel and middle stringer.



D 5. Apply the other sheet in the same manner as described above. Trim the nose sheeting flush with the instrument panel and the front of the fuselage sides.

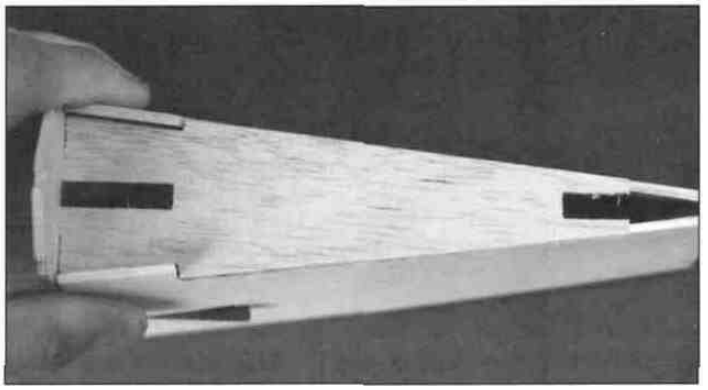
INSTALL PUSHROD TUBES



D 1. Cut the **36" outer pushrod tube** into two 18" lengths. Roughen the outside of the tubes with 150-grit sandpaper so that glue will adhere to them. Slide the outer pushrod tubes through the rudder and elevator pushrod holes in the fuselage sides, then through formers F5, F4, and F3. Position the tubes so they extend 1/4" **past the front of former F3.** Glue the tubes in position with thick CA.

D 2. If you would like to install a tube to route the **receiver** antenna through, slide another tube (not included) through the holes at the **bottom** of each former. The antenna tube should extend 1" past the aft edge of the fuselage sides. Glue the antenna tube to the formers only, and cut it off 3" in front of F3.

INSTALL THE STABILIZER BASE



D 1. Trial fit the die-cut 1/8" plywood **top deck former** #4 and the die-cut 1/8" balsa **stabilizer base** into position as shown on the plans. Squeeze the fuselage sides together, making sure that the fuselage side and the aft fuselage doubler contact the top deck former. You may have to **wet** the fuselage sides a little to help them bend inward toward the stabilizer base. Sand and make adjustments if necessary.

D 2. Pull the fuselage sides together so they are flush with the stabilizer base and **only** glue the stabilizer base into position **- not the former.**

D 3. Remove former F4 and securely glue the stabilizer base from the **inside** of the fuselage too. **Do not glue the rear of the fuselage sides together.**

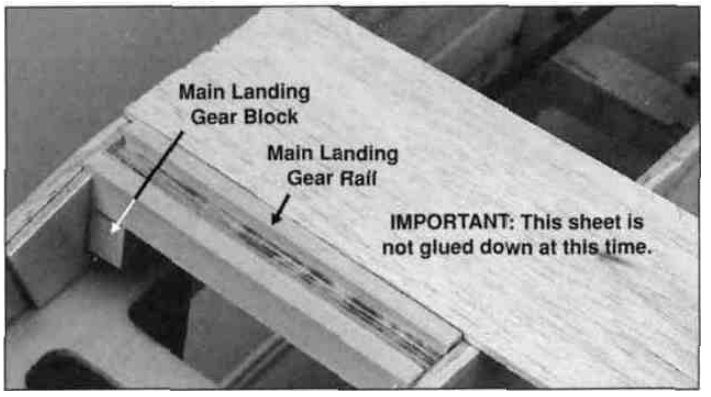
D 4. Before we continue, double check all glue joints made so far and apply extra glue if necessary.

SHEET THE FUSELAGE BOTTOM

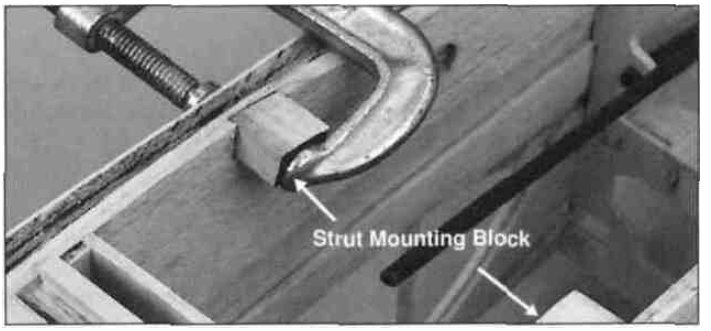
EXPERT TIP

From this point on you will be finishing the outside of the fuselage, so you'll want to use some care to prevent dents and "dings." You could invest a few dollars in a Robart Super Stand or cut an old styrofoam ice chest or cardboard box to fit the fuselage. Foam padding in the cradle will prevent unnecessary hanger rash.

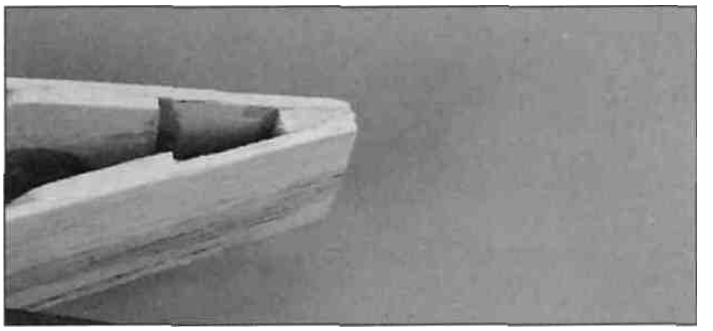
D 1. Use a sanding block to sand the bottom edges of the fuselage flat to accept the bottom sheeting. Remove any excess glue that may interfere with the sheeting.



D 2. Test fit the 5/8" **x** 3/4" **x 1/2" hardwood main landing gear blocks** and **main landing gear rail** into the landing gear doublers. Place a piece of 3/32" sheeting **next to** the main landing gear rail. The main landing gear rail should be flush with the 3/32" sheeting. If it is not, adjust the main landing gear blocks slightly. Glue the **main landing gear blocks** and **main landing gear rail** in place with **6-minute epoxy.**

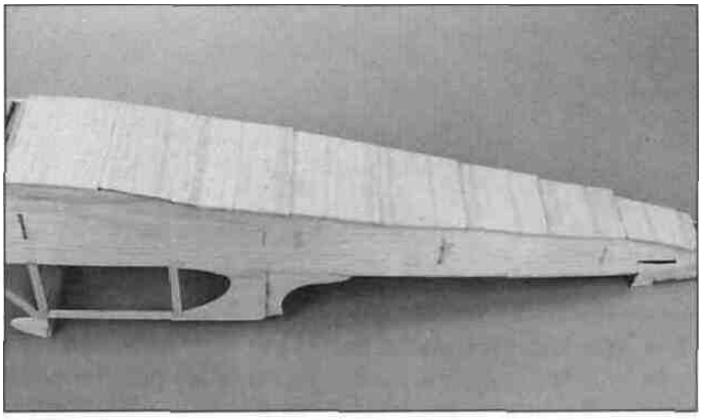


D 3. Glue the two **3/8" x** 5/8" x 5/8" **hardwood strut mounting blocks** in the notches in the lower fuselage doubler with 6-minute epoxy. Make sure the strut mounting blocks are flush with the bottom of the fuselage sides.



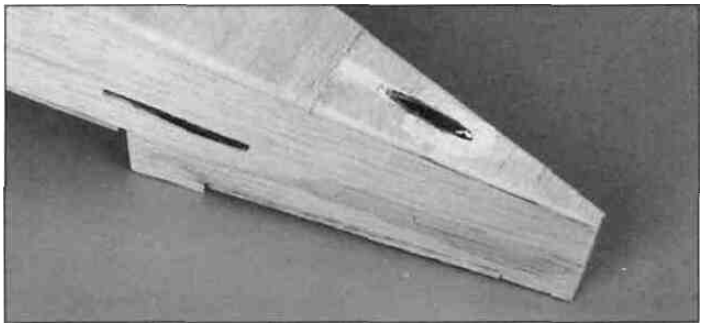
D 4. Using medium CA, glue the tapered balsa **tail wedge** in position where the rear of the fuselage sides meet.

D 5. If you are planning to install the optional Great Planes 20-size Sport Floats, now is the time to add the die-cut 1/8" birch ply **aft float mounting plate** (included with the floats). See the plans for its location. We strongly encourage you to put your Cub on floats someday - it's a thing of beauty.

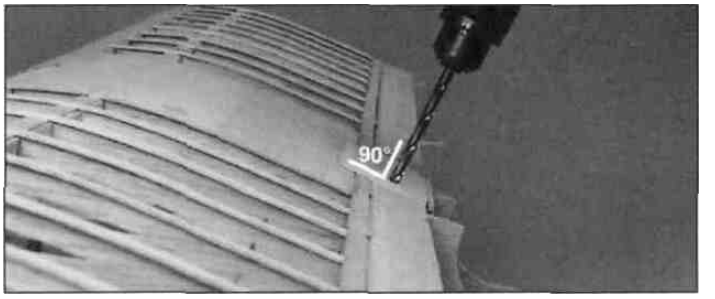


D 6. Sheet the bottom of the fuselage with 3/32" x 3" x 30" balsa sheet. Apply the sheeting, cross-grain, starting at the **aft** edge of the main landing gear rail and working towards the tail. If an antenna tube was installed earlier, a slot will need to be cut in the last piece of sheeting before gluing it on (see photo below). Start the slot approximately 1-1/2" **forward** of the aft fuselage joiner. Cut the slot wide enough and long enough to allow the tubing to exit the fuselage. Make sure the slot is centered between the fuselage sides.

D 7. Finish sheeting the bottom of the fuselage, starting at the **front** of the main landing gear rail and working toward the front of the fuselage. Glue two scrap pieces of 3/32" sheeting onto the ends of the main landing gear rail to fill the area between the forward and aft sheeting. After the sheeting has been applied, trim the sheeting flush with the sides of the fuselage and sand a radius on the two bottom edges per the cross-section on the plans.

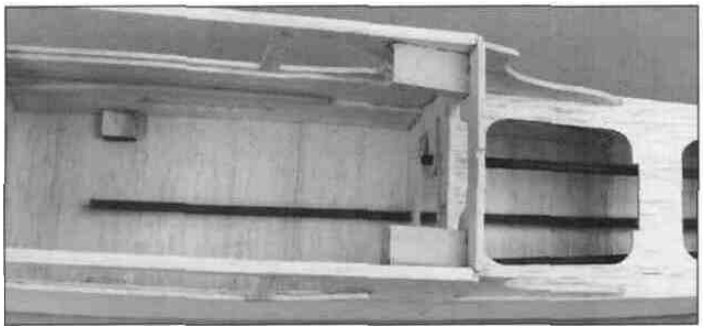


D 8. Glue the antenna tube to the bottom sheeting with thick CA and trim it flush with the sheeting. Apply filler to blend the area where the antenna tube exits the sheeting.

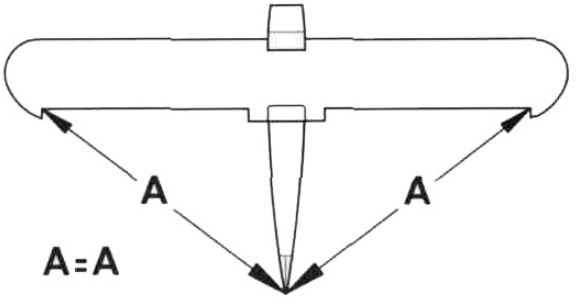


D 3. Tape the wing in position so that it cannot move. Use a 5/32" (or #25) drill bit to drill a hole through the wing and wing bolt blocks. Two small 90-degree triangles help you to align the drill perpendicular to the top surface of the wing. **IMPORTANT: Do not allow the wing to shift during this procedure.**

MOUNT THE WING ON THE FUSELAGE

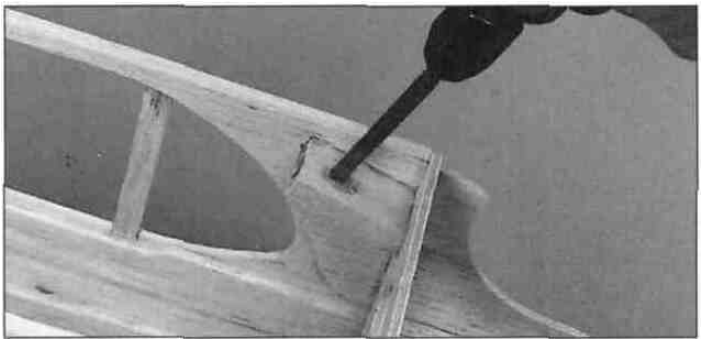


D 1. Test fit the 3/8" x 3/4" x 1-1/2" hardwood wing bolt blocks in the slots in the back of the cabin doubler and former F3. Glue the blocks in position with 30-minute epoxy. Use plenty of epoxy for a very secure installation.

