

ULTRA SPORT 60

INSTRUCTION BOOK



PLEASE READ THROUGH THIS INSTRUCTION BOOKLET IN ITS ENTIRETY BEFORE BEGINNING ASSEMBLY. IT CONTAINS IMPORTANT INSTRUCTIONS AND WARNINGS CONCERNING THE ASSEMBLY AND USE OF THIS MODEL.

WARNING! THIS IS NOT A TOY! THIS IS NOT A BEGINNER'S 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 to 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.

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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.

INTRODUCTION

Congratulations! Thank you for purchasing the Great Planes **Ultra Sport 60!** Jim Feldmann's original design was featured as a construction article in the August, 1989 issue of RC Modeler magazine, and has been hailed by many as "the best sport flying airplane ever"! The design starts with the legendary "Kaos" wing platform, and features modern styling and state-of-the-art construction techniques. The result is an ultra-stable, ultra-smooth flying airplane that does what you want it to, no more and no less.

The Ultra Sport 60 is easy to build, totally predictable, smooth-flying and has very docile stall characteristics, making it the ultimate sport airplane for the modeler who wants to fly with a higher degree of precision. Because it naturally tracks through maneuvers better than other sport airplanes, you'll fly better when you're flying an Ultra Sport 60.

This is not a beginner's airplane! While the Ultra Sport 60 is easy to build and flies great, we must discourage you from selecting this kit as your first R/C airplane. It is 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 have already learned the basics of R/C flying and you are able to safely handle an "aileron trainer" airplane such as the Great Planes Trainer Series or Big Stick Series airplanes, the Ultra Sport 60 is an excellent choice.

PRECAUTIONS

1. You must build the plane **according to the plans and instructions.** Do not alter or modify the model as represented by the plans, 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.
2. You must take time to **build** straight, true and strong.
3. You must use a proper R/C **radio** that is in first class condition, the correct sized **engine** and correct **components** (fuel tank, wheels, etc.) throughout your building process.

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

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

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 at this time.

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

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

INSTRUCTIONS IN BOXES LIKE THIS ARE VERY IMPORTANT AND SHOULD BE FOLLOWED CAREFULLY

COMMON ABBREVIATIONS USED IN THIS BOOK AND ON THE PLANS:

Elev = Elevator
Fuse = Fuselage
LE = Leading Edge (front)
LG = Landing Gear
Lt = Left
Ply = Plywood
Rt = Right
Stab = Stabilizer
TE = Trailing Edge (rear)
Tri = Triangle
= Inches

DECISIONS YOU MUST MAKE NOW

ENGINE AND MOUNT SELECTION

The recommended engine size range is as follows:

.60 - .65 cubic inch displacement 2-cycle

.70 - .91 cubic inch displacement 4-cycle

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.

This kit includes the new Great Planes Adjustable Engine mount. This mount will work on most .40-.60 2-Cycles and .40-.70 4-cycles. Cut or break the "spreader bar" off each mount half. The surfaces where the spreader bars were attached need to be very smooth to allow the mount halves to fit together. Snap the two mount halves together. Slide the mount halves apart until the engine mounting lugs will sit flat on the beams.

NOTE: If you choose to power your Ultra Sport 60 with a 4-cycle engine, keep in mind that the RPM of your engine will be considerably less than that of a 2-cycle engine; therefore, you should select a **higher pitch propeller** to keep the speed and overall performance roughly equivalent to that of a 2-cycle engine. For example, an 11x7 or 11x8 prop would be used with a .61 (2-cycle) engine; but an 11x11 prop may be the best choice for a .91 4-cycle engine.

LANDING GEAR CONFIGURATION

The Ultra Sport 60 may be built with a "**taildragger**" or "**tricycle**" landing gear configuration, and a **retractable main** gear may be installed if you want to really "clean up" this airplane for ultra-smooth and precise aerobatics.

There is not, however, room for a nose gear retract; therefore, if you want retracts, you'll have to use the "tail-dragger" configuration.

OTHER ITEMS REQUIRED

- Four-channel radio with 4 servos (additional channel and retract servo required if retracts are being used).
- Propellers (see engine instructions and above engine notes for recommended sizes).
- Spinner (2-3/4" diameter)
- Fuel Tank (11 to 14 ounce)
- Main Wheels* - 2 (2-1/2" dia. for fixed gear and retract)
- Nose Wheel* - 1 (2-1/2" diameter, required for trike only)
- Tail Wheel - 1 (1" diameter, required for taildragger only)
- 5/32" Wheel Collars - 4 or 6
- 3/32" Wheel Collars - 2 (required for taildragger only)
- Iron-on Covering Material
- Silicone Fuel Tubing
- Wing Sealing Tape (or silicone sealer ... see instructions)
- Latex Foam Rubber Padding (1/4" thick)
- Dubro "E-Z Connectors" (or equivalent) - 2
- Main Gear Retracts: (optional)
 - Mechanical: Dave Brown 2-Gear Main, or equivalent
 - Pneumatic: Robart #605 90-degree mains, or equivalent (requires #188 air control kit)
- Plastic Pilot (Williams Bros. 2-5/8" scale)

•"Lightweight wheels are recommended.

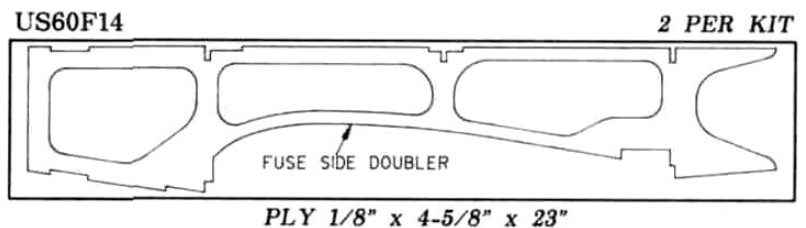
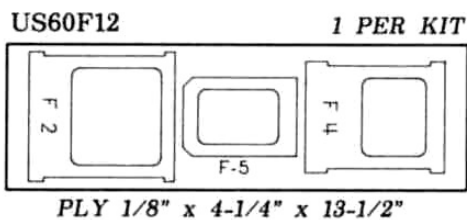
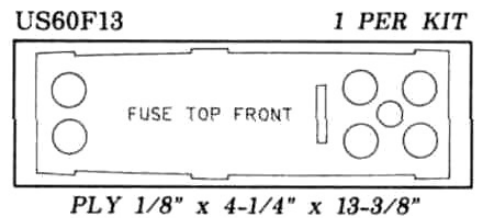
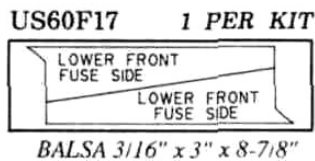
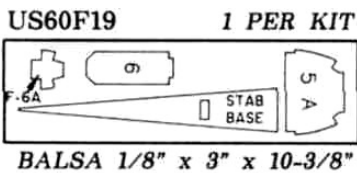
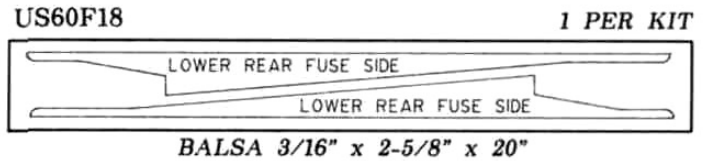
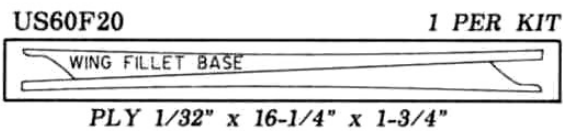
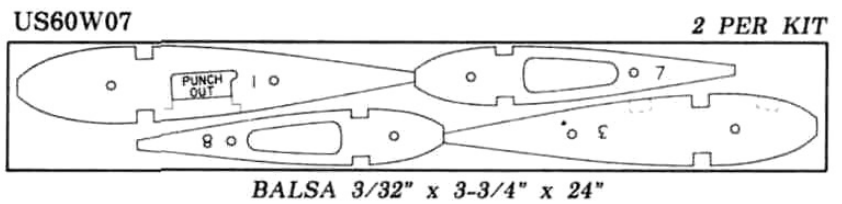
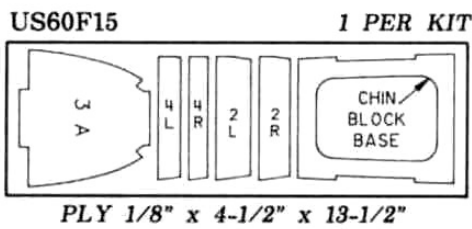
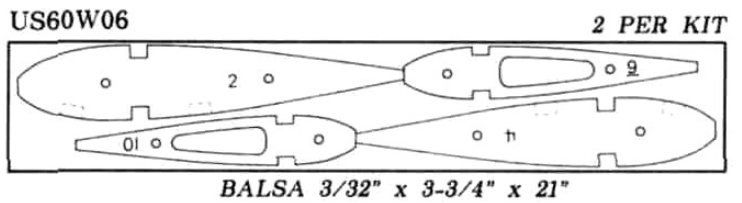
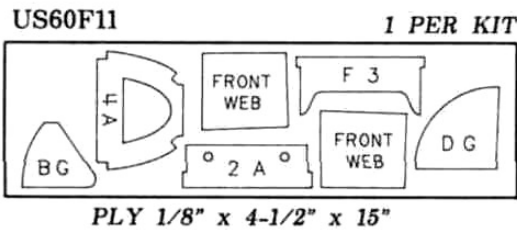
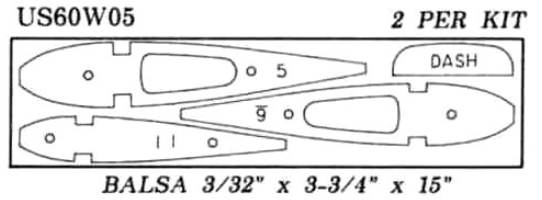
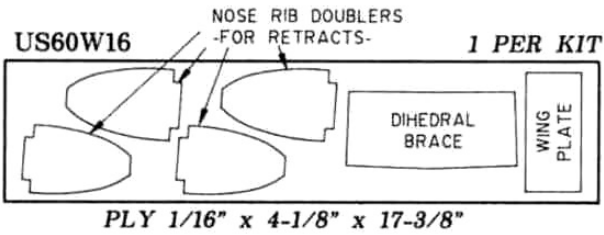
SUPPLIES AND TOOLS NEEDED

- 2 oz. Thin CA Adhesive
- 2 oz.** Medium or Thick CA Adhesive
- 2.5 oz. 30-Minute Epoxy
- Hand or Electric Drill
- Drill Bits: 1/16", 5/64", 3/32", 7/64", 1/8", 9/64", 5/32", 13/64", 7/32", and 1/4"
- Sealing Iron
- Heat Gun
- Hobby Saw (Xacto Razor Saw)
- Xacto Knife, #11 Blades
- Pliers
- Screw Drivers
- T-Pins
- Straightedge
- Masking Tape
- Sandpaper (coarse, medium, fine grit)*
- T-Bar Sanding Block, or similar
- Waxed Paper
- Lightweight Balsa Filler
- 1/4-20 Tap, Tap Wrench
- Vaseline Petroleum Jelly
- Isopropyl Rubbing Alcohol (70%)
- 3M "77" Spray Adhesive (optional)
- Dremel Moto Tool or similar (optional)

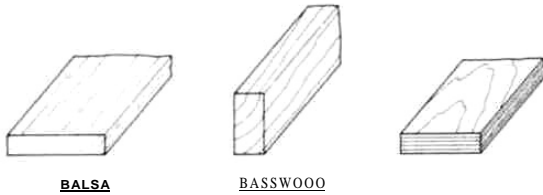
*NOTE: On our workbench, we have four 11" T-Bar sanders, equipped with #50, #80, #100 and #150-grit sandpaper. This setup is all that is required for almost any sanding task. We also keep some #320-grit wet-or-dry sandpaper handy for finish sanding before covering.

DIE DRAWINGS

Use this drawing to help you identify the die-cut parts



TYPES OF WOOD



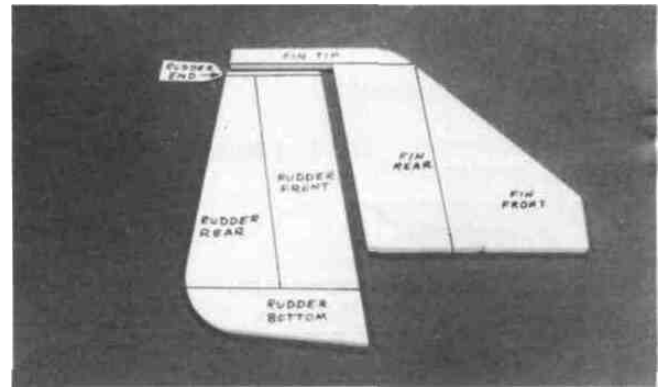
GET READY TO BUILD

1. Unroll the plan sheets. Re-roll them inside out to make them lie flat. NOTE: You may cut the fuselage plan into two sections for ease of building on the "Bottom View," by cutting along the "cut line" shown on the plan.
2. Remove all parts from the box. As you do, figure out the name of each part by comparing it with the plans and the parts list. Using a felt tip pen, write the part name or size on each piece to avoid confusion later. Use the die-cut patterns shown on page 5 to identify the die-cut parts and mark them before punching out. 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 Xacto 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.
3. As you identify and mark the parts, separate them into groups, such as **fuse** (fuselage), **wing**, **fin** and **stab** (stabilizer), and **hardware**.

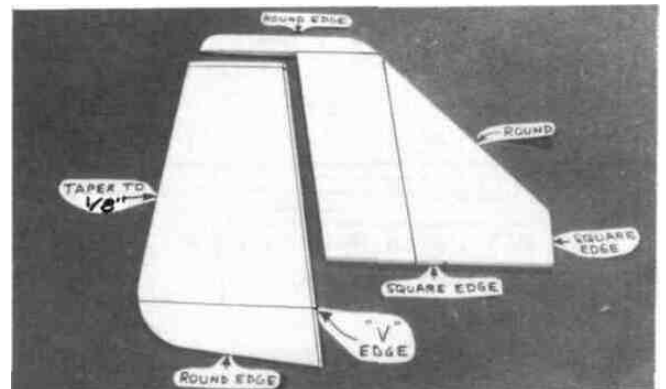
"TAIL FEATHERS"

BUILD THE FIN AND RUDDER

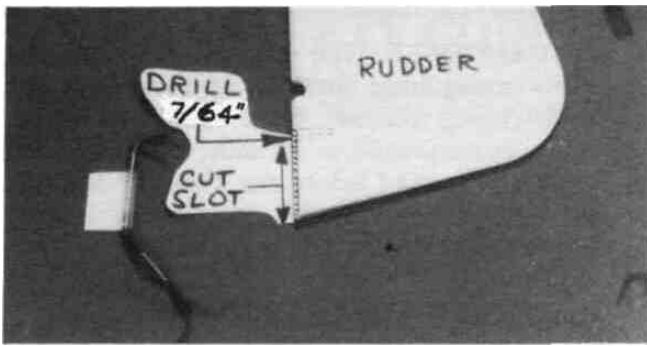
1. Find the following parts: **5/16" balsa fin front, fin rear, rudder front, rudder rear** and **rudder bottom**. Compare the parts to the plans to make sure you have the correct parts. Also find the 5/16" x 5/8" x 5-3/4" balsa stick, and the 1/8" x 3/8" x 11-7/8" balsa stick.
2. Cut the 1/8" x 3/8" x 11-7/8" balsa stick into 5 pieces having lengths of: 2-7/8", 2-7/8", 1-5/8", 1-5/8" and 2-3/4". The 2-3/4" length is the rudder end. The remaining pieces are the elevator ends.



