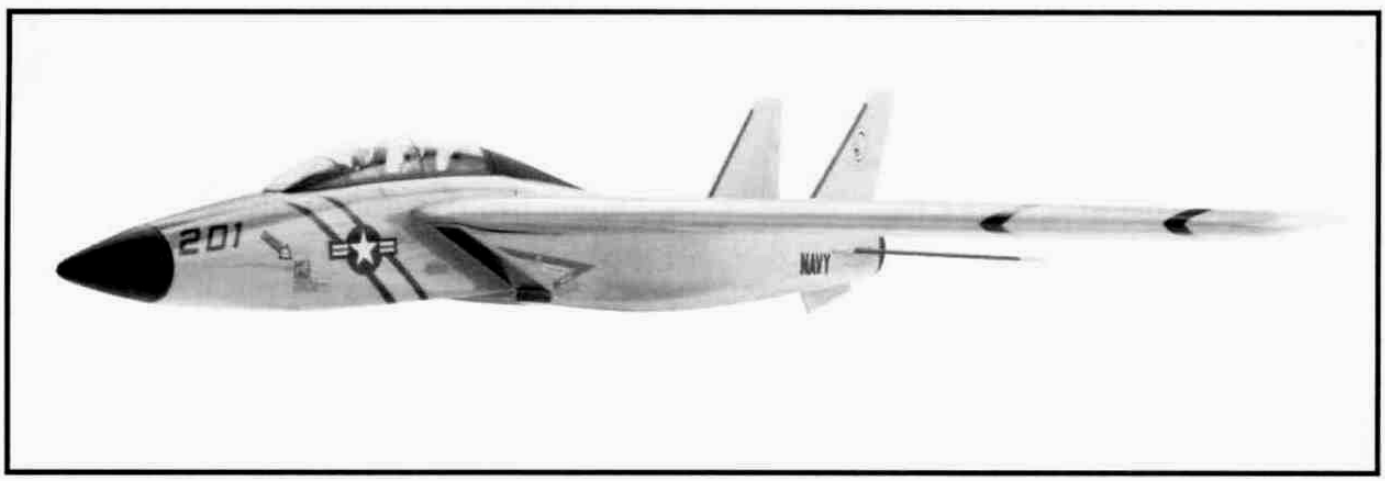
F-14 TOMCAT

INSTRUCTION BOOK



WARRANTY

Great Planes Model Manufacturing Co , Inc guarantees this kit to be free of 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, he is advised to immediately return this kit in new and unused condition to the place of purchase.

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

GREAT PLANES®
MODEL MANUFACTURING COMPANY

P 0 BOX 788 URBANA ILL NOIS 61801 (217) 398-8970

 F146P03 V1 1

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WARNING! THIS IS NOT A TOY!
THIS IS NOT A BEGINNERS AIRPLANE!

This R/C kit and the model you will build is not a toy! It is capable of serious bodily harm and property damage. **IT IS YOUR RESPONSIBILITY AND YOURS ALONE —** to build this kit correctly, properly install all R/C components and flying gear (engine, tank, pushrods, etc.) and to test the model and fly it only with experienced, competent help, using common sense and in accordance with all safety standards as set down in the Academy of Model Aeronautics Safety Code. It is suggested that you join the AMA and become properly insured before you attempt to fly this model. IF YOU ARE JUST STARTING R/C MODELING, CONSULT YOUR LOCAL HOBBY SHOP OR WRITE TO THE ACADEMY OF MODEL AERONAUTICS TO FIND AN EXPERIENCED INSTRUCTOR IN YOUR AREA.

Academy of Model Aeronautics
5151 East Memorial Drive
Muncie, IN 47302-9252 (800) 435-9262

INTRODUCTION

Congratulations and thank you for purchasing the Great Planes **F-14 TOMCAT'**

The Great Planes F-14 is a high performance propeller-driven sport airplane that resembles the real F-14 Tomcat. In the air, the prop is invisible, adding to the realism. The smoothness and speed of this airplane allow you to experience the thrills of flying a jet-like airplane without the complexity and high cost of a dueled fan model.

This is not a beginner's airplane! While the F-14 TOMCAT is not difficult to build and flies great, we must discourage you from selecting this kit as your first R/C airplane. It is very fast, highly maneuverable and lacks the self-recovery characteristics of a good basic trainer such as the Great Planes PT Series airplanes. On the other hand, if you are confident with your flying skill and can safely handle aileron airplanes such as the Great Planes Ultra-Sport Series or Big Stik Series airplanes, the F-14 is an excellent choice. If you currently fly an aileron airplane but you are unsure about your ability to handle the F-14. we recommend that you build and fly a low-wing sport plane before building and flying your F-14.

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 and we'll be glad to help. If you are calling for replacement parts, please look up the part numbers and the kit identification number (stamped on the end of the carton) and have them ready when calling.

PRECAUTIONS

1. You must build the plane **according to the plans and instructions.** Do not alter or modify the model as doing so may result in an unsafe or unflyable model. In a few cases the plans and instructions may differ slightly from the photos. In those instances you should assume the plans and written instructions are correct. Also you may notice a slight difference in length between longer parts and the plans. This is normal and is caused by the plans expanding and shrinking with the changing moisture content in the an. Do not modify the paits to fit the plan.

2 You must take time to **build** straight, true and strong. **IMPORTANT** - Glue should never be substituted tor a good joint. Take a little extra time to get a close fitting joint and glue it properly. It will be stronger, neater, and much lighter than a bad joint held together with a glob of glue!

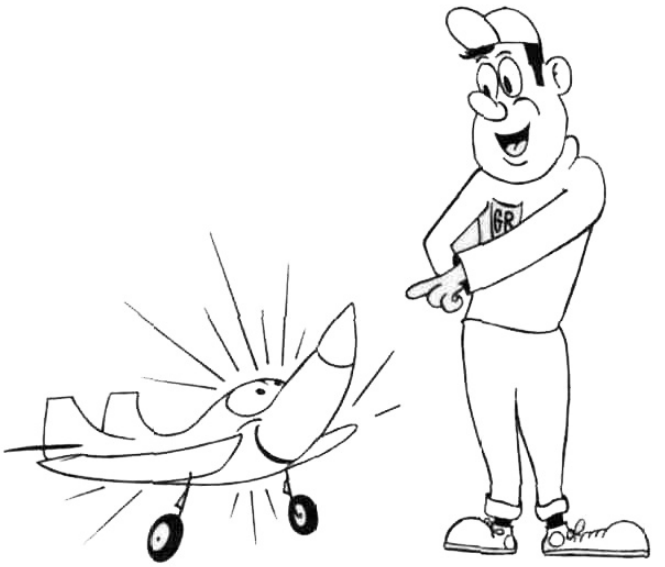
3. You must use a proper R/C **radio** that is in first class condition and meets the current AMA and FCC requirements and the requirements of your local flying club, the correct sized **engine** and correct **components** (fuel tank, wheels, etc)

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

5. You must **test** the operation of the model before the first and each successive flight to insure that all equipment is operating Also you must make certain that the model has remained structurally sound

6. You must **fly** the model **only with the competent help** of a well experienced R/C pilot if you are not already an experienced and knowledgeable R/C pilot.

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



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

OTHER ITEMS REQUIRED

- D Four-channel radio with 4 or 5 servos (additional channel and retract servo required if retracts are being used)
- D Propellers (see engine instructions for recommended sizes) Top Flite® "Power Props" recommended.
- D 2-1/4" Spinner (Hobbico 2-1/4" Jet spinner #HCAQ3750 recommended)
- D Fuel Tank (GPMQ4104)
- D 5/32" Wheel Collars (GPMQ4306)
- D Iron-on Covering Material (Top Flite Super MonoKote® gray, black and cub yellow recommended)
- D Fuelproof Paint for Tail Cones, and possibly for trim Note Chevron "Perfect Paint" matches Top Flite Super MonoKote, and is available in spray cans.
- D 36" Throttle Pushrod (GPMQ3710)
- D Silicone Fuel Tubing (GPMQ4131)
- D 1/16" thick Wing Seating Tape (GPMQ4422) or silicone sealer see instructions
- D Latex Foam Rubber Padding (HCAQ 1000)
- D 2 Plastic Pilots Williams Bros Military 1-1/2" Scale #171
- D Wheels (see page 5)

THE OPTIONAL RETRACTS ALSO REQUIRE:

- D Hobbico Low-Profile Retracts (HCAP4000)
- D #2 X 3/8" Socket Head Screws (GPMQ3120)
- D Dubro #103 Strip Aileron Horn (DUBQ1780)
- D Nose Gear Retract Pushrod (A Sullivan red outer guide tube and a 34" threaded rod works well for this)
- D Three 3/32" Wheel Collars (GPMQ4302)
- D Screw-Lock Pushrod Connector (GPMQ3870)
- D 2-56 Metal Clevises (GPMQ3790)

SUPPLIES AND TOOLS NEEDED

- D 2 oz Thin CA Adhesive (GPMR6003)
- D 2 oz Medium or Thick CA Adhesive (GPMR6009)
- D 2 5 oz Epoxy (GPMR6047)
- D Silicone Adhesive
- D 7/64 Ball Driver (GPMR8003)
- D 440Tap(GPMR8101)
- D Hand or Electric Drill
- D Drill Bits 1/16", 5/64", 7/64", 1/8", 5/32", 3/16", 13/64", 1/4" and 5/16"
- D Sealing Iron and Heat Gun (Hobbico or Top Flite recommended)
- D Hobby Saw (X-acto Razor Saw)
- D X-acto Knife, #11 Blades
- D Pliers
- D Screw Drivers
- D T-Pins (HCAR5200)
- D Straightedge
- D Masking Tape (Required for construction)
- D Sandpaper (coarse, medium, fine grit)*
- D T-Bar Sanding Block (or similar)
- D Waxed Paper
- D Lightweight Balsa Filler
- D Vaseline Petroleum Jelly
- D Isopropyi Rubbing Alcohol (70%)
- D 3M "77" Spray Adhesive (optional)
- D Dremel Moto Tool or similar (optional)
- D 5/64 and 2mm Ball Driver (for Hobbico Retracts)

***NOTE: On our workbench, we have four 11" T-Bar sanders, equipped with #50, #80, #100 and #150-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.**

DECISIONS YOU MUST MAKE NOW

ENGINE, MOUNT AND MUFFLER SELECTION

The recommended engine for the F 14 is a 60* - 75 cubic inch displacement **2-cycle *NOTE:** Performance may be marginal if a non-Schneurle-ported 60 cu in 2-Cycle engine is used. The engine you select will determine how you build the fuselage, so it is important that you have the engine close at hand while building Because of the size limitations and the nature of this model, 4-cycle engines are more difficult to install and balance and therefore are not recommended.

This kit includes a Great Planes **MM60** engine mount (or similar mount) that fits most 60 - 61 (2-Cycle) engines (slight modification of this mount is required to mount the OS 61 SF by filing the inside edges of the engine mount beams) If the supplied mount can't be modified to fit your engine, it may be necessary to purchase a different mount (check with your hobby dealer).

SELECTION OF WHEELS

To save weight, we recommend using lightweight wheels **REMEMBER:** Large wheels are ugly and unrealistic on a model of this type, so try to keep the wheels as small as possible.

If you will be flying from a concrete or asphalt runway, we recommend 2-1/4" main wheels and a 2" nose wheel

For grass fields, larger wheels will be required, such as 2-1/2" main wheels and a 2-1/4" to 2-1/2" nose wheel.

If you will be installing retracts, you should try to limit the wheel size to a maximum of 2-1/4" main wheels and a 2" nose wheel or the wheel wells will be excessively large.

POSSIBLE RADIO INSTALLATIONS

The F-14 is designed to satisfy a wide variety of modelers' desires The following radio installation options will allow you to customize the plane to fit whichever radio you want to use.

Our recommended radio installation requires 5 standard servos and a 180 degree retract servo (if retracts are used) This will allow you to use one standard servo for the rudders, two servos for the elevators (one for each), one for the throttle and one for the ailerons This set-up will give you very precise control and is easy to install

You can also fly the plane with 4 standard servos by using only one servo to drive both elevators In this case the elevator servo is mounted up in a front servo tray and two long pushrods are used This will work Ok, but there is generally more "play" in the elevators (due to the longer, curved pushrods) This method is not recommended if you intend to use a high powered engine or do a lot of high speed flying

Both rudders can be operated from one servo without any problems because their linkage is much straighter If you don't plan on doing much acrobatic flying, you can even get by with only one operating rudder In this case you would just run one pushrod straight back to the rudder **on the same side as the servo** The other rudder would be glued on to the fin and would not move

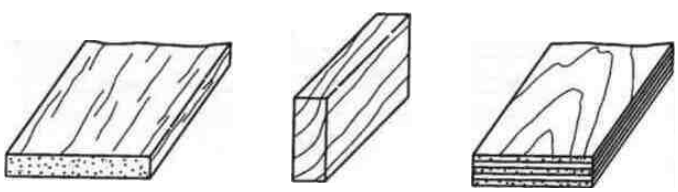
RETRACTABLE LANDING GEAR (optional)

This airplane flies very well with a fixed landing gear, and **retracts are not necessary,** however, they do add realism and speed, and are a nice addition (it you are prepared for the extra work involved in their installation) Since the retracts are all located in the fuselage, one retract servo (such as the Futaba FP-S136G) can be used to actuate all three retracts

COMMON ABBREVIATIONS USED IN THIS BOOK AND ON THE PLANS:

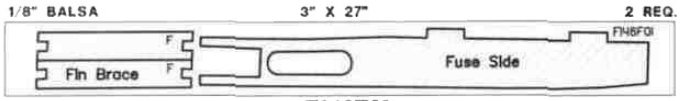
Elev = Elevator
Fuse = Fuselage
LE = Leading Edge (front)
LG = Landing Gear
Ply = Plywood
Stab = Stabilizer
TE = Trailing Edge (rear)
= Inches

TYPES OF WOOD



Balsa **Basswood** **Plywood**

DIE-CUT PATTERNS



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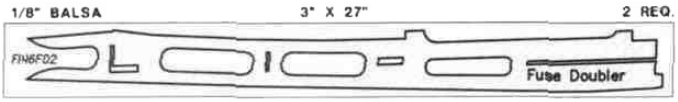

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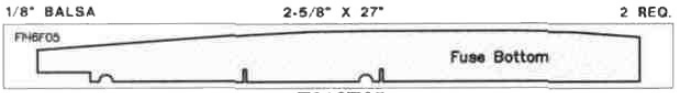

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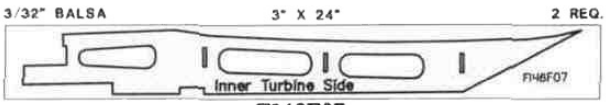

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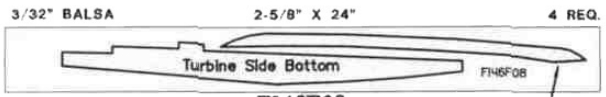

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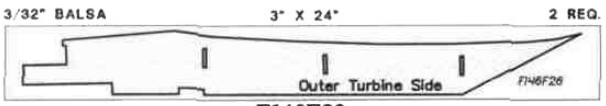

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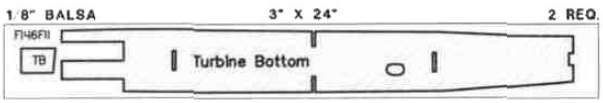

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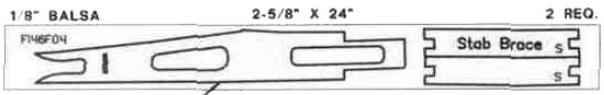

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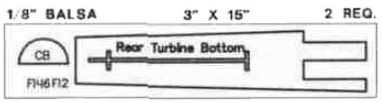

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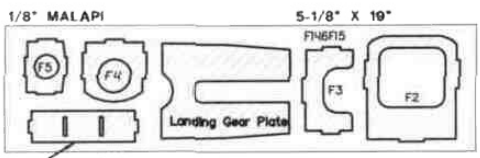

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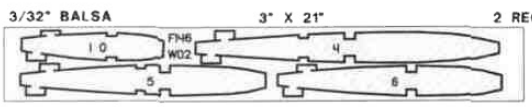

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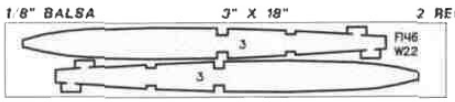

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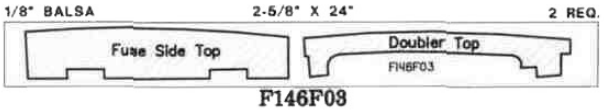

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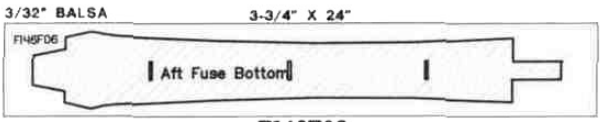

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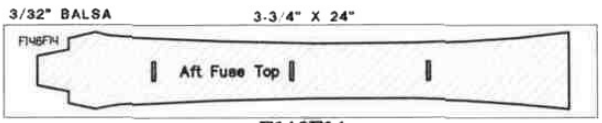

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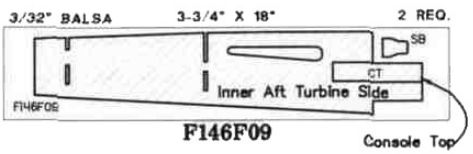

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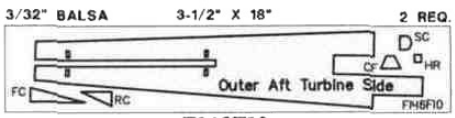

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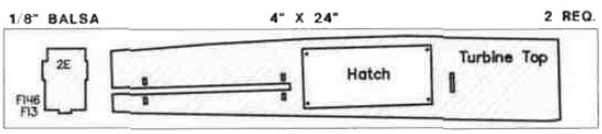

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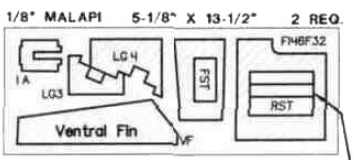

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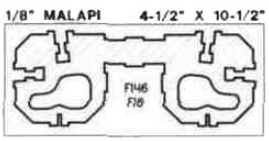
Front Retract Rails



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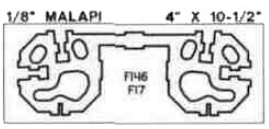

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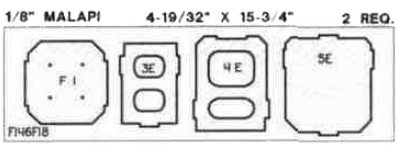

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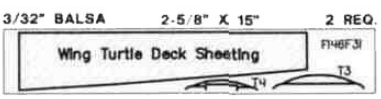

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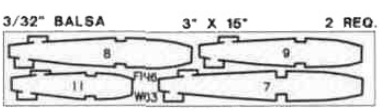

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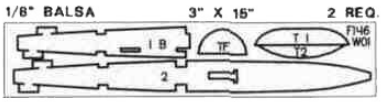


F146W01

GET READY TO BUILD

D 1. Unroll the plan sheets and re-roll them inside out. This will help them lie flat.

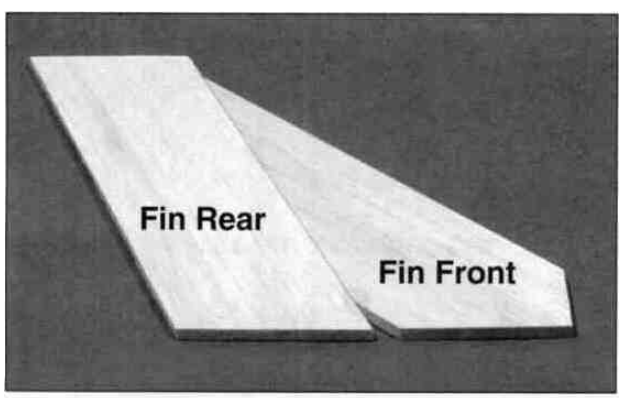
D 2. Remove all parts from the box. As you do, determine the name of each part by comparing it with the plans and the parts list at the back of this book. Using a felt tip pen, write the part **name** or **size** on each piece to avoid confusion later. Use the die-cut part patterns shown on page 6 to identify the die-cut parts, but **do not punch them out** until you are ready to use them. **Save all scraps.** If any of the die-cut parts are difficult to punch out, do not force them! Instead, first cut around the parts with an X-acto knife. After punching out the die-cut parts, use your T-Bar or sanding block to **lightly** sand the edges to remove any die-cutting irregularities.

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

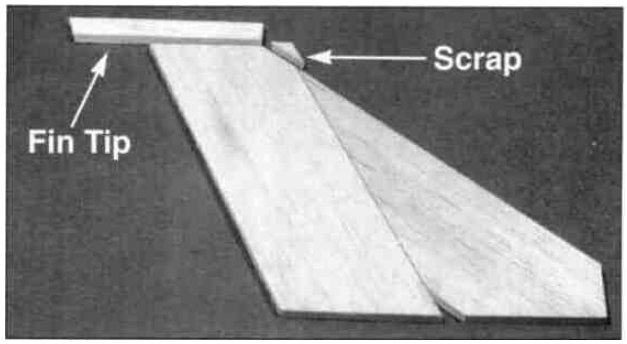
"TAIL FEATHERS"

BUILD THE FINS AND RUDDERS

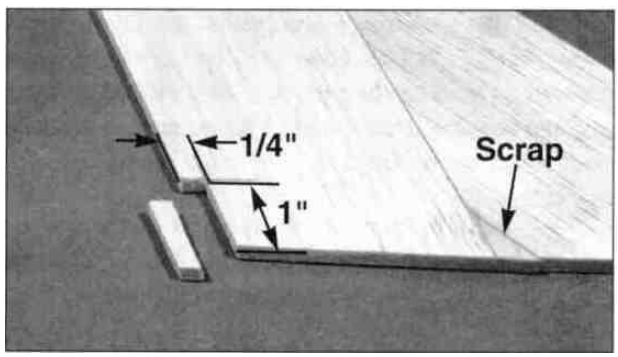
D 1. Tape the **fuselage side view** portion of the plan down onto your flat work surface. Tape a piece of waxed paper over the fin and rudder portion of the plan.



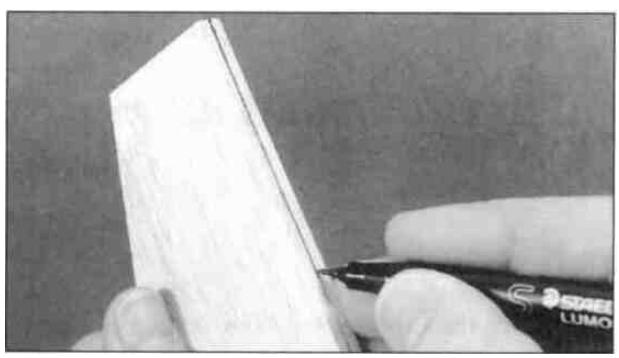
D D 2. Glue the 1/4" balsa **fin from** (146R01) to the 1/4" balsa **fin rear** (F146R03) so their bottoms are even with each other. Note that there will be a triangle of wood missing between the two pieces. This can be filled in the next step.



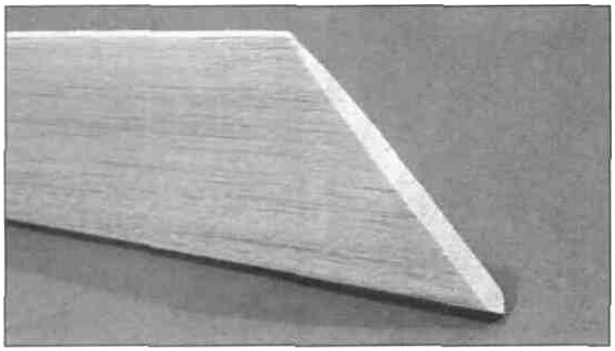
D D 3. Cut the tip of the fin rear to match the leading edge sweep of the fin front. Glue the little triangle piece of scrap into the "V" at the bottom. Cut the **1/4" x 5/8" x 9" balsa stick** (F146R04) in half to make two 4-1/2" long **fin tips.** Glue the tip in place at the end of the fin **rear.**



D D 4. Draw a line parallel with the trailing edge of the fin and 1/4" in front of it. Draw another line **parallel** with the bottom edge of the fin and 1" above it. Cut out a clearance notch for the torque rods using the lines as a guide as shown in the photo.



D D 5. Use a sanding block with medium (150) grit sandpaper to sand the edges and both sides of the stab smooth. Carefully draw a **centerline** all around the edges of the stab and elevator. This will make it easier to maintain symmetry when sanding later.



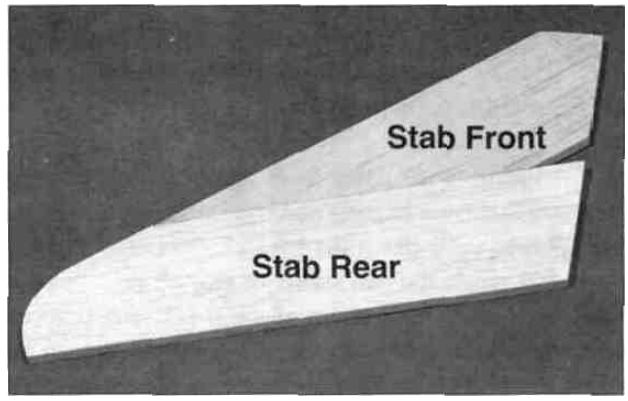
D D 6. Using a sanding block and **coarse** (50 or 80-grit) sandpaper, sand both sides of the rudder to a **taper** (see cross-section on plans). The trailing edge should end up approximately 3/32" wide. (Do not sand to a sharp edge). Leave the top and bottom edges square. Sand the leading edge of the **rudder** to a **"V-shape"** as **shown** on the plan. **NOTE: If you are going to have only one operating rudder, do not sand the LE of the fixed rudder to a "V" as described above.** Leave it square and Just glue it in place against the TE and tip of the fin. **HINT:** It is a good idea to keep new, sharp sandpaper on your sanding blocks. You will notice that it "cuts" the wood and the glue much cleaner and produces a much smoother finish.

D D 7. Sand the top and front edges of the **fin** to a rounded shape (see cross-section on plans). Sand the trailing edge of the **fin tip** (at the top of the rudder) to the same taper as the rudder.

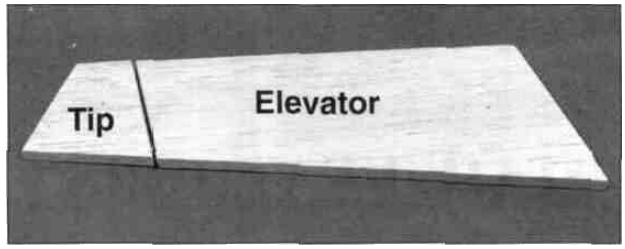
D 8. Go back to step 2 and build another fin and rudder.

BUILD THE STABILIZERS AND ELEVATORS

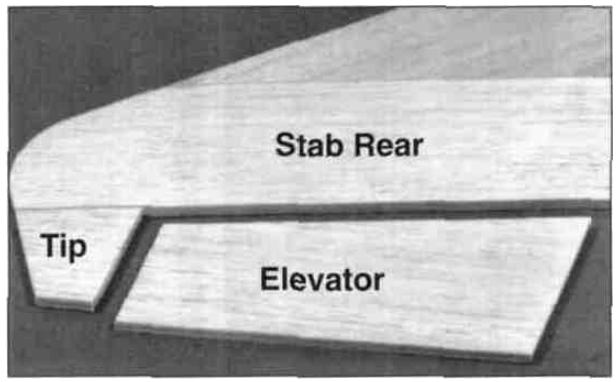
D 1. Tape the **fuselage top view** portion of the plan down onto your flat work surface and cover the stabilizer portion of the fuselage top view with wax paper.



D D 2. Glue the 1/4" balsa **stab front** (F146S01) to the 1/4" balsa **stab rear** (F146S03) so the root ends are even **with** each other. Note that there is a triangle of missing wood formed when the two pieces are properly joined. There are no scrap pieces to fit in there. You can cut one if you desire, although it is not necessary.



D D 3. Position the 1/4" balsa **elevator** (F146S04) over the plan and mark where the stab tip will be cut oft. Cut the tip off with a razor saw and glue it to the stab rear. Do this over the plans so you will be sure to position it correctly.



D D 4. Use a sanding block with medium (150) grit sandpaper to sand the edges and both sides of the stab smooth. Carefully draw a **centerline** all around the edges of the stab and elevator. This will make it easier to maintain symmetry when sanding later.

D D 5. Using a sanding block and **coarse** (50 or 80-grit) sandpaper, sand both sides of the elevator to a **taper** (see cross-section on plans). The trailing edge should end up approximately 3/32" wide. (Do not sand to a sharp edge). Leave the ends square. Sand the leading edge of the **elevator** to a **"V-shape"** as shown on the plan.

D D 6. Sand the tip and front edges of the stab to a rounded shape (see cross-section on plans). Sand the trailing edge of the stab tip to the same taper as the elevator.

D D 7. Draw a line **parallel** with the trailing edge of the stab and 1/4" in front of it. Draw another line **parallel** with the root edge of the stab and 1" out from it. Cut out a clearance notch for the torque rods just as you did on the fins earlier.

D 8. Go back to step 2 and build another stab and elevator.

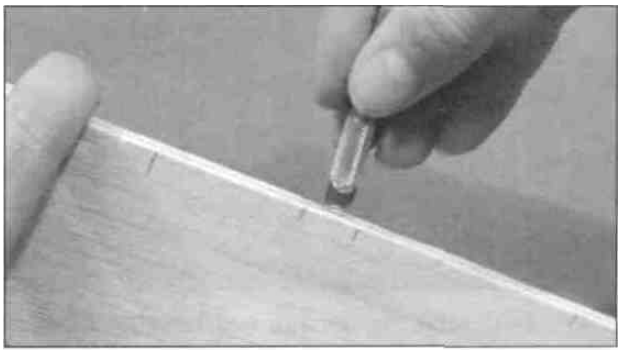
TEMPORARILY INSTALL HINGES AND TORQUE RODS

D 1. Using the plans as a guide, mark the hinge locations on the stabs, elevators, fins and rudders. Also designate one of each surface as being **"right"** and the others as **"left."**

CAUTION!!! You must use extreme care when cutting hinge slots with an X-acto knife, to avoid cutting yourself! If the balsa part breaks while you are pushing on the knife, the blade could go into your hand before you know it! A good precaution is to wear leather gloves while performing the following steps.

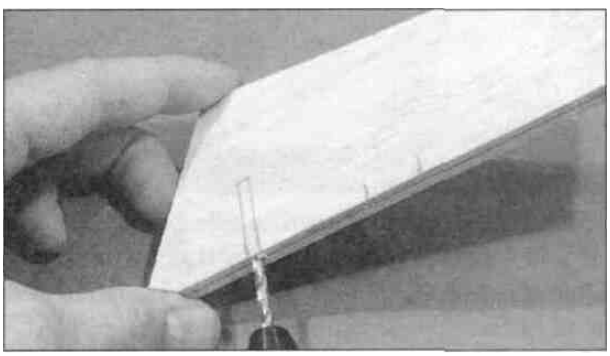
D 2. Cut the hinge slots on the centerlines you drew earlier. Our recommended hinge slotting method is described below.

A. Begin by carefully cutting a **very shallow slit** at the hinge location. The first cut is to establish your cut in the right place, so concentrate on staying on the line and **don't cut too deep.**

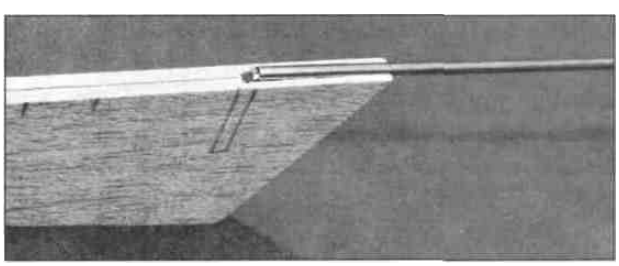


B. Make three or four more cuts in the same line, **going slightly deeper each time.** As you make these additional cuts. work on going straight into the wood. Continue this process while **"wiggling"** the knife handle forward and backward until the blade has reached the proper depth for the hinge.