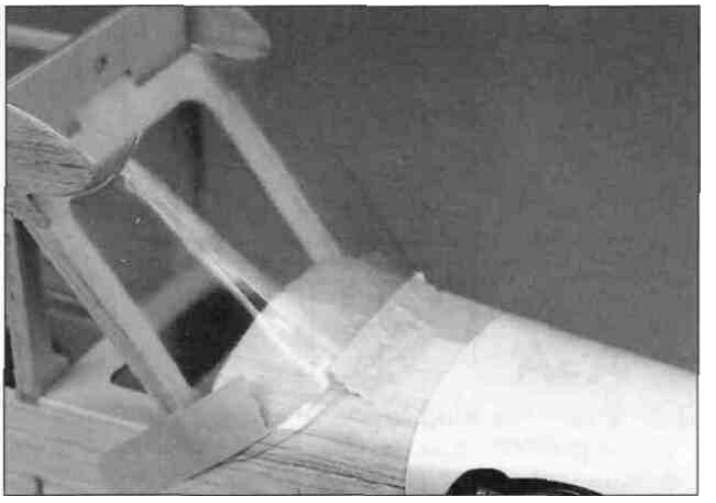


D 2. Lightly sand the wing saddle area of the fuselage to remove any glue bumps or slivers of wood. If you elect to use wing seating foam tape (this is an option, our Cub 20 uses none) take this into account while mounting your wing to the fuselage. Place the wing in the wing saddle and visually align it with the fuselage. Use a tape measure to measure the distance from the corner of the aileron bay to the center of the tail post. Then measure the distance from the other aileron bay and check if the distances are the same (see diagram). Adjust the wing until both distances are equal. When the wing is **perfectly aligned,** make reference marks on the wing trailing edge and former F3 to help keep the parts aligned during the next step.

D 4. Remove the wing and enlarge the holes in **only the wing** with a 13/64" drill bit.



D 5. Use a #10-24 tap to cut threads into the wing bolt blocks. After cutting the threads, put a couple of drops of thin CA on the threads in the wing bolt blocks. After the CA has fully cured, screw the tap back through the holes to clean up the threads. Bolt the wing to the fuse with two **nylon 10-24 wing bolts** and leave it in place for the next few steps.

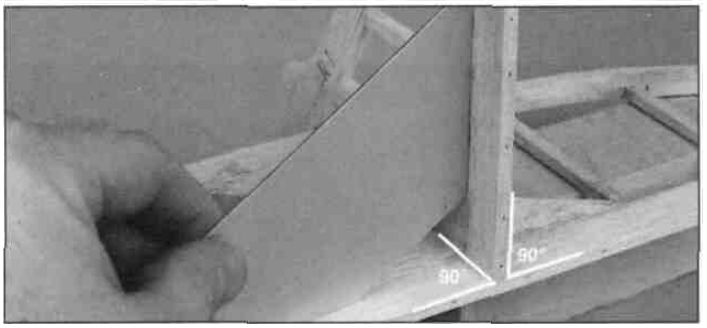


D 6. Trim the clear **windshield** along the embossed "cut lines," then tape it in position on the front of the cabin.

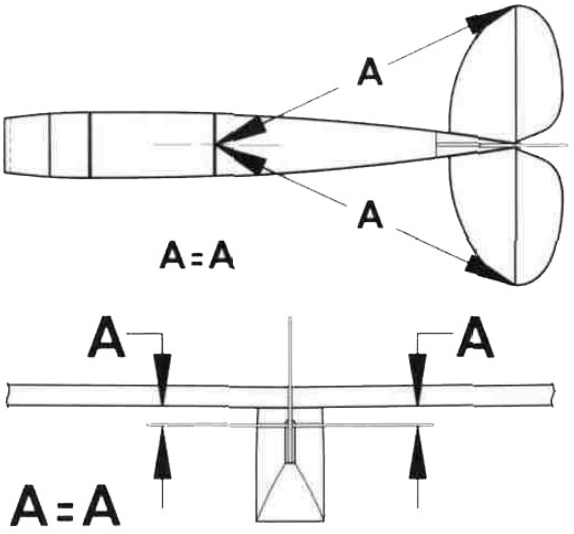
D 7. Note the gap between the LE of the wing and the windshield. Install the 3/16" x 1-5/8" x 1-5/8" **wing root shims** and sand them to reduce the gap to 1/32" on each side.

D 8. Remove the wing and glue the root shims to the wing **with thin CA and sand them to the contour of the LE.**

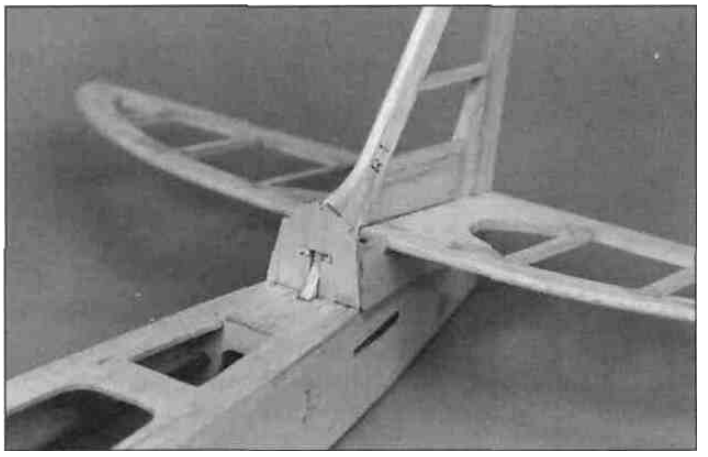
MOUNT THE STABILIZER AND FIN



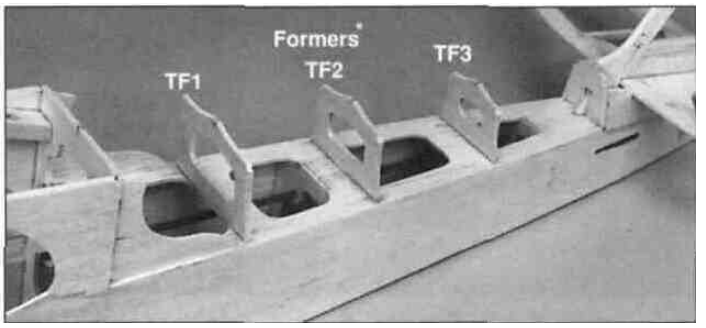
D 1. Slide the fin post through the slot in the stabilizer and make sure the fin base will meet the stabilizer. You may cut a notch in the aft edge of the **fin** LE to get it to fit - **do not** cut a notch in the **stabilizer LE.** Using a 90 degree triangle to keep the fin perpendicular to the stabilizer and stabilizer TE. Securely glue the fin in position with **30-minute epoxy.**



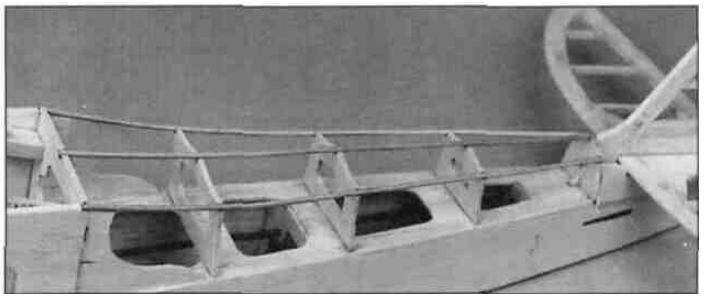
D 2. Mount the wing to the fuselage. Verify that the stabilizer is aligned with the wing and the fin is aligned with the centerline of the fuselage. When this is achieved, securely glue the stabilizer and fin to the fuselage with 30-minute epoxy. **Double-check this alignment while the epoxy is curing.**



D 3. Check that the fin leading edge R1 is securely glued to the aft fuselage deck and the stabilizer deck. Add thick CA where necessary, then glue the **turtle deck former TF4** in position.



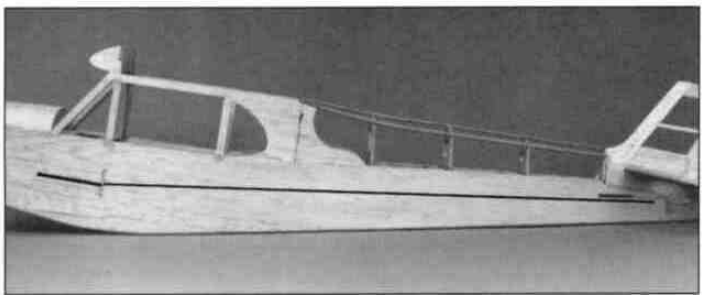
D 4. Glue the remaining die-cut 1/8" balsa turtle deck formers **TF3, TF2, TF1** in position perpendicular to the aft fuselage top.



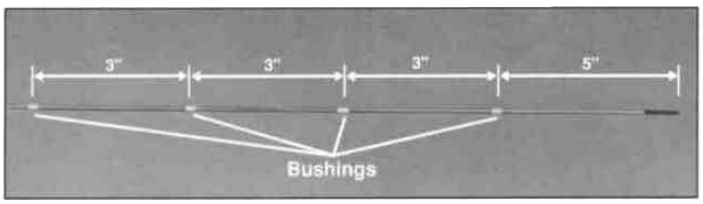
D 5. Cut the 1/8" x 15" **hardwood dowels** to fit from the front edge of former TF3 to the aft edge of former TF4, then glue them in place.

INSTALL THE FUSELAGE STRINGERS

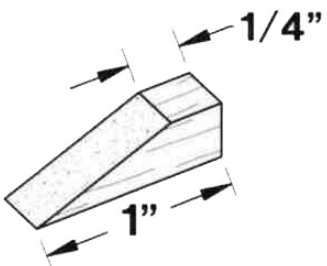
D 1. From the two remaining 3/16" x 3/16" x 30" balsa sticks, cut two to the length shown on the plans for the **fuselage side stringers.** Each piece should be approximately 23-5/8" long. Use the remaining length of 3/16" balsa stick for the front portion of the fuselage side stringer and cut it approximately 5" long.



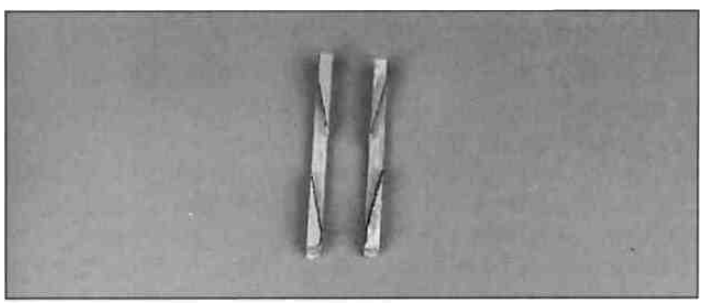
D 2. Use a straightedge to mark a line on the fuselage sides where the stringers are to be located, taking measurements from the plans.



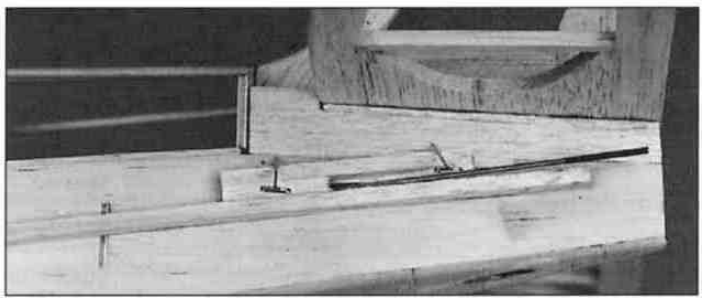
D 3. Cut eight 1/4" long bushings from the plastic **inner pushrod tube** provided in the kit. Cut two **36" wire pushrods** 25" long, measured from the threaded end. Slide **four bushings** on each wire pushrod, spacing them about 3" apart starting five inches from the threaded end. If the bushings are loose, put a drop of CA on the wire at each bushing to hold it in place. Install the pushrods in the tube, but **not until you are sure the CA has cured.**



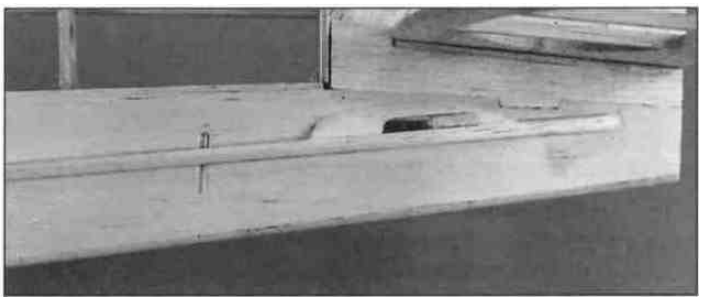
D 4. From the remaining 3/16" balsa stick, cut four 1" pieces and two 3" pieces. On each of the four 1" pieces, make a mark 1/4" from one end and cut a bevel as shown in the sketch.



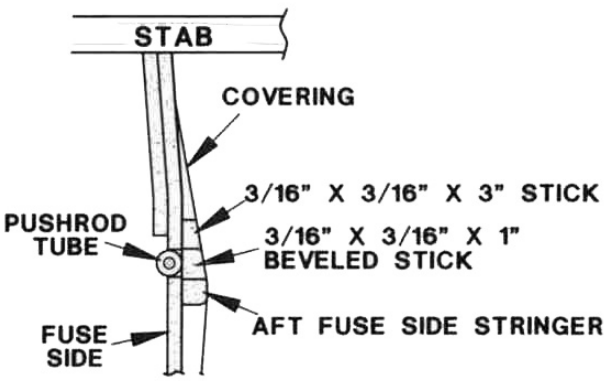
D 5. Glue two diagonally cut sticks on each 3" stick. **Note:** Be sure to make a right and a left side. These pushrod exits will support the covering around the pushrods.