3. Working on a flat surface covered with waxed paper, glue the **fin front** to the **fin rear**, then glue on the **fin tip**. Sand the front of the fin tip to blend with the fin, as shown on the **plan**.
4. Using a T-bar or sanding block, sand both sides of the fin smooth. Then sand the leading edge and top edge to a **rounded** shape, as shown on the plan. Draw a **centerline** along the trailing edge of the fin to mark the hinge line.
5. Glue the **rudder front** to the **rudder rear**, then glue on the **rudder bottom** and **rudder end**.
6. Draw a centerline all around the edges of the rudder.



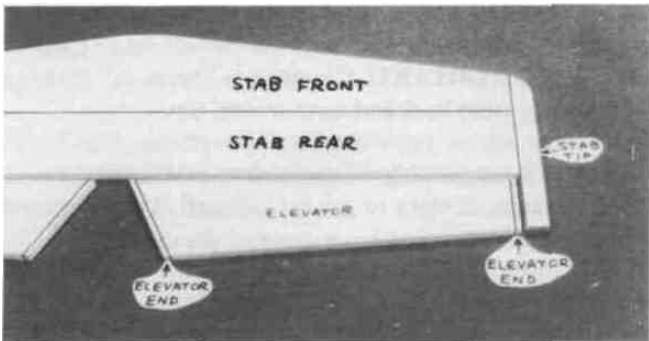
7. Using a sanding block and **coarse** (50 or 80-grit) sandpaper, sand both sides of the rudder to a **taper** as shown on the plans. The trailing edge should end up approximately 1/8" wide and have a rounded shape. (Do not sand to a sharp edge). Sand the bottom edge to a rounded shape. Sand the leading edge to a **"V-shape"** as shown on the plan.
8. Hold the fin and rudder together and mark the fin tip at the rudder trailing edge. Cut off the fin tip and sand it to match the rudder as shown on the plan.
9. If you are building a "tailedragger", check the plans and mark the location of the tailgear on the rudder. Drill a



7/64" hole in the rudder, and groove the rudder leading edge to accept the **tailgear wire** and the nylon **tailgear bearing**. **DO NOT GLUE YET!** (The hole is drilled slightly oversize to allow for positioning, and to create a hard epoxy "sleeve" around the wire).

BUILD THE STABILIZER AND ELEVATORS

- 1. Find the following parts: 3/8" balsa stab front, stab rear and elevators. You'll also need the 3/8" x 5/8" x 11" balsa **stab tip** stock, the 1/8" **elevator ends** that you previously cut, and the 1/8" wire **elevator joiner**.

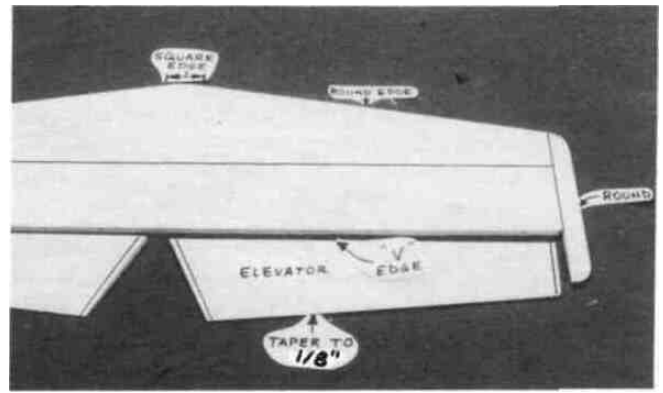


- 2. Glue the **stab front** to the **stab rear**. Then glue on the **stab tips**. Sand the front of the stab tips to blend with the **stab**.

- 3. Glue the elevator ends to the elevators and sand to blend.

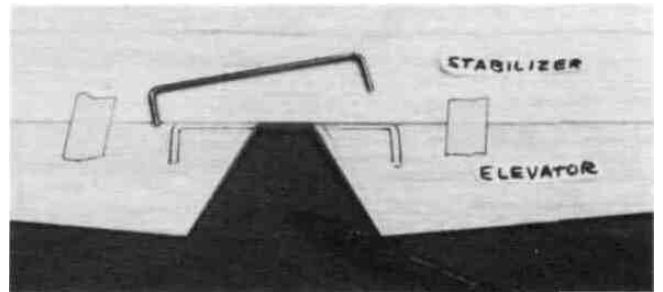
- 4. Sand both sides of the stab smooth, then sand the leading edge and lips to a **rounded** shape. (Leave the center portion of the LE **square**). Draw a centerline along the trailing edge of the stab to mark the hinge line.

- 5. Draw a **centerline** all around the edges of the elevators.

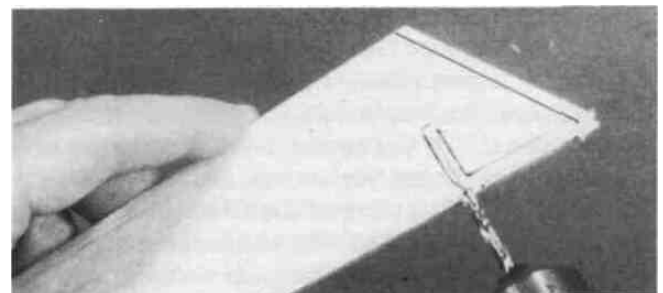


- 6. Sand both sides of the elevators to a **taper** as shown on the plans. The trailing edge should end up approximately 1/8" wide and have a rounded shape (do not sand to a sharp edge). Sand the leading edge to a "**V-shape**" as shown on the plan.

- 7. Temporarily tape the elevators to the stab, providing 1/16" clearance between the elevator end and the stab tip.

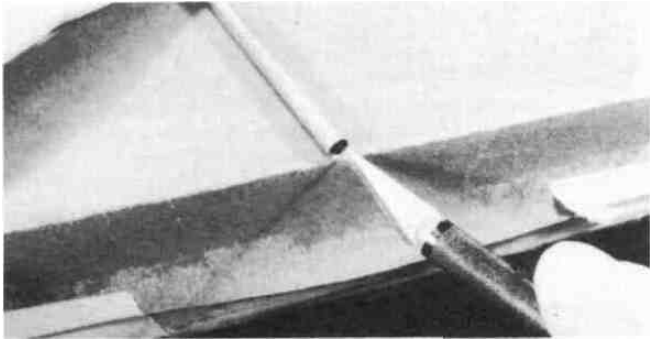


- 8. Lay the 1/8" wire **elevator joiner** in place on the elevators and mark its outline using a fine point felt-tip pen.



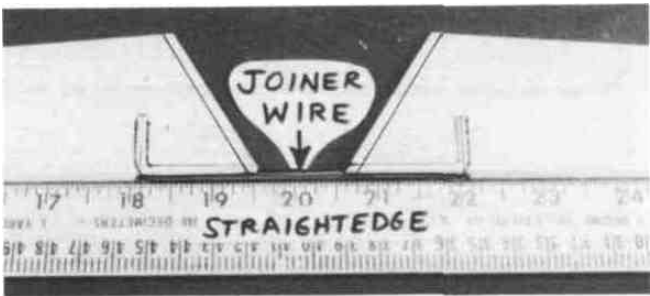
- 9. Accurately drill holes in the elevators for the 1/8" wire joiner. Begin by drilling a 1/16" or 5/64" pilot hole, then drill the final hole to a depth of 7/8" with a 9/64" drill bit. (The hole is drilled slightly oversize to allow for positioning, and to create a hard epoxy "sleeve" around the wire).

- 10. Using an Xacto knife, sharpen the inside of one end of a 1/8" diameter brass tube and use it to cut grooves in the



leading edge of the elevators to accept the joiner wire.

- 11. Roughen the joiner wire with coarse sandpaper, then clean the wire thoroughly with alcohol to remove any oily residue.



- 12. Trial fit the joiner wire into the elevators, then glue it in using 5-minute or 30-minute epoxy. Work plenty of epoxy into the holes with a toothpick, then lay the elevator leading edges along a straightedge to insure perfect alignment.

INSTALL THE HINGES (Do not glue)

NOTE: One-piece molded polypropylene hinges are supplied in this kit. If you choose to use these hinges or the "pinned"-type hinges, you may cut the hinge slots at this time. However, if you choose to use the one-piece hinges that are paper covered for CA glue installation, you may wait until after covering before cutting the hinge slots.

- 1. Lay the rudder and elevators on the plan and mark the **hinge locations**. Place the rudder against the fin TE and transfer the marks over to the fin. Place the elevators against the stab TE and transfer the marks over to the stab. Note: Heavy duty hinges should be used on the rudder if you are building a taildragger.

CAUTION!!!: You must use extreme care when cutting hinge slots with an Xacto 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 and always cut away from your hand while performing the following steps.

- 2. Cut the hinge slots **on the accurate centerlines which you previously drew**, using an Xacto knife or a slotting fork and slotting hook. The recommended procedure for cutting hinge slots with an Xacto knife is given below.

A. Begin by carefully cutting a **very shallow slit** in the trailing edge at the hinge location. This first cut is to establish your cut in the right place, so concentrate on staying on the centerline 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 back and forth 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

- 3. **IMPORTANT!** Condition or "break-in" the hinges by folding them back and forth several times.

- 4. Insert the hinges into the slots and trial fit the rudder and elevators in place on the fin and stab. **Do not glue the hinges until after you have covered the model.**

WING

NOTE: The following instructions explain how to build the wing on a flat surface, directly on the plans. An alternate method is to use a Great Planes Wing Jig (available from your local hobby dealer). Many expert modelers prefer to use a wing jig for high performance airplanes, as it helps to insure a straight, warp-free wing, especially if you do not have a workbench or building board that is perfectly flat. If you choose to use the Wing Jig, please read the instructions that are included with the jig before beginning.

BUILD THE WING PANELS

NOTE: 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.

- 1. Tape the plan to your flat work surface, and cover the wing drawing with waxed paper (so you won't glue the wing to the plan!). **NOTE;** If your work space is limited, you may cut the left and right wing half drawings apart.
- 2. The shaped and notched wing **leading edges (LE)** and **trailing edges (TE)** are fastened together by thin strips of balsa. Separate them by folding until the balsa breaks. Sand away the excess balsa that remains along the edges after breaking them apart, using a T-bar with 100-grit sandpaper.
- 3. Before using the 1/4" x 1/2" x 30" hard balsa **spars**, examine them carefully for possible imperfections. Look for knots, soft spots, diagonal grain and any other imperfections. If possible, position each spar so the imperfections (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).

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



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

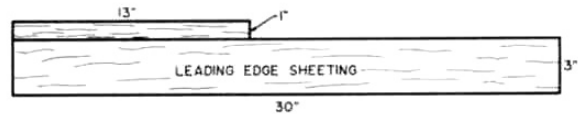


- 4. Find the four 1/8" x 1/2" x 14-1/2" balsa **spar doublers**. Sand one end of each spar doubler to a taper as shown in the "Wing Spar Detail" on the plan. Glue the spar doublers to the spars, and sand off any excess glue.

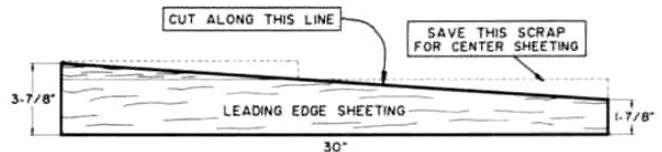
- 5. Carefully punch out all the die-cut 3/32" balsa **wing ribs**. Sand the edges **slightly** to remove any die-cutting irregularities.

NOTE: If you will be installing a retractable landing gear, disregard Steps 6 and 7.

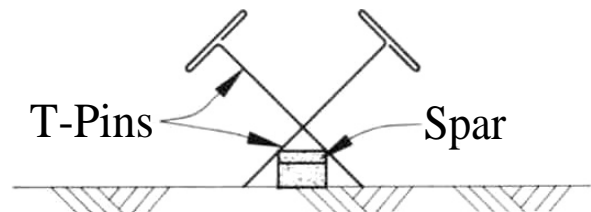
- 6. Note that the wing plan shows two alternate locations for the main landing gear blocks. Note also that Ribs W-2, W-3 and W-4 have **partial cutouts** for each of the two locations. If you are building your plane as a **taildragger**, cut out the **front** notches in these ribs. If you are building your plane with a **tricycle gear**, cut out the **rear** notches. (If you will be installing retracts, do not cut out any of the notches).
- 7. Glue the die-cut 1/16" ply **landing gear doublers** to ribs W-2, W-3 and W-4. Be sure to glue them to the correct side of the ribs, as shown on the plan (make a **right** and a **left** set). Sand the doublers even with the edge of the ribs.
- 8. Prepare the **leading edge sheeting** as follows: Edge glue the 3/32" x 1" x 13" balsa sheets to the 3/32" x 3" x 30" balsa sheets as shown here ...



Now measure and mark the balsa sheeting (see sketch below), then cut the angle in the sheeting, cutting along a metal straightedge for accuracy.

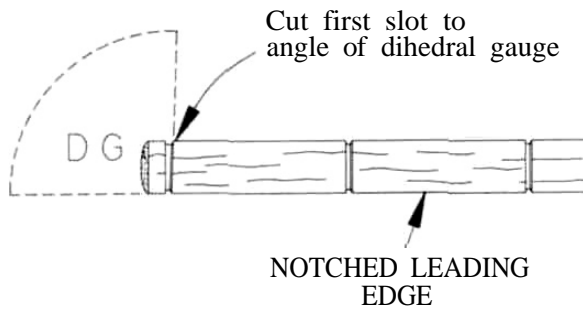


NOTE: Follow steps 9 through 34 to build the **RIGHT** wing panel, then repeat these steps to build the **LEFT** wing panel

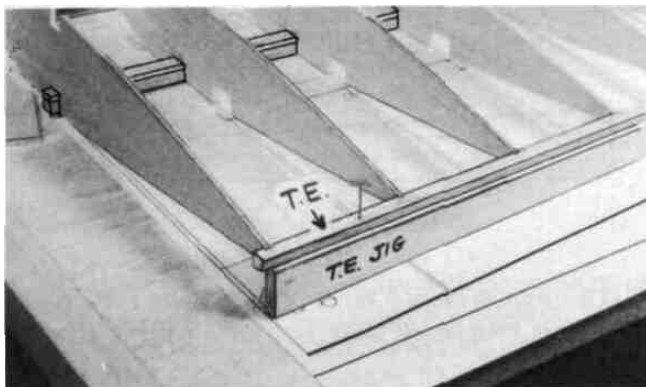


- 9. Pin one of the spars to the plan with the spar doubler **up** and toward the root **NOTE:** The spars are cut slightly too long. Center the spar on the plan so an equal amount protrudes on both ends.