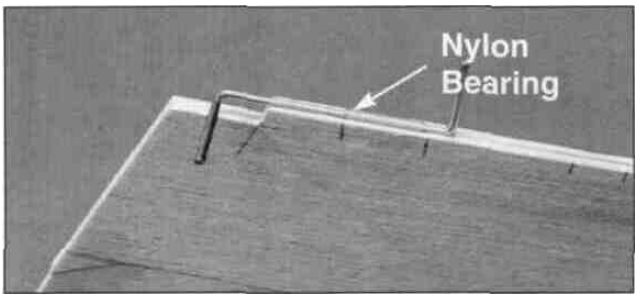
C. Trial fit the hinge into the slot. If the hinge is difficult to push in. re-insert the knife and move it back and forth in the slot a few times to enlarge the slot. **Do not glue the hinges yet.**



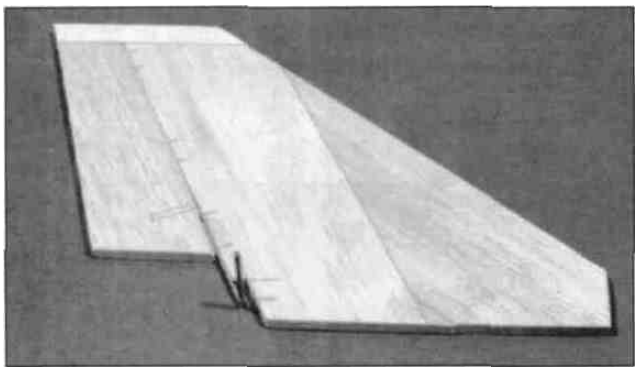
D 3. Check the plans and mark the location of the torque rods on the rudders and elevators. Drill 7/64" holes in the rudders and elevators (the holes are drilled slightly oversize to allow for positioning, and to create a hard epoxy "sleeve" around the wire). Groove the rudder and elevator LE to accept the torque rod wires and nylon bearings (See below).



HINT: Using an X-acto knife, sharpen the inside of one end of a 1/8" diameter brass tube. and use it to cut the groove in the **leading edge** of the rudders and elevators.



D 4. Determine the **torque rod bearing** locations from the plan. Then use a hinge slotting tool to cut the slots in the stabs and fins tor the nylon torque rod bearings. Cut a groove in the trailing edge of the stabs and fins to accept the torque rods and nylon bearings.



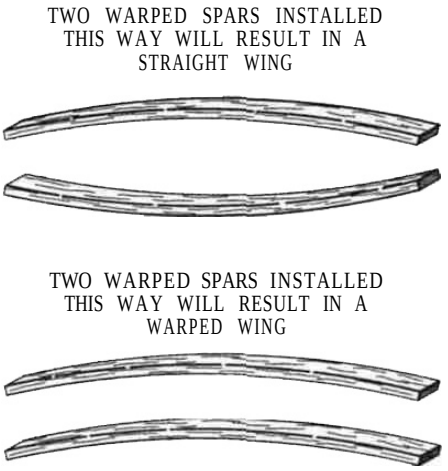
D 5. Trial fit all these parts together using the torque rods and hinges and trim the **fin tips** flush with the trailing edges of the rudders. Check the operation of the control surfaces but do not glue anything yet.

"WING"

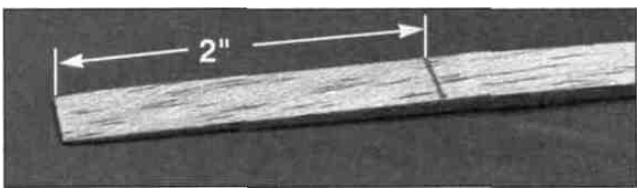
NOTE: The following instructions explain how to build the wing on a flat surface, directly on the plans. The jig tabs will automatically build in 1-3/4 degrees of washout and enable you to build a wing as straight as your work surface. Because this wing has a lot of taper and sweep, it is not advisable to build it on a Great Planes Wing Jig.

SPARS

D 1. Before using the hard balsa **spars,** examine them carefully for possible imperfections. Look for knots, soft spots, diagonal gram and any other



imperfections. If possible, position each spar so the imperfections (if any) are on the outer half of the wing panel (toward the tip), where they will be least affected by high stress. If the spars are warped slightly, try to "balance them out" by installing the warped spars in opposite directions (see sketch). **NOTICE:** If you feel that any of the wing parts are unusable due to severe warps or other defects, give us a call and we'll replace the parts.



D 2. Sand 2" of one end of each 1/8" x 3/8" x 18" balsa **spar doubler** (F146W05) to a taper as shown in the **"Wing Spar Detail"** on the plan.

D 3. Glue the spar doublers to the 1/8" x 3/8" x 30" balsa **spars** (F146F04) with thick CA as shown in the "Wing Spar Detail." Take your time and press the spar assembly flat against the work surface while the glue is curing. Also rotate the assembly onto its side and press it down to keep the doubler and spar aligned and straight. Do this on a **flat** work surface and most warps can be eliminated. Wipe off any excess glue before it cures.

BUILD THE WING PANELS

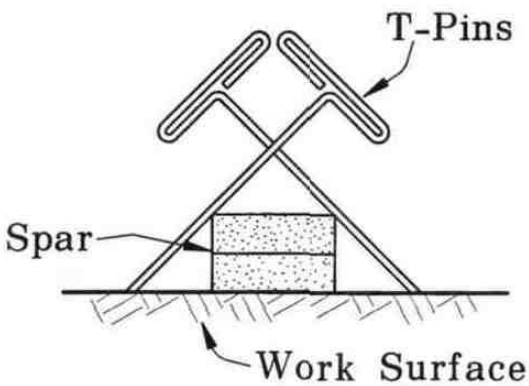
NOTE: If you build in the conventional manner, by pinning the components to your workbench, it will be helpful to build the wing on a piece of "Celotex"* or

other semi-soft (and flat) surface, into which you may easily stick pins to firmly hold down the wing parts while building, to avoid warps. *Available from lumber companies and home centers.

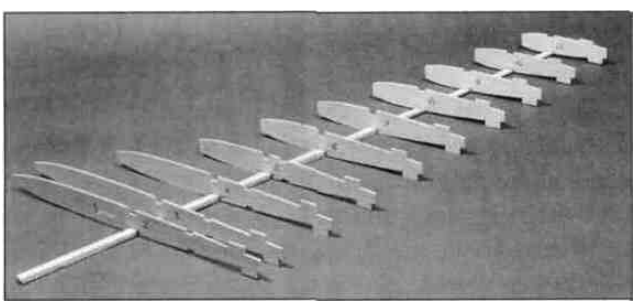
NOTE: You should also be aware of the following: This wing is constructed with 1-3/4 degrees of **washout** (TE higher than LE at the wing tip) built-in. When the wing is upright, the tabs on the rear portion of the ribs set the ribs at the proper angles to achieve this slight twist. When you flip the wing over to work on the bottom side, the jig tabs on the top of the wing will hold the correct washout in the wing.

D D 1. Cut the Wing Plan apart on the heavy dashed line. Tape the right (or left) wing panel plan to your flat work surface, and cover the wing drawing with waxed paper (so you won't glue the wing to the plan!).

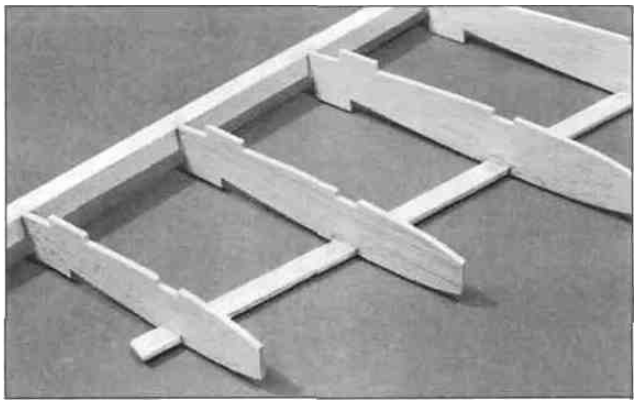
D D 2. Carefully punch out all the die-cut 3/32" and 1/8" balsa **wing ribs.** Sand the edges **slightly** to remove any die-cutting irregularities or "fuzz."



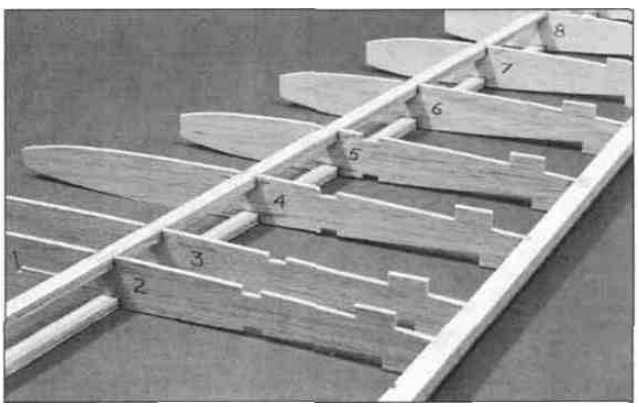
D D 3. Cross-pin one of the spars to the plan with the long spar down. and with the thick end (2 laminations) toward the root. The tapered end of the spar doubler should end just inside (1/4") of rib W8.



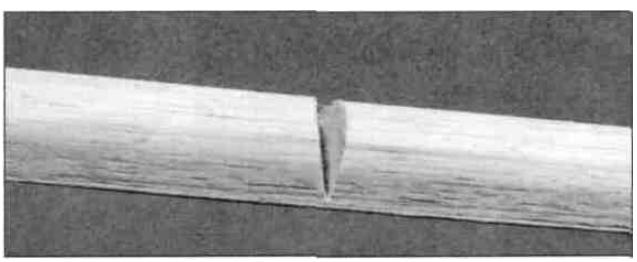
D D 4. Glue ribs W2 through W11 onto the spar in their correct position. **Notice that the ribs are installed with the rear-most jig tab against the work surface.** Use a 90-degree triangle to keep the ribs vertical.



D D 5. The shaped and notched wing **trailing edges** (F146W07) are fastened together by a thin strip of balsa. Separate them by **cutting** with an X-acto knife. Position the TE in place by working the rear ends of the ribs into the notches in the TE. Center the TE vertically on each rib and glue it in place with thin CA.

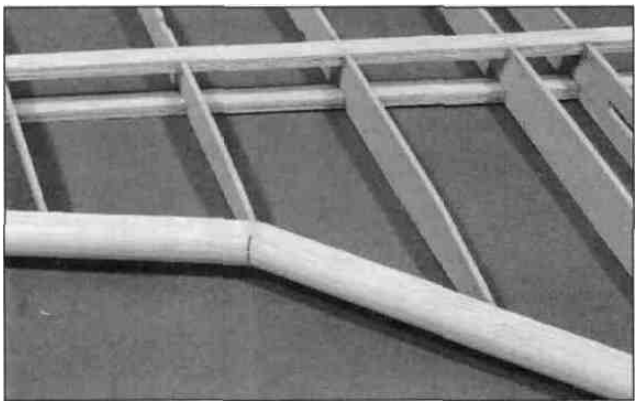


D D 6. Glue the top spar in place (with the long spar on top). Make sure it is fully seated in the notches so it does not stick above the top surface of the ribs. **Remember,** the spar doubler stops just inside rib W8.

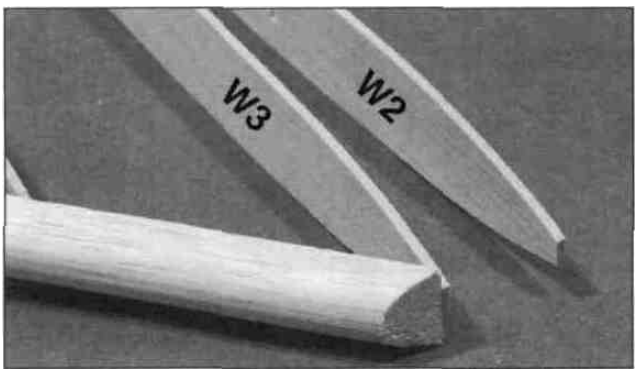


D D 7. Position a shaped balsa **Leading** Edge (F146W06) over the Leading Edge Template on the wing plan and mark where the notch goes. Use a razor saw to

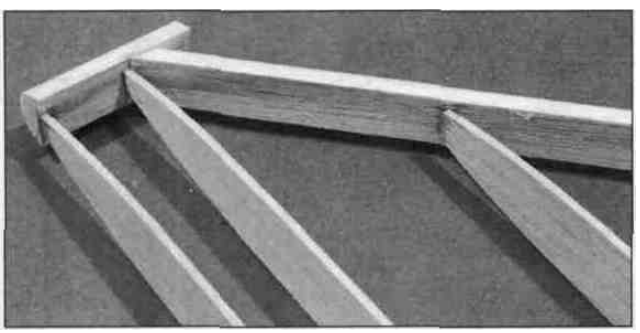
cut the notch. Make sure you cut the notch perpendicular to the LE and notice that it does not need to go all the way through the LE.



D D 8. Glue the LE to rib W5 so the notch is positioned as shown on the plan and the LE is centered (up and down) on the rib. Center the LE on ribs W6 through W11 and glue it in place with thin CA. Next, glue the LE to rib W3 and lastly to rib W4. The LE may break in two during this step, but this is OK, just glue it back together as you perform the step. **IMPORTANT** - Use the plans as a guide to keep the front of rib W3 positioned correctly.

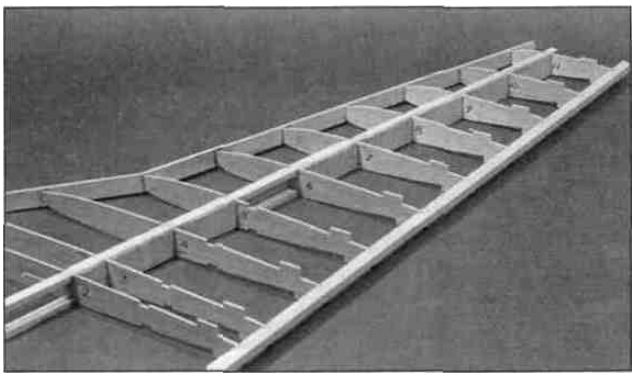


D D 9. Cut the excess LE off flush with the front of rib W3. Sand it if necessary to get the face of the LE cut aligned with rib W2.



D D 10. Glue the remaining piece of LE to ribs W2, W3 and the slanted piece of LE already installed. Trim the LE flush with W2 and the slanted piece of LE.

NOTE: In the following steps you'll find it necessary to remove some of the pins holding the wing down to your building board. As you do, take other steps as necessary to continue holding the wing down, such as by applying weight to the top of the wing, or by relocating the pins.



D D 11. Glue the pre-cut 1/16" balsa vertical grain **shear webs** to the **rear edge** of the spars in all rib bays **except inside of rib W2** and **between ribs W5 and W6.** Also glue shear webs on the **front edge** of the spars in the first 5 rib bays starting with the W2-W3 bay. **NOTE:** You may wish to trial fit, mark, and trim each web before gluing it in. **The webs must be securely glued to the spars.**

D D 12. Trim the tip end of the **LE,** TE and spars off flush with rib W11.

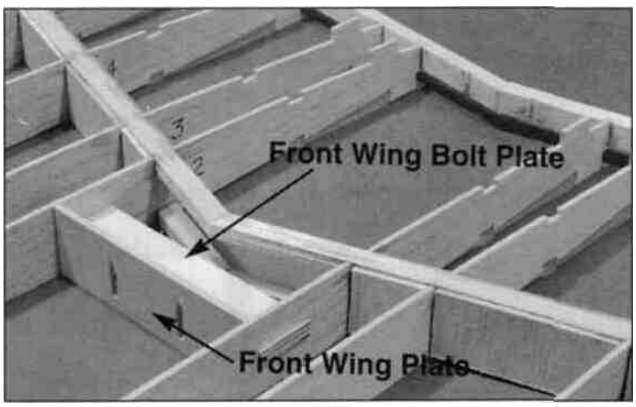
D D 13. Trim off the root end of the spars and TE **slightly** longer than their correct length (approx. 1/64" longer). Later, when the two wing halves are joined, they will be sanded to the correct length. Remove the wing panel from the work surface.

D 14. Go back to step 1 and assemble the other wing half. **Be sure to build a right wing and a left wing!**

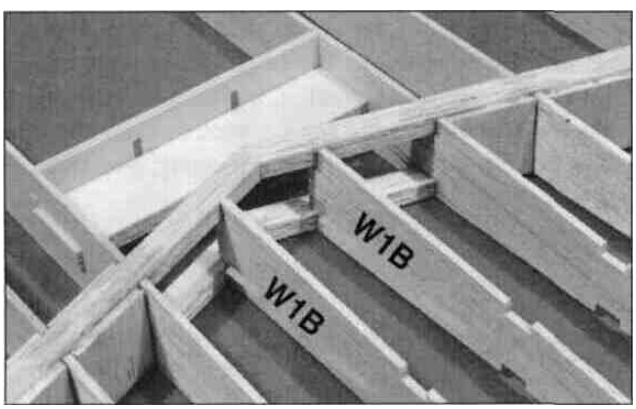
ASSEMBLE THE TWO PANELS

D 1. Cut out the two dashed semi-circles on the left wing plan. Place the left wing plan over the right wing plan and carefully line-up the centerlines of each plan. Tape the two plans together. Test fit the two panels together over the plans and sand the spars and TE as necessary until you achieve the proper spacing and wing sweep. Insert the die-cut 1/8" ply **front wing plate** (F146F15) and the 1/4" x 1" x 4-13/32" ply **front wing**

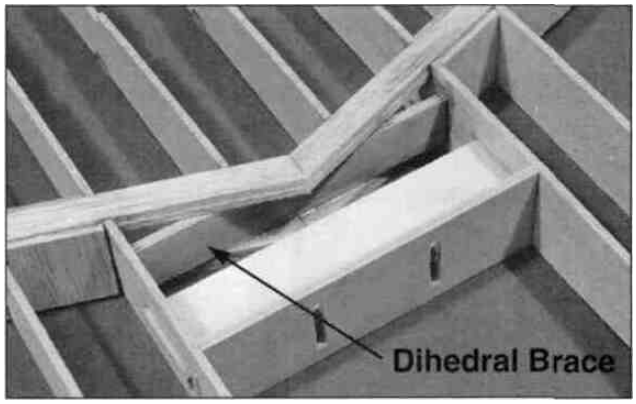
bolt plate (F146W18) to check the spacing. Make sure both panels are on a **flat** surface and lined up correctly with the jig tabs against the work surface. Refer to the plans and the following photo. **NOTE:** The notches for the middle spar should form a straight line when the proper amount of sweep is achieved.



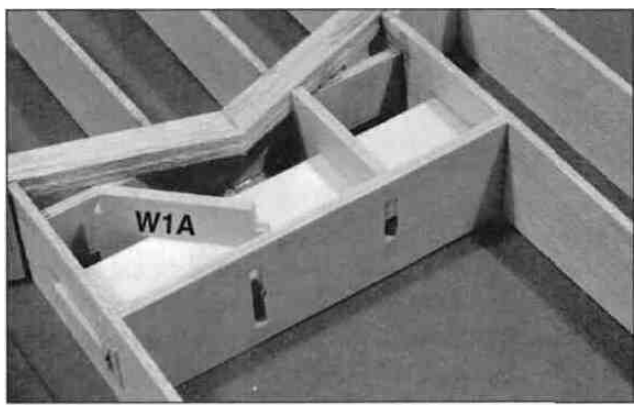
D 2. When satisfied with the fit of the two panels, insert the front wing bolt plate along with the wing front plate into the slots in the W-2 ribs and glue the spars and **TE'S** together with epoxy. Also glue the plates in place.



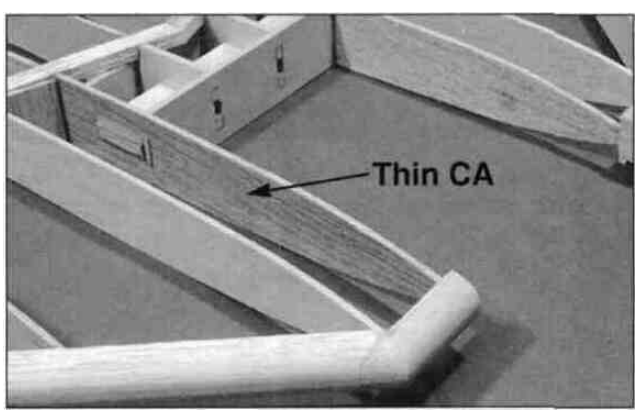
D 3. Install the die-cut 1/8" balsa **W1B ribs** (F146W01) by inserting them into the trailing edge slots and rotating them until the front notches contact the spars. Make sure the aileron servo rail slots in the ribs are positioned **down** (near the work surface) and glue them in place.



D 4. Securely glue the 1/8" x 23/32" x 4-5/32" ply **dihedral brace** (F146W12) in place between the spars and against the W1B ribs with epoxy.

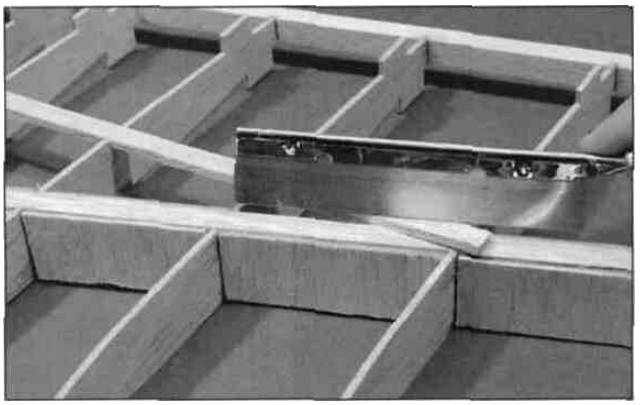


D 5. Slide the die-cut 1/8" ply **W1A ribs** (F146F32) into place by positioning them at an angle as shown on the left side of the photo and rotating them until they fit into place as shown on the right side of the photo. Be careful not to push the wing front plate out away from the wing bolt plate during this step. Sand the inside slot of the W1A ribs if they are hard to slide over the wing bolt plate. Glue all these pieces together with thin CA followed by either epoxy or thick CA.

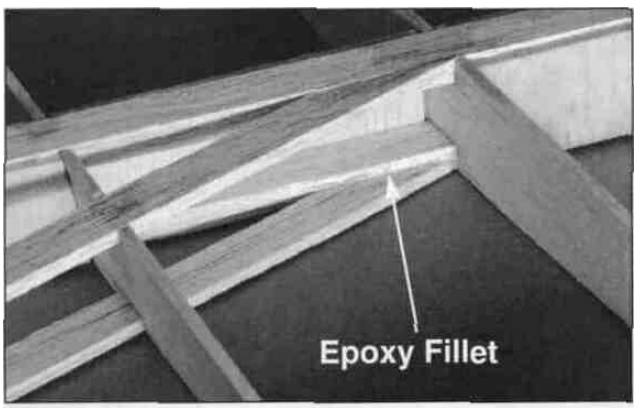


D 6. Soak the entire **outer** side of each W2 rib with

thin CA to help harden the wood. Cut four 1" long pieces of 1/2" triangle from the 1/2" **x 36" triangle** (WSTR001H) and glue them in place above and below the front wing bolt plate and against the W2 ribs. Add epoxy or thick CA around every joint in this area to make sure everything is **securely** glued in place.

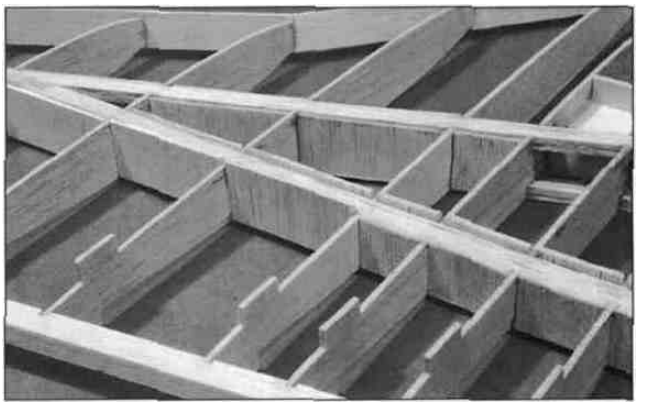


D 7. Trim the 1/8" x 3/8" x 24" balsa **top middle spar** (F146W17) to fit in place by positioning it in the notches and using a razor saw to accurately cut the taper on both ends. **NOTE:** It is important to get the best joint possible between the middle spars and the main spars. Securely glue the middle spar in place with epoxy.

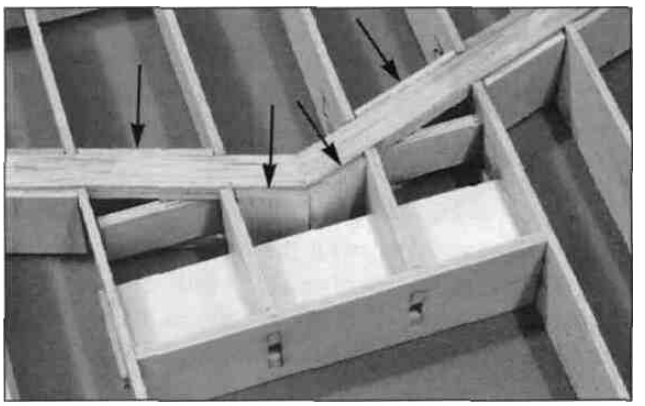


D 8. Flip the wing over and install the 1/8" x 3/8" x 24" balsa **bottom middle spar** just as you did the top one in the last step. Make a nice epoxy fillet where both middle spars contact the main spars.

D 9. Turn the wing back over so the top is up and install 1/16" balsa shear webs on the front **and** the back



of the middle spar in all rib bays. The shear webs will be too tall and too wide, so just trim them to fit and securely glue them in place.



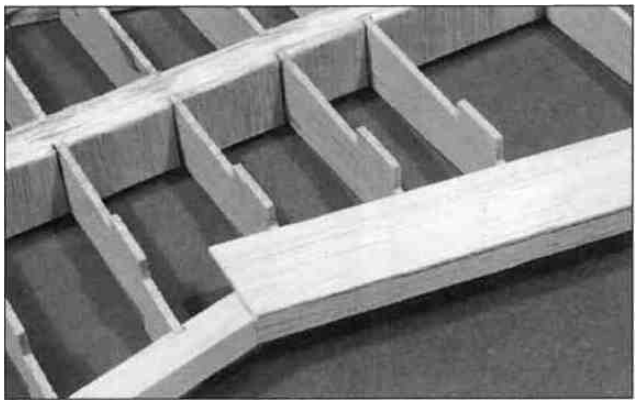
D 10. Cut pieces of shear webs to lit in the three center bays of the main spar and securely glue them in place.

D 11. Cut two 1-1/2" long **aileron servo rails** from the 1/8" x 3/8" x 15" basswood strip (F146F30). Slide these into the slots in the W1 ribs and use your aileron servo to properly space them. They should be installed as far forward as possible and far enough apart to allow you to get the servo in and out. Securely glue them in place.

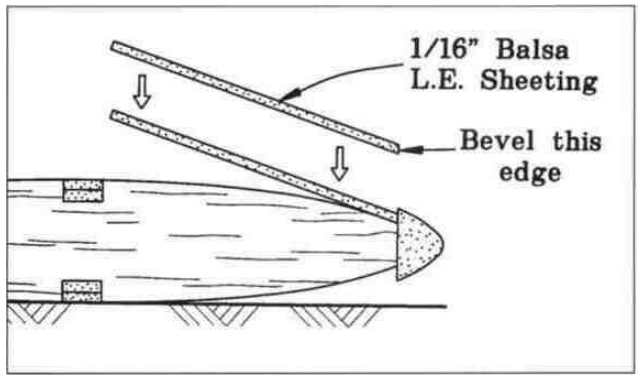
INSTALL THE WING SHEETING

NOTE: In the next steps, maintain straightness by keeping the jig tabs and spar down on the flat surface.

D 1. Lightly sand the tops of the ribs to blend with the notched trailing edge, then glue the two top 1/16" x 1" x 30" balsa **trailing edge sheets** (F146W14) in place.

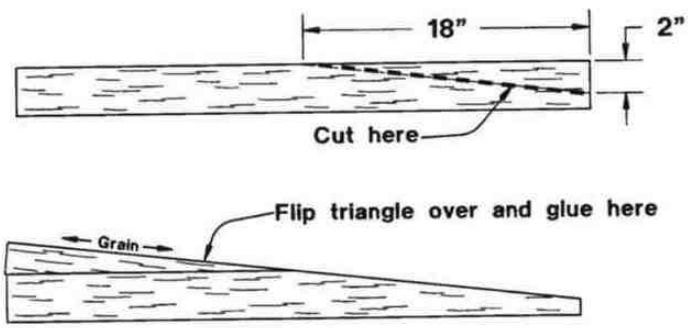


NOTE: The edge of the TE sheet may not be exactly straight, but just position the sheet so it slightly overlaps past the TE, and any overlap can be sanded off flush with the TE later.



aft edge of the sheeting is approximately in the middle of the spar, then cut off the excess sheeting on the ends, leaving approx. 1/4" extra to allow for positioning.

NOTE: It will be helpful to have the following items handy for the next steps: Thin CA, thick (slow cure) CA and a straight piece of wood (such as an aileron).

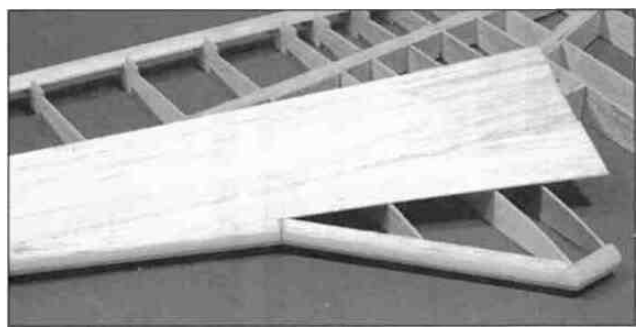


D 2. Make four **leading edge** sheets by cutting a triangle 2" wide on the end and 18" long off of one end of each 1/16" x 3" x 36" balsa **wing sheet** (F146W13). **HINT:** Use an X-acto knife and cut a straight line using a metal straightedge. Flip the triangle over and glue it to the rest of the sheet as shown in the sketches above. Notice the grain direction on the small triangle.

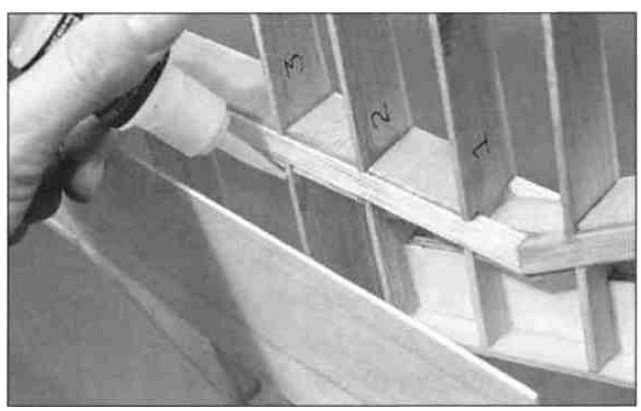
D 3. Sand the both sides of each LE sheet smooth with a sanding block and fine grit sandpaper.

D 4. Before applying the leading edge sheeting in the next steps, use your T-bar to lightly sand off the edges of the shear webs and smoothly blend the ribs to the spar. Also, clean up the LE/rib joints to remove any glue globs.