D 6. Temporarily pin a stringer to the fuselage side and position the previously constructed pushrod exit on the stringer centered on the pushrod. Glue the pushrod exit **to the stringer** but **not** to the fuselage. Build a pushrod exit for the other side.

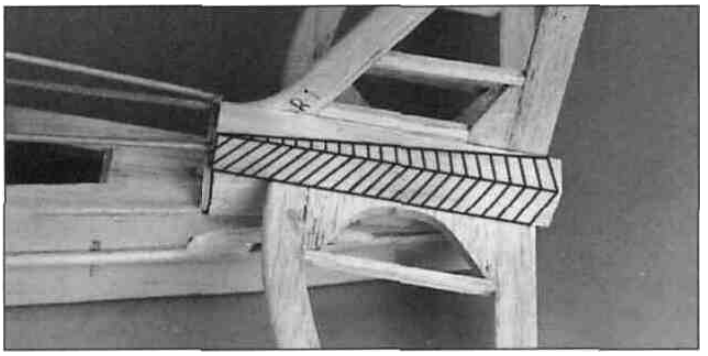


D1 7. Remove the stringer/pushrod exit from the fuselage and round the **outer** corners of the stringer so it will resemble a "tube." Sand the bevel at the rear of the long stringer and the front of the short stringer. Glue the front and rear stringers to the fuselage along the line you previously marked.

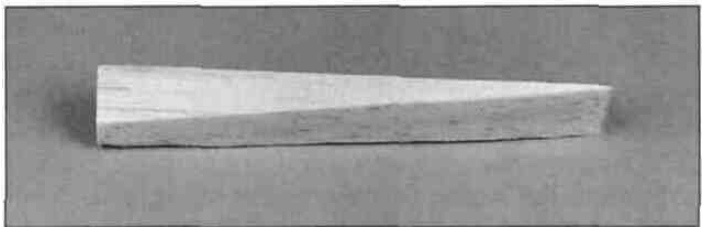


D 8. Sand the pushrod exit to the same angle that will be formed by the covering when stretched from the stringer to the fuse side under the stabilizer.

INSTALL THE TAIL FAIRING

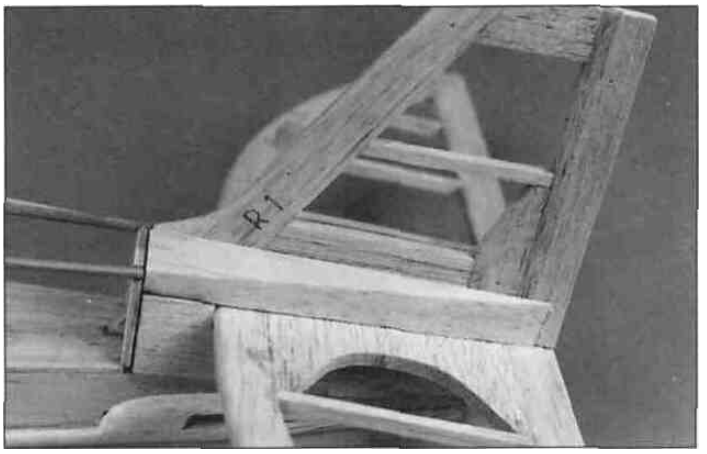


D 1. Trial fit the 5/8" x 3/4" x 5-1/4" balsa **tail fairing blocks** on each side of the fin, on top of the stabilizer Sand the front of the blocks to butt against turtle deck former TF4 Mark a line on the top of both blocks from the outside edge of TF4 to where the block meets the trailing edge of the fin.



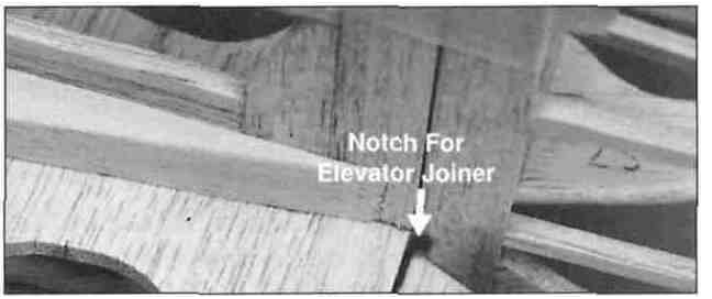
D 2 Remove the tail fairing blocks and cut them to a wedge shape with a razor saw.

D 3. Trace the outline made by former TF4 and the stringers on the front face of each block Remove the blocks and carve them to conform to the correct shape

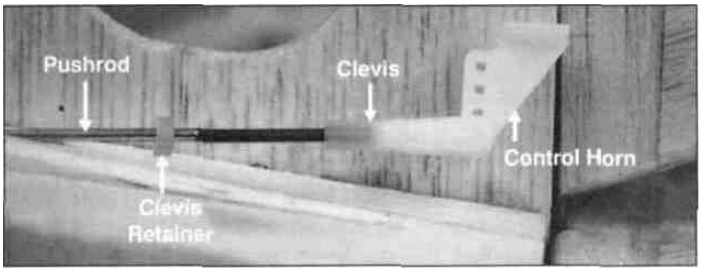


D 4 Glue the tail fairing blocks in position and fill any gaps with HobbyLite filler, then sand to shape to match former TF4 and the 1/8" dowels.

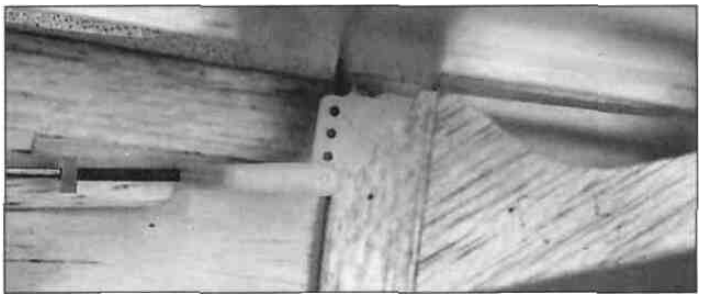
Install The Control Horns

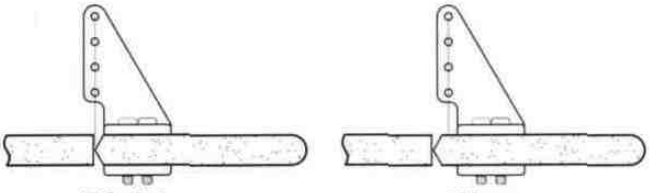


D 1 Temporarily attach the elevator and rudder to the stabilizer and fin If you are using the CA hinges provided in the kit and have not cut slots for them, attach the elevator and rudder with masking tape Cut a notch in the leading edge of the rudder to accommodate the joiner wire in the elevator

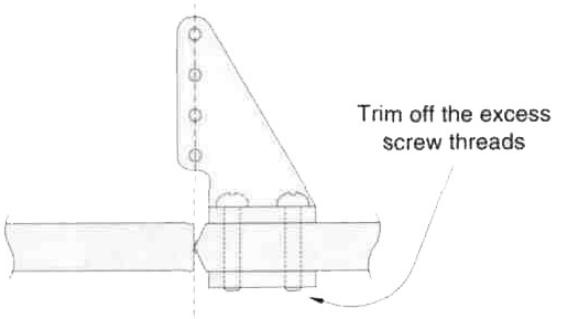


D 2 Slide a silicone **clevis retainer** on the elevator and rudder control rods Screw a **nylon clevis** 14 turns onto the end of the rudder and elevator **pushrods** Install a **nylon control horn** on each of the clevises.





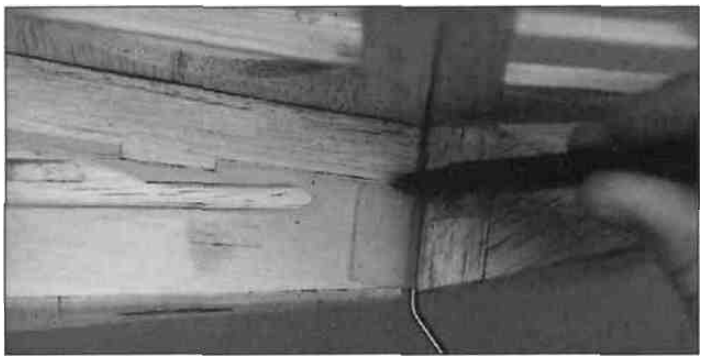
D 3 Hold the control horn in position on the elevator (see the sketch above for correct alignment) The pushrod should not be bent and should slide smoothly in the outer pushrod tube Mark the location for the horn screws on the elevator Drill two 3/32" horn screw holes through the elevator Use a T-pin to prick a few holes in the area under the control horn and apply a drop or two of thin CA to the pin holes to strengthen the balsa wood After the CA has cured, install the control horn with the two *#2-56* machine screws and the backing plate Repeat this process for the rudder.



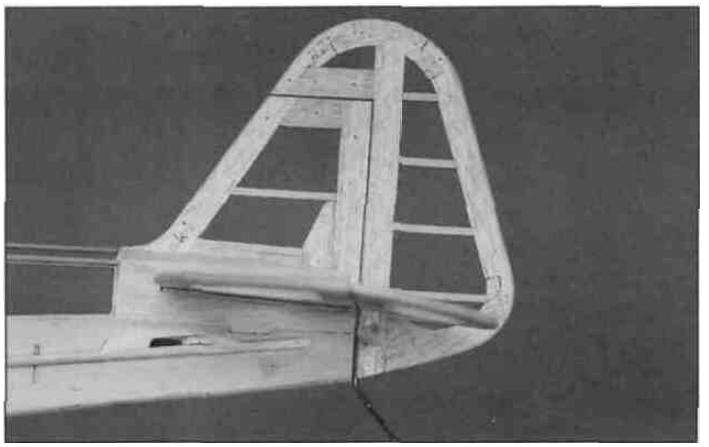
D 4. If you prefer to shorten the screws for better appearance, use a Dremel Moto Tool and a cut-off wheel to cut the screws. **Remove the screws from the airplane before cutting. After cutting,** use a file to slightly chamfer the end of the threads, similar to the original screw.

INSTALL THE TAIL GEAR

D 1. Install the tail gear "arm" into the hole you made in the rudder. Hold the rudder up to the tin.



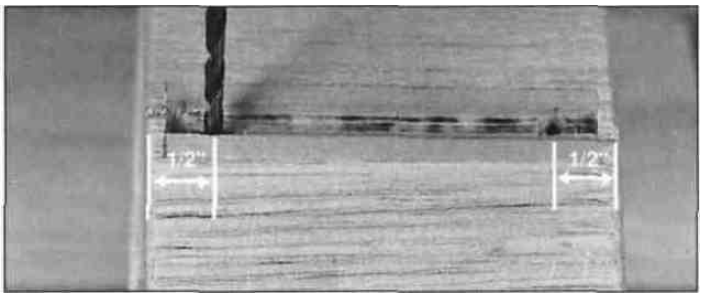
D 2. Mark the location of the **tail gear bearing** on the aft edge of the fuselage. Cut a slot in the center of the tail post to accept the tail gear bearing. **Hint:** Use a 1/16" bit to drill several closely spaced holes, then connect the holes using a hobby knife.



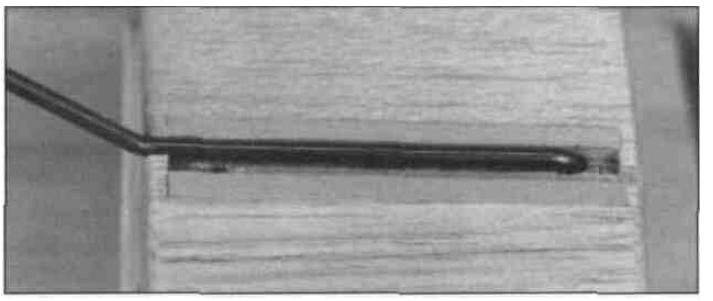
D 3. Temporarily install the bearing and rudder. The rudder should fit flush with the fin and aft edge of the fuse. If not, check if the bearing is fully seated or that the groove in the rudder is deep enough. **Note:** Do not glue the bearing in place until after the model is covered.

INSTALL THE MAIN LANDING GEAR

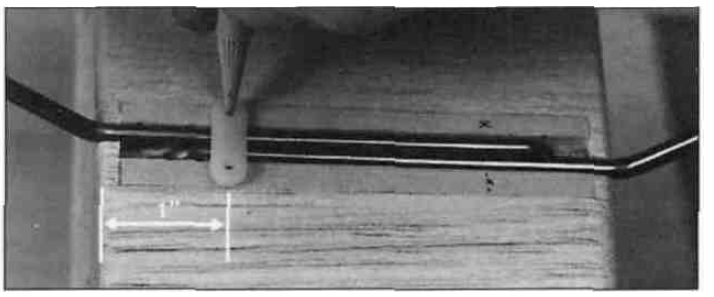
D 1. Use a flat file to chamfer **both** ends of each main landing gear wire, removing any sharp edges.