□□ 10. Place the ribs on the spar in their approximate position, but do not glue. **NOTE:** Make sure ribs W-2, W-3 and W-4 are installed with the LG notches **down**, and W-1 is installed with the servo opening pointing **up**.



□□ 11. Examine the shaped, notched leading and trailing edges. Notice that the notches at one end of each LE and TE are only 2-5/8" apart. These are the notches for W-1 and W-2. Also notice that all notches in the LE and TE are **vertical**; however, rib W-1 will be installed at a slight angle using the Dihedral Gauge. Therefore, you should now modify the notch for W-1 by cutting it to the angle of the rib. You may determine the approximate angle of the cut by holding the Dihedral Gauge (DG) against the LE as shown above.



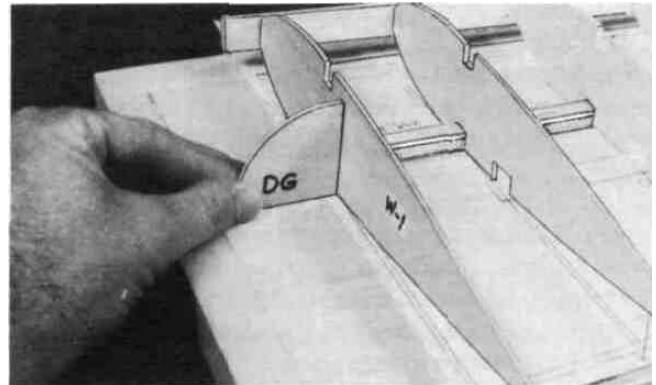
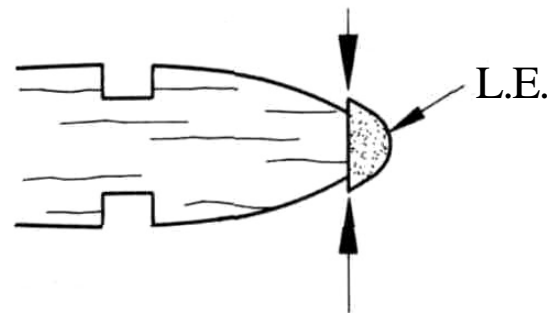
□□ 12. Insert the rear ends of the ribs into the notches in the TE, then block up the TE with the 1/4" balsa TE Jig supplied. **NOTE: The narrow end of the TE jig is at rib W-1.** Pin the jig to the building surface.

□□ 13. Pin the TE to the TE Jig, making sure the ribs line up with the plan.

□□ 14. Glue ribs W-2 through W-11 to the TE. (Apply glue sparingly, to avoid gluing the TE to the TE Jig).

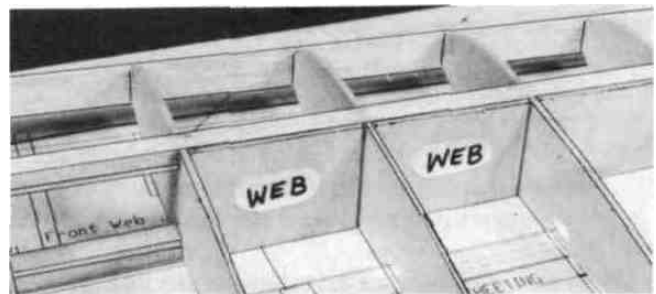
□□ 15. Insert the front ends of the ribs into the notches in the LE. **NOTE:** Position the LE as shown at the top of the next column.

CENTER L.E. VERTICALLY ON FRONT OF RIBS



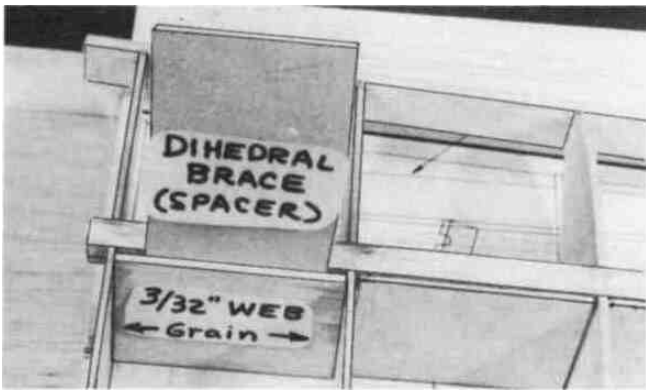
□□ 16. Make sure the ribs are fully down on the plan and all ribs are inserted into the LE notches. Angle rib W-1 slightly using the dihedral gauge (DG). Glue W-1 to the TE, LE and bottom spar. Glue all other ribs to the LE and bottom spar.

□□ 17. Glue the top spar in place, making sure you do not change the angle of W-1.

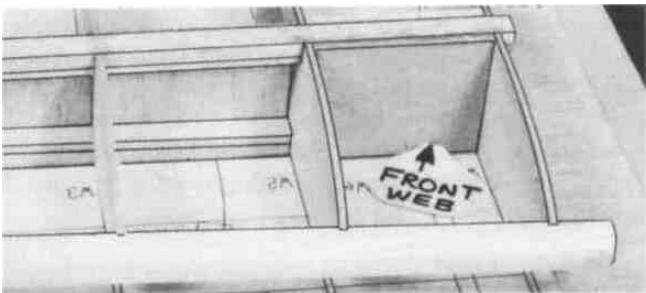


□□ 18. Glue the pre-cut 3/32" balsa vertical grain shear webs to the rear edge of the spars in all rib bays **except between ribs W-1 and W-2**. **NOTE:** You may wish to trial fit, mark, and trim each web before gluing in. **NOTE:** The webs must be securely glued to the spars, but it is **not** necessary to glue the webs to the ribs.

□□ 19. You will now make a "pocket" for the 1/16" ply dihedral brace by installing a 3/32" balsa web 1/16" **behind** the spars. Sand one of the 3/32" x 2-3/16" x 2-1/2" balsa **horizontal grain** webs for a good fit between W-1 and W-2. (See photo at top of next page.)



Using the 1/16" ply **dihedral brace** as a temporary spacer, glue the 3/32" web to W-1 and W-2.



□□ 20. Glue the die-cut 1/8" ply **front web** to the front edge of the spars between ribs W-1 and W-2.

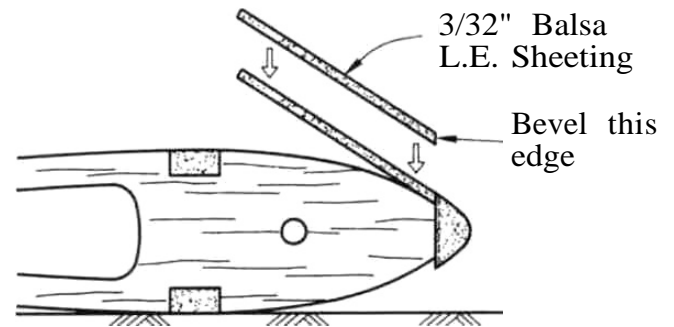
NOTE: In the next steps, maintain straightness by keeping the wing down on the flat surface and on the TE Jig.



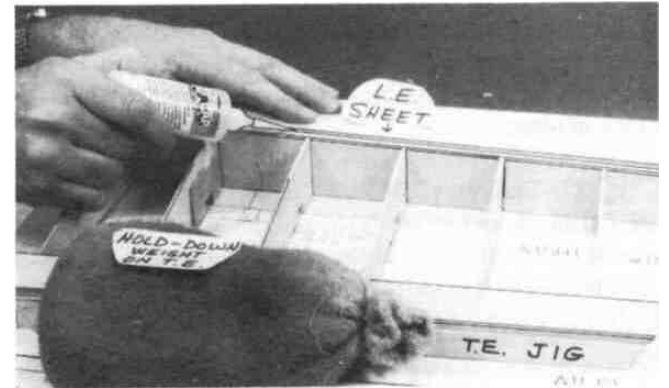
□□ 21. Lightly sand the lops of the ribs to blend with the notched trailing edge; then glue one of the 3/32" x 1-3/4" x 30" balsa trailing edge sheets in place. **NOTE:** The edge of the TE sheet may not be exactly straight, but just position the sheet so it slightly overlaps the TE, and any overlap can be sanded off later.

□□ 22. Before applying the leading edge sheeting in the next step, use your T-bar to lightly sand off the edges of the shear webs and smoothly blend the ribs to the spar.

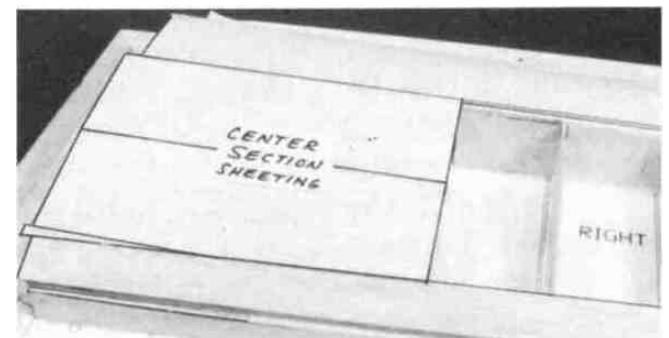
□□ 23. Prepare the 3/32" balsa **leading edge sheeting** by sanding the front edge to a slight bevel so it will fit snugly against the back of the leading edge.



NOTE: It will be helpful to have the following items handy for the next step... thin CA, thick CA, a wet cloth, masking tape and T-pins. Read through the following step and go through a "dry run" before actually gluing.

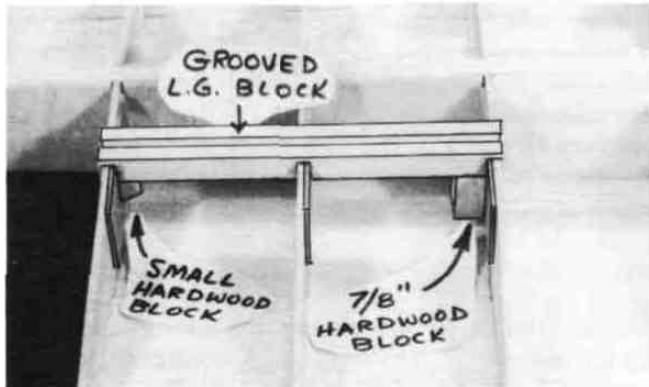


□□ 24. Position the leading edge sheeting at the rear edge of the notched LE so there is an equal amount protruding on both ends of the wing. Using thin CA, glue the front (beveled) edge of the leading edge sheeting to the back edge of the leading edge. Now wet the top surface of the sheeting so it will bend easier. Apply thick CA glue to the top edge of the ribs and to the front half of the spar, then immediately bend the sheeting down onto the ribs and spar. Hold the sheeting down with masking tape, pins and your hands until the glue has set.



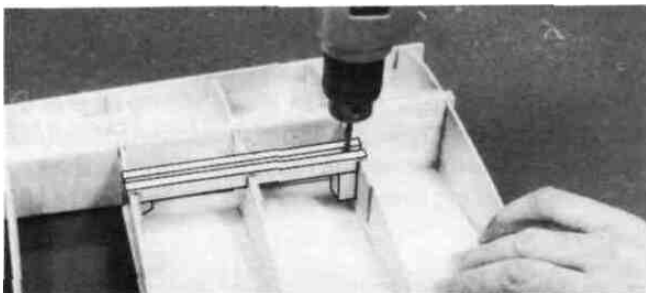
□□ 25. Using the 3/32" x 3" x 8-13/16" balsa sheets, glue the top center section sheeting in place as shown on the plan. (Use the scraps trimmed from the LE sheeting for the aft pieces).

NOTE: If you are installing retracts, disregard steps 26 through 29.



26. Remove the wing from the building board and trial fit the long grooved hardwood **LG block** into the notches in ribs W-2, W-3 and W-4 (see the landing gear detail drawing on the wing plan for proper positioning). File the notches if necessary for a good fit. Now use epoxy to securely glue the block in place.

27. Epoxy the 7/16" x 5/8" x 7/8" **hardwood block** to the LG block and to the 1/16" ply doubler on rib W-2, as shown on the plan and in the photo, then epoxy the **small hardwood block** to the other end of the LG block and to the 1/16" ply doubler on rib W-4.



28. Drill a 5/32" hole down through the grooved LG block and the 7/8" block. Line up the drill so you are drilling straight down through the middle of the 7/8" block.

29. Trial fit the 5/32" diameter **main landing gear wire** into the landing gear block at this time. Cut or file the groove and hole in the landing gear block as necessary for a good fit

30. Using a razor saw and a sanding block, carefully cut off and sand all excess sheeting, spars, LE and TE even with W-I and W-II.

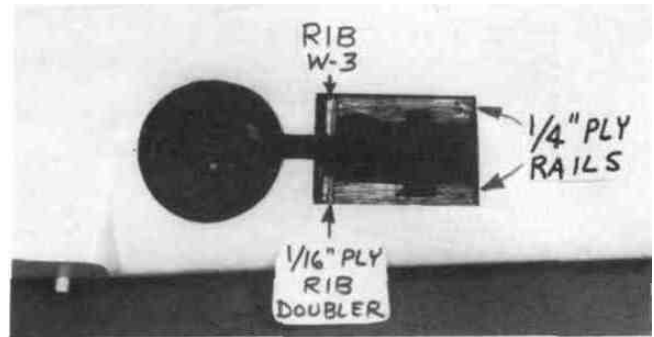
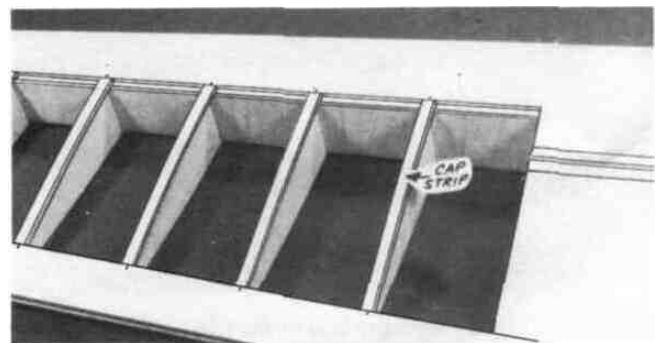


Photo of finished wing with retract mechanism removed.

NOTE: If you will be installing retracts, now is the time to glue in the 1/16" ply die-cut rib doublers to the front portion of ribs W-3 and W-4. (Make sure the front rib doublers are on the outboard side of W-3 and the inboard side of W-4). This is also the time to install the 1/4" x 13/16" x 2-11/16" ply retract mounting rails on the bottom of the wing, in the location shown on the plan. Lock and strengthen the joints between the 1/4" ply rails and the 1/16" ply rib doublers by gluing 1/4" balsa triangle stock to these joints. You should also now do some planning and trial fitting of the retract and pushrod, customizing the installation as necessary [to accommodate your retracts]. **Installing retracts requires careful planning and a lot of trial fitting;** therefore, you should take the time now to plan out your installation.