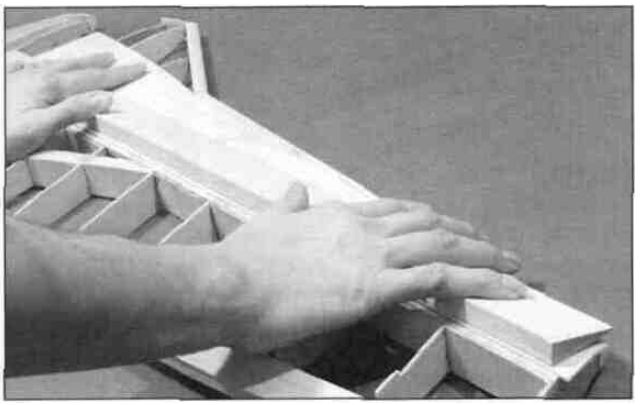
D 5. Sand the front edge (the edge with the triangle glued to it) to a slight bevel so it will fit snugly against the back of the leading edge. Trial fit it before proceeding. Position the sheeting left or right until the



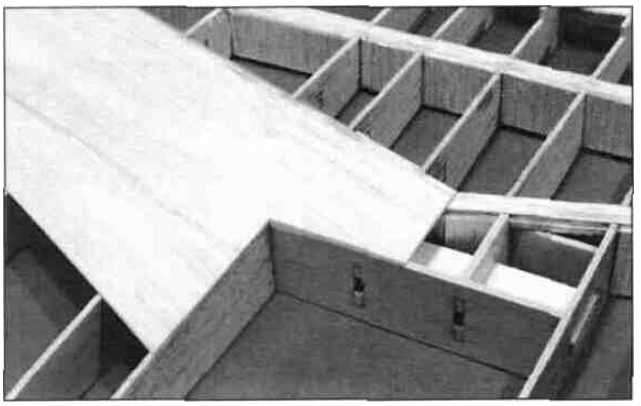
D 6. Hold the sheeting tightly against the LE at a slight angle so it sits down on the LE of the ribs. Use **thin** CA to glue the sheeting to the LE only. Do not glue it to the ribs yet.



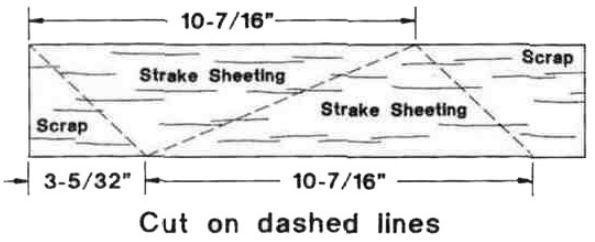
D 7. Tilt the wing up, with the LE down, and apply a drop or two of thick or slow curing CA to each rib. Hold the wing at an angle so the glue will flow down and coat the edge of each rib. Apply a line of glue to the



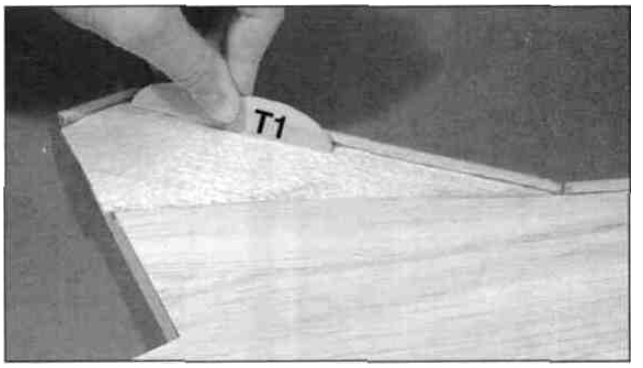
front edge of the spar. Immediately place the wing on your **flat** work surface and press the sheeting into place. Use a piece of wood (an aileron works OK) to hold the sheeting in place while the glue cures. It is important to keep the wing flat during this process as the LE sheeting will "lock" the wing together.



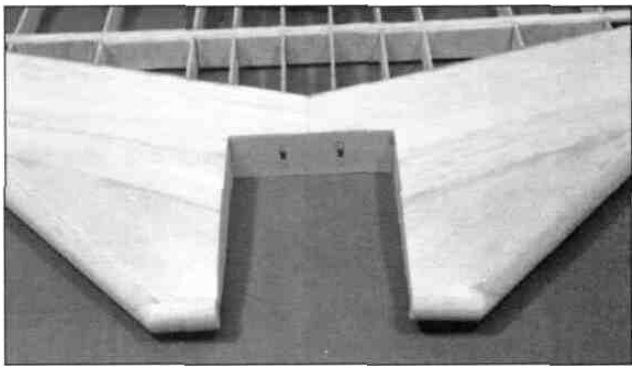
D 8. Trim the tip end of the sheeting flush with rib W11. Trim the root end of the sheeting flush with the centerline of the wing, rib W2 and the wing front plate.



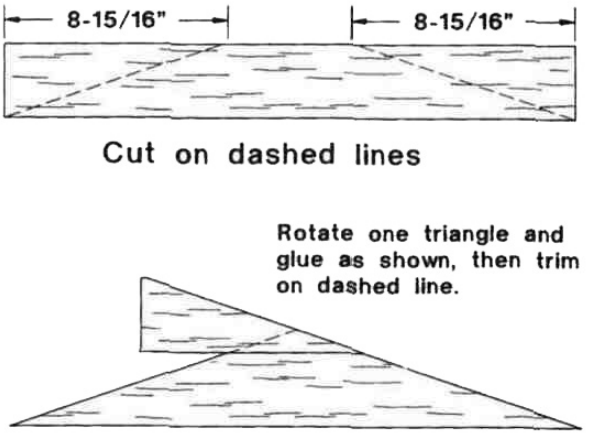
D 9. Cut the four pieces of 1/16" x 3" x 15" balsa stock sheeting (F146W23) as shown in the sketch above. Test fit one of the pieces in place in front of the leading edge sheeting and trim and sand it as necessary to make it fit. **NOTE:** The grain should run along the LE.



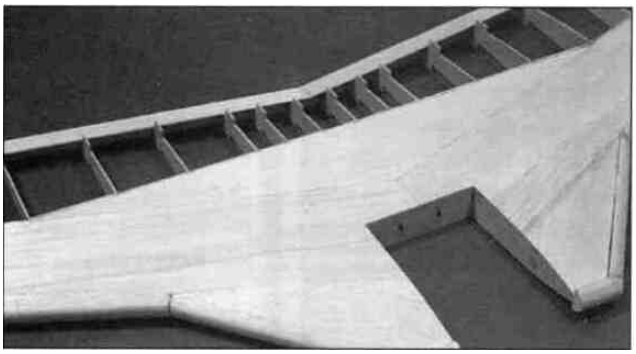
D 10. First glue the sheeting against the LE sheeting already in place. Try to line up the edges as closely as possible. Drip some thick CA down the ribs and press the sheeting into place. Add CA along the LE and use a small but flat piece of wood to keep the sheeting straight along the LE (turtle deck former T1 works well for this). Trim the end of the sheeting flush with rib W2.



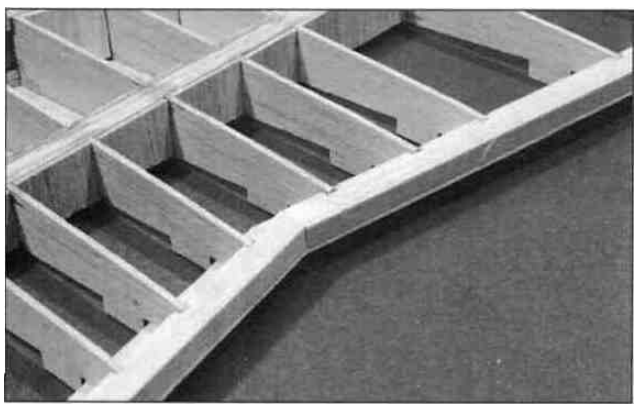
D 11. Sheet the opposite wing panel using the same procedure outlined above.



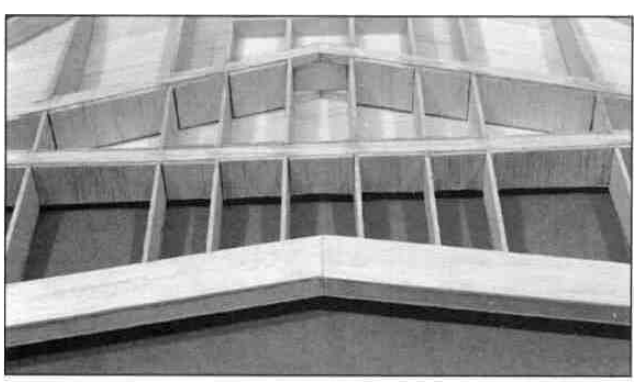
D 12. Cut two 1/16" x 3" x 24" balsa **center sheets** (F146W15) and assemble two triangles as shown above. Use one in the next step and save the other for the bottom of the wing.



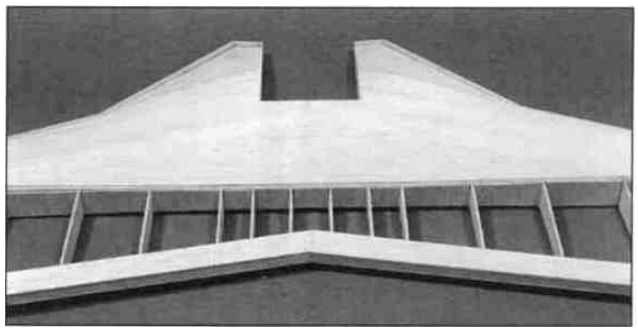
D 13. Test fit the triangle sheeting into place and sand it if necessary to achieve a good fit. It should go half way back on the middle spar. Glue it in place by applying thick or slow curing CA to the ribs and spars and holding the sheeting in place while the glue cures.



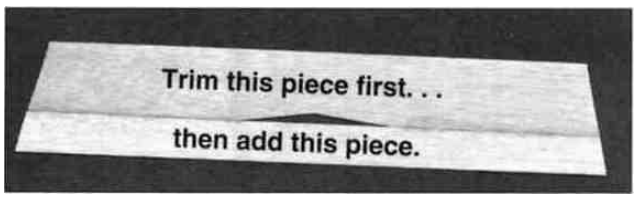
D 14. Flip the wing over and carefully trim off the jig tabs on the bottom of the wing (the side **opposite** the side you just sheeted). Use a sanding block with a fine grit sandpaper to touch up where the tabs were and to blend the ribs into the TE. **Be careful not to change the shape of the ribs during this step.**



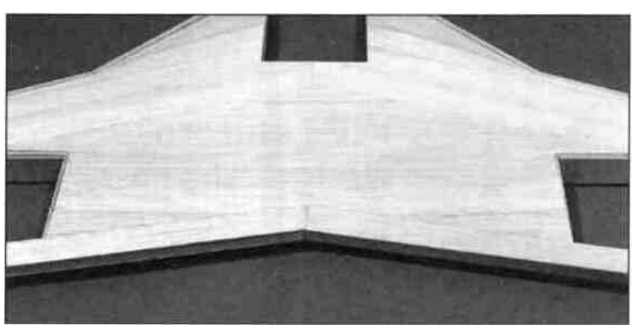
D 15. Add the remaining two 1/16" x 1" x 30" balsa **TE sheets** just as you did earlier on the top surface. Do one panel at a time and keep the panel flat on the work surface until the glue cures. **Note:** Due to the taper of the wing, the jig tabs on the top surface of the wing will only keep one panel flat at a time.



D 16. Install the remaining 1/16" leading edge sheeting, the strake sheeting and the center triangle sheet using the same procedure outlined in steps 2-13.

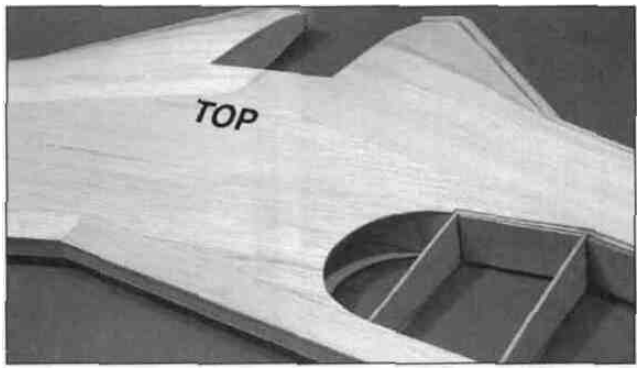


D 17. Trim one of the 1/16" x 3" x 18" balsa **rear wing sheeting** (F146W21) pieces to fit in place behind the triangle center sheet. An easy way to do this is to tape it in place behind the triangle center sheet and lay a straight edge along the front edge of the 1" TE sheeting. Mark where both sides of the TE sheeting continue under the rear sheeting. Remove the rear sheeting and cut out the triangle formed by the lines you marked. Cut another of the rear sheeting pieces in half **lengthwise** and glue one half to the rear edge of the piece you just trimmed to fit.



Tape the sheeting back into place and mark where the TE sheeting intersects the outside edges. Cut the aft piece of sheeting to fit and glue the rear sheeting in place with thick or slow **CA.**

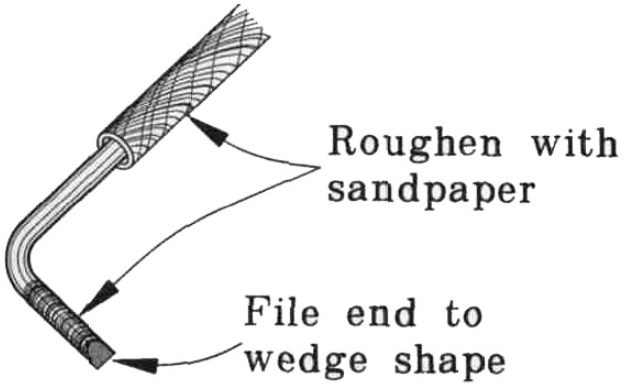
D 18. Cut a semicircle out of the sheeting between ribs W4 and W5 as shown in the next photo.



D 19. Flip the wing over. On the side that still has the jig tabs attached, write the word "top" near the center of the wing. Trim and sand off the remaining jig tabs. Touch up the ribs with a fine grit sanding block and add the rear sheeting just as you did in steps 17 and 18. Trim all sheeting flush with the W11 ribs and lay the wing aside until later.

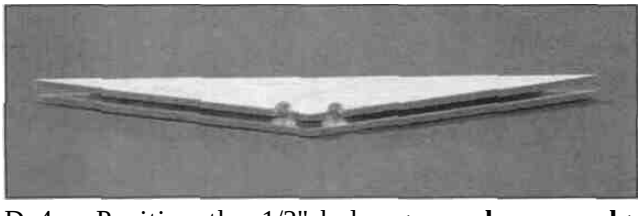
INSTALL AILERON TORQUE RODS

D 1. Roughen the un-threaded end of the **aileron torque rods** (WBNT167) with 100-grit sandpaper, and file the same end to a wedge shape.



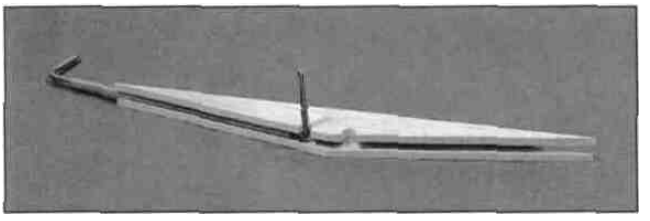
D 2. Roughen the surface of the plastic bearing tubes with 100-grit sandpaper.

D 3. Clean the torque rods and bearing tubes with alcohol.



D 4. Position the 1/2" balsa **grooved rear wedge** (F146W10) over the plans and mark where the torque rods come up through it. Cut notches there to clear the torque rods. Test fit the wedge on the wing and sand it if needed to get a good fit. Test fit the torque rods in the groove to make sure they fit OK. If not, sand the groove and notch until they do. Also cut small clearance notches on the bottom side of the wing where the threaded portion of the torque rod will be located. **Note: The torque rod horns must exit the BOTTOM of the wing!**

D 5. Slide the plastic bearings toward the threaded end of the torque rods. Then use a toothpick to apply a small amount of petroleum jelly to the ends of the plastic tubes (to help prevent glue from getting inside and locking up the torque rods).

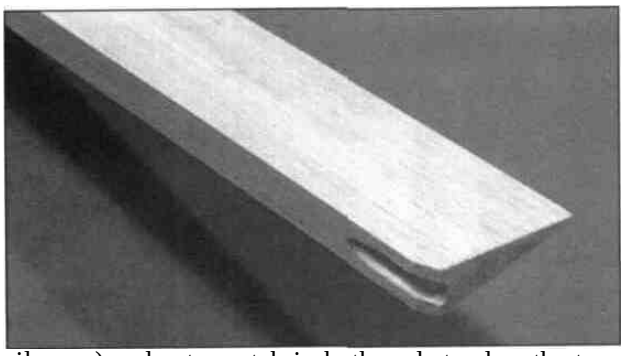


D 6. Use epoxy to glue the plastic bearing tubes into the grooves in the rear wedge. Make sure the torque rods are fully seated in the groove. Wipe off any excess glue and allow it to harden.

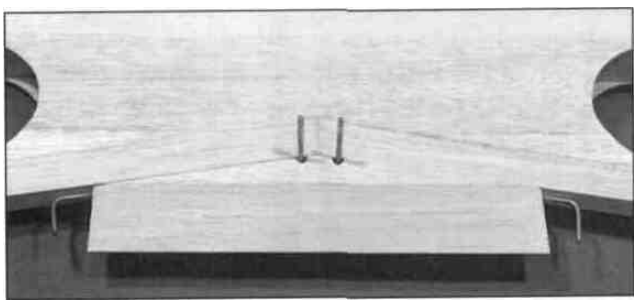
D 7. Sand the TE of the wing to make it straight with square edges.

D 8. Trial fit the rear wedge/torque rod assembly onto the wing trailing edge. It should be centered up and down on the wing TE so the torque rods are located at the centerline of the TE. Sand the TE if necessary to get a good fit then glue the wedge in place with epoxy. **HINT:** Use masking tape to hold the wedge against the wing TE and to aid in positioning it.

D 9. Locate the tapered balsa **center TE** (F146W09) (it is 10-1/8" long and has the same cross section as the



ailerons) and cut a notch in both ends to clear the torque rods. Also sand the very front of the ends if needed to make it fit in place against the rear wedge. Tape it in place with masking tape and check to make sure it is not tilted up or down You can use the edge of a 1/8" balsa **fuse doubler** (F146F02) as a template to check the center TE alignment, but be sure to check it from the top **and** the bottom of the wing When satisfied with its alignment, glue it in place with thin CA **Be very careful around the ends so you don't glue the torque rods!**



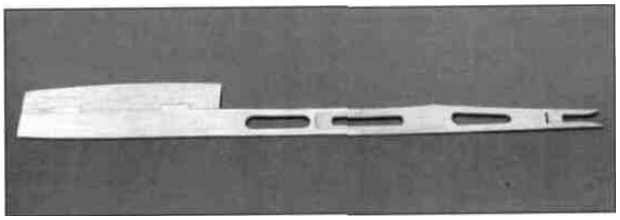
D 10 Use some lightweight wood filler to blend the rear wedge and center TE in with the contour of the wing. After the filler has cured, use a sanding block to smooth things out.

This is all we will do to the wing until after it has been fitted to the fuselage and the turtle deck has been added This will help keep the wing tips, cap strips and ailerons from getting dinged up in the process.

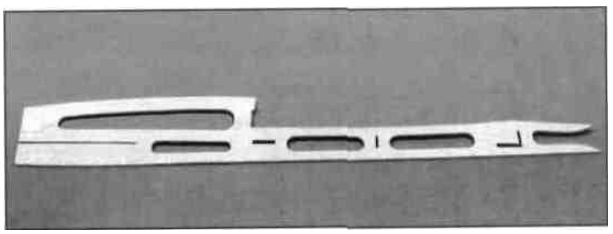
FUSELAGE ASSEMBLY

PREPARE FUSE SIDES

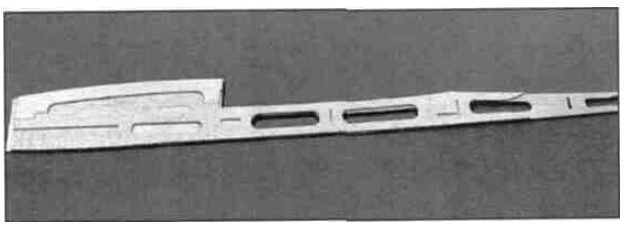
D D 1. Working over the fuselage side view covered with waxed paper, trial fit a die-cut 1/8" balsa fuse **side**



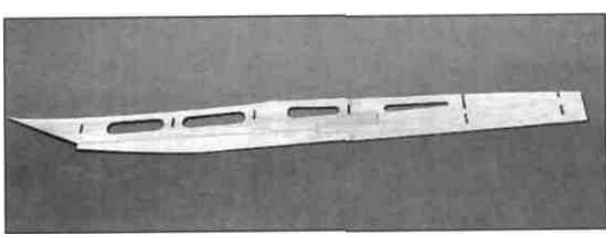
top (F146F03), **fuse side bottom** (F146F01) and **aft fuse side** (F146F04) together, sanding as necessary for a good fit Make sure they line up with the plans and glue them together.



D D 2 Assemble a 1/8" balsa **fuse doubler** by gluing a die-cut 1/8" balsa **doubler top** (F146F03) to a die-cut 1/8" balsa **doubler bottom** (F146F02).

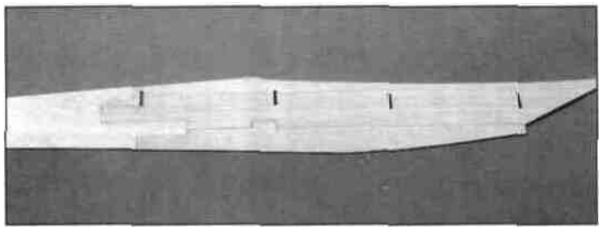


D D 3 Position the doubler on top of the fuse side and align its edges and lightening holes with the edges and lightening holes of the fuse side Glue the doubler to the fuse side by applying **thin** CA around all edges of the doubler, including the lightening holes **NOTE:** The doubler stops 1/4" before the front of the fuse side to hold F-l **Important:** Do not make two right sides' Glue the doubler to the opposite side when making the second side.

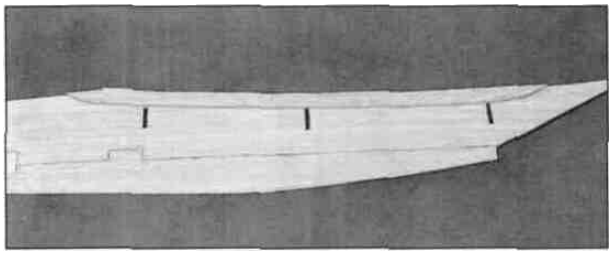


D D 4. Assemble a turbine **inner** side by test fitting a die-cut 3/32" balsa **turbine inner side** (F146F07), **turbine side bottom** (F146F08) and **turbine inner aft**

side (F146F09) together over the plans Carefully sand them if needed to achieve close fitting joints When satisfied with the fit. add thin CA to all joints After the glue has cured, apply thick CA to any loose-fitting joints.



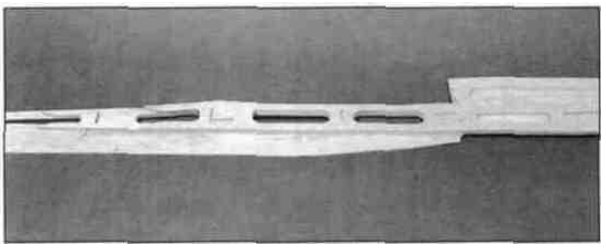
D D 5. Assemble a turbine **outer** side by test fitting a die-cut 3/32" balsa **turbine outer side** (F146F26), **turbine side bottom** (F146F08) and **turbine outer aft side** (F146F10) together over the plans Carefully sand them if needed to achieve close fitting joints When satisfied with the fit. add thin CA to all joints After the glue has cured, add thick CA to any loose fitting joints. Sand both sides smooth with a fine sanding block.

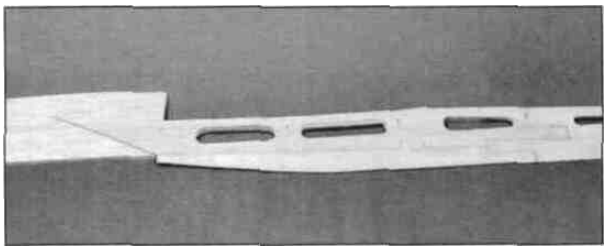


D D 6 Glue a die-cut 3/32" balsa **turbine side doubler** (F146FOS) to the **outer** turbine side Line if up with the wing saddle and add thin CA around the edges When doing this step for the second side, make sure you glue the doubler to the opposite side, making a right and a left set

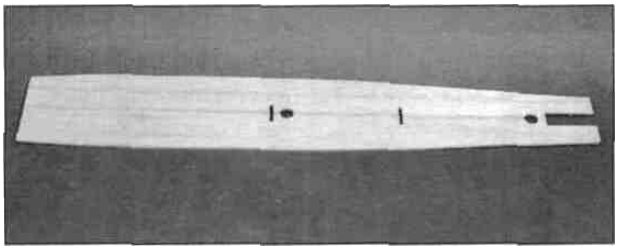
D D 7 Inspect all glue joints for gaps and add thick CA if necessary to strengthen the joints Repeat the above steps to make another set of sides. **Make sure you assemble a RIGHT and a LEFT set of sides!**

D 8 Place the two assembled fuse sides together. Lightly sand the edges as necessary to make the two sides **identical** Do the same for the turbine sides Also sand the **sides** of each assembly smooth with a fine sanding block It is rather hard to do this later'

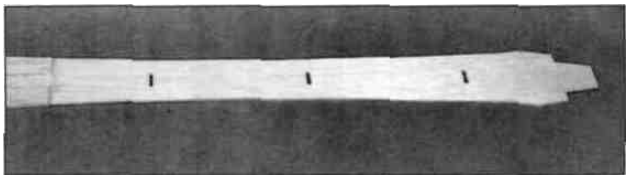




D 9 Carefully position a turbine **inner** side on each fuse side Do this over the fuse side view on the plans and use the wing saddle to help align them Make sure they are correctly positioned and add thin CA around the edges, lightening holes and former notches. **IMPORTANT -** Be very accurate when doing this. Make sure the two turbine sides are installed at the same angle and position in relation to the sides To check this, hold the two fuse sides together and compare the alignment of the turbine sides before securely gluing the second side **NOTE:** The turbine inner side is attached to the fuse side, not the doubler



D 10 Test fit the two die-cut 1/8" balsa **front fuse bottom** halves (F146F05) together Sand them **slightly** if needed and glue them together Test fit the die-cut 3/32" balsa **rear fuse bottom** (F146F06) in place

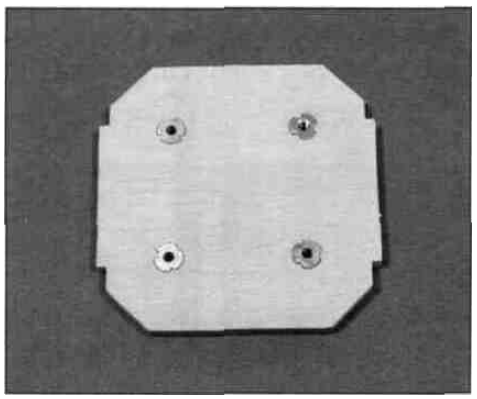


Line up the entire bottom over the plans to keep if straight and glue the rear onto the front Make sure both pieces are pressed flat against the work surface Write the word "TOP" on the side facing up (this will keep the smooth side towards the outside of the fuse) When the glue has cured, flip if over and sand the bottom smooth with a tine sanding block.

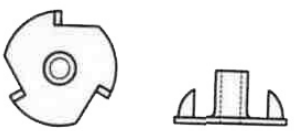
PREPARE THE FIREWALL (F1)

NOTE: Photos show a 60-size engine mount (Great Planes MM60 included) set up for a side mounted 2-cycle engine. If you will be using a different mount, you'll have to determine the correct mounting position.

D 1. Locate the two 1/8" die-cut ply **F-l's** (F146F18) and use a fine sanding block to remove any fuzzy edges. Use epoxy to glue the two pieces together, making a 1/4" thick firewall. Make sure they are accurately lined up with one another and one of the sides with the punch marks is showing. Wipe off any excess glue before it cures.



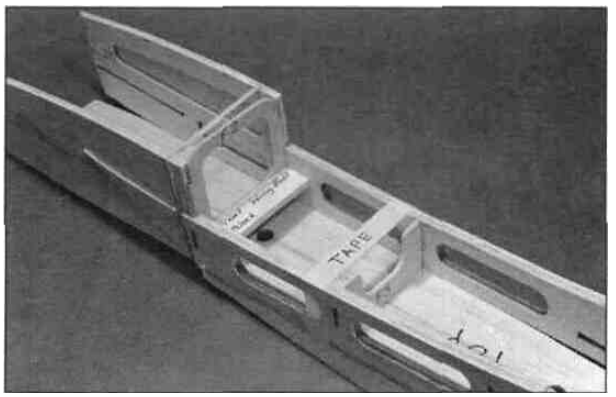
D 2. If you are using the engine mount supplied, you can drill at the punch marks provided. If you are using a different mount, center the engine mount on the firewall and mark the bolt locations through the mount. Drill 5/32" holes at the bolt locations, then install the 6-32 **blind nuts** (NUTS003) on one side of F-l. This will be the back. Press the blind nuts in with a vise, or tap them in with a hammer.



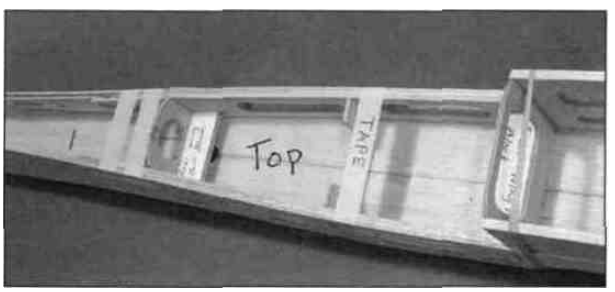
D 3. Temporarily attach the engine mount to the firewall with the 6-32 x 5/8" socket head bolts (SCRW037) to make sure the holes are in the correct position. Adjust the holes if necessary and then glue the blind nuts in place. Remove the mount.

ASSEMBLE FUSELAGE

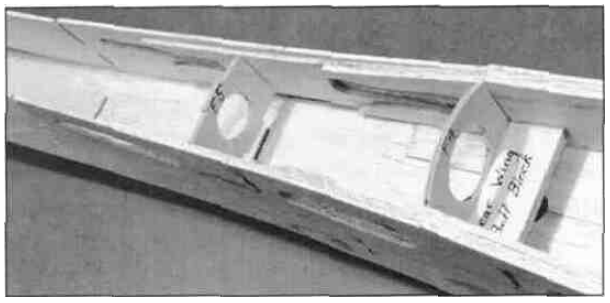
D 1. Trial fit the die-cut 1/8" ply formers **F-2, F-3, F-4, F-5** (F146F15). the 1/4" ply **front wing bolt block** (F146F20) and the 1/4" ply **rear wing bolt block** (F146F25) to make sure they fit into the appropriate slots. If there is any excess glue in any of the fuse doubler slots, clean it out with an X-acto knife. If it is necessary to trim any of the formers, be sure to trim both sides of the formers the same amount to keep them symmetrical.



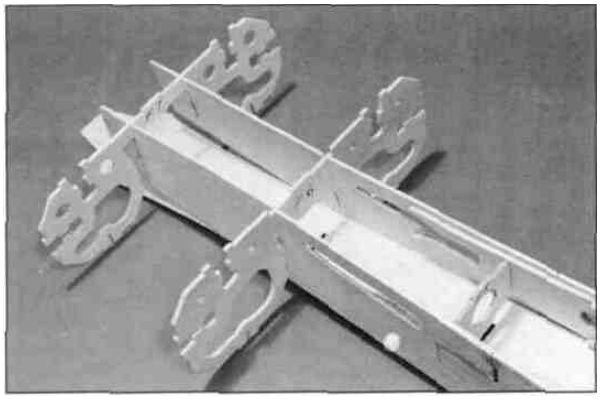
D 2. Assemble formers **F-2, F-3** and the 1/4" ply **front wing bolt block** between the two fuse sides. Add the bottom (with the word "top" toward the formers) to keep everything straight and use masking tape and/or rubber bands to hold things together. Make sure all the tabs are fully seated in their notches and add a couple of drops of thin CA to each joint. Use only as much glue as required to hold things together. We will come back and securely glue everything a few steps later.