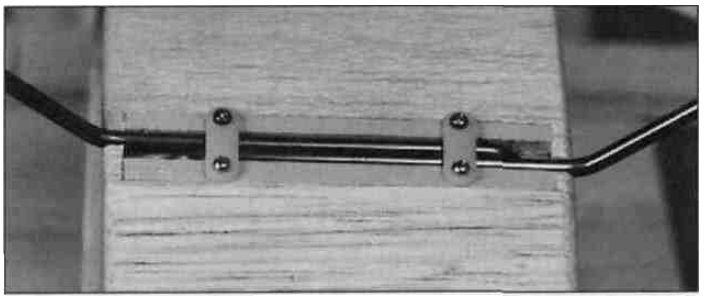
D 2. Refer to the plan and the photo above to determine the locations to drill the landing gear holes. One hole should touch the **aft** edge of the groove and the other hole, the **forward** edge. Both holes are approximately 1/2" **inboard** from the fuselage sides. Drill 5/32" holes perpendicular to the main landing gear rail. The holes go through the main landing gear rail and the main landing gear block.



D 3. Install the **landing gear wires** in the main landing gear rail. The wires lay side-by-side and flush with the top of the main landing gear rail. You will have to carve the inner corners of the holes slightly to allow for the bend in the landing gear wires.



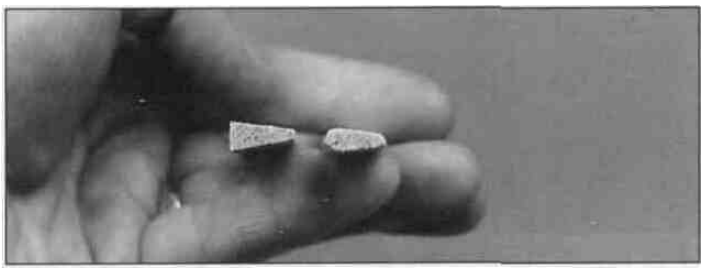
D 4. Position the **nylon landing gear straps** over the landing gear wires, approximately 1" from the fuse sides. Mark the locations for the mounting screws. Drill a 1/16" hole at each of these marks.



D 5. Secure the landing gear straps to the main landing gear rail with #2 x 3/8" sheet metal screws.

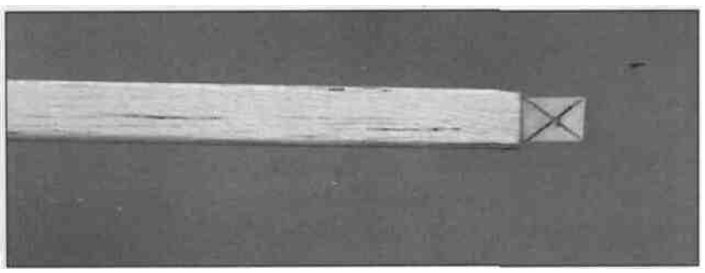
BUILD AND INSTALL THE WING STRUTS

Note: The wing struts are for scale appearance only. Built according to the plan and instructions, the airframe has sufficient strength for normal acrobatic flying without the struts. We suggest that the wing struts be removed if the plane will be flown in a fast, non-scale manner, because the struts will flutter at high speeds. Before proceeding, make sure that you have the wing seated and installed on the fuselage in its final position.



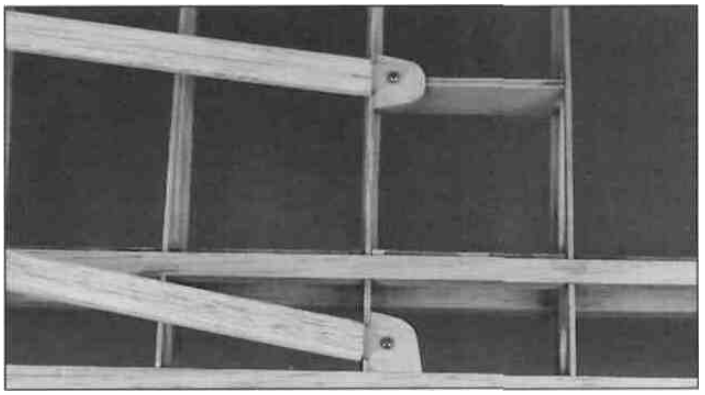
D 1. Round the LE and TE of the four 3/16" x 1/2" tapered balsa **wing struts** with 150-grit sandpaper.

D 2. Cut six CA hinge pieces 1/4" x 1".

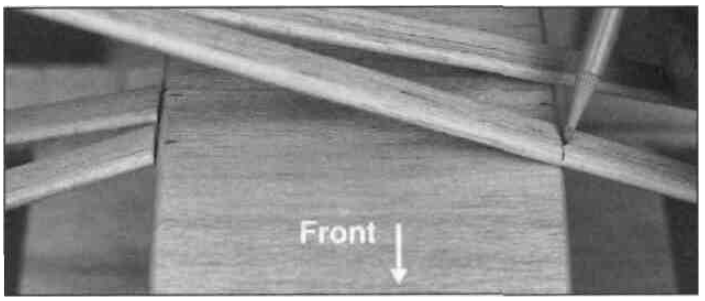


D 3. Cut a slot 1/2" deep in one end of each **wing strut.** Insert the CA hinges and glue them in place with thin CA. Drill a 1/16" hole through the center of the protruding CA hinge.

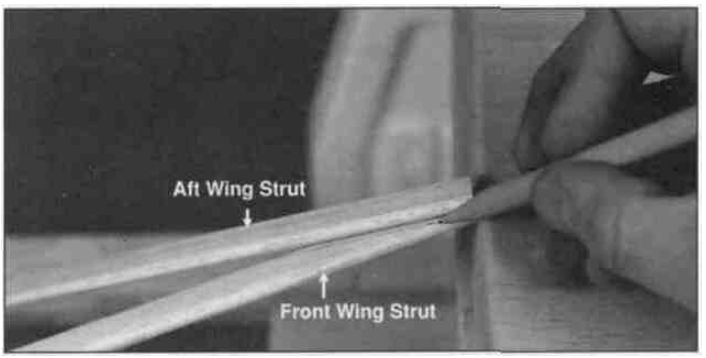
D 4. Refer to the fuselage plan for the location of the wing strut mounting blocks inside the fuselage. Mark their locations lightly with a pencil.



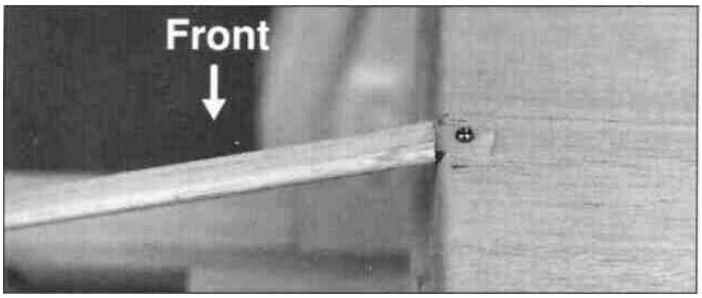
D 5. Drill a 1/16" hole in the center of each of the four strut mounting plates in the wing. Attach the struts to the strut mounting plates with #2 x 3/8" sheet metal screws.



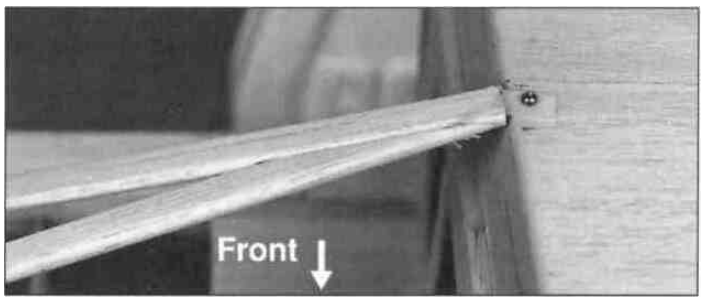
D 6. Lay the wing struts so that they are positioned across the fuselage at the marked wing strut mounting blocks. Mark where the wing struts cross the edge of the fuselage. Cut the wing struts off at the marks and check their **fit.**



D 7. Position the unfinished end of the **forward** strut at the wing strut mounting block on the fuselage. With the **aft** strut positioned on top, draw a line on the forward strut where the aft strut crosses it. Remove the front strut and cut away the balsa behind the line you drew.



D 8 Carefully cut a slit 1/2 deep in the end of the **aft** wing strut Install a 1/4" x 1" CA hinge in the slit and secure it to the wing strut with thin CA Center the CA hinge from the **aft** strut over the marked wing strut mounting block on the fuselage Drill a 1/16" hole through the center of the CA hinge and the wing strut mounting block Attach the strut to the fuselage with a #2 x 3/8" sheet metal screw

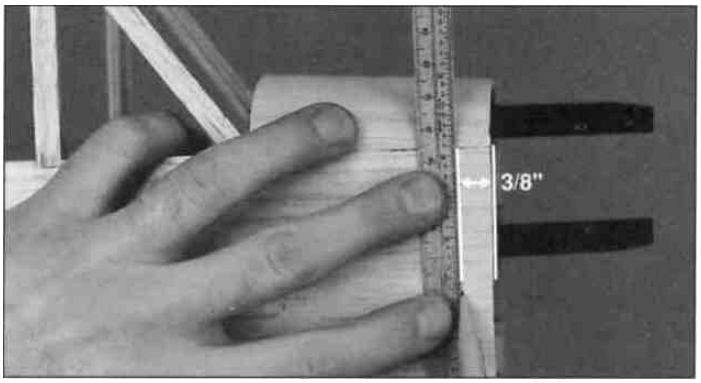


D 9 Reinstall the **forward strut** on the wing Test fit the forward wing strut against the **aft** strut Trim the forward wing strut as needed to achieve a good fit Glue the struts together with thick CA.

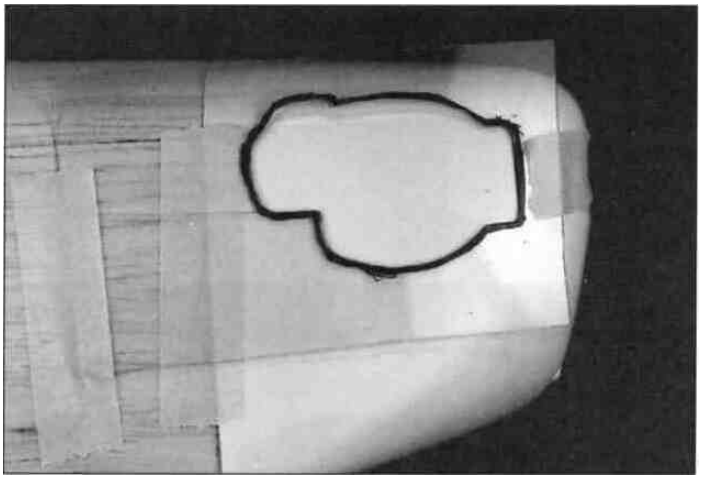
D 10 Apply balsa filler in the joint between the two struts to blend them together Repeat the process for the struts on the other side

INSTALL THE COWL

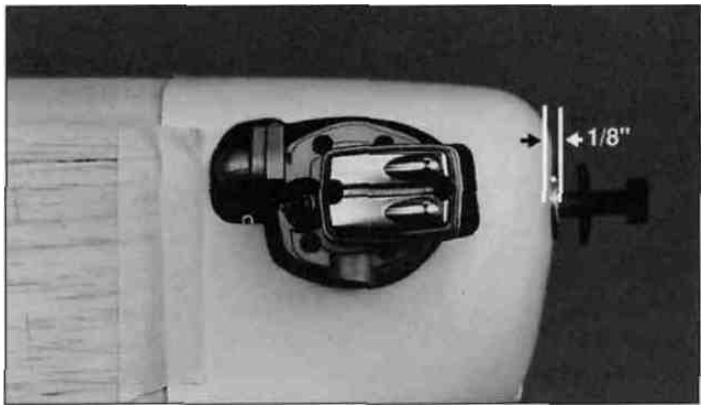
D 1 Using a hobby knife or Lexan® scissors, cut along the cut lines at the **base** of the **cowl.** Cut out the three openings in the front of the cowl for the air intake and crankshaft Use a sanding block and 150-grit sandpaper to smooth out the base of the cowl



D 2 With a pencil, draw a line around the fuselage 3/8" from the **forward** edge of the fuselage sides Without the engine on the engine mount test fit the cowl on the fuselage The aft edge of the cowl should be **even** with the line Measure from the firewall to the front of the cowl. The distance must be 4" or slightly less to prevent the propeller from rubbing on the front of the cowl Trim the aft edge of the cowl to meet the line on the fuselage Sand the fuselage to obtain a good fit at the corners of the cowl When you are satisfied with the fit, remove the cowl and reinstall the engine.