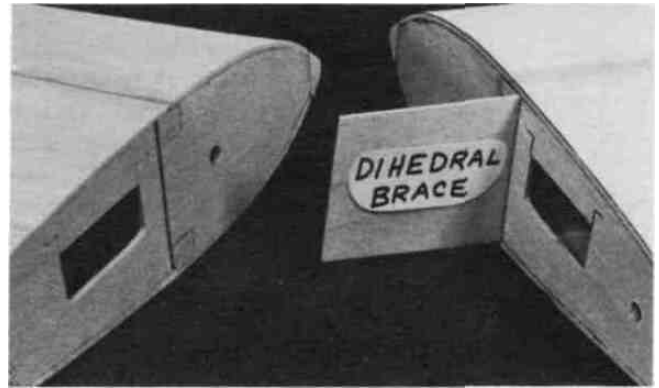
31. With the wing upside down, again use the **TE jig** to support the TE. Then install the bottom TE sheeting, LE sheeting and Center Section sheeting, cutting and fitting the sheeting around the LG block as necessary. **IMPORTANT NOTE:** To insure a straight wing, you must pin or weight the TE securely down on the TE jig while the bottom sheeting is glued in place!



32. From the 3/32" x 3/8" x 30" balsa sticks, cut and glue **cap strips** to all exposed ribs, top and bottom. **HINT:** For easier positioning of the cap strips, first mark the location of each rib on the LE and TE sheeting.

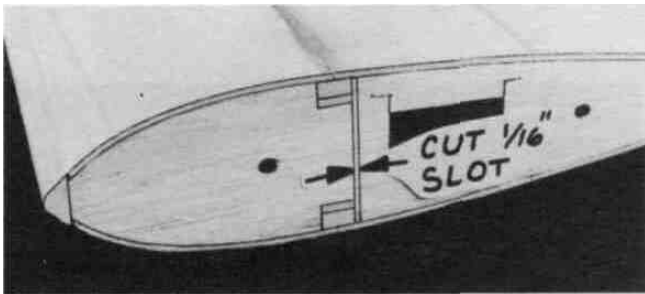
33. Trim the sheeting flush with ribs W-I and W-II and sand the entire wing panel smooth. Sand the leading edge to smoothly blend with the LE sheeting (see the note on the following page).

IMPORTANT: The shape of the leading edge will affect the way this airplane performs snap rolls and spins. A blunt, rounded leading edge will "soften" the stall, making the plane very docile when flying slowly, enabling it to flare nose-high for very slow landings; however, this may cause the plane to be a little sluggish when trying to enter a snap roll or spin. A sharper leading edge will help the plane enter snap roll and spin maneuvers more crisply, while sacrificing only a little of the low speed stability. The leading edge has been approximately pre-shaped to the sharper cross-section, so try to maintain the same LE radius when sanding to blend with the LE sheeting. To **avoid tip stalls**, **make sure the leading edges of both wing panels have the same shape.**



NOTE: 30-minute epoxy is strongly recommended for the wing joining process.

- 3. Mix up a batch of **30-minute** epoxy and push some into the dihedral brace slots. Smear epoxy on the spar ends, and on both sides of the 1/16" ply dihedral brace. Slide the dihedral brace in place, push the wing panels together and **immediately proceed to the next step.**



- 34. Mark and cut out a 1/16" slot in W-1 just behind the spars, for the dihedral brace.

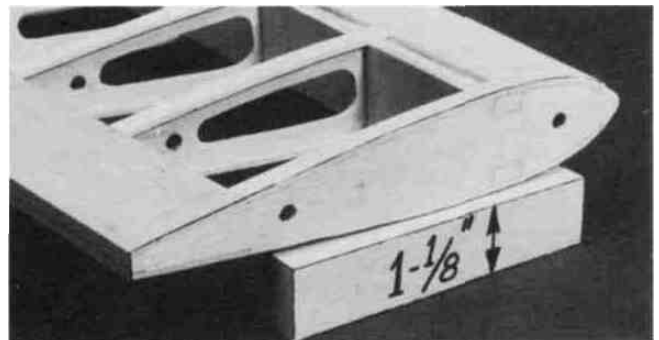
- 35. Now go back and repeat Steps 9 through 34 to build the left wing panel.

JOIN THE WING PANELS

NOTE: Read steps 1 through 4, then make a "dry run" through these steps before actually proceeding.

- 1. Lay a piece of waxed paper down and place the two wing panels, right side up, so that the W-1 ribs are together. Using the 1-1/8" x 1-9/16" x 9-3/4" balsa wing tip blocks, block up both wing tips **1-1/8-inch**. Sand the wing panels at the center so they will fit together without a gap.

- 2. Trial fit the 1/16" ply **dihedral brace** to make sure it will readily slide into place. (The photo for this step is at the top of the next column).

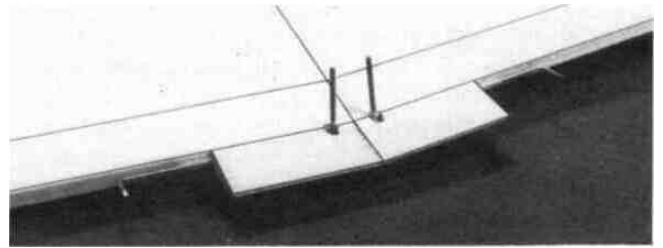
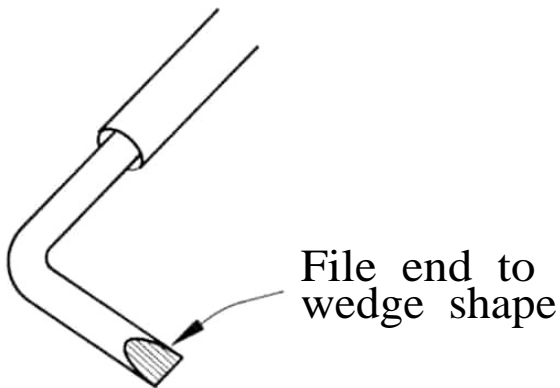


- 4. With the wing tips blocked up 1-1/8 inch, carefully align the LE and TE of both wing panels at the center and, while holding them in correct alignment, apply thin CA glue to "lock" the panels together. **Do not apply CA glue to any area that is already coated with epoxy.** Allow the epoxy to fully harden before disturbing the wing.

- 5. Sand the wing joint smooth all around.

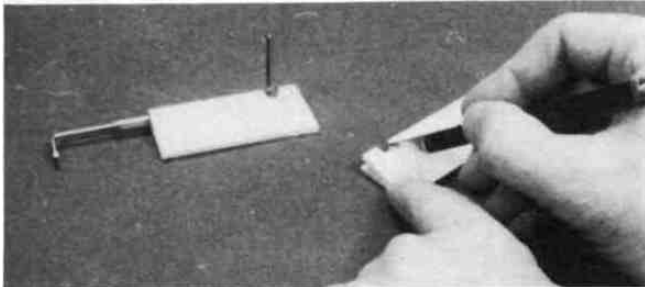
INSTALL AILERON TORQUE RODS

- 1. Roughen the short end of the **aileron torque rods** with 100-grit sandpaper, and file the same end to a wedge shape. (See sketch on next page).



pieces in place with epoxy. **HINT:** Use masking tape to hold these pieces to the wing TE, to aid in correct positioning.

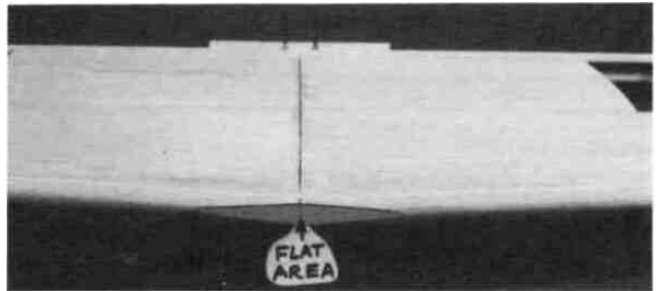
- 2. Roughen the surface of the plastic bearing tubes with 100-grit sandpaper.
- 3. Clean the torque rods and bearing tubes with alcohol.
- 4. Find the two grooved, tapered balsa **center trailing edge** pieces. Lay them on the plan, mark and cut them off to match the plan for length and angle at the centerline.



- 5. Trial fit the torque rods into the center TE pieces. Determine from the plan where to cut the clearance notches, which will permit the torque rod horns to travel freely. Also cut small clearance notches in the wing TE. Note: **The torque rod horns must exit the TOP of the wing!**
- 6. 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).
- 7. Use 5-minute epoxy or thick CA to glue the plastic bearing tubes into the grooves in the center TE pieces. Wipe off any excess glue and allow it to harden.
- 8. Trial fit the trailing edge / torque rod assemblies onto the wing trailing edge. Sand the center trailing edge pieces slightly where they join, for a good fit. Glue these

SAND "FLATS" ON LE AND TE

- 1. Study the wing plan near the wing centerline. Note that the center portion of the LE and TE must be sanded flat.



- 2. Sand approximately 5/32" into the LE at the centerline, and approximately 3/32" into the TE at the centerline. (The flats will end up approximately 4-1/2" wide at the LE, and 2" wide at the TE).

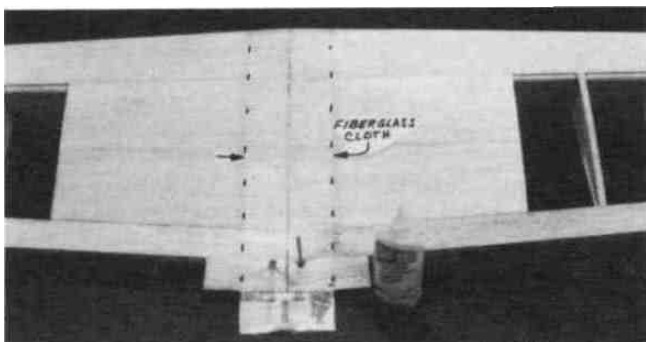
FIBERGLASS THE CENTER SECTION

NOTE; Because of the high stresses in the center of this wing, Fiberglass reinforcement is REQUIRED. Please do not omit this important section!

NOTE: If you have previous experience with applying fiberglass, feel free to use your favorite method, providing that it results in a strong bond between the glass cloth and the wood. If this is your first time, we offer the following suggested method, which is the fastest and easiest we have seen.

- 1. Make **location marks** for the fiberglass reinforcement cloth, 2" each way from the wing centerline.

- 2. **Trial fit** the 4" wide fiberglass cloth in place. You can use a scissors or a paper punch to cut holes in the glass cloth for the aileron torque rod horns.
- 3. Wrap small pieces of masking tape around the threaded portion of the aileron torque rods to protect them from the spray adhesive in the next step.
- 4. Spray a very light mist of 3M "77" Spray Adhesive on the center section in the area to be glassed. Hold the spray can at least 12" away from the surface when doing this to avoid a heavy buildup. The purpose of this is only to give the wood a little "tackiness". If you apply too much spray it could result in a poor glue bond. Allow the spray to dry for 5 minutes before proceeding to Step 5.



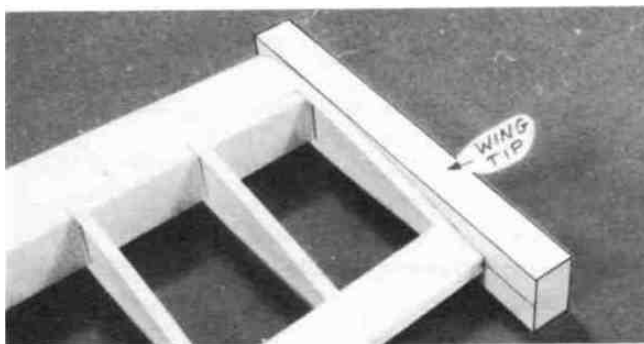
- 5. Beginning at the trailing edge, lay the glass tape in place on the wing. Gently press the cloth in place, working out all the wrinkles. The "77" spray adhesive should hold the cloth down to the surface, but will permit you to lift and reposition the cloth if you make a mistake. Keep working forward along the top of the wing, around the leading edge, and along the bottom of the wing, ending at the trailing edge. Do not attempt to wrap the glass cloth around the trailing edge.
- 6. Working outdoors or in a **very well-ventilated area** apply **thin** CA glue to the glass cloth. Begin by running a bead of glue down the center of the glass cloth strip, then continue applying the glue in lines until all the cloth has been secured. Run the thin CA out 1/4" beyond the edges of the glass cloth to help protect the balsa sheeting when sanding later. **WARNING: This operation produces a larger than normal quantity of CA fumes, so adequate ventilation is a must!**
- 7. Inspect the surface of the glass cloth. If any areas are not glued down, apply a couple more drops of CA glue and press down with a piece of waxed paper until the glue sets.
- 8. To make sure the glass cloth is fully "wetted out" and bonded to the balsa, you may apply more thin CA, a few drops at a time, and spread it out with a piece of waxed paper.

- 9. After the glue has set, trim the excess cloth at the trailing edge with a sharp Xacto knife followed by a sanding block.
- 10. Carefully sand the **edges** of the glass cloth with a T-bar sander with 80 or 100-grit sandpaper. Also, **lightly** sand the surface of the glass cloth with a piece of sandpaper held in your fingers to remove any rough spots. **WARNING: When sanding fiberglass, wear a dust mask to avoid breathing airborne glass fibers.**

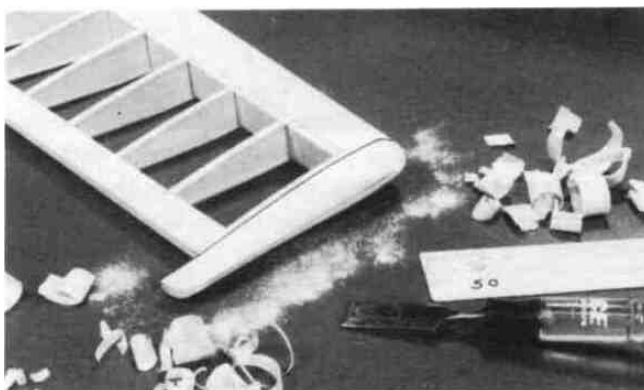
INSTALL WING TIPS

NOTE: The wing tips will be carved from the 1-1/8" x 1-9/16" x 9-3/4" balsa blocks.

- 1. Draw a centerline on the ends of the wing and on the wing tip blocks.

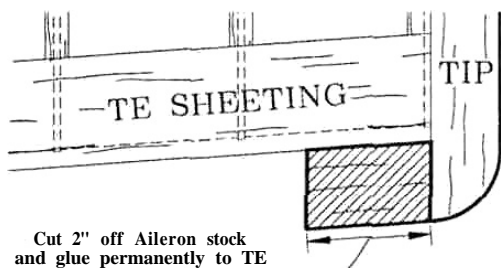


- 2. Securely glue a wing tip block to the left end of the wing, and **tack glue** a wing tip block to the right end of the wing, lining up the centerlines you previously drew. You will **later** break only the right lip loose and hollow it out.



- 3. Cut, carve and sand the wing tips to the appropriate shape as shown on the plan. **HINT;** Use 50-grit sandpaper and a sharp wood chisel or razor plane to speed up this operation. **NOTE:** Leave the tips oversize in the area of the ailerons, for now.

- 4. Cut the **right** wing tip loose from the wing and use a Dremel Moto Tool to hollow out the wing tip. (This will help to compensate for the weight of the engine head and muffler).
- 5. Now securely glue the right wing tip in place.