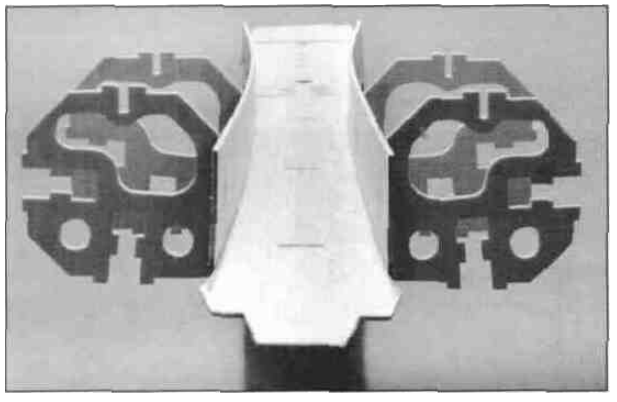
D 3. Install the 1/4" ply **rear wing bolt block** and former **F-4** using thin CA. Push the rear of the fuse bottom down below the fuse sides to allow the sides to relax some. This will make it easier to hold the fuse sides against F-4.



D 4. Snap former **F-5** into place and glue it to the fuse sides only. Keep the fuse bottom pushed down for now.

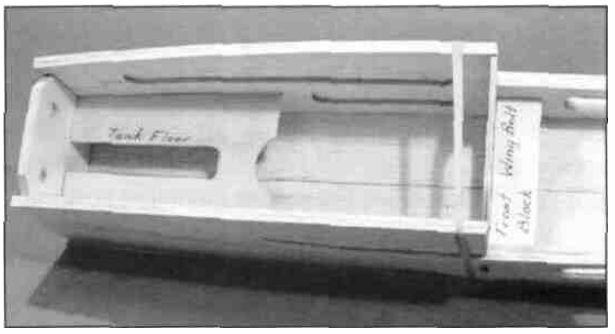


D 5. Slide formers **F-6** (F146F16) and F-7 (F146F17) into their respective slots and pull the fuse sides out against the formers. Push the fuse bottom up against the bottom of F-5, F-6 and F-7 to lock the fuse sides in place. Glue the fuse sides and the fuse bottom to the formers **below** the fuse bottom but do not glue the sides above the bottom yet.

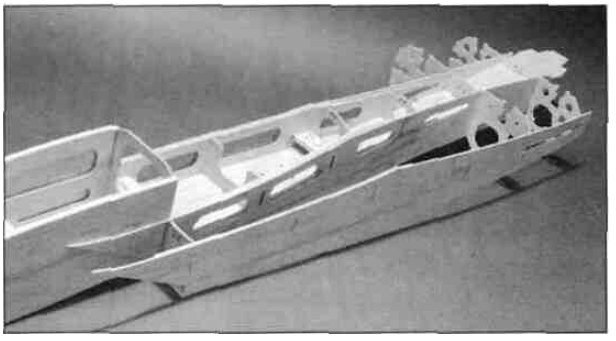


D 6. Sight along the rear portion of the fuse bottom to make sure it lays smoothly and then add thin CA along the fuse bottom from F-2 back to F-7.

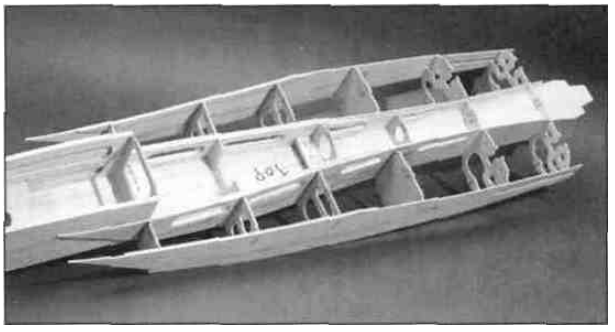
D 7. Test fit the 1/8" ply **fuel tank floor** (F146F15) and the **firewall** (F-l) into place in the front of the



fuselage. Sand the tank floor if necessary to get a good fit around the firewall and glue these in place with epoxy. **Before** the epoxy cures, pull the fuse bottom up into place and center the fuse sides with the bottom. Glue the bottom into place with CA The triangular gaps formed are for 1/2" triangle stock which will be added later. **NOTE:** If you are not installing retracts and would like to use a larger than 10oz. fuel tank, you can leave the fuel tank floor out. It does add some rigidity to the front but it is not absolutely necessaiy. Although the fuselage will hold a much larger tank, the balance of the plane may be greatly affected by the extra fuel in the nose.

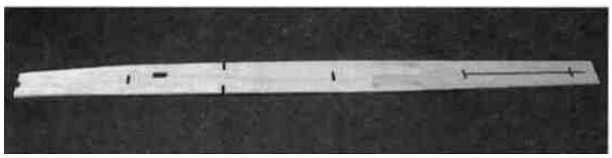


D 8. Tack glue former **F-2E** (F146F13) into place on the turbine inner side with **one drop** of thin CA. Tack glue a turbine outer side onto F-2E, F-6 and F-7 with the doubler facing the fuselage. Install the opposite turbine side the same way. **Do not securely glue around F-2E until the rest of the formers are installed.**

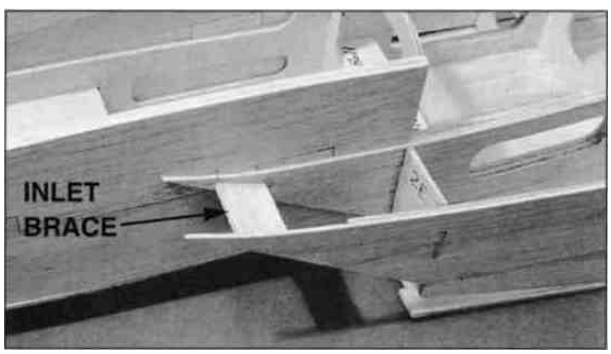


D 9. Snap formers **F-3E. F-4E** and **F-5E** (F146F18) into place on both sides of the fuselage. **Do not glue**

yet! Due to the bending of the turbine side. it is normal for formers F-2E to slant slightly. This is all right but try to make both slant the same amount.



D 10. Locate the die-cut 1/8" balsa **front turbine bottoms** (F147F11) and **rear turbine bottoms** (F146F12) and assemble the turbine bottoms over the plans. Sand the pieces if needed to achieve a good joint and glue them together. Test fit the assembled turbine bottoms in place on the bottom of each turbine. **Do not glue the bottoms in place!** Use the bottoms as guides to align the formers and glue the formers to the **sides only.**



D 11. Position the die-cut 1/8" balsa **inlet braces** (F146F11) so they hold the turbine outer sides at a natural curve, as shown on the plans and glue them in place. Remove the bottoms after the glue has cured.

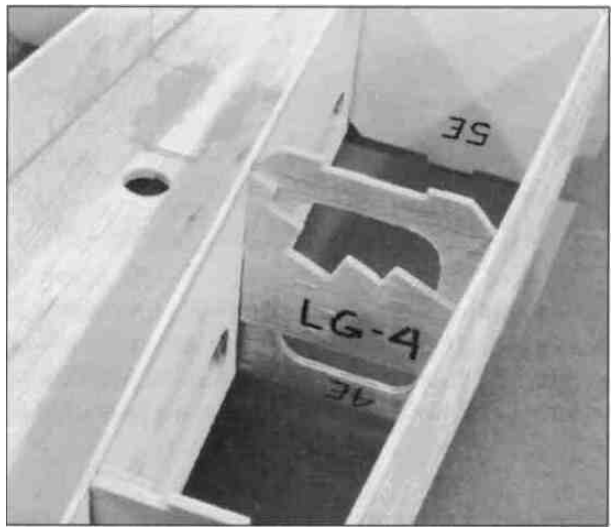
D 12. Add 1/2" **balsa triangle** (WSTR001H) above and below both 1/4" ply wing bolt blocks and then soak the fuse sides around both with thin CA to strengthen this area.

SUGGESTION: From this point on, we recommend using a padded "cradle" such as a Robart Super Stand to protect the fuselage from dents and dings. You can modify the stands to fit the fuselage by cutting one upright off flat and enlarging the other upright to fit the front of the fuselage.

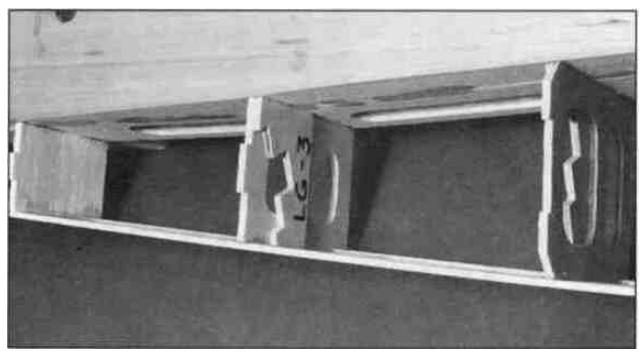
LANDING GEAR

Skip ahead to the **"RETRACTS"** section if you are installingretracts.

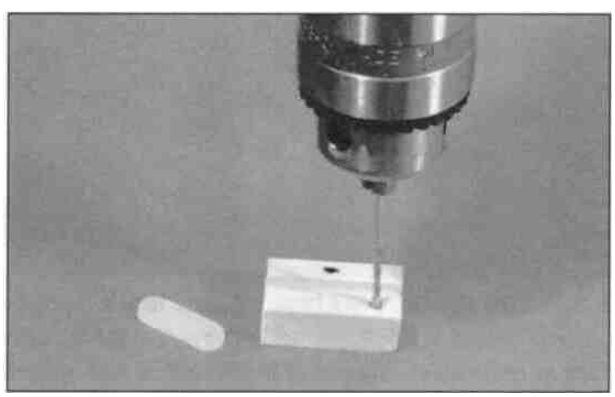
FIXED GEAR



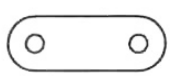
D 1. Test fit the 1/8" ply landing gear doublers **LG-3** and **LG-4** (F146F32) against formers F-3 and F-4 respectively. They should be positioned as shown in the

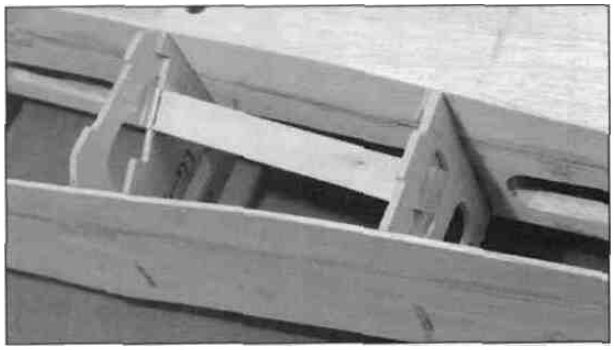


cross section views on the plans. LG-3 on the **back** of F-3 and LG-4 on the **front** of F-4. Sand them if necessary and then epoxy them in place.

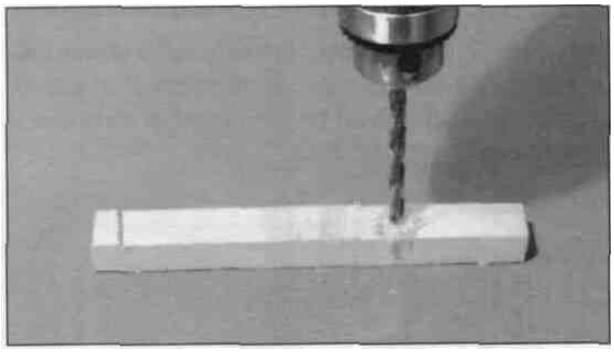


D 2. Position a **nylon landing gear strap** (NYLON36) towards one end of a 7/16" x 5/8" x 1-1/8" basswood **short grooved LG block** (F146F28) and mark where the holes will be located. Drill 1/16" holes at these locations. Do this to both 1-1/8" pieces.

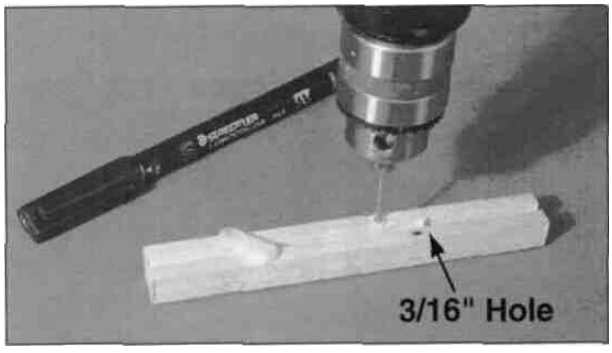




D 3. Test fit the 7/16" x 5/8" x 5-1/8" basswood **grooved landing gear blocks** (F146F27) into the middle slot on the landing gear doublers with the groove towards the top of the fuse. Center it between the two doublers and draw a line on the grooved block at the front of LG-4.

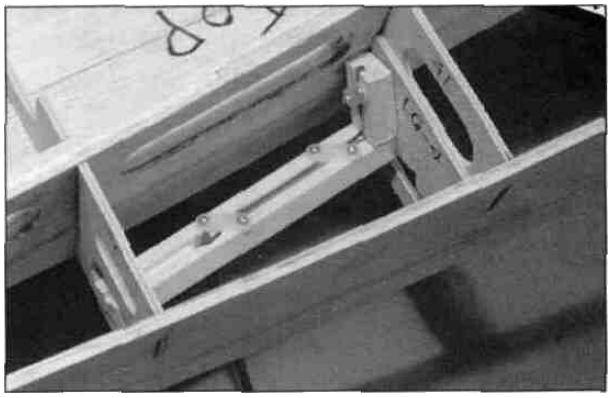


D 4. Remove the grooved block and drill a 3/16" hole 3-1/4" in front of the **midpoint** of the line you just drew. Drill the hole perpendicular to the LG block and centered so it connects with the groove on the other side.

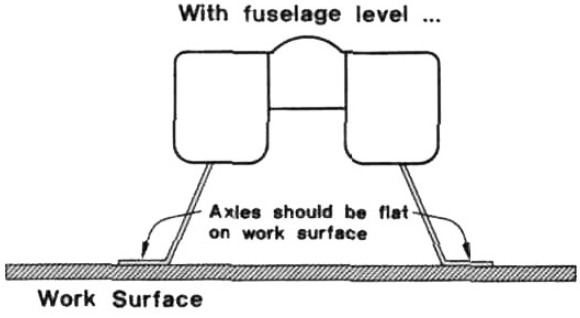


D 5. Flip the grooved landing gear block over **and** drill two sets of 1/16" holes using the nylon landing gear straps as templates. One set of holes should start near the 3/16" hole and the other should start about 1" from the other end of the block as shown in the photo.

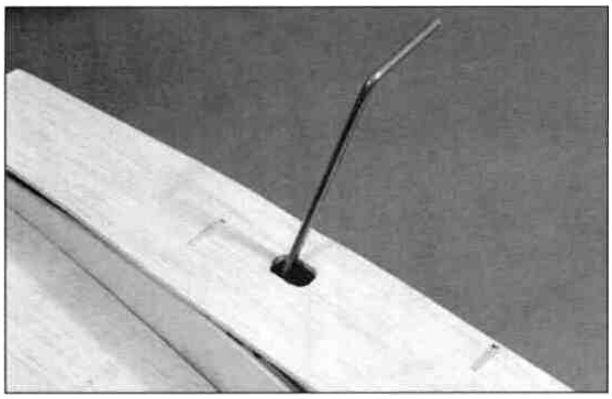
D 6. Epoxy the 7/16" x 5/8" x 5-1/8" grooved hardwood landing gear block in place with the line you drew earlier even with the front of LG-4. **NOTE:** The groove should be towards the top of the fuselage.



D 7. Insert the axle end of the 5/32" **main gear wire** (WBNT165) from the top of the fuse through the 3/16" hole and pull the gear down into the groove. Notice there is a right and a left main gear. Press the 1-1/8" block (with the holes up) onto the wire sticking up out of the groove. Install the three nylon landing gear straps using #2 x 3/8" **sheet metal screws** (SCRW024) to pull the wire fully into the grooves. Check to make sure the 1-1/8" block will seat flat against LG-4. If not, adjust the bend in the wire and/or elongate the 3/16" hole to get things to fit correctly. **Do not glue the short blocks in yet!**



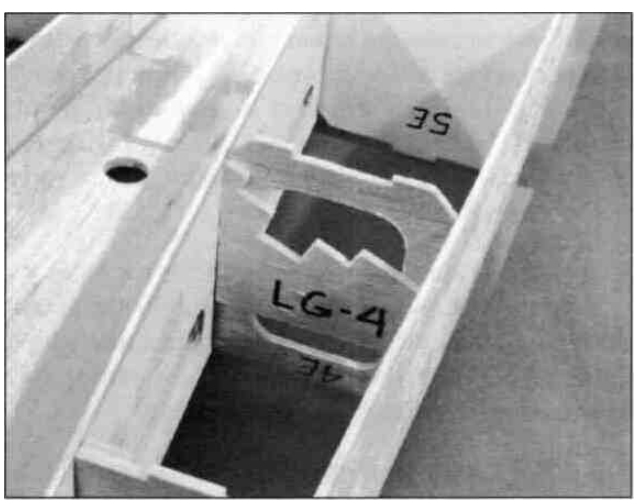
D 8. With both main gear installed, set the fuse on the work surface to check the alignment and tilt of both main gear. Hold each axle flat against the work surface and allow the fuselage to rest on former F-7 so it is level. Make any necessary adjustments and then epoxy the 1-1/8" blocks into place. Remove the main gear and apply a generous fillet of epoxy around all landing gear components.



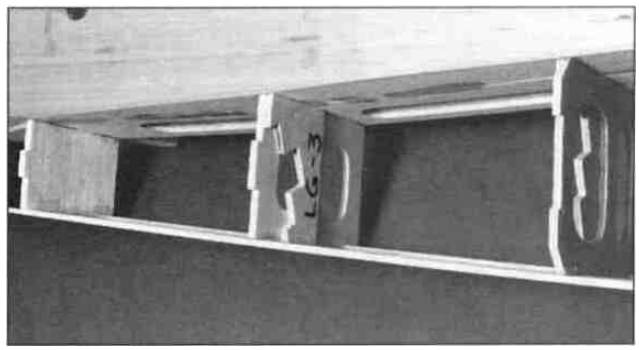
D 9. Glue the turbine bottoms into place. Make sure the die-cut strut opening is near the outside of the fuselage. Temporarily replace the main gear to check the size and location of the strut opening. Enlarge it if necessary to allow for the flexing that will occur during rough landings. Skip ahead to GENERAL FUSELAGE ASSEMBLY on page 27.

RETRACTS

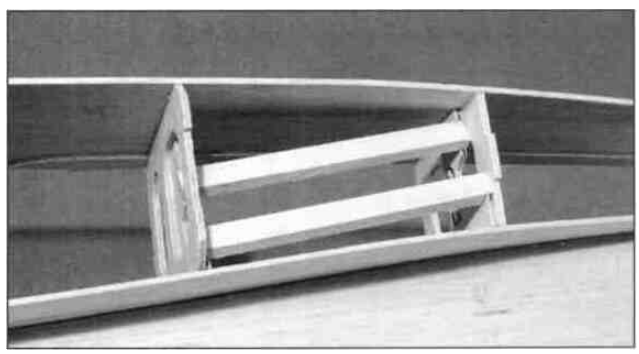
The following instructions explain how to install Hobbico Low Profile Mechanical Retracts (HCAP4000). If you are using another type of retract, you will have to modify the following instructions to suit your installation.



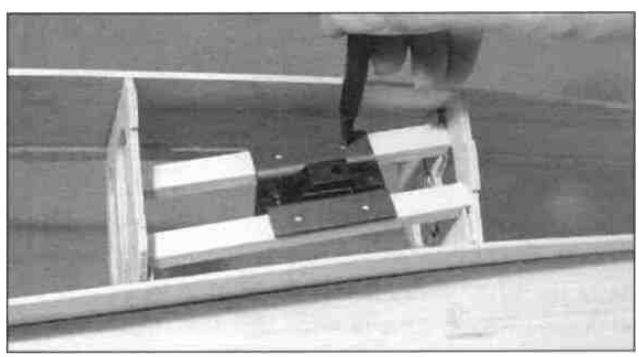
D 1. Test fit the 1/8" ply landing gear doublers LG-3 and **LG-4** (F146F32) against formers F-3 and F-4 respectively. They should be positioned as shown in the cross section views on the plans: LG-3 on the **back** of



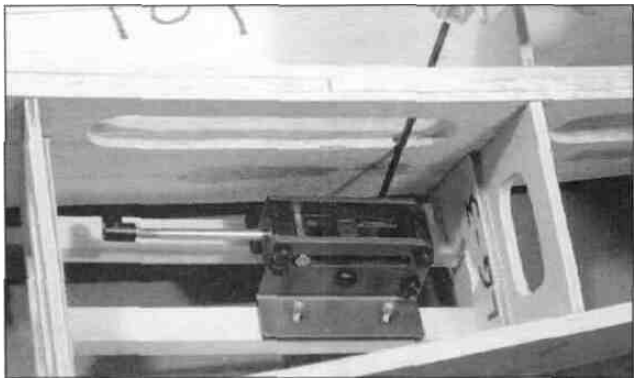
F-3 and LG-4 on the **front** of F-4. Sand them if necessary and then epoxy them in place.



D 2. Locate the 1/4" x 1/2" x 4-7/8" basswood **retract rails** (F146F23) and sand them to fit between F-3E and F-4E. Take your time and try to get a good joint between the rails and the formers. Epoxy them in place.

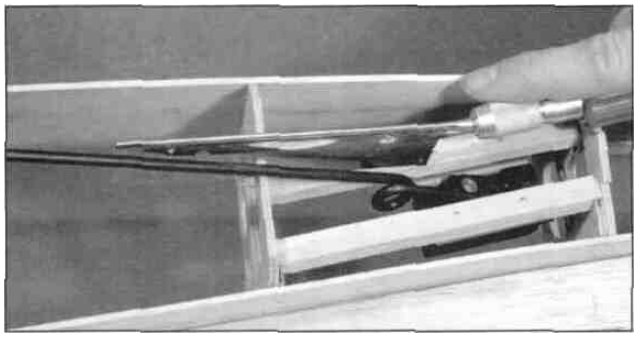


D 3. Position the retract between the rails (from the bottom of the fuse) so the strut is approx. 1-1/2" behind F-3E. Mark where the retract mounting holes should be, remove the retract and drill 1/16" holes in the retract rails. It is important to keep the drill **perpendicular to the rails** when drilling since the retract is actually going to be installed from the top. **NOTE:** Due to the angle of the retract, it is very helpful to use socket head sheet metal screws (not included) along with a ball driver to secure the retract. We used Du-Bro #380 #2 x 3/8" SHSMS. Larger #4 screws could be used but are not necessary.



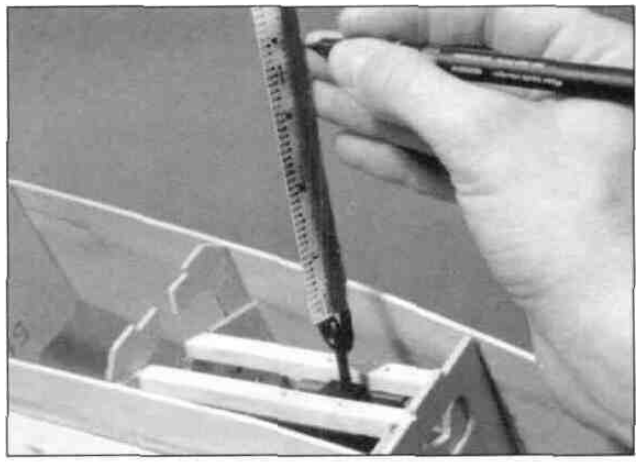
D 4. Using the socket head sheet metal screws, install the retract (from the top), with the actuator arm pointing towards the rear. using the socket head sheet metal screws. **Note:** There is a right and a left strut. Install the retracts so the bottom leg of the strut is "outside" of the coil.

D 5. Use a 2 mm ball driver to loosen the strut retaining set screw in the retract and twist the strut so the coil is pointing towards the rear of the plane. Re-tighten the set screw.

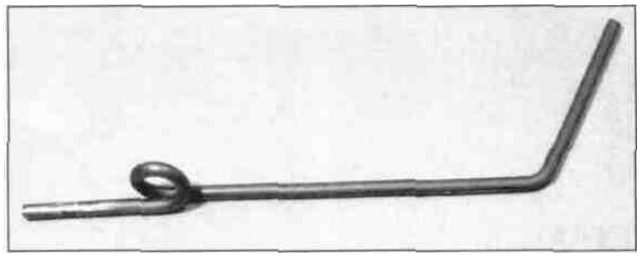


D 6. Retract the strut until it hits former F-4E. Use a razor saw to cut through the former approx. 1/8" on each side of the strut. Fully retract the strut to make sure the coil doesn't hit the actuator arm. If it does, loosen the set screw and twist the strut slightly until it retracts without binding. Re-tighten the set screw.

D 7. With the retract in the down position, check to make sure the top end of the strut is flush with the top of the retract mechanism (this is how they came). If it isn't, loosen the set screw and move the strut up or down until it is. Make a mark 3-3/4" below the bottom of the coil on the **front** of the strut. If your strut is black, you can make a light scratch. It is important that you mark the



front as best as possible so you make the bend correctly and keep the coil pointing the way it should.

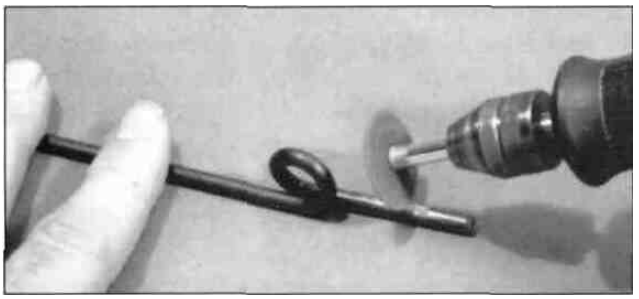


D 8. Remove the strut from the retract and make a bend where you made the mark. Try to keep the bend perpendicular to the front of the strut (where your mark is) and be sure to make a right and a left. Use the **Retract Strut Template** on the plan to achieve the correct angle. If you don't have a wire bender that will bend the wire in a tight radius, you can use a vise and a hammer. Insert what will be the axle part of the strut into the vise with the front mark even with the top of the vise jaws. Make sure the mark is directly facing the side of the vise jaws and use the hammer to help bend the strut. If you push on the coil while you tap the strut just above the vise jaws, you will get a nice tight bend. Occasionally remove the strut and check it against the Retract Strut Template on the plans to get the right amount of bend.

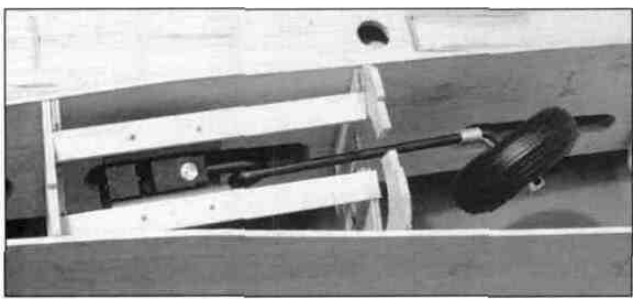
D 9. Determine the correct length for the axles by installing the wheels and collars, and cut off the excess axle flush with the wheel collar. A Dremel tool with a reinforced cut-off wheel works well for cutting this hardened wire, but always wear eye protection.

D 10. Use a small piece of 150 grit sandpaper to make some fine scratches on the **front** of the strut in the area where the existing notch (for the set screw) is. Use a black permanent marker to color the area you just scratched up. Replace the struts in the retracts with the wheels attached and twist them until the wheels are

pointing **straight ahead** in relation to the fuselage. Also check to be sure the top of the strut is flush with the retract mechanism. Gently tighten the set screw and then check to make sure they retract smoothly without the coils binding on anything. When satisfied with their operation and alignment, tighten and loosen the set screw a couple of times to make a mark where it is touching the strut.



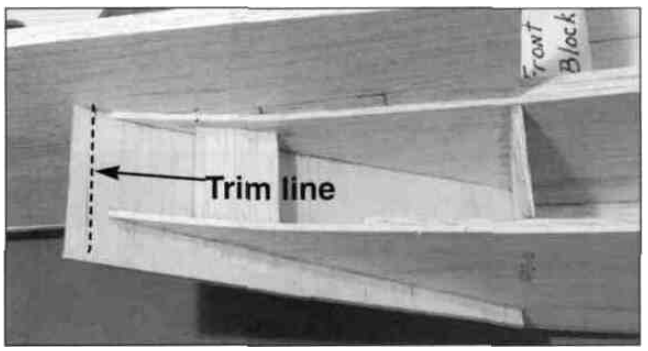
D 11. Remove the struts and locate the marks where the set screw was. Lay the strut down with the axle flat against the work surface. The set screw mark should be pointing directly up. Use a small file or a dremel tool with a cutoff wheel to make a notch (not just a flat spot) that extends 1/8" above and 1/8" below where the mark was. Be careful to keep the notch level with the work surface or your wheel will be twisted off line.



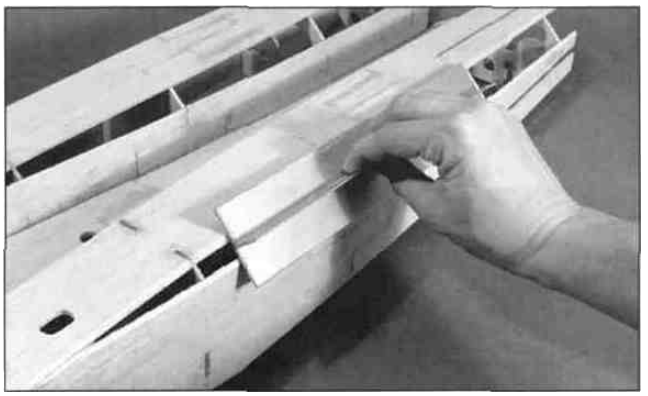
D 12. Replace the struts in the retracts and tighten the set screws down onto the notches you just made. Check to make sure the wheels are still pointing straight ahead. If not, remove the strut from the retract and adjust the notch until the wheel is straight. If your notch gets too deep, you can use a vise or a couple pair of pliers to twist the wheel straight. Do this by holding the axle (don't scratch it) and twisting the coil. Operate the retract to make sure everything works smoothly.

D 13. Remove the strut from the retract and glue the turbine bottoms in place. Make sure you install them with the die-cut strut opening near the outside of the fuselage.

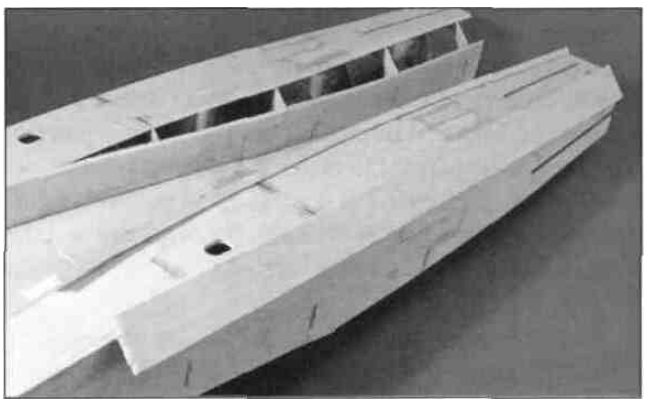
GENERAL FUSELAGE ASSEMBLY



D 1. Cut the 3/32" x 3" x 7-7/8" balsa **inlet sheeting** (F146F33) into four 1-7/8" long pieces. Use these to sheet the bottom of the turbine inlets as shown in the photo. Trim and sand them flush with the turbine outer side. Trim the front of the sheets perpendicular with the fuse sides approx. 1/8" in front of where the turbine sides end.

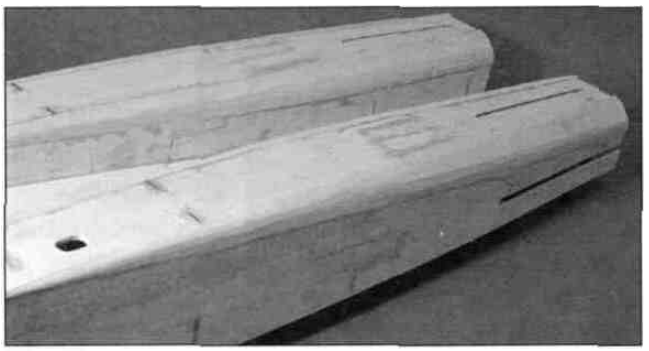


D 2. Use a sanding block to sand the edges of the turbine sides and bottoms down to the formers. Use a long sanding block (10" or longer) and keep it pressed against the side **and** the bottom to keep from sanding dips and unnecessary angles into the balsa.