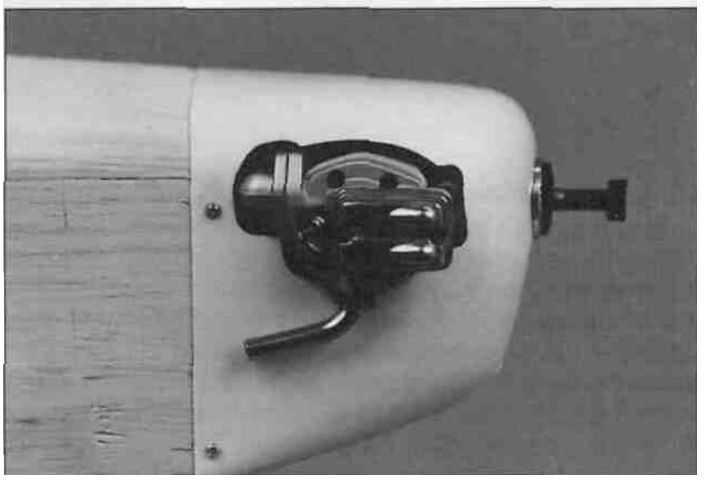


D 3 Cut a piece of clear **butyrate** or **thin card stock** (not included) long enough to cover the engine and 3" of the fuselage Hold the butyrate over the head of the engine and with a marker draw the outline of the head and any other parts that will protrude out of the cowl Trim the area from inside the lines on your pattern Test fit the pattern over the engine and trim as needed to provide a 1/8" clearance around the engine After the pattern is trimmed, tape it to the fuselage Use more pieces of butyrate to locate where other holes will need to be cut (for example, the needle valve and muffler) **Carefully** remove the engine without disturbing the patterns Reinstall the cowl, lining up the **aft edge** of the cowl with the lines on the fuselage Tape the cowl to the fuselage to prevent it from moving With the patterns lying on top of the cowl, **mark** the openings on the cowl Remove the cowl and trim out the openings



D 4. Reinstall the engine on the engine mount and trial fit the cowl over the engine. Allow approximately 1/8" clearance all around the engine head and muffler for cooling. Also, check that there is 1/8" clearance between the front of the cowl and the propeller.

D 5. With the cowl taped securely in position, refer to the plan for the location of the #2 x 3/8" sheet metal screws that hold the cowl on the fuselage. Drill 1/16" holes through the cowl and the fuselage at these locations. If the cowl needs to be cut at the rear to allow it to slide past the head of the engine, a fifth screw will need to be installed. One on each side of the cut.

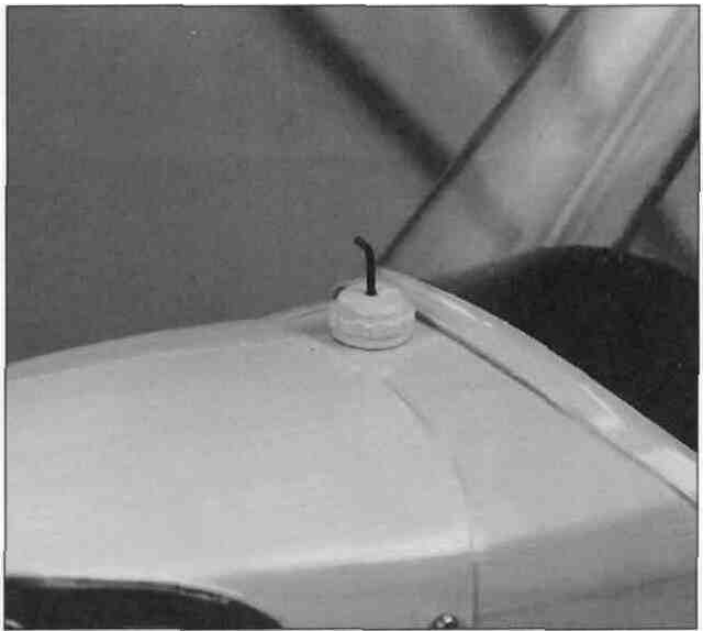


D 6. Remove the cowl and locate the four holes you just drilled through the front of the fuselage. Glue a 1/8" x 1/2" x 1/2" plywood **cowl mounting block** to the inside of the fuse sides, centered over each hole. **Redrill** the four 1/16" holes through the cowl mounting blocks. Reinstall the cowl and attach it to the fuselage with four #2 x 3/8" sheet metal screws.

D 7. Cut out the **dummy engine and exhaust pipe,** then sand their edges smooth. Test fit the dummy engine and exhaust pipe on the cowl. The cylinder heads on the dummy engine should line-up with the prop shaft of the real engine. Trim and sand as required for a good fit. Glue the dummy engine to the cowl with thick **CA.**

SCALE DETAILS

D 1. Cut out the two hubcaps and sand their edges smooth.



D 2. The gas cap was carved from a dowel, primed, then painted Cub Yellow. The fuel gauge is simply a piece of 1/16" music wire bent and inserted in a hole drilled through **the** middle of the gas cap.

FINISHING

FINAL SANDING

Fill any scuffs and dings with balsa filler or by "expansion " See Expert Tip below After the filler has hardened, sand the entire structure with progressively finer grades of sandpaper, ending with 320-grit

Many surface blemishes on a framed model are caused by bumps and balsa chips on the work surface This type of "ding" is best repaired by applying a drop or two of window cleaner or tap water to the blemish, then running a hot sealing iron over the spot to expand the wood fibers After the surface has dried, sand the expanded area smooth.

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

D 1 Temporarily attach the wing and engine (with muffler) to the fuselage

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

D 3 If one wing consistently drops when you lift the model, it means that side is heavy Balance the airplane by gluing 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 MODEL WITH MONOKOTE FILM

The Cub 20 does not require much painting to obtain the scheme shown on the box, as most of the finish is done with **Top Flite® MonoKote®** covering The only painting required is the cowl, windshield frame, dummy engine and hubcaps

The technique we will describe here is how the model pictured on the box was finished Remove the engine and engine mount, landing gear, windshield and control horns Make sure the structure is smoothly sanded with **320-grit sandpaper.** Remove all dust from the structure with a **Top Flite Tack Cloth** so the covering will stick well

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

You can practically eliminate wrinkles in your covering that sometimes occur when the model is left out in the sun or in the back of 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. Cut a piece of MonoKote film about 2" larger all around than the surface you are covering Strip off the backing and position the film Tack the film down **smack dao in the middle of the surface.**

C Pull (as in stretch) the film toward one end, sealing it to the balsa from the **center out to the tip.** Work out any **wrinkles and air pockets** as you proceed with a combination of **circular and back and forth motion.**

D Do the same procedure working the **opposite direction** from the center

E Pull and seal **diagonally toward the four corners,** always starting from the center The trick is to shrink out any wrinkles before you seal the film to the surface.

F Use a heat gun to heat and to stretch the film around curved surfaces like the stab and rudder tips, while pulling on the excess material You may need to pull hard to get out all of the wrinkles, so wear a glove if you need to Follow-up the heat gun with your sealing iron to secure the bond.

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

When covering areas that involve sharp junctions, like the tail section, cut narrow strips (1/4" to 3/8") and apply them in the corners **before** covering the major surfaces 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 This can weaken the stab to the point where it may fail in flight'

Special Notes For Covering The Cub 20 Fuselage:

The idea is to make the Great Planes Cub 20 appear to have an "open structure" like the full-size Piper Cub Therefore, the covering is not bonded to, or touching much of the fuselage structure On the fuselage sides, the only areas where the covering is bonded to the frame are along the bottom edge, the side stringer and pushrod exits, from the fuselage front to about 1/2" aft, stringers on the turtledeck, wing saddle, cabin window frame corners, tail fairing block, a 1/4" wide strip along the bottom of the stabilizer and the fuselage rear Bond the MonoKote film to these areas but use a heat gun to shrink the covering over the rest of the structure Use a piece of masking tape to lift the covering anywhere it was accidentally stuck down

The covering on the fuselage should be bonded to the entire fuselage bottom and upper front deck Be sure to use a Hot Sock when ironing down the covering to sheeted surfaces

Recommended Covering Sequence:

1 TE surfaces of wing
2 Bottom of left wing panel
3 Bottom of right wing panel
4 Top of left wing panel (overlap covering 1/4" at wing LE and wing centerline)
5 Top of right wing panel (overlap covering 1/4" at the LE and wing centerline)
6 Tail Junction Strips as described above
7 Stab bottom
8 Stab top
9 Fin left and right **side**
10 Fuse bottom
11 Fuse sides
12 Fuse top
13 Rudder left and right side
14 Bottom of elevators
15 Top of elevators
16 Die-cut landing gear fairing
17 Ends of ailerons
18 Bottom of ailerons
19 Top of ailerons
20 Wing struts

PAINTING YOUR MODEL

Paints Used On The Prototype:
There are several parts on the Cub 20 that require painting Two-part epoxy paints such as K&B or Hobbypoxy are highly recommended where durability and fuel resistance are important On the Cub 20 we used an airbrush to apply Hobbypoxy primer and Hobbypoxy Cub Yellow on the cowl, hub caps, windshield and fuel cap We brush painted the cabin interior with the same paint We used Testers chrome and black to paint the dummy engine, then fuelproofed it with Hobbypoxy clear Testors paint was also used on the pilot figure An alternative to Hobbypoxy is Top Flite LustreKote - available in aerosol cans LustreKote is fuelproof and is a perfect color match to MonoKote film

Surface Preparation:
Degrease and clean all plastic parts with rubbing alcohol, then allow to dry before proceeding Mask off the area on the windshield that will not be painted with masking tape. Examine the photos on the box to determine which portions of the windshield are to be painted Lightly sand the area with 400-gnt sandpaper and wipe clean Spray the **cowl, windshield and hubcaps** with a **thin** coat of primer The primer provides a good base coat for the paint to adhere to It's best to allow the primer to dry overnight before sanding Wet sand the primer with 320 and 400-gnt sandpaper using a block where possible.

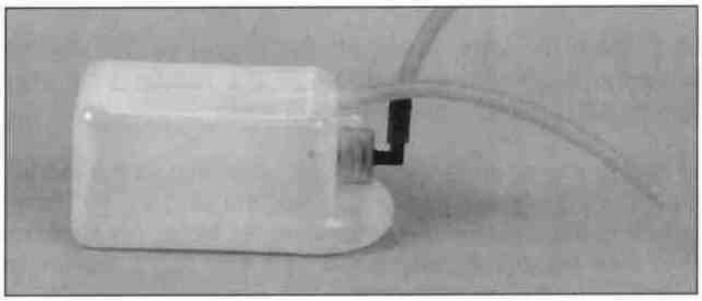
Color Application:
Two-part epoxy paints are not difficult to use if you have spray equipment or an airbrush Use equal parts of the mixed color paint (Part A) and gloss hardener (Part B), then stir well Use about 1/3rd of the total volume of parts A and B combined, of Hobbypoxy thinner Remember to use an approved respirator or mask, and spray paint in a well ventilated area.

FUELPROOFING

D 1 Fuelproof the firewall We recommend brushing on one of the following 30-minute epoxy thinned with a little alcohol, polyester resin, or fuelproof paint or dope.

D 2. Fuelproof any external wood that is exposed

FINAL ASSEMBLY



D 1. Our prototype Cub 20 uses a 4 **oz.** Great Planes fuel tank with the right-angle fuel supply nipple to avoid kinking the fuel tube Attach 1/2" foam rubber on top, bottom and sides of the tank Mount the foam rubber to the tank floors and fuselage sides with double-sided tape to make sliding the fuel tank in and out easier Also, attach a piece of foam rubber to the front of the fuel tank to prevent it from hitting the firewall Cut two 8" pieces of medium fuel tubing Mark a "P" on both ends of one piece of fuel tubing and a "V" on both ends of the other fuel tubing Insert the fuel tubing through the holes in the firewall Set the fuel tank in the fuselage Connect the fuel tubing marked "P" on the fuel pickup nipple and the tubing marked "V" on the vent nipple Slide the fuel tank into the fuel tank compartment while carefully pulling the fuel tubing out the front of the firewall

D 2 Connect the fuel tube marked "P" to the nipple on the carburetor Install the cowl over the engine and attach it to the fuselage with the #2 x 3/8" sheet metal screws Install the muffler on the engine and attach the fuel tubing marked "V" to the nipple on the muffler

INSTALL THE CONTROL SURFACE

D 1 Roughen the elevator joiner wire with 150-grit sandpaper, then clean the wire thoroughly with alcohol and a paper towel to remove any oil residue

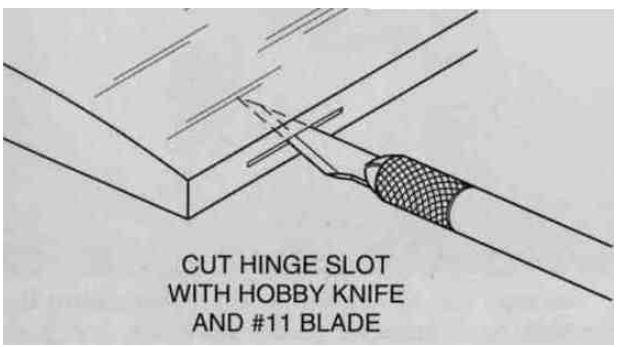
D 2 Glue the joiner wire in the elevators with 6-minute epoxy After applying the epoxy, lay the elevators on a flat surface with the leading edge along a straightedge to ensure perfect alignment

Note: Cut 17 hinges 5/8" x 1" from the 2" x 9" supplied hinge material

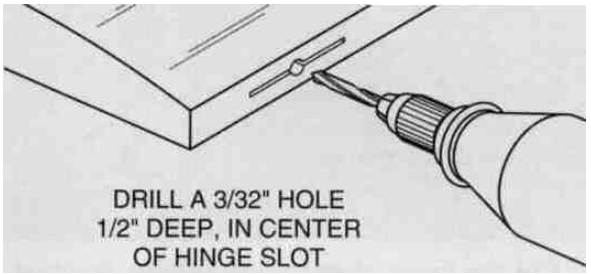
D 3 Attach the elevator assembly to the stabilizer with six hinges using the technique described in the Expert Tip section that follows After the CA has cured, flex the elevators to "break them in "

The hinge material supplied in this kit consists of a 3-layer lamination of mylar and polyester It is specially made for the purpose of hinging model airplane control surfaces Properly installed, this type of hinge provides the best combination of strength, durability and ease of installation We trust even our best show models to these hinges, but it is essential to install them correctly Please read the following instructions and follow them carefully to obtain the best results These instructions may be used to effectively install any of the various brands of CA hinges

The most common mistake made by modelers when installing this type of hinge is not applying a sufficient amount of glue to fully secure the hinge over its entire surface area, or, the hinge slots are very tight, restricting the flow of CA to the back of the hinges This results in hinges that are only "tack glued" approximately 1/8" to 1/4" into the hinge slots The following technique has been developed to help ensure thorough and secure gluing.



