Ultimate! BIPLANE

INSTRUCTION MANUAL

WARRANTY

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

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

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

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

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

GREAT PLANES® MODEL MANUFACTURING COMPANY

P.O. Box 788 Urbana, IL 61803 (217) 398-8970

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

Your Ultimate 40 is not a toy, but rather a sophisticated, working model that functions very much like a full size airplane Because of its realistic performance, the Ultimate 40, if not assembled and operated correctly, could possibly cause injury to yourself or spectators and damage property.

If this is your first biplane model, we recommend that you get help from an experienced, knowledgeable modeler with your first flights. You'll learn faster and avoid risking your model before you're ready to take the controls for yourself.

For information on flying clubs in your area, you can contact the national Academy of Model Aeronautics (AMA), which has more than 2,500 chartered clubs across the country Contact AMA at the address or toll-free phone number below:

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

INTRODUCTION

The Great Planes **Ultimate** 40 is a high performance, propeller-driven sport biplane that closely resembles the full size Ultimate The Ultimate 40 is very stable and forgiving, allowing even intermediate skill level pilots to enjoy it

This is not a beginner's airplane! While the Ultimate 40 is easy to build and flies great, we must discourage you from selecting this kit as your **first** R/C airplane It lacks the self-recovery characteristics of good basic trainers such as the Great Planes **PT" Series** On the other hand, if you have already learned the basics of R/C flying, and you are able to safely handle a 40-size low wing airplane, the **Ultimate** 40 is an excellent choice to try your skills at flying a biplane.

PRECAUTIONS

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

2 Take time to build straight, true and strong

3 Use an R/C radio system that is in first-class condition, and a correctly sized engine and components (fuel tank, wheels, etc) throughout 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 every flight to insure that all equipment is operating, and you must make certain that the model has remained structurally sound Be sure to check clevises or other connectors often and replace them if they show signs of wear or fatigue.

NOTE We, as the kit manufacturer, can provide you with a top quality kit and great instructions, but ultimately the quality 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. 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 airplane, please call us at (217) 398-8970. If you are calling for replacement parts, please reference the part numbers and the kit identification number (stamped on the end of the carton) and have them ready when calling.

DECISIONS YOU MUST MAKE

Engine Selection

There are several engines that will work well in your Ultimate 40. We recommend a *hot* 2-stroke such as an **O.S.® .40FX** or **SuperTigre™ G45** with a **Pitts** style muffler. For unsurpassed power and realistic sound, an O.S. FS-52 4-stroke can't be beat. The engine you select will determine how you build the firewall section, so it is important that you have the engine close at hand while building.

PREPARATIONS

Required Accessories

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

- D Four-channel radio with four servos
- D Engine - See **Engine Selection** above
- D Propeller (Top Flite Power Point"), Refer to your engine's instructions for proper size
- D Fuel tank 10oz (GPMQ4104)
- D Medium fuel tubing (GPMQ4131)
- D 2-1/4" Main wheels (GPMQ4222)
- D 1"Tailwheel(GPMQ4241)
- D Top Flite MonoKote (Approximately 3 rolls)
- D Pilot figure (Williams Bros #185)
- D 1/4" Latex foam rubber padding (HCAQ1000)
- D Switch and charge jack (GPMM1000)
- D Top Flite LustreKote" Paint - See **Painting** (page 37)
- D 1/16" Wing seating tape (GPMQ4422)
- D 6" Servo extension
- D 2-1/2" White spinner (GPMQ4520)
- D Fuel fill valve (GPMQ4160)

Building Supplies and Tools

These are the building tools that are required. *We recommend Great Planes Pro" CA and Epoxy glue.*

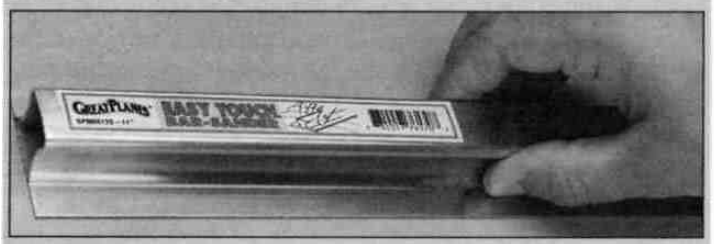
D 2 oz. Pro CA (Thin, GPMR6003)
D 2 oz Pro CA+ (Medium, GPMR6009)
D 1 oz Pro CA- (Thick, GPMR6014)
D 6-Minute Pro Epoxy (GPMR6045)
D 30-Minute Pro Epoxy (GPMR6047)
D Hand or electric drill
D Sealing iron (TOPR2100)
D Heat gun (TOPR2000)
D Hobby saw
D Hobby knife, #11 Blades
D Razor plane (Master Airscrew®)
D Pliers (Common and Needle Nose)
D Screwdrivers (Phillips and flat tip)
D T-pins (HCAR5150)
D 60" Retractable Tape Measure (HCAR0478)
D Straightedge with scale
D Masking tape (TOPR8018)
D Sandpaper (coarse, medium, fine grit)
D Easy-Touch" Bar Sander (or similar)
D Plan Protector (GPMR6167)
D Lightweight balsa filler such as Hobbico^ HobbyLite" (Hobbico HCAR3400)
D 1/4-20 Tap and Drill (GPMR8105)
D Isopropyl rubbing alcohol (70%)
D White body putty (Squadron SQUR1500)
D Ballpoint pen
D 90° Building square (HCAR0480)
D Micro balloons (TOPR1090)
D Canopy glue
D Drill bits 1/16", 5/64", 3/32", 7/64", 1/8", 9/64", 5/32", 3/16", 13/64", 1/4", 5/16", 3/8"
D Builders triangle set (HCAR0480)

Optional Supplies and Tools

D CA Applicator Tips (HCAR3780)
D Epoxy brushes (GPMR8060)
D Epoxy mixing sticks (GPMR8055)
D CA Debonder (GPMR6039)
D Hot Sock "(TOPR2175)
D Single-edge razor blades (HCAR0312)
D Curved tip canopy scissors for trimming plastic parts (HCAR0667)
D 4 oz Pro Wood Glue (GPMR6161)

EXPERT TIP

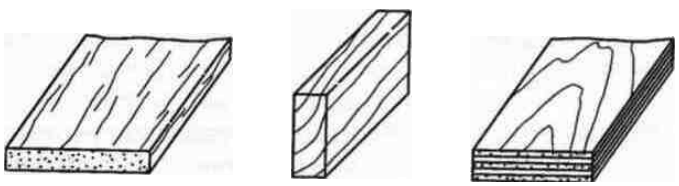
On our workbench, we have three 11" **Great Planes Easy-Touch Bar Sanders**, equipped with 80, 150 and 220-grit sandpaper. This setup is all that is required for almost any sanding task. We also keep some 320-grit wet-or-dry sandpaper handy for finish sanding before covering.



Great Planes **Easy-Touch Bar Sanders** are made from lightweight extruded aluminum and can be found at most hobby shops. They are available in five sizes – 5-1/2" (GPMR6169) for those tight, hard-to-reach spots; 11" (GPMR6170) for most general purpose sanding; and 22" (GPMR6172), 33" (GPMR6174) and 44" (GPMR6176) for long surfaces such as wing leading edges. The **Easy-Touch Adhesive-Backed Sandpaper** comes in 2" x 12' rolls of 80-grit (GPMR6180), 150-grit (GPMR6183), 180-grit (GPMR6184) and 220-grit (GPMR6185) and an assortment of 5-1/2" long strips (GPMR6189) for the short bar sander. The adhesive-backed sandpaper is easy to apply and remove from your sanding bar when it's time for replacement.

Custom sanding blocks can be made from balsa or hardwood blocks and dowels for sanding difficult to reach spots

Types of Wood



Balsa **Basswood** **Plywood**

Common Abbreviations

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

Building Notes

There are two types of screws used in this kit.

Sheet metal screws are designated by a number and a length. For example #6 x 3/4"

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

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

Whenever the instructions tell you to **glue** pieces together, CA or epoxy may be used When a **specific** type of glue is required, the instructions will state the type of glue that is **highly recommended.** When 30-minute epoxy is specified, it is highly recommended that you use only 30-minute (or slower) epoxy because you will need either the working time or the additional strength.

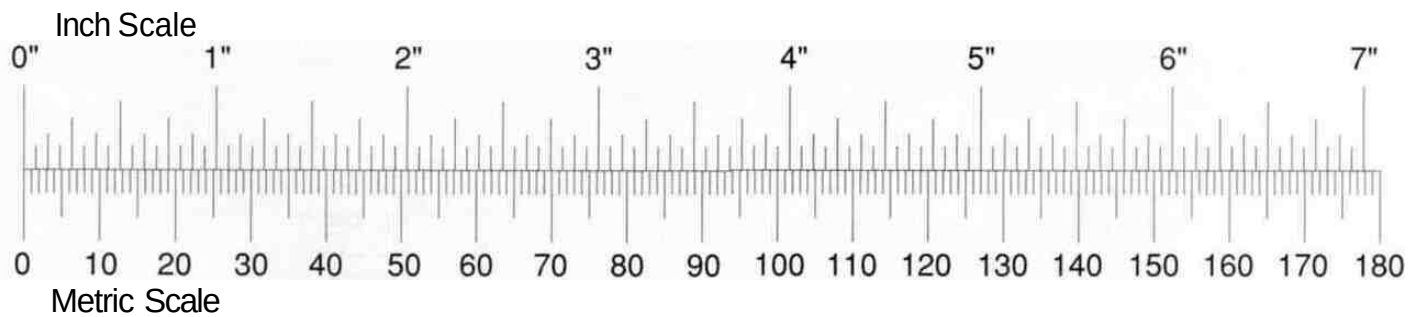
Several times during construction we refer to the "top" **or** "bottom' of the model or a part of the model For example, during wing construction we tell you to "glue the top main spar" or "trim the bottom of the former" It is understood that the "top" or "bottom" of the model is as it would be when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

Get Ready to Build

D 1. Unroll the plan sheets Reroll the plan sheets inside out to make them lie flat Place wax paper or Great Planes Plan Protector over the plan to prevent glue from sticking to the plan.

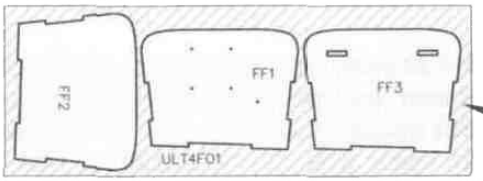
D 2 Remove all parts from the box As you do, determine the name of each part by comparing it with the **plan** and the **parts list** included with this kit Using a felt-tip or ballpoint pen, lightly write the part **name** or **size** on each piece to avoid confusion later Use the die-cut patterns shown on pages 6 and 7 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 remove, do not force them' Instead, cut around the parts Use your Easy-Touch Bar Sander 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, stab** (stabilizer) and **hardware** Resealable food storage bags are handy to store parts in as you sort, identify and separate them into subassemblies.



DIE-CUT PATTERNS

ULT4F01 1 REQ

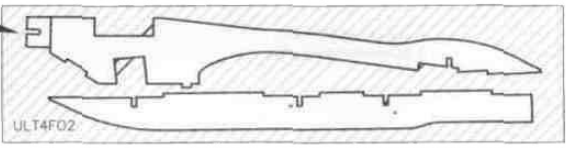


1/8" X 5-3/4" X 15-3/4" PLYWOOD

Wheel Pant Mount

Firewall

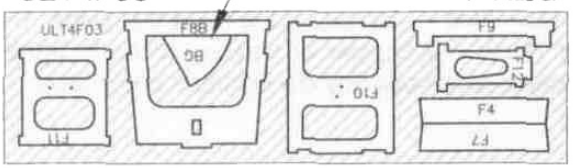
ULT4F02 2 REQ



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

Bevel Gauge for Backrest

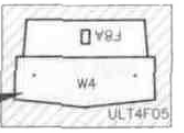
ULT4F03 1 REQ



1/8" x 5-1/8" x 19" PLYWOOD

ULT4F05 1 REQ

Wing Bolt Plate

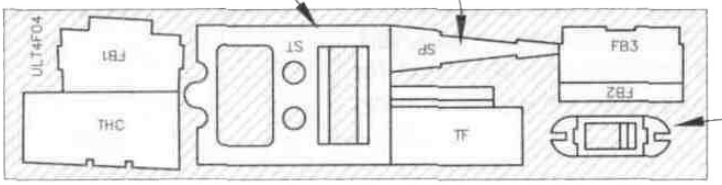


1/16" X 4-1/8 X 5-3/4 PLYWOOD

Servo Tray

Stab Plate

ULT4F04 1 REQ



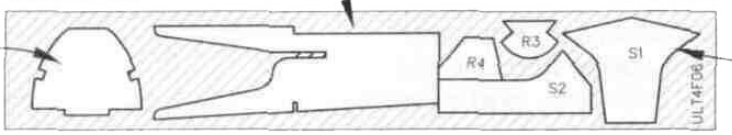
Aileron Servo Tray

1/8" x 5-3/4" x 23-3/4" PLYWOOD

Stab Doubler

ULT4F06 2 REQ

Back Rest

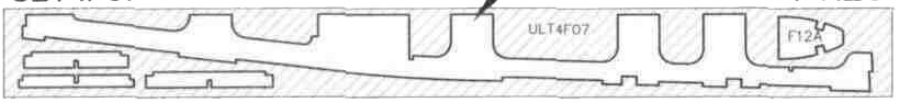


Stab Center

1/8 X 4" X 24" BALSA

Upper Deck Half Left

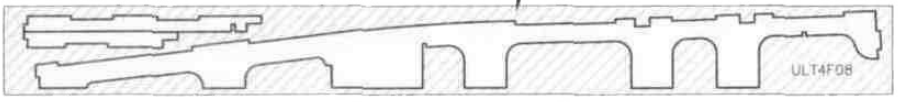
ULT4F07 1 REQ



1/8 X 3" X 30" BALSA

Upper Deck Half Right

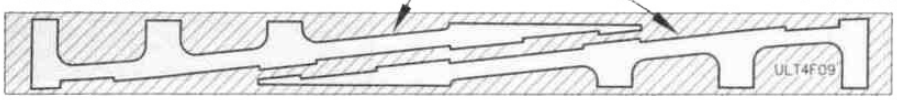
ULT4F08 1 REQ



1/8 X 3" X 30" BALSA

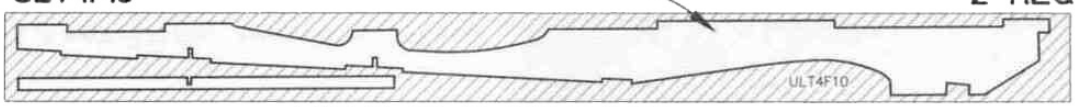
DIE-CUT PATTERNS

ULT4F09 — Aft Fuse Bottom — 1 REQ



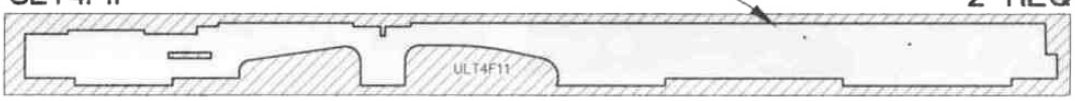
1/8" X 2-3/4" X 30" BALSA

ULT4F10 — Lower Fuse Side — 2 REQ



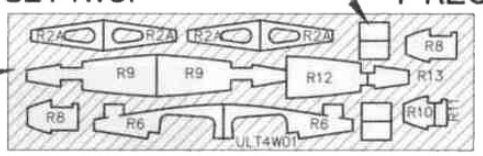
1/8" X 3" X 36" BALSA

ULT4F11 — Upper Fuse Side — 2 REQ



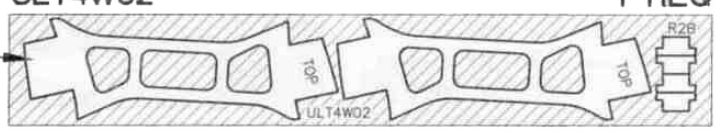
1/8" X 2-3/4" X 36" BALSA

ULT4W01 — LE Joiners — 1 REQ — Rib Joiners



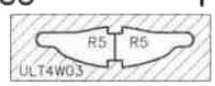
1/8" x 4-5/8" x 15-3/4" PLYWOOD

ULT4W02 — 1 REQ — Interplane Struts



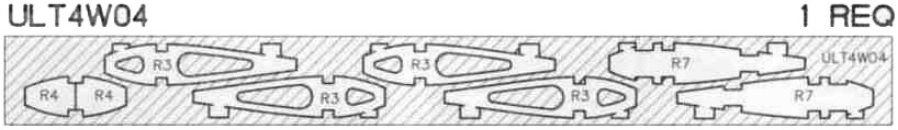
1/8" x 3-3/4" x 23-3/4" PLYWOOD

ULT4W03 — 1 REQ



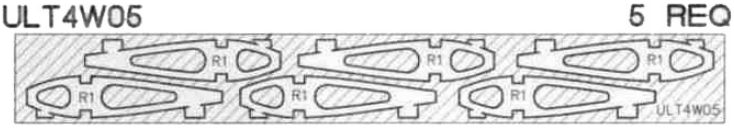
1/8" x 2-1/4" X 6-1/4" PLYWOOD

ULT4W04 — 1 REQ



3/32" X 3" X 30" BALSA

ULT4W05 — 5 REQ

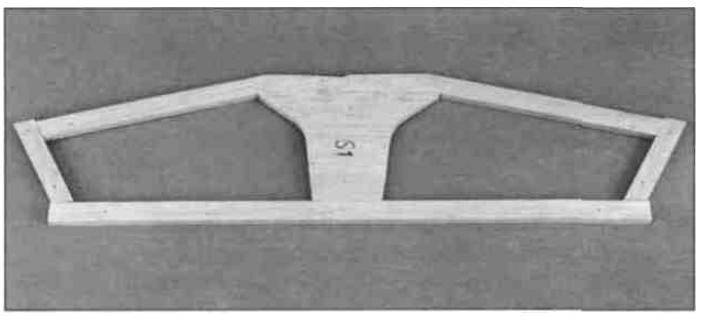


3/32" X 3" X 30" BALSA

BUILD THE TAIL SURFACES

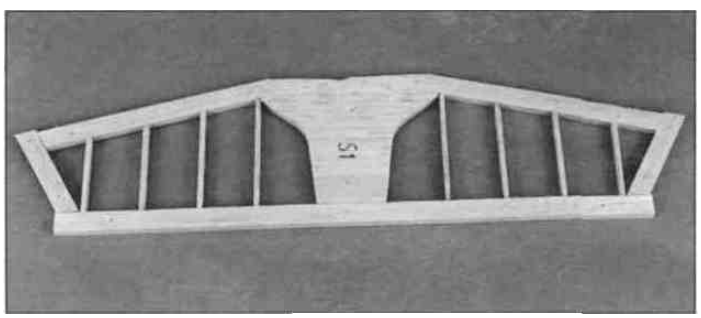
Glue together the pairs of die-cut 1/8" balsa **stabilizer center S-1, fin bottom S-2, rudder bottom R-3** and **rudder tip R-4** to make 1/4" thick parts.

Build the Stabilizer



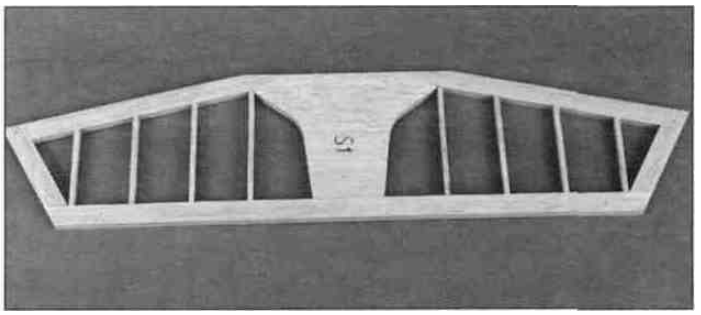
D 1 Pin the die-cut 1/4" balsa stabilizer center S-1 over the stabilizer plan Cut the stab outer frame from a 1/4" x 1/2" x 36" balsa stick, allowing approximately 1/16" extra at the joints The joints will be sanded flush after the stab is removed from the building board Glue the outer frame and stab center together and pin it in position over the plan Use the plans or a straightedge as a guide to make sure the **stab TE** is **straight** as you glue it in position.

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



D 2 Make the 1/8" **stab ribs** from a 1/8" x 1/4" x 36" balsa stick. Glue the ribs in position.

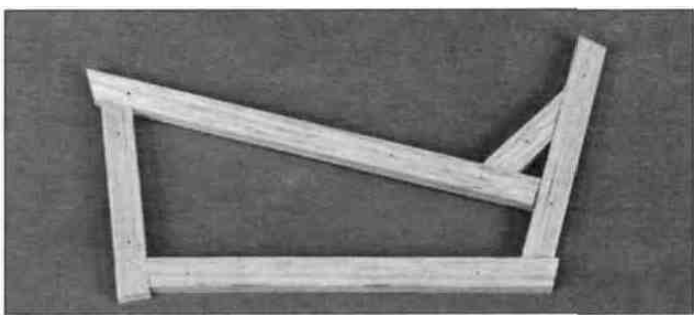
Hint: Use a sharp, single-edge razor blade to cut the stab ribs.



D 3 Remove the stab from your building board Inspect all the glue joints and add CA to any joints that don't look strong Sand the LE and TE flush Sand the entire top and bottom surfaces of the stab until they are flat and even Be careful that you don't sand any area of the stab too thin.

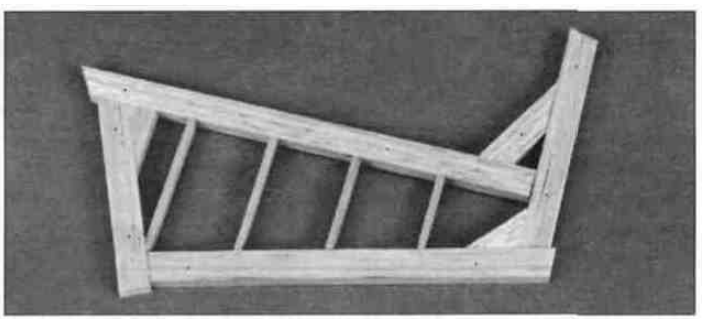
Build the Elevators

D D 1 Cut a 1/4" x 1/2" x 36" balsa stick to make the **elevator LE** and **TE** Pin the LE and TE in position over the plan Allow the LE to extend 1/16" past the root and the TE to extend 1/16" past the tip.

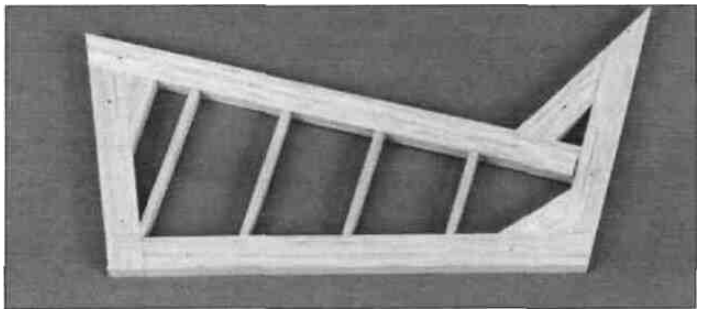


D D 2. Cut the root and tip frame from the remaining 1/4" x 1/2" x 36" balsa stick Glue and pin the **elevator** in position over the plan.

D D 3 Cut **gussets** from a 1/4" x 1/2" x 36" balsa stick and glue them in place



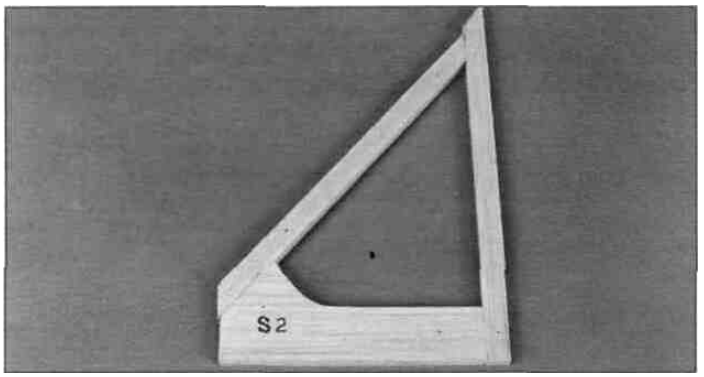
D D 4 Make the 1/8" **elevator ribs** from a 1/8" x 1/4" x 36" balsa stick and glue them in place



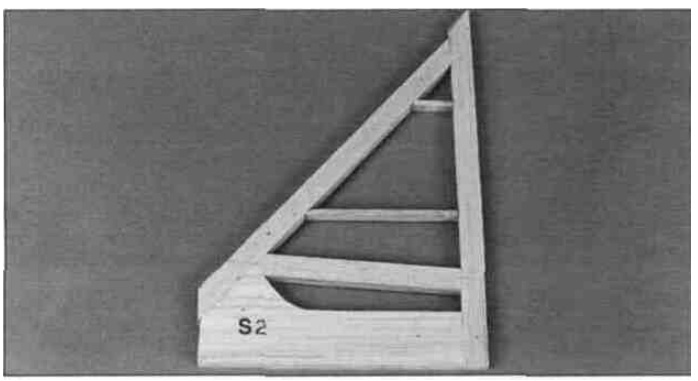
D D 5. Remove the elevator from your building board. Inspect all the glue joints and add CA to any joints that don't look strong. Sand the LE,TE, root and tip flush. Sand the entire top and bottom surface of the elevator flat and even. Be careful that you don't sand any area too thin.

D 6. Go back to step 1 and build the second elevator following the same procedure.

Build the Fin



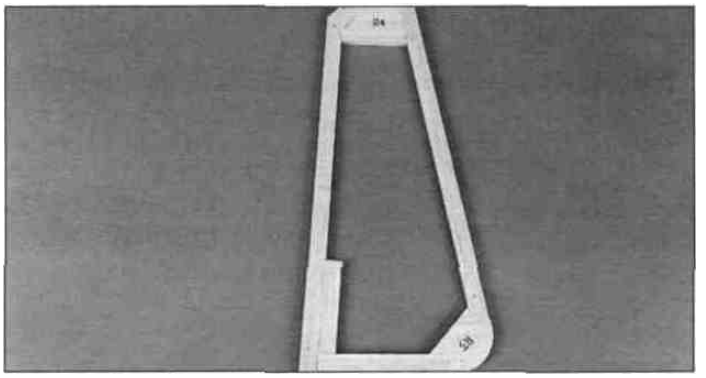
D 1. Pin the die-cut 1/4" balsa fin bottom S-2 over the fin plan. Cut the fin outer frame from a 1/4" x 1/2" x 36" balsa stick, allowing approximately 1/16" extra at the joints. Glue the outer frame and fin bottom together and pin it in position over the plan. Use the plans or a straightedge as a guide to make sure the **fin TE** is **straight** as you glue it in position.



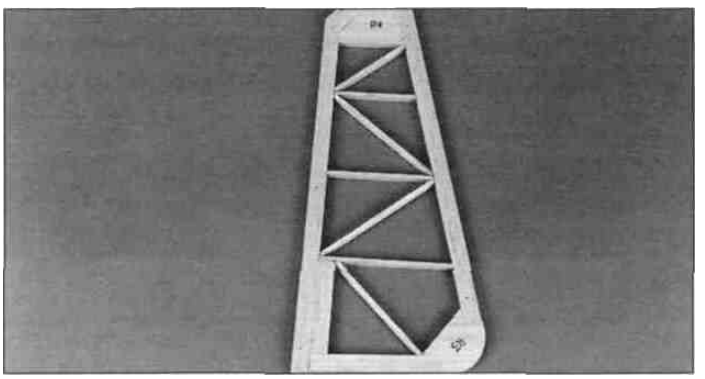
D 2. Cut the top two **fin ribs** from the remaining 1/8" x 1/4" x 36" balsa stick. Cut the bottom rib from a 1/4" x 1/2" x 36" balsa stick. Glue the fin ribs to the fin LE and TE.

D 3. Remove the fin from your building board. Inspect all the glue joints and add CA to any joints that don't look strong. Sand the joints flush and the entire top and bottom surfaces of the fin flat and even. Be careful that you don't sand any area too thin.

Build the Rudder



D 1. Pin the die-cut 1/4" balsa rudder bottom R-3 and rudder tip R-4 over the rudder plan. Cut the rudder outer frame from a 1/4" x 1/2" x 36" balsa stick, allowing approximately 1/16" extra at the joints. Glue the outer frame, rudder bottom and rudder tip together and pin it in position over the plan. Use the plans or a straightedge as a guide to make sure the **rudder LE** is **straight** as you glue it in position.



D 2. Cut the **rudder ribs** and **diagonal braces** from the remaining 1/8" x 1/4" x 36" balsa stick. Glue the ribs and braces in position.

D 3. Cut the remaining 1/4" x 1/2" x 36" balsa stick to make the **LE gusset.** Glue the gusset in position.

D 4. Remove the rudder from your building board. Inspect all the glue joints and add CA to any joints that don't look strong. Sand the joints flush and the entire top and bottom surface of the rudder flat and even. Be careful that you don't sand any area too thin.

Hinge the Tail Surfaces

D 1. Place the stab and elevators over their locations on the plan and lightly mark the **hinge locations** on the TE of the stab and LE of the elevators.

D 2. Mark the centerline of the **hinges** on the stab's TE and elevator's LE using the following centerline method.