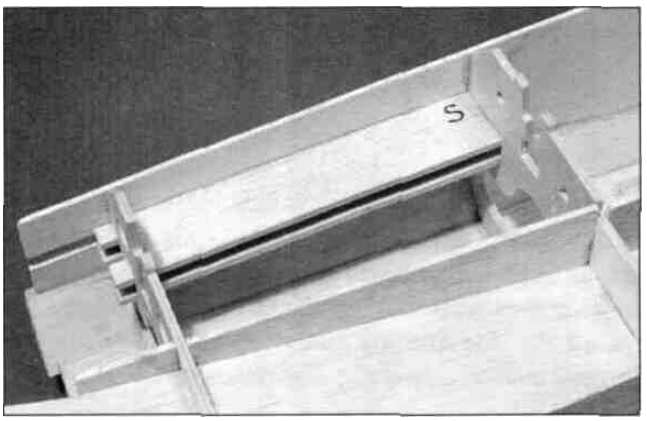


D 3. Glue the four **bottom** 1/4" x 1-3/8" x 27" balsa **turbine corners** (F146F21) into place. Thin CA works

well for this because it allows you to hold them in position and then add the glue. After gluing them in position apply a bead of medium CA from the inside of the fuselage.

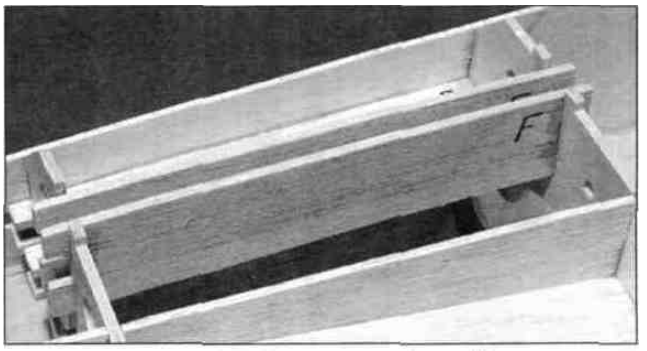


D 4. Trim the excess wood off of the turbine comers with a hobby knife. Save a couple large scraps of this wood for use when constructing the nose cowl. Then use a razor plane and a sanding block with coarse sandpaper to roughly shape the turbine corners to the cross sections shown on the plans. There is no need to fine sand the comers yet, because they may get banged around during the rest of the construction.

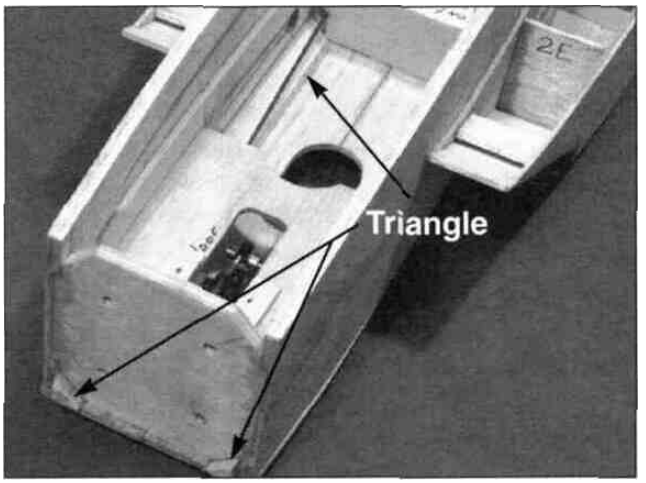


D 5. Locate the four die-cut 1/8" balsa **stab supports** (F146F04) and notice that they have an "S" embossed on them near one corner of the support. Test fit them into place between F-6 and F-7 so the "S" is in the **forward, outside** corner of the fuselage. Trim them if necessary to make them fully seat in the notches and insert a piece of 1/4" thick balsa (a stab) to check the support positioning. A tight fit is preferred and a loose fit is not acceptable. Hold the supports against the balsa if neccessary to get a good fit and glue them to the formers.

D 6. Locate the four die-cut 1/8" balsa **fin supports** (F146F01) and notice that they have an "F" embossed on them near one corner of the support. Test fit them into place between F-6 and F-7 so the "**F**' is in the **forward,**



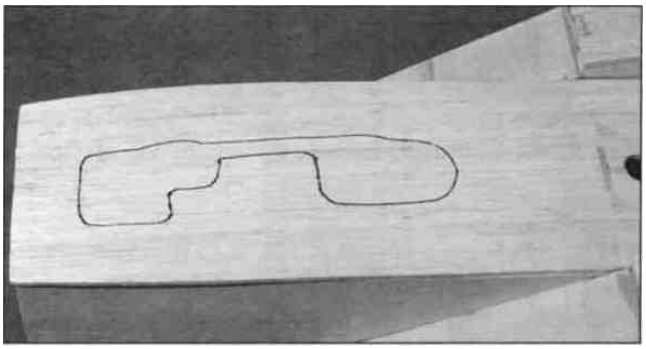
top corner of the fuselage. Trim them if necessary to make them fully seat in the notches and insert a piece of 1/4" thick balsa (a fin) to check the support positioning. A tight fit is preferred and a loose fit is not acceptable. Hold the supports against the balsa if neccessary to get a good fit and glue them to the formers.



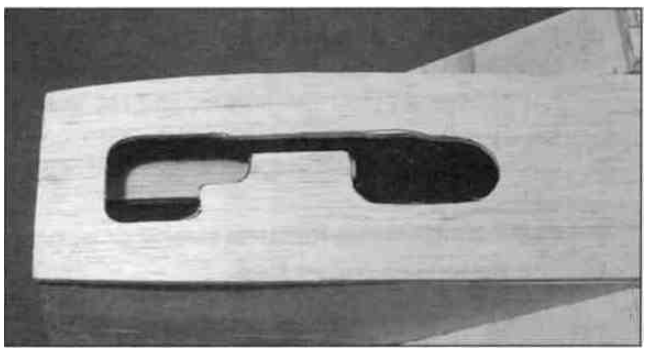
D 7. Cut two 10-1/2" pieces of 1/2" triangle from the 1/2" x 30" **triangle stock** (WSTR001H). Slide these into place along the fuse bottom through the gaps by the firewall. They extend from F-2 to the **front** of the firewall. Press them into the corner of the fuselage and glue them in place with thin CA. If you are not using retracts, skip ahead to "Install Radio" on page 29.

INSTALL NOSE GEAR RETRACT

D 1. Glue the die-cut 1/8" ply front retract rails (F146F32) in place on **top** of the fuel tank floor as shown in the photo for step 5 of this section.

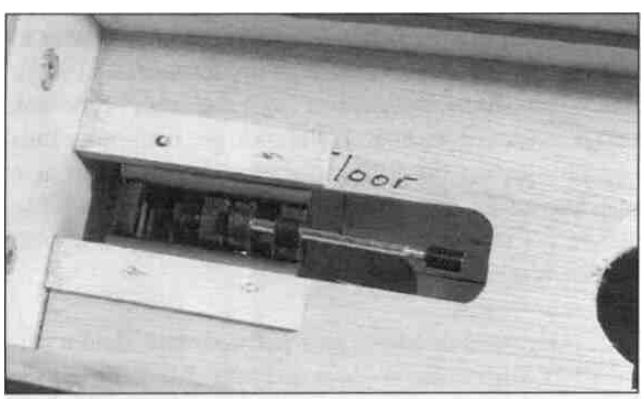


D 2. Cut the **front retract opening pattern** out of the plans and position it on the fuse bottom with the back edge against the turbine inlets. Trace the opening onto the fuse bottom.



D 3. Carefully cut the front retract opening into the fuse. It is a good idea to cut about 1/16" inside the opening and use a Dremel tool with a sanding drum to nicely shape the opening to the desired size. **NOTE:** If you are using retracts other than Hobbico low profile or your nose strut is a different length or shape, you will have to modify the retract opening to fit your nose gear.

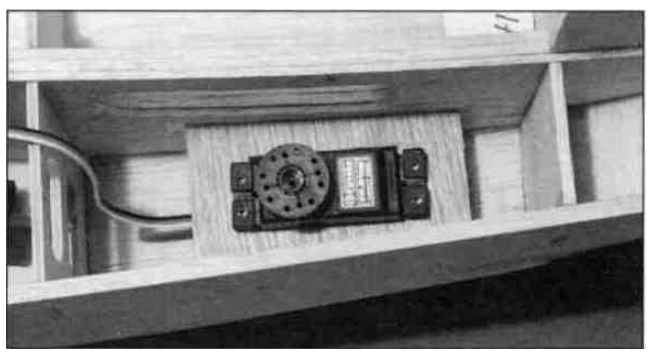
D 4. Position the nose retract unit inside the fuse and line it up with the centerline of the fuse bottom. Move it forward so the front of the unit is approx. 1/4" behind the front edge of the retract cutout. Mark where the mounting holes should be drilled and remove the retract.



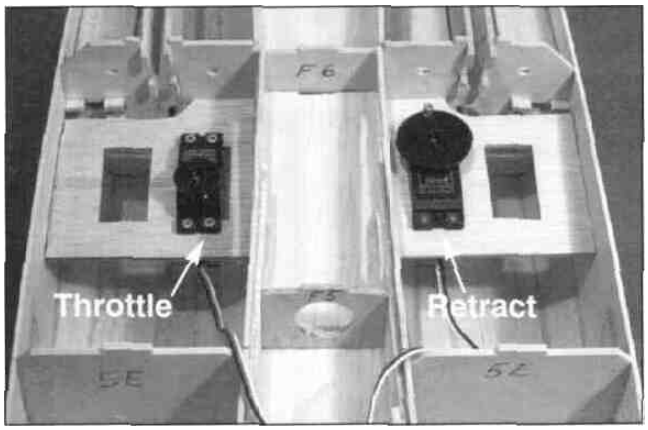
D 5. Drill the mounting holes where marked. Since we mounted our retracts with #2 socket head sheet metal screws, we drilled 1/16" holes. Mount the retract using the screws you're going to use and then grind off any of the screws that protrude up into the fuel tank compartment. This will keep the screws from damaging the fuel tank.

INSTALL RADIO

As discussed on page 5, there are several possible radio installation options that you can use with the F-14. **The following instructions explain our recommended radio installation.** It requires one rudder servo, two elevator servos, and one retract servo. If you prefer to use a different installation, read these instructions but ignore or modify any steps that do not apply to your installation.



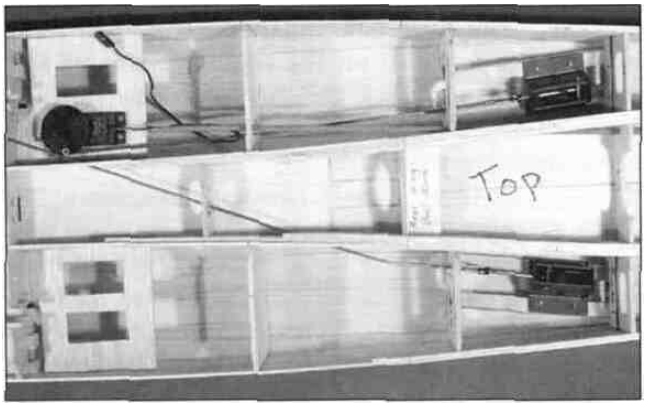
D 1. Locate one of the die-cut 1/8" ply Front servo **trays** (F146F32) and test fit it in place on the **right*** side of the fuse. This tray will be for the rudder servo, so test fit your rudder servo in the opening to make sure it will fit. Enlarge the opening if necessary. ***NOTE:** As a general rule, the rudder servo should go on the same side as the nose gear retract steering arm. **If you are using fixed gear, install the rudder servo on the left side of the fuse. The nose gear pushrod will then pass through the firewall on the opposite side of the throttle pushrod.** Tack glue the servo tray in place **approx.** 3/8" below the lightening hole in the inner turbine side. Put your servo in place and check to see if the servo arm is positioned correctly in relation to the lightening hole. The **bottom** surface of the servo arm should be slightly above the bottom of the lightening hole so the nose gear pushrod can go **under** the front wing bolt block. Adjust the height of the servo tray if necessary and securely glue it in place. Mount the rudder servo using the screws that came with your radio. If you are only using one elevator servo, install the remaining front servo tray on the other side of the fuselage. If you are using two elevator servos, there is no need to install the other front servo tray.



D 2. Punch out the two die-cut 1/8" ply rear servo **trays** (F146F32) and test fit your servos to make sure they fit. You will normally have to enlarge the opening for the retract servo. Test fit the trays in place. Refer to the plans to see how they are positioned and sand them if needed to get them to fit. Tack glue the rear servo trays in place approx. 1/2" below the lightening hole in the inner turbine side. Put your servos in place and check to see that the servo arms are positioned just below the middle of the lightening hole. Adjust the servo trays if necessary and securely glue them in place. If you are not installing retracts, skip ahead to step 10.

RETRACT PUSHRODS

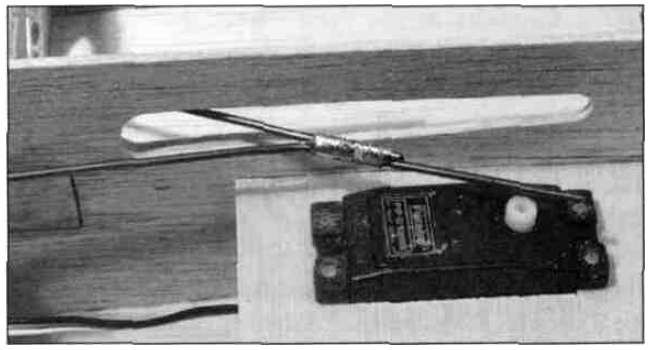
D 3. Route the nose retract pushrod first. Try to run it in a straight line from the servo, through F-2 and along the fuse side up to the fuel tank floor. The retract pushrods are not included in the kit. We used a Sullivan red pushrod outer tube as a guide tube and a steel rod with yellow pushrod spacers (see step **12** on page 32) on it for the nose gear. Do not cut the pushrod to length yet.



D 4. Route the main gear pushrods as shown in the photo. Due to the short distance here, we just used steel pushrod wires without guide tubes. This will work fine if you keep them running in as straight a line as possible so they don't flex during operation. Install an E-Z connector approximately 9/16" from the center on a large servo arm. Put the retract servo in place with the servo arm on it to get an idea where the three pushrods must meet. Use a 2-56 steel clevis on the retract end of each.

NOTE: There are a couple of places in the construction sequence where you are required to **solder** certain metal parts together. When you find it necessary to solder, use the following procedure:

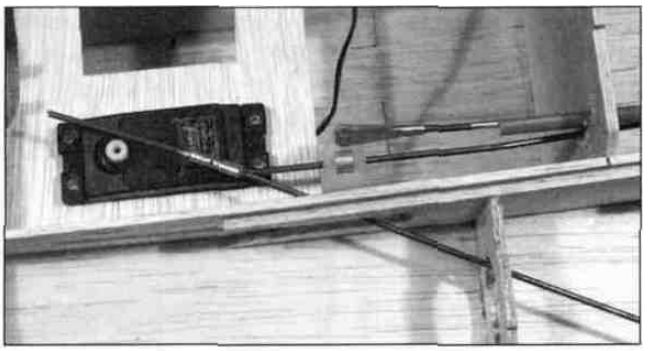
A. Roughen the area to be soldered with fine sandpaper, then thoroughly clean the items to be soldered with alcohol or degreasing solvent.
B. Assemble the items to be soldered.
C. Apply a small dab of soldering flux.
D. Heat the metal with a soldering gun or iron, and apply solder to the metal. The metal must get hot enough to melt the solder, and the solder must freely *flow* into the joint.
E. Do not move the parts until the solder has cooled.
F. Clean off the excess flux with alcohol or solvent.
G. Test the joint by pulling hard.



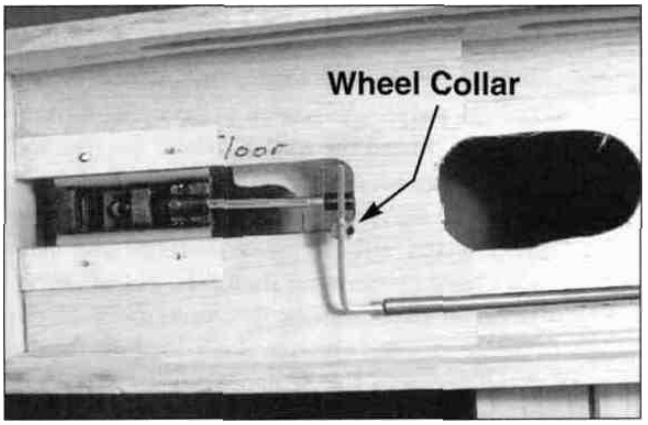
D 5. The two main gear pushrods need to be joined as shown in the photo. Bend the two rods so they come together parallel with each other and cut one off 3/4" after they join. Wrap the two rods with soft bare copper wire and actuate the retracts to make sure they both operate together without the rods binding. When satisfied with the fit, flow solder into the copper wire to hold the two together (acid core solder works best for this). This whole process is a "trial and error" type task that takes some patience. If the rods get bent more than necessary during the fitting process, just use them as a pattern to make new rods with the correct bends. You want to get this right now because it is tough to correct after the fuselage is closed up.

D 6. Remove the main gear pushrods and slide a Du-Bro #103 Strip Aileron Horn and wheel collar onto the pushrod that runs on the same side as the nose gear rod. Replace the main gear pushrods and position the aileron

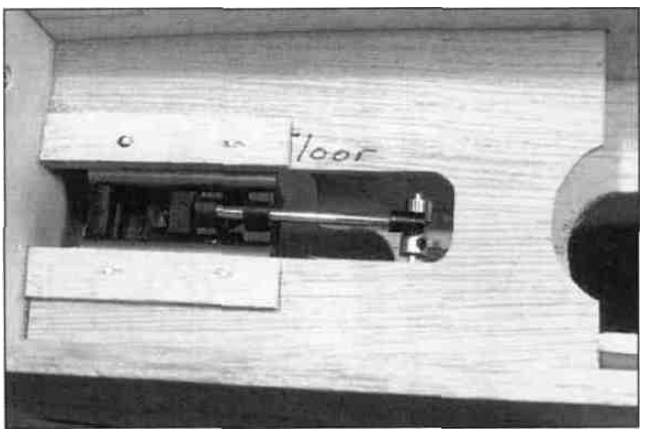
horn as shown in the next photo. Tighten the set screw on the horn.



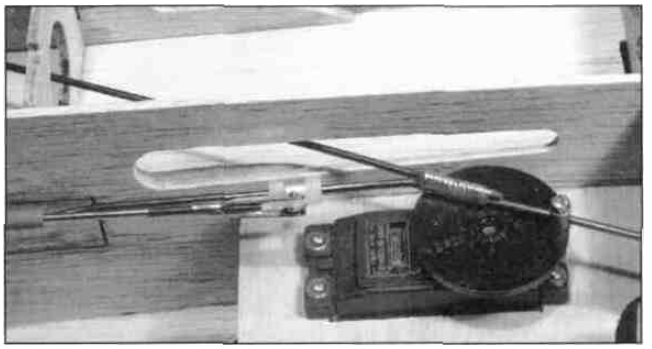
D 7. Pull the nose gear pushrod back and position it on **top** of the fuel tank floor. Thread a 2-56 steel clevis onto the nose gear pushrod and hook it up to the strip aileron horn. Position the red pushrod outer tube where you want it and cut it to the correct length.



Pull all three retract pushrods towards the rear of the plane until both main gear actuating arms are pulled as far as they will go. Pull the nose gear actuating arm back. Bend the nose gear wire so it will pass through the hole in the actuating arm as shown in the photo. Slide a 3/32" wheel collar (not included) onto the nose gear rod.

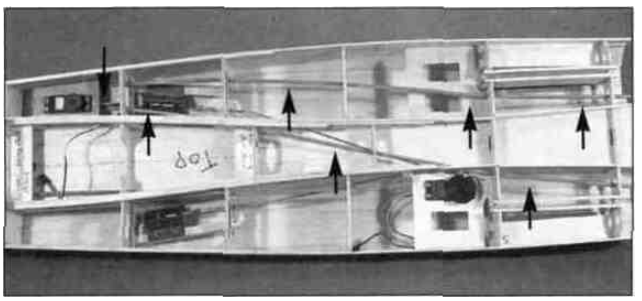


D 8. Return the nose gear pushrod below the fuel tank floor and slide it through the actuating arm. Secure it with another 3/32" wheel collar and check the operation of all three retracts. The actuating arms of all three retracts should hit the front and back stops together. If they don't, adjust the steel clevises and the nylon aileron horn until they all work together.

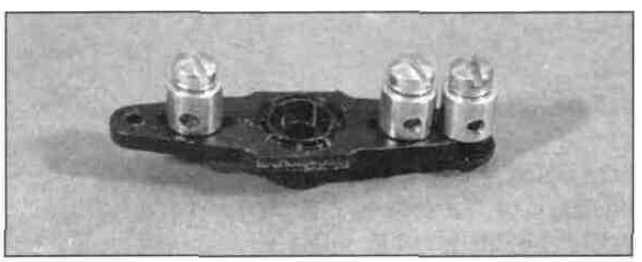


D 9. Mount the retract servo using the screws that came with the radio or servo. Hook the pushrods up to the retract servo wheel using the E-Z connector and rotate the wheel by hand (180 degrees) to check the operation of the pushrods. Make sure they are not binding.

PUSHRODS

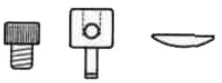


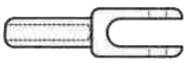
D 10. Route the two- rudder pushrod outer tubes (PLTB002) as shown in the photo. A long 3/16" drill bit is very handy here. Drill holes wherever necessary to run the rods as straight as possible. Cut the excess tubes off about an inch or so in front of F-7. *If you are going to operate only one rudder, just run one outer tube straight back from the servo. (See comments regarding rudder options on p. 5.)



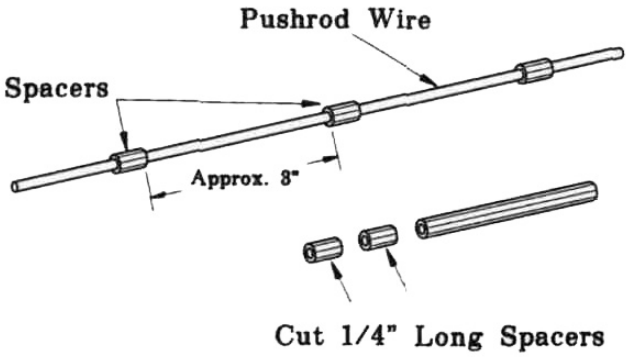
D 11. Assemble the rudder servo horn by installing the three **EZ connectors** as shown in the photo (three parts

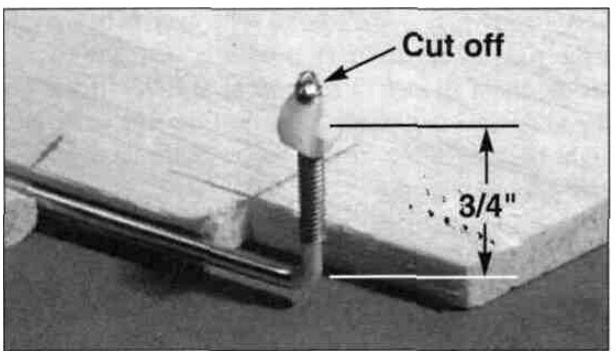
make up each EZ connector - EZCONN01. EZCONN02 and EZCONN03). The two inner connectors should be the same distance from the center of the horn. The outer connector is for the nose gear steering pushrod. Make sure the plastic washers are fully pushed onto the connector bodies.



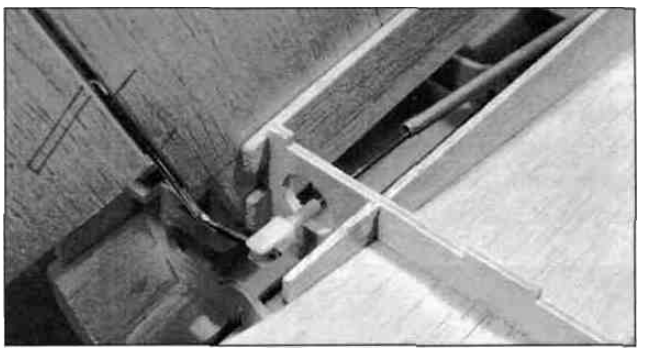


D 12. Screw a **nylon swivel clevis** (NYLON21) 3/4 of the way onto the end of two **34" pushrod wires** (WIRES17). Cut 1/4" long spacers from the 6-1/2" piece of **yellow pushrod inner tube** (PLTB004) and slide 7 spacers onto each wire approx. 3" apart. **Note:** If these spacers do not slide on easily, cut them to a shorter length. When installing pushrods, position the plastic spacers so they always stay inside the pushrod guide tubes. If the spacers are not a tight fit on the pushrod wires, apply a drop of thin CA to secure each spacer.



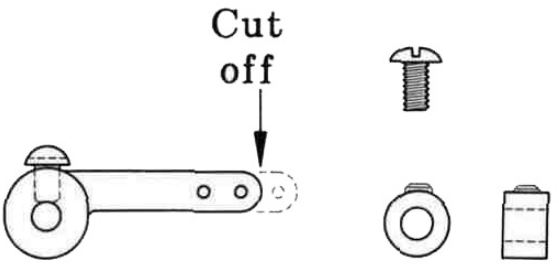


D 13. Screw a **nylon swivel** (NYLON20) onto each of the four **small torque rods** (WBNT168). **NOTE:** The torque rod swivels must be loose enough to swivel freely; therefore, we recommend that you cut threads **halfway** through the hole in the nylon swivels using a **4-40 tap. IMPORTANT -** We have noticed that the swivels are sometimes looser than desired if you tap the threads all the way through the swivel. This looseness is not very noticeable but can cause control surface flutter and therefore cannot be permitted. Cut the threads a **little** at a time, checking the swivel on the torque rod each time until it rotates with very little friction. Cut the excess threads off of the torque rod just past the swivel.



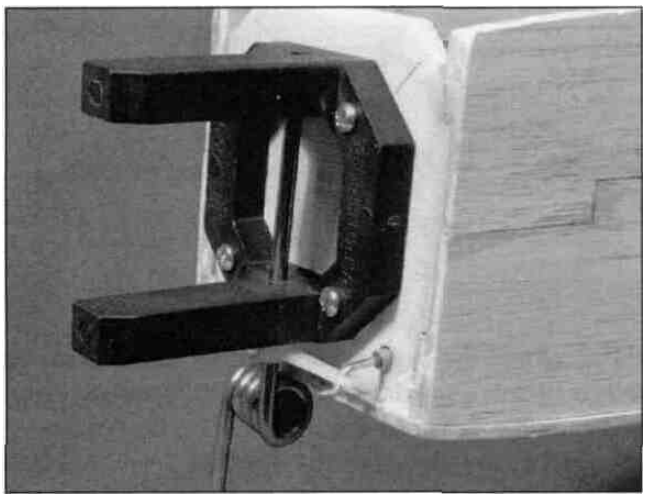
D 14. Hook the swivel clevises up to the nylon swivels on the torque rod. Install the torque rods in the fins and rudders, slide the rudder pushrod wire into the outer tubes and insert the fin/rudder assemblies into their slots. The pushrod wires should pass through the EZ-connectors and any excess wire should be cut off about 1" past the connector. Check the movement of the rudders to make sure the clevises don't bind on former F-7. Trim the holes in F-7 if necessary to allow the torque rods to move freely. Remove the fins and rudders but leave the torque rods attached to the swivels. The torque rods can be rotated and tucked down between the fin supports.

STEPS 15 AND 16 ARE FOR FIXED GEAR ONLY!

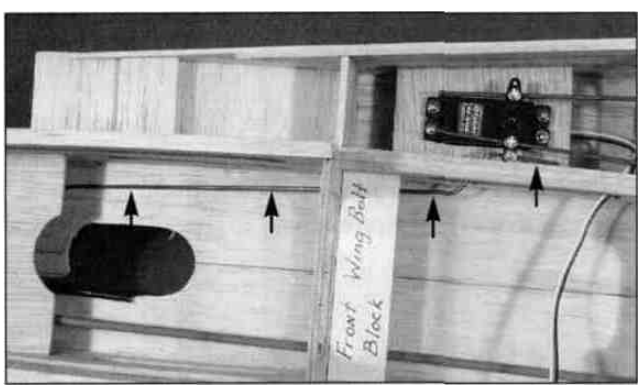


D 15. Cut 1/4" off the end of the **nylon steering arm** (NYLON16) as shown in the sketch above. Install the steering arm on the nose gear strut using the 5/32" **wheel collar** (WHCL005) and the **6-32 x 1/4" pan head screw**

(SCRW020). Insert the nose gear strut into the engine mount and attach the mount to the firewall. The steering arm should be on the same side as the rudder servo (left side) and the top of the nose gear coil should be approx. 1/16" below the fuse bottom.

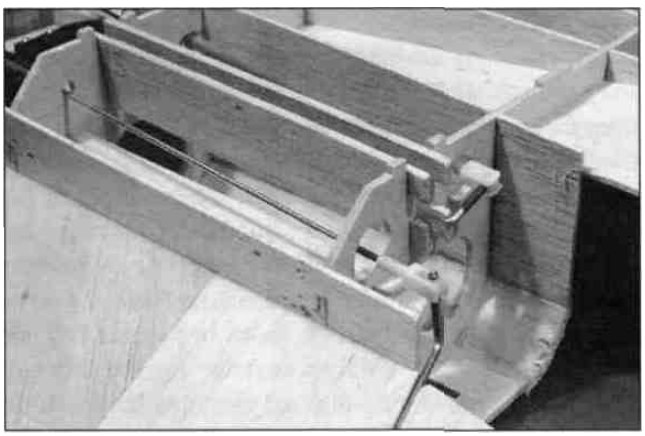


D 16. Drill a 3/16" hole in the firewall, just above the outer hole in the steering arm. Use a red pushrod outer tube to route the pushrod from the firewall to F-2. This will help keep fuel residue from seeping into the tank compartment. Bend the nose gear pushrod from a 2-56 threaded rod and connect it to the steering arm. NOTE: A "Z"-bend is shown in the photo, but an "L"-bend works just as well in this application and is much easier **to** work with. Skip to step 18.

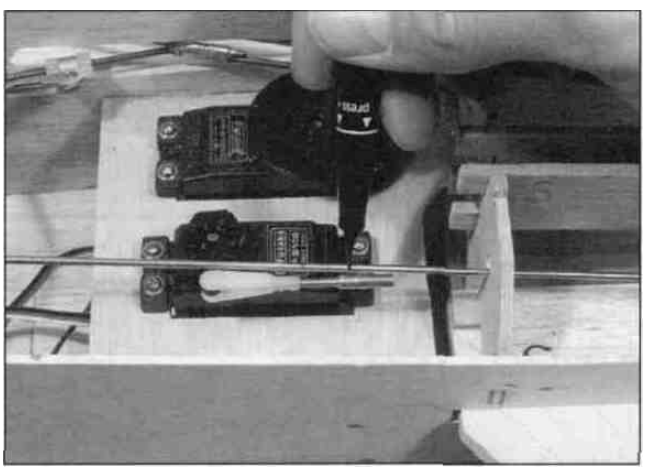


D 17. For retracts, use a steel clevis (not included) to hook the pushrod to the retract steering arm. Also, it is not necessary to use an outer guide tube since the pushrod won't go through the firewall. Just drill a hole **in** F-2 and bend the pushrod wire as shown in the photo.

D 18. Install the elevator servos using the screws provided with the radio. Position the elevator servos so the elevator pushrods will **both** hook up to the servos on the **same** (left) side of the servos. This is necessary because the servos will both rotate the same direction when hooked up to a Y-hamess. The photos that follow show both elevator pushrods hooked up on the **outside** of the servos. This is fine when using a computer radio, but **not correct** if you are using a Y-harness. One elevator would go up and the other would go down in this case. The plans show the correct installation when using a Y-harness. Screw a **nylon swivel clevis** (NYLON21) on two of the **12" threaded rods** (WIRES 16) to make the elevator pushrods. Drill two 3/16" holes in F-6 to allow the elevator pushrods to pass through and hook up to the servos without bending.