A Cut the hinge slot using a #11 blade in a standard #1 knife handle The CA hinges provided have a thickness that fits this type of slot very well Trial fit the hinge into the slot If the hinge does not slide in easily, work the knife blade back and forth in the slot a few times to provide more clearance (it is really the **back edge** of the blade that does the work here in widening the slot)

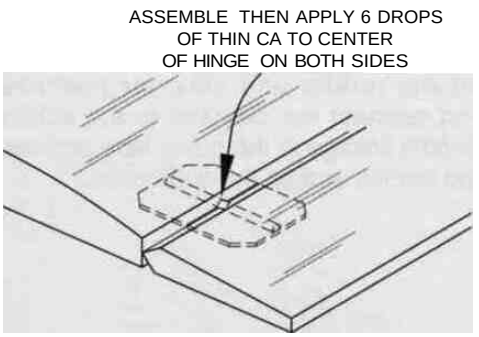


B Drill a 3/32" hole, 1/2" deep, in the center of the hinge slot. If you use a Dremel® Moto-Tool for this task, it will result in a cleaner hole than if you use a slower speed power or hand drill Drilling the hole will twist some of the wood fibers into the slot making it difficult to insert the hinge, so you should re-insert the knife blade, working it back and forth a few times to clean out the slot

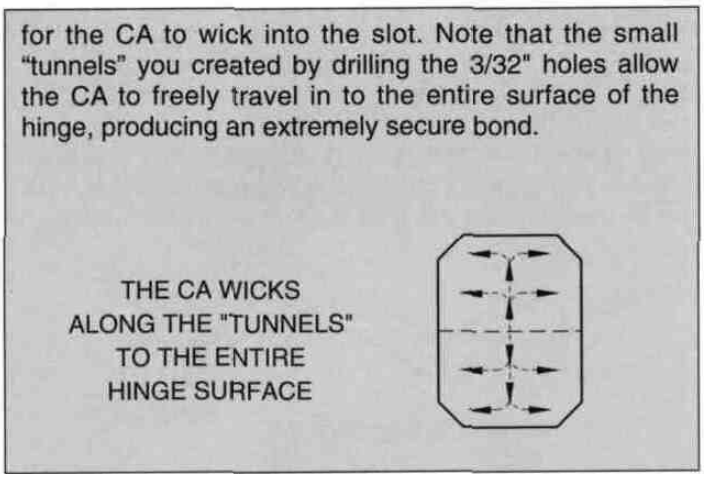
C Trial fit the hinges into the slots and temporarily attach the control surface, to verify the fit and operation

D Rather than just making a single slit, it is better to cut away a narrow rectangle of covering to provide an adequate opening for the CA glue to wick into the slot.

E Insert the hinges and install the control surface Verify the left-right positioning of the control surface, and close up the hinge gap to 1/32" or less It is best **to** leave a very slight hinge gap, rather than closing it up tight, to help prevent the CA from wicking along the hinge line Make sure the control surface will deflect **to** the recommended throws without binding If you have cut your hinge slots too deep, the hinges may slide in too far, leaving only a small portion of the hinge in the control surface To avoid this, you may insert a small pin through the center of each hinge, before installing This pin will keep the hinge centered while installing the control surface Remove the pins before proceeding.



F Apply 6 drops of thin CA adhesive to both sides of each hinge, allowing a few seconds between drops



D 1 Cut the hinge slots for the **rudder** and test fit the rudder to the fin with the tail gear wire in position When satisfied with the fit, remove the rudder Coat the wire with petroleum jelly where it passes through the bearing, to prevent it from becoming glued to the bearing Use 30-minute epoxy to glue the tail gear wire bearing into the fuse.

D 2 Pack the tail gear wire hole in the rudder with epoxy, then install the rudder in the same way as the elevators using two hinges

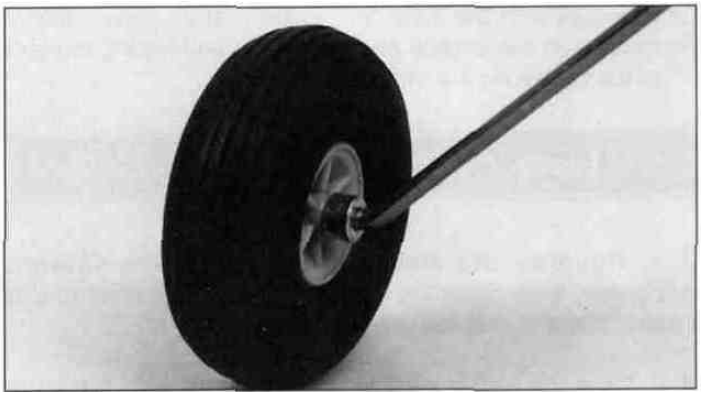
D 3. Cut the hinge slots for the ailerons and test fit the ailerons to the wing When satisfied with the fit, remove the ailerons Coat the aileron torque rod with petroleum jelly where it passes through the bearing to prevent epoxy from entering the bearing.

D 4 Pack the torque rod hole in the aileron with epoxy, then install the aileron in the same way as the elevators using three hinges on each aileron.

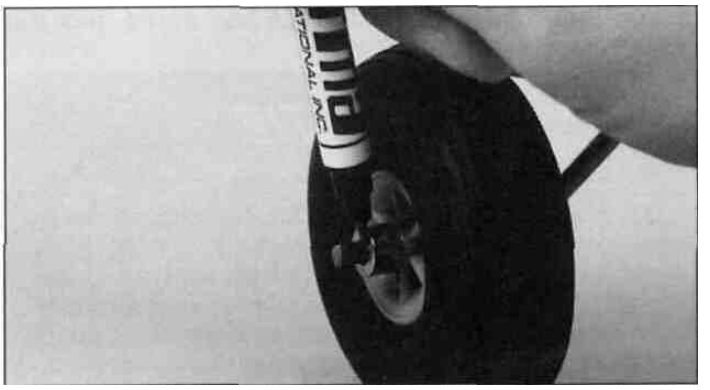
D 5. Insert the rudder and elevator pushrods in the fuselage and connect the clevises to the control horns Insert the throttle linkage in the guide tube and connect the linkage to the throttle arm on the carburetor.

D 6. Install a propeller on the engine If you are using a spinner nut to hold the propeller on the engine, install it at this time.

INSTALL THE WHEELS

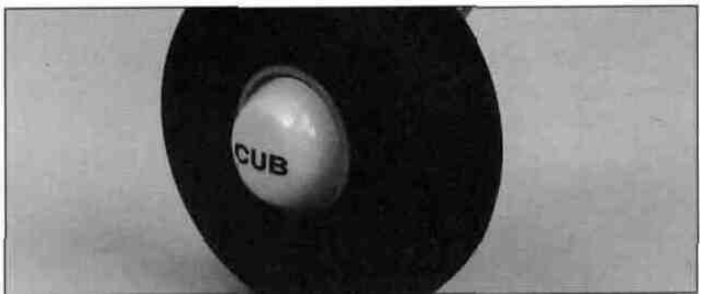


D 1 Install the 5/32" **wheel collars** (not included) against the inside bend of each landing gear wire Install the **main wheels** and the other 5/32" wheel collars to secure the wheels to the landing gear Place the wheel collars as close to the wheels as possible without interfering with free rotation



D 2 Mark the landing gear at the outboard edge of the wheel collar Remove the wheel collar and cut off the excess landing gear wire to allow the hubcaps to be mounted to the wheel.

D 3 File or grind a flat spot where the wheel collar set screw contacts each axle.



D 4 Reinstall the wheel and wheel collar **using liquid thread locking compound** on the set screw, and glue the hubcaps to the wheels with thick CA

D 5 Install a 3/32" **wheel collar** on the tail gear wire Slide the **tail wheel** on and secure it to the tail gear wire with another 3/32" wheel collar.

INSTALL THE WINDOWS

D 1 Lightly sand a strip approximately 1/8" wide along the inside of the windshield (around the perimeter) **Note:** To avoid sanding more than you want, it is helpful to first apply strips of masking tape on the inside of the windshield, 1/8" in from the edge

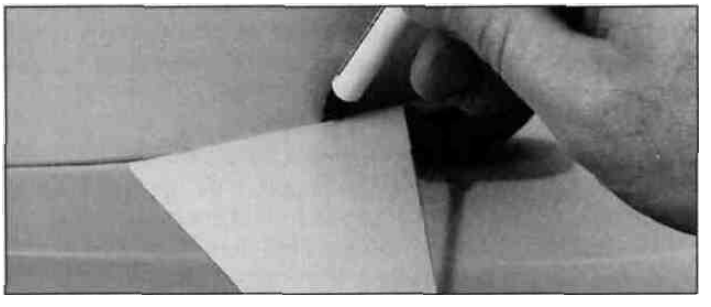
D 2 Hold the windshield in place on the fuselage Use a fine tip marker to trace a line directly onto the covering around the windshield Remove the windshield and use a **sharp** #11 blade to cut the covering just inside the line you drew A sharp blade is important so you don't have to use much pressure and will allow you to cut only the covering and not the underlying wood Decide how you are going to treat the front deck behind the windshield One option is to leave the yellow covering in place and paint it flat black — if this is your plan, then just remove a 1/8"-wide strip of covering in the area where the windshield will be glued to the front deck If you want to recover this area with black MonoKote film, then you should remove the yellow covering behind the cut that you made in this step and recover this area, leaving a 1/8" strip uncovered.

D 3 Cut out and apply the instrument panel decal to the instrument panel.

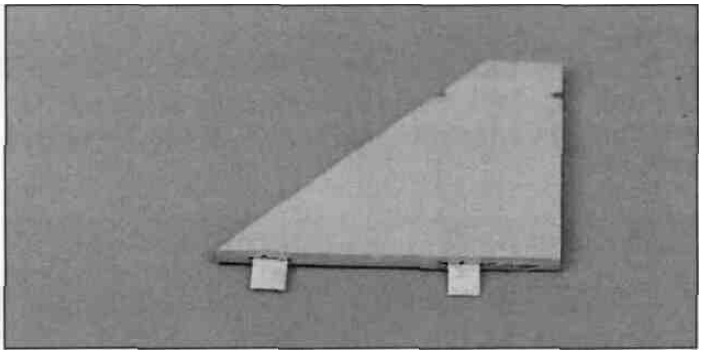
D 4 Carefully glue the windshield in place with "56"-type Canopy Adhesive We do not recommend CA, as it may fog the plastic Use masking tape to hold it in place while the glue dries.

D 5 The side windows are cut from the sheet of supplied butyrate Use the fuselage plan as a guide to trim the windows to fit along the inside of the cabin side After the windows have been trimmed to fit, glue them in place with "56"-type Canopy Adhesive.

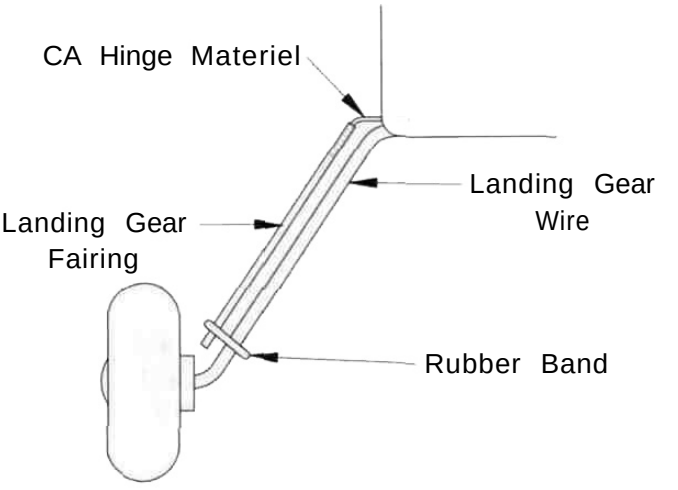
INSTALL THE LANDING GEAR FAIRING



D 1 Attach the 1/8" die-cut **landing gear fairing** to the landing gear with a small rubber band Mark the top edge of the landing gear fairing and the fuselage in two locations where the CA hinges will be attached to the fuselage Make sure both marks on the fuselage are **behind** the landing gear rail



D 2 Cut four 1/4" x 3/4" pieces of CA hinge from the extra hinge material Cut two slots 1/2" deep, **centered** at the marks on the **edge** of the landing gear fairing and in the edge of the fuselage Glue the CA hinge material half-way into the slots in the landing gear fairing with thin CA.