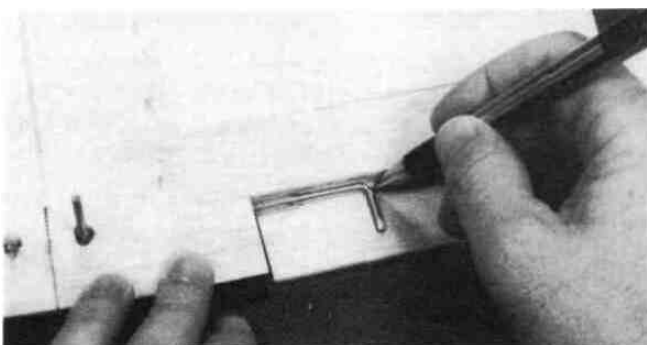


- 6. Cut 2" off one end of the tapered ailerons and glue the 2" pieces permanently to the trailing edge as shown in the sketch. This moves the aileron away from the turbulence caused by the tip vortex. Make sure you carefully line up this piece with the top and bottom surfaces of the wing.

INSTALL AILERONS

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

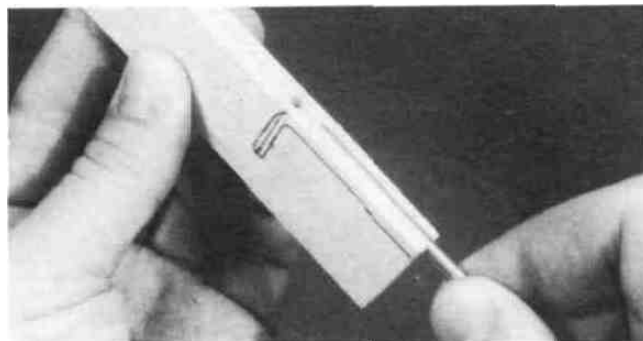
- 1. Draw an accurate **centerline** along the LE of the tapered balsa **aileron** and the wing TE,
- 2. Check the length of your ailerons against the actual aileron openings and **trim** the ailerons as necessary. You should provide approximately 1/16" gap at each end of the ailerons.



- 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.**

- 4. Drill a 7/64" hole in the ailerons at the torque rod locations, starting at the leading edge centerline and drilling **straight** in to the proper depth. (The hole is drilled slightly oversized to allow for positioning, and to create a hard epoxy "sleeve" around the wire).

- 5. Use the sharpened 1/8" diameter brass tube to **cut a groove in the leading edge of the ailerons** to accept the torque rods. Cut these grooves a little larger at the beginning,



to make room for the torque rod bearings. Trial fit the ailerons onto the torque rods and cut or file as necessary until they fit.

- 6. Lay the ailerons on the plan and mark the **hinge locations** on the ailerons. Use **two** hinges near the tips. Place the ailerons against the wing TE and transfer the marks over to the wing.

- 7. Cut the hinge slots in the ailerons and wing TE using an Xacto knife or hinge slotting tool.

- 8. **IMPORTANT!** Condition or "break-in" the hinges by folding them back and forth several times,

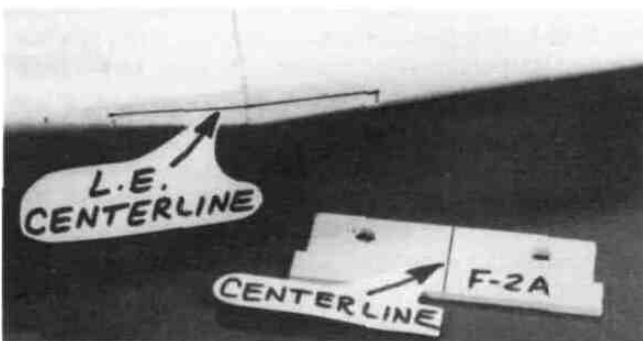
- 9. Sand the leading edge of the ailerons to the same **"V"-shape** as shown on the wing rib detail drawing.

- 10. 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.**

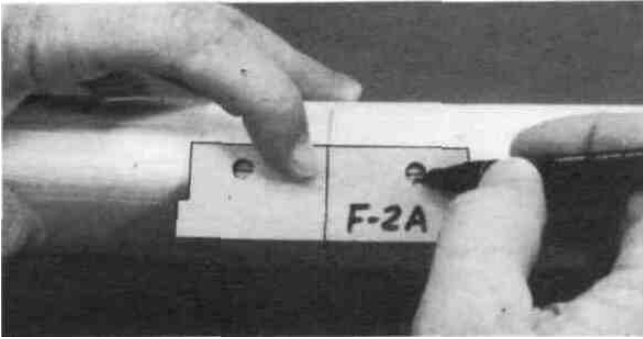
There should be no hinge gap!

- 11. Now is a good time to finish the wing tips. Tape the ailerons on in the neutral position, and sand the wing tips to blend with the ailerons.

INSTALL WING DOWELS



- 1. Mark a horizontal centerline on the flat which you sanded on the wing LE. Also mark a vertical centerline on the die-cut 1/8" ply former **F-2A** (the Wing Dowel Plate).



2. Holding the die-cut 1/8" balsa **F-2A** on the leading edge, in the exact center of the wing, mark the dowel locations through the dowel plate holes.

3. Remove F-2A and double check to make sure the dowel locations are both the same distance from the wing center joint

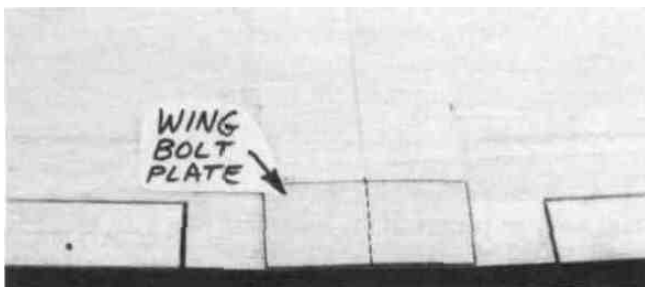
4. It is important that you now drill the dowel holes **accurately!** To insure accurately positioned holes, begin by drilling small (1/8") holes in the center of the marked locations. Then gradually increase drill bit sizes until you have finally drilled the holes to 1/4" **diameter**. The final holes you drill must extend 3-3/4" into the wing to penetrate the front webs. **NOTE:** Try to drill **straight in**.

5. Sand **one end** of each wing dowel to a rounded or pointed shape. This is the end that will be inserted. Do not sand the other end at this time.

6. Trial fit the dowels into the dowel holes, and trial fit the dowel plate over the dowels. If the dowels fit too tightly, you may enlarge the holes slightly using a round file, or you may sand the dowels down slightly. **Do not** glue the dowels **in place** at this time.

INSTALL WING BOLT PLATE

1. Mark a centerline on the die-cut 1/16" x 3-15/32" x 1-5/8" ply **wing bolt plate**.



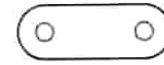
2. Position the wing bolt plate on the **bottom** of the wing, and line it up with the wing TE and centerline. Glue it in place.

3. Sand the wing bolt plate flush with the wing TE.

FILL LANDING GEAR SLOTS

1. Temporarily install the main LG wires.

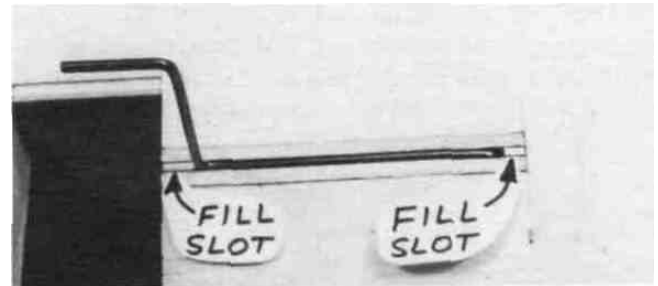
2. Check the plan for the location of the nylon landing gear straps and temporarily install them, using #2x3/8" sheet metal screws.



NYLON LANDING
GEAR STRAP



#2X3/8" SHEET
METAL SCREW



notched LG blocks and sand flush with the surface of the wing. This will aid in covering later.

INSTALL RETRACTS (OPTIONAL)

NOTE: Hardware for retract installation is not included in the kit

1. Study the retract drawings on the plan, and the I installation instructions provided with your retracts, and plan your retract installation before proceeding,

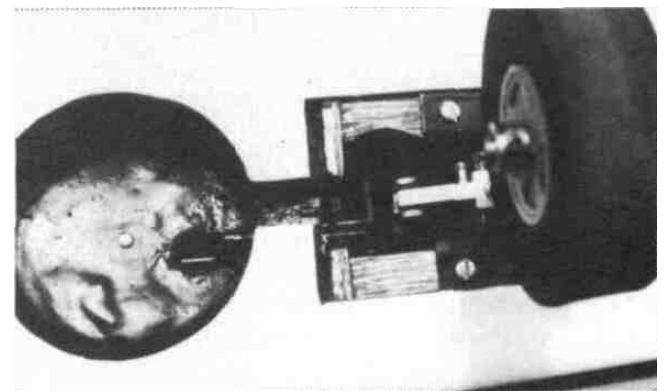


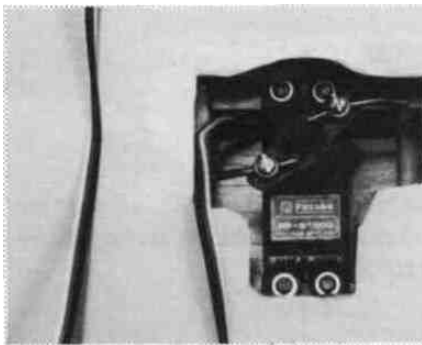
Photo shows finished wing with retract installed.

2. Cut an opening in the bottom LE sheeting for the

retract mechanism. Cut a clearance slot in rib W-3 for the LG wire. Cut an opening in the bottom LE sheet and in rib W-2 for the wheel well.

3. Enclose the wheel well by running vertical grain 1/16" balsa between the bottom and top sheeting; or you may make the wheel well from an appropriately-sized styrofoam cup.

of the spars) for your retract servo, and bend and fit a pushrod to run between the servo and the retract mechanism. Run the pushrod just under the top LE sheeting until it passes over the wheel well, then make two 90-degree bends and connect it to the retract mechanism.



5. Temporarily mount your retract servo and trial fit all retract components. Test the operation of your retracts making sure they operate freely and reliably. Also make sure they "lock" in both the up and down positions.

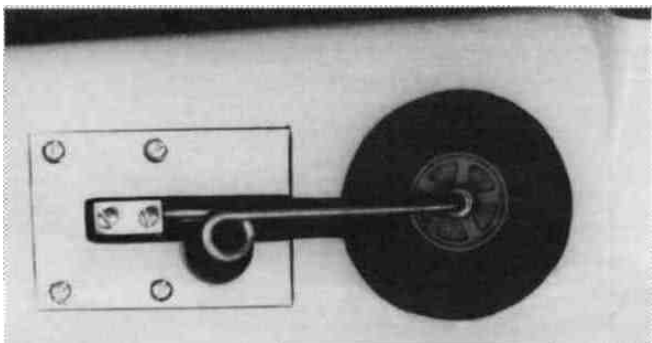


Photo shows finished wing with retract installed.

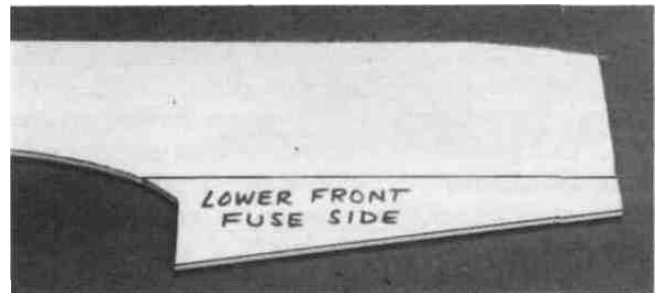
6. Blend the bottom sheeting as neatly as possible around the retracts.

7. Use polyester resin or 30-minute epoxy thinned with alcohol to fuelproof the entire retract well area.

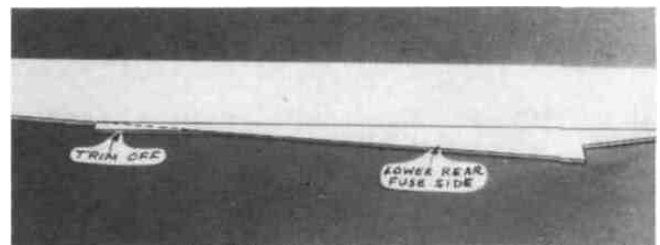
FUSELAGE ASSEMBLY

PREPARE FUSE SIDES

1. Lay one of the shaped 3/16" balsa **fuselage sides** in place on the fuselage plan side view. Carefully position the fuse side so the front edge lines up with **the front** of F-1 on the plan. Tape or pin the fuse side so it can't move. **NOTE:** The fuse side may be a little longer at the rear than indicated by the plan. This is as it should be.



2. Carefully position the die-cut 3/16" balsa **lower front fuse side** so the rear edge lines up with the front of the wing saddle opening on the plan (the rear edge of F-2A). You may have to lightly sand the top edge of the die-cut 3/16" balsa for a good fit against the bottom edge of the fuse side. Edge glue the lower front fuse side to the fuse side. **NOTE:** Use waxed paper under the balsa to avoid gluing to the plan.



3. Carefully position the die-cut 3/16" balsa **lower rear fuse side** so the vertical front edge lines up with the rear of the wing saddle opening on the plan (the front edge of F-4). Edge glue the lower rear fuse side to the fuse side.

4. Trim and sand off the die-cut "bumps" from the front and rear portion of the lower rear fuse side, blending with the upper fuse side.

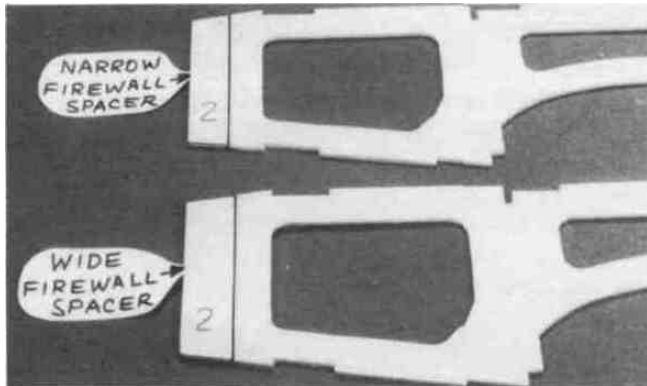
5. Sand the fuse side smooth on both sides using a T-bar and 100-grit sandpaper, then repeat the above steps to make the other fuse side.

6. Find the two die-cut 1/8" ply **fuselage doublers** and the four die-cut 1/8" ply **firewall spacers**. Note that the spacers are marked "2 L", "2 R", "4 L", and "4 R".