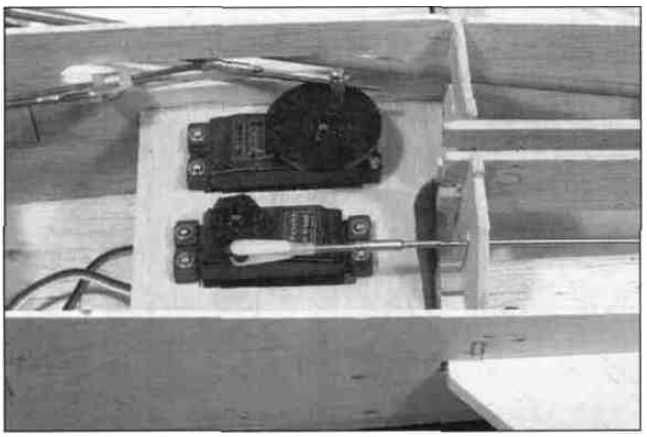


D 19. Hook the swivel clevises up to the nylon swivels on the elevator torque rods. Install the torque rods in the elevators and stabs. Slide the elevator pushrod wires through the holes in F-6 and F-7 and insert the stab/elevator assemblies into their slots.

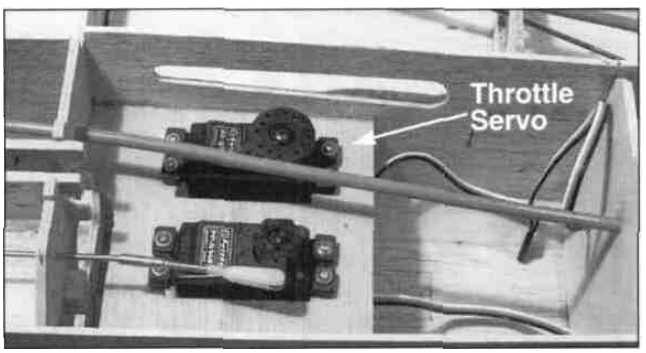


D 20. Screw a **nylon clevis** (NYLON 17) onto both **brass threaded couplers** (METAL018) until the threads protrude inside the clevis, and hook the clevises up to the outer hole in the elevator servo horns (a large horn is recommended). Position the elevators in their neutral

position and mark on the pushrod wires where to cut them off (approx. 1/16" before the coupler tapers down).



D 21. Remove the elevator pushrods from the fuselage and cut them oft at the mark. Remove the nylon clevises from the threaded couplers and solder the couplers to the wires with acid core solder. After things cool down, replace the clevises and hook the pushrods up to the servos. Move each servo arm throughout its range and check the elevator movement for binding. Adjust the clevises until the elevators are at neutral when the servo arms are at neutral. Trim the holes in formers F-6 and F-7 if necessary to obtain clearance for the elevator pushrods. Remove the stabs and elevators but leave the torque rods attached to the swivels. The torque rods can be rotated and tucked in between the stab supports.

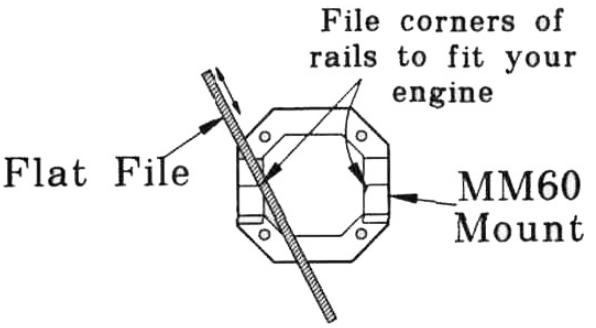


D 22. Install the throttle servo using the screws provided with your radio. It should be installed in the remaining rear servo tray opening to help balance the airplane.

DRILL ENGINE MOUNT

(Great Planes MM60D90 or similar glass-filled nylon mount)

NOTE: If the engine mount supplied in the kit does not appear to fit your engine (example: OS .61 SF), you may have to file the comers of the engine mount rails to make room for the crankcase. If the mount would require a large amount of filing, just replace the mount with one that correctly fits your engine.



D 1. Place the engine pointing straight ahead on the mount (in the approximate location shown on the plans) and mark the mounting hole locations on the mount. At the marked locations, accurately drill 7/64" (or #36) holes. **NOTE:** If you have access to a drill press, use it for drilling these holes to insure that they are drilled vertically.

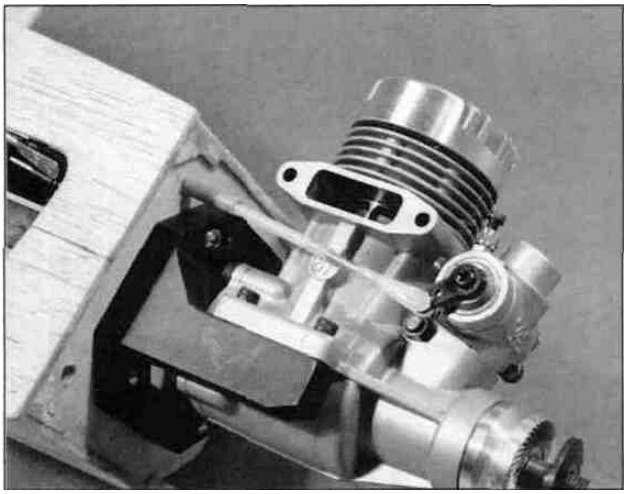
D 2. Now you may use one of the following methods to attach your engine to the mount:

Method 1: Screw the #6 x 3/4" **sheet metal screws** (provided in the kit) through the engine mounting flange and into the mount. When first installing these screws, put a drop of oil into each screw hole.

Method 2: Cut threads into the holes you just drilled using a 6-32 tap and tap wrench. If you use this method, you'll have to supply your own bolts (6-32 x 1" socket head cap screws) for attaching the engine to the mount.

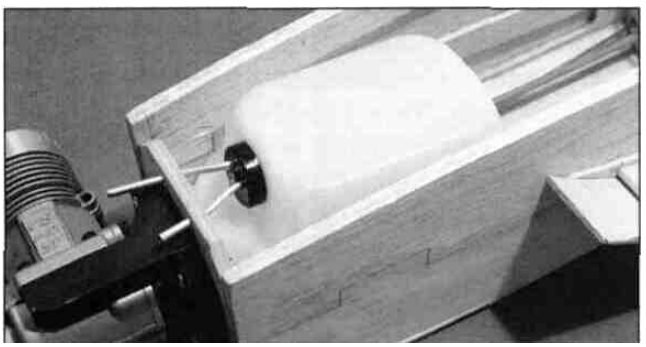
D 3. Attach the engine mount to the firewall using the 6-32 x 5/8" cap screws.

D 4. Screw your engine to the mount, and determine the location where the **throttle pushrod** will pass through F-1. Due to the length of the throttle pushrod, a flexible plastic pushrod (not included) works well for this. Drill a 3/16" hole (or whatever size you need) in the firewall for the throttle pushrod guide tube. The hole should be 1/4" away from the outside of the fuselage to



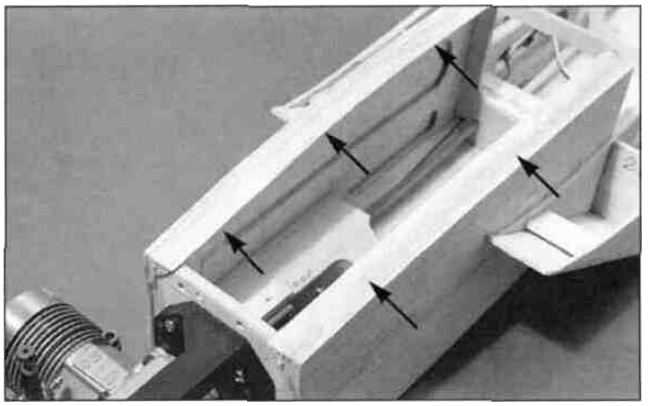
allow room for the nose sides. Route the outer guide tube through the openings in the formers back to the throttle servo. Drill any holes necessary to keep the pushrod as straight as possible. Cut the pushrod to length and use nylon clevises and 1" threaded studs on both ends. Sand the outside of **all** the plastic pushrod guide tubes with 100-grit sandpaper. Then glue them in place.

INSTALL FUEL TANK



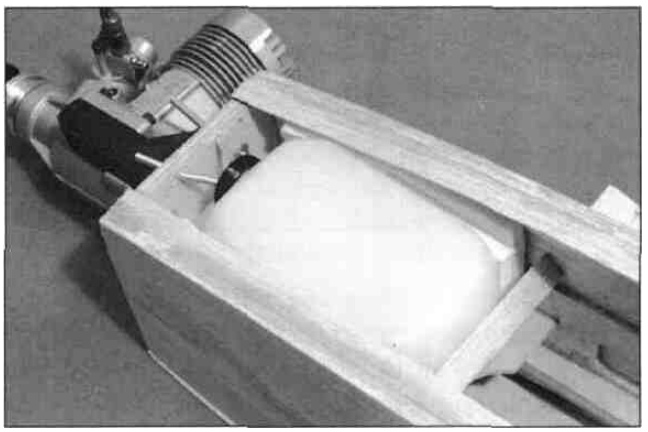
D 1. Assemble your 10 oz. fuel tank. We recommend using a Dubro 10 oz. tank and bending the brass tubes as shown in the photo. This keeps the fuel lines on the outside of the fuselage where they will be accessible. Drill two 5/32" holes above the engine mount for the tubes to pass through the firewall. **HINT:** To avoid kinking the tubes when bending, we use **K&S Tubing Bending Springs.** Cut the brass tubes off so they protrude approximately 1/2"- 3/4" past the firewall.

D 2. Remove the tank and install two 10-1/2" long pieces of 1/2" **balsa triangle** (WSTR001H) along the **top** edge of each fuse side. Bend the triangle to conform



with the top surface of the fuse side. You can cut relief slots in the triangle if needed to get it to bend easier.

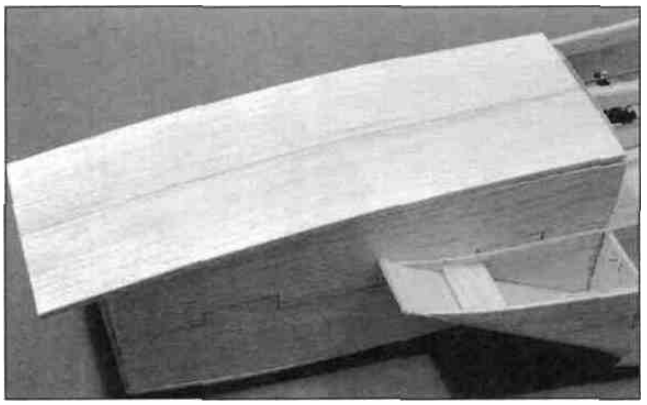
D 3. Now remove all three retracts and **fuelproof** the inside of the fuel tank compartment and the area between F3E and F5E by brushing on a coat of polyester resin, finishing epoxy or other fuel proof paint. This will keep the wood from getting fuel soaked and soft when residue gets blown or splashed in through the wheel wells. When this has cured, replace the retracts.



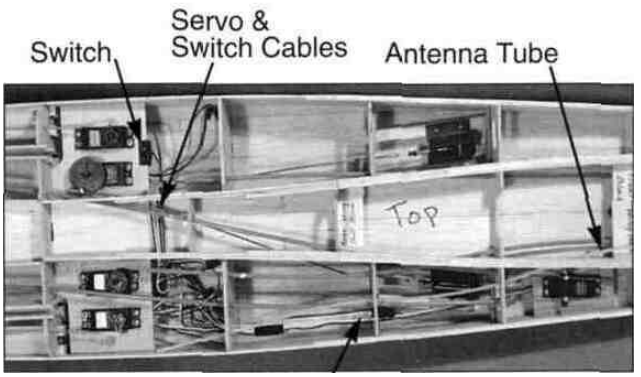
D 4. Replace the fuel tank and mark on the firewall which brass tube is which. Put an "F" next to the fuel tube and a "V" next to the vent tube. Cut pieces of latex foam rubber and place them on both sides of the fuel tank to cushion the fuel tank from engine vibration. Apply silicone adhesive around the tubes to seal off the holes in the firewall. Cut a scrap piece of balsa to fit behind the tank and glue it in to hold the tank in place.

FINAL FUSELAGE CONSTRUCTION

D 1. Sand the top surface of the fuse sides above the tank compartment with a sanding block.

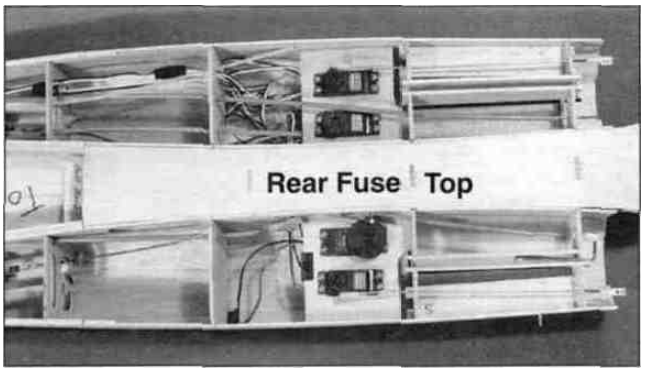


Cut the 3/16" x 2" x 24" **balsa sheet** (F146F19) in half **lengthwise** to make two 12" pieces. Glue these two pieces together to form the **front fuse top.** Glue the top in place against the front of F-2 and the top of the fuse sides. **HINT:** Keep the centerline of the fuse top aligned with the centerline of the fuse and it will be easier to keep the front end symmetrical when sanding later. Remove the engine and mount and sand the fuse sides, top and bottom flush with the front of the firewall.

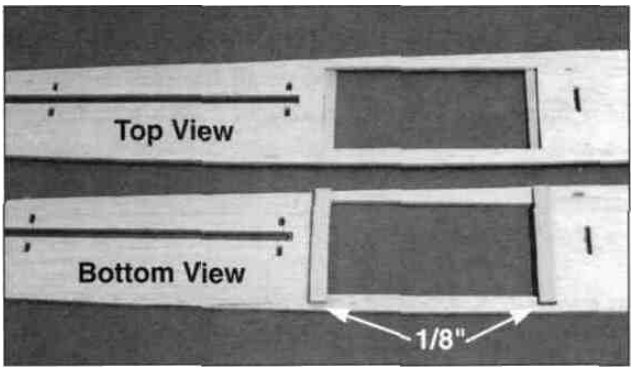


D 2. Determine where you will install the receiver, battery and switch harness and go ahead and route the wires now. It is much easier to do this now than later. Normally the receiver will go on the side of the fuselage that has the most servos (same side as the rudder servo) and the battery pack will go on the other side. The switch can go on either side. Use the switch cover plate as a template to cut a notch and drill two holes to mount the switch in one of the rear servo trays. After covering, add a rod to operate the switch from outside the fuse. Route the servo cables through the lightening holes and **tack** glue them in place with silicone adhesive. Route an aileron extension from the receiver to the compartment between F3E and F4E to make it easy to hook up the ailerons when installing the wing. Tack glue the extension in place. It is also a good idea to run an extra guide tube from the receiver to the nose of the plane in which to route the **antenna.**

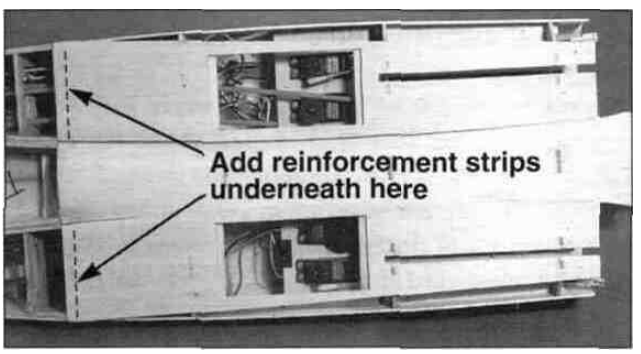
D 3. Check all the pushrods and make sure they are securely glued in place. Test fit the die-cut 3/32" balsa



rear fuse top (F14614) in place. Trim it if necessary and glue it in place. Glue it to the formers **first** then use thin CA to glue it to the fuse and turbine sides. Also glue the fuse top and bottom together at the rear. The gap between the top and bottom will be filled in later.



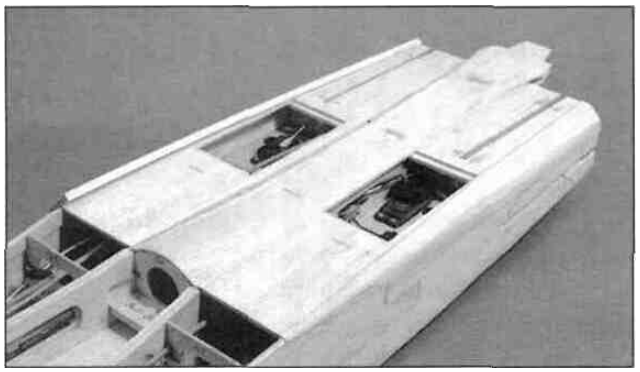
D 4. Punch the hatch covers out of the die-cut 1/8" balsa **turbine tops** (F146F13) and set them aside for now. Cut four 3" long pieces from the 1/8" x 3/8" **x 15" basswood stick** (F146F30). These will be the hatch rails. Glue them in place on the **bottom** of each 1/8" balsa turbine top. They should be centered in relation to the hatch cutout and positioned so 1/4" overlaps the cutout. Glue one to the front of each hatch cutout and one to the back. Keep the rails 1/8" away from the curved edge of the turbine top so they will clear the turbine side.



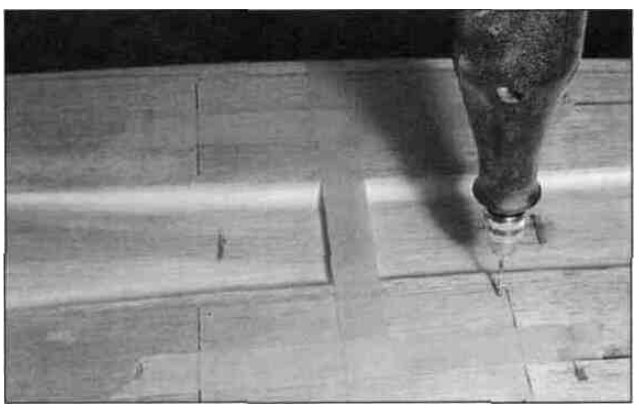
D 5. Glue the turbine tops in place using thick CA on each former and then thin CA along the inner turbine

side. Cut two strips of 1/8" balsa approx. 3/8" wide and 2-7/8" long (from scrap around the die-cut sheets). Glue these strips **underneath** the **front** edge of each turbine top to reinforce them.

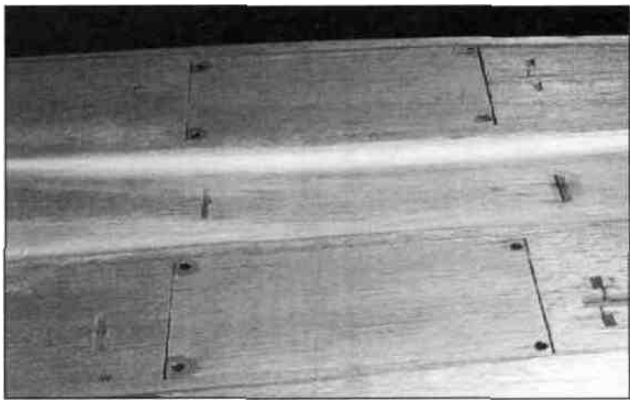
D 6. Use a sanding block with medium grit sandpaper to sand the edges of the turbine tops and outer sides flush with the formers. Glue the two **top** 1/4" x 1-3/8" x 27" balsa **turbine corners** (F146F21) in place just as you did the bottom comers earlier.



Be careful to keep the turbine top flat around the hatch area. The thin area around the hatch cut out will tend to bend down when you're sanding and it will not get sanded correctly. Then when you apply the turbine comer, it will be pushed down slightly and the hatch will not line up with it. Rough sand the comers to the cross sections shown on the plans.

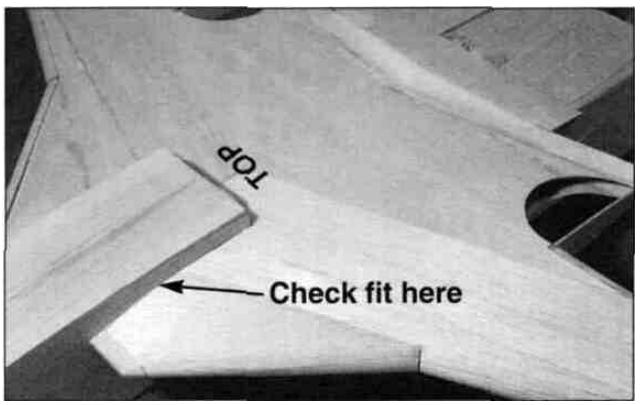


D 7. Set the hatch covers in place in the hatch openings and check their fit. They need to have a 1/32" gap on **all four sides** to allow for the covering. Sand them if needed to get the correct fit. When satisfied with their fit, tape them in place to keep them from moving and drill 1/16" holes at each punch mark. Remove the hatch covers and enlarge the holes **in the hatch only** to 5/64". Write on the front **bottom** of each hatch cover whether it is the right or left cover so you can keep them straight.



D 8. Put a drop of thin CA on each hatch cover hole and allow it to soak in and cure. **Carefully** countersink each hole so the flat head screws will be flush with the top surface of the hatch cover. Test fit the hatch covers using the #2 x 3/8" **flat head sheet metal screws** (SCRW069) provided.

FIT THE WING TO THE FUSE

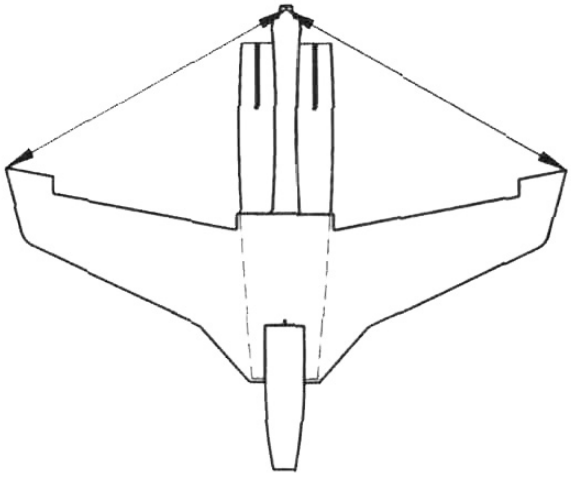


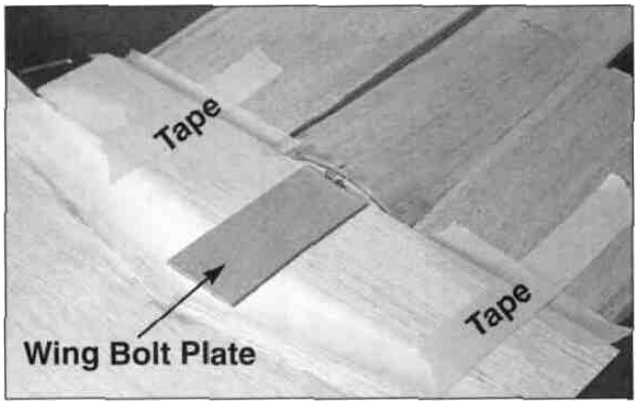
D 1. Gently sand the wing saddle smooth and then set the wing in place **with the top up.** Check the fit of the wing strakes around the fuselage. They should fit very close with no more than 1/32" of gap on both sides. Fill in any voids with either balsa or wood filler.

D 2. Use a T-pin and a piece of string to check the alignment of the wing. Stick the T-pin in the middle of the tail and loop the string around the pin. Pull the string over to the joint formed between W 11 and the spar and

hold your finger there on the string. Swing the string over to the other tip and compare the measurement. Adjust the wing if necessary and repeat this again until the measurements are equal. When they are equal, make a mark on the wing and the fuse so you can tell when they are aligned. Put a couple strips of masking tape along the center TE and the turbine tops. Also wrap a strip of tape along the top of each strake and down onto the inlets to help hold the wing in place.

These measurements must be equal!



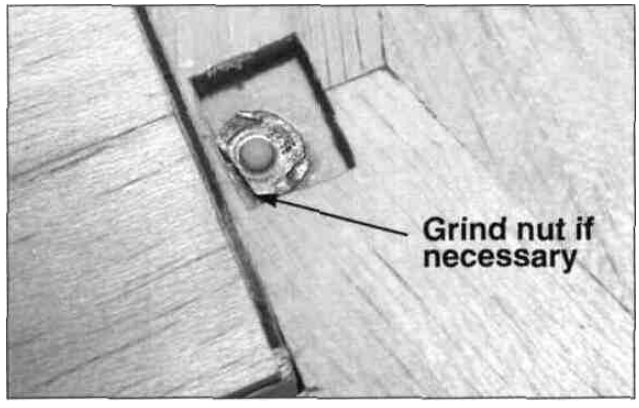


D 3. Securely glue the 1/16" x 1-1/4" x 3" ply **rear wing bolt plate** (F146W19) in place with thick CA. **It** should be centered in relation to F-4, and the back edge of the wing bolt plate should be about 1/16" in front of F-4. Be careful not to glue the wing to the fuse!

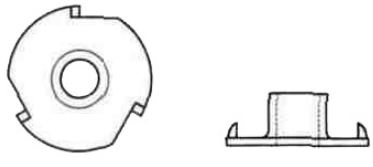
D 4. Check the alignment of the wing one more time to be sure and then carefully turn the plane over. Holding the wing **firmly** in place, drill a 1/4" hole in the center of each die-cut hole in the fuse bottom. Hold the fuselage level and keep the drill perpendicular to the

wing bolt **blocks** in the fuse. Drill the holes all the way through the wing bolt **plates** and the top surface of the wing. **IMPORTANT - Do not allow the wing to move while drilling!**

D 5. Remove the wing and re-drill the holes **in the wing only** to 5/16". Enlarge the front hole in the **bottom** wing sheeting **only** to approx. 1/2" diameter so the sheeting doesn't get banged up when inserting the bolts. Also remove about a square inch of sheeting around the bolt hole on the **top** surface of the wing so you can work there in the next step.

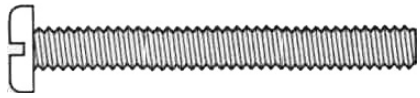


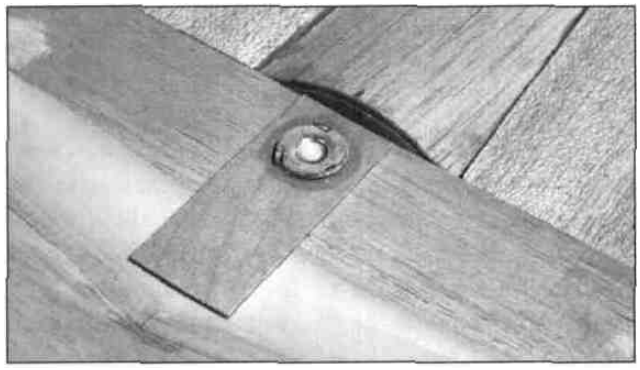
D 6. Use a pair of wire cutters to cut off the three "teeth" on the two **1/4" blind nuts (NUTS020).**



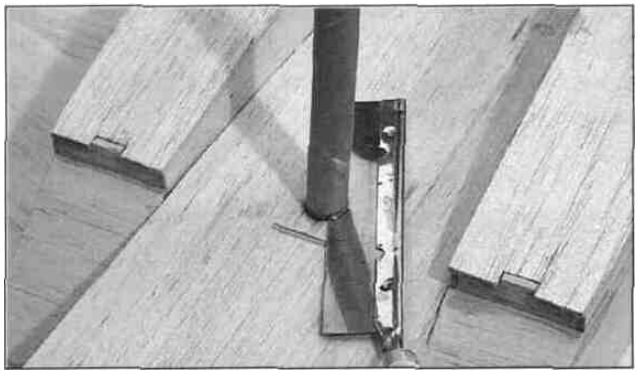
NOTE: You can bend the teeth even with the flange if you don't want to cut them off. If you have a 1/4-20 tap, run it through the blind nut a couple of times from the un-flanged end to clean up the threads. Roughen the flange of the blind nuts with sandpaper to help the glue

stick. Press the blind nuts into the holes in the wing **from the top.** Replace the wing on the fuse and use the **1/4-20 nylon bolts** (NYLON 13) to screw the wing into place. Hold the blind nuts with your fingers to keep them from turning, but do not over-tighten the bolts at this point. If the front hole ends up too far forward to fit the blind nut in, just cut or grind the blind nut until it fits.





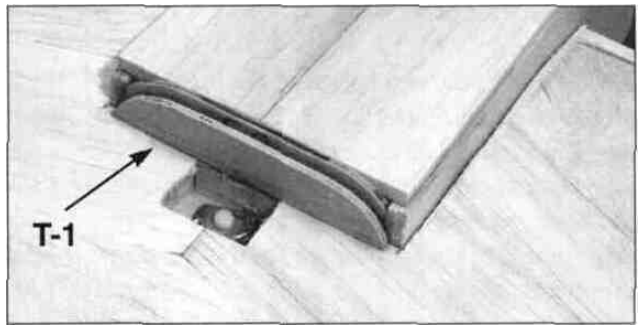
D 7. Use thick CA to **tack glue** the blind nuts into place (be careful not to glue the bolts in). Remove the wing bolts and **securely** glue the blind nuts in place. Force the glue under the flange of the blind nuts and allow it to build up a flat surface for the blind nut to seat against.



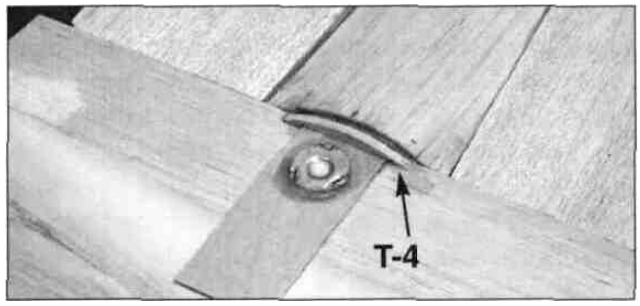
D 8. Replace the wing using the nylon bolts and turn the plane upside down. Insert the 1/2" **diameter paper tube** (PTUBE001) in the front hole and push it down over the head of the nylon bolt and against the wing bolt block. Carefully glue it to the fuse bottom with thick CA. **Be careful to only use a drop or two of CA so it doesn't drip down and glue the bolt in place.** Cut off the excess tube with a razor saw and do the same for the rear hole. Remove the bolts from the wing and add a **little** thick CA around the tubes to glue them to the wing bolt blocks. Sand the tubes flush with the bottom of the fuse and then soak the tubes with several drops of thin CA.

BUILD THE WING TURTLE DECK

D 1. Install the wing on the fuse using the wing bolts and check the fit of the wing in the wing saddle. If it does not seat well, remove the wing and sand the saddle slightly to improve the fit. When satisfied with the fit of the wing in the saddle, replace the wing on the fuse.

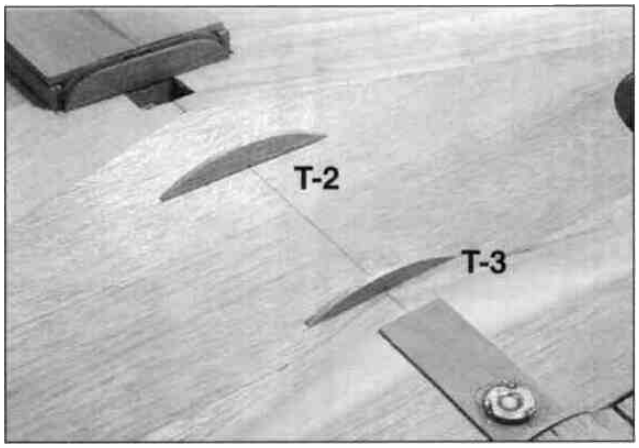


D 2. With the wing bolted in place, test fit the die-cut 1/8" balsa **T-1** (F146F01) and the die-cut 3/32" balsa **T-4** (F146F31) in place against formers F-2 and F-4 respectively. They should match up with the formers **minus a** 3/32" **offset** so when the 3/32" balsa wing turtle



deck is added, it will blend in with the front and rear sheeting. Due to the building and manufacturing tolerances, it is not unusual to have to sand these parts to achieve the correct offset. When satisfied with their fit, glue them in place approx. 1/32" away from the formers. Use glue sparingly to avoid gluing the wing to the fuse.