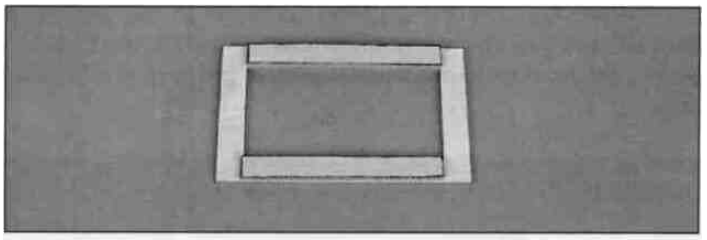


D 3 Slide the CA hinges into the slots in the fuselage and reattach the landing gear fairing to the landing gear with the rubber band Glue the CA hinges into the fuselage with thin CA.

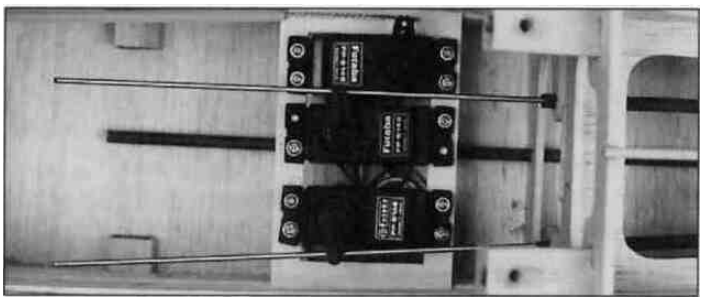
RADIO INSTALLATION

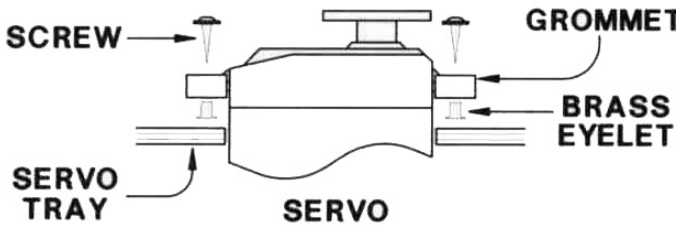
D 1 The receiver battery may be installed nearly anywhere in the cabin area that allows for correct balance **Wrap** the receiver battery **with** 1/4" **foam rubber** The recommended battery location is underneath the fuel tank just ahead of former F2

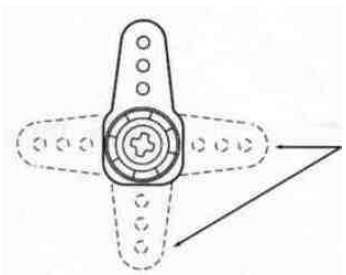
D 2 We have found the best place to mount the receiver switch is on the bottom of the fuselage We used a Great Planes Switch & Charge Jack Mounting Set (not included) to mount the switch This allows us to charge the receiver battery without removing the wing



D 3. Cut two 1/4" x 3" servo tray doublers from scrap 1/8" ply. Then glue them to the bottom of the servo tray as shown.







D 4. Mount three servos in the servo tray following the manufacturer's recommendations and referring to the sketch above. On all servos, install "cross" style servo horns with three of the arms cut off. Refer to the fuselage plan for the proper orientation of the servos in the servo tray. Set the servo tray in the fuselage on the lip created by the lower fuselage doubler. **Do not** glue the servo tray in yet.

D 5. Connect the servos, receiver switch and aileron extension to the receiver according to the radio manufacturer's instructions.

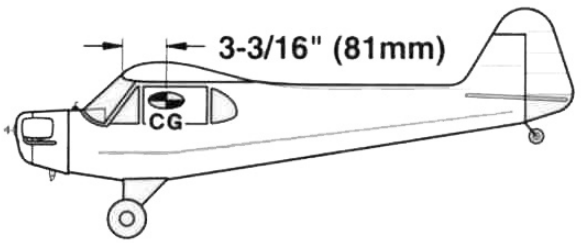
D 6. Wrap your receiver in a plastic bag, then wrap with foam rubber. Secure the foam with a couple of rubber bands. Place the receiver on the floor of the cabin just **behind former F2.** Later, after the plane has been balanced properly, glue a scrap stick of balsa over the receiver to hold it in place.

D 7. If the aileron servo hits the top of the wing when installed in the aileron servo tray, glue the aileron servo tray doublers (saved from when the aileron servo tray was installed during wing assembly) on each end of the aileron servo tray. Install a servo in the aileron servo tray following the manufacturer's recommendations.

D 8. Mount the wing on the fuselage and balance the plane as instructed below.

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.



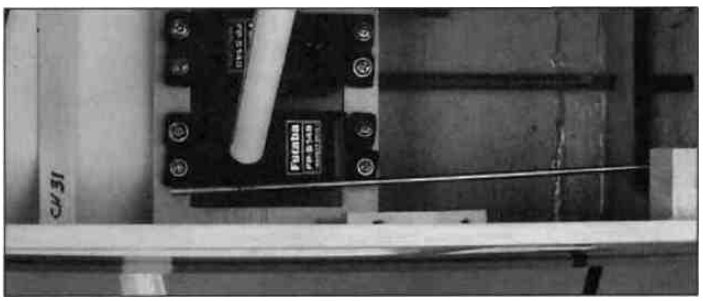
D 1. Accurately mark the balance point on the bottom of the wing on both sides of the fuselage. The balance point is shown on the plan **(CG),** and is located **3-3/16" (81mm) back from the leading edge** as shown in the sketch and on the plan. Hint: Use the fuselage plan to help you accurately locate the proper balance point on the wing. This is the balance point at which your model should balance for your first flights. Later, you may wish to experiment by shifting the balance up to 3/16" **forward or back** to change the flying characteristics. Moving the balance **forward** may improve the smoothness and arrow-like tracking, but it may then require more speed for takeoff and make it more difficult to slow down for landing. Moving the balance **aft** makes the model **more agile** with a lighter and snappier "feel." In any case, **please start at the location we recommend and do not at any time balance your model outside the recommended range.**

D 2. With the engine, muffler and prop installed (but with an empty fuel tank), block up the tail until the stabilizer is level, then lift the model at the balance point. If the tail drops when you lift, the model is "tail heavy" and you must move the servo tray toward the nose to balance. If the nose drops, it is "nose heavy" and you must move the servo tray toward the tail to balance. If moving the servo tray does not move the weight enough to balance the

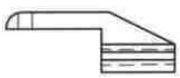
plane, the receiver and battery can also be moved If this is still not enough, nose weight may be easily installed by using a heavy spinner hub or gluing lead weights into the engine compartment Tail weight may be added by using Great Planes (GPMQ4485) "stick-on" lead weight Later, if the balance proves to be OK, you can open the fuse bottom and glue these in permanently After the plane is properly balanced, glue the servo tray in place with thick CA.

FINISH RADIO INSTALLATION

D 1 Turn on your transmitter and receiver, then center the elevator and rudder servos. Be sure that the trim levers are centered



D 2 Center the elevator, then mark the pushrod where it crosses the outside servo horn hole. Enlarge the servo horn hole with a 5/64" drill bit



D 3. Make a 90-degree bend in the pushrod on your mark, then insert it through the enlarged hole in the servo horn. Secure it with a **nylon Faslink".**

D 4 Repeat steps 2 and 3 for the rudder.

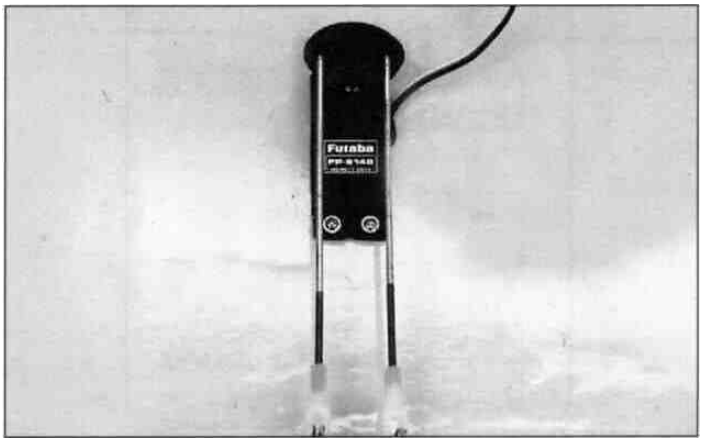
D 5 Hookup the throttle using a brass **screw lock pushrod connector** (not included) on the servo horn. Make sure that the servo does not stall at either end of its travel

D 6. Route the receiver **antenna** in one of the following ways:

a Insert the antenna into the "pushrod guide tube" and tape it securely at the aft end.

b Route the antenna out the side of the fuselage just under the TE of the wing Anchor the antenna to the top of the fin with a rubber band.

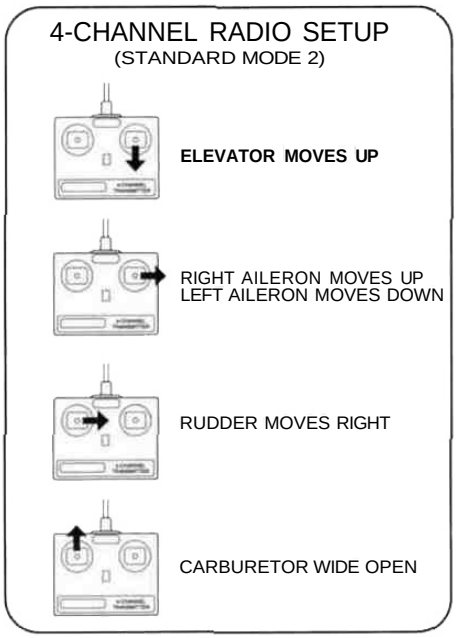
Note: Do not shorten the antenna! Leave any excess trailing behind the model.



D 7 Install two swivels on the aileron torque rods threaded 1/4" below the top edge of the aileron torque rod arms. Screw a clevis 14 turns onto the threaded end of each 6" wire pushrod Connect the clevises to the swivels and slide a silicone clevis retainer over the clevis Plug the aileron servo into the receiver Install a servo wheel setup for differential throw (see the definition below) Switch on the transmitter, then the receiver With the aileron servo centered, hold the aileron pushrods on the servo wheel and mark the hole locations on the pushrods Make a Z-bend at the marks and insert the Z-bend in the servo wheel Install the servo wheel on the servo and check the aileron throws as shown below Lowering the swivels will cause the ailerons to deflect more if you need more throw

** 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."*

** Adverse Yaw The tendency of an airplane to yaw in the opposite direction of the roll For instance, when right aileron is applied, the airplane yaws to the left, thus opposing the turn Adverse yaw is common in trainer type airplanes having flat-bottom wings, and is most noticeable at slow speeds and high angles of attack, such as during takeoffs and when stretching a landing approach Caused by the unequal drag of the upward and downward deflecting ailerons, this undesirable trait can be minimized by setting up the ailerons with "Differential Throw," or by "coordinating" the turns, using aileron and rudder control simultaneously.*



D 8. Turn on the radio system and check the direction of all control functions. They must all move in the direction shown in the sketch. If not, change the position of the reversing switches on your transmitter.

CONTROL SURFACE THROWS

NOTE: Throws are measured at the widest **part** of the elevators, rudder, and ailerons. Hold a ruler vertically on your workbench or block it up on books to perform these measurements.

SINGLE RATE TRANSMITTER

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

ELEVATOR:	1/2" up	1/2" **down**
RUDDER:	1-3/8" right	1-3/8" left
AILERONS:	7/16" up	5/16" down

DUAL RATE TRANSMITTER

"Dual Rate" is a feature on some radios which allows you to switch the control surface throws in flight. This lets you change the responsiveness of your model with regard to the maneuvers you are doing.

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

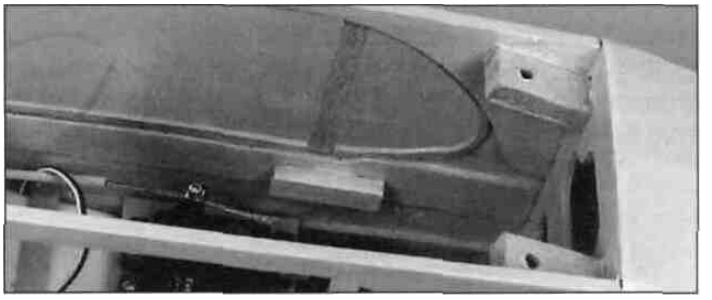
	(High Rate)	(Low Rate)
ELEVATOR:	5/8" up	3/8" up
	5/8" **down**	3/8" down
RUDDER:	1-3/8" right	1-3/8" right
	1-3/8" left	1-3/8" left
AILERONS:	7/16" up	3/8" up
	5/16" down	1/4" down

NOTE: The balance and surface throws for this aircraft have been extensively tested. We are confident that they represent the settings at which the Cub 20 flies best. Please set up your aircraft to the specifications listed above. If, after a few flights, you would like to adjust the throws to suit your taste, that's fine. Too much throw can force the plane into a stall or snap roll, so remember, "more is not better."