EXPERT TIP

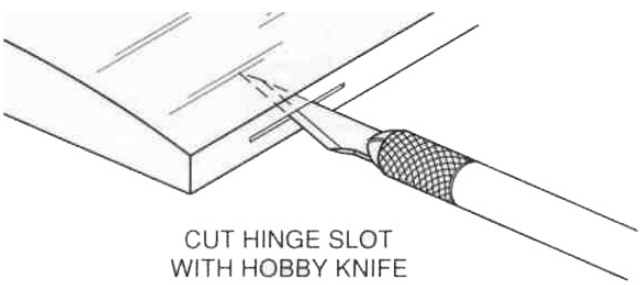
HOW TO MARK A CENTERLINE

It's important that the hinges are centered and parallel to the part you are hinging. The best way to start is by accurately marking the hinge centerline.

A. Lay the stab and a ballpoint pen on a flat surface. Mark a "test line" on the trailing edge of the stab.

B. Flip the stab over and mark another line in the same location as the first. If you see only one line, then it is on center. Proceed and mark the **centerline** at each hinge location. If you see two lines, use playing cards or business cards to adjust the height of the pen until you can mark the centerline.

C. Use the same technique to mark the centerline along the entire length of both elevators.



CUT HINGE SLOT
WITH HOBBY KNIFE
AND #11 BLADE

D 3. Cut the hinge slots in the elevator and stab using a #11 blade. Begin by **carefully** cutting a very shallow slit at the hinge location to accurately establish the hinge slot. Make three or four more cuts, going a little deeper each time. As you cut, slide the knife from side to side until the slot has reached the proper depth and width for the hinge.

D 4. Cut the hinges for the elevators and rudder from the supplied 2" x 9" **hinge material.** Use the hinge drawing on the fuse plan as a guide. Trim off the corners and **temporarily** join the elevators to the stabs with the hinges, adjusting any hinge slots if necessary. **Do not glue in the hinges until you are instructed to do so.**

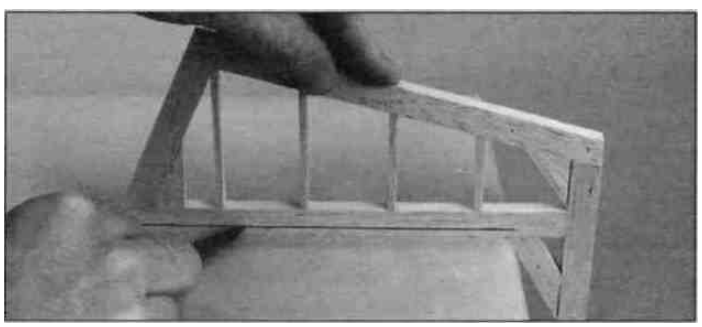
D 5. Return to step 1 and use the same procedure **to** hinge the rudder and fin.

Finish the Tail Surfaces

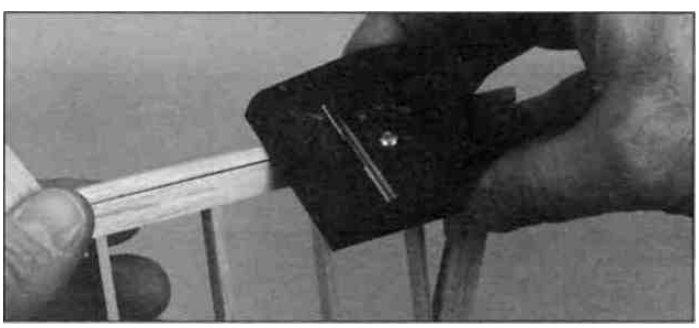
D 1. Refer to the Expert Tip that follows and shape the LE of the elevators and rudder to a "V" shape as shown on the plans.

EXPERT TIP

HOW TO BEVEL THE LEADING EDGE



A. Place the leading edge of one of the elevators on your work surface and use your ballpoint pen to mark a "bevel to" line on both sides about 1/8" high.

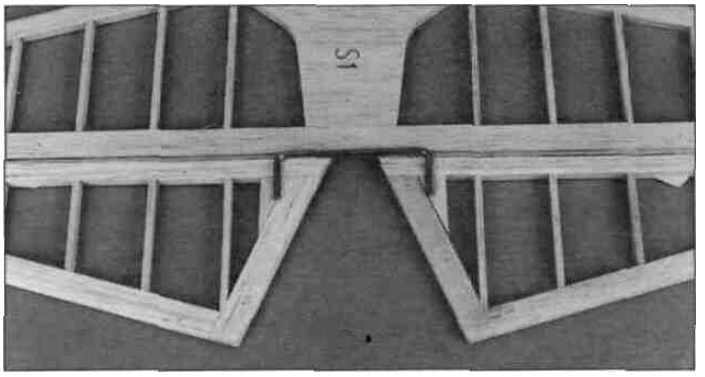


B. Using the bevel to lines and the centerline as a guide, make the "V" on the leading edge of the elevators with a razor plane or your bar sander.

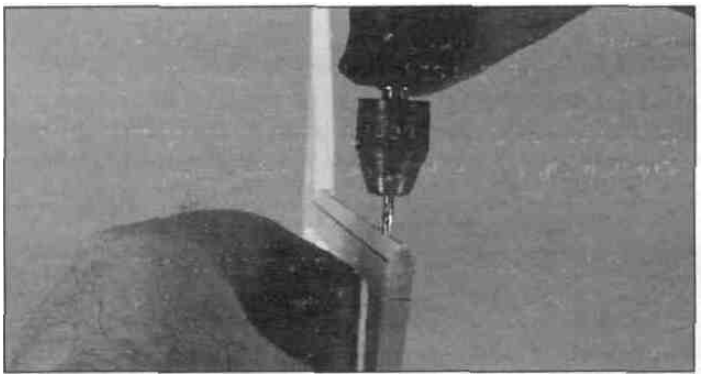
D 2. Use the same procedure to bevel the leading edge of the rudder.

D 3 Draw a centerline on the LE of the stab and fin and on the TE and tip of the elevators and rudder Sand a radius on the edges as shown on the plan using the centerline as a guide to keep the radius symmetrical Do **not** round the TE of the stab or fin.

Fit the Torque Rods



D 1 Position the stab and elevators over the fuselage top view Mark the location of the elevator joiner on the elevators.

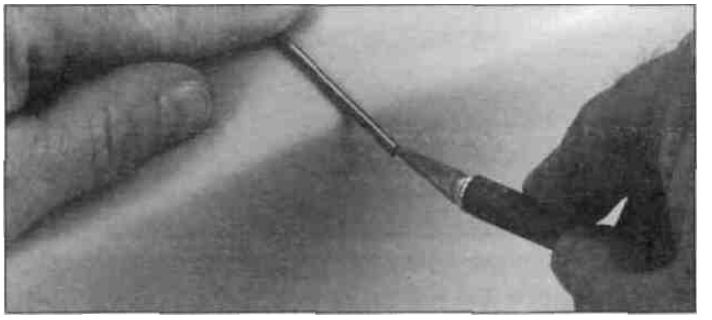


D 2 Drill 3/32" pilot hole into the elevator LE, on the centerline, at the torque rod marks As you drill the holes keep the drill aligned with the top and bottom surfaces of the elevator Enlarge the holes with a 1/8" drill **bit.**

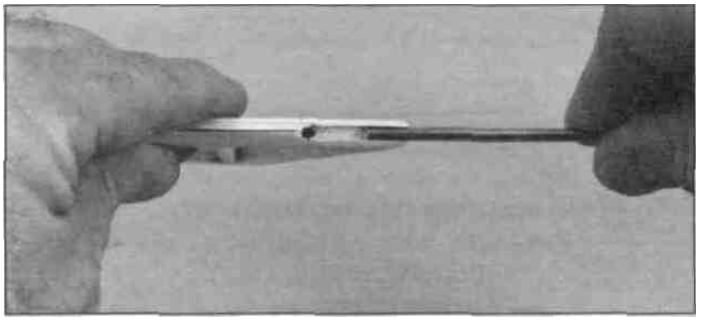
D 3 Cut a 1/8" groove in the leading edge of both elevators to recess the joiner wire (see expert tip that follows) **Do not** glue the joiner wire in position at this time.

EXPERT TIP

HOW TO CUT A GROOVE FOR A TORQUE ROD

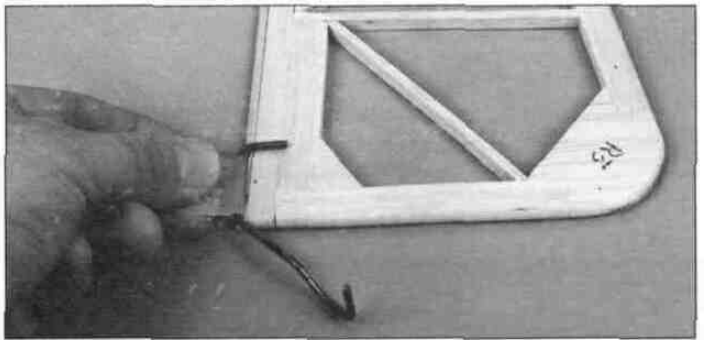


A. Use a hobby knife to sharpen the inside of a piece **of** 1/8" brass tube Roll the tube as you carve the end.



B. Use the sharpened tube to carefully gouge the leading edge You ll have to make several passes to make the recess deep enough for the torque rod.

Install Tailwheel Bracket on Rudder



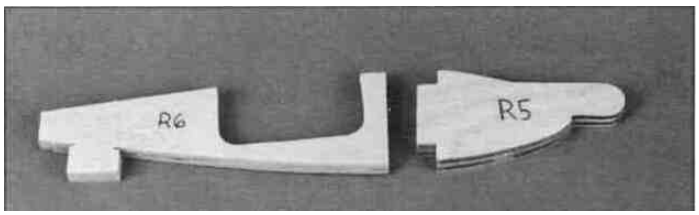
D 1 Position the rudder over the plan and align the **tailwheel bracket** over the rudder Mark the tailwheel bracket "arm" location on the LE of the rudder. Drill a 7/64" hole, 3/4" deep at the mark.

D 2 Cut a groove from the tailwheel bracket hole to the bottom of the rudder that will allow the nylon tailwheel bearing to fit flush with the LE of the rudder **Do not** glue the tailwheel bracket in at this time.

BUILD THE BOTTOM WING

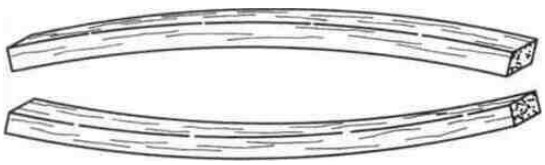
The Ultimate 40 bottom wing is built as one piece.

Wing Preassembly

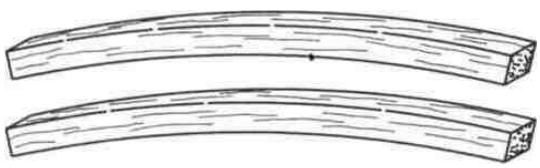


D 1. Use 30-minute epoxy to glue together the die-cut 1/8" plywood ribs **R-5** and **R-6.**

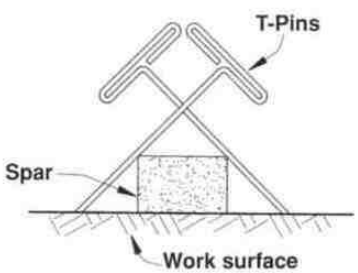
TWO WARPED SPARS INSTALLED THIS WAY WILL RESULT IN A STRAIGHT WING

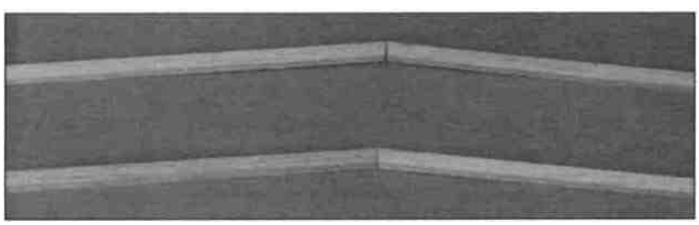


TWO WARPED SPARS INSTALLED THIS WAY WILL RESULT IN A WARPED WING



D 2. Match sets of 1/4" x 3/8" x 24" balsa **wing spars** so any warps will counteract each other.



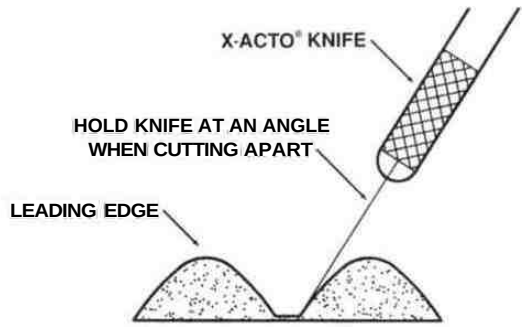


D 3. Trim the end of two main spars to the angle shown on the plan. Use 6-minute epoxy to glue the ends of the main spars together. Before the epoxy cures, use the cross-pinning technique (see sketch above) to pin the main spars against the building board.

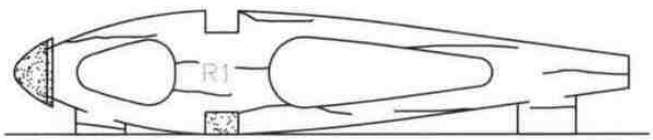
Build the Wing

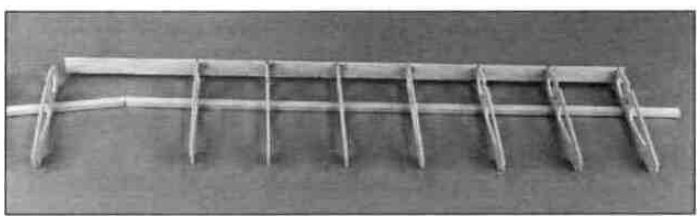
D 1. Pin the die-cut 3/32" balsa ribs **R-1** in position over the main spar.

Note: The jig tabs should be contacting the plan. Use **small** T-pins to pin the **aft jig tabs** to the building board over their location on the plan.

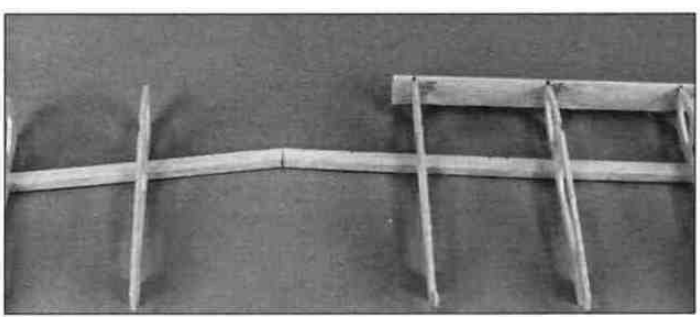


D 2. The shaped and notched balsa wing **LE** and **TE** are fastened together by thin strips of balsa. Separate them by cutting with a hobby knife, as shown in the sketch above.



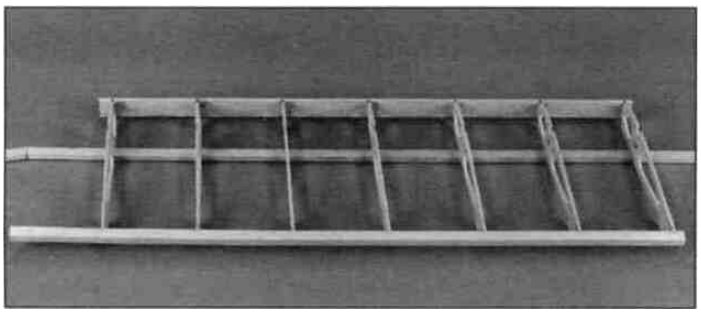


D D 3. Center the LE vertically on the front of the ribs with each rib inserted in its respective notch. Use a straightedge **to** check that the LE is straight before gluing it in position.



D D 4. Cut the LE at the root as shown on the plan. Save the piece you cut off for the wing center section.

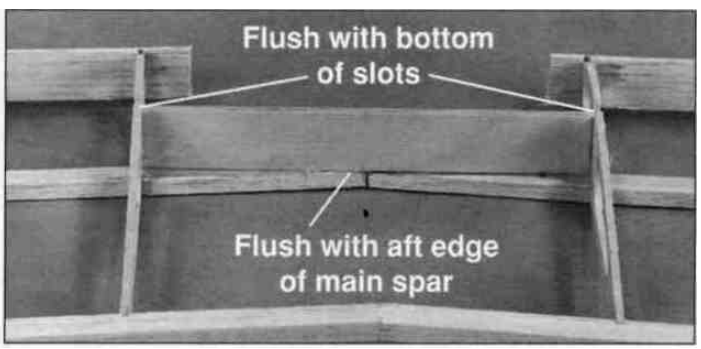
D 5. Repeat the process to install the other LE.



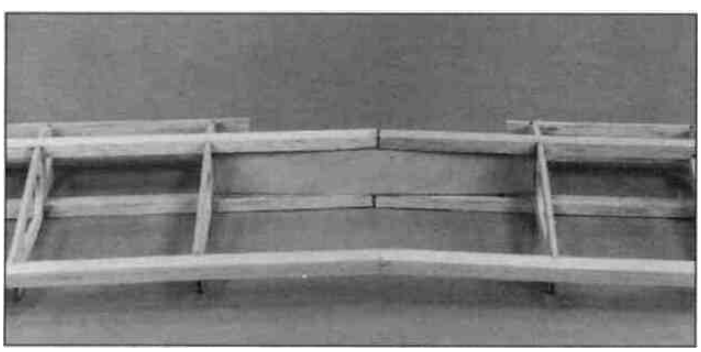
D 6. Position the TE on the aft end of the ribs, flush with the top and bottom edge of the ribs. Use a straightedge to check that the TE is straight before gluing it in position. Trim the root end to match the plan.

D 7. Fit the second TE, trimming the root end to butt against the first TE. Use a straightedge to check that the TE is straight before gluing it in position.

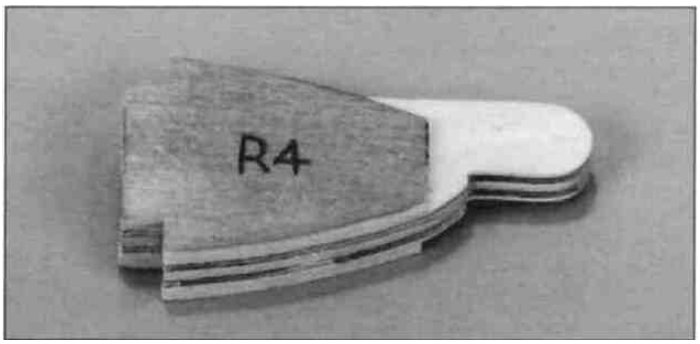
D 8. Glue ribs R-1 to the bottom main spar, perpendicular to the building board.



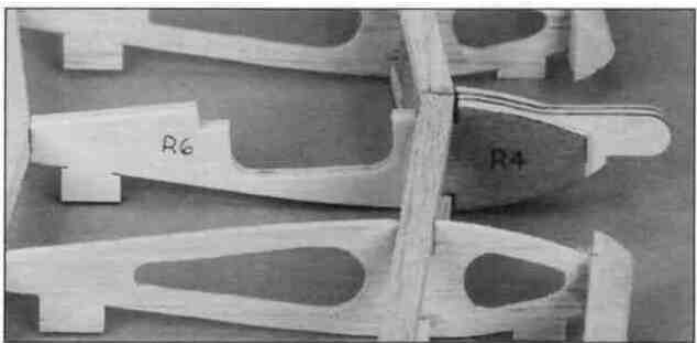
D 9. Use 30-minute epoxy to glue the 1/8" plywood joiner between the R-1 root ribs, perpendicular to the building board. The center of the joiner should be flush to the aft edge of the main spar and the joiner ends should be flush with the forward edge of the main spar. Make sure the top of the joiner is flush with the bottom of the slots for the top main spar.



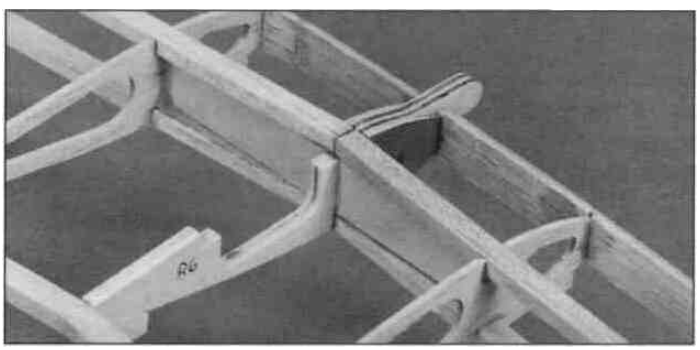
D 10. Use 30-minute epoxy to glue the top spar to the joiner and thin CA to glue the joiner to the ribs. Hold the **spar** in place with a weight until the epoxy cures.



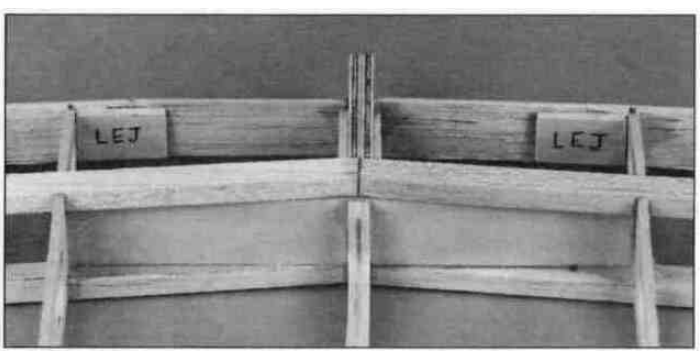
D 11. Glue the die-cut 3/32" balsa ribs **R-4** flush with both sides of R-5.



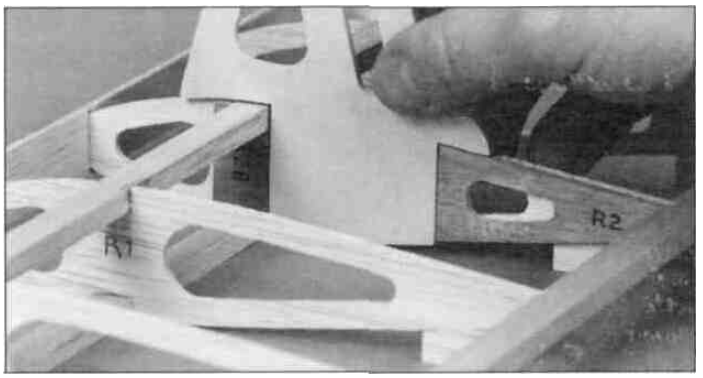
D 12. Use 6-minute epoxy to glue rib R-6 to the joiner and the TE. Make sure that the rib is seated on and perpendicular to the building board. Glue rib R-5 to the front of the joiner and spars, perpendicular to the building board and parallel with the R-1 root ribs.



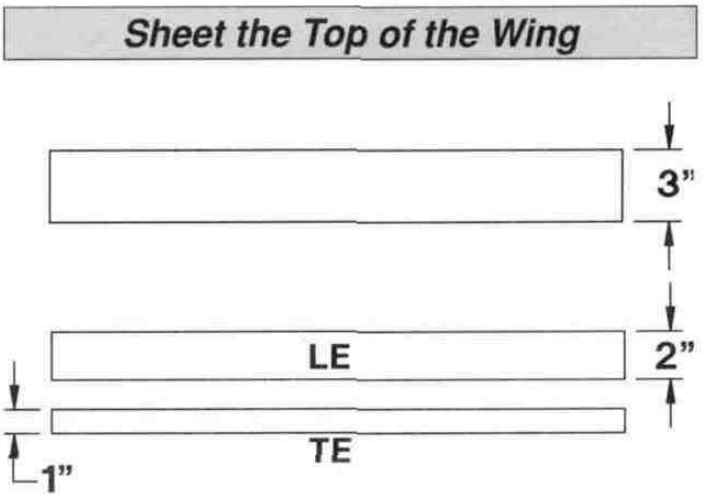
D 13. Trim the leftover LE to fit between ribs R-1 and R-5, centered on the front of ribs R-4. When satisfied with the fit, glue them in place.



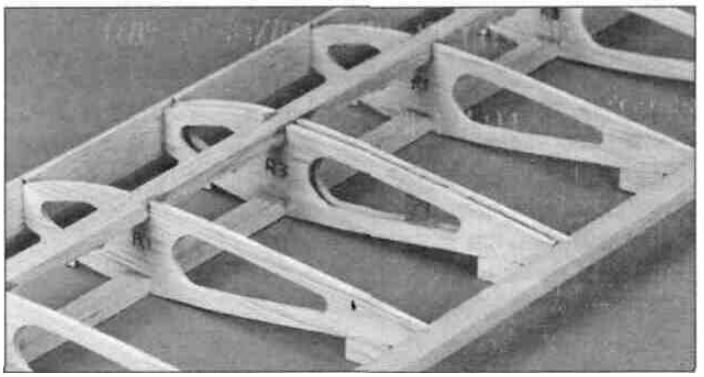
U 14. Use 6-minute epoxy to glue the die-cut 1/8" plywood leading edge joiner (LEJ), centered vertically, across the joint between the center LE and the outer LE.



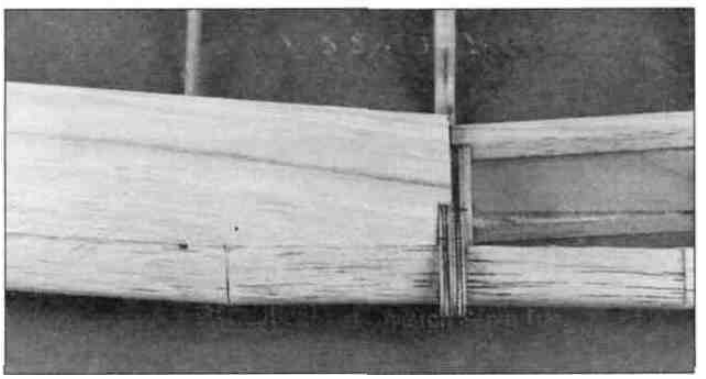
D 15 Test fit the die cut 1/8" plywood ribs R-2A and R-2B in position as shown on the plans Check the fit of the wing strut between R-2A and the wing spars The strut should fit snug but be easy to insert and remove When satisfied with the fit, remove the strut and glue ribs R-2A and R-2B **to R-1.**



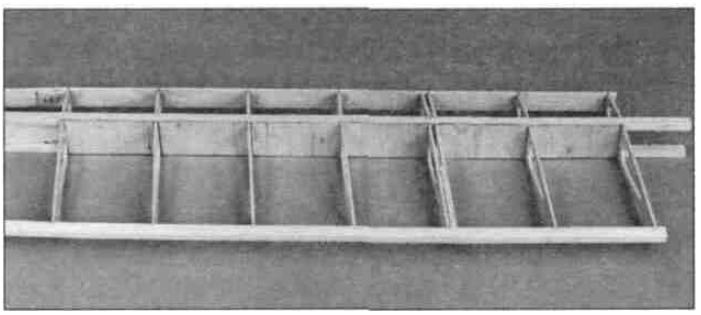
D 1. Cut the 2" **LE** and 1" **TE sheeting** from **eight** 1/16" x 3" x 24" balsa sheets The LE and TE sheets will be used on both wings.



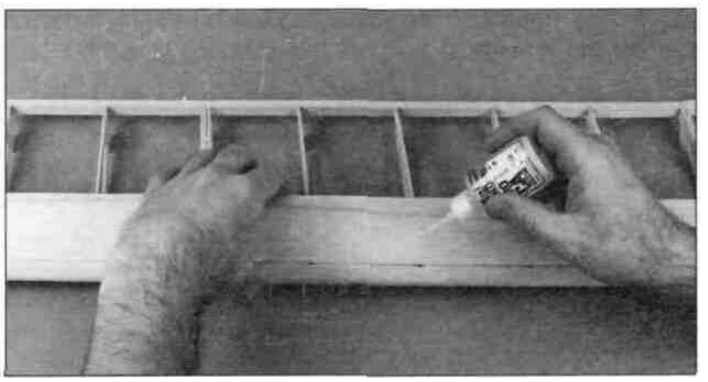
D 16 Insert the die-cut 3/32" balsa rib R-3 between the spars and carefully rotate it into position Glue it to ribs R-2A, R-2B, the wing spars and the LE and TE.



D 2 Test fit the LE wing sheet to one wing panel Sand a slight bevel on the front of the sheet The aft edge of the sheet should cover the forward half of the main spar The root end should cover one R-4 and R-5 rib.



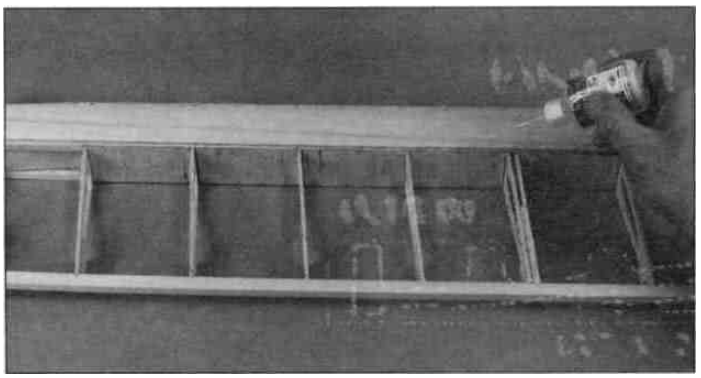
D 17 From a 1/16" x 3" x 24" balsa sheet cut and glue **shear webs,** perpendicular to the aft edge of the main spars The shear webs must be glued securely to the main spars.



D 3 Remove any pins that are holding the wing to the building board in front of the main spar You may need to place weights on the wing to keep the main spars flat against the building board Position the front of the LE sheet against the LE and glue it in position with thin CA.