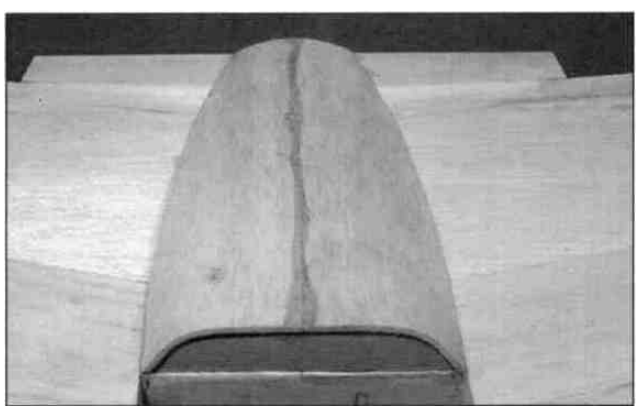
D 3. Measure back from T-1 approx. 3-3/4" and draw a line parallel to T-1. Measure 4" back from the line you just drew and draw another parallel line. Now draw a line from the center of F-2 to the center of F-4. Measure the bottom of the die-cut 1/8" balsa **T-2** (F146F01) and the die-cut 3/32" balsa **T-3** (F146F31)



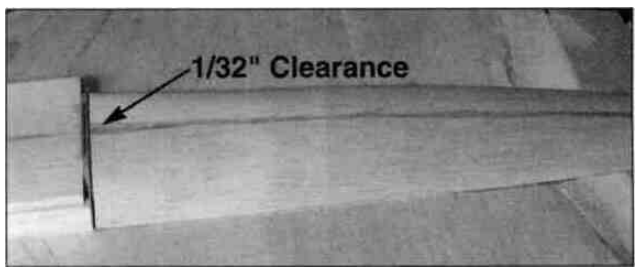
and mark the center of each of these. Glue T-2 and T-3 on the parallel lines you just drew so their center mark is on the centerline of the wing.

D 4. Test fit the two halves of the die-cut 3/32" balsa **wing turtle deck sheeting** (F146F31) together. Sand them if necessary to achieve a good joint between the two. Glue them together with thin CA and then sand both sides smooth. Wet one side of the sheeting with a damp sponge or paper towel and allow the water to soak in for 5 minutes or so.

D 5. Remove the wing from the fuse and center the turtle deck sheeting on T-l and T-4. Carefully bend it into place to check its fit. It will probably need a little trimming to make it fit well. First trim it to fit T-l and T-4 and then check its fit on T-2 and T-3. **NOTE:** When fitting the sheeting, trim equally on each side to keep it symmetrical. This can be tricky to get just right, so don't get in a hurry, take your time and trim a little at a time. If you end up with gaps, just fill them with model filler. Check to make sure you can see the parallel lines you drew earlier when the sheeting is in place. If not, lengthen them. The edges of the turtle deck sheeting should "flow" from the shape of the fuse front into the shape of the rear fuse top.



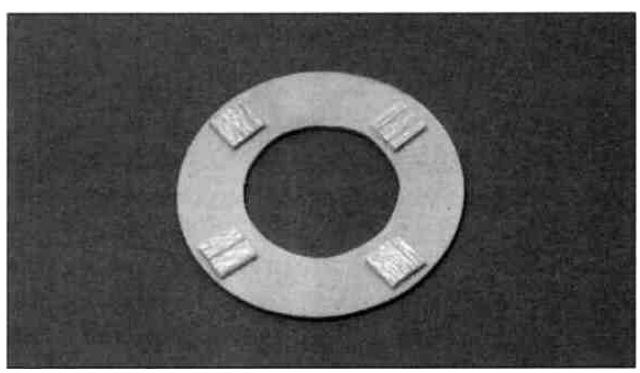
D 6. When satisfied with the fit. glue it in place by first correctly positioning it, then adding thin CA at the center of T-l and T-4. Allow the glue to cure, then work it down into place a little at a time on one side and then the other until it is completely attached to T-l and T-4. Now poke a few holes with a pin where T-2 and T-3 are (use the parallel lines as a guide) and apply a couple drops of thin CA to each hole. Press the sheeting down against T-2 and T-3 while the glue is curing. Glue the edges down with thin CA.



D 7. Test fit the wing in place again and trim the turtle deck sheeting so the wing will have enough clearance to fit on and off easily (approx. 1/32" at both ends). Don't worry if the turtle deck doesn't match up perfectly with the fuselage, we will use model filler later to smooth things out.

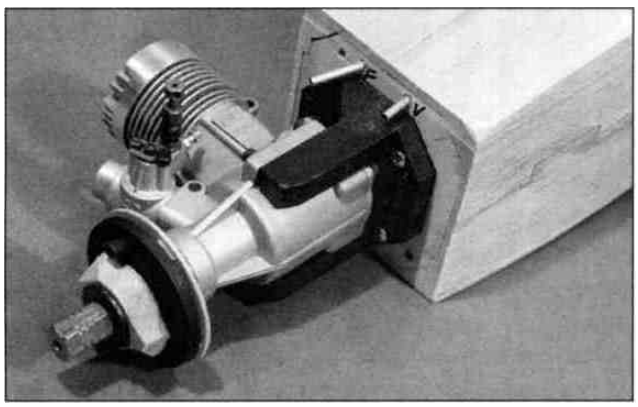
ENGINE COMPARTMENT

D 1. Attach the engine mount to F-l, and attach the engine to the mount. Remove the nose gear from the engine mount. Mark the outline of the engine mount on the firewall with a pencil.



D 2. From a scrap of 1/16" balsa, cut four small pieces and tack glue them to the 1/16" ply **spinner ring** (US40F02) as shown, using a very small amount of thick CA (these will be removed later). **IMPORTANT NOTE:** Due to the small engine compartment, shock absorbing engine mounts that allow the engine to move are not recommended.

D 3. Now center your 2-1/4" diameter **spinner backplate** (HCAQ3750 recommended) over the spinner ring, and tack glue it to the 1/16" spacers.



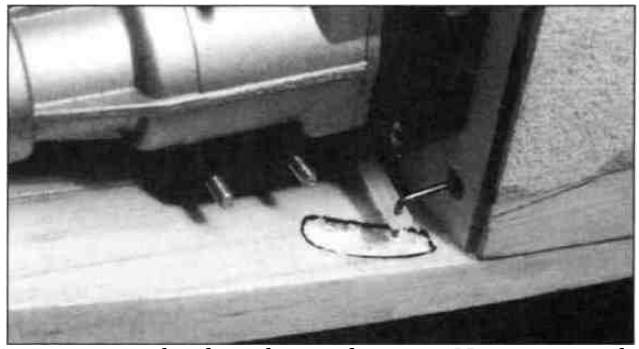
D 4. Slide the spinner ring/spinner backplate assembly onto the drive shaft and temporarily hold it in place with the prop and prop nut. (Photo shows only the **hub** of an old prop).

D 5. Locate the three identical **1/4" shaped balsa cowl pieces** (F146F29) in the kit. With the fuselage upside down, trial fit one of the pieces in place on the bottom of the engine compartment. Study the plan to see the correct positioning of this part. The cowl pieces should be centered in relation to the side they are installed on. Note how the front of the cowl piece meets the spinner ring. By trial and error, sand a little at a time off the front and rear of the bottom cowl piece until it mates at the proper angle with the firewall and the back of the spinner ring. Now glue the cowl piece to the firewall and the spinner ring.

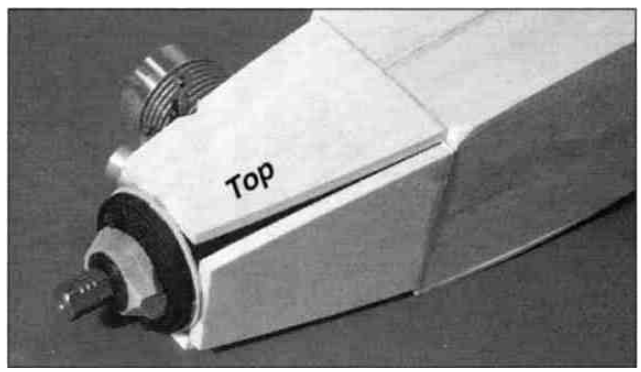
NOTE: If you have installed a retractable nose gear, skip steps 6 and 7.

D 6. Turn the fuselage right side up and use a long 5/32" drill bit (or a sharpened piece of 5/32" O.D. brass tube) to drill a hole in the bottom cowl piece for the nose gear strut. Insert the drill through the holes in the engine mount and drill down through the bottom cowl piece.

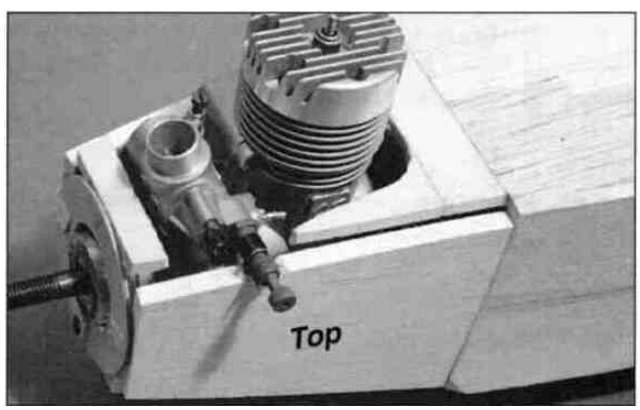
D 7. Temporarily install the nose gear, steering arm and nose gear pushrod wire. Notice that the steering arm and the pushrod wire will bind against the cowl piece, especially in a turn. Carve out a **clearance slot** for the



nose gear pushrod in the cowl piece. Now remove the nose gear parts.



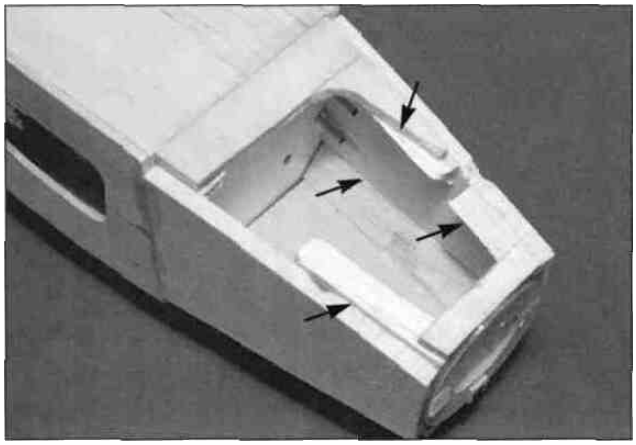
D 8. Custom fit another cowl piece for the **top** of the nose between the firewall and the spinner ring, trimming as necessary for needle valve clearance. Also fit the remaining cowl piece to the side of the nose. When satisfied with the fit of these two pieces, glue them in place. **NOTE:** The corner gaps are intended to be there. Later, they will help gauge when the nose has been sanded enough.



D 9. Use scraps of 1/4" wood (from the turbine corners) to fill in around the engine side of the nose. **SUGGESTION:** The temptation is to close up this area too much! We recommend that you leave large enough openings to allow you to easily remove the engine and mount and also have convenient access to the throttle linkage.

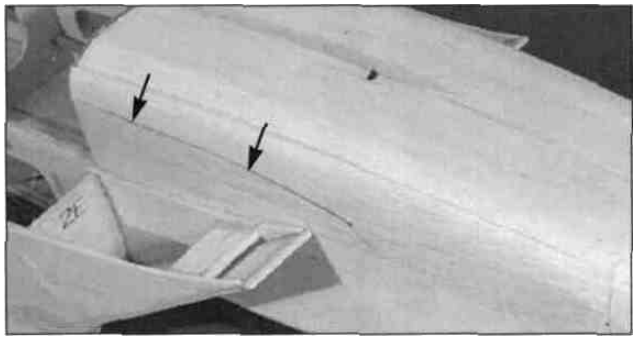
D 10. Remove the prop nut and propeller. Carefully pop the spinner backplate loose with a screwdriver and remove the spacers. Remove the engine and mount in preparation for the next steps. You may have to cut away some of the scrap wood you just installed to get the engine out. This is ok, you have to be able to service the engine.

D 11. Check the fuel tank brass tubes and cut out around them if necessary so the fuel tubing will slide on later. If necessary, carve out the area of the nose side if needed for the nose gear steering arm and pushrod clearance.

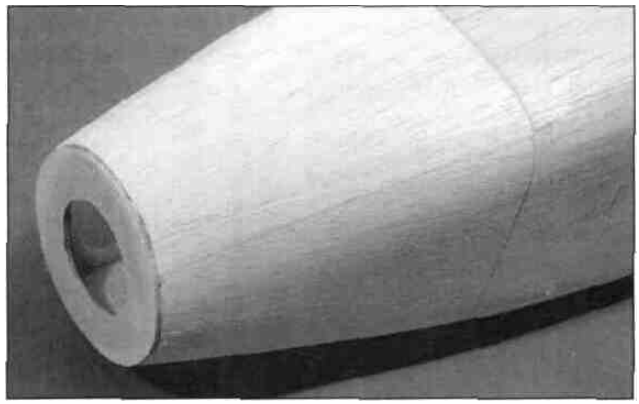


D 12. From the 1/2" balsa triangle **stock** (WSTR001H), cut lengths to fit in all the corners of the nose, between the firewall and the spinner ring. Add thick CA around the inside of the spinner ring and the front of the firewall to secure everything.

D 13. Trim the triangle stock as needed to temporarily re-install the engine and mount. Trim the cowl bottom as necessary to get the muffler on the engine. Trim the cowl to allow a 1/8" gap around all engine parts including the muffler. When satisfied with the clearance, remove the engine and mount.



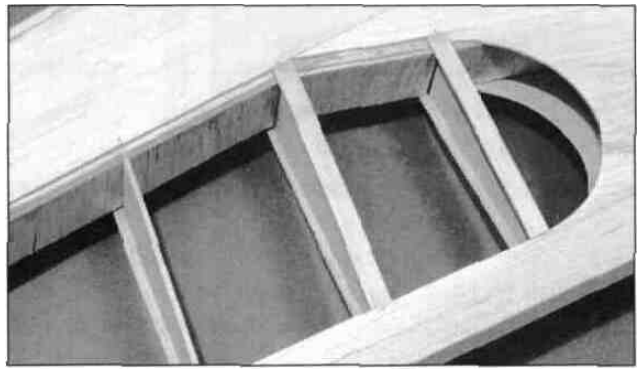
D 14. Set the wing on the fuse and draw a line along the top surface of the wing on the side of the fuselage. Do this on both sides of the fuse. Remove the wing.



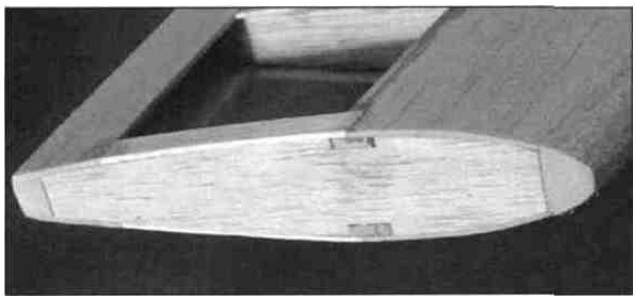
D 15. Using a razor plane and a sanding block with coarse sandpaper, rough sand the front of the fuselage as shown above. The nose should be perfectly round at the spinner ring and flow smoothly to the cross sections shown on the plans at the firewall and F-2. The **bottom** comers should become sharper as they near the inlets and flow smoothly into the fuse bottom. Do not sand below the wing outline you drew or you will increase the wing gap.

D 16. Now, with the engine and mount removed, **fuelproof** the inside of the entire engine compartment with polyester resin or epoxy thinned with alcohol.

FINAL ASSEMBLY

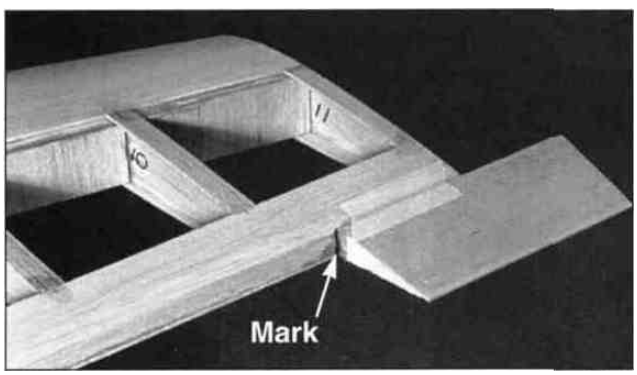


D 1. From the 1/16" x 3/8" x 30" balsa sticks (F146W20) cut the **cap strips** to fit between the leading edge sheeting and the trailing edge sheeting and glue them in place over each rib. Do this for both sides of all the ribs. **HINT -** For easier positioning of the cap strips, first mark the location of the ribs on the LE and TE sheeting.



D 2. Sand the outside of each W11 to obtain a square and flat surface to attach the wing tips. Also sand the TE sheeting flush with the TE.

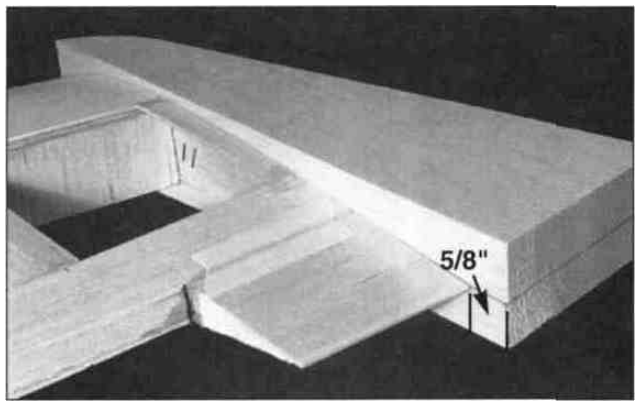
D 3. Lay each **tapered balsa aileron** (F146W08) over the plan with the tip extending approximately 1" past rib W11. Cut the **aileron end** off at the angle shown on the plans. Lay the wing over the plan and make a mark on the TE'S where the inner edge of each aileron end should go.



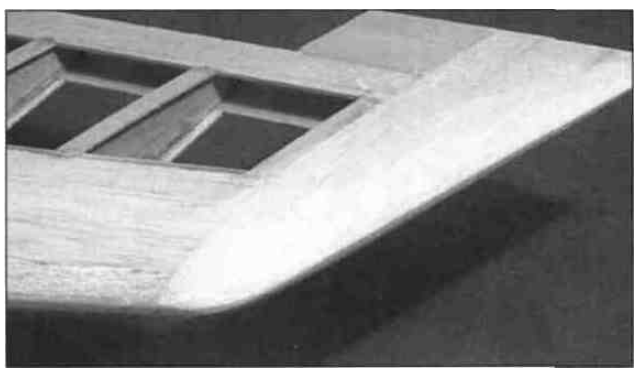
D 4. Tape the aileron ends in place with masking tape so the slanted edges line up with the marks on the TE. Check the alignment of the aileron ends with the airfoil contour at rib **W11.** It is of utmost importance that they are correctly aligned and do not tip up or down. Also look along the trailing edge of the aileron end to make sure it is pointing at the center TE. When satisfied with their alignment, glue them in place with thin CA. Remove the tape and add thick CA if needed to fill any gaps. Cut and sand the outer end flush with rib W11.

INSTALL WING TIPS

D 1. Draw a centerline on the outer surface of W11 (from the front of the LE to the TE of the aileron end) and all the way around each wing tip. This will help you install them correctly and sand them symmetrically.



D 2. Line the centerline of each wing tip up with the centerline of each rib W11 and securely glue them in place. **IMPORTANT -** The aft edge of the wing tip block must be approximately 5/8" behind the aileron end TE, to allow for wing sweep.



D 3. Use a razor plane and coarse grit sandpaper to carve and sand the wing tips to the appropriate shape as shown in the photo and on the plans. Blend the tips with the top and bottom surfaces of the wing and with the tapered aileron piece. **NOTE:** Do not sand the TE of the tip to a sharp edge, as it will be too fragile. Instead, leave it approximately 1/16" thick. You can put a strip of masking tape around rib W11 to keep from sanding it during this step.

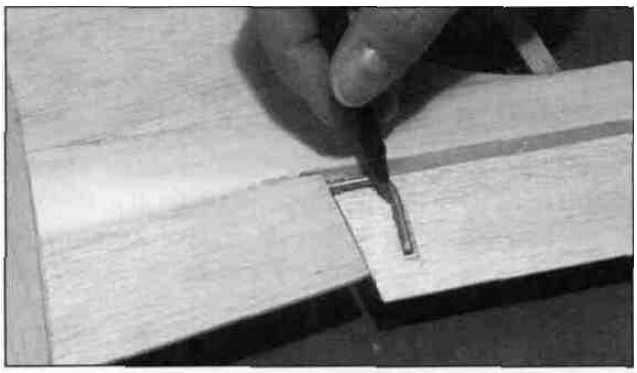
D 4. Soak the trailing and outer edges of each wing tip with thin CA and allow it to cure. This will harden the wood and help protect it from dings.

INSTALL AILERONS

NOTE: Do not glue the aileron hinges until after your model has been covered.

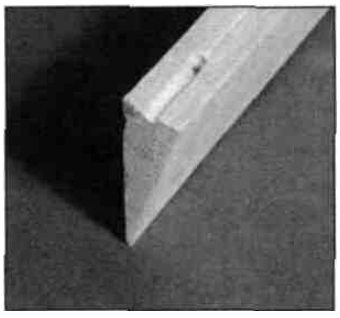
D 1. Draw an accurate centerline along the LE of the tapered balsa **ailerons** and the wing TE.

0 2. Check the length of your ailerons against the actual aileron openings and **trim** the ailerons as necessary. You should provide approximately 1/16" gap at each end of the ailerons.



D 3. Lay the ailerons in place in the openings, with the torque rods resting on top of the ailerons. **Mark the torque rod locations on the top of the ailerons.** Mark the **inside** end of each aileron with an "L" for the left one and an "R" for the right one.

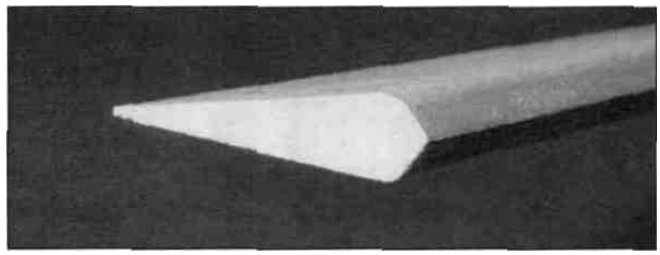
D 4. Drill a 1/8" hole in the ailerons at the torque rod locations, starting at the leading edge centerline and drilling **straight** in to the proper depth.



D 5. Use a sharpened 1/8" diameter brass tube to **cut a groove in the leading edge of the ailerons** to accept the torque rods. Trial fit the ailerons onto the torque rods and cut or file the groove as necessary until they fit.

D 6. Lay the ailerons on the plan and mark the **hinge locations** on the ailerons. Place the ailerons against the wing TE and transfer the marks over to the wing.

D 7. Cut the hinge slots in the ailerons and wing TE using an X-acto knife, following the procedure and cautions on page 9.

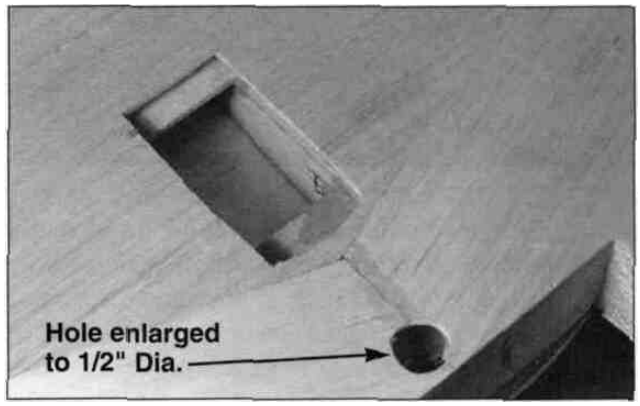


D 8. Sand the leading edge of the ailerons to the same **"V"-shape** as shown on the wing rib detail drawing. Round off the sharp comers on the top and bottom of the aileron as show.

D 9. Insert the hinges into the slots and trial fit the ailerons in place on the wing. **Do not glue the hinges until after you have covered the wing.** Sand the inside, TE corner of each aileron at an angle to match up with the center TE as shown on the plans.

THERE SHOULD BE NO HINGE GAP!

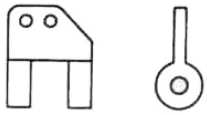
INSTALL AILERON SERVO



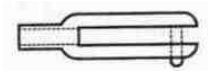
D 1. Cut the sheeting away for the aileron servo between the Wl ribs and behind the main spars **on the bottom of the wing.** The opening should extend to the back of the rear servo rail you installed earlier. Test fit your servo in place on the rails and cut out the **top** wing sheeting if needed to allow the servo to sit on the rails. **CAUTION: Do not cut into any wing spars!**

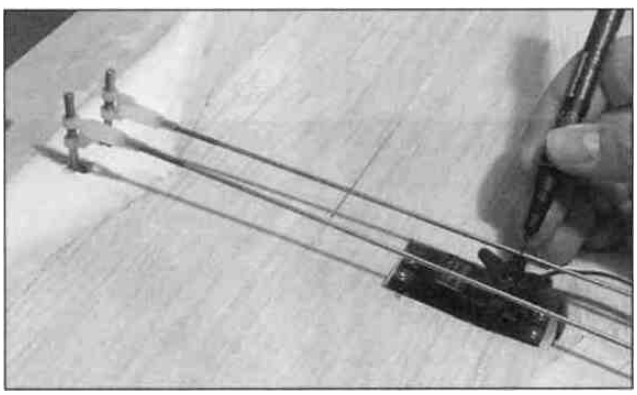
D 2. Use the **aileron servo** to determine where to drill the mounting holes. Drill the holes with a 1/16" diameter bit and mount the servo using the screws provided with your radio. Remove the servo and put a drop of thin CA on each mounting hole in the rails and allow the glue to cure. Remount the servo and install a large "X" type servo horn.

D 3. Drill out the **nylon aileron connectors** (NYLON 10) with a 7/64" drill bit and cut threads in them using a 6-32 tap. Screw the connectors onto the aileron torque rods until the highest holes are approximately 5/8" above the wing sheeting.



D 4. Screw a **nylon clevis** (NYLON17) onto the two remaining **12" threaded pushrod wires** (WIRES 17) until the threads are exposed inside the clevis.



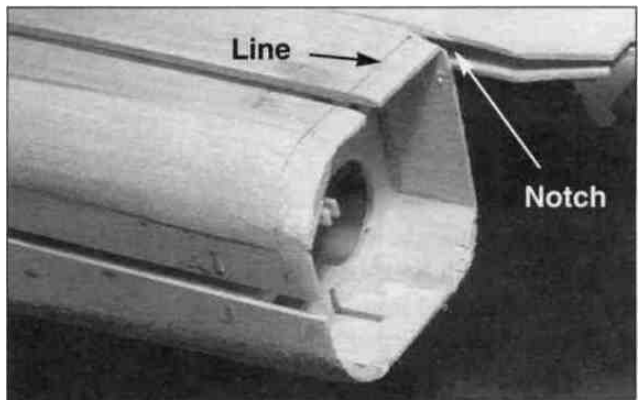


D 5. Attach the clevises to the aileron connectors. Then, with the ailerons in the neutral position, mark the pushrod wires where they cross the holes in the servo horn. Remove the pushrods and make a **"Z-bend"** in the rods at that point.

D 6. Remove the servo horn from the servo and work the Z-bends into the wheel. **NOTE:** You may have to enlarge the servo wheel holes with a 5/64" diameter drill bit. Replace the servo horn and check the operation of the ailerons. Enlarge the notches in the center wedge and the TE'S if required to achieve full aileron throw (See page 55 for the recommended amount of aileron movement).

D 7. Final sand the entire surface of the wing using a sanding block with fine sand paper. The LE cross section at the front of the strakes is shown on the fuse side view. On the swept back portion of the strakes, the LE should gradually taper from the sharper cross section at the front to the normal cross section at rib W5. **NOTE:** The strake LE shape is very important, so try to achieve the shapes shown on the plan.

INSTALL EXHAUST NOZZLES

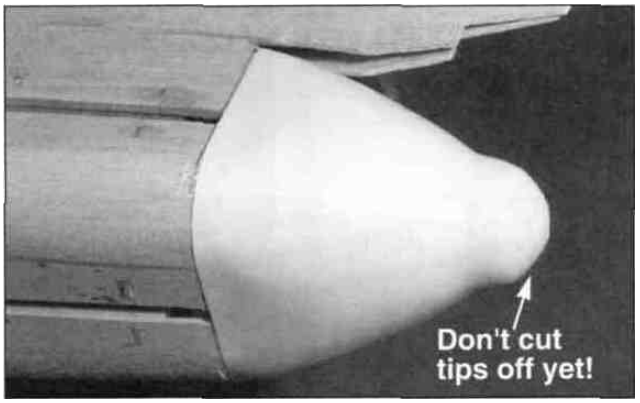


D 1. Use a medium or fine grit sanding block to final shape the fuselage comers. First sand the turbine sides, top and bottom to bring the corners flush with the edges. Then sand the corners so they blend smoothly with the sides. Now draw a line all around the turbine 3/8" forward of the back edge of the fuse. Sand the wood behind this line to taper it a little more than the rest. This will help you get the exhaust nozzles on.

D 2. Cut a 1/16" wide notch between the fuse top/bottom and the turbine inner side and top. It should be about 1/2" deep as shown in the photo at step 1 to clear the nozzles.

D 3. Cut the **ABS exhaust nozzles** (F146F24) out of their bases by carefully trimming along the bottom scribe line. Do not cut the tip off yet. Put a full sheet of fine grit sandpaper on the work surface and slowly drag the exhaust nozzles across it to sand the edges smooth. Also **lightly** sand the inside of the nozzles where they will glue to the wood (about 1/2") with fine sandpaper.

D 4. Notice that the nozzles have one comer that is sharper than the other three. This corner goes **up** and **toward the center** of the fuselage. Test fit the exhaust nozzles in place. Do not force them into place or you may crack them. They need to slip over the fuselage approximately 3/8". Sand the fuse if necessary to achieve a **good** fit. Test fit both nozzles at the same time



so you can compare how they fit in relation to each other. They should both be located the same distance forward and when compared from the side and above, they should be aligned with each other.

D 5. When satisfied with the fit of the nozzles, rotate the rudder and elevator torque rods and insert them in the fin and stab slots so they will be out of the way. Correctly position the nozzles and then add **thin** CA around the edges of the nozzles.

D 6. Cut the tips off both nozzles by trimming them along the scribe line and then lightly sanding them to match each other in length. Save the tips to test paint and iron temperatures on later. **NOTE:** If you prefer a larger outlet in the tail cones, you can trim and sand them closer to the fuselage. Add thick CA around the **inside** of each nozzle where the fuse wood stops.

D 7. Insert the fins, stabs and die-cut 1/8" ply **ventral fins** (F146F32) into their appropriate slots. Sand the fins and stabs if necessary to get them to fit all the way down into the slots. Install the torque rods in the fins and stabs. Carefully trim the ABS nozzles if needed to get these items to fit. **IMPORTANT -** When trimming the nozzles, do not leave any "corners" in the cut outs. Always make nice circular cuts and sand the edges of the cut with fine sandpaper. A corner will eventually allow a stress crack to form. While these surfaces are inserted in the fuselage, lightly draw a line on the fins, stabs and ventral fins marking where the fuse joint is. This will tell us how far to cover these surfaces later. The nozzles can be painted after the plane has been covered

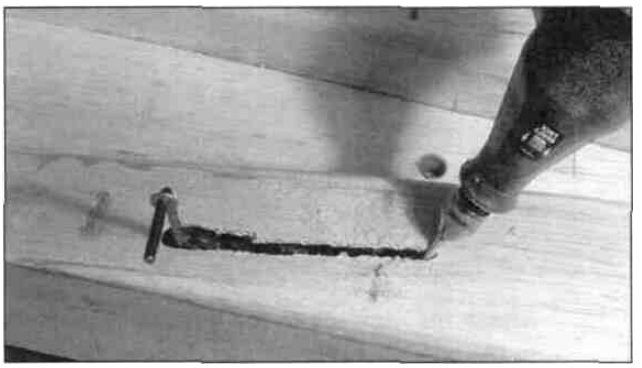
D 8. Use scraps of wood and lightweight wood filler to fill in between the rear of the fuse top and the fuse bottom. Use the filler to blend the exhaust nozzles into the fuse and sand this area smooth.