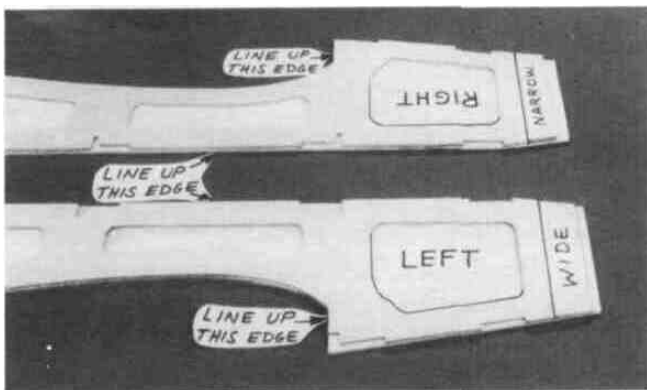
Use the #2 firewall spacers if you will be installing a 2-cycle engine such as the OS Max 61 SF.

Use the #4 firewall spacers if you will be installing a small 4-cycle engine, such as the OS FS 70 Surpass.

If you will be installing a larger (longer) 4-cycle engine, such as the OS FS 91 Surpass, do not use **any** firewall spacer on the right side, and use the 1/8" x 1/8" x 3-5/8" hardwood stick as a firewall spacer on the **left** side.



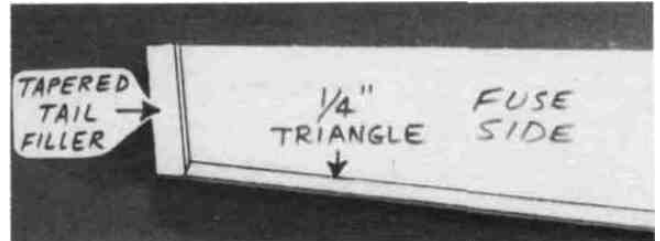
7. Edge glue the appropriate firewall spacers to the front edge of the fuselage doublers. Note that the spacers are not the same size. They will automatically set the engine at the required 2-degrees right **thrust**.



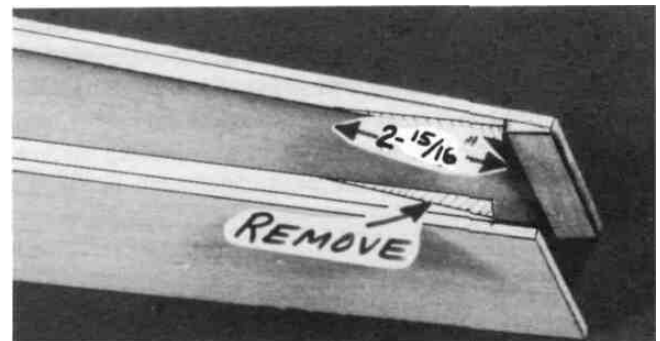
8. Carefully position the fuselage doublers on the fuse sides, **making a RIGHT and a LEFT side**. The doubler with the smaller firewall spacer goes on the right fuselage side ..

PLAN IT OUT! It is important that the fuse doubler and fuse side line up along the **top edge** and the **front of the wing opening**. While holding in position, apply thin CA glue around all the notches and lightening holes, then around the edges. Make sure you apply sufficient glue so it flows under the doubler to produce a strong bond. **NOTE:** The narrow and wide firewall spacers will automatically position the firewall to result in 2-degrees of **right engine thrust**.

9. Glue the tapered balsa **tail filler** to the aft end of one of the fuse sides and sand it even with the top and bottom edges.



10. From the 1/4" balsa triangle, cut pieces to fit between the tail filler and the **rear** of F-4, along the bottom inside of both fuse sides. Glue in place.



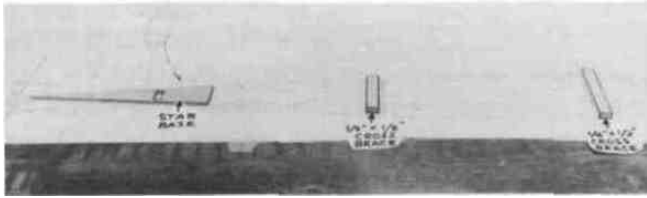
11. Sand the aft ends of the balsa triangle to a taper, which will permit the fuse sides to be pulled together at the aft end. **NOTE:** The taper shown in the photo is approximate and may have to be modified during assembly.

ASSEMBLE LOWER FUSELAGE

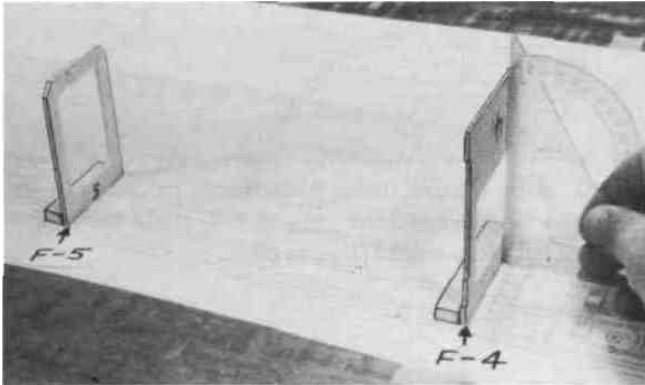
1. Tape the fuselage plan to your workbench and cover the **Fuse Bottom View** with waxed paper.

NOTE: The fuselage is assembled **upside down**.

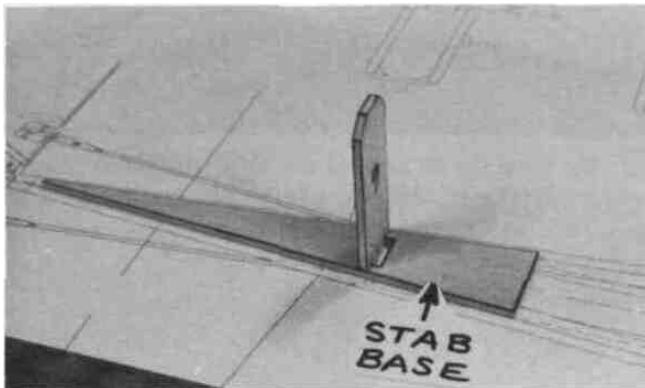
2. Pin or tack glue (using 3M "77" Spray Adhesive) the 1/8" die-cut balsa stab base accurately in position on the plan. Align the front edge of the stab base with the line on the plan.



3. Accurately position the two pre-cut 1/4" x 1/2" balsa **cross-braces** on the plan, and pin them in place behind F-4 and F-5. **Note:** The front cross-brace (at F-4) extends only out to the doublers.



4. Trial fit formers **F-4** and **F-5** to the front of the Cross-braces (the formers are upside down), and sand the edges of the formers slightly to match the angle of the fuse sides. Glue the formers to the cross-braces, **making sure that each former is installed perpendicular to the building surface.**



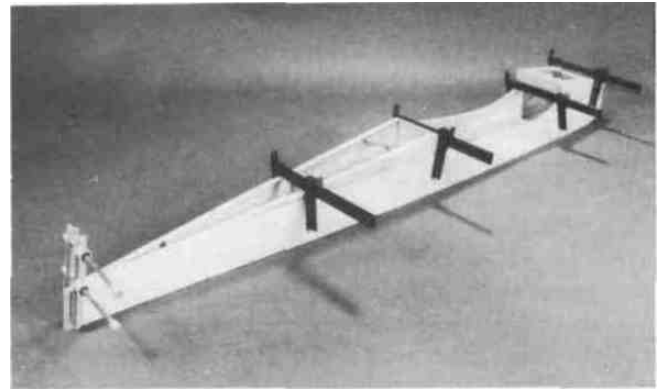
5, Insert **F-6** upside down in the **rear** of the slot in the stab base. Sand the edges of F-6 slightly to match the angle of the fuse sides. Align F-6 perpendicular to the stab base and glue it in place.



6. Accurately position the 1/8" die-cut ply **fuse top on**

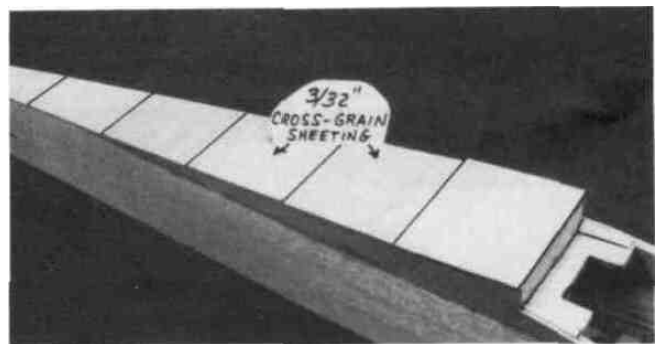
the plan and hold it **securely** in place with pins, tape or weights (or you may spray it lightly with 3M "77" spray adhesive, to hold it firmly but temporarily down on the plan).

7. Trial fit (do not glue) the following parts together **Fuse top, fuse sides, die-cut 1/8" ply F-2, F-3, F-4** and the die-cut 1/8" ply **Chin Block Base**. Check the fit of all parts and trim, file or sand as necessary for a good fit. Pull the aft ends together and re-sand the 1/4" triangles if necessary.



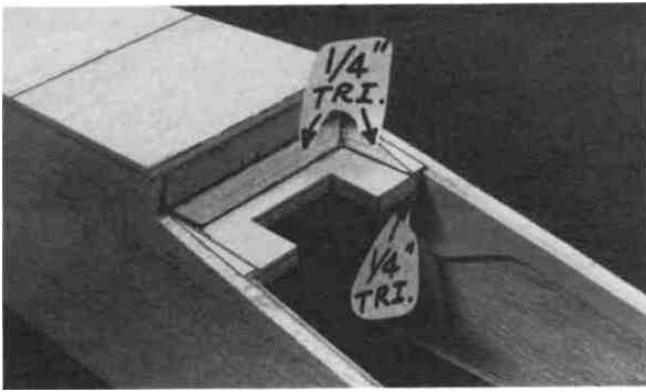
8. Once you have everything fitting properly, **re-assemble** the above parts, using clamps, pins, tape and weights to hold everything together and flat on the workbench. **Make sure F-2 is pushed as far forward as possible, and F-4 is pushed as far aft as possible.** There should be waxed paper underneath to prevent gluing the fuse to the plan. Apply thin CA glue to the joints, then follow with thick CA glue in any joints that are not tight fitting.

9. Sand the bottom of the fuse to remove any excess glue, and to provide a flat surface for the sheeting.



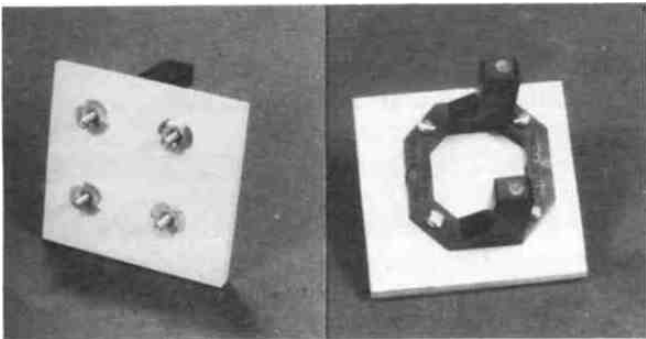
pieces of **cross-grain sheeting** to the bottom of the fuse, beginning at the front of F-4 and running to the aft end of the fuse.

11. Now you may remove the fuselage from the work surface and sand the edges of the bottom sheeting flush with the fuse sides.



12. Find the 1/4" ply **wing hold-down block** and trial fit it into the notches in the fuse side doublers, sanding as necessary for a good fit. Glue the hold-down block in place **securely**, using 30-minute epoxy, then cut pieces of 1/4" balsa triangle and glue them in place above and below the hold-down block. Sand the triangles flush with the wing saddle.

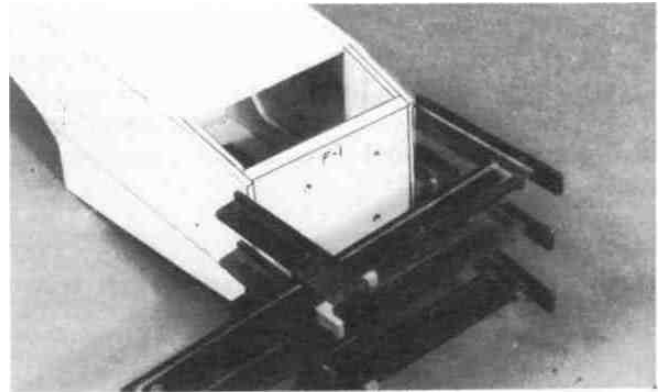
13. The 1/4" ply firewall (F-1) location and size will vary, depending on which engine you install. The location has been set by the firewall spacers. The firewall supplied in your kit is the correct size if you are installing a .91 4-stroke engine; however, if you are installing a smaller engine, such as a .70 4-stroke or a .61 2-stroke, you will have to cut the firewall down to the correct size. The fuse plan shows the firewall sizes and engine mounting required for the three locations. Cut the firewall to size and sand the sides and bottom at an angle to match the fuse. Trial fit to make sure it will fit correctly before proceeding to the next step.



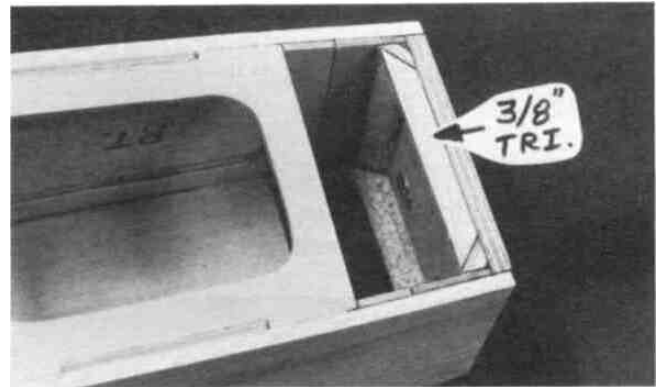
14. Before installing the **firewall** (F-1), you may drill F-1 for your engine mount and install the 6-32 blind nuts. You may cut out the appropriate F-1 drawing from the plans, tape it to F-1 and use it as a guide for drilling the four 5/32" holes. If you will be using a mount not shown on the plans you'll have to determine the correct mounting position. Note that the mount should not be positioned on the vertical and horizontal centerlines of F-1, but should be offset slightly above the centerline and slightly toward the left side. (When taking measurements off the plan, keep in mind that the plan shows the bottom view of the airplane). Drill the holes and install the blind nuts on the back of F-1, pressing them in with a pliers or a vise.



6-32
Blind Nut



15. Use 30-minute or 5-minute epoxy to securely glue F-1 to the fuse sides, holding with clamps or tape until the glue has firmly set. **NOTE:** Before the glue sets, double check to make sure F-1 is properly aligned with the top and bottom edges of the fuselage, and fully back against the firewall spacers. After the glue has fully hardened, sand off the front of the fuse sides flush with the front of F-1.



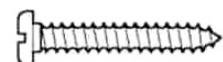
16. Cut pieces of 3/8" balsa triangle to fit around the aft edges of F-1, and glue them in place.

DRILL ENGINE MOUNT (Great Planes MM60L mount)

1. Place the engine pointing straight ahead on the mount 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.

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

Method 1: Screw the #6 x 1" 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.