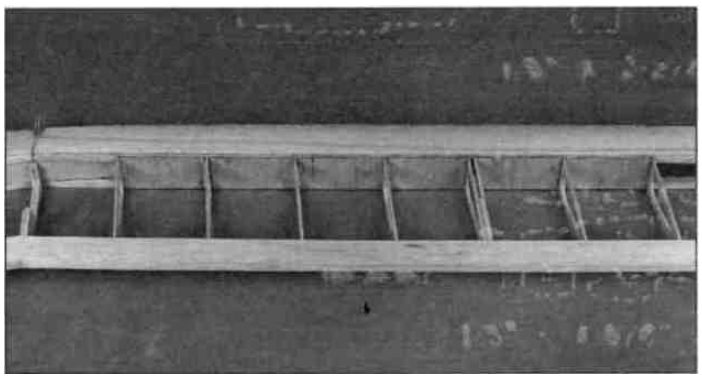
D 4 Carefully lift the sheet away from the ribs and apply a bead of medium or thick CA to the top of the ribs Working quickly, pull the sheet back toward the main spar as **you press** it down against the ribs and the main spar.

D 18 Sand the top of the wing so that the spars, shear webs and TE are flush with the top of the ribs.

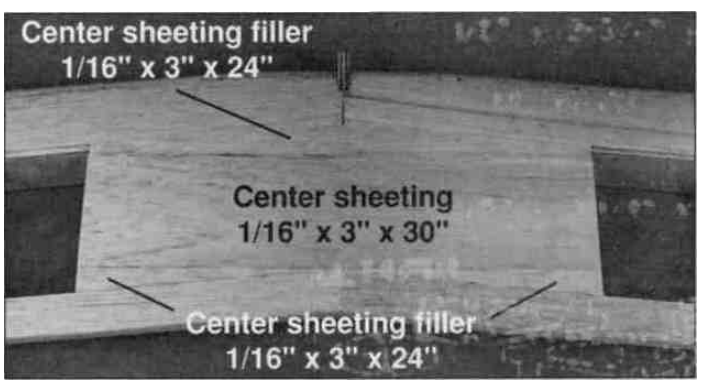


D 5. Use thin CA to glue the LE sheet to the main spar.

D 6. Fit and glue the second LE sheet to the other wing panel, following the same procedure.

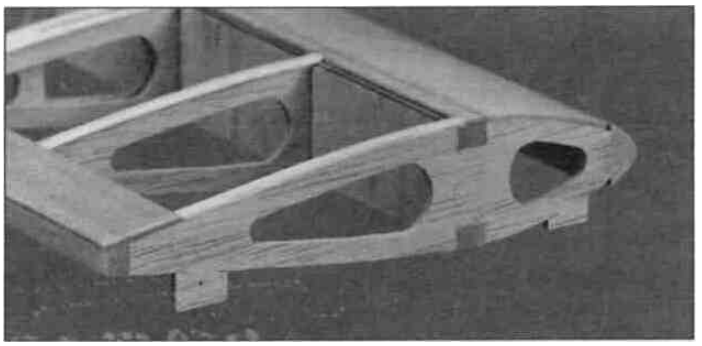


D 7. Glue the 1/16" TE sheet, cut in step 1, to the TE and the top of the ribs



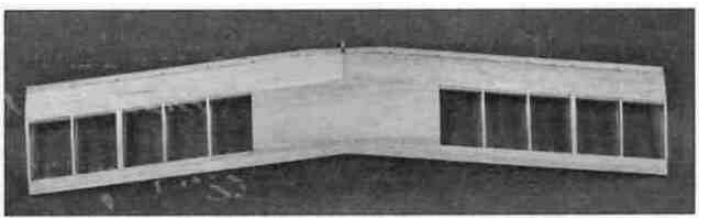
D 8. Use a 1/16" x 3" x 30" balsa sheet to make the **center sheeting** between the LE sheet and the TE sheet. Save the remaining sheeting for the bottom center sheeting. The **center sheeting filler** is made from a 1/16" x 3" x 24" balsa sheet.

Note: See the plans for clarity. Before you glue the center sheeting in position, remove any T-pins from under the sheeting.



D 9. From 1/16" x 3/16" x 30" balsa stick, cut and glue **cap strips** to the top of the R-1 ribs. The edge of the cap strip on the R-1 **tip** rib should be flush with the side of the rib. Use two cap strips, edge-glued at the center of rib R-2A on the double rib, for the strut. Trim the cap strip over the slot for the strut.

Hint: A single-edge razor blade works well for this type of cutting.



D 10. Remove the wing from your building board. Cut and sand the LE, TE, main spars and top sheeting flush with the side of tip rib R-1.

Sheet the Bottom of the Wing

The bottom of the wing is sheeted following the same procedure as the top of the wing.

D 1. Use a hobby knife and sanding bar to remove the jig tabs on the bottom of the ribs. Sand the TE, main spars, shear webs and the top of the ribs to blend them together.

D 2. Cut out the aileron servo opening in the top center sheeting using the aileron servo cutout in rib R-6 as a guide. Make the opening slightly smaller than the servo cutout in the rib. The opening will be enlarged when the servo tray is installed.

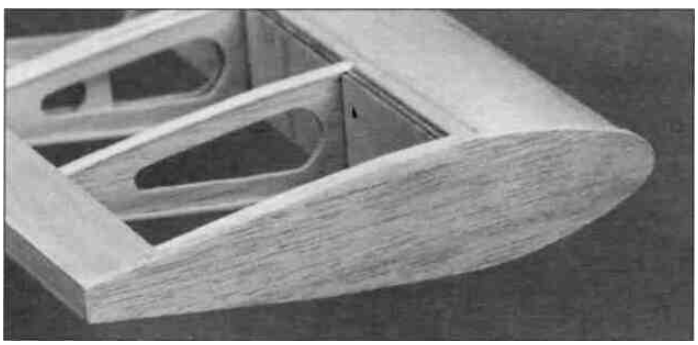
D 3. Position the wing on your building board with the bottom side up. Place weights on the wing to keep the main spars in contact with the building board. Glue the bottom LE sheeting in position following the same procedure used for the top LE sheeting. **Remember,** you previously cut the LE sheeting when you sheeted the top of the wing.

D 4. Glue the 1/16" TE sheet, cut in step 1 of "sheet the top of the wing", to the TE and the bottom of the ribs. Use a leftover piece of balsa sheeting to fill the gap at the center of the LE.

D 5. Use the 1/16" x 3" x 30" and 1/16" x 3" x 24" balsa sheeting, leftover from the top center sheeting, to make the bottom center sheeting between the LE sheet and the TE sheet.

D 6. Test fit the struts in the slots in the top of the wing, making sure they seat against the top wing sheeting. From 1/16" x 3/16" x 30" balsa stick, cut and glue **cap strips** to the top of ribs R-1. The edge of the cap strip on the R-1 tip rib should be flush with the side of the rib. Use two cap strips, edge-glued at the center of rib R-2A on the double rib, for the strut.

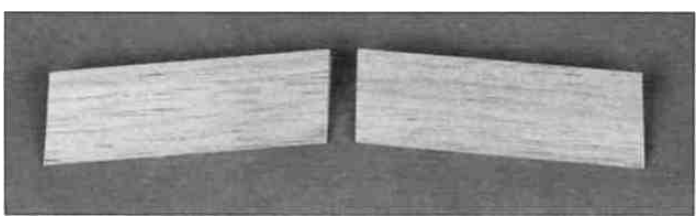
D 7. Trim and sand the LE and TE sheeting flush with the side of tip rib R-1.



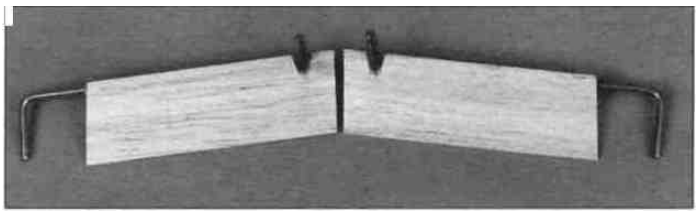
D 8. Make the wing tips from a 1/8" x 3" x 18" balsa sheet. Hold the sheet against tip rib R-1 and draw an outline of the rib. Cut and glue the wing tips to tip ribs R-1.

Complete the Bottom Wing

D 1. Sand the TE sheet flush with the aft edge of the TE.

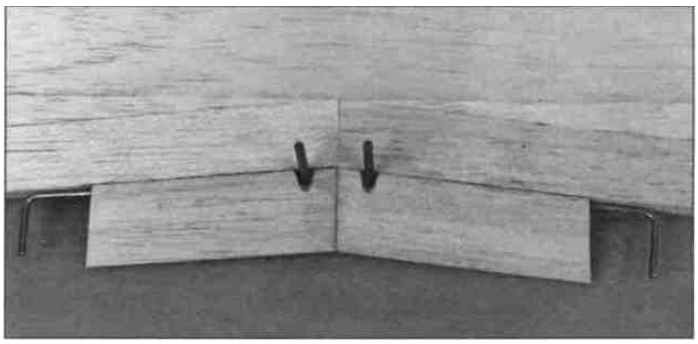


D 2. Position the tapered and grooved 1-1/4" x 4-1/2" balsa **wing center TE** pieces over the plan. Trim the root ends to match the angle shown on the plan. Test fit the center TE on the TE of the wing.

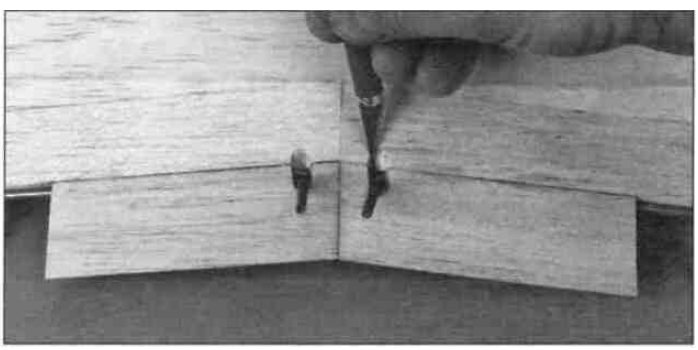


D 3. Mark the location of the aileron torque rod exits. Cut a notch in the **top LE** of both pieces as shown.

Note; Be sure you make a right and left piece.

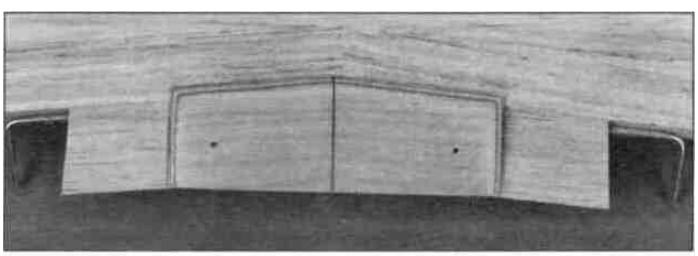


D 4. Roughen both torque rod tubes with coarse sandpaper and apply a dab of petroleum jelly to the exposed wire. Use **30-minute epoxy** to glue the torque rod tubes in the slot at the front of the center TE pieces. Before the epoxy cures, glue the center TE pieces to the TE of the wing. Wipe off any excess epoxy with a paper towel dampened with isopropyi rubbing alcohol. Hold the center TE pieces in place with masking tape until the epoxy cures.



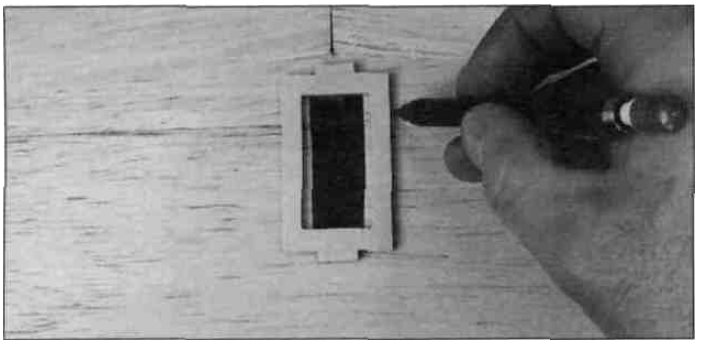
D 5. Extend the torque rod exit slots into the TE of the wing.

D 6. Sand the center TE flush with the top and bottom TE sheeting.

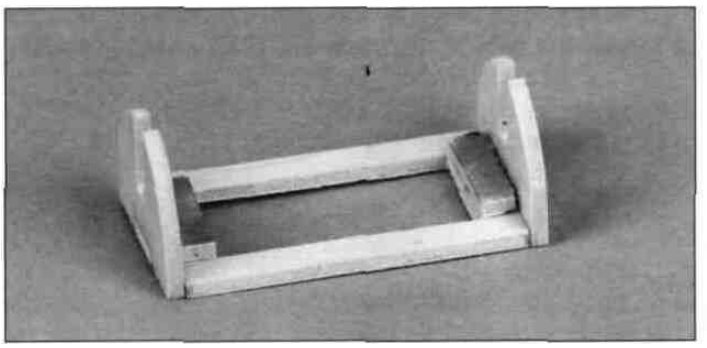


D 7. Draw a centerline on the die-cut 1/16" birch plywood **wing bolt plate.** Sand a bevel on the **front** and **sides of**

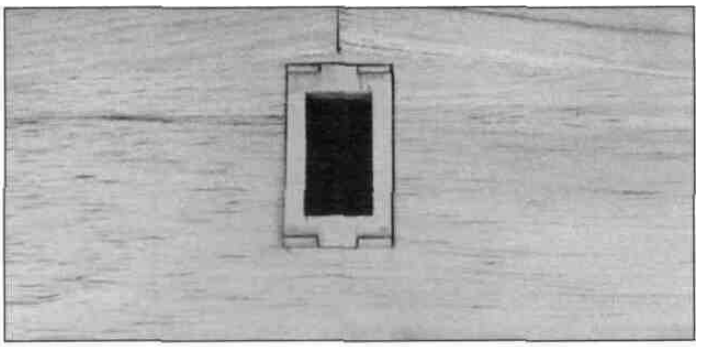
the wing plate. Leave the aft edge of the wing bolt plate square Use 30-mmute epoxy to glue the wing bolt plate to the bottom of the wing, centered on the **center TE** The aft corners of the wing bolt plate are flush with the aft end of the center TE. Use clamps or weights to hold the wing bolt plate tight against the wing.



D 8. Trim the opening for the aileron servo tray until you can see the aileron servo cutout in ribs R-6 Center the die-cut 1/8" plywood **aileron servo tray** over the cutout (save the tray doublers die-cut inside the servo tray) Mark the outside perimeter of the tray and cut the wing sheeting from inside these lines.

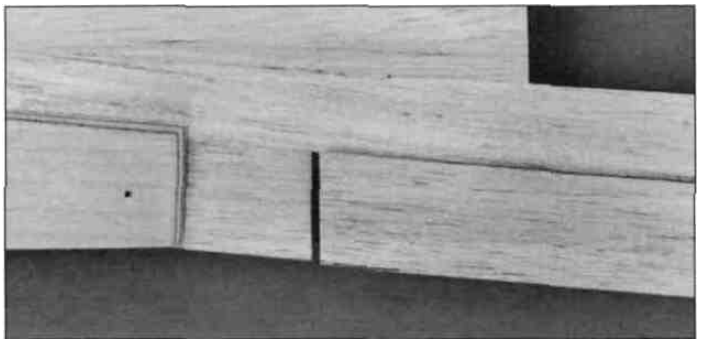


D 9. Glue the die-cut 1/8" plywood **aileron servo tray supports** to the ends of the aileron servo tray, perpendicular to the tray Glue the tray doublers to the bottom of the aileron servo tray.



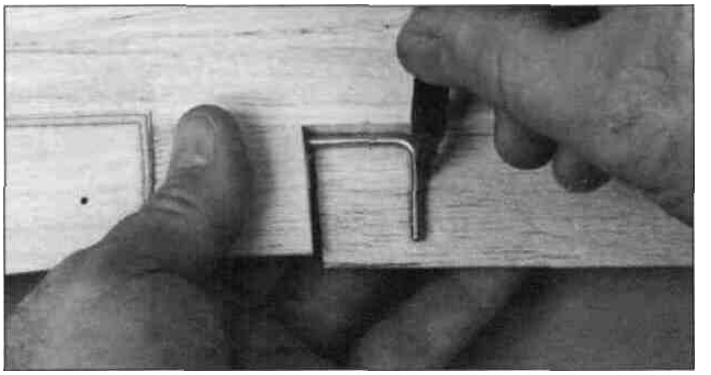
D 10. Glue the servo tray to ribs R-6

Build the Ailerons



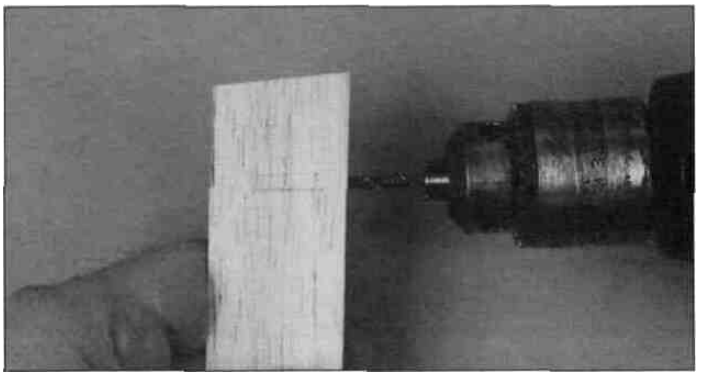
D D 1 Trim one end of the 1-1/4" x 24" balsa aileron to the same angle as the center TE.

D D 2. With a gap of 1/16" between the aileron and the center TE, cut the end of the aileron approximately 1/16" past the wing tip This will allow you to sand the aileron flush with the wing tip.



D D 3 Place the left aileron on the trailing edge of the wing and mark the location of the torque rod.

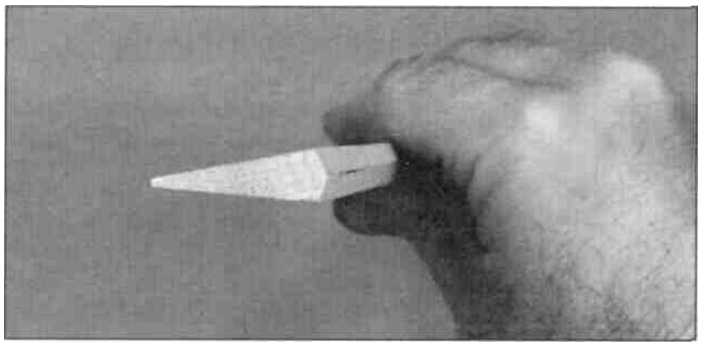
D D 4. Draw a centerline on the LE of the aileron.



D D 5. Drill a 1/8" hole on the centerline for the aileron torque rod Use a sharpened 1/8" brass tube to cut a groove in the LE for the aileron torque rod.

D D 6. Use the leftover hinge material, cut four aileron hinges.

D D 7. Mark the location for the hinges on the aileron and wing. Cut the hinge slots and **without using glue,** test fit the aileron on the wing.



D D 8. Remove the aileron from the wing. Mark the "bevel to" lines and sand the LE of the aileron to a "V" as shown on the plan.

D 9. Perform steps 1 through 7 to fit the second aileron onto the wing.

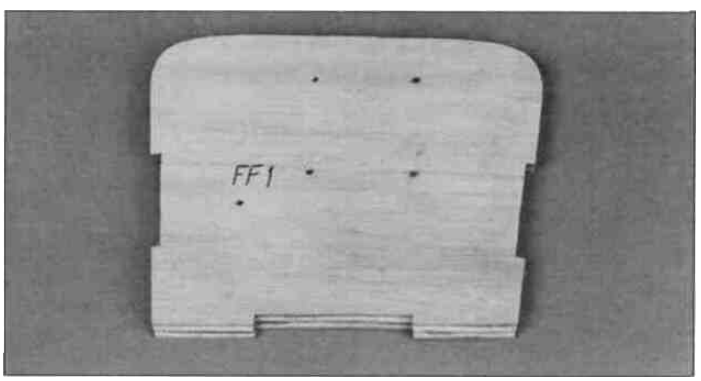
Great looking wing! Guess what? You still have to build the top wing.

BUILD THE FUSELAGE

We will build the fuselage next. It will be needed when you assemble the top wing.

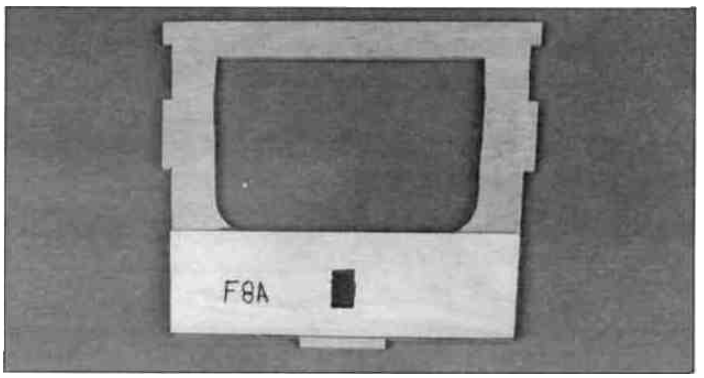
Fuselage Preassembly

Completely read this section on *Fuselage Preassembly* and test fit all the parts. These parts require the strength and working time of **30-minute** epoxy glue. This extra working time will allow you to assemble most of the parts at once.

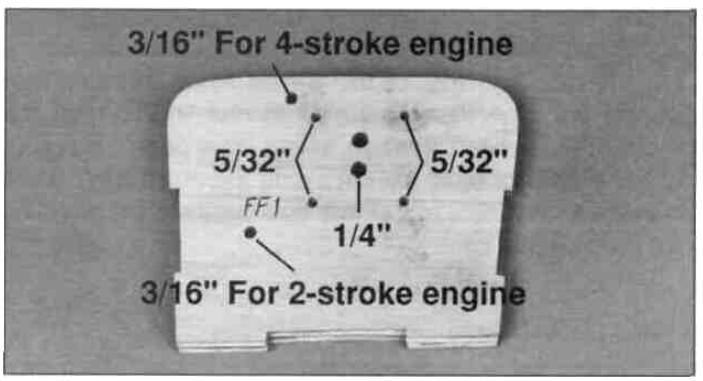


D 1. Glue the three die-cut 1/8" ply firewall formers **FF-1, FF-2** and **FF-3** together. Former FF-2 must be sandwiched between FF-1 and FF-3. Make sure that the embossed label on each former is facing **forward** and the top and side edges are aligned. The bottom edges will be offset. Wipe off any excess epoxy before it cures.

Note: If the formers are warped, clamping them together will not remove the warp. It is best to clamp them to a flat table or board.

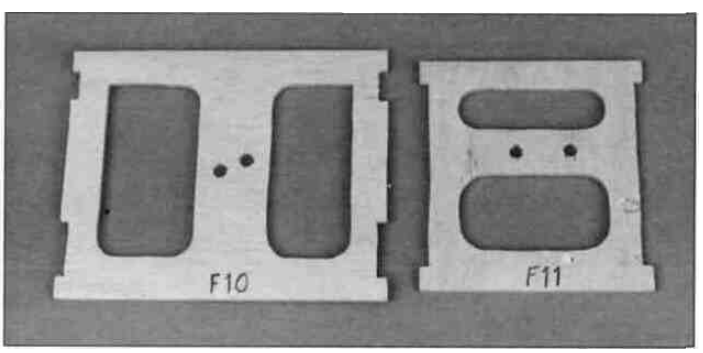


D 2. Glue the die-cut 1/16" birch plywood F-8A doubler to the front of the die-cut 1/8" plywood former **F-8B.** Make sure the slots in F-8A and F-8B are aligned.

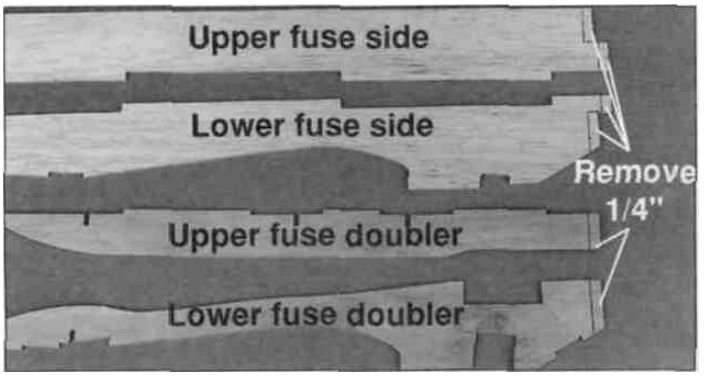


D 3. After the epoxy has cured, drill 5/32" holes at the four engine mount punch marks. Drill a 3/16" hole for the throttle pushrod at the appropriate location. Drill two 1/4" fuel line holes in the center of the engine mount holes.

D 4. Press four **6-32 blind nuts** into the holes from the back of the firewall. Tap the blind nuts with a hammer to fully seat them and apply a few drops of thin CA around each blind nut to secure them in position.

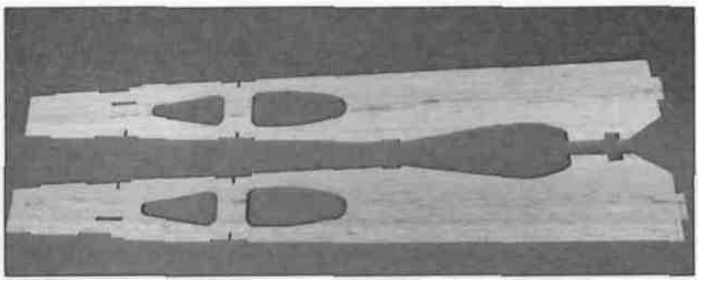


D 5. Drill 3/16" holes at the punch marks in the die-cut 1/8" plywood fuselage formers **F-10** and **F-11.**



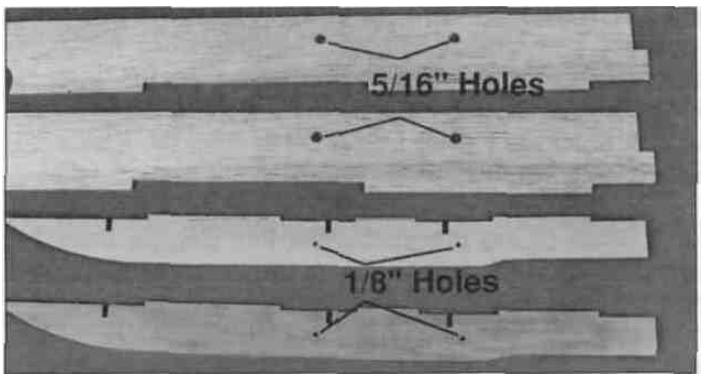
D 6. Cut 1/4" from the front of one die-cut 1/8" balsa **lower fuse side,** one **upper fuse side,** one die-cut 1/8" plywood **lower fuse doubler** and one **upper fuse doubler.** Mark each of these parts **right side.**

Assemble the Fuselage Sides

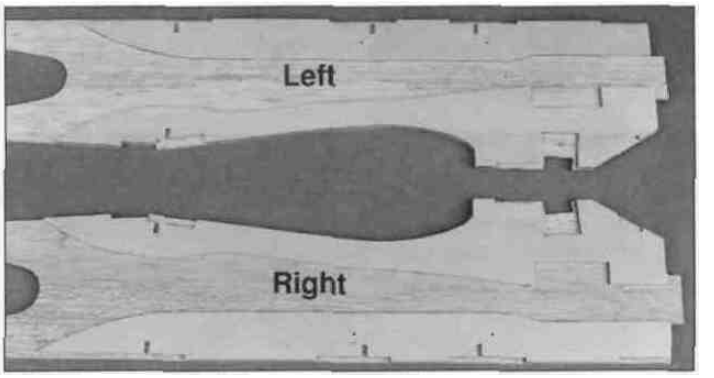


D 1. Build two fuse sides by gluing together the balsa lower and upper fuse sides. Make sure to glue the two **right side** pieces together.

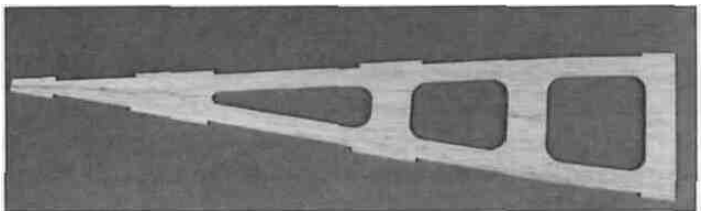
D 2. Sand the fuse sides smooth.



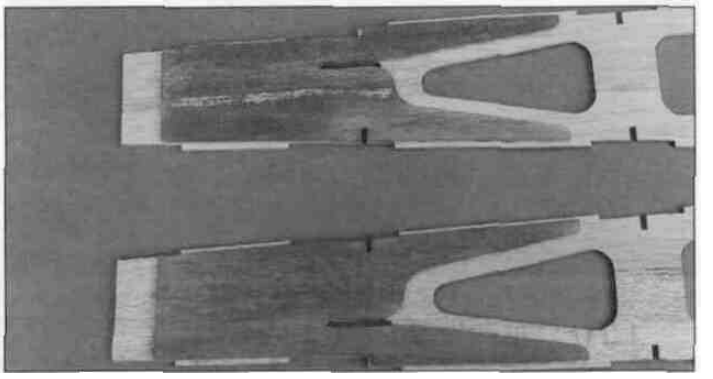
D 7. Drill 1/8" holes at the punch marks on the upper fuse doublers. Drill 5/16" holes at the punch marks on the upper fuse sides.



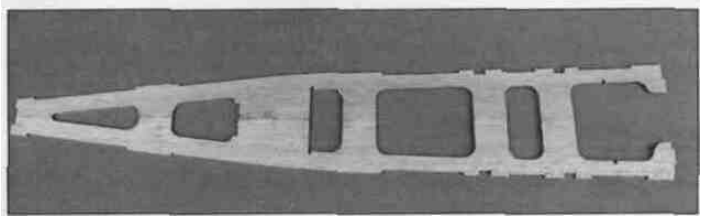
D 3. Caution: Make sure to glue the right side doublers to the right side fuse. Position the fuse sides next to each other as shown. Glue the die-cut 1/8" **lower fuse doublers** to the fuse sides, aligning the edges of the **wing saddle** and the **forward edges.** Glue the die-cut 1/8" **top fuse doublers** to the fuse sides, aligning the **top** and **front** edges.