CUT THE MAIN GEAR RETRACT OPENINGS

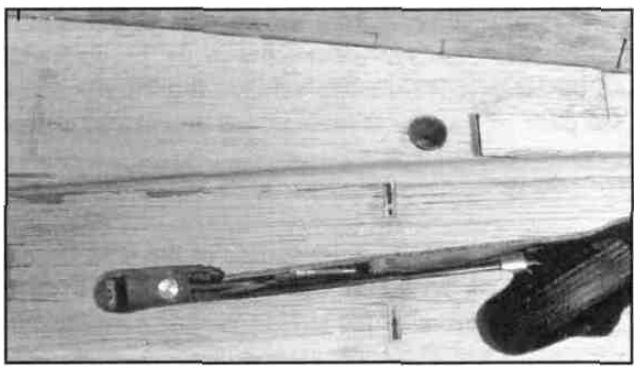
The retract openings are made using a **fit and cut** type of operation that will take a little time but is not hard to do.

D D 1. Insert the right main gear strut in the right side retract to the proper depth and tighten the set screw. This is tough to do because the ball driver is way down inside, but it can be done. A long nose pliers may come in handy.

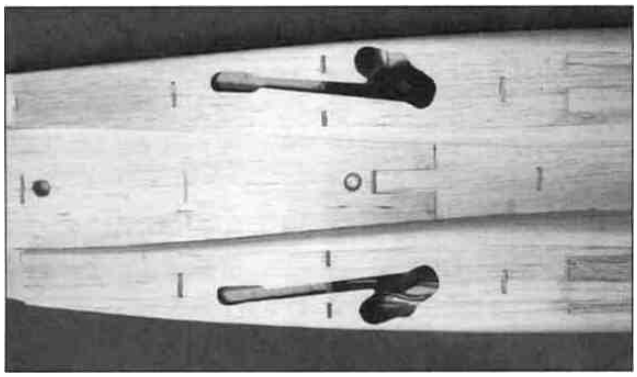
D D 2. Retract the strut until it hits the edge of the opening and notice where it touches the wood. Cut a small notch there and allow the strut to retract a little farther. Make another small notch and allow the strut to retract a little farther. A Dremel tool with a small carbide grinder will make this process much easier.



D D 3. Continue this process until the strut can fully retract into the fuselage. Install a 2-1/4" wheel on the strut and perform the same type of fit and cut procedure until the wheel will fit into the fuselage.



D D 4. Carefully trim the edges of the retract opening to smooth them out and make them look nice and symmetrical. A Dremel tool with a small sanding drum or a fine grit carbide drum works well for this.



D 5. Repeat this procedure for the **left** side retract.

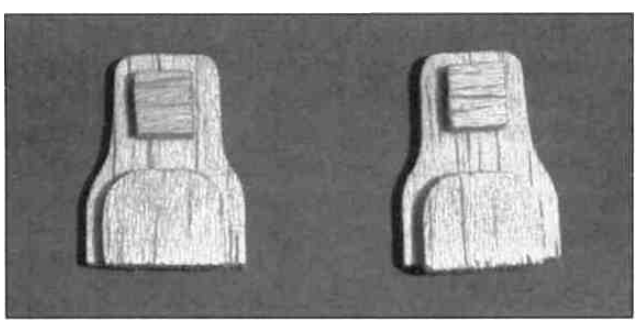
"FINISHING"

BLEND WING TO FUSE

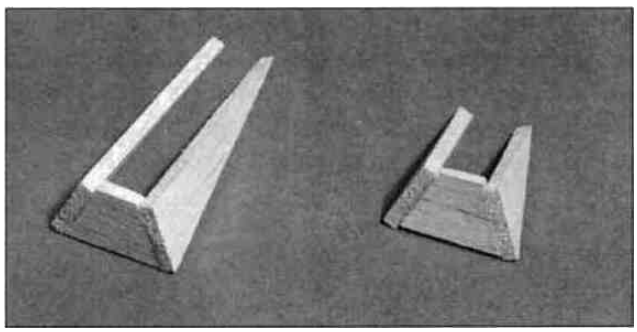
D 1. We need to blend the wing **turtle deck** into the fuse at F-2 and at F-4. It will usually require some filling and sanding. Use lightweight wood filler anywhere you might sand through the sheeting trying to get it to match up. Try to achieve a nice, smooth transition from the fuse front to the wing and back to the fuse. Don't be afraid of using plenty of filler or scrap wood to achieve the correct shape.

D 2. Sand the inner turbine side/turbine top corners to a nice radius. You should also use lightweight wood filler to fill the corners formed between the fuse top and the turbine sides. Be careful not to sand into the hatch area here.

INSTRUMENT CONSOLE & SEATS



D 1. You will find the instrument console and seat **parts on** the 3/32" balsa die-cut sheets F146F09 and F146F10. There are two sheets of each. Very lightly sand the edges of the seat back (SB), the seat cushion (SC) and the head rest (HR) with fine sandpaper to remove any burrs. Glue the seats together as shown in the photo. Sand the bottom of each seat so it will tilt back as shown on the fuse side view of the plans.



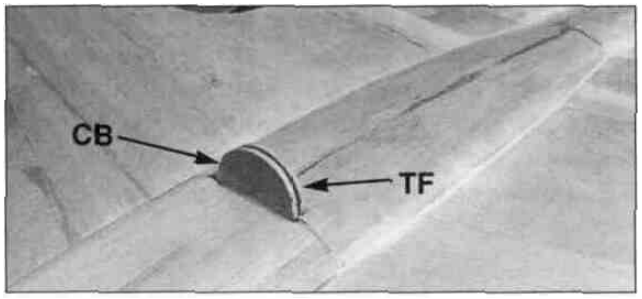
D 2. Lightly sand the edges of the **front console sides** (FC), the **rear console sides (RC),** the **console faces** (CF) and the **console tops** (CT). Assemble the consoles by first gluing the sides onto the faces as shown in the above photo. Sand the top edges of both consoles so the top will fit nicely. Then glue the tops on. Sand the bottoms of the consoles so they will sit flat and then final sand them to remove any burrs.

D 3. Paint the seats and the consoles. We used flat black on the consoles and seat backs with a military green on the head rest and seat cushion.

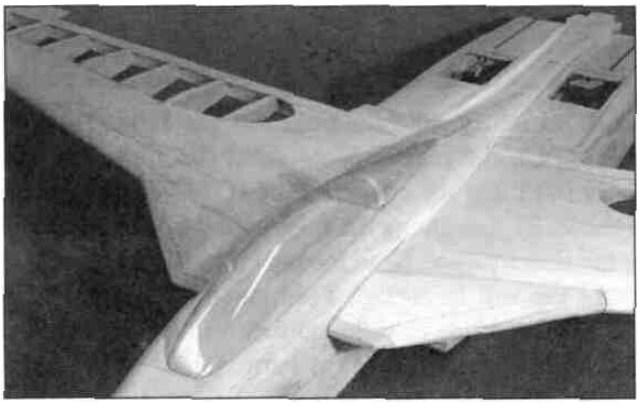
PREPARE THE CANOPY

NOTE: Although the real F-14's generally have clear canopies, some modelers prefer to tint their canopies. You may tint your canopy by immersing it in a concentrated mixture of Rit Dye and hot tap water. The colors blue, black, brown and dark green work well. Remove the canopy after 5 minutes and rinse it off to check the amount of tint. The hotter the water and the longer you leave it in the dye solution, the darker it will tint. The powdered dye will produce a darker tint than will the liquid. **CAUTION:** Do not heat the dye water above hot tap water temperature, as this could deform the canopy.

D 1. Using a scissors, carefully cut the **canopy** (CANPY054) along the trim line. The trim line is actually a little lower than normal to give you more room to accurately **sand** the canopy to fit the fuselage.



D 2. **Tack glue** the die-cut 1/8" balsa **cockpit back (CB)** (F146F12) to the top of former F-2. It should be centered in relation to the fuselage and perpendicular to the fuse top. **Tack glue** the die-cut 1/8" balsa **turtle deck face** (TF) (F146W01) to the wing and approximately 1/8" **directly** behind the cockpit back.



D 3. Trial **fit** the canopy onto the fuse, lightly pressing it into place. Refer to the plans to get an idea where the canopy should be positioned. Trim and sand as necessary for a good fit. You can also sand the cockpit back and the turtle deck face if needed to get the canopy to fit. **NOTE:** The trim line on the canopy is approximate. Your canopy trim will vary, depending on how you sanded the fuselage. When satisfied with the fit of the canopy, securely glue the cockpit back and the turtle deck face in place.

D 4. Final sand the edges of the canopy with fine (320 grit) sandpaper. It is important that the canopy does not have any nicks along the edges, as the engine vibration could cause them to spread. Add the canopy frame by applying striping tape (or paint) along the molded in lines on the inside of the canopy. **NOTE:** Do not glue the canopy in place until after you have covered your model.

BALANCE THE AIRPLANE LATERALLY

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

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

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

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

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

FINAL SANDING

Check over the entire structure carefully, inspecting for any poorly glued joints, gaps and "dings". Apply additional glue and/or balsa filler as necessary. Then sand the entire fuselage and wing smooth using progressively finer grades of sandpaper. Vaccum the entire structure before covering.

COVERING

Because it is assumed that you have had some previous model building experience, we won't go into detail in regard to the covering procedure. **Follow the instructions included with your covering material.**

A FEW COVERING NOTES

1. When covering the tail surfaces, cut the covering, before applying it, to overlap the fuse joint lines you drew earlier by about 1/8". **DO NOT, under any circumstances, attempt to cut the covering material after it has been applied to the fin and stab, except around the leading and trailing edges and the tip.** Modelers who do this often cut through the covering and part-way into the balsa fin or stab. This can weaken the **fin or** stab to the point where it may fail in flight!

2. Allow the covering to overlap onto the nozzles approximately 1/8" but have the iron on a slightly lower heat setting so you do not melt the nozzles. It is a good idea to test the temperature of the iron on a scrap piece of ABS you cut from the tip of the nozzles.

3 When covering inside the "tunnel" between the turbines, take your time and allow the covering to overlap about 1/8" to provide a fuel proof seal A lot of fuel residue will end up in this area

4 If you are using the color scheme we used on the prototypes, use Cub Yellow Monokote for the yellow stripes. Black for the inlets and de-icing boots on the tail feathers and Gray for everthmg else

RECOMMENDED COVERING SEQUENCE:

1. Ventral fins
2. Stab bottom
3 Stab top
4. Elevators
5. Fins
6. **Rudders**
7. Fuse bottom
8 Turbine insides
9 Turbine bottoms
10. Turbine sides
11 Fuse sides
12 Fuse top
13 Turbine tops
14 Ends of ailerons
15 Bottom of ailerons
16. Top of ailerons
17 Bottom of left wing panel
18 Bottom of right wing panel
19. Top of left wing panel (overlap covering 1/4" at wing LE)
20. Top of right wing panel (overlap covering 1/4" at the LE)
21. Wing Turtle Deck

GLUE FINS AND STABS IN PLACE

D 1 Apply strips of masking tape on the fuselage along each side of all four tail surface slots This will help keep the excess glue off the plane Mix up a batch of 15 minute epoxy and apply some to the exposed wood on both sides of each fin and stab Insert the fins and stabs into their correct slots and wipe off any excess epoxy with a paper towel soaked in rubbing alcohol Look through the exhaust nozzles and in the hatches to make sure the control surfaces are fully seated in the former notches Remove the tape before the glue sets

D 2. Glue the **ventral fins** (F146F32) in their slots with epoxy using the same procedure outlined above

GLUE THE AILERON HINGES

D 1 Lay the ailerons on the plans and mark on the leading edge of each part the locations of the hinges and torque rods Now use a sharp X-acto knife to cut slits in the covering at the hinge locations Trial fit the hinges to make sure you have found the slots which you previously cut In the same manner, slit the covering at the hinge locations in the wing Also cut the covering away from the torque rod slots

D 2 Using a small stick work a generous amount of **epoxy** into the aileron torque rod holes Push the ailerons and aileron hinges into place and **wipe off all** excess **epoxy** Now carefully position the ailerons so they have the correct spacing at the root and tips, and glue the hinges with several drops of thin CA (assuming you are using the hinges included in the kit)

GLUE ELEVATOR AND RUDDER HINGES

D 1. Lay the rudders and elevators on the plans and mark, on the leading edge of each part the locations of the hinges and torque rods Now use a sharp Xacto knife to cut slits in the covering at the hinge locations. Trial fit the hinges to make sure you have "found" the slots which you previously cut Transfer the hinge marks over to the fins and stabs In the same manner slit the covering at the hinge locations in the fins and stabs Also cut the covering away from the torque rod slots

D 2. Using coarse sandpaper, roughen the part of the torque rods that will be glued into the control surfaces Then clean off the sanded portion of the rods with alcohol or a degreasing solvent Using a toothpick, apply a small amount of Vaseline where the torque rods enter the nylon bearings (to prevent glue from getting inside and locking them up)

D 3 Using a small stick, work a generous amount of **epoxy** into the torque rod holes and the nylon bearing slots Push the control surfaces and hinges into place and **wipe off all** excess **epoxy** Now check the side to side positioning of the control surfaces and glue the hinges in place with thin CA

INSTALL COCKPIT

D 1 Assemble your pilot figures, and paint them with your choice of colors (any hobby enamel may be used for this).

D 2. Position the canopy in place and hold it down while you mark its outline on the fuse and wing with a fine point permanent marker If you are going to use a different color for the cockpit (we used flat black), it needs to be taken care of now Black MonoKote, flat black paint, or 400 grit "Wet or Dry" sand paper works well for this

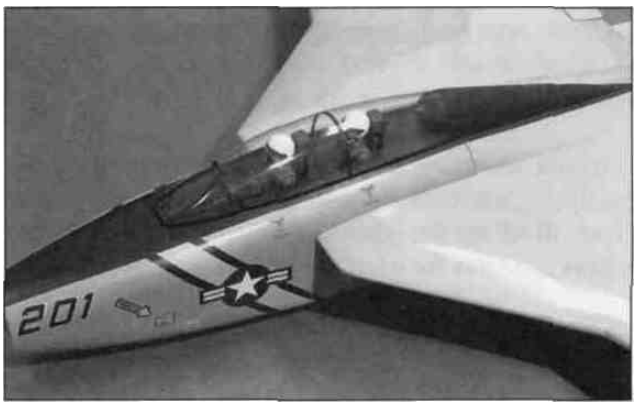
D 3. Position the pilots, seats and consoles where they go The side view of the plans will give you the approximate locations **Tack** glue them in place and then replace the canopy to make sure everything fits OK It is not unusual to have to sand the base of the pilots so their heads don't hit the canopy When satisfied with their location, securely glue them in place.

GLUE CANOPY IN PLACE

D 1 Install the wing on the fuse with the nylon bolts. Poke **pinholes** (1/8" apart) through the covenng material in the area where the canopy will be glued to the fuselage and the wing Lightly sand a strip on the canopy approximately 1/16" wide along the edge to help the glue stick to it. Carefully clean the canopy and the cockpit to remove any dust.

D 2. Apply a bead of **thick** CA around the CB (canopy back) and the TF (turtle deck face) Accurately place the canopy on the fuselage and the wing and very carefully apply **small** amounts of medium viscosity CA glue around the edges To control the amount of CA, it is very helpful to use the small diameter teflon applicator tubing, supplied with most CA glues, or use a "Z End" applicator tip Allow plenty of time for the CA to fully cure **Do not use accelerator spray on the canopy.** Take your time on this step!

D 3 When the glue has completely cured, use a razor saw and/or a hobby knife to carefully cut between CB and TF. Carefully remove the wing from the fuselage and **lightly** sand the cut edges of the canopy smooth. Do not sand too much or the gap will be excessive.



D 4 It you are going to paint the back of the canopy (like the prototype on the box) you should do this now. Replace the wing on the fuse and mask oft the area you want to paint so you don't get paint on the rest of the plane.

D 5. To hide the canopy glue joint, you can use 1/8" - 1/4" wide striping tape as a border around the canopy.

DECALS AND TRIM

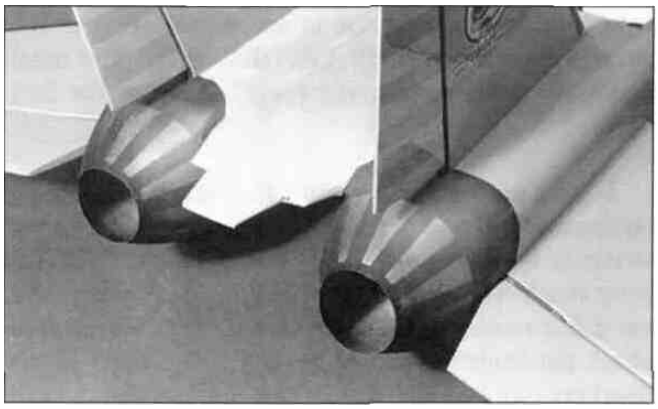
D 1. The decal sheet included gives you everything you need to trim your model the way our prototypes were done Study the photos on the box to determine where to place the decals.

D 2 Thoroughly clean your airplane before applying decals

D 3 Cut out the individual decal items and apply them in the locations shown or wherever you prefer

HINT: To apply decals accurately, peel only a small portion of backing from one end, cut off the backing with a scissors, position the decal carefully, press down the exposed portion of the decal, peel off the rest of the backing, then (working from the already stuck down end) carefully press down the rest of the decal.

D 4. Determine how you would like to paint the exhaust nozzles, and test the paint you are going to use on a scrap piece of ABS You should check to make sure it won't harm the plastic **and** test it to see that it's fuel proof. Lightly sand the ABS with 400 grit paper and thoroughly clean the surface before painting Apply masking tape (Great Planes EZ Mask works well tor this) around the front edges of the nozzles Make sure both nozzles are evenly masked so they will look alike and allow the paint to slightly overlap the covering If you are going to spray the paint, mask oft the entire plane so



you don't get over spray on it. We used a base coat of silver, then cut little trapezoids out of masking tape. These were evenly spaced out around the nozzles and we then sprayed flat black through an air brush to add the exhaust leak look. Remove the tape pieces and add a **very** light mist of flat black to soften the sharp lines left from the tape.

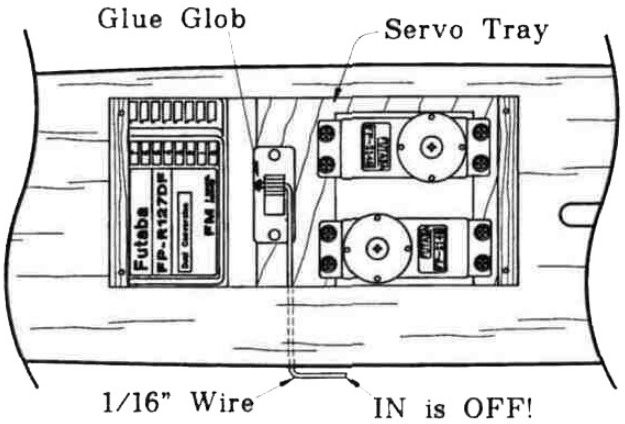
D 5. If you wish to add "panel lines," you may try a "Staedtler Lumocolor 313 Permanent" fine point pen, which is available **from** engineering/drafting supply stores. Although not completely fuelproof. we like using this pen because it draws very nicely on Super MonoKote. and the lines may be removed if necessary with 70% rubbing alcohol. The plane may be cleaned with most cleaners without affecting the lines, however.

WING SEATING

D 1. Apply 1/16" thick x 1/4" wide foam **wing seating tape** to the wing saddle area (outer turbine sides and front of the inlet) to seal the wing/fuse joints.*

***NOTE:** An alternate method of sealing the wing/fuse joint is to use **"silicone bathtub sealer."** This is an excellent method, used by many experts because it results in a permanent and nearly perfect wing saddle joint. Briefly, the technique is as follows: 1. Cover the bottom of the wing center section with waxed paper or plastic kitchen wrap. Pull out all wrinkles and tape it to the wing. 2. Squeeze out a bead of silicone sealer onto the wing saddle area and front of the inlets. 3. Lay the wing in the saddle and push down gently. The excess silicone sealer will squeeze out. 4. Allow to dry without disturbing for at least 24 hours. 5. Remove the tape, then remove the wing from the saddle (leaving the waxed paper or plastic wrap in place). 6. Gently pull the waxed paper or plastic wrap away from the sealer. 7. Using a new single-edge razor blade, trim the sealer flush with the wing fillets, and along the inside of the fuselage.

RE-INSTALL ENGINE & RADIO



D 1. Make a switch pushrod by bending a short length of music wire at a 90 degree angle so its small "leg" is about 3/8" long. Drill a hole in the switch to accept the small leg and drill another hole in the side of the fuse for the pushrod to pass through. Install the switch so that the pushrod has to be pushed in to turn the radio on. Hook the pushrod up to the switch and with the switch in the off position, grasp the wire just outside of the fuselage and bend it 90 degrees (forwards the tail). Cut off the excess wire. Now sand the "nose" of a clothes pin so it will clamp onto the switch pushrod and fit between the fuselage and the bend. Paint it bright orange and write "**REMOVE BEFORE FLYING**" on it. Use the clothes pin to make sure the radio stays off when not in use.

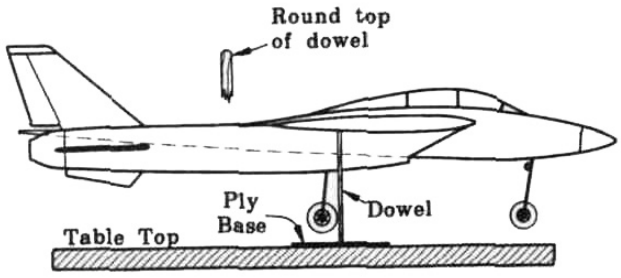
D 2. Re-install the engine, propeller, battery, receiver, and **wheels.** Hook up the radio and attach the wing to the fuselage. Route the antenna through the antenna tube. Check the control surface throws using the chart on page 55.

BALANCE YOUR MODEL

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

D 1. Accurately mark the balance point on the BOTTOM of the wing on both sides of the air intakes. The balance point is shown on the plan (CG), and is located 8-1/4" inches forward of the **aileron trailing edge** at rib W7. This is the balance point at which your model should balance for your first flights. Later, you

may wish to experiment by shifting the balance up to 1/2" **forward or back** to change the flying characteristics Moving the balance **forward** may improve the smoothness and arrow-like tracking, but it may then require more speed for takeoff and make it more difficult to slow down for landing Moving the balance aft makes the model more agile with a lighter and snappier "feel " If you move the balance aft, the elevator will have more authority, possibly resulting in a plane that is too maneuverable If this happens, you should reduce the maximum elevator throw slightly In any case **do not balance your model outside the recommended range.**



D 2. The best way to balance your F 14 is to make a **balancing stand** from two 8" square pieces of 1/4" plywood and two 3/8" dowels Mark the fore and aft limits of the balance range on the **bottom** of the wing (at rib W7) and place the airplane on the balancing stand with the dowels on rib W7 and the fuel tank empty Move the airplane forward or aft on the stand until it balances with the stab level If it balances outside the "balance range," you must either shift the location of radio components (the battery pack can be installed all the way up into the fuel tank compartment if needed) or add weight to the nose or tail until it balances within the range **NOTE:** Nose weight may be easily installed by using a Prather "Spinner Weight" (available in assorted weights up to 2 ounces), or by gluing strips of lead into the engine compartment under the engine Tail weight may be added by using Prather "stick-on" lead weights. Later, if the balance proves to be OK, you can open the fuse bottom and glue these in permanently

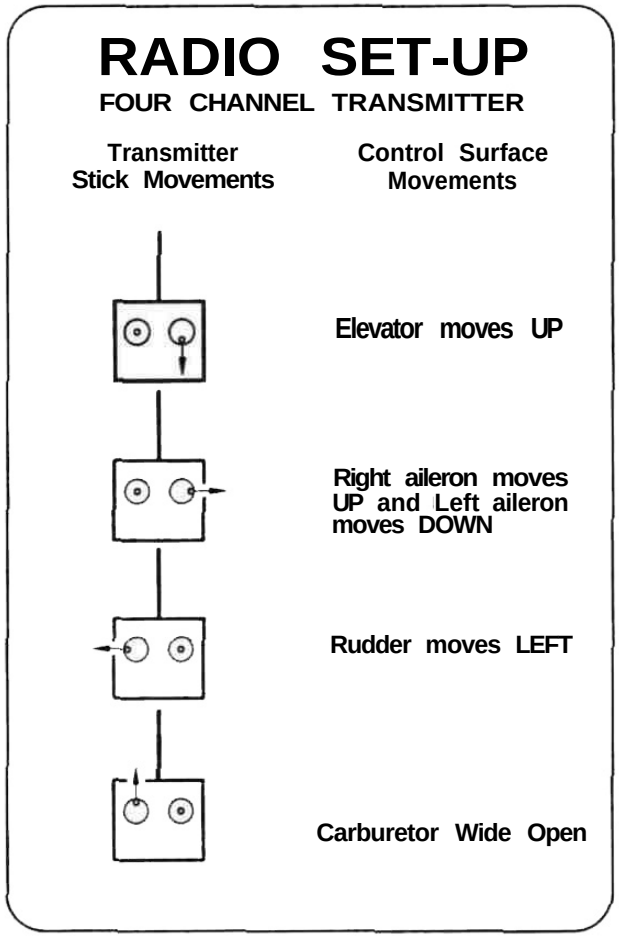
FINAL HOOKUPS AND CHECKS

D 1 Check for wing twist as follows:

NOTE: Even if you have built your wing on a perfectly flat surface and used utmost care, it is possible that your wing may have a twist due to uneven shrinking of the covering material **VERY IMPORTANT!: You must check for this condition and correct it before the first night**

If you do not own a **wing incidence meter,** we recommend that you purchase one from your local hobby dealer or borrow one from another modeler With the wing attached to the fuselage, block up the fuselage until the stab is exactly level Then use the incidence meter to check the angle of your wing at the root (next to the fuselage) and at the tips The meter should read 0 degrees at the root, and minus 1 3/4 degrees at the tips (this means that the trailing edge is higher than the leading edge at both tips) If the incidence meter reveals a deviation of more than 1/4 degree from the desired readings, you must grasp the wing at the tip and twist it slightly, while reheating the covering material Keep checking, twisting and reheating until the wing twist is removed **NOTE:** If you have corrected a wing twist by this method you should periodically re-check to make sure the correction has held

D 2 Make sure the control surfaces move in the proper direction as illustrated in the following sketch



"PRE-FLIGHT"

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.

FIND A SAFE PLACE TO FLY

The best place to fly your R/C model is an AMA (Academy of Model Aeronautics) chartered club field. Ask your hobby shop dealer if there is such a club in your area and join Club fields are set up for R/C flying which makes your outing safer and more enjoyable The AMA can also tell you the name of a club in your area. We recommend that you join AMA and a local club so you can have a safe place to fly and also have insurance to cover you in case of a flying accident (The AMA address is listed on the front cover of this instruction **book).**

If there is no flying club in your area, you need to find a large area, free of obstructions, with a smooth surface that can be used as a runway, and located at least 6 miles away from any other R/C airplane operation and away from houses, buildings and streets. A schoolyard may look inviting but it is too close to people, power lines and possible radio interference.

GROUND CHECK THE MODEL

If you are not thoroughly familiar with the operation of R/C models, ask an experienced modeler to check to see that you have the radio installed correctly and that all the control surfaces do what they are supposed to. The engine operation must also be checked and the engine "broken in" on the ground by running the engine tor at least two tanks of fuel. **Follow the engine manufacturer's recommendations for break-in.** Check to make sure all screws remain tight, the hinges are secure and the prop is on tight

RANGE CHECK YOUR RADIO

Check the operation of the radio every time before you fly. This means with the transmitter antenna collapsed and the receiver and transmitter on, you should be able to walk at least 100 feet away from the model and still have control. Have someone help you Have them stand by your model and, while you work the controls, tell you what the various control surfaces are doing

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

ENGINE SAFETY PRECAUTIONS

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

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

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

Use safety glasses when starting or running engines.

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

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

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

Use a "chicken stick" device or electric starter; follow instructions supplied with the starter or stick.

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

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

The engine gets hot' Do not touch it during or after operation Make sure fuel lines are in good condition so fuel is not leaked onto a hot engine, causing a fire.

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

RADIO CONTROL

1. I will have completed a successful radio equipment ground range 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 flyer, 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...

AMA SAFETY CODE

Read and abide by the Academy of Model Aeronautics Official Safety Code, a portion ot which is reprinted here

GENERAL

1 I will not fly my model aircraft in competition or in the presence ot spectators 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 and avoid flying in the proximity of full-scale aircraft Where necessary, an observer shall be utilized to supervise flying to avoid having models fly in the proximity of full-scale aircraft

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

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

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

The Great Planes F-14 is a great flying sport scale airplane that flies smoothly and predictably, yet is highly maneuverable It does **not** have the self-recovery characteristics of a primary trainer, therefore, you must either have mastered the basics of R/C flying or seek the assistance of a competent R/C pilot to help you with your first flights

TAKEOFF: If you have dual rates on your transmitter, set the switches to "high rate" for takeoff, especially when taking off in a cross wind Although the F-14 has good low speed characteristics, you should always build up as much speed as your runway will permit before lifting off, as this will give you a safety margin in case of a "flame-out " When the plane has sufficient flying speed, lift off by smoothly applying a little up elevator (don't "force" it off into a steep climb'), and climb out gradually

FLYING: We recommend that you take it easy with your F 14 for the first several flights and gradually "get acquainted" with this fantastic ship while your engine gets fully broken-in Add and practice one maneuver at a time, learning how she behaves in each one High speed passes and "victory rolls" are certainly most impressive, but always remember to keep safety in mind Do not exceed the recommended throws for the elevator, as this will only result in an increased possibility of tip stalls when full elevator is applied Snap rolls and spins are not as natural to this airplane as with those designed for aerobatics They may require some experimentation with throws, balance and technique

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

LANDING: When it's time to land, do a couple of slow fly-by's at a safe altitude to become familiar with the plane's slow flying characteristics The aerodynamic design of the F-14 gives it a flying quality not often found in R/C models You will notice that as the nose comes up, the strakes start working and the fuselage starts adding some lift As this happens, the plane will tend to balloon. This is the same characteristic that helps give the F-14 its maneuverability in normal flight Once the plane has entered this "floating" stage it is still very controllable and can be slowed down for a very gentle landing The trick to making smooth slow landings is to slow the plane earlier than normal and gently allow the plane to enter its floating mode Then use the throttle to regulate the glide path. It will take a little practice, but it sure is fun to learn.

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

GOOD LUCK AND GREAT FLYING!

SEE THE FULL LINE OF GREAT PLANES AIRPLANES AT YOUR HOBBY DEALER WE HOPE YOU WILL SELECT ANOTHER "GREAT PLANE" AS YOUR NEXT PROJECT
THANK YOU!

We recommend the following CONTROL SURFACE THROWS:

NOTE: Throws measured at the widest part of the control surface, with full deflection of the transmitter stick.

	LOW RATE	HIGH RATE
ELEVATOR:	1/2" both directions	3/4" both directions
RUDDER:	1/2" both directions	As **much** as **possible**
AILERONS:	1/4" both directions	1/2" both directions

NOTE: These control surface "throws" are approximate and provide a good starting point for the first flights with your F 14 You may wish to change the throws slightly to provide the smoothness or quickness you prefer Due to the maneuverability of this model and the high control surface throws that it will handle, it might be a good idea to use exponential type control surface movements if your radio is capable of this

2-VIEW