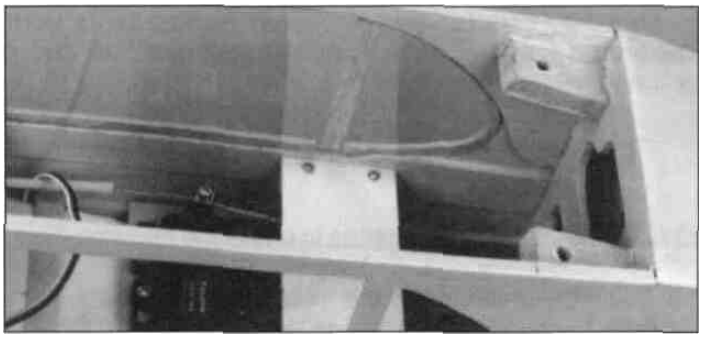
INSTALL THE PILOT (OPTIONAL)

D 1. We used a 2" Williams Bros #184 Sportsman Pilot with 1/4" cut off the base to allow the pilot's head to clear the aileron pushrods. Assemble your pilot and paint it as desired.

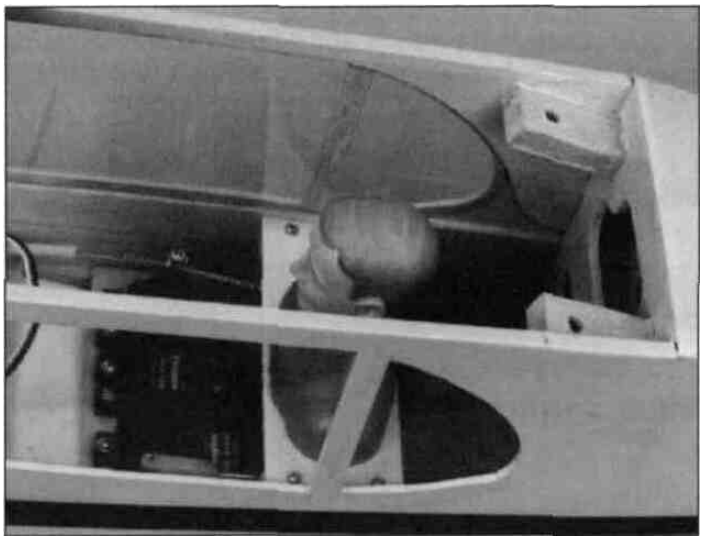
D 2. Cut two pieces of scrap 3/16" x 3/16" **hard balsa** 1-1/2" long. For a shelf to support the pilot, cut one piece of scrap 1/8" **plywood** 1-1/2" wide to fit between the fuselage sides, centered between the rear window braces. Drill two 3/32" holes at each end of the 1/8" plywood (see the photo for step 4 for the approximate location). In J-3 Cubs, the pilot would fly from the rear seat when flying solo.



D 3. Tack glue or **pin** the two 3/16" square balsa pieces 1/4" below the top edge of the top fuselage doublers on each side of the fuselage, centered between the rear window braces. The top edge of the balsa pieces must be 1/8" above the elevator and rudder pushrods. Place the 1/8" plywood shelf on the 3/16" balsa pieces and mark the **four** holes on the balsa pieces.



D 4. Remove the plywood shelf and the 3/16" balsa pieces. Drill a 1/16" hole at each mark. Thread #2 x 3/8" **sheet metal screws** (not included) into the 1/16" holes. Remove the screws and place a drop of thin CA into each hole to harden the balsa.



D 5 Put the pilot on the plywood shelf, replace the wing and check the clearance between the pilot's head and the aileron pushrods If they do not touch, glue the pilot to the plywood shelf with CA If necessary, sand the base of the pilot to allow more "head room "

CHARGE THE BATTERIES

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

FIND A SAFE PLACE TO FLY

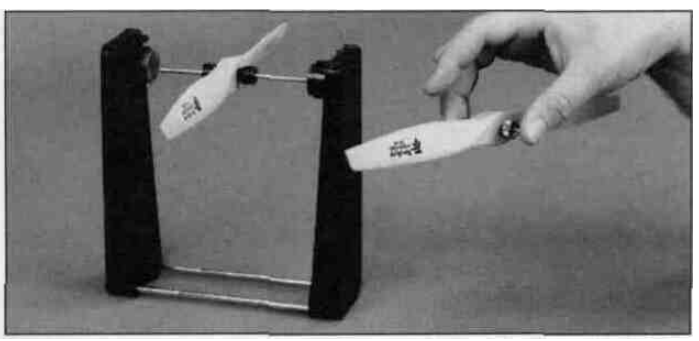
The best place to fly your R/C model is an AMA (Academy of Model Aeronautics) chartered club field Ask your hobby shop dealer if there is such a club in your area and join Club fields are set up for R/C flying and that makes your outing safer and more enjoyable The AMA also can tell you the name of a 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 near the front 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.

PREFLIGHT

BALANCE THE PROPELLER

Balance your propellers carefully before flying An unbalanced prop is the single most significant cause of damaging 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 rough 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

GROUND CHECK THE MODEL

If you are not thoroughly familiar with the operation of R/C models, ask an experienced modeler to check to see that you have the radio installed correctly and that 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

Wherever you do fly, you need to check the operation of the radio before every time you fly This means with the 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 someone help you Have them stand by your model and, while you work the controls, tell you what the various control surfaces are doing

Repeat this test **with the engine running** at various speeds with an assistant holding the model If the control surfaces are not always acting correctly, **do not fly!** Find and correct the problem first

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. **Therefore 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, **as** 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 (pencils, 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 running propeller

Make all engine adjustments from behind the rotating propeller.

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

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

AMA SAFETY CODE

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 airpor* operator I will give right of way to, and avoid flying in the proximity of full size aircraft Where necessary an observer shall be utilized to supervise flying to avoid having models fly in the proximity of full scale aircraft

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

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

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

RADIO CONTROL

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

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

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

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

FLYING YOUR CUB

The Great Planes J-3 Cub is a great flying sport scale airplane that flies smoothly and predictably, yet is highly maneuverable Its flight characteristics are quite docile and forgiving It does not however, have the self-recovery characteristics of a primary R/C trainer, therefore, you must either have mastered the basics of R/C flying or obtained the assistance of a competent R/C pilot to help you with your first

TAKEOFF:

If you have dual rates on your transmitter, set the switches to "high rate" for takeoff, especially when taking off in a crosswind 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" When you first advance the throttle and the tail begins to lift, the plane will start to turn left (a characteristic of all "taildraggers") Be ready for this, and correct by applying sufficient right rudder to hold it straight down the runway The left-turning tendency will go away as soon as the tail is up and the plane picks up speed Be sure to allow the tail to come up Depending on the surface you are flying from, you will need to apply very little to no up elevator until flying speed is obtained Don't hold the tail on the ground with too much up elevator, as the J-3 Cub will become airborne prematurely and will possibly stall When the plane has sufficient flying speed, lift off by smoothly applying up elevator (don't "jerk" it off to a steep climb!), and climb out gradually

CAUTION (THIS APPLIES TO ALL R/C AIRPLANES):

If, while flying, you notice any unusual sounds, such as a low-pitched "buzz," this may be an indication of 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 probably will flutter again under similar circumstances unless you can eliminate the slop or flexing in the linkages Here are some things which can result in flutter Excessive hinge gap, Not mounting control horns solidly, Sloppy fit of clevis pin in horn; Elasticity present in flexible plastic pushrods, Side-play of pushrod in guide tube caused by tight bends, Sloppy fit of pushrod wire in servo arm, Insufficient glue used when gluing in the elevator joiner wire or aileron torque rod, Excessive flexing of aileron, caused by using too soft balsa aileron, Excessive "play" or "backlash" in servo gears, and insecure servo mounting

FLYING:

We recommend that you take it easy with your J-3 Cub for the first several flights, gradually "getting acquainted" with this classic plane as your engine gets fully broken-in Add and practice one maneuver at a time, learning how she behaves in each The Cub is a surprisingly lively model -especially with a 26 4-stroke While there are maneuvers where full throttle is required, avoid "boring holes in the sky" and try to stay within a sensible and realistic scale-like flight envelope

LANDING:

When it's time to land, fly a normal landing pattern and approach Keep a few clicks of power on until you are over the runway threshold Just cut the power to a reliable, low idle and the Cub will naturally bleed off airspeed Maintain a "nose down" attitude during descent, then level off before touchdown - there is no need to "flare " As a rule of thumb (for this type airplane only), if the airplane looks like it is level, it is probably flared about right for landing For your first landings, plan to land slightly faster than stall speed and on the main wheels, as this is the easiest way to land your J-3 Cub Later, with a little technique, you will find you can make slow, 3-point landings

Have a ball! But always stay in control and fly in a safe manner.

GOOD LUCK AND GREAT FLYING!

Building Notes:

BUILDING NOTES

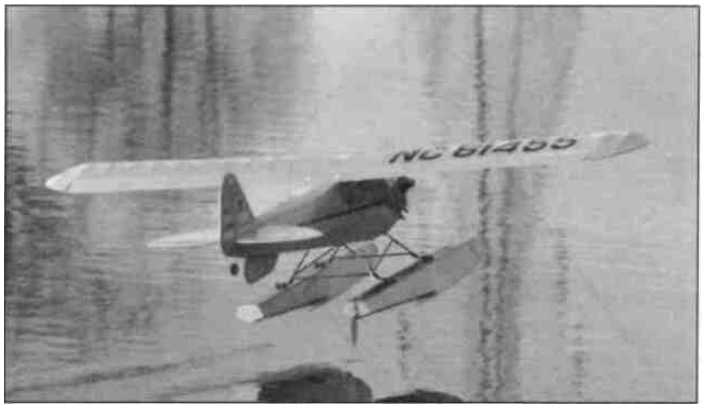
Kit Purchase Date _____ Date Construction Finished _____

Where Purchased._____ Finished Weight._____

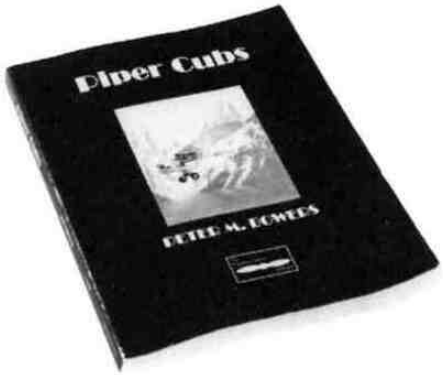
Date Construction Started_____ Date of First Flight._____

Flight Log

THESE ACCESSORIES WILL COMPLEMENT YOUR CUB EXPERIENCE



Ideally suited to your Cub 20, the Great Planes **Sport Float 20** kit will add a new dimension to your R/C flying enjoyment. Stock # GPMQ1870

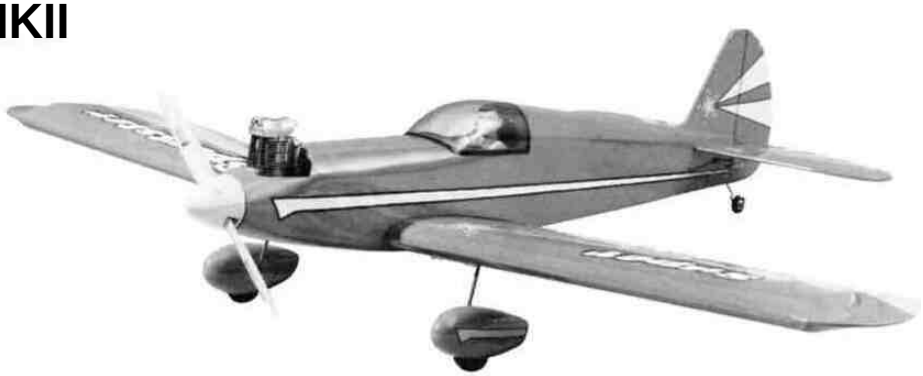


"Piper Cubs" is a fascinating 212 page history of the J-3 Cub in all its diverse roles. Packed with over 200 photos, scale marking specifications, trim scheme ideas and three-views, it's *the* documentation resource for any scale builder or J-3 Cub enthusiast. Available through your Great Planes dealer. Stock # GPMZ2200.

ANOTHER GREAT PLANE

Super Sportster™ 40 MKII

A classic sport design, now with state-of-the-art technology!



GPMA0205

Over the years, the original Super Sportster 40 has provided thousands of R/C pilots with pure modeling pleasure. With its straightforward assembly, popular styling and easy handling, it has become one of the best-selling sport planes ever produced.

Great Planes has taken this popular design one step further to create the Super Sportster 40 MKII - a kit that combines all of the best features of the original Sportster with the latest advanced in R/C engineering. The result? An even sleeker profile, that builds and flies better than ever!

- Simple, straightforward design goes together quickly.
- Agile enough to perform almost any aerobatic maneuver.
- Perfect if you're just moving up to a low-wing sport plane or for experienced pilots who want a relaxing "sport" aircraft.

Wingspan: 55 in (1400 mm)
Wing Area: 563 sq in (36.3 sq dm)
Weight: 5-6 lb (2270-2720 g)
Length: 46 in (1170 mm)
Wing Loading: 20.5-24.5 oz/sq ft (63-75 g/sq dm)
Radio Required: 4-channel with 4 servos
Engine Required: 2-stroke .40-.46 cu in (6.5-7.5 cc)
4-stroke .40-.70 cu in (6.5-11.5 cc)

TWO-VIEW DRAWING

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