D 8. Glue the die-cut 1/8" balsa **aft fuse bottom** together.



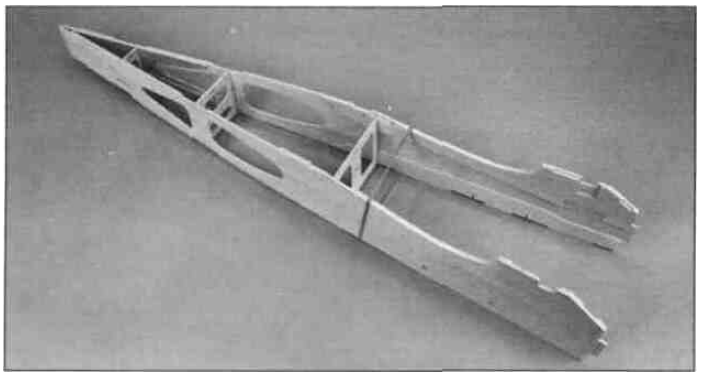
D 4. Glue the die-cut 1/8" balsa **aft fuse doubler** to the aft fuse sides. Align the **notch** and **the pushrod exit slot.**



D 9. Glue the die-cut 1/8" balsa fuse **top deck** together.

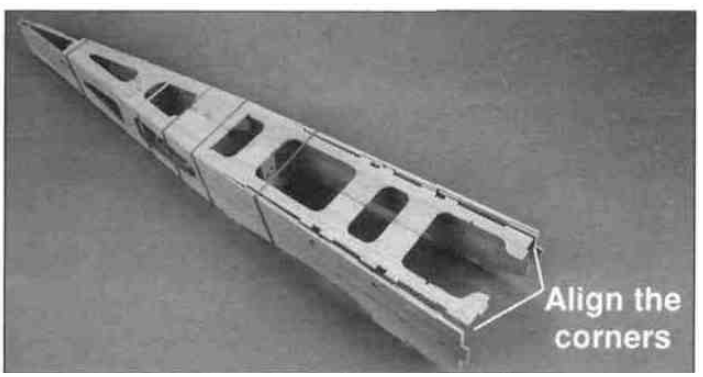
Install the Formers

Important: Install all formers with the **embossed lettering facing the nose** of the fuse. Do not glue the fuse together until instructed to.



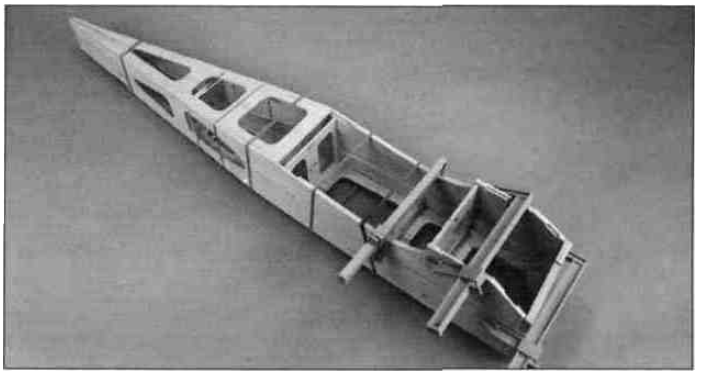
D 1. Insert die-cut 1/8" plywood formers **F-10, F-11** and **F-12** into their appropriate slots in the fuse sides. Make sure the modified **right fuse side** is on the right side. Use rubber bands placed around the fuselage sides to hold the formers in place.

D 2. Install the aft fuse bottom.



D 3. Install the fuse top deck.

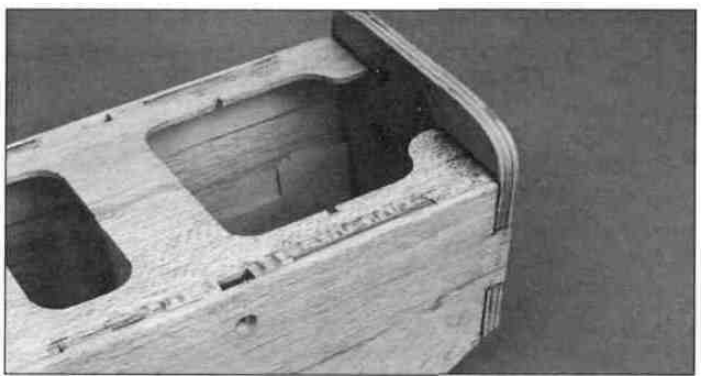
Note: The front of the top deck is angled to build right thrust in the firewall. Use rubber bands to temporarily hold the tail section together.



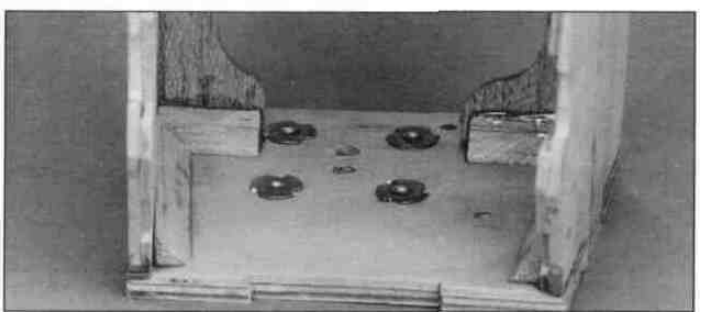
D 4. Install the die-cut 1/8" plywood formers F-9, **F-8A/B** and the **firewall** as you pull the fuse sides together. You may need to use clamps, placed along the bottom of the fuse, along with rubber bands to hold the sides together.

D 5. Align the fuse over the bottom view of the fuse plan with the firewall hanging over the edge of the building board. With the formers perpendicular to your building board, use thin CA to **glue** formers F-12 thru F-8A/B to the fuse sides, top deck and aft fuse bottom. The fuse sides should be perpendicular to the building board from the tail to former F-10. At F-10 the bottom of the fuse starts to taper in. The bottom of former F-8A/B is glued flush with the front of the wing saddle. **Do not** glue the firewall at this time.

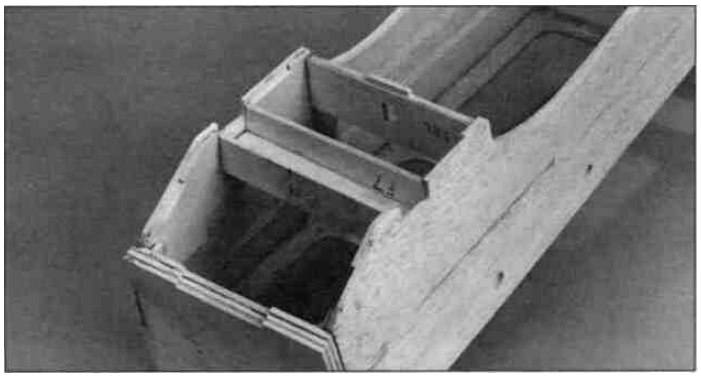
D 6. After gluing the joints with thin CA, go back and reinforce all joints with medium CA. After the CA cures, remove the rubber bands and clamps.



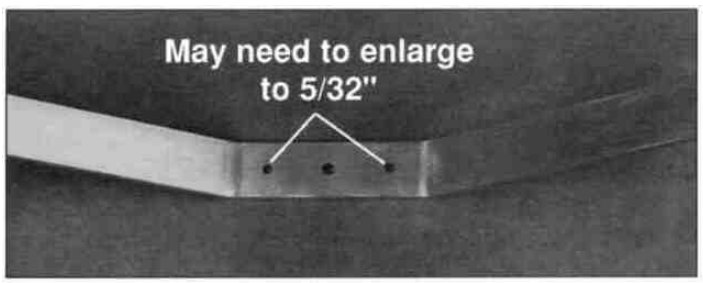
D 7. With the fuse still positioned over the fuse plan bottom view, use 30-minute epoxy to glue the firewall to the fuse sides.



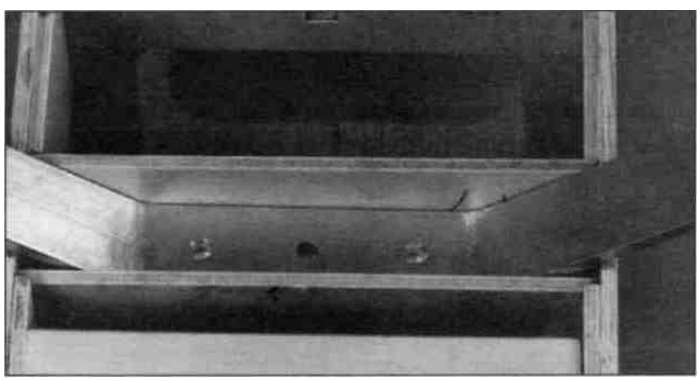
D 8. Use 6-minute epoxy to glue 3/8" balsa triangle sticks to the joints between the fuse sides, the top deck and the firewall.



D 9. Fit the die-cut 1/8" plywood landing gear braces **F-4,** F-7 and the 1/4" plywood **landing gear plate** in the fuse sides. Use 6-minute epoxy to glue the braces and plate in position.

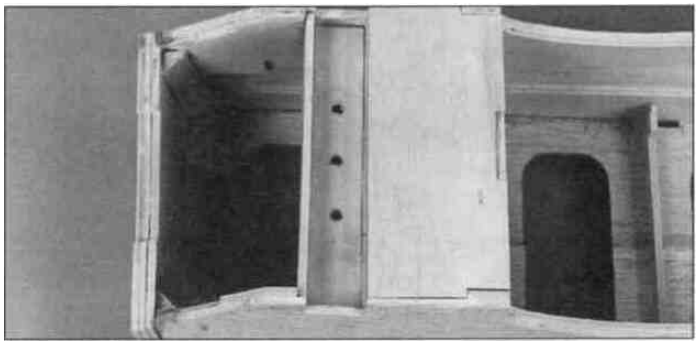


U 10. The two outer holes in the aluminum **landing gear** may need to be enlarged to 5/32".

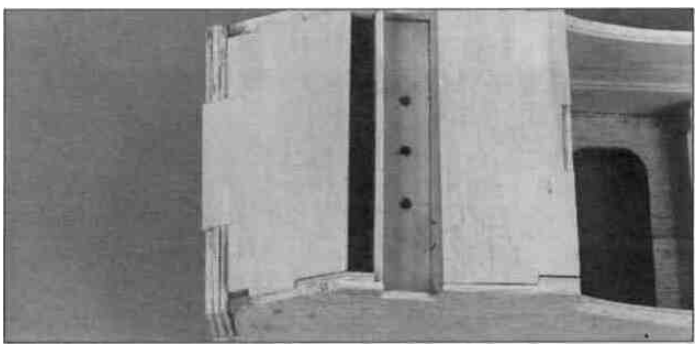


D 11. Center the landing gear on the shaped 1/4" plywood **landing gear plate** and mark the three mounting holes. Remove the landing gear and drill 5/32" holes through the plate at the marks.

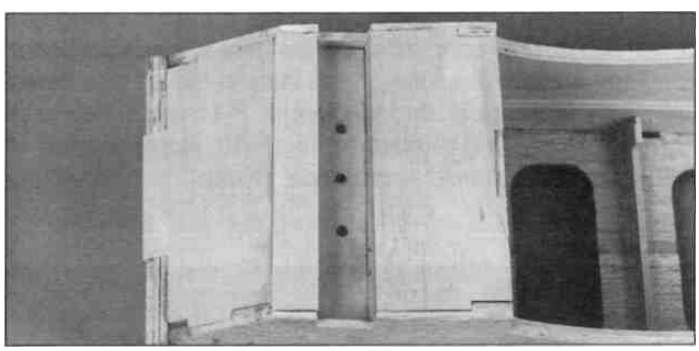
D 12. Place the landing gear on the landing gear plate. Insert **6-32 x 1/2" cap head screws** with #6 **washers** through the landing gear and landing gear plate. Thread a 6-32 blind nut on the cap head screw from the back side of the landing gear plate. Screw the cap head screw into the blind nut pulling it into the landing gear plate. Apply a few drops of thin CA around each blind nut flange to secure them in position.



D 13. Remove the landing gear. Use 6-minute epoxy to glue the die-cut 1/8" plywood **landing gear back plate (FB-3)** to the fuse sides, F-7 and F-8A/B.



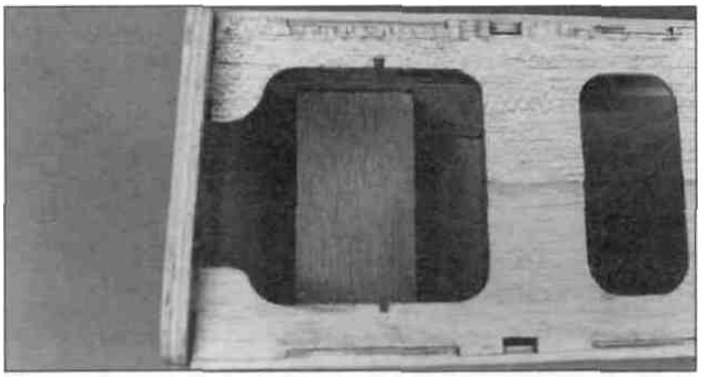
D 14. Trim the angled notch in the bottom of the firewall so that the die-cut 1/8" plywood **forward bottom plate (FB-1)** fits flush with the fuse sides. Use 6-minute epoxy to glue the plate in place and to make a fillet between the firewall and the plate on the inside of the fuse.



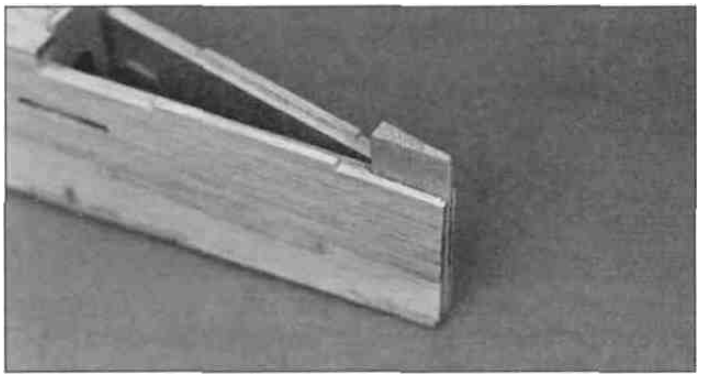
D 15. Sand the bottom edge of the forward bottom plate flush with the lower fuse doublers and former F-4. Use 6-minute epoxy to glue the die-cut 1/8" plywood **landing gear front plate** (FB-2) to F-4, the lower fuse doublers and the forward bottom plate. The back edge of the front plate should be flush with F-4.

D 16. Sand the landing gear front plate flush with the forward bottom plate. Sand the fuse sides and the forward bottom plate flush with the firewall.

D 17. Now is the best time to fuelproof the fuel tank compartment. Use fuelproof model paint, 30-minute epoxy thinned with alcohol or finishing resin to coat the compartment. Do not get paint or epoxy on the threads of the blind nuts. Also fuelproof one side and the edges of the fuel tank floor.

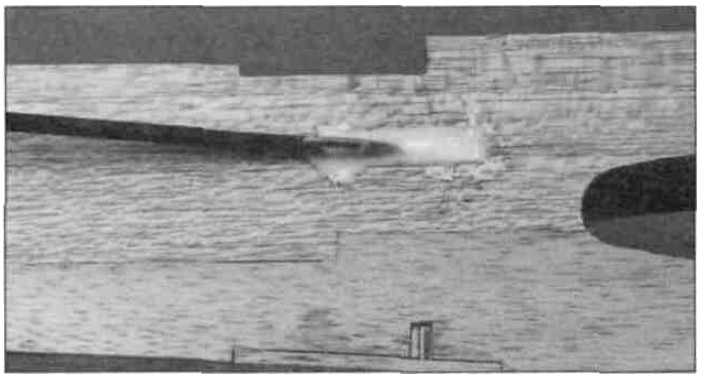


D 18. Use 6-minute epoxy to glue the fuel tank floor, fuelproofed side down, into the notches in the lower fuse doubler. After the epoxy has cured, fuelproof the top of the tank floor.



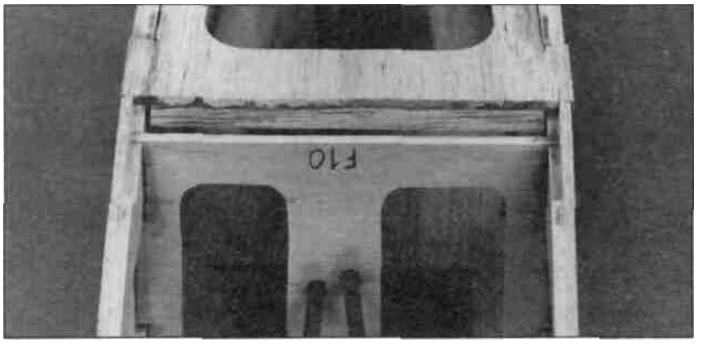
D 19. Glue the shaped balsa tapered **tail wedge** in position where the aft fuse sides meet.

D 20. Carefully sand the outside of the **plastic outer guide tubes** with coarse sandpaper so the glue will adhere better. Install the guide tubes through the slots in the aft fuse sides. The guide tubes pass through former F-11 and cross each other before passing through former F-10. Approximately 7" of the guide tube should protrude past F-10.

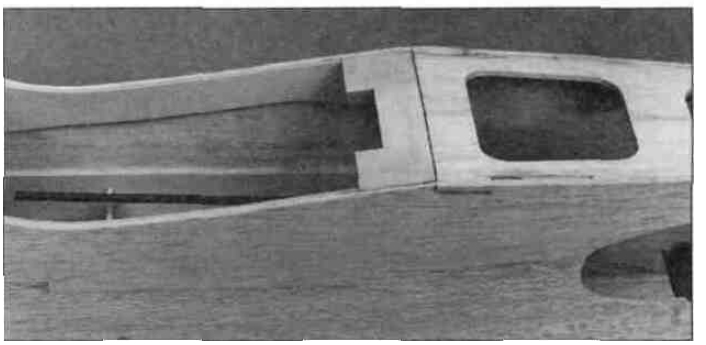


D 21. Glue the guide tubes to the formers with medium CA. Glue the guide tubes to the exit slots with a 50/50 mixture of microballoons and epoxy. Completely fill the slots with the mixture. After the epoxy cures, cut off the excess guide tube and sand the tube and epoxy flush with the fuse sides. Save the excess guide tube for use later.

Note: Talcum powder may be substituted for microballoons.



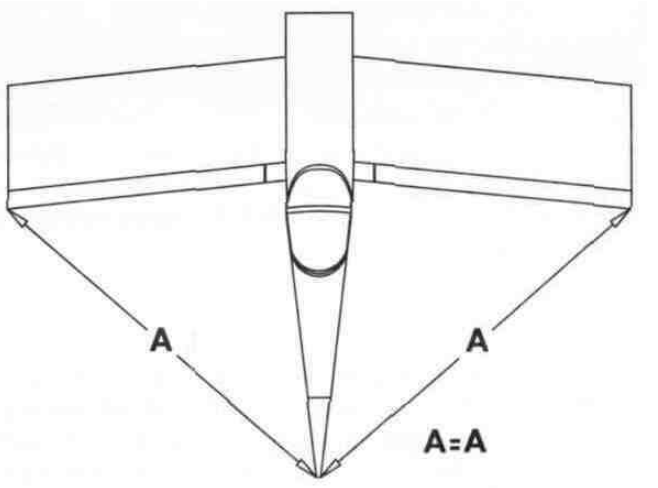
D 22. Glue a piece of 1/8" x 1/4" balsa stick under the forward edge of the bottom deck.



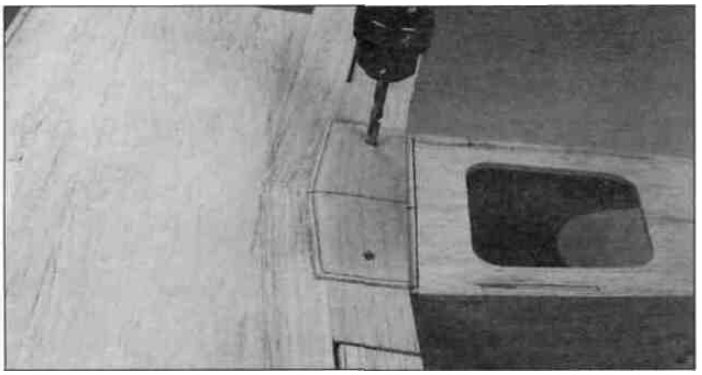
D 23. Use 30-minute epoxy to glue the shaped 1/4" plywood **wing bolt plate** to the fuse sides, lower fuse doublers and former F-10.

Mount the Wing on the Fuselage

D 1. With the fuselage upside-down in a foam cradle, fit the wing in the wing saddle. The wing dowel should slide easily into the slot in F-8A/B. Carefully sand the wing saddle to eliminate any gaps between the wing and fuse.



D 2. Visually center the wing on the fuselage. Check that the wing tips measure the same distance from the center of the tail and tape the wing in position.

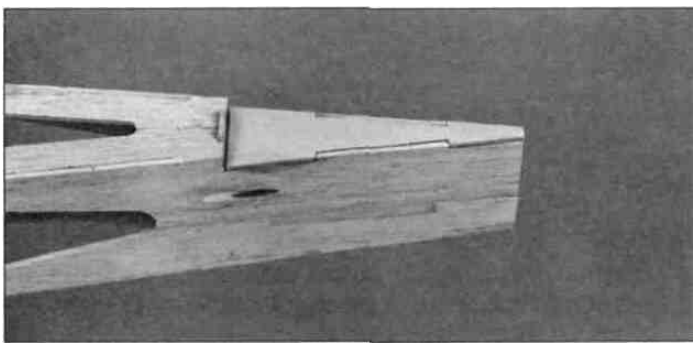


D 3. With the wing in position, drill a 13/64" hole at each punch mark on the wing bolt plate. The hole must extend through the wing and wing bolt plate, perpendicular to the bottom surface of the wing. **Do not** allow the wing to move out of position while drilling these holes.

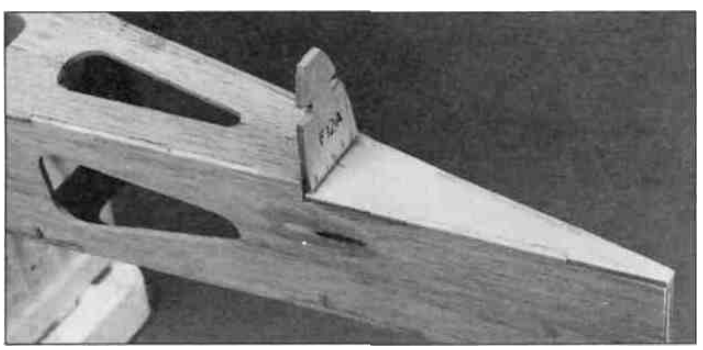
D 4. Remove the wing and enlarge the holes in **only** the wing with a 1/4" drill.

D 5. Tap the holes in the wing bolt plate with a 1/4-20 tap. Apply a few drops of thin CA to the threads in the wing bolt plate. After the CA cures, screw the tap back through the holes to clean up the threads. Bolt the wing to the fuselage with two **1/4-20 nylon wing bolts** and leave it in place for the next few steps.

Install the Stabilizer & Fin



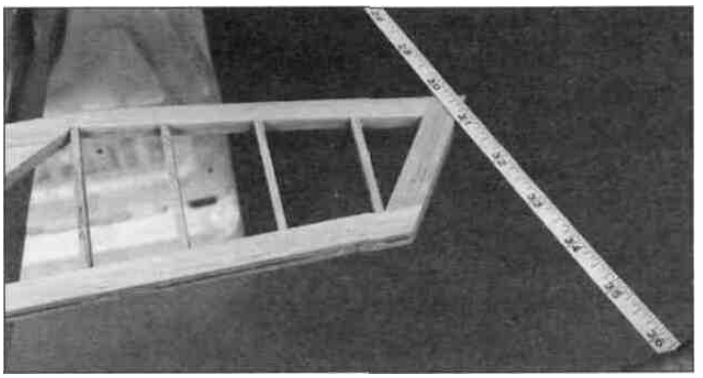
D 1. Trim the tail wedge flush with the fuse sides. Use 30-minute epoxy to glue the die-cut 1/8" plywood **stab plate** to the fuselage sides and the tail wedge.



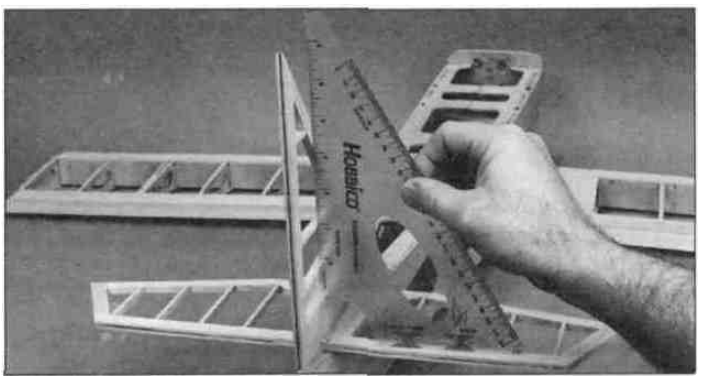
D 2. Glue the die-cut 1/8" balsa former **F-12A** centered on the front of the stab plate, perpendicular to the plate.

D 3. Final sand the stab and fin.

D 4. Draw an accurate centerline on the top of the stab, perpendicular to the stab TE.



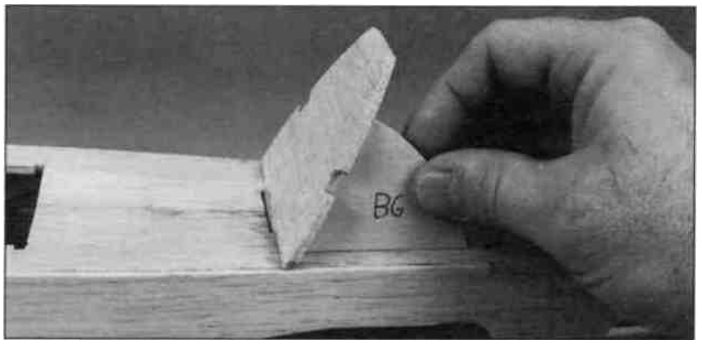
D 5. Center the stab on the stab plate using the centerline you drew in step #4. Study the aft end of the structure from 8-10 feet back. If the stab tips are not equidistant **above** the wing, carefully sand the **high** side of the stab plate until the stab is aligned. Check that the stab tips measure the same distance from the center of the firewall. Draw alignment marks on the bottom of the stab. Remove the stab and apply 30-minute epoxy to the stab plate and the bottom of the stab between the align marks. Place the stab back on the stab plate and recheck its alignment. Hold the stab in position with weights or clamps until the epoxy cures.



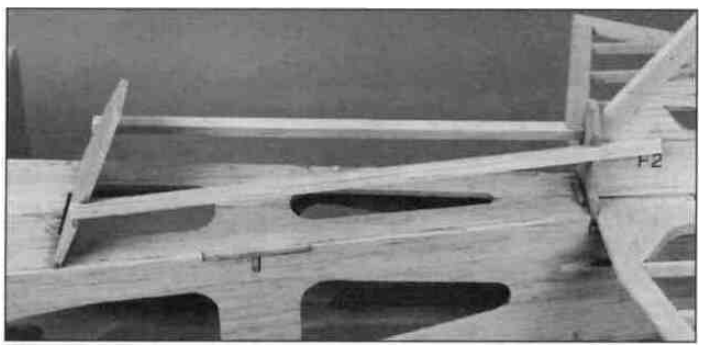
D 6. Place the fin over the fin plan and mark a turtle deck top line on both sides of the lower 1/4" x 1/2" balsa cross member. Use 30-minute epoxy to glue the fin along the centerline of the stab and the back of former F-12A. Use T-pins at the base of the fin to hold it in place. Use masking tape from the top of the fin to the stab to hold the fin perpendicular to the stab until the epoxy cures.

D 7. Remove the bottom wing until after the fuselage is completely assembled.

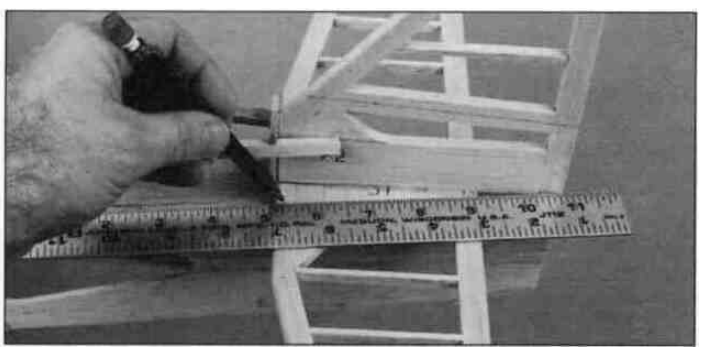
Assemble the Turtledeck



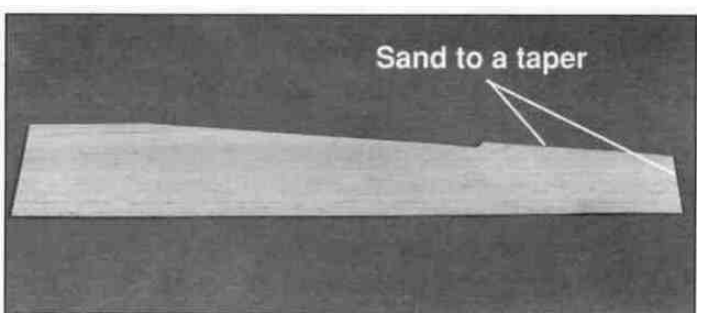
D 1. Use the die-cut 1/8" plywood backrest gauge to set the angle of the backrest. Sand the bottom edge of the backrest to match the top deck and glue the backrest in position.