#6 x 1" Screw

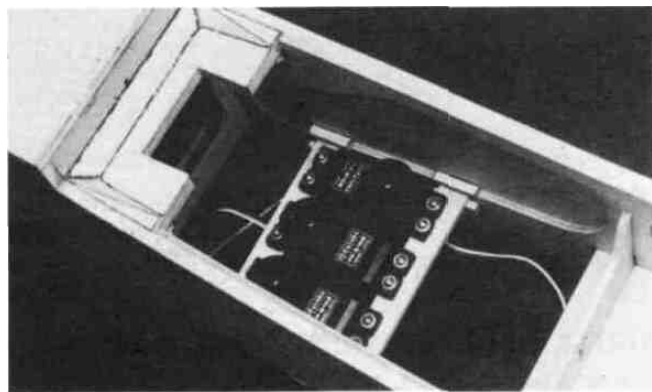
Method 2: Cut threads into the holes you just drilled using a 6-32 tap and tap wrench. If you use this method you'll have to supply your own bolts (6-32 x 1" socket head cap screws) for attaching the engine to the mount. **NOTE;** 8-32 hardware is recommended if you are installing a 4-cycle engine.

INSTALL SERVOS AND PUSHROD GUIDE TUBES

NOTE: Although you may choose to wait until later, this is the best time to install the pushrod guides, because the fuselage is wide open and it is very easy to work inside.

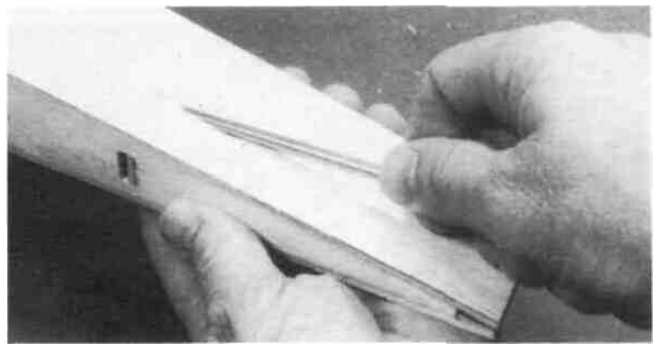
IMPORTANT: Before proceeding, **plan your servo and pushrod installation.** Especially note which side of the fuselage the throttle pushrod and nose gear pushrod (if any) will be located. Remember that the throttle arms of 2-cycle and some 4-cycle engines are on opposite sides. It will be helpful to actually sketch your pushrod locations on the plans with a pencil. It is desirable for the throttle pushrod (and the nosegear steering pushrod) to run along the **sides** of the fuselage. It is also desirable (but not essential) for the rudder and elevator pushrods to cross inside the fuselage, to avoid any sharp bends.

- 1. Set the fuselage upside down on blocks at least 1-inch high.



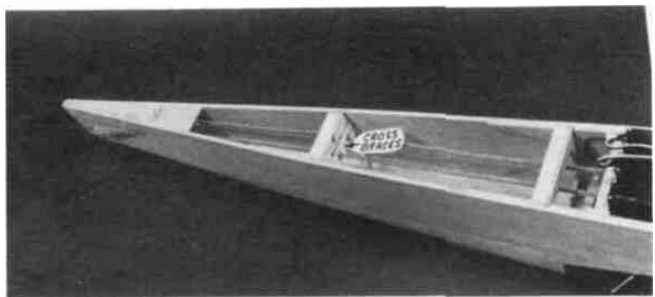
- 2. Trim the 3/16" x 1/2" x 3-5/8" ply **servo rails** to fit between the fuse side doublers in the locations shown on the plan. Temporarily mount your servos to the rails, then glue the rails to the fuse side doublers. Lock the rails in place by gluing scraps of plywood on the top and bottom of the rails.
- 3. Sand the outer surface of the **pushrod guide tubes** with 100-grit sandpaper to provide a surface to which the glue will adhere.

- 4. Use an Xacto knife to sharpen one end of a piece of 3/16" (outside diameter) brass tubing, then use this tubing to cut the **pushrod exit holes** (you may use a 3/16" drill bit, but



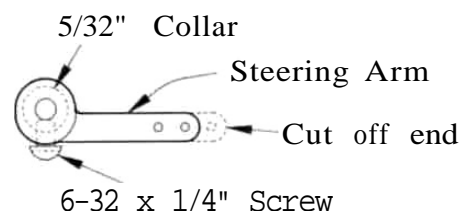
the brass tube method gives a much neater cut). Determine the location of these holes from the plans. You may chuck this brass tube in an electric drill to aid in getting through F-6.

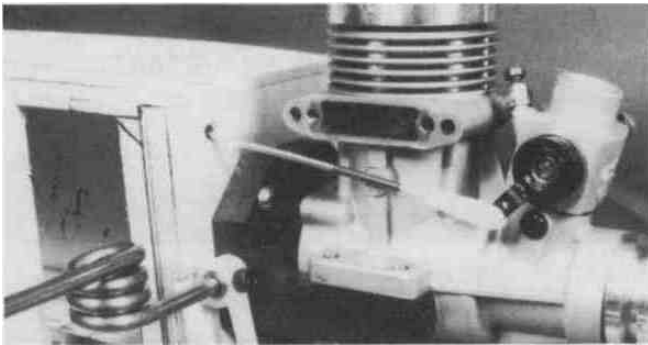
- 5. Insert the plastic pushrod tubes through the holes you just cut and through formers F-6, F-5 and F-4.



- 6. Route the pushrod tubes according to your radio installation plan. Temporarily insert the 34" pushrod wires into the tubes and hold them in the correct position at the servo end. **Keep the tubes as straight as possible.** Glue the tubes to the fuse sides at the rear exit points using thin CA glue. Use scraps of 1/8" balsa to anchor the tubes to F-5. **Do not anchor the tubes to F-4 at this time**, to allow for slight adjustment of their positions later.

- 7. Cut off the tubes at the exit points and sand them flush with the fuse sides using a sanding block.
- 8. Temporarily install the **engine mount, nosegear** (and **nosegear steering arm** if you are building a tricycle configuration).
- 9. **Cut 1/4" off the end of the steering arm**, then drill a 3/16" hole in F-1, just above the outer hole of the arm. **NOTE:** The drill should be aimed toward the rudder servo to avoid tight bends in the pushrod. The photo for this step is at the top of the next page.



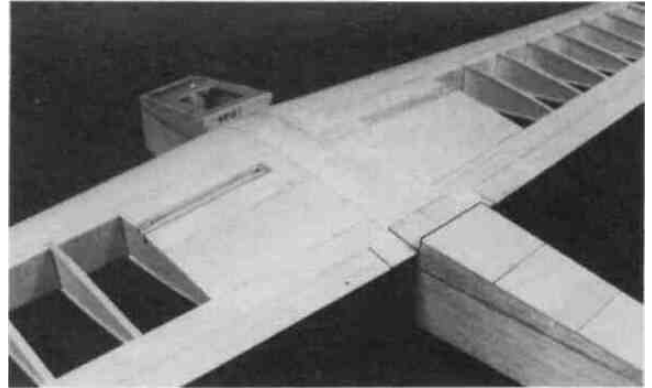


- 10. With the engine resting on the mount, plan the **throttle pushrod** routing. The pushrod should be located as close as possible to the fuse sides (to allow room for the fuel tank), and the guide tube should not have any tight bends. Drill a 3/16" hole in F-1 for the throttle pushrod guide tube.
- 11. Drill or carve holes in F-2 and F-3 for the guide tubes. Cut the remaining 36" plastic pushrod guide tube in half and trial fit the tubes in the fuselage. (Also see the photo on page 35.)
- 12. Sand the plastic pushrod guide tubes with 100-grit sandpaper, then glue them in place. Trim and sand the tubes flush with the front of F-1.
- 13. Cut the **pushrod** wires (supplied) to the required lengths and temporarily install the throttle and nose gear pushrods. **NOTE:** A 34" wire, threaded one end, is supplied for the throttle pushrod, and a 19" wire (no threads) is supplied for the nosegear pushrod.
- 14. Now remove the pushrod wires, engine, engine mount and servos.

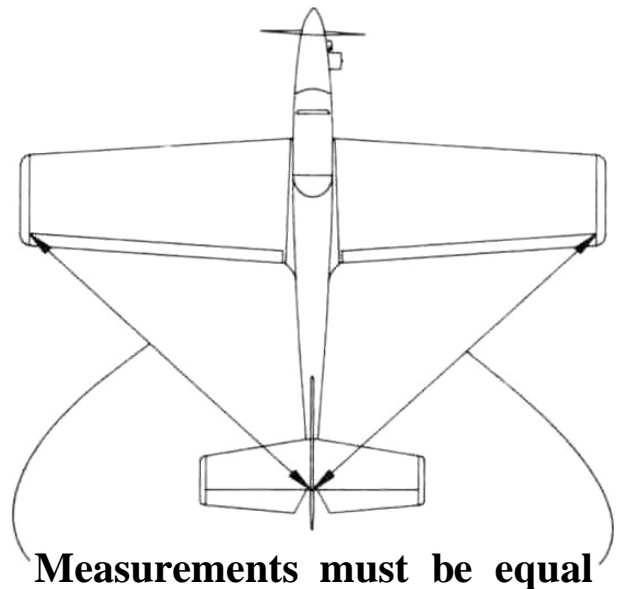
MOUNT THE WING TO THE FUSE

- 1. Sand the top surface of the fuse to remove any excess glue so the fuse will lie flat on the workbench.
- 2. Sand the entire wing saddle area lightly until the fuse side doublers and fuse sides are flush.

- 3. Insert the die-cut 1/8" ply **F-2A** in place against the back of F-2 (**do not glue**).
- 4. Insert the 1/4" wing dowels into the wing so they stick out only 1/8".



- 5. With the fuselage upside down on a flat surface, trial fit the wing into the wing saddle. If the wing is slightly too large (front to rear) to fit into the saddle, sand the rear edge of the saddle and the wing trailing edge slightly until it fits.



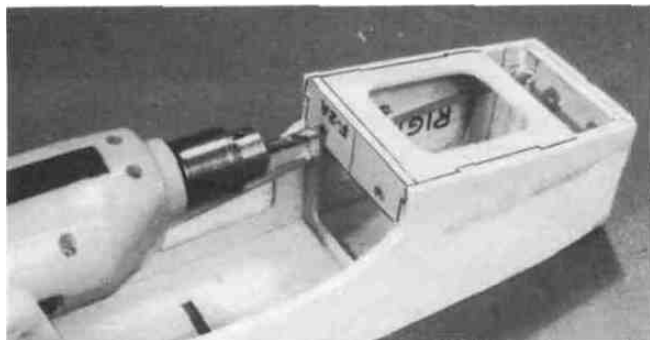
- 6. Carefully **align** the wing in the saddle as follows:

If you have drilled the dowel holes accurately, the wing should now be **centered**, side to side. Measure down from the bottom of both tip ribs to the flat surface. If the measurements are not equal (within 1/16"), sand the saddle slightly until the wing sits level in the saddle. Also measure from the rear corner of each wing tip to the tail end of the fuselage. These measurements must also agree within 1/16". If not, shift the wing slightly until they do. With the wing in this position you may now check the wing **incidence** using an "incidence

meter" or by measuring down to the flat surface from the center of the leading and trailing edges. The measurements should be the same (zero degrees incidence). **CAUTION:** If your flat surface is not **level**, you will get erroneous incidence readings! If you are working on a flat surface that is not level, you must set the wing incidence the same as your flat surface.

7. After making the necessary corrections to align the wing, **tack glue** F-2A to F-2 with a couple drops of CA. Also make **alignment marks** on the wing TE and the front of F-4 so you may easily re-align the wing later.

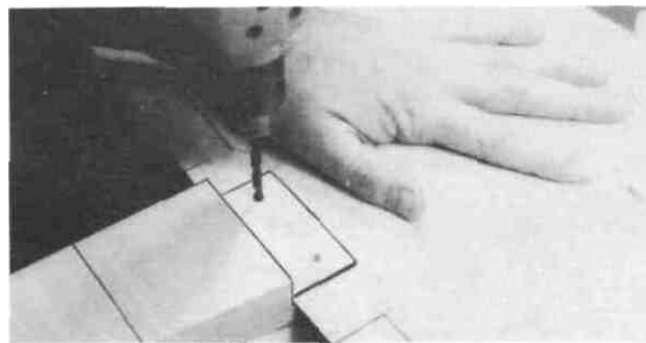
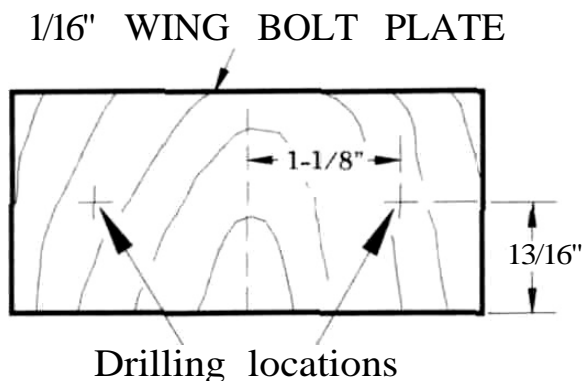
8. Remove the wing and **securely glue** F-2A in place by flowing thin CA into the wing dowel holes and around the edges. Follow up with thick CA in any gaps around the edges.



9. Drill 1/4" holes through F-2 using the holes in F-2A as a guide.

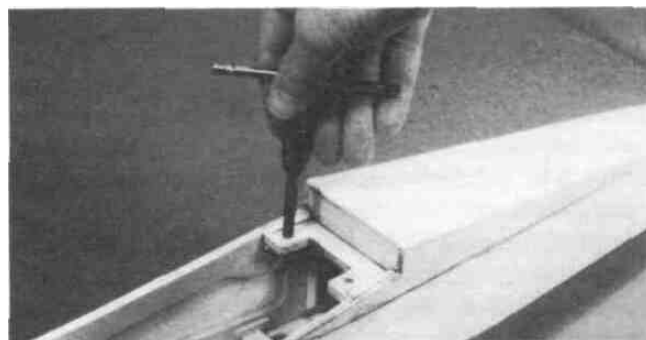
10. Use a pliers to grasp the ends of the wing dowels and pull them out. Now you may slightly round (or chamfer) the ends of the dowels for easier insertion into F-2A. Mix up a batch of 30-minute epoxy, use a long stick to work some epoxy into the dowel holes, smear epoxy on the dowels, then re-insert the dowels into the wing, leaving them protrude 3/8". Wipe away all excess epoxy, then allow the epoxy to fully harden.

11. Study the wing plan to determine where the **wing bolt holes** are to be drilled. By measuring, transfer the locations to the wing bolt plate on the bottom of the wing. After marking the bolt locations, replace the wing in the saddle and re-align it accurately, as in step 6.



12. Holding the wing **firmly** in place, drill 13/64" holes at the locations you marked in step 11, drilling down through the 1/16" ply wing bolt plate and through the 1/4" ply hold-down block in the fuselage. Try to drill straight in, perpendicular to the 1/16" ply bolt plate. **IMPORTANT!: Do not allow the wing to move while drilling!**

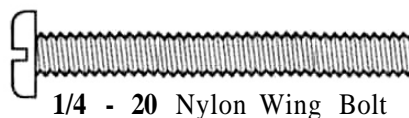
13. Remove the wing and re-drill the holes **in the wing only** to 1/4".