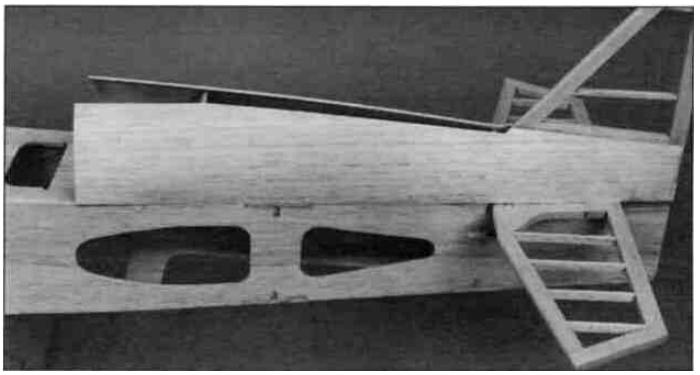
D 2. From the 1/4" x 1/4" x 24" balsa stick, cut and glue stringers to fit from the notches in the backrest to the fin.



D 3. Draw a line on the top of the stab from the fuse side to the TE of the fin.

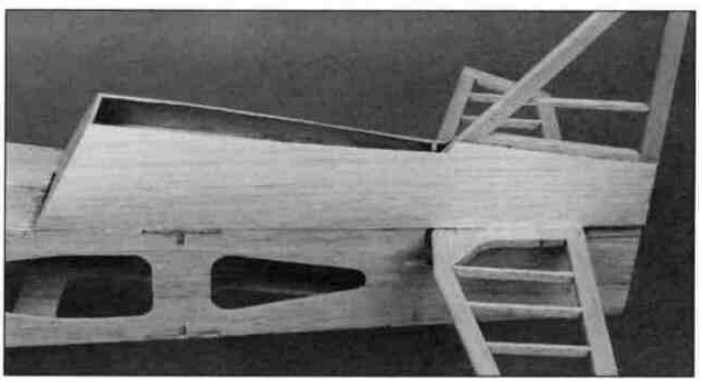


D 4. Use the turtledeck template on the fuse plans as a guide to cut the **turtledeck** sheeting from 3/32" x 3" x 24" balsa sheets. Taper the sheeting at the aft end and the top edge in the fin area so that the sheeting will fit flush with the fin.

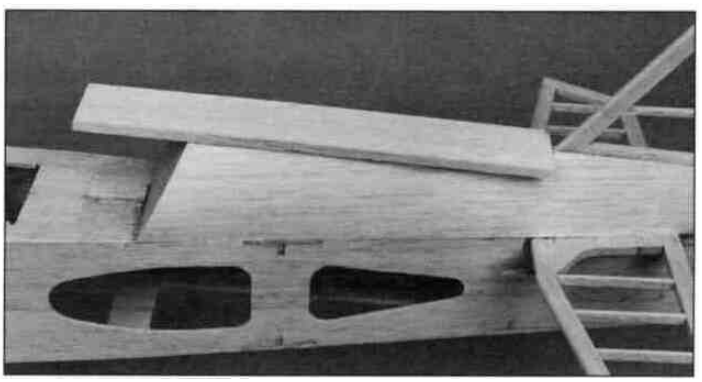


D 5. Wet the outside of the turtledeck sheeting with warm water, allowing it to soak in for a few minutes. Position the sheets on the top of the fuse against the bottom of the backrest and former F-12A, and flush with the TE of the fin. Make sure the sheet is aligned with the line drawn on the stab and fin. Start by gluing the turtledeck sheet to the top of the fuse and stab. Next, glue it to the formers and backrest. Finally, glue it to the stringers and the fin.

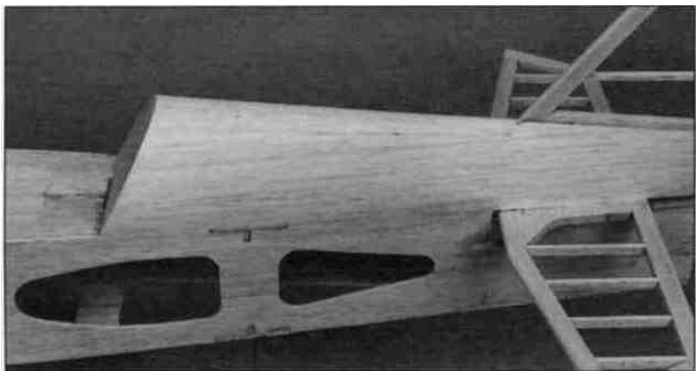
D 6. Repeat the process to install the turtledeck sheet on the other side of the fuselage.



D 7. Trim and sand the turtledeck sheet flush with the front and top of the backrest and the top of the former F-12A.

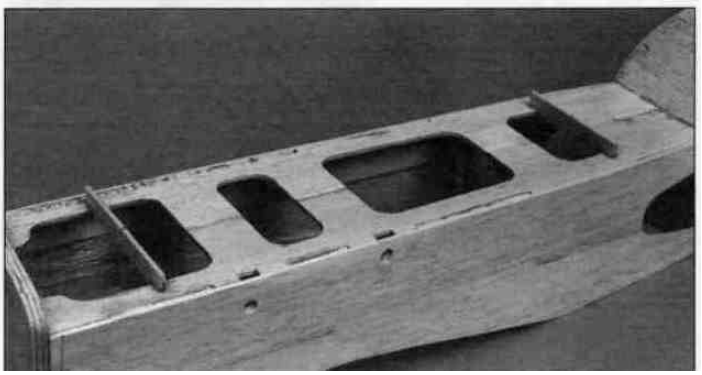


D 8. Sand an angle, to match the LE of the fin, on one end of the 1/4" x 2" x 10" balsa **turtledeck top.** Center the turtledeck top on the backrest, former F-12A and the turtledeck sheeting and glue it in place.

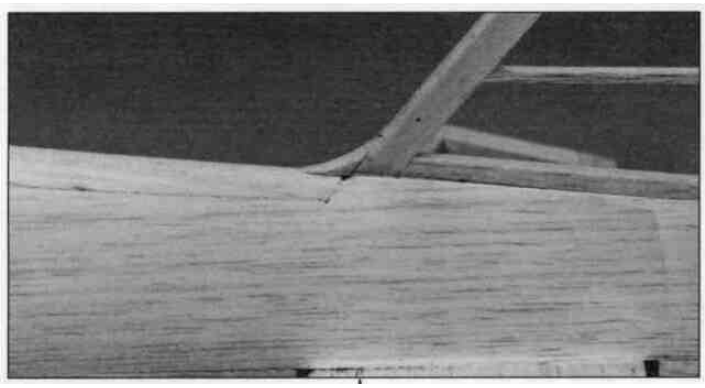


D 9. Carve and sand the turtledeck top to match the curve of the turtledeck sheeting. Refer to the cross-section drawings on the fuse plan. Trim and sand the forward end flush with the front of the backrest.

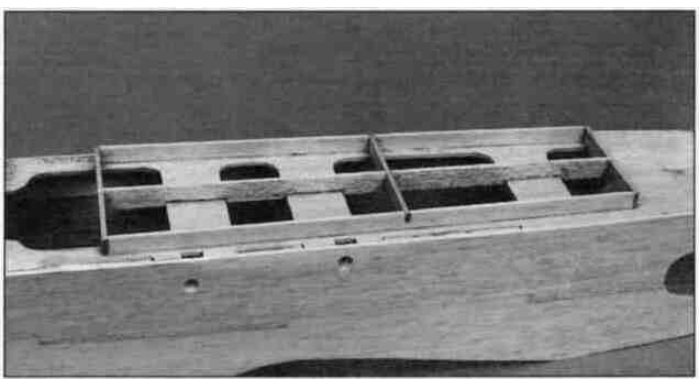
Build the Top Deck



D 1. Glue the die-cut 1/8" balsa former **F-5** and the **instrument panel (IP)** perpendicular to the top deck.

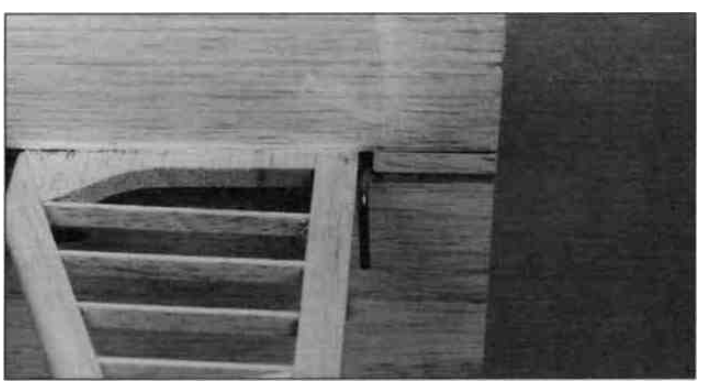


D 10. Make a **fin fillet** from a 1/4" x 1/2" balsa stick. Glue the fillet to the LE of the fin and the turtledeck.



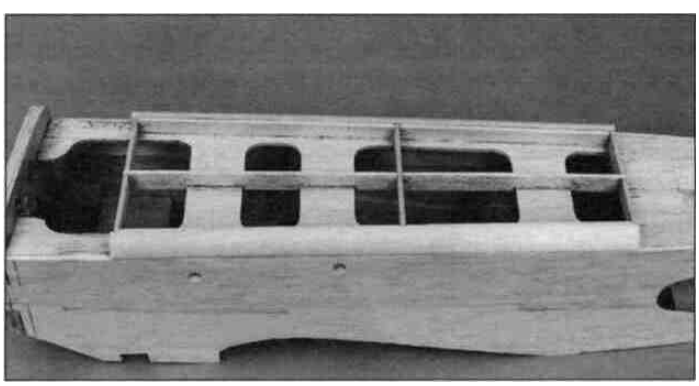
D 2. Glue the three die-cut 1/8" balsa **longitudinal braces** to the top deck, IP and former F-5. The center lingitudinal brace is die-cut as two pieces and will need to be glued together. Glue the die-cut 1/8" balsa former **F-6** over the longitudinal braces.

D 3. Mark the location for the cabane slots on the top **of** the longitudinal braces.

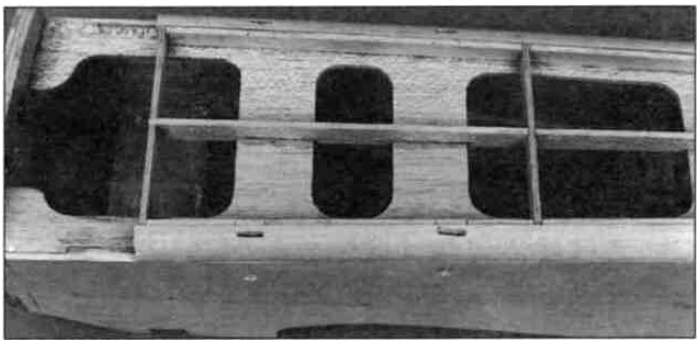


D 11. Remove the elevator joiner wire from the elevators. Insert the joiner wire in the slot behind the stab. Use the remaining 1/8" x 1/4" balsa sticks to fill the slot. Leave a gap of 1/32" between the filler and the joiner wire.

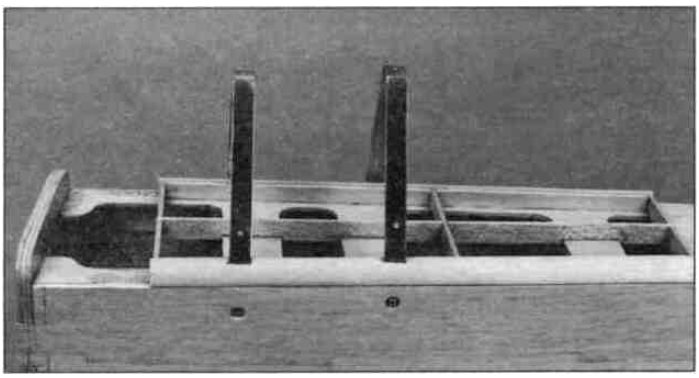
D 12. Sand the filler flush with the fuse sides and the turtledeck sheeting.



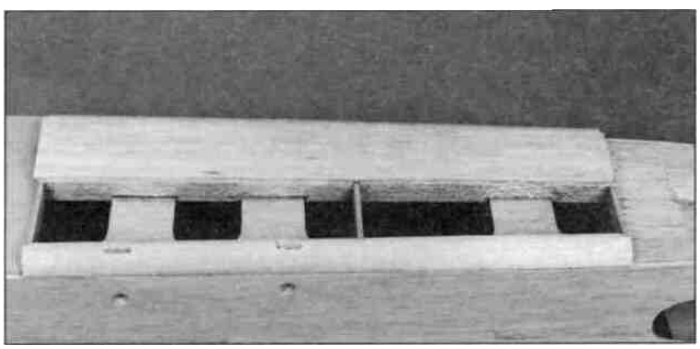
D 4. Cut and glue a shaped balsa **1/2" quarter round** stick to the side of the longitudinal braces and the fuse sides, between IP and F-5.



D 5. Use a 1/16" drill bit to drill a hole through the quarter round at the marks on the longitudinal braces for the cabane slots. After locating the slots, use a hobby knife or small, flat file to enlarge the slots in the quarter round.



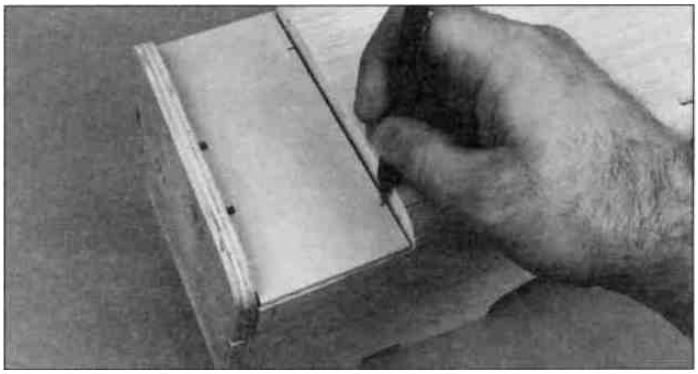
D 6. Test fit the aluminum **cabane** in the slots. Insert 4-40 x 3/8" machine screws through the fuselage and the cabane. This is just to check for fit before the top deck is sheeted Once all the holes line up, remove the cabane and set them aside.



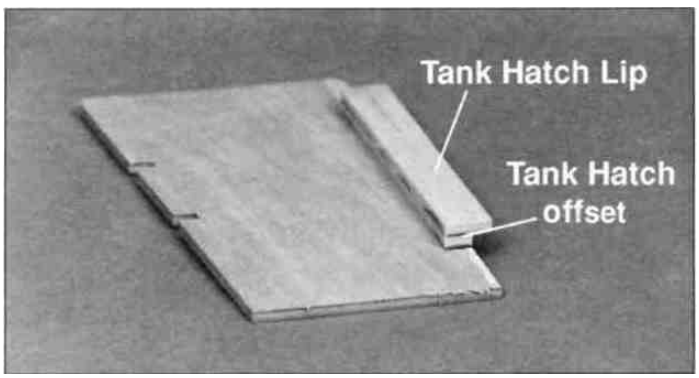
D 7. Make two 13-1/2" long **top deck sheets** from the 3/32" x 3" x 36" balsa sheet. Fit the edge of one sheet against the side of the quarter round. Mark the sheet at the center of the middle longitudinal brace and cut the sheet to width. Make sure that the sheet is centered on the middle longitudinal brace as you glue the sheet in position.

D 8. Sheet the other half of the top deck.

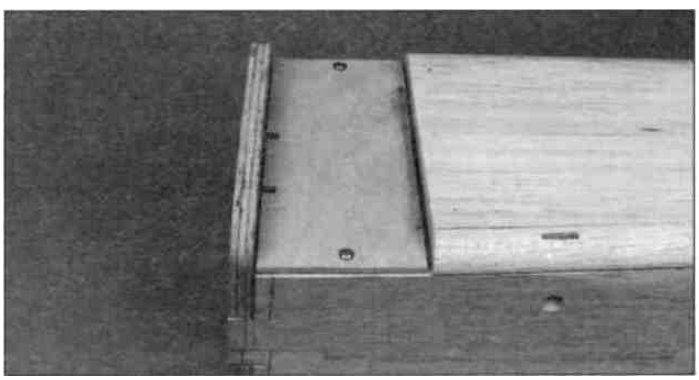
D 9. Sand the forward and aft ends of the top deck sheet flush with former F-5 and lP.



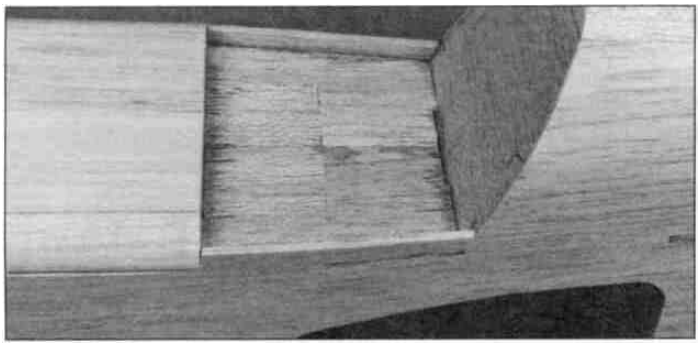
D 10. Center the die-cut 1/8" plywood **tank hatch** over the opening in front of the top deck. Mark on the hatch the location of the opening under the rear of the hatch.



D 11. Glue the die-cut 1/8" plywood **tank hatch offset** on the bottom of the tank hatch, between the marks and flush with the edge. Glue the die-cut 1/8" plywood **tank hatch lip** on top of the offset, flush with the front of the off-set.



D 12. With the tank hatch against the firewall, drill a 3/32" pilot hole through the tank hatch and deck, centered on the edge of the tank hatch. Remove the tank hatch and enlarge the holes to 1/8" in the **hatch only.** Reinstall the hatch and secure it to the deck with two #4 x 1/2" screws. Harden the screw holes by removing the tank hatch and putting a drop of thin CA in the deck holes. Reinstall the hatch after the CA cures.

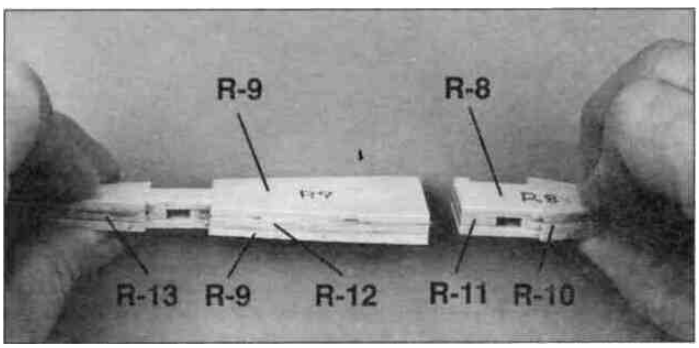


D 13. From the leftover 1/8" x 1/4" balsa sticks, make cockpit sides to fit between the IP and the backrest. Glue the cockpit sides in position, flush with the fuse sides.

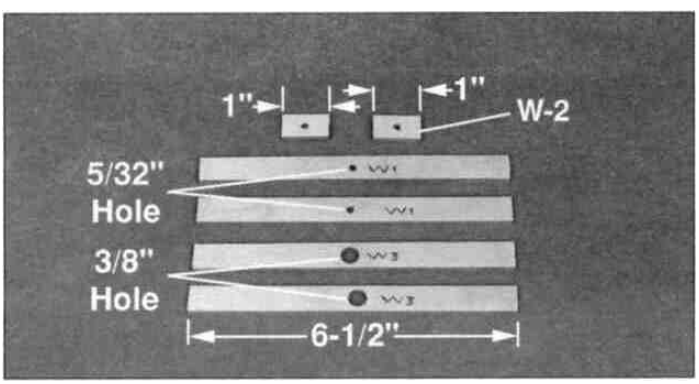
BUILD THE TOP WING

Wing Preassembly

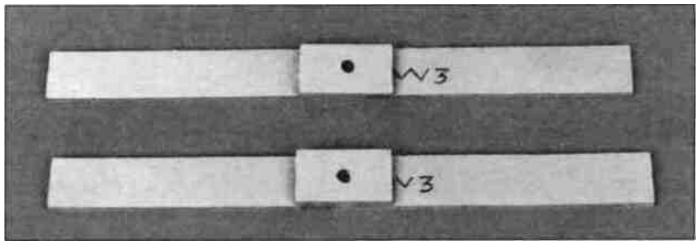
With the fuselage done we can now build the top wing.



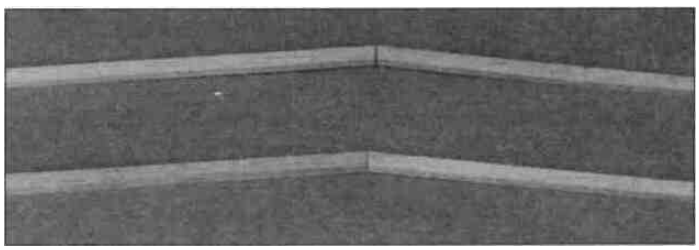
D 1. With the notches aligned, use 30-minute epoxy to glue together the die-cut 1/8" plywood ribs **R-10** and **R-11** sandwiched between ribs **R-8.** Glue the die-cut 1/8" ribs **R-12** and **R-13** sandwiched between the ribs **R-9.**



D 2. Cut two 6-1/2" long W-1, two 1" long W-2 and two 6-1/2" long W-3 wing bolt plates from the 1/8" x 5/8" x 30" birch plywood stick. Place a mark in the center of each bolt plate. Drill a 5/32" hole in the center of W-1 and W-2 and a 3/8" hole in the center of W-3.



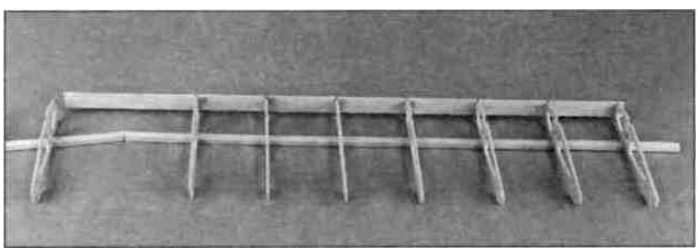
D 3. Use 30-minute epoxy to glue the W-2 bolt plates, centered over the hole in the W-3 bolt plates.



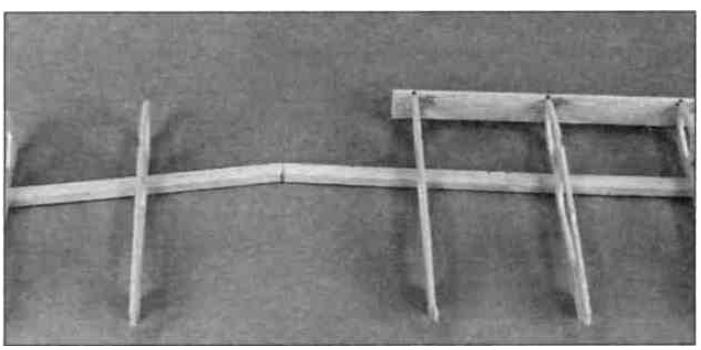
D 4. Trim the ends of two main spars to the angle shown on the plan. Use 6-minute epoxy to glue the ends of the main spars together. Before the epoxy cures, use the cross-pinning technique to pin the main spars to the building board.

Build the Wing

D 1. Pin the die-cut 3/32" balsa ribs **R-1** and **R-7** in position over the main spar.

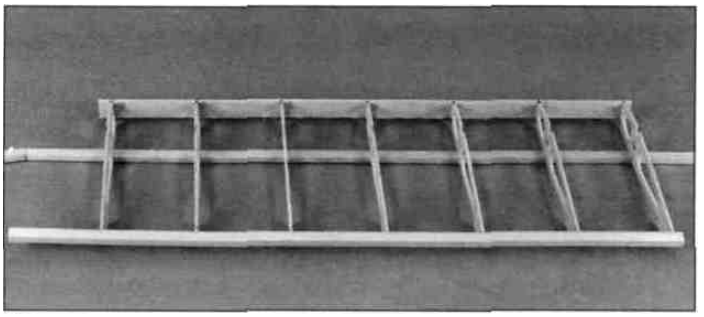


D 2. Separate the LE and TE'S with a hobby knife. Center the LE vertically on the front of the ribs with each rib inserted in its respective notch. Use a straightedge to check that the LE is straight before gluing it in position.



D 3. Cut the LE at the root as shown on the plan. Save the piece you cut off for the wing center section.

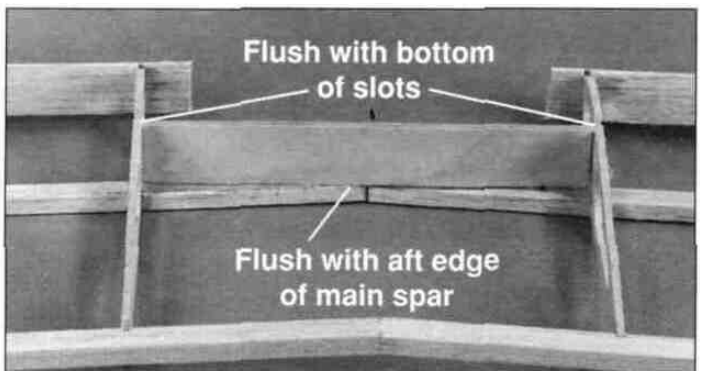
D 4. Repeat the process to install the other LE.



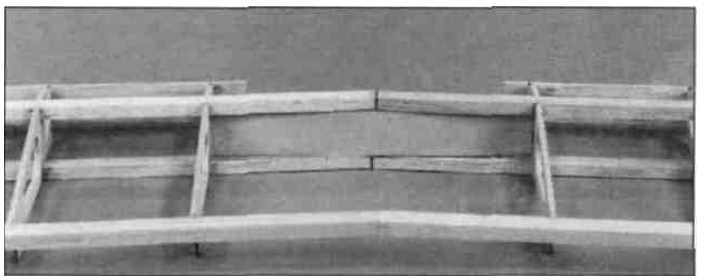
D 5. Position the TE on the aft end of the ribs, flush with **the** top and bottom edge of the ribs. Use a straightedge to check that the TE is straight before gluing it in position. Trim the root end to match the plan.

D 6. Fit the second TE, trimming the root end to butt against the first TE. Use a straightedge to check that the TE is straight before gluing it in position.

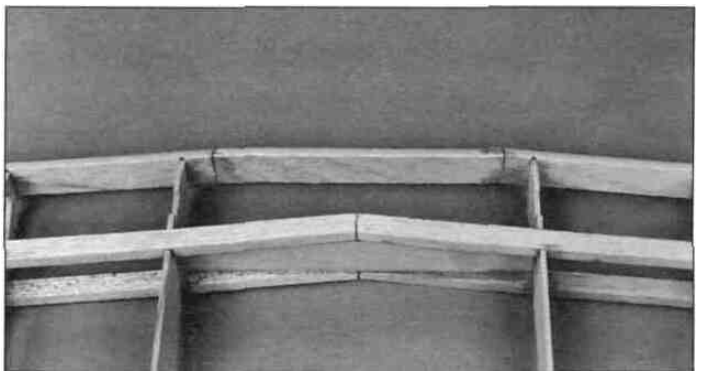
D 7. Glue ribs R-1 and R-7 to the bottom main spar, perpendicular to the building board.



D 8. Use 30-minute epoxy to glue the die-cut 1/8" birch ply joiner between the R-7 root ribs, perpendicular to the building board. The center of the joiner is flush to the back of the main spar and the joiner ends are flush with the front of the main spar. Make sure the top of the joiner is flush with the bottom of the slots for the top main spar. Allow the epoxy to cure before proceeding with the next step.

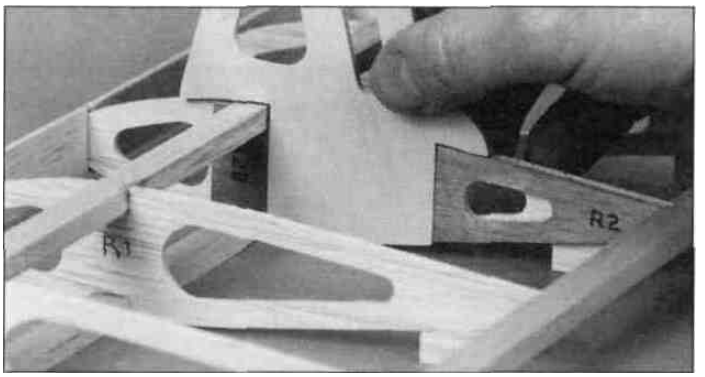


D 9. Use 30-minute epoxy to glue the top spar to the joiner and thin CA to glue the joiner to the ribs. Hold the spar in place with weights until the epoxy cures.

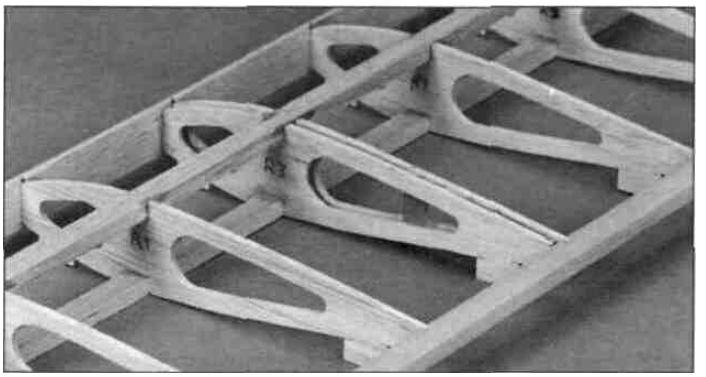


D 10. Trim the leftover LE to fit between the installed **LE.** When satisfied with the fit, glue it in place.

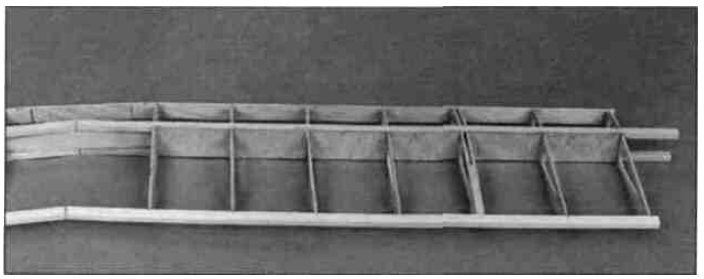
D 11. Use 6-minute epoxy to glue the die-cut 1/8" plywood leading edge joiner (LEJ), centered vertically, across the joint between the center LE and the outer LE.



D 12. Test fit the die-cut 1/8" plywood ribs R-2A and R-2B in position as shown on the plans. Check the fit of the wing strut between R-2A and the wing spars. The strut should fit snugly, but be easy to insert and remove. When satisfied with the fit, remove the strut and glue ribs R-2A and R-2B to R-1.



D 13. Insert the die-cut 3/32" balsa rib R-3 between the spars and carefully rotate it into position and glue it to ribs **R-2A,** R-2B, the wing spars and the LE and **TE.**

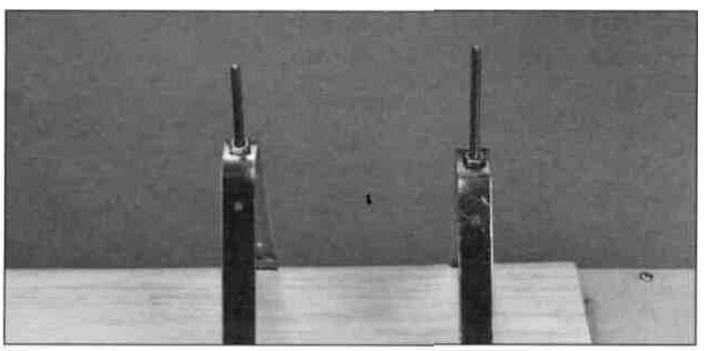


D 14 From a 1/16" x 3" x 24" balsa sheet, cut and glue **shear webs,** perpendicular to the aft edge of the main spars The shear webs must be glued securely to the main spars

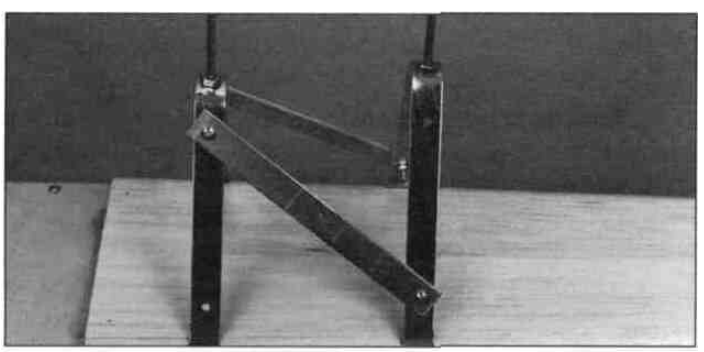
D 15 Sand the top of the wing so that the spars, shear webs and TE are flush with the top of the ribs.

We need to mount the top wing on the fuselage now to set the location of ribs R- 8/9.

D 16 Mount the cabane to the fuselage with four 4-40 x 3/8" machine screws, eight #4 washers and four 4-40 x 3/8" nuts Install a #4 washer on a bolt, Insert the bolt through the fuse and cabane and secure it with a #4 washer and 4-40 nut



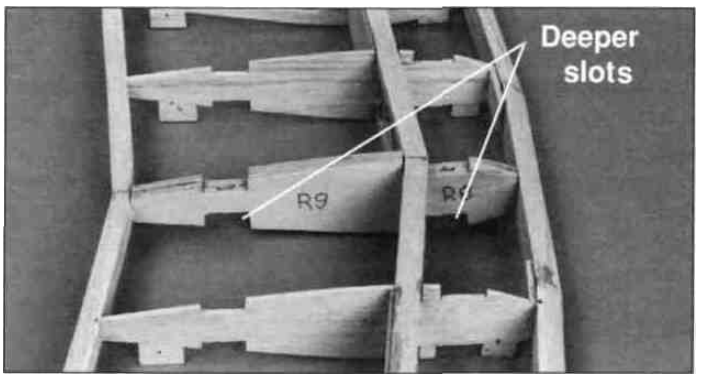
D 17 Install a 6-32 x 2" machine screw from the bottom up through the top of the forward cabane and a 6-32 x 1-1/2" machine screw in the aft cabane Secure the screws to the cabane with 6-32 nuts.



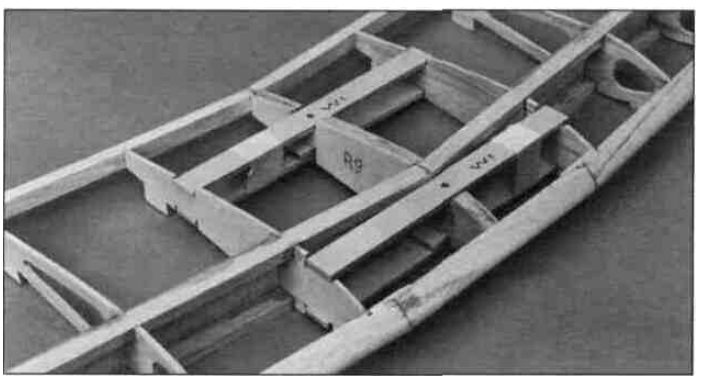
D 18 Mount the aluminum **cross braces** to the cabane with four 4-40 x 3/8" machine screws and 4-40 nuts

D 19. Install the bottom wing on the fuselage.

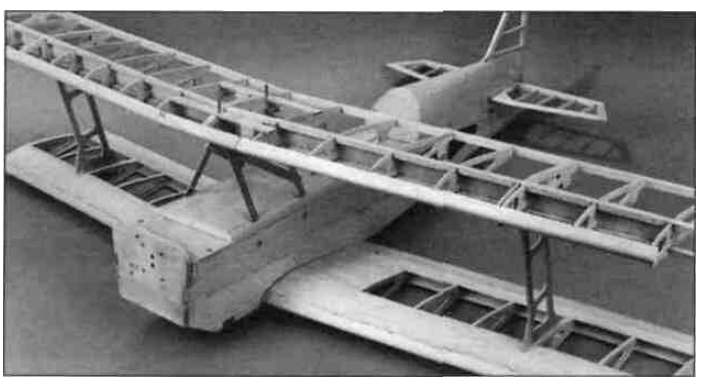
D 20 Enlarge the slots through ribs R-8 and R-9 to 5/32" to allow the 6-32 machine screws to pass through



D 21 Test fit ribs R-8 in position between the LE and the wing joiner Lightly sand the inside of the TE to allow ribs R-9 to fit between the wing joiner and the TE The **deeper** slots in the ribs for the bolt plates face the bottom **Do not** glue the ribs to the wing



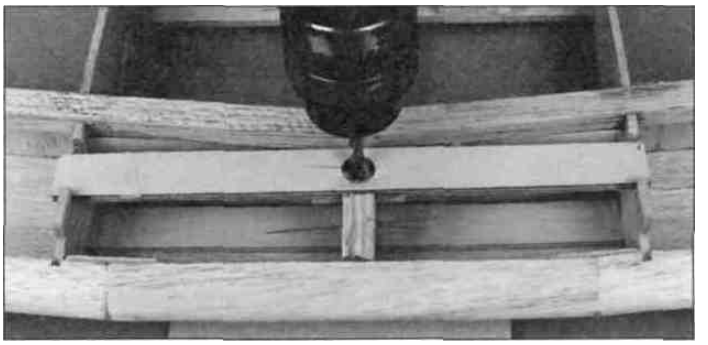
D 22 Use masking tape to hold the top bolt plates W-1 and the bottom bolt plates W-2/3 together on ribs R-8 and R-9.



D 23 Insert the outer wing struts in the bottom wing. Carefully install the top wing with the bolts in the cabane inserted through the bolt plates and the outer wing struts inserted in their slots Make sure the top wing is fully seated on the nuts on top of the cabane.

D 24 Secure the top wing to the cabane with two #6 washers and 6-32 lock nuts Make sure the outer wing struts are seated against the bottom wing Measure the distance from the fin to both wing tips Adjust the bolt plates and ribs R-8 and R-9 until the distance is equal.

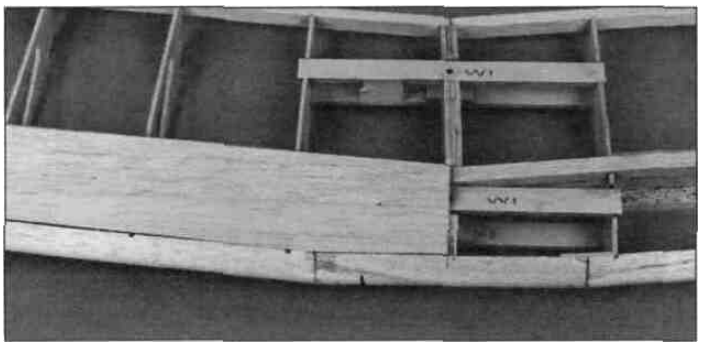
D 25. After positioning the top wing in its proper location, place alignment marks on the front bolt plates, ribs R-8, the wing joiner and the LE. Remove the wing and use 30-minute epoxy to glue ribs R-8 and the front bolt plates to the LE, wing joiner and ribs R-7. Reinstall the top wing on the model and check it for proper alignment before the epoxy cures. Allow the epoxy to cure before removing the wing. **Do not** Glue ribs R-9 and the aft bolt plates in at this time.



D 7. Drill a 5/32" hole through the top LE sheeting using the hole through ribs R-8 as a guide.

Sheet the Top of the Wing

D 1. Remove the wing and pin or weight it flat on your building board. Make sure all the forward and aft jig tabs are in contact with the building board.



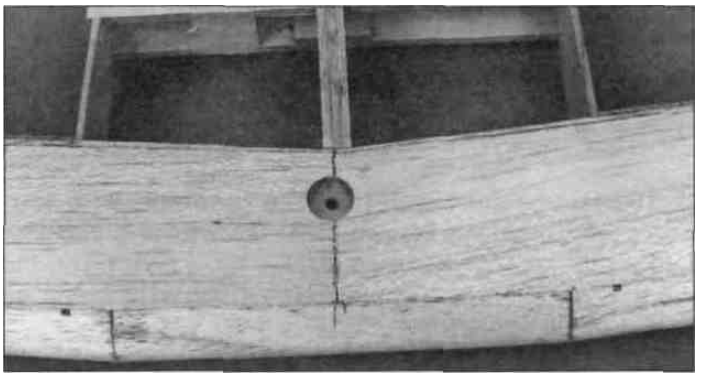
D 2. Test fit the 2" wide balsa LE wing sheet, cut during assembly of the bottom wing, on the wing. Sand a slight bevel on the front of the sheet. The aft edge of the sheet should cover the forward half of the main spar. The root end should cover to the center of rib R-10.

D 3. Position the front of the LE sheet against the LE and glue it in position with thin CA.

D 4. Carefully lift the sheet away from the ribs and apply a bead of medium or thick CA to the top of the ribs. Working quickly, pull the sheet back toward the main spar as you press it down against the ribs and the main spar.

D 5. Use thin CA to glue the sheet to the main spar.

D 6. Fit and glue the second LE sheet to the other wing panel, following the same procedure.



D 8. Use a sharp hobby knife to enlarge the hole to 1/2" in the LE sheeting **only.**

Install the Aft Root Ribs

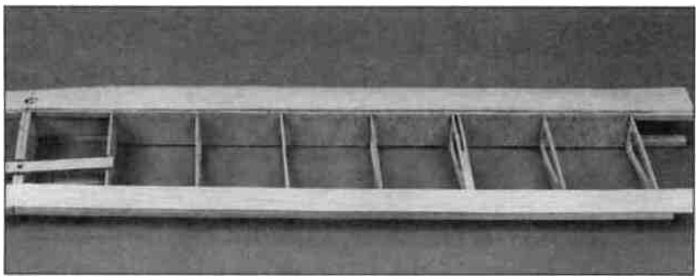
D 1. Mount the top wing on the fuse along with the struts.

D 2. Secure the top wing to the cabane with two #6 washers and 6-32 lock nuts. Make sure the outer wing struts are seated against the bottom wing. Measure the distance from the fin to both wing tips. Adjust the bolt plates and rib R-9 until the distance is equal.

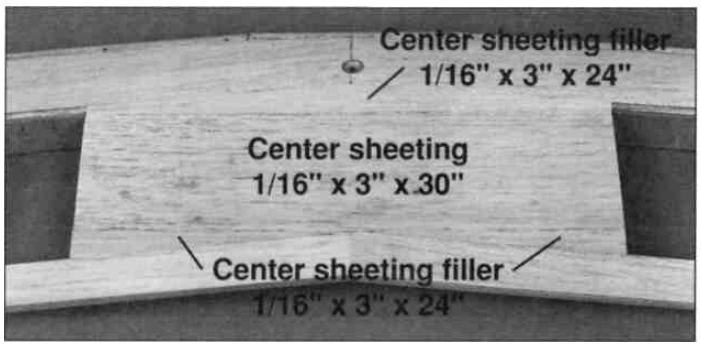
D 3. After positioning the top wing in its proper location, place alignment marks on the aft bolt plates, ribs R-9, the wing joiner and the TE. Remove the wing and use **30-minute epoxy** to glue ribs R-9 and the aft bolt plates to the TE, wing joiner and ribs R-7. Reinstall the top wing on the model and check it for proper alignment before the epoxy cures. Allow the epoxy to cure before removing the wing.

Finish Sheeting the Top of the Wing

D 1. Remove the top wing from the fuse and pin or weight it flat on your building board. Make sure all the forward and aft jig tabs are against the building board. Sand the top of the ribs flush with the TE.

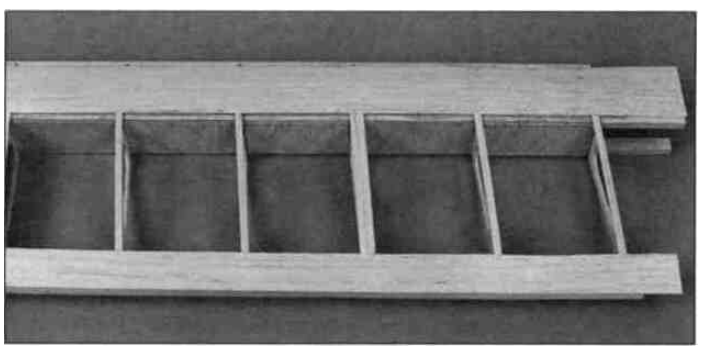


D 2. Glue the 1/16" x 1" x 24" **TE sheets,** cut during assembly of the bottom wing, on top of the ribs and flush with the TE.



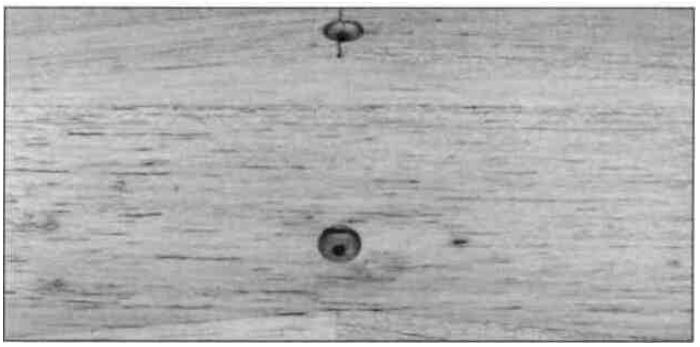
D 3. Use a 1/16" x 3" x 30" balsa sheet to make the **center sheeting** between the LE sheet and the TE sheet. Save the remaining sheeting for the bottom center sheeting. The **center sheeting filler** is made from 1/16" x 3" 24" balsa sheet. Before you glue the center sheeting in position, remove any T-pins from under the sheeting.

Note: Refer to the plans for clarity.



D 4. From the 1/16" x 1/4" x 30" balsa stick, cut and glue **cap strips** to the top of the R-1 ribs. The edge of the cap strip on the R-1 tip rib should be flush with the side of the rib. On the double rib for the strut, glue tow cap strips.

D 5. Drill a 5/32" hole through the top center sheeting using the hole through ribs R-9 as a guide.



D 6. Enlarge the hole to 1/2" in the center sheeting only. Leftover balsa can be inserted under the center sheeting around the two 1/2" holes to support the sheeting.

D 7. Remove the wing from your building board. Cut and sand the LE, TE, main spars and top sheeting flush with the side of tip rib R-1.

Sheet the Bottom of the Wing

The bottom of the wing is sheeted **following the same** procedure as the top of the wing.

D 1. Use a hobby knife and sanding bar to remove the jig tabs on the bottom of the ribs. Sand the TE, main spars, shear webs and the bottom of the ribs even.

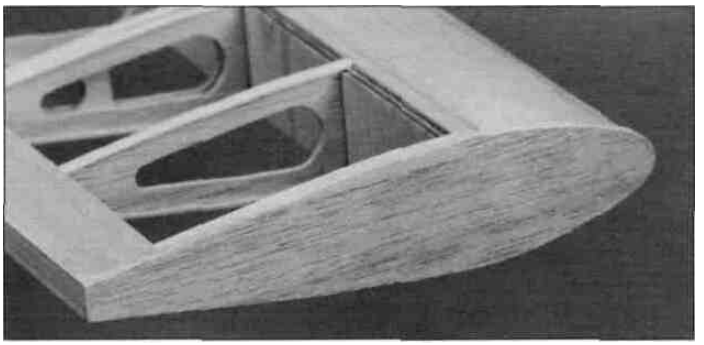
D 2. Lay the wing on your building board with the bottom side up. Place weights on the wing to keep the main spars in contact with the building board. Glue the bottom LE sheeting in position following the same procedure used for the top LE sheeting.

D 3. Glue the 1/16" TE sheet to the TE and the bottom of the ribs.

D 4. Use the remaining 1/16" x 3" x 30" balsa sheet from the, top center sheeting, to make the center sheeting between the LE sheet and the TE sheet.

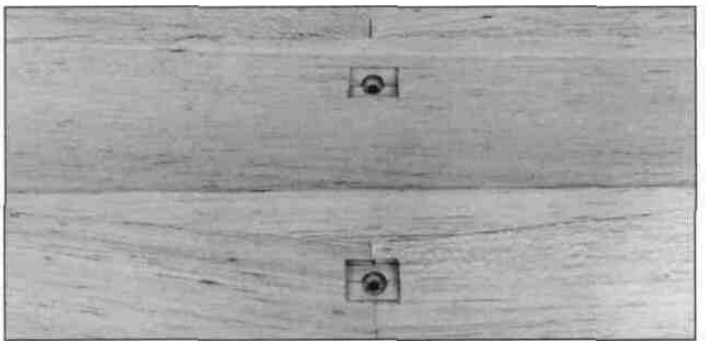
D 5. From the 1/16" x 1/4" x 30" balsa stick, cut and glue cap strips to the top of the R-1 ribs. The edge of the cap strip on the R-1 tip rib should be flush with the side of the rib. On the double rib for the strut, glue two cap strips on **rib R-2A** and the slot is then trimmed.

D 6. Trim and sand the LE and TE sheeting flush with the side of tip rib R-1.



D 7. Make the wing tips from leftover 1/8" x 3" x 18" balsa sheet. Hold the sheet against tip rib R-1 and draw an outline of the rib. Cut and glue the wing tips to tip ribs R-1.

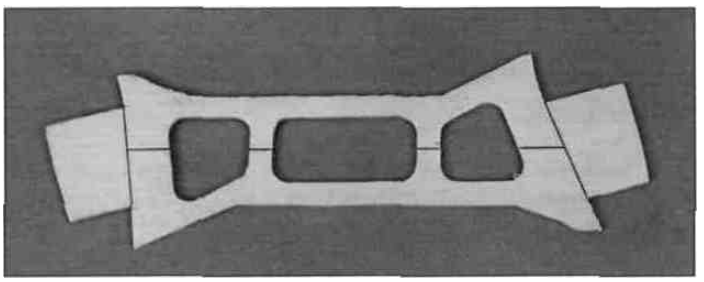
D 8. Drill a 5/32" hole through the bottom sheeting using the hole through ribs R-8 and R-9 as a guide.



D 9. Enlarge the holes to 5/8" wide by 3/4" long in the bottom sheeting only. Leftover balsa can be inserted under the bottom sheeting around the two holes to support the sheeting.

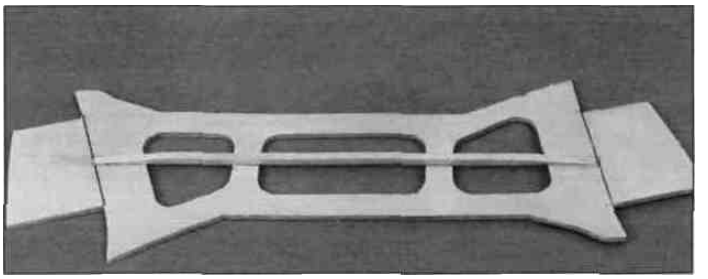
D 10. Test fit the top wing on the fuselage. The holes in the bottom sheeting may need to be enlarged to allow the cabane to seat on the bolt plates.

D 11. Measure the distance between the top and bottom wings next to the fuse and at the wing tips. If the distance at the tips is larger, reduce the length of the struts a little at a time until the wings are parallel.



D 12. Draw lines on both sides of the struts connecting the bases. Draw a line down the center of the strut parallel to the side of the strut.

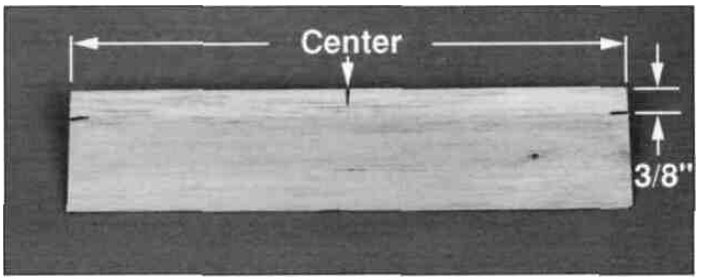
D 13. From the 1/8" x 1/8" x 36" balsa sticks, cut **strut braces** to fit between the lines connecting the bases. Measure 1-1/8" from each end and sand a bevel from the end to the bevel line.



D 14. Finish sand the strut with 320-grit sandpaper. Glue the strut brace along the centerline of the strut from base line to base line. Install the strut braces on both sides of each strut.

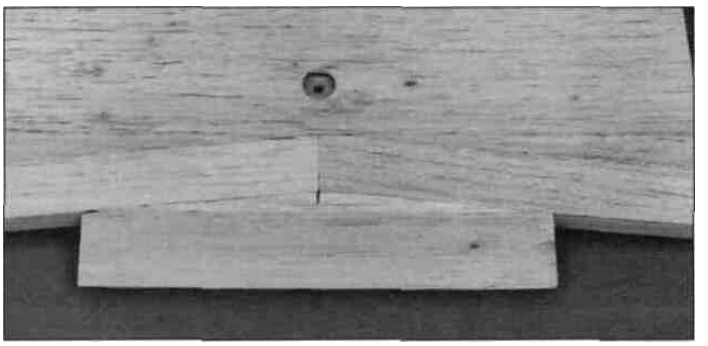
Complete the Bottom Wing

D 1. Sand the TE sheet and TE flush.



D 2. Mark the centerline on both sides of the shaped 1-5/8" x 7-1/2" balsa **center TE.** Place a mark 3/8" back from the LE on both ends.

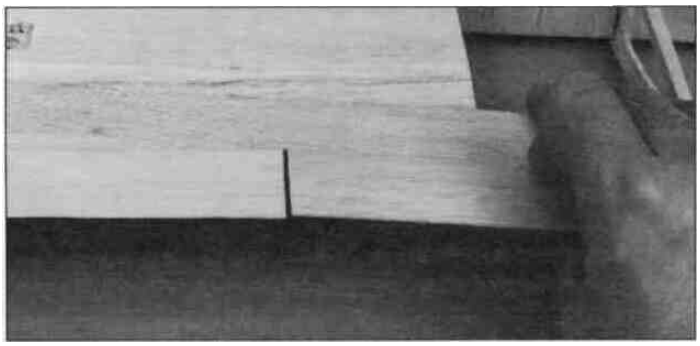
D 3. Draw lines connecting the centerline and the end marks. Use a razor plane and sanding bar to trim the center LE from the center mark to the end marks.



D 4. Glue the center TE to the TE of the top wing. Make sure the center TE is **centered** on the wing and the ends of the center TE are **flush** with the wings TE sheeting.

5. Sand the center TE flush with the top and bottom wing sheeting. **Be careful** not to sand the TE too thin.

Build the Ailerons



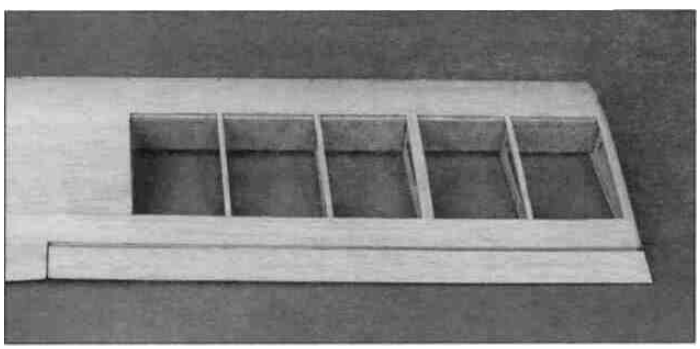
D D 1. Trim one end of the 1-1/4" x 24" balsa aileron to the same angle as the center TE.

D D 2. With a gap of 1/16" between the aileron and the center TE, Mark the end of the aileron approximately 1/16" past the wing tip. This will allow you to sand the aileron flush with the wing tip later. Cut the aileron at the mark.

D D 3. Draw a centerline on the LE of the aileron.

D D 4. Cut out four aileron hinges from the leftover hinge material.

D D 5. Mark the location for the hinges on the aileron and wing. Cut the hinge slots and without using glue, test fit the aileron to the wing.



D D 6. Remove the aileron from the wing. Mark the "bevel to" lines and trim the LE of the aileron to a "V" as shown on the plan.

D 7. Perform steps 1 through 6 to fit the remaining aileron onto the wing.

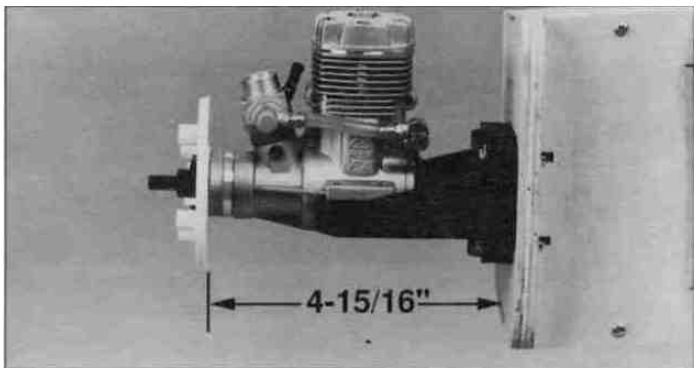
Now that the fuselage and wings are assembled, remove the cabane from the fuse and rough sand the completed airplane. Refer to the cross-section drawings often while sanding. At this point we just want to blend the fuse sides with the turtledeck and front deck and sand a radius at the joint between the bottom and sides of the fuse.

ENGINE INSTALLATION

D 1. Cut the "spreader bar" from the supplied Great Planes engine mount. Use a hobby knife to remove any flashing **so** the halves fit together properly.

D 2. Temporarily mount the engine mount to the firewall with four 6-32 x 1" machine screws and #6 washers. Do not tighten the screws all the way so you can adjust the mount.

D 3. Place your engine on the mount and slide the halves in or out so the engine fits. When the engine mount is adjusted and centered, tighten the mounting screws.

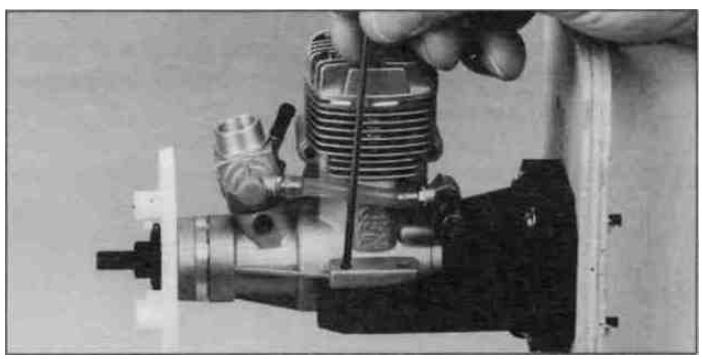


D 4. Position the engine on the mount so that the drive washer (or the backplate of the spinner) is 4-15/16" away from the firewall. Refer to the Expert Tip that follows, then mark and drill the engine mounting holes for the #6 x 3/4" engine mounting screws.

EXPERT TIP

HOW TO ACCURATELY MARK & DRILL THE ENGINE MOUNTING HOLES ON THE ENGINE MOUNT

A. Use C-clamps to hold the engine in position.



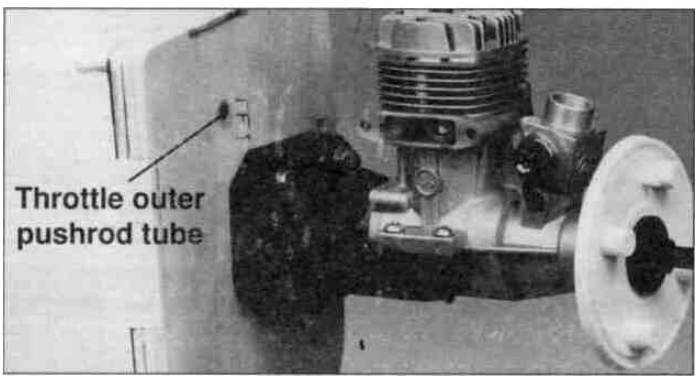
B. Use a torch or a lighter to heat the end of a sharpened wire rod and mark the center of the engine mounting holes. It just takes a little pressure of the heated rod to dimple the plastic.

C. Remove the engine from the engine mount and the mount from the fuse. Use a drill press, if you have one, to drill a 1/16" pilot hole at each dimple. If you do not have a drill press, use a hand drill making sure the holes are perpendicular to the engine mount beams.

D. Use a 7/64" drill bit to enlarge each hole.

E. Reinstall the engine mount on the fuse. Mount the engine on the engine mount with four #6 x 3/4" sheet metal screws. Hint: Rub the screw threads on a bar of soap before threading them into the engine mount. They will thread in much easier.

Optional: Modelers who prefer to mount their engines with machine screws instead of sheet metal screws should drill the engine mounting holes with a #36 drill and tap the holes with a 6-32 tap. 6-32 x 3/4" machine screws (not included) are recommended.

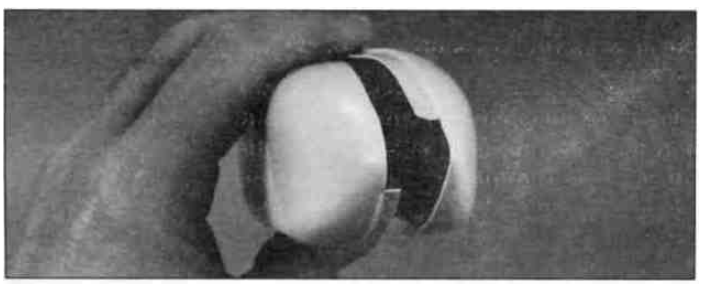


D 5. Roughen a piece of leftover outer pushrod tube. Insert the outer pushrod tube through the throttle hole in the firewall. Glue the tube flush with the firewall.

ASSEMBLE THE PLASTIC PARTS

Assemble the Wheel Pants

*We **highly recommend** that all plastic joints and screw holes be strengthened with fiberglass cloth (not included) and thin CA on the **inside** of the joint.*



D 1. Trim one matching set of wheel pant halves along the embossed cut lines. Notice that the top of the outer pant goes over the lip of the inner pant and the bottom of the inner pant goes over the lip of the outer pant. You can use a hobby knife to carefully score along the cut lines and flex the plastic until the excess breaks free, or use a small scissors to cut along the cut line. Hobbico curved tip canopy scissors (HCAR0667) work extremely well. For now, don't worry about accurately cutting out the opening in each wheel pant half-just cut an approximate opening for the wheels.

D 2. Use your bar sander to carefully true the edges of the overlapping pieces of the wheel pant halves so when you glue them together the seam will be as small and straight as possible. Notice that the rear of the pant halves do not overlap. Roughen all the areas that are to be glued, including the indentation on the inside of both inner pant halves.

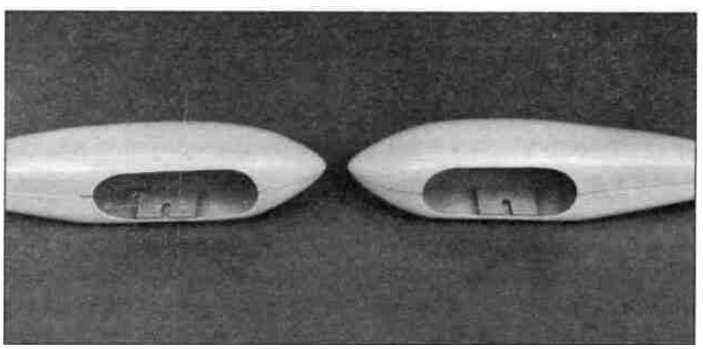
D 3. Test fit the wheel pant halves together and make adjustments where necessary for the best possible fit.

D 4. Join the wheel pant halves by carefully spot gluing them with thin CA. Glue the top, the front and then the rear where the two halves butt together. After the halves **are** joined, apply thin CA along the length of all the seams.

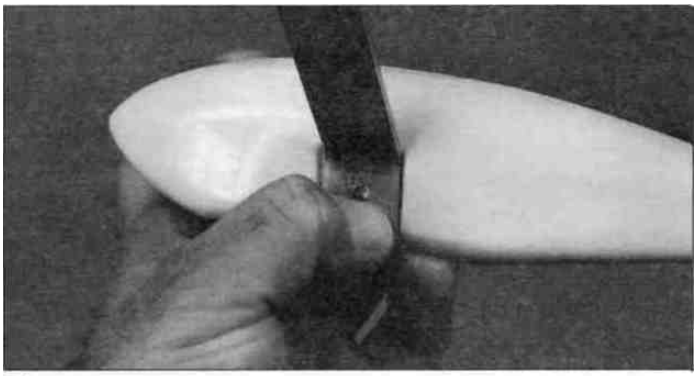
Note: Do **not** use CA accelerator. Use of accelerator on the ABS plastic may cause cracks and/or prevent paint from adhering.

D 5. Use your hobby knife or a power tool with a sanding drum to accurately cut out the wheel opening, testing the fit of the wheel as you proceed.

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

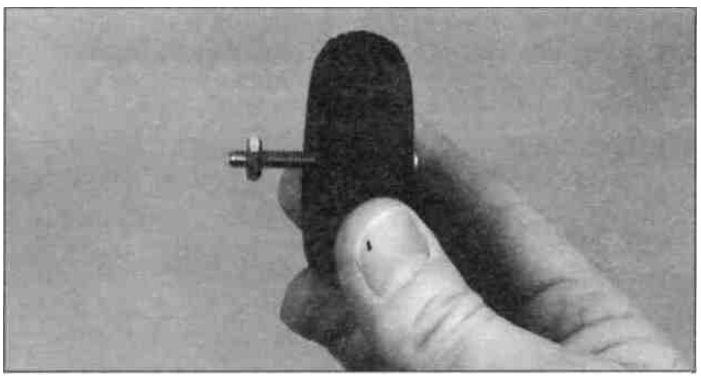


D 6. Use medium CA to glue the die-cut 1/8" plywood **wheel pant mount** to the **inside** of each wheel pant.



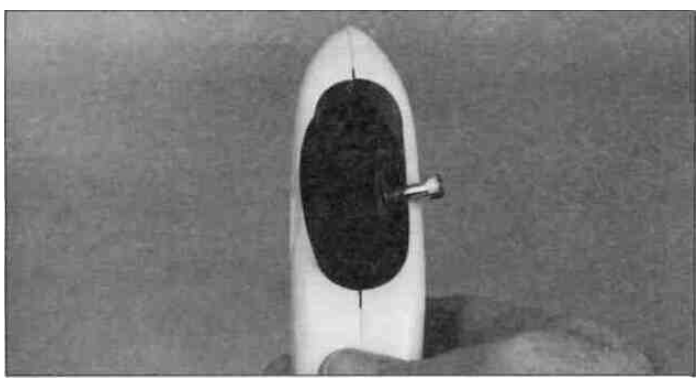
D 7. Use a metal file to chamfer the edges and corners of the aluminum landing gear so it will fit neatly in the recess of the wheel pant. Position the wheel pant on the aluminum landing gear. Accurately mark the location of the axle mounting hole on the pants.

D 8. Drill a 11/64" hole in the wheel pant at the mark.

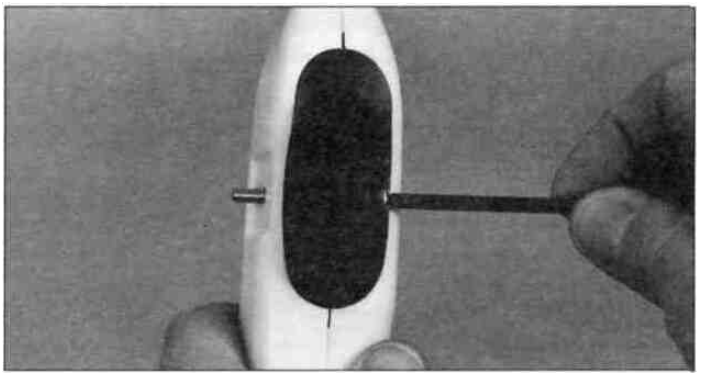


D 9. Insert the 8-32 x 1-1/2" socket head screw through the wheel hub of your 2-1/4" wheel. Thread an 8-32 nut on the socket head screw approximately 1/8".

D 10. Test fit the wheel in the wheel pant using the following procedure.

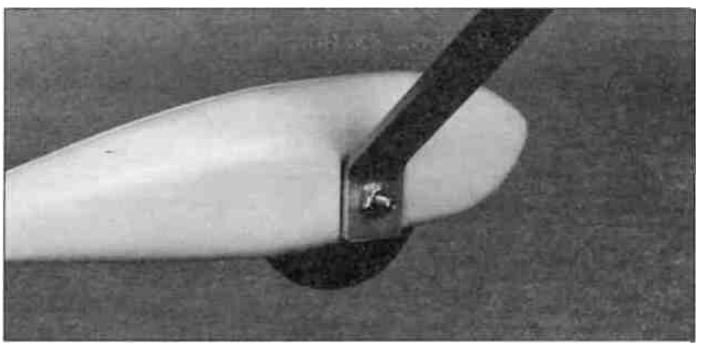


A. Insert the threaded end of the screw into the wheel pant axle hole. The socket head of the screw will be protruding from the pant.



B. Use a 9/64" hex wrench to thread the socket head screw through the wheel pant until the wheel goes in and the socket head screw goes into the pant.

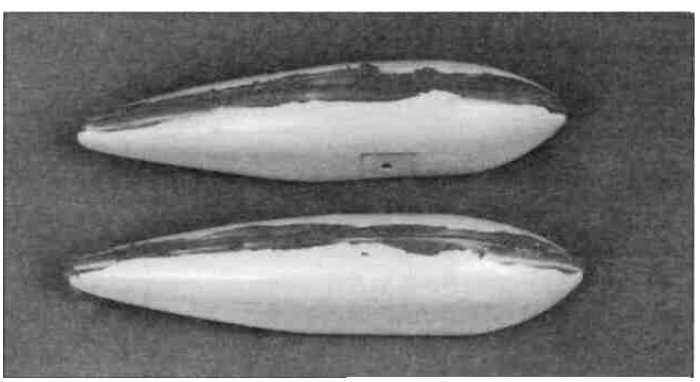
C. Adjust the tightness of the nut with hemostats or needle nose pliers.



D 11. Enlarge the axle notch to 11/64" in the landing gear. Temporarily mount the wheel pant to the landing gear with another 8-32 nut.

Note: When you reinstall the wheel after the wheel pant has been painted, put masking tape on the bottom of the pant so the screw will not scratch it.

D 12. Perform the same procedure to assemble and mount the other wheel pant to the landing gear.



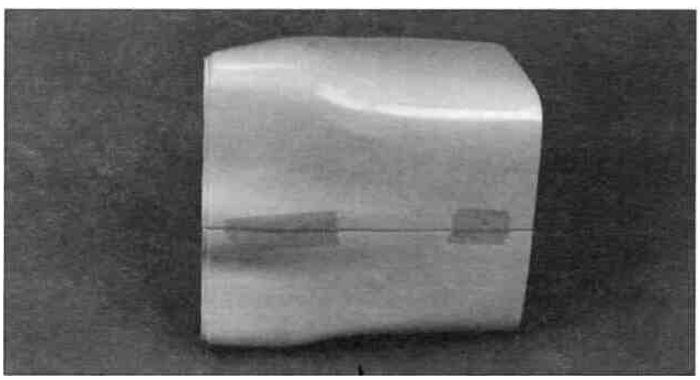
D 13. Before painting the wheel pants, fill the seams and other imperfections with filler such as Squadron White Putty, or resin filler such as Bondo . We use Bondo most of the time because it cures quickly and is easy to sand. Squadron putty works well, but it takes several hours to cure.

D 14. After the filler cures, sand it flush with the plastic. **Wet** sand the entire wheel pant with 400-grit sandpaper in preparation for primer.

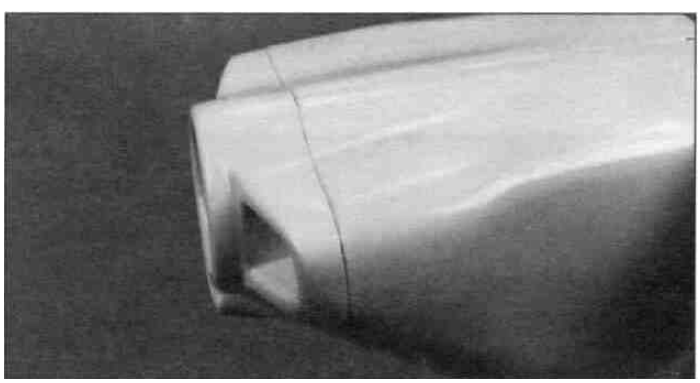
Note: Don't forget to reinforce the joints with fiberglass cloth and CA.

Assemble the Cowl

D 1. The cowl is assembled following the same procedure **as** the wheel pants. Cut the cowl along the embossed cut lines. Use your bar sander to true all the edges. For now the opening in the cowl front only needs to be roughly cut out. Use coarse sandpaper to roughen the inside of all the overlapping areas so the glue will adhere better.

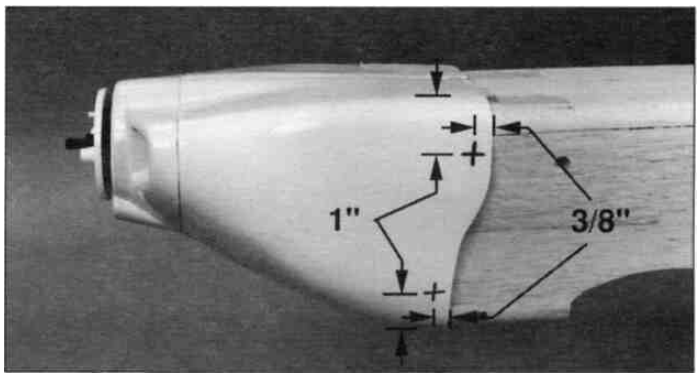


D 2. Tape the left and right side pieces together, then wick a small amount of thin CA along the seams of the overlapping joints. After the CA has cured, remove the tape and make sure you have thoroughly glued the two pieces together by inspecting the glue joints and adding thin CA if necessary.



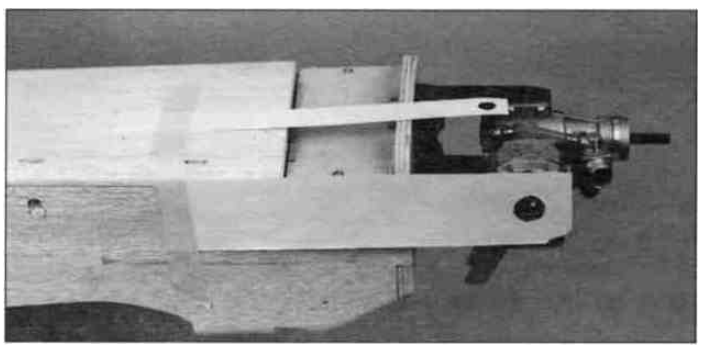
D 3. Tape the cowl front to the sides. Use thin CA to tack glue the bottom of the cowl front to the side. Next tack glue the top of the cowl front to the sides. After the top and bottom are glued, start gluing the seam along the sides.

D 4. Use a sharp hobby knife or a Dremel MultiPro® with a sanding drum to accurately cut the engine opening in the front of the cowl.

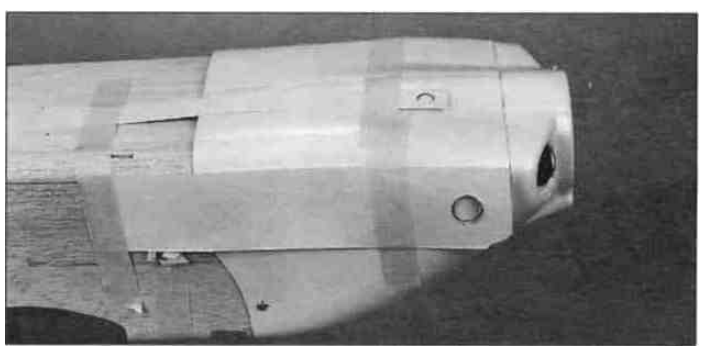


D 5. Slide the cowl over the engine and fuselage. Reinstall the spinner backplate and center the cowl 1/6" to 3/32" behind the spinner backplate. Tape the cowl in position and place four marks (two on each side of the cowl) 3/8" in from the back edge and approximately 1" from the top and bottom of the cowl.

D 6. Drill a 3/32" hole through the cowl and fuse at each mark. Remove the cowl and enlarge the holes in the **cowl only** to 1/8". Apply a couple of drops of thin CA to the cowl mounting holes in the fuse to harden the wood. Attach the cowl to the fuse with four #4 x 1/2" sheet metal screws.

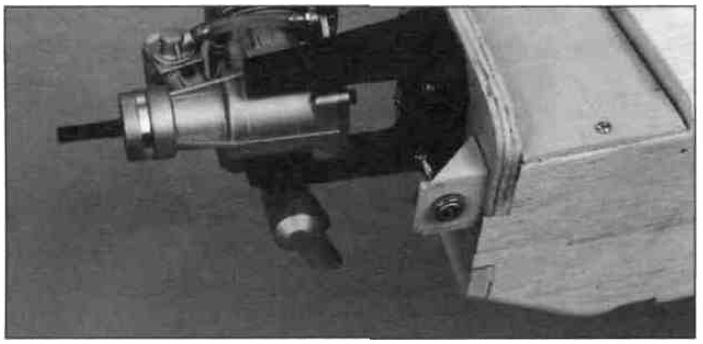


D 7. Remove the cowl and use a piece of thin cardboard or plastic to make templates for the cutouts in the cowl for the glow plug, needle valve and exhaust. Tape the templates to the fuselage side to accurately indicate the position of the glow plug, needle valve and exhaust.



D 8. Remove the engine and install the cowl. Transfer the glow plug, needle valve and exhaust holes from the templates onto the cowl.

D 9 Remove the cowl and templates, then remount the engine Cut out the holes in the cowl, then test fit it to the fuselage You may want to make the cuts slightly smaller than the template outline to allow for adjustment.



D 10 On our prototype Ultimate we made a mount for the Great Planes Easy Fueler from 1/8" leftover plywood and securely glued it to the side of the fuselage We cut an access hole in the cowl for the fueler using the template method.

D 11 Apply fiberglass around the inside of the mounting holes and along the seams Fill the seams or other imperfections in the cowl as described in the preceding ***Assemble the Wheel Pants*** section, then wet sand the entire cowl with 400-gnt sandpaper to prepare it for priming

BALANCE THE MODEL LATERALLY

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

Now that the model is nearly completed, you should balance it laterally (side-to-side). An airplane that is laterally balanced will track better during aerobatic maneuvers Here's how.

D 1. Temporarily attach the elevators, rudder, engine, cowl, landing gear, cabane, wings and struts. Lift the model by the propeller shaft and the bottom of the fuse near the rudder This will require an assistant. Do this several times

D 2. The wing that consistently drops indicates the heavy side. Balance the model by adding weight to the other bottom wing tip.

COVERING

Preparing the Surface

D 1. Remove the engine, landing gear, cabane, plastic parts and any other hardware you may have installed

D 2 Most of the model should be rough-sanded by now, with all the rough edges sanded and rounded following the cross section views on the plans Fill all dents, seams, low spots and notches with HobbyLite ' balsa colored filler.

EXPERT TIP

Here is an easy method to remove minor dents in wood where the wood grain has not been broken.

A. Wet the area of the dent with water.

B. Carefully rub a hot sealing iron over the dent.

C. As the wet wood is heated, the wood grain will swell **up.**

D Allow the wood to dry before sanding smooth.

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

Covering Technique

Cover the model with Top Flite MonoKote film, using the suggested covering sequence that follows Before you cover the fuselage, first apply 1/4" wide strips of MonoKote film in the corners where the stab meets the fuselage and the fin meets the fuselage Then, proceed to cover the fin and stab with pre-cut pieces that meet in the corners and overlap the 1/4" strips Never cut the covering on the stab and fin after it has been applied except around the leading and trailing edges and the tips Modelers who do this may cut through the covering and into the stab and fin This will weaken the structure to a point where it may fail during flight.

Some modelers prefer to cover the top and bottom of the ailerons with one strip of MonoKote film This is done by covering the bottom first, then wrapping the MonoKote film **up** over the leading edge.

We used Top Flite MonoKote White (TOPQ0204), Cub Yellow (TOPQ0220), Orange (TOPQ0202), Missile Red (TOPQ0218) and Black(TOPQ0208) to cover our Ultimate.

Suggested Covering Sequence

Fuselage and Tail:

1 1/4" strips at fin and stab as described
2 Aft fuselage bottom
3 Forward fuselage bottom
4 Fuselage right side up to the top center of the turtle deck and center of nose
5. Fuselage left side up to the top center of the turtle **deck** and center of nose, overlapping by 1/8"
6 Fin TE followed by stab tip and TE
7 Stab bottom, followed by top
8 Fin right side, followed by the left side
9 Elevator LE and root ends
10 Elevator bottoms, followed by the top
11 Rudder LE, right side followed by the left side

Wing:

1 Tips of bottom wing
2 Trailing edges of bottom wing
3 Bottom right, followed by the left wing panel
4 Top right, followed by the left wing **panel**
5 Tips of top wing
6 Trailing edges of top wing
7 Bottom right followed by the left wing panel
8 Top right, followed by the left wing panel
9 Aileron tips, followed by the bottom and top **of** the ailerons

PAINTING

After the model is covered, use fuelproof model paint, 30-mmute epoxy thinned with alcohol or finishing resin to coat areas that may be exposed to raw fuel or exhaust residue such as the firewall and wing saddle

Top Flite LustreKote fuelproof paint is recommended for painting all ABS plastic and aluminum parts At least one coat of LustreKote primer is highly recommended to fill in small scratches left from sanding as well as small pin holes in the filler Wet sand between coats with 400-gnt sandpaper and apply a second coat of primer if necessary

Before painting the canopy use a scissors or a hobby knife to trim along the molded cut lines True the edges with your bar sander and 220-grit sandpaper Use 400-gnt sandpaper to scuff the frame portion of the canopy so the paint will stick We recommend you paint the canopy frame with Pactra Formula-U or Chevron Perfect Paint Use masking tape or frisket film to cover the portion of the canopy that is not to be painted If you are not sure that the paint is compatible with the clear canopy, test the paint on a leftover piece of canopy material For painting the pilot, we have discovered that acrylic water base paints such as the types found at craft stores work great The acrylic paints look realistic on the pilots because they are flat Best of all, they cleanup with water We covered the cockpit floor, sides and backrest with 600-gnt sandpaper glued in place with 3M Super 77 spray adhesive

FINAL HOOKUPS & CHECKS

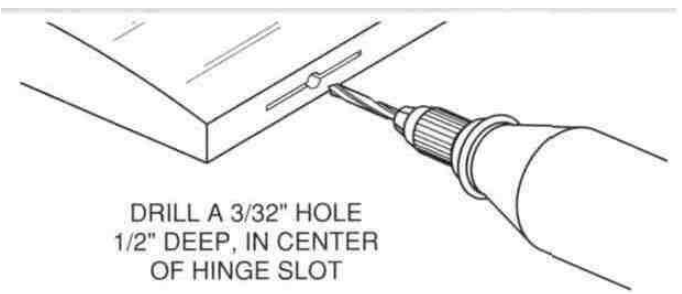
Install the Hinges

1 Starting with the **elevators and stab, cut the covering** from the hinge slots

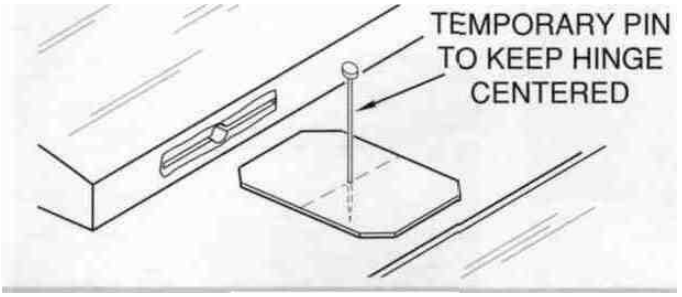
Installing CA Hinges

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



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

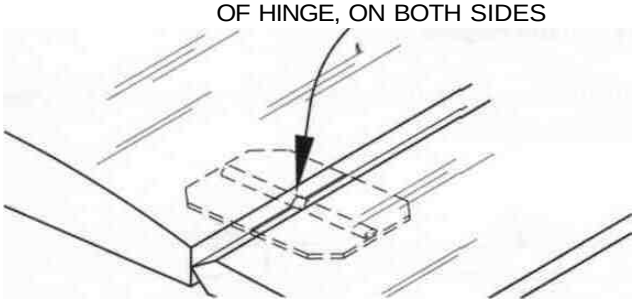


It is best to leave a very slight hinge gap rather than closing it up tight, to help prevent the CA from wicking along the hinge line Make sure the control surfaces will deflect to the recommended throws without binding If you have cut your hinge slots too deep, the hinges may slide in too far leaving 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 you install the control surfaces.

D 2 Clean the elevator joiner wire with alcohol and a paper towel to remove any oil residue

D 3 Glue the joiner wire in the elevators with 6-minute epoxy Before the epoxy cures, tape a flat stick to the left and right side of the stab and to the elevators This will ensure that both elevators are even

ASSEMBLE THEN APPLY 6 DROPS
OF THIN CA TO CENTER
OF HINGE, ON BOTH SIDES



D 4 Apply 6 drops of thin CA adhesive to both sides of each hinge Allow a few seconds between drops for the CA to wick into the slot

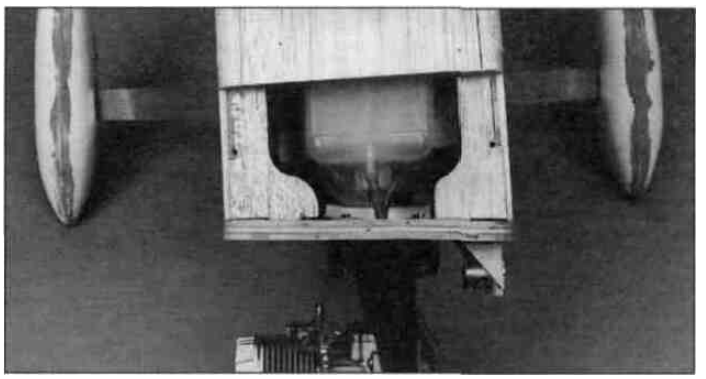
D 5 Pack each of the torque rod holes in the ailerons with 30-minute epoxy (a toothpick works well for this) Install the ailerons with their hinges Repeat the gluing technique described previously and allow the epoxy to cure.

D 6 Cut a slot in the TE of the fin for the tailwheel bracket **nylon bearing**

D 7 Lightly coat the tailwheel wire with petroleum jelly where it enters the nylon bearing This will prevent the wire from becoming glued to the bearing

D 8 Pack the tailwheel bracket hole in the rudder and the slot in the TE of the fin with 30 minute epoxy Install the rudder with its hinges Repeat the gluing technique described previously and allow the epoxy to cure

Install the Hardware



D 1 Assemble the fuel tank according to the manufacturer's instructions Remove the fuel tank hatch Place 1/4" foam padding (not included) on the tank floor Insert the fuel tank into the fuel tank compartment If using the Great Planes 10oz fuel tank place a piece of foam padding at the front of the tank Insert a piece of foam padding between the tank and the top deck Also glue a piece on the bottom of the fuel tank hatch Insert two 12" pieces of fuel tubing (not included) through the firewall Connect one of the fuel tubes to the fuel pick-up fitting and the other to the pressure fitting

D 2 Reinstall the landing gear with 6 32 x 1/2" cap head screws and #6 washers Reinstall the engine mount and engine Apply thread lock to the bolts holding the engine to **the** firewall and the landing gear to the fuse

D 3 Shorten and connect the fuel pick-up line to the carburetor (or fuel fill valve) Connect the pressure line to the muffler

D 4 Install a 1" tailwheel (not included) on the tailwheel wire Secure the tailwheel with a 3/32" wheel collar and 4-40 x 1 /8" set screw

D 5 Reinstall the cabane on the fuse Apply thread lock to all the 4-40 x 3/8" bolts when reassembling the cabane.

Attach the Canopy

D 1 Before permanently installing the canopy, securely glue your pilot in place on the cockpit floor For the most security, in addition to glue secure the base of the pilot to the cockpit floor with a #4 sheet metal screw (not included) from the underside of the cockpit floor

D 2 Place the canopy on the fuselage in the location shown on the plan Temporarily hold it in position with tape **or rubber** bands

D 3 Use a felt tip pen to accurately trace the canopy outline onto the MonoKote film Remove the canopy

D 4 Without cutting into the balsa, use a sharp hobby knife to carefully cut and remove a strip of covering 1/16" wide, approximately 1/32" inside of the line you made Wipe away the line with a paper towel dampened with alcohol.

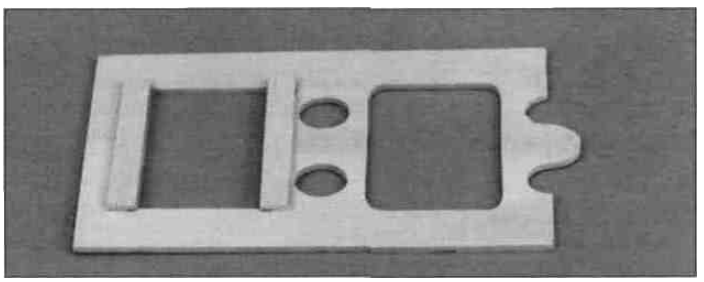
D 5 Reposition the canopy on the fuse and confirm that it covers the exposed wood Glue the canopy to the fuse with a glue formulated for gluing on canopies such as Pacer "Formula 560" canopy glue Hold the canopy in place with masking tape or rubber bands.

RADIO INSTALLATION

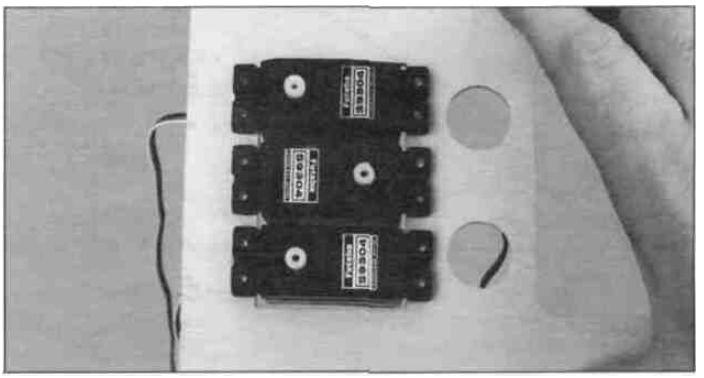
With the Ultimate completely assembled except for the radio system, turn to page 44 and check the balance point of the plane The radio tray can be installed with the servos forward or aft If the plane is tail heavy, install the servo tray with the servos forward ^ If the plane is nose heavy, install the servo tray with the servos aft.

Install the Rudder, Elevator & Throttle Servos

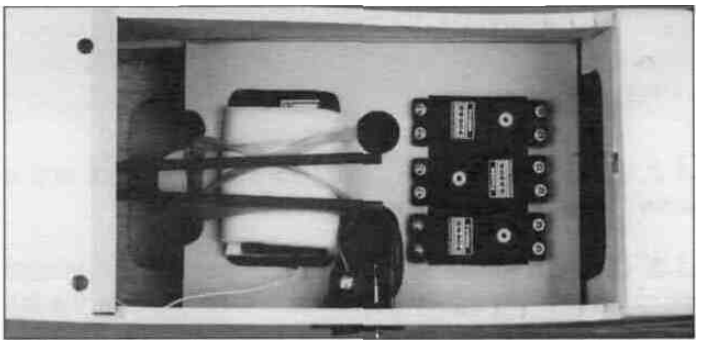
D 1. After determining the location for the servos, test tit the die-cut 1/8" plywood **servo tray** in the fuse The edges of the servo tray will need to be sanded to allow it to fit on the lip created by the top forward fuse doubler The servo tray is installed as far forward as possible, even with the servos at the aft end.



D 2 Glue the die-cut 1/8" plywood **servo tray doublers** to the bottom of the servo tray, flush with the edges of the servo cut-out.

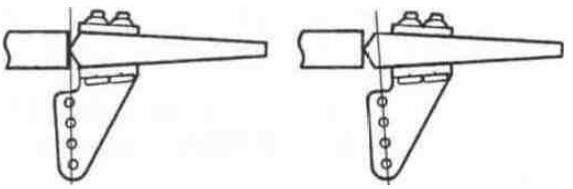


D 3 Install the servos in the servo tray as shown, spacing them apart as necessary so the servo arms do not interfere with each other.

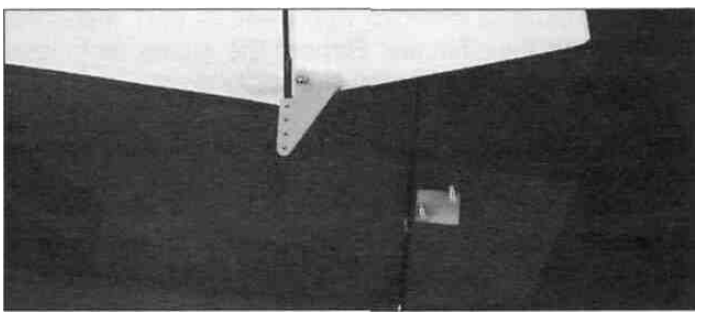


D 4 Plug the servos into the receiver Wrap the receiver in foam padding and rubber band it in the servo tray Insert the servo tray under the outer pushrod tubes and glue it in position Install the receiver switch and plug the receiver battery into the receiver.

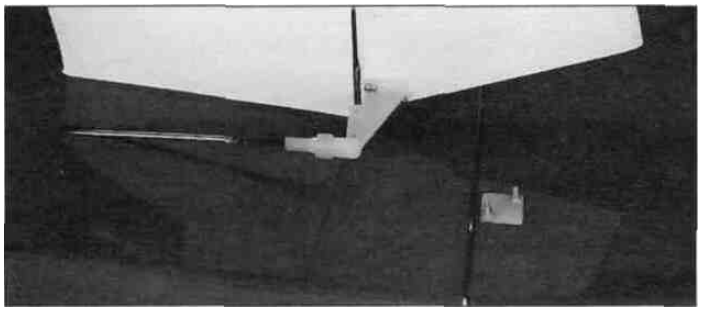
D 5. Cut the outer pushrod tubes 2" short of the rudder and elevator servos.



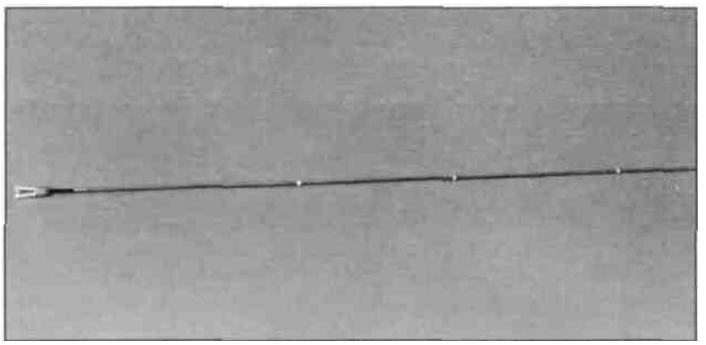
RIGHT **WRONG**



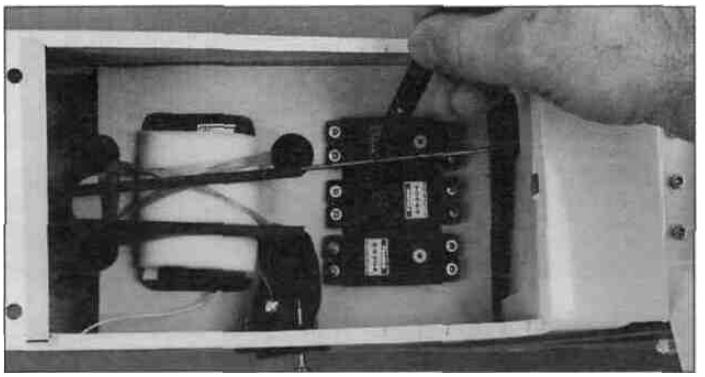
D 6 Position the **large control horns** on the elevator and rudder as shown in the sketch and on the plan Mark the location of the mounting holes and drill a 3/32" hole at the marks Mount the control horns on the rudder and elevator with the **backing plate** and **2-56 x 5/8" screws.**



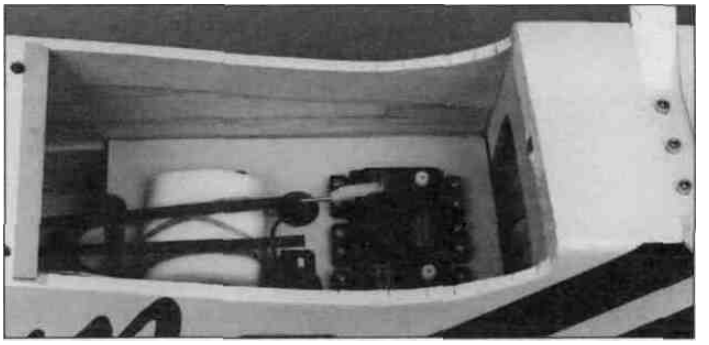
D 7. Slide a **silicone retainer** over the threaded end of two 36" threaded pushrods. Thread a **nylon clevis** 13 turns onto each pushrod. Slide the pushrods into the rudder and elevator outer pushrod tubes. Connect the clevises to the control horns and mark the pushrods where they enter and exit the outer pushrod tubes.



D 8. Cut ten 1/4" long bushings from the 6-1/2" plastic inner pushrod tube. Slide four bushings onto the pushrods, evenly spaced between the marks. Adjust the bushings nearest the marks so they will not come out of the ends of the outer pushrod tubes. If the bushings slide easily on the pushrods, use CA to hold them in position.

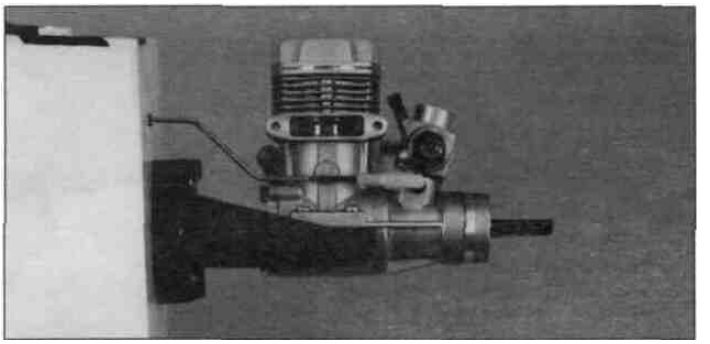


D 9. Reinstall the pushrods in the outer pushrod tubes and connect the clevises to the control horns. With the radio switched on and the servos centered, position the control surfaces to neutral. Mark the pushrod where it crosses the mounting holes in the servo arm.

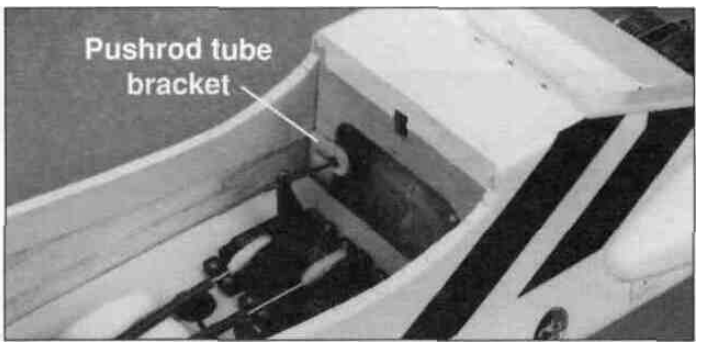


D 10. Disconnect the clevises from the control horns and make a 90' bend at the marks you made. Cut the pushrod 3/8" above the bend. Connect the pushrods to the servos with **faslinks.**

Note: If necessary, enlarge the holes in the servo arms with a 5/64" drill bit (or a #48 drill for precision).

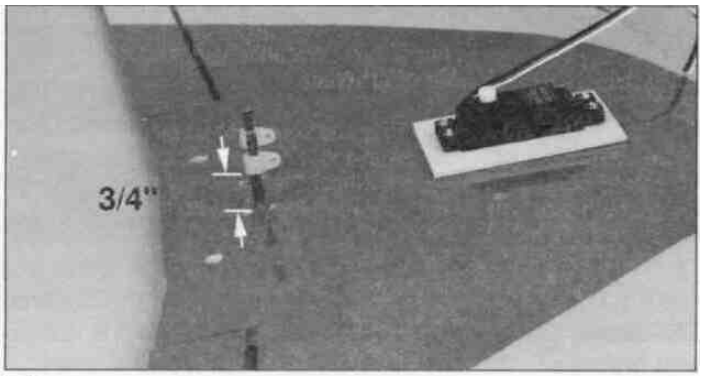


D 11. Install a silicone retainer and nylon clevis on the third 36" threaded pushrod. Bend and cut the pushrod to fit your engine installation making sure that the muffler does not interfere with the pushrod. Install two pushrod bearings on the pushrod. Insert the pushrod in the throttle outer pushrod tube.

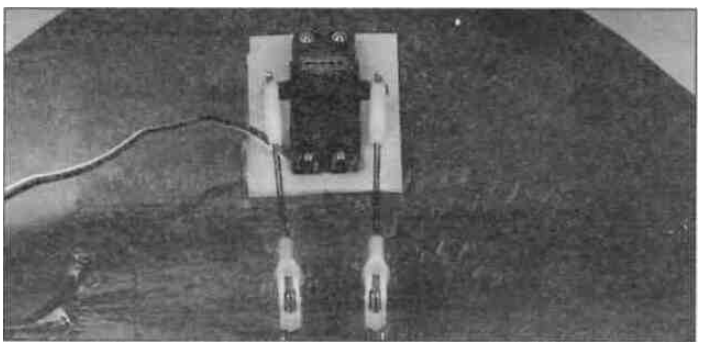


D 12. Install the Screw-Lock Pushrod Connector in the throttle servo arm. Slide the throttle pushrod through the pushrod connector and connect the clevis to the throttle arm on the carburetor. With the radio switched on, adjust the throttle trim to high. Move the throttle stick to full throttle and move the throttle arm on the carburetor to open. Tighten the 4-40 x 1/8" cap screw in the pushrod connector. Check the movement of the throttle. The carburetor should not close completely when the throttle stick is moved to low. The carburetor should close completely only when the throttle trim is moved to low. An outer pushrod tube bracket can be made from leftover plywood with a notch cut in it and glued to former F-8A.

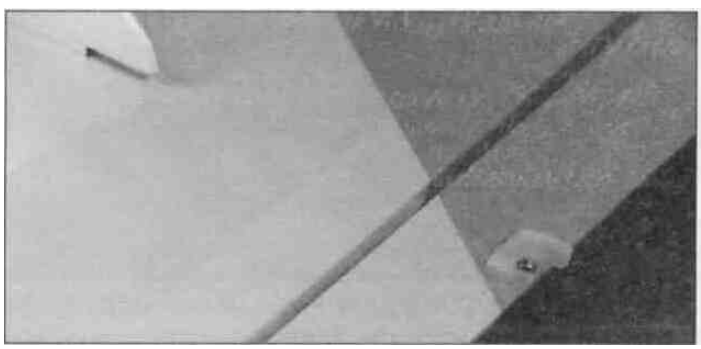
Install the Aileron Servo



D 13. Install the aileron servo in the aileron servo tray. Thread the nylon 6-32 torque rod connectors on the torque rods until they are 3/4" from the wing sheeting.

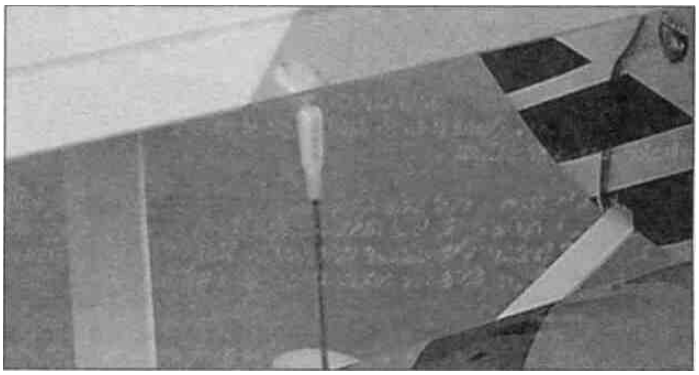


D 14. Thread nylon clevises onto two 12" threaded pushrods Connect the clevises to the torque rod connectors and secure them with silicone retainers. Bend, cut and attach the other end of the pushrods to the aileron servo with faslinks, as described before.

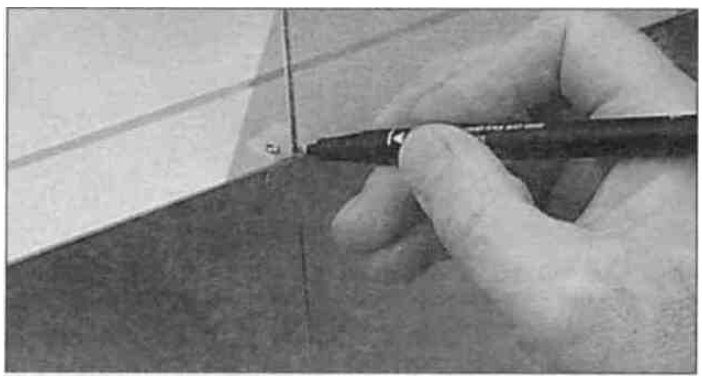


D D 15. Attach both wings to the fuse Position the **small control horns** on the TE of the ailerons, in line with the struts. With the control horn base flush with the TE of the aileron, mark the location of the mounting holes Drill a 3/32" hole at the marks Trim the control horn so that only the bottom hole remains Mount the control horns on the ailerons with the **backing plate** and **2-56 x 3/8" screws.**

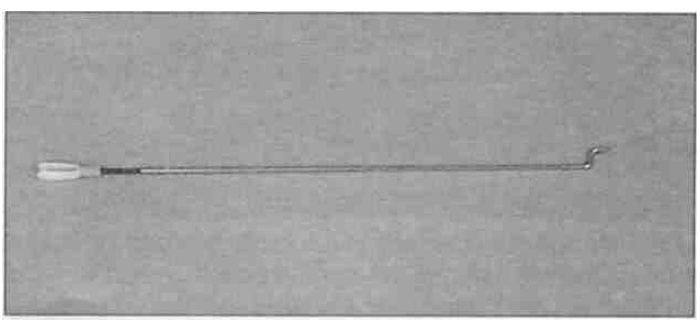
Note: The control horns go on the top of the aileron, on the bottom wing and on the bottom of the aileron, on the top wing.



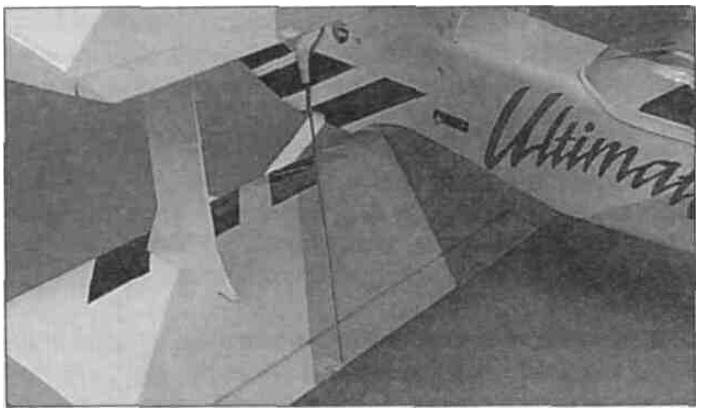
D D 16 Thread a **nylon clevis** 13 turns onto the end of a 12" threaded pushrod. Attach the clevis to the control horn on the top wing aileron.



D D 17. Set the ailerons on the top and bottom wings to neutral. Mark the pushrod at the attachment hole in the control horn.



D D 18. Remove the pushrod and make a "Z-bend" at the mark.



D D 19. Slide a silicone retainer on the pushrod. Use a 5/64" or *#48* drill bit to enlarge the hole in the control horn on the bottom aileron **only.** Insert the "Z-bend" in the control horn and attach the clevis to the control horn on the aileron of the top wing. Slide the retainer over the clevis to secure it to the control horn.

D 20. Assemble the other aileron pushrod following the same procedure.

CHECK THE WING INCIDENCE

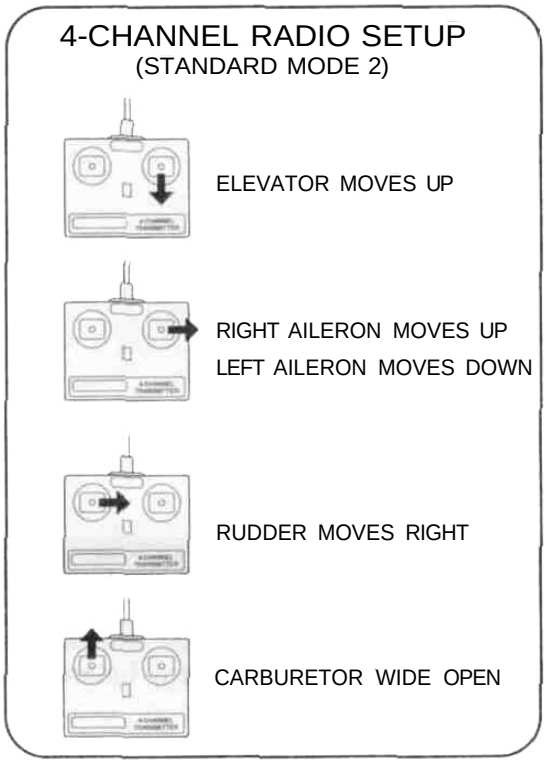
D 1. Mount both wings on the fuselage and block-up the tail so that the stab is level.

D 2. Set an incidence meter on the bottom wing. Take measurements next to the fuse and at the wing tips. The incidence on the bottom wing should be 0°.

D 3. Check the incidence of the top wing. It should be 0°. If the incidence needs to be changed, #6 washers can be inserted under the 6-32 nuts on top of the cabane.

D 4. After the incidence is set, cut off the 6-32 bolts above the locking nuts that hold the top wing in position.

SET THE CONTROL THROWS



The throws are measured at the widest part of the elevators, rudder and ailerons. Adjust the position of the pushrods at the servo horns to control the amount of throw. You may also use the ATV'S if your transmitter has them but the mechanical linkages should still be set so the ATV'S are near 100% for the best servo resolution (smoothest, most proportional movement).
Note: We found that some mixing of the elevator and aileron with the rudder will make flying knife-edges easier.

We recommend the following control surface throws:

	High rate	Low rate
Elevator	5/8"	7/16"
Rudder	1-1/4"	1-1/4"
Ailerons	1/4"	3/16"

Mixing **Rudder/Elevator**

left rudder -1/8" up elevator
right rudder -1/16" down elevator

Rudder/Aileron

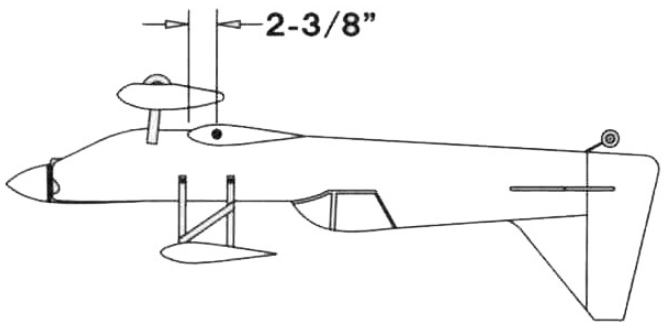
left rudder -1/16" right aileron
right rudder -1/32" left aileron

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

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

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 The **balance point (C.G.)** is located **2-3/8"** back from **the** leading edge of the bottom wing, next to the fuse sides as shown in the sketch and on the fuselage plan Accurately mark the balance point on the top of the bottom wing on both sides of the fuselage Use thin strips of tape or a felt-tip pen **to** make the marks

Hint: Reference the full-size fuse plan to help you locate the proper balance point This is the balance point at which your model should balance for your first flights After initial trim flights and when you become more acquainted with your Ultimate, you may wish to experiment by shifting the balance up to **1/4"** forward or backward to change its flying characteristics Moving the balance forward may improve the smoothness and stability, but the model may then require more speed for takeoff and may become more difficult to slow for landing Moving the balance aft makes the model more agile with a lighter, snappier "feel" **and** often improves knife-edge capabilities In any case, please start at the location we recommend Do not at any time balance your model outside the recommended range.

D 2 With the wing attached to the fuselage, all parts of the model installed (ready to fly) and an empty fuel tank, hold the model upside down with the stabilizer level

D 3 Hold the model at the balance point If the tail drops, the model is "tail heavy and you must add weight to the nose to balance the model If the nose drops, it is "nose heavy" and you must add weight to the tail to balance the model If possible, first attempt to balance the model by changing the position of the receiver battery If you are unable to obtain good balance by doing so, then it will be necessary to add weight to the nose or tail to achieve the proper balance point.

Note: Nose weight may be easily installed by using a "spinner weight" or gluing lead weights to the firewall Tail weight may be added by using Great Planes (GPMQ4485) "stick-on" lead weights.

PREFLIGHT

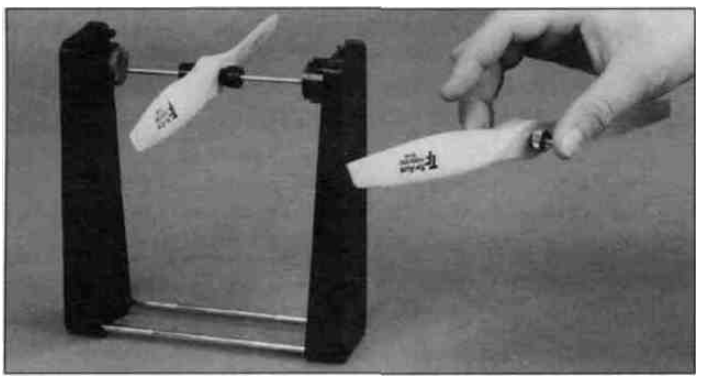
At this time check all connections including servo horn screws, clevises, servo cords and extensions Make sure you have installed the nylon retainer on the Screw-Lock Pushrod Connector and the silicone retainers on all the clevises.

Charge the Batteries

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

Balance the Propeller

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



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

Find a Safe Place to Fly

Since you have chosen the Ultimate 40, we assume that you are an experienced modeler Therefore, you should already know about AMA chartered flying fields and other safe places to fly If for some reason you are a relatively inexperienced modeler and have not been informed, we strongly suggest that the best place to fly is an AMA chartered club field Ask the AMA or your local hobby shop dealer if there is a club in your area and join Club fields are set up for R/C flying and that makes your outing safer and more enjoyable The AMA address and telephone number is in the front of this manual If a club and flying site are not available, find a large, grassy area at least 6 miles away from houses, buildings and streets and any other R/C radio operation like R/C boats and R/C cars. A schoolyard may look inviting but is too close to people, power lines and possible radio interference.

Ground Check the Model

Inspect your radio installation and confirm that all the control surfaces respond correctly to the transmitter inputs The engine operation must also be checked by confirming that the engine idles reliably, transitions smoothly and rapidly to full power and maintains full power, indefinitely The engine must be "broken-in" on the ground by running it for at least two tanks of fuel Follow the engine manufacturer's recommendations for break-in Make sure all screws remain tight, that the hinges are secure and that the prop is on tight

Range Check Your Radio

Whenever you go to the flying field, check the operational range of the radio before the first flight of the day First, make sure no one else is on your frequency (channel) With your transmitter on, you should be able to walk at least 100 feet away from the model and still have control While you work the controls, have a helper stand by your model and tell you what the control surfaces are doing Repeat this test with the engine running at various speeds with a helper holding the model If the control surfaces are not always responding correctly, do not fly! Find and correct the problem first Look for loose servo connections or corrosion, loose bolts that may cause vibration, a defective on/off switch, low battery voltage or a defective receiver battery, a damaged receiver antenna, or a receiver crystal that may have been damaged from a previous crash.

Engine Safety Precautions

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

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

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

Use safety glasses when starting or running engines.

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

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

Keep these items away from the prop' loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects such as pencils or screwdrivers that may fall out of shirt or jacket pockets into the prop.

Use a "chicken stick" or electric starter to start the engine Do not use your fingers to flip the propeller 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 right after operation Make sure fuel lines are in good condition so fuel will not leak onto a hot engine, causing a fire.

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

AMA SAFETY CODE (EXCERPT)

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

General

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

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

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

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

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

Radio Control

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

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

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

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

FLYING

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

The Great Planes Ultimate 40 is a great flying biplane that flies smoothly and predictably The Ultimate 40 does not, however, possess the self recovery characteristics of a primary R/C trainer and should only be flown by experienced RC.

Takeoff

Takeoff on "high" rates if you have dual rates on your transmitter - especially if you are taking off into a crosswind. For all models it is good practice to gain as much speed as the length of the runway will permit before lifting off. This will give you a safety margin in case the engine quits. When the plane has gained enough flying speed to safely lift off, gradually and smoothly apply up elevator and allow the model to climb at a shallow angle (do not yank the model off the ground into a steep climb!)

Flight

We recommend that you take it easy with your Ultimate 40 for the first several flights, gradually "getting acquainted" with this great model as your engine gets fully broken in. If you feel as though you have your hands full, keep this in mind: pull back on the throttle stick to slow the model down. This will make everything happen a little slower and allow yourself time to think and react. Add and practice one maneuver at a time, learning how the Ultimate 40 behaves in each. For smooth flying and normal maneuvers, use the low rate settings as listed on page 43.

Sometimes well before it's time to land, you should climb your Ultimate 40 to a safe altitude, cut the throttle to an idle and check out the model's low speed characteristics. Do this a few times so you know what to expect upon landing and how the Ultimate 40 handles stalls.

Landing

When it's time to land, fly a normal landing pattern and approach. Keep a few clicks of power on until you are over the runway threshold. For your first few landings, plan to land slightly faster than stall speed.

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

Flight Log

DATE	COMMENTS
/ /	Purchased
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/ /	Finished Construction
/ /	First Flight
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TWO VIEW

Photocopy this drawing and use the copies to design your trim scheme.