14. Use a **1/4-20 tap** and a **tap wrench** to cut threads in the ply hold-down block in the fuselage.

15. **Harden** the threads in the hold-down block with thin CA glue, then re-tap the threads after the glue is **completely dry**.

16. **Trial fit** the wing to the fuse using the two 1/4-20 nylon bolts provided. You may cut the bolts off to their proper length, so they protrude about 1/4" below the hold-down block in the fuselage.

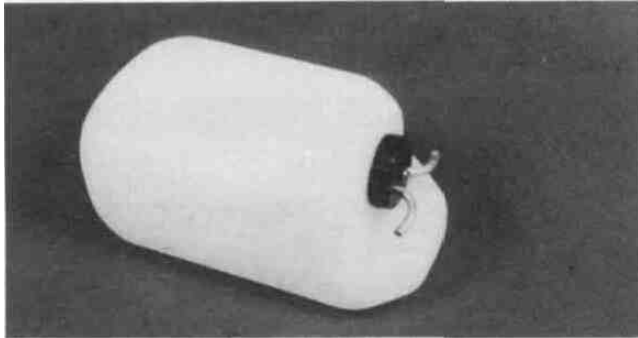


17. Later you will apply foam **wing seating tape** or **silicone sealer** to the wing saddle. To allow space for this wing cushion material, you may sand the saddle **slightly** in the areas where the wing touches the saddle, to provide a small gap.

18. Sand off the bottom edge of F-2 and F-2A flush with the bottom of the chin block base. And, while you're at it,

sand the entire fuse bottom, forward of F-2A, in preparation for installation of the chin block.

FIT FUEL TANK and FUELPROOF TANK COMPARTMENT

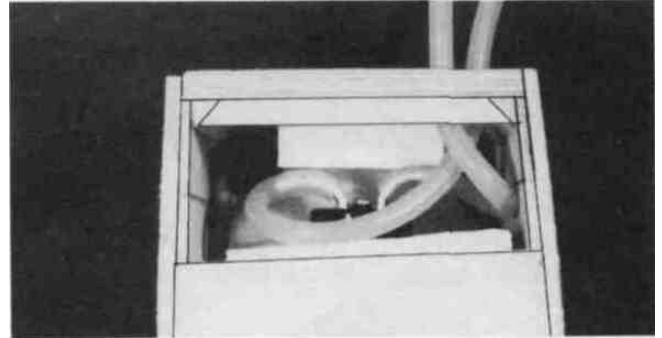


- 1. Assemble your 11 to 14 oz. fuel tank. We recommend bending the brass tubes as shown in the photo to prevent them from cutting through the silicone fuel lines if pressed against the firewall. (Try not to "kink" the tubes when bending, however).
- 2. Try sliding the tank in through F-2. If the opening is not large enough, sand or file the opening until the tank slides in easily.
- 3. Temporarily install the engine mount and note how far the mounting screws protrude into the fuel tank compartment. Remove the screws and cut them off so they do not protrude more than 1/8" (to prevent puncturing the fuel tank).



- 4. Drill two holes (7/32" or size to fit your fuel tubing) near the top of F-1 for your fuel tubing vent and fill lines. The location of these holes will depend somewhat upon the type of engine you are using, etc. It is OK to drill the holes in the upper left and upper right corners, but we prefer drilling both holes in the upper right corner (as viewed from the rear) for easier access.

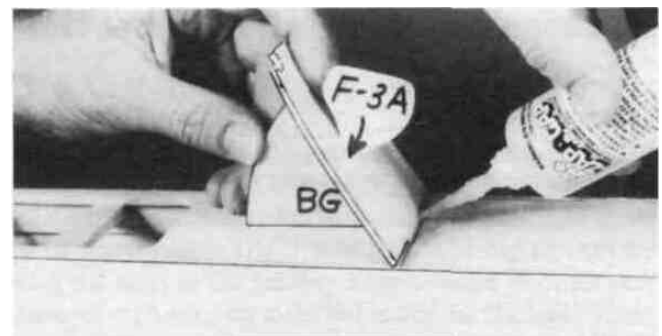
- 5. Now remove the engine mount and **fuelproof** the inside of the fuel tank compartment and the front of F-1 by brushing on a coat of polyester resin or 30-minute epoxy thinned with alcohol. **NOTE:** Later when installing the nose pieces, you will fuelproof the chin block before installing it.



- 6. You may permanently install the **fuel tank** at this time, or you may wait until the plane is nearly completed. If you do it now it will be easier to feed the fuel lines through F-1, and to make sure there are no kinks in the lines; however, you'll have to work around them while completing the nose. When you install the tank, be sure to cushion it from vibration and prevent it from moving by surrounding the tank on all sides (and front) with latex foam rubber. Leave a few inches of extra fuel tubing in front of F-1 (you can cut off the excess later). The photo shows how to route the fuel tubing to prevent kinking.

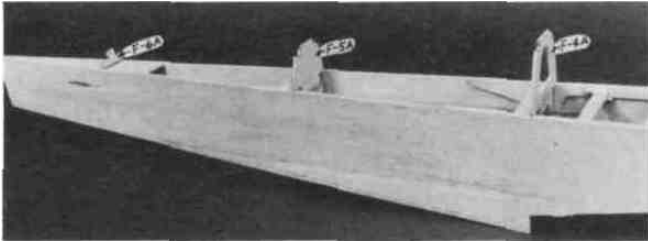
INSTALL TURTLE DECK

You'll need the following parts: Die-cut 1/8" ply **F-3A**, F-4A, and **Backrest Gauge (BG)**; die-cut 1/8" balsa F-5A and F-6A; two 1/4" x 1/4" x 27" balsa **turtle deck stringers**; two 3/32" x 3-1/4" x 28-1/4" balsa **turtle deck sides**; the 1/2" x 2-3/8" x 26" balsa **turtle deck top block** and a roll of masking tape.



- 1. Glue the die-cut 1/8" ply "backrest" (F-3A) to the fuse top, using the "backrest gauge" (BG) to set it at the

correct angle. **NOTE:** The gauge is used only for setting the angle (do not glue the gauge in).



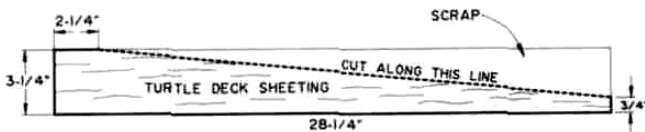
- 2. Glue **F-4A** to the front of F-4.
Glue **F-5A** to the front of F-5.
Glue **F-6A** to the front of F-6 (insert the F-6A tab through the slot in the stab base).



- 3. Glue the 1/4" x 1/4" x 27" balsa **stringers** to the formers. **HINT:** If F-3A is slightly warped, you may straighten it during this step by twisting it straight while gluing the stringers. Trim and sand the ends of the stringers flush with the front of F-3A and the rear of F-6A.

- 4. Use a sanding block to sand the sides of the stringers to blend with the formers (see the cross-section drawings on the plan). Also use a long sanding block to sand the stringers and the tops of the formers in a straight line from F-3A to F-6A.

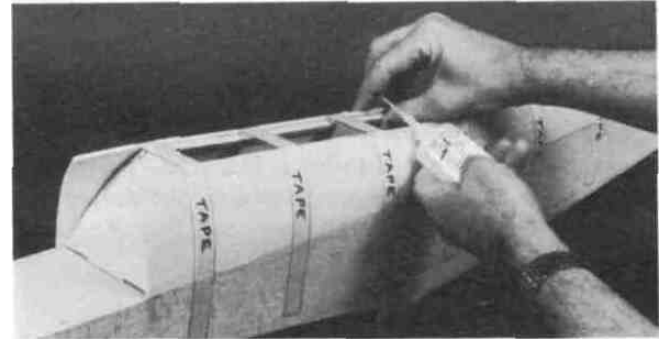
- 5. Prepare the **turtle deck sides** by cutting the two 3/32" x 3-1/4" x 28-1/4" balsa sheets to the angle shown in the following sketch.



- 6. **Trial fit** one edge of the sheering down onto the top of the fuse side. Sand the edge of the sheering if necessary, for a good fit

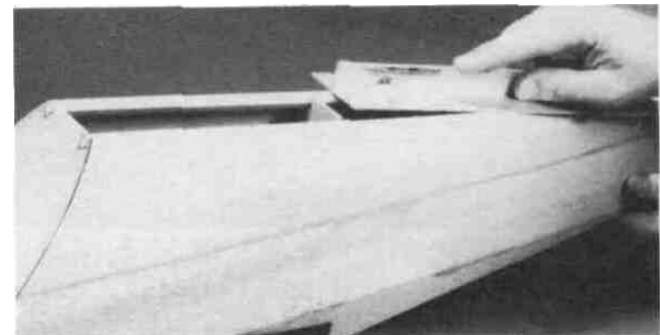


- 7. Glue the bottom edge of the sheering to the top of the fuse sides.



- 8. Wet the outside surface of the sheering with a damp rag to permit easier bending. Apply thick CA glue to the edges of the formers and the stringers, then immediately bend the sheering around the formers and onto the stringers. **HINT:** This requires about 5 sets of "hands," so use several long pieces of masking tape to pull the sheering together; then, working a small section at a time, add CA and press the sheering to the stringers.

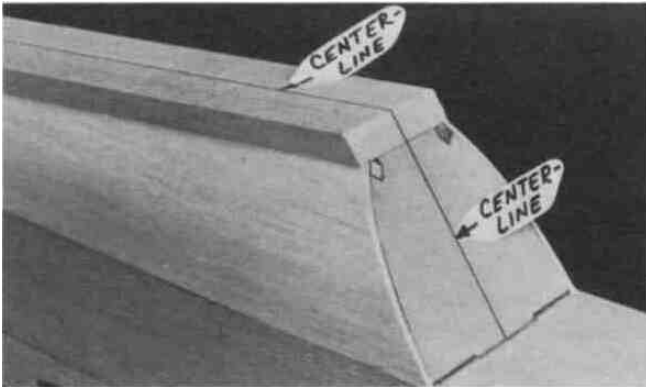
- 9. Trim and sand the sheering flush with the front of F-3A and the rear of F-6A.



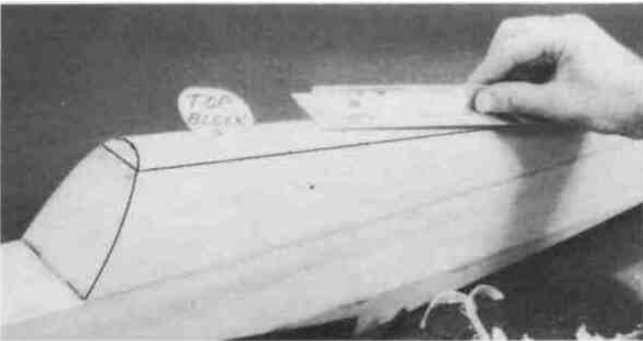
- 10. Using a long T-bar or sanding block with 80-grit sandpaper, sand the sheering and stringers flush with the **top edges** of the formers.

NOTE: The turtle deck is designed to be as light as possible, while still providing sufficient durability for normal use. If your airplane will be handled by "ham-fisted" people who like to squeeze hard when holding the airplane in the turtle deck area, you may want to add an extra 1/4" x 1/4" balsa stringer on the inside of the turtle deck sheeting, between F-3A and F-4A, about halfway down.

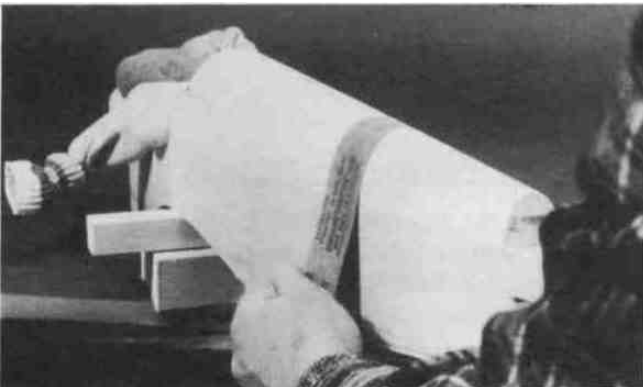
11. Glue the 1/2" x 2-3/8" x 26" balsa **turtle deck top block** to the tops of the formers, stringers and sheeting, then trim the ends of the top block flush with F-3A and F-6A.



HINT: In the next step it will be helpful in keeping the top block symmetrical if you first mark a centerline on the top of the top block from front to back (this is a line from the centerline of F-3A to F-6A).

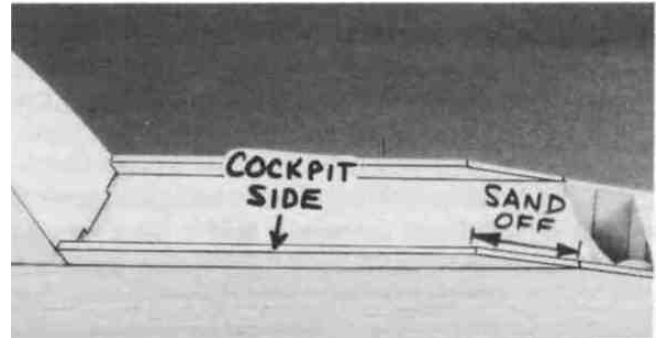


12. Carve and sand the top block to blend smoothly with the sheeting (see the cross-sections on the plan). **HINT:** Use a razor plane (or a sharp wood chisel) and a sanding block with 50-grit sandpaper for rough shaping the top block.

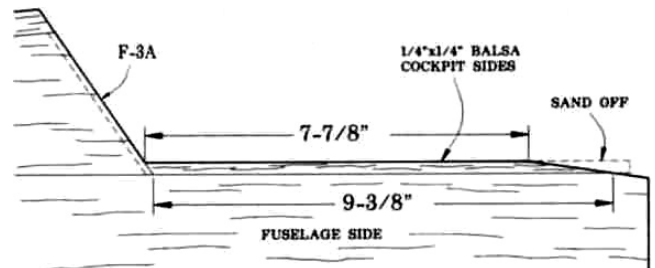


HINT: For a super-smooth and uniform finish on your turtle deck, cut a 2-1/4" x 11" strip of 320 or 400-grit wet-or-dry sandpaper, and work it like a "shoe-shine cloth" across the top of the turtle deck.

ASSEMBLE THE NOSE SECTION



1. Find the 1/4" x 1/4" x 10" balsa **cockpit sides**. Cut off one end of each stick at an angle to fit the front edge of the backrest (F-3A).
2. Glue the cockpit sides to the top edge of the fuse sides and to F-3A. The outside edge of the cockpit sides should be flush with the outside edge of the fuse sides.
3. Measure, mark and sand off the cockpit sides according to the sketch. Then sand the top front corners of the fuse sides on the same angle, to blend with the cockpit sides.



4. Attach the engine mount to F-1, and attach the engine to the mount. Remove the nose gear.
5. From a scrap of 1/32" ply, cut four small pieces and tack glue them to the 1/16" ply **spinner ring** as shown, using a very small amount of thick CA (these will be removed later). **IMPORTANT NOTE:** If you have chosen to use shock-absorbing rubber engine mounts, then you must provide more space between the spinner ring and the